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Individual Resilience, Social Support, and Health Risk Behaviors in Adolescents and Young Adults: Study on Cross-sectional and Longitudinal Samples

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INDIVIDUAL RESILIENCE, SOCIAL SUPPORT, AND HEALTH RISK BEHAVIORS IN ADOLESCENTS AND YOUNG ADULTS: STUDY ON CROSS-SECTIONAL AND LONGITUDINAL SAMPLES

INDIVIDUAL RESILIENCE, SOCIAL SUPPORT, AND HEALTH RISK BEHAVIORS IN ADOLESCENTS AND YOUNG ADULTS: STUDY ON CROSS-SECTIONAL AND LONGITUDINAL SAMPLES

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ABSTRACT

Resilience is considered the ability that a person gains positive achievements despite exposure to significantly adverse life conditions. However, a majority of previous research has focused on human developmental tasks or academic achievements. Evidence of resilience on health risk behaviors has not been comprehensively established yet. The purposes of this dissertation were to extend the existing literature about the stability of resilience through time, to examine how the resilience scale concurrently and prospectively predict resilience statuses, and to explore effects of social support over a long period of lifetime. The dissertation used a secondary database from the public-use version of the National Longitudinal Study of Adolescent Health (Add Health). Resilience status was defined as a lack of health risk behaviors of suicide, violence and substance use. Resilience scale was constructed by using 35 items from the Add Health data. Data were analyzed data were analyzed using logistic regression and Generalized Estimating Equations (GEE) models. The results showed that resilience status in general and adversity populations varied over time. However, when viewed over a long period of lifetime, individual resiliency on health risk behaviors appears to be rather stable. The resilience scale and its subscales strongly predicted resilience status at a given point in time or over time. Parental support had little or no effect on resilience status, having more number of close friends increased the risk of some health behaviors, and religious services led participants to become more resilient on some health risk behaviors. This research will provide policy makers better knowledge about the role of resilience on health risk behaviors during the transition from adolescence to adulthood. The findings may contribute to the existing literature by extending the knowledge of how resilience on the domain of health risk behaviors changes over time and which factors influence on the resilience process.

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CHAPTER 1: INTRODUCTION

Adolescence

Adolescence is a period of human development that serves as a bridge or transition from childhood to adulthood. This stage faces with rapid and dramatic changes in physical and metal developments. The transition from childhood to adulthood is most important in every individual's life. Children become more independent and begin to look at the future in terms of career, relationships, families, housing, etc. During this period, they explore their possibilities and begin to form their own identity based upon the outcomes of what they are exploring.

There is variation in definition and classification of adolescence. Adolescence is generally considered as the period of life from puberty, which commonly started at the age of ten to maturity. In the view of psychological development, Erikson (1950), in his famous theory: Erik Erikson's stages of human development, classified an adolescent is a person between the ages of 13 and 19 whereas a young adult is generally a person between the ages of 20 and 24.

Adolescence is considerably affected by the individual biological, cognitive and psychological characteristics in a context of social and ecological environment. This developmental stage of life is especially important because adolescents begin to establish permanent healthy or unhealthy attitudes toward risk behaviors. Therefore, any risk and protective factors in this period can potentially influence health behaviors in the later stages of life. For instance, socioeconomic status (SES), as measured by family income, poverty status, or level of parents' education, is strongly associated with the health of adolescents as well as the health of persons of all ages in the United States (MacKay & Duran, 2008). Friends, school, family, and community, generally called sociostructural environment, often have direct effects

on health behaviors. For example, parent-family connectedness and school connectedness were protective against every health risk behavior such as violence, substance uses, suicide, and unsafe sex (M. D. Resnick et al., 1997).

Tradition approach focused on the exposure to risk. For example, children and adolescents are likely to have negative health-related outcomes in adulthood if they are reared under conditions of poverty, neglect, abuse, or other disadvantageous living circumstances. However, a certain number of children, adolescents, and young adults who suffer from various adverse circumstances achieve positive developmental outcomes. In fact, when faced with many of the negative circumstances, one exhibits competency in a wide variety of behavioral and health-related outcomes (Arrington & Wilson, 2000). This phenomenon leads researchers and policy makers to comprehend the intriguing questions: Why some individuals display at risk behaviors and others, in the same environment and under the same conditions, do not; what factors contribute to this process; and what interventions are suitable to promote competence for at-risk populations. Thus, new models for human development that take protective factors, also called resilience factors, into account have burgeoned in recent years (Luthar, Cicchetti, & Becker, 2000). Research on the areas of vulnerability and resilience has stimulated an interest in the identification of protective factors contributing to the lives of young people.

Resilience

Resilience is an important psychological factor that affects the quality of life and life outcomes. Resilience is considered the ability that a person gains positive achievements despite exposure to significantly adverse life conditions. People who are labeled *resilient* often have positive attributes including high self-esteem, high self-efficacy, internal locus of control, and

positive coping styles. Resilience is also considered a positive outcome that results from positive mental health, social competence, academic achievement, and social supports from friends, family and community. Most authors now view resilience as a dynamic process rather than a personality trait or characteristic

There has been evidence that individual resilience affects positively on health behaviors and health outcomes. Resilience helps adolescents and young adults effectively cope with a wide range of stress-related risks or adverse conditions including psychological stressors such as eating disorders, suicidal ideation, and depression; physical stressors such as chronic illness, HIV infection, violence, and sexual abuse; familial stressors such as domestic violence and inter-parental conflict; social stressors such as romantic relationships; and societal stressors such as discrimination (Garcia, 2009).

Health Risk Behaviors

A variety of risk behaviors has been studied in health science and health education. Health-related risks usually results from personality and social behaviors such as violence, tobacco, alcohol and other drug use, unsafe sex, unhealthy diet, and physical inactivity. The dissertation explored some health risk behaviors including suicide, violence, and substance use that appear to be important for both adolescents and young adults.

Violence, suicide, and substance abuse are serious public health problems in the United States. Homicide and suicide are the second and the third leading causes of death among American adolescents and young adults aged 15–24 years, respectively (Centers for Disease Control and Prevention [CDC], 2011a). Substance abusers usually suffer severe adverse long-term health outcomes and are likely to develop addictive behaviors in the later stages of life.

Although the prevalence of these health-risk behaviors among adolescents and young adults has decreased in recent years, many young people continue to engage in behaviors that are harmful to their health. Many patterns of behavior initially established during the adolescence period are associated with adult morbidity and mortality (MacKay & Duran, 2008).

Rationale for the Study

The majority of resilience research has been conducted in younger populations, e.g., children, youths, and young adolescents. Relatively little is known about how resilience operates in adulthood. There is also limited knowledge of resilience processes during the transition from adolescence to adulthood. In reality, the major developmental changes occur during adolescence are faster and greater than in childhood or older adulthood. Therefore, studying in the populations of adolescents and young adults will provide precious information about how protective factors positively influence on the dynamic periods of human development and establish stable behaviors in the later stages of life.

Resilience was first developed by psychologists who were interested in the competence of children despite adversity. The construct of resilience has been applied to health science, health communication and promotion, and public health in recent years. Thus, most competences in literature are human developmental tasks and academic achievements. Several domains of resilience on health areas have been explored, for example, resilience and recovery from HIV/AIDS, cardiovascular diseases, trauma, and suicide. However, evidence of resilience on health risk behaviors has not been comprehensively established yet.

Competence varies in different stage of life. Academic achievement is the prominent competence during childhood and early adolescence whereas professional achievements,

marriage situation, and parenthood responsibilities are most concerned for late adolescents and adults. Obviously, no unique domain of outcome can assess competence throughout the human life, especially during the transition from adolescence to adulthood. Health behaviors appear to be an appropriate domain to assess competence in both adolescents and young adults because such behaviors are very important for every person during these development stages of life.

To date, most research on resilience has relied too heavily on cross-sectional design. Among few longitudinal studies, most have explored resilience on children or early adolescence and followed up from one to five years. Thus, there is limited knowledge about effects of resilience over time. Following up participating adolescents over a 13-year period, the National Longitudinal Study of Adolescent Health (Add Health) is a good source of data to address this issue. With rich information and nationally representative design, the Add Health data would reveal precious findings related to resilience process over a long period of lifetime.

Statement of the Problem

Most psychologists have agreed that resilience is a dynamic process that can be changeable over time rather than a personality trait, depending on the interaction between personnel characteristics and socio structural environments. However, some researchers, for instance, Werner and Smith (1982; 1992) and Masten et al. (2004), found that resilience could be stable over time in some particular populations under particular circumstances. In psychological approach, many authors thus have still used other terms such as *invulnerability, ego-resiliency,* and *resilient person* that appear to refer to long-term and stable personality characteristics, whereas the term *resilience* implicates a dynamic process. This contradiction in

the conceptualization of resilience existing in the literature has led to non-consensus in the conceptualization of resilience to date.

The original term of resilience refers as a process that a person gains competence in the context of past or present adversity. However, the ability to gain achievements, to be healthy, to cope with stress, and to overcome with difficulties during lifetime is absolutely of all human beings instead of restriction in those who suffer from adverse life conditions. There is also limited knowledge about the resilience process in non-adversity populations, although the resilience process in adversity populations has been adequately studied.

Variation in current conceptualization of resilience also results in variation in the measure of individual resilience attribute. As a result, many resilience measurements have been developed to predict a person labeled resilient in the recent decades. Not surprisingly, no "gold standard' for measuring resilience has been consented to date (Windle, Bennett, & Noyes, 2011). Current and popular scales used in research and practice have been applied in particular populations with particular competences. Furthermore, most of such scales have been tested their validity and reliability in cross-sectional norm groups (Windle et al., 2011). To date, there is limited knowledge about how well these scales predict individual resilience over time. However, if such scales potentially predict resilience status, policy makers will have an important tool to understand personal, psychosocial, and environmental factors that lead individuals to participate in health risk behaviors.

Based on the common conception that resilience is a dynamic process and unstable, it may be difficult to establish a measurement tool that predict resilience status over long periods of lifetime. However, a large number of previous research showed that many individual and social factors buffer the effects of risks over time (Ghazarian & Roche, 2010; W. Johnson, Giordano,

Manning, & Longmore, 2011; Masten et al., 2004; Werner & Smith, 1992). Thus, participants who have such positive factors in early adolescence might be likely to become resilient in the later stages of life such as late adolescence and adulthood.

Although usually being one of subscales in many resilience scales, social support has not been totally explored its long-term effects as a part of resilience factors. The dissertation would examine the role of social support as the independent predictors as well as a subscale of the resilience measurement.

Purpose, Research Question, and Hypotheses

Purpose. The purposes of this research were to extend the existing literature about the stability of resilience through time, to develop and examine how the resilience scale concurrently and prospectively predict an individual resilience status, and to explore effects of social support over a long period of lifetime.

Research question and hypotheses. The dissertation uses data from the National Longitudinal Study of Adolescent Health (Add Health). Participants were longitudinally surveyed through four different points in time (wave) during 1995–2009. This research explored both resilience status and a resilience scale. Resilience status was the competence in health behaviors, that is, participants absent from health risk behaviors including substance uses, violence and suicide were classified as "resilient".

Question 1. The first question was to address the conceptual contradictions in resilience's stability—whether resilience statuses (resilient vs. non-resilient on health risk behaviors) were static and stable conditions, or dynamic and changeable processes. In other words, the question was equally stated as "whether or not health risk behavior's status would remarkably change

over time in the general population as well as the adversity population". Three hypotheses were derived from the first research question:

Hypothesis 1.1. Rates of health risk behaviors would significantly vary from wave to wave in cross-sectional samples. Because each wave was representative of some age-specific sectors of the national population, such as middle adolescent, young adults, or adults, changes in health risk behaviors would implicate that resilience status varied in age-specific subgroups of the U.S. population.

Hypothesis 1.2. There would be a remarkable large number of individuals changing from non-engaging to engaging in health risk behaviors and vice versa over time in the longitudinal sample. These changes would implicate that resilience status in each adolescent usually fluctuated during the transition to adulthood

Hypothesis 1.3. The trajectories (patterns of change) of health risk behaviors would be identical for both general population and adversity population.

Question 2. The second research question was whether the resilience scale would be appropriate to evaluate individual resilience statuses in both cross-sectional and longitudinal samples. In other words, the question was whether the resilience scale would predict resilience statuses concurrently and prospectively. To address the question, the researcher proposed a resilience scale based on self-reports of respondents. Resilience-related items were empirically selected from the Add Health data sets, and then summed to create scores. Two hypotheses were derived from the second research question:

Hypothesis 2.1. Participants who had higher resilience scores at baseline would be less likely to engage in health risk behaviors (or more likely to become resilient) at this time-point than those who had lower scores.

Hypothesis 2.2. For the longitudinal data, participants who had higher resilience scores at baseline would be less likely to engage in health risk behaviors (or more likely to become resilient) over time when compared to those who had lower scores.

Question 3. The third research question captured the role of social support on resilience status—whether actual social supports including parental supports and supports outside family would play a role on resilience status during the transition from adolescence to adulthood.

Hypothesis 3.1. At each point in time, participants who had higher scores of actual social support would be less likely to engage in health risk behaviors (or more likely to become resilient) than those who had lower scores.

Hypothesis 3.2. For the longitudinal data, participants who had higher scores of actual social support would be less likely to engage in health risk behaviors (or more likely to become resilient) over time when compared to those who had lower scores.

Significance of the Study

This research will provide policy makers better knowledge about the role of resilience on health risk behaviors during the transition from adolescence to adulthood. The findings may help therapists, social workers, and health educators promote resilience to prevent health risk behaviors in youth. Fortunately, resilience, especially in early stages of life, can be gained, maintained, and improved through various methods such as providing better social support, training to cope with stressful events and adverse circumstances, and mentoring to create positive objectives for the future. Resilience-based interventions thus may apply resilience as a useful tool to reduce risk factors and improve protective factors related to health and quality of life.

This study may contribute to the existing literature by extending the knowledge of how resilience on the domain of health risk behaviors changes over time and which factors influence on the resilience process.

Definition of Key Terms

Resilience. A dynamic process that an individual exhibit positive behavioral adaptation (competence) when he/she is exposed to significant adversity, trauma, tragedy, threat, stress, or other negative condition of life (adversity). In the dissertation, resilience was defined as a status that an individual did not engage in health risk behaviors such as suicide, violence, and substance uses.

Adversity. Negative environmental conditions that interfere with or threaten the accomplishment of age-appropriate developmental tasks. In the dissertation, adversity was negative conditions in which the participants were lived at baseline such as poverty, low mother's education, single parent, unemployed parents, disabled parent(s), intimate partner violence, parental alcohol use, not English at home, and low SES community.

Competence. The ability of an individual to gain particular achievements in particular stages of life. In this research, competence was the ability of an individual not to engage in health risk behaviors that harm his/her health.

Health risk behavior. Any activity undertaken by an individual that potentially increase negative effects on health. The dissertation explored three types of health risk behavior: suicide, violence, and substance uses.

Suicide. The self-inflicted destructive act with explicit or inferred intent to die. This research explored two non-fatal suicidal behaviors: ideation and attempt. Suicidal ideation is any thought of suicide whether the thoughts include a specific plan to commit suicide or do not. Suicide attempt is any self-inflicted destructive act with explicit or inferred intent to die.

***Violence*.** The intentional use of physical force to cause injury, death, or psychological harm for other(s). In this research, violent behavior was actions that an individual could potentially cause injuries to other(s) or that someone could lead him/her to be injured.

Substance use. Regular and frequent use of illegal or harmful substances. In the dissertation, substance use was the consumption of tobacco, alcohol, and illicit drug such as marijuana, cocaine, or inhalants.

CHAPTER 2: LITERATURE REVIEW

Introduction

This chapter begins with brief histological and theoretical descriptions of resilience research. Definition, operationalization, conceptualization, theoretical approaches, and measurements of resilience are presented to provide a comprehensive understanding of the construct. Next, elements that involve in resilience process such as risk, risk factor, vulnerability, and protector factor are described using various sources of prior theoretical and empirical research. The review points out the important problems of health risk behaviors among adolescents and young adults. This section ends with a short description of the link between the literature and the current research.

Resilience

Resilience is an important psychological factor that affects the quality of life and life outcomes. Research on protective factors that moderate the impact of risk and adversity on adaption in children, adolescents, and young adults has been conducted for nearly 40 years. However, conceptualization and application of resilience to practice have been debated.

Historical context. According to Masten (2007), four waves of research in resilience have been developed to date. The first generation of research on resilience started in early 1970s. Pioneers were interested in investigating how children overcome adversity to achieve good developmental outcomes. Most research at this time was designed as longitudinal studies, which conducted on children who suffered from adverse life conditions. Researchers pointed out some

risk and protective factors contributing to the mental, psychological, and social development of vulnerable children and adolescents.

Norman Garmezy, the first psychologist in this area, observed that many children at risk for psychopathology were developing well. He founded a program of research, named Project Competence, at University of Minnesota. His focus was on the study of competence in children at risk for schizophrenia due to parental mental disorders and other socio-cultural disadvantage factors, such as poverty and stressful life events. In his point of view, the competence of an at-risk child served as a protective factor against the expression of behavior disorders. He assumed that the premorbid competence foretold recovery from mental disorder (Garmezy, 1973). Although resilience was not part of the descriptive picture of these atypical schizophrenics, these aspects of premorbid social competence might be viewed today as prognostic of relatively resilient trajectories (Luthar et al., 2000).

Designed as a longitudinal study, the Project Competence had followed up participants over 30 years. Garmezy, Masten, and Tellegen (1984) found some children could protect themselves from high-risk families or high-risk environments such as drugs and alcohol. The authors assumed that the children had some factors that helped them resist the influence of such dangers. They called these factors as stress-resistant, the ability to cope with stress. Results from the Project Competence Studies of Stress Resistance in Children revealed that children whose mothers suffered from severe mental illness were at risk for undesirable developmental outcomes, e.g., less competence and more disruptive behaviors, when compared to those whose mothers did not. Nonetheless, a certain number of at-risk children developed normally in terms of academic achievements that were similar to or exceeded the competence of children without the risk.

Werner was one of the earliest psychologists to use the term resilience. She studied in development of children born on the Hawaiian Island of Kauai in 1955. The cohort sample was followed up to assess factors that affected the development of participants from birth to adulthood. Most participating children were raised by mothers who were low educated and by fathers who were semi- or unskilled labors. She found that children who grew up in bad situations such as poverty, alcoholic, or mentally ill parents tended to develop serious learning problems, metal health problems, and delinquencies in childhood or adolescence. However, one third of all at-risk children did not develop such behavioral disorders. Werner called this group of children *resilient*. All resilient children had developed into competent, confident, and caring youths by ages of 10 and 18. At age of 18, the resilient youth had a more internal locus of control, a more positive self-concept, a more nurturing, a positively achievement-oriented attitude toward life, and the strong cohesiveness to their family, friends and community (Werner & Smith, 1982).

The second generation of research on resilience began in 1980s. In spite of identifying protective factors, empirical and theoretical research focused on understanding factors contributing to positive outcomes, and mechanisms that help individuals overcome their adversity. Researchers also identified processes that promote resilience under normative conditions. For example, Davey, Eaker, and Walters (2003) explored the process of resilience in different personality profiles such as disagreeableness, extraversion, agreeableness, and openness to new experiences. The authors suggested that there might be different compensatory mechanisms operating for adolescents with different personality profiles. At that time, researchers paid more intention on the role of biological, social, and cultural processes into models and studies of resilience (Luthar, 2003). The conceptualization of resilience also

developed in this wave. Most researchers agreed that resilience was seen at one point in lifetime but not another, and in some aspects of competence but not others.

The third generation of research on resilience focused on intervening to promote resilience in at-risk populations. Based on the understanding of mediating and moderating processes for resilience, multifaceted interventions were designed to prevent or reduce risk behaviors and other problems. Such resilience-based interventions demonstrated success in reducing negative effects of adversity on different populations of interest. For example, the New Beginnings Program was developed to promote resilience resources in children after their parents divorced. The intervention had a strong positive impact on youth adaptation outcomes over time, including short-term effects that were measured after six years of follow-up and long-term effects after collecting 15-year follow-up data (Wolchik, Schenck, & Sandler, 2009). Other interventions were successfully applied in diverse at-risk populations including enhancing emotional resilience in people who were at cardiovascular risk (Davis, 2009), building coping strategies to reduce risk from natural disasters like flooding and climate changes (Jabeen, Johnson, & Allen, 2010), applying resilience-based interventions in school settings (Merrell, 2010), building resilience in young people in a residential children's home (Houston, 2010), applying a resilience-based intervention for children of parents with mental illness (Fraser & Pakenham, 2008), etc.

The fourth and most current wave of research has been developed in recent years. Research on resilience is based on developments of technology, science, and statistics for a better understanding of the complex processes that lead to resilience (Masten, 2007). Kim-Cohen, Moffitt, Caspi, and Taylor (2004) studied a cohort of twin pairs to separately detect the role of genetic and environment on resilience processes in young children who suffered from SES

deprivation. The authors found that approximately 70% of the variation in behavioral resilience against SES deprivation was accounted for by genetic effects, and the rest of the variation was accounted for by unique environmental effects and measurement error. More specifically, a study by Cole et al. (2011) reported that individual status on the IL6-174 genotype helped participating adolescents confront SES adversity. The authors proposed the term *biological resilience*, meaning that individual genetic characteristics interacting with socio-environmental conditions overcome adversity in life. In a new study using Add Health data to explore the role of adolescent's genotype, Beaver, Mancini, DeLisi, and Vaughn (2011) reported that some of the genetic polymorphisms, including DRD2, DRD4, DAT1, and 5-HTTLPR, protected adolescents from victimization. The author implicated that some of the genetic polymorphisms increased the odds of resiliency while others did not or decreased. Advanced techniques for behavioral research, e.g., brain imaging, genetic testing, and bimolecular signatures, will be applied to expand the knowledge of resilience in future.

Definition of resilience. The concept of resilience was first introduced in the early 1970s. However, there has been variation in definition of resilience. Resilience in children and adolescents was originally described by Garmezy (1976) as "worked well, played well, loved well, and expected well". Generally, resiliency is referred to as a process to deal with adverse events in life. Werner and Smith (1982) considered resilience as "the capacity to cope effectively with the internal stress of their vulnerabilities (such as developmental imbalances and unusual sensitivities) and external stresses (such as illness, major loses, and dissolution of the family)". Luthar et al. (2000) considered resilience as the ability of individuals to survive and thrive despite exposure to negative circumstances. According to Richardson (2002), resilience is a reintegration process that an individual or group returns to normal functioning, called homeostasis, with the support of protective factors after exposed to stressors or adversity. Other authors proposed

many similar concepts, for instance, “a class of phenomena characterized by good outcomes in spite of serious threats to adaptation or development” (Masten, 2001) or “the ability to bounce back or cope successfully despite substantial adversity (Rutter, 1985). Most researchers currently conceptualize resilience as the individual and social capacity to cope positively with risk, stress, and adversity.

Conceptualization of resilience. Anthony (1974) and Pines (1975) introduced a concept of *invulnerable child* to describe children who were reared under condition of severe and prolonged adversity, but achieved emotional health and high competence. The term *invulnerability* seemed to refer to a stable personal trait. Pioneers in this area first assumed that some internal personal characteristics, e.g., IQ (Garmezy et al., 1984) or positive feature of the socio-ecologic environment, e.g., good relationships with parents (Rutter, 1979) served to protect children from adversity. However, other authors argued that resilience may be a set of traits (Jacelon, 1997) or an outcome (Olsson, Bond, Burns, Vella-Brodrick, & Sawyer, 2003).

When an enormous number of studies have extended across time and across aspects of adversity, such as stress, trauma, loss of parents, and severe diseases, researchers realized that the concept of resilience would be refined. The conceptualization of resilience has shifted from the stable personality attribute or trait to the dynamic process. Most researchers now consensus that resilience is a process that results from ongoing transactions between an individual and the environment, rather than an internal characteristic (Luthar & Zelazo, 2003, pp. 510-549). Therefore, resilience is attributed for a person at one specific point in lifetime, but not for entire life. This concept is particularly important because if resilience is interpreted as a personality trait, individuals with negative outcomes may blame for their failures by their inherent characteristic, and policymakers may also use it as justification to withhold important services to

at-risk populations by arguing that resilience comes from within the individuals (Luthar & Cicchetti, 2000; Vanderbilt-Adriance & Shaw, 2008).

Based on the definition, the contextual construct of resilience requires two fundamental judgments. The first judgment is that a person has to be exposed to significant risk or adversity. Individuals are not labeled resilient if there has never been a significant threat to their development. The second judgment is that that the person is "doing good" or "doing okay" (Masten, 2001). Although most researchers consent to the definition and the concept of resilience, the standard criteria to classify which individual is labeled resilient has still been ambiguous and debated. This controversy is due to the definition itself. Technically, a resilient person can be classified under many different ways. For instance, regarding to the first judgment, there has been variation in identifying type, level, and duration of the exposure to risk or adversity. Some research has explored resilience in one specific aspect of adversity such as low SES, lone parent, or parental mental disorders, whereas others have compared people who develop resilience when faced with high cumulative risk of adversity versus low risk.

Competence is also vague to identify. A resilient person may do well at a certain point in lifetime, but may not display this competence at other time-points. The identification of domains of competence is controversial. Similarity, issues of when and how to assess the competence are still debatable. For example, a person may display resilient at one domain of competence, as academic achievement, but does not in other domain, as health risk behaviors. Furthermore, levels of a competence vary across lifespan. For instance, the academic achievement is less important in adulthood than that in children or early adolescence. Not surprisingly, resilience rates fluctuate greatly in literature. In a review, Vanderbilt-Adriance and Shaw (2008) reported resilience rates varied from 1.5 to 92% in the existing research (majority of studies reported the

rates of 40−60%). According to the authors' explanation, the variation in resilience rates resulted from differences in study settings, e.g., sample demographics, number of risks, and the type and number of outcomes measured.

Resilience over time. There is limited number of research to examine whether resilience is changeable or stable across time. In the Kauai study, Werner and Smith (1982) noticed that among infants who had encountered high risk factors before age two, about 30% of those children managed to overcome the adversity. Surprisingly, none developed any serious learning and behavior problem in childhood or adolescence. However, following up the participating children to adulthood (ages of about 31–32), she found that the proportion of participants who "had turned into caring and efficacious adults" increased to 66%, that is, a majority of individuals changed from vulnerability to resiliency. On the contrary, some who grew up in relatively supportive home environments in childhood and adolescence became more vulnerable when faced with an accumulation of stressful life events in adulthood (Werner & Smith, 1992). This research demonstrated that a vulnerable person's life course can change at any time and is not completely determined in early childhood.

The Environmental Risk Longitudinal Twin Study was conducted on a birth cohort of 1,116 twin pairs and their families that were representative of twins born in England and Wales. When exposed to multiple family and neighborhood stressors, one-third of the children who were classified as resilient at age five fell into the non-resilient group by age seven (Jaffee, Caspi, Moffitt, Polo-Tomas, & Taylor, 2007).

There is only one exception. After following up participants over 20 years, the Project Competence reported that resilience endured the transition from childhood to adulthood (Masten et al., 2004). The reason for continuity in resilience over time in this study while not found in

other research may be from the target populations. The Project Competence conducted mostly on the White middle class children while others studied in populations with low SES or parental mental disorders.

Construct of resilience. Resilience is conceptualized as the ability of individuals to survive and thrive despite exposure to adversity. There are two critical components captured in the definitions: (a) presence of significant risk or exposure to significant adversity, and (b) achievement of good developmental outcomes despite risk. Resilience is the result of the interaction between individuals and their environments, and the processes that either promote well-being or protect them against the overwhelming influence of risk factors. These processes can be individual coping strategies, or may be assisted along by good families, schools, communities, and social policies that make resilience more likely to occur.

Resilience measurements. There is a variation in the establishment of resilience construct. Werner and Smith (1982) referred to three general elements: (a) good developmental outcomes despite high-risk status, (b) sustained competence under stress, and (c) recovery from trauma. In the view of psychological approach, Titus (2006) suggested three dimensions of resilience: (a) good outcomes despite risk, (b) human resistance to destruction, and (c) positive construction. According to Johnson, Gooding, Wood, and Tarrier (2010), resilience is defined as appraisals of the individual's ability to (a) cope with emotions, (b) solve problems, and (c) gain social support.

Due to variation in conceptualization of resilience, many different measurement scales have been developed to use in general and clinical populations. However, there has been no "gold standard' for measuring resilience to date (Windle et al., 2011). Appendix A presents a description of resilience scales that are currently and commonly applied in research and practice.

The Connor-Davidson Resilience Scale (CD-RISC) comprises of 25 items, each rated on a 5-point scale (Campbell-Sills & Stein, 2007; Connor & Davidson, 2003). The scale was developed under the conceptualization that resilience was a personal ability to cope successfully with stress. The CD-RISC was originally to assess treatment response of anxiety, depression, and stress reactions in clinical settings. The validity and reliability were tested in both general and clinical norm groups. The scale showed very high internal consistency ($\alpha = .93$), good test-retest reliability (intraclass correlation coefficient = .87), and acceptable convergent validity with high correlations to other scales such as the Kobasa Hardiness Scale ($r = .83$), the Perceived Stress Scale ($r = -.76$), the Sheehan Stress Vulnerability Scale ($r = -.32$), and the Sheehan Disability Scale ($r = -.62$). Factor analysis yielded five factors: (1) personal competence, high standards, and tenacity; (2) trust in one's instincts, tolerance of negative effect, and strengthening effects of stress; (3) positive acceptance of change and secure relationships; (4) control; and (5) spiritual influences. The authors concluded that the CD-RISC was a good measure of resilience that could potential utilized in both clinical practice and research.

The Resiliency Scales for Children and Adolescents (RSCA) consists of 64 five-point-Likert items categorized into three self-report questionnaires and ten subscales: sense of mastery scale (three subscales: optimism, self-efficacy, and adaptability), sense of relatedness scale (four subscales: trust, support, comfort, and tolerance), and emotional reactivity scale (three subscales: sensitivity, recovery, and impairment). The RSCA was standardized in many norm groups and showed that the reliability, convergent validity, divergent validity, and criterion validity were acceptable. The scale was originally used in clinical practice to screen personal resiliency and vulnerability characteristics in children and youth. However, the RSCA did not cover family or external resources (Prince-Embury, 2007) .

Resilience Scale for Adults (RSA) includes 37 items (Friborg, Hjemdal, Rosenvinge, & Martinussen, 2003). The scale was original developed to examine psychological and personal protective factors presumed to facilitate adaptation to psychosocial disorders. The RSA was tested in psychiatric outpatients and a general sample of adults aged 18–75 years. Factor analysis yielded five dimensions: personal competence, social competence, family coherence, social support, and personal structure. Validity and reliability were acceptable. The authors concluded that the RSA was an appropriate assessment tool of protective factors in health and clinical psychology to prevent psychological disorders and to maintain mental health.

Resilience Scale for Adolescents (READ), introduced by Hjemdal, Friborg, Stiles, Martinussen, and Rosenvinge (2006), was the expansion of the RSA for adolescents. Including 39 items, the READ showed good fit for five factors: personal competence, social competence, structured style, family cohesion, and social resources. Standardized with junior high school students in Norway, the scale was satisfied in both validity and reliability. The authors concluded that the READ with five-factor solution captured protective factors for resilience at levels of individual dispositional attributes, family cohesion, and external support systems.

Child and Youth Resilience Measure (Ungar et al., 2008) includes 28 five-point-Likert items. The purpose of this scale was to examine the concept of resilience across different cultures. The scale was standardized in children and youth at risk in 11 countries with 11 different languages. Items were categorized into four dimensions: individual, relational, community, and culture. The authors found that the key factors underlying resilience were universally accepted across countries, but there were some differences in perception of the youths when completing the questionnaire.

Ego-Resiliency Scale (ER89), developed by Block and Kremen (1996), consists of 14 four-point-items. Ego-resilience was conceptualized as the characterological ability of individuals to adapt their level of control temporarily up or down to environmental context. Individuals with a high level of ego-resiliency are more likely to exhibit positive developmental outcomes when confronted by stressful circumstances than those with a low level. Standardized in college students aged 18 and 23 years, the ER89 was highly correlated to intelligence and other personality scales. Although referred to a stable characteristic, the concept of ego-resilience has been still widely used in practice and research to date.

Resilience Scale (Wagnild & Young, 1993) comprises of 25 seven-point scale scored from 1 = *disagree* to 7 = *agree*. Another 14-item version was developed later. The scale was developed to measure a person's capacity to live a full and rewarding life through five dimensions: equanimity, perseverance, self-reliance, meaningful life, and existential aloneness. The scale has demonstrated good psychometric properties in many studies involving adolescents and adults. The scale with strong reliability and validity support was one of the most popular measurement tools to screen individual resilience-related attributes.

Dispositional Resilience Scale (DRS-15), developed by Bartone (2007), consists of 15 four-point-Likert items. The scale was used to measure psychological hardiness of commitment, control, and challenge. Standardized with military and non-military samples, the DRS-15 demonstrated good internal consistency ($\alpha = .82$) and test-retest reliability ($\alpha = .78$). However, the concept of hardiness refers to fixed personality style, contrary to the basic notion of resilience as a dynamic process.

Resilience Appraisals Scale (RAS) was introduced by Johnson et al. (2010). Based on the concept of individual's appraisal system, the appraisals model suggested that positive self-appraisals might be important for buffering risk behaviors, potentially providing a key source of resilience. The RAS consisted of 12 five-point-items and categorized into three subscales: emotion coping appraisals, situation coping appraisals, and social support appraisals. The RAS developed originally to support the Schematic Appraisals Model of Suicide. Tested in college students in England, the RAS showed that positive self-appraisals buffered individuals from suicidality in the face of stressful life events.

Resilience Indices (RI) used 31 items in Add Health data at Wave I to construct the scale (Ali, Dwyer, Lopez, & Vanner, 2010). The RI was used to examine factors associated with resilience and vulnerability on three levels: personal, family, and community. Exploratory factor analysis yielded three exclusive factors: overall-resilience, family-resilience, and self-resilience. The results showed that the high scores in the Resilience Indices reduced risk for smoking, drinking alcohol, and using illegal drugs.

Brief Resilience Scale (BRS), introduced by Smith et al.(2008), comprises of six 5-point items. The strategy was to use as few items as necessary to develop a reliable scale for capturing the construct of resilience. The BRS was developed under the notion of resilience as bouncing back from stress. The scale was tested in several samples including undergraduate students, cardiac rehabilitation patients, and healthy controls. The authors found that the set of few items was reliable and measured as a unitary construct, and that the BRS scores could predict health outcomes when controlling for resilience resources.

Theoretical approaches in resilience studies. Many theories, models, and frameworks have been proposed to explain how the resilience process helps individuals overcome adverse and stressful events.

One of the earliest models to explain the phenomenon was the Resiliency Process Model developed by Richardson and his associates (2002; 1990). At any point in time, every individual is in the status of biopsychospiritual homeostasis in which the person adapts physically, mentally, and spiritually to current life circumstances. The balance usually is attacked by a variety of internal and external stressors or adverse life events. If the adaption is ineffective or the protective factors are insufficient, the biopsychospiritual homeostasis is disrupted. At that time, the person copes with this disruption through a reintegrative process that makes him/her return to or reestablishes the homeostasis with one of the following outcomes: resilient reintegration, reintegration back to homeostasis, reintegration with loss, and dysfunctional reintegration. *Resilient reintegration* means that the adaption to the disruption leads to a new and higher level of homeostasis. *Reintegration back to homeostasis* occurs when the person returns to the previous level of homeostasis. *Reintegration with loss* occurs when the person recoveries from the adversity but is in the lower level of homeostasis. In *dysfunctional reintegration*, the person deals with adversity through maladaptive strategies, e.g., destructive behaviors such as suicide, violence, or substance abuse. In the model, resilience is the reintegrative process that leads the individual to deal effectively with the adverse life events and to maintain homeostasis (see Figure B.1 in Appendix B).

The Resiliency Process Model also explains why resilience process occurs in individuals who are exposed to adversity. Disruption in homeostasis is the result of the interaction between negative life events and protective factors. One disruption occurs and people fail to adapt

positively (reintegration with loss and dysfunctional reintegration), they learn from the circumstance. When faced with the similar situation that resulted in the previous disruption, one can find some ways to avoid the failure. Resilience process occurs during entire lifespan, so that most events become routine and less likely to be disruptive.

The Developmental-Contextual Model of Resilience, proposed by Schoon (2011), emphasized the human development within an ecological system. In her view, experiences to adversity in early stages of life such as childhood or early adolescence do not necessarily predict negative development outcomes later. Human development results from the interaction of genetic, biological, psychological, and SES factors in the context of environmental supports and constrains. Given a particular individual x environment interaction, resilience is different processes that can promote an effective life adaption through the experience of adversity. Based on the developmental-contextual perspectives, resilience process can be explained by different models. The *compensatory model* assumes that resources within an individual and the environmental context neutralize the negative effects of the risk exposures. These resources include self-regulation, self-esteem, cognitive competences, family support, supportive social networks, and social policies. The *moderating effect model* (or *protective model*) of resilience suggests that exposure to a protective factor has beneficial effects only for individuals who are exposed to risks but not benefit for those who are not exposed. When the level of risk is high, resilience protective factors lead a person to reduce the risk effects, to prevent negative chain reactions, and to provoke positive chain reactions. On the other hand, the *challenge model* explains the resilience process in individuals who are exposed to low-level risk. Experience with low-level risk is benefit because this provides a chance to practice and enhance problem-solving skills. The risk exposure, however, must be challenging enough to stimulate the positive

response and not be overpowering to produce significant harmful effects. The *turning point model* is appropriate to explain resilience in adult or older populations. Delayed recovery comes from positive adult experiences or turning point experiences. Most turning points occur during transition periods such as entering into college, marrying, or parenting. The new social roles and changes in environmental context can contribute to positive adaption in the face of adversity.

Fergus and Zimmerman (2005) proposed a framework for understanding how adolescents gain healthy developments such as the absence of substance use, violent behavior, and sexual risk behavior in the face of risk. The central element in the framework is the promotive factors that help adolescents avoid the negative effects of risk. Promotive factors are either *asset*—the positive factors that reside within the individual such as coping skill and self-efficacy, or *resource*—the external positive factors such as social supports. Depending on a particular context and situation, the authors explained several mechanisms of how promotive factors help a young person gain competence and avoid the negative effects of risks. In the *compensatory model*, a promotive factor counteracts or operates in an opposite direction of a risk factor. Positive outcomes thus follow the direction of the promotive factor. In another model, the *protective model*, promotive factor moderates or reduces the effects of a risk on a negative outcome. Protective factors alter the relationship between a risk and outcomes in different ways: neutralizing the negative effects of risks (protective-stabilizing model) or lowering the effects of risks (protective-reactive model). In the *challenge model*, the association between a risk and an outcome is not linear. Exposure to very low levels and high levels of risks increase negative outcomes, however, rather low and moderate risk levels are likely to reduce negative outcomes or to increase positive outcomes. The explanation is that confronting with enough of the risks helps an adolescent has a chance to practice skills or to employ resources. Another type of the

challenge model is the *inoculation model*. This model assumes that exposure to low or moderate risk levels helps inoculate adolescents to the risk. As a result, they are prepared to deal successfully with higher levels of the risk when they confront it in the future (see Figure B.2 in Appendix B). The framework has been applied popularly in research to build models for testing theoretical hypotheses.

Risk and Protective Factors in the Context of Resilience

Definition of risk. A simple and common definition of *risk* or *at-risk* is an elevated chance or a probability of undesirable outcomes. However, when applying it into practicing and delivering health services, the concept of risk may be more complex. G. Resnick and Burt (1996) defined:

> Risk is the presence of negative antecedent conditions (risk antecedents), which create vulnerabilities, combined with the presence of specific early negative behavior or experiences (risk markers) that are likely to lead, in time, to problem behavior that will have more serious long-term health consequences (risk outcomes) (p. 174).

This definition included four major elements of risk: risk antecedents, risk markers, behaviors, and outcomes. The authors also suggested an ecological perspective on risk. People increase at-risk when their environments make them vulnerable such as lack of social resources, exposure to stress events, and insufficient family and community supports.

McWhirter, McWhirter, McWhirter, and McWhirter (1995) emphasized the future time dimensions inherent in the term of risk: “at-risk is viewed not as much as a current situation, although it is sometimes unfortunately used in that way, but rather as an anticipated potential”.

The underlying concept is that an individual or a group of people has an obvious chance to develop adverse health-related outcomes within long periods of lifetime.

Risk factor. The World Health Organization (2003) defined that a risk factor is "any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury". There are various sources of risk such as low SES, underweight, unsafe sex, high blood pressure, and consumption of tobacco, alcohol and illegal drugs. Risk factors also come from a number of stressful events that have occurred recently or throughout a lifetime, e.g., massive community trauma, low birth weight, and divorce. Risk factors can occur at multiple levels including family, community/institutional, and social/cultural levels.

Low SES is one of the most important risk factors for health risk behaviors in all stages of life. Low family income reduces the ability to purchase healthy food, live in comfortable housing or healthy environment, and access to appropriate health care services (MacKay & Duran, 2008). Low education prevents young people from learning updated knowledge to maintain and improve their health. Family context is a prominent source of either risk factor or resilience factor contributing to human development. Parental mental disorders strongly influence on the developmental outcomes of children, adolescents, and possibly young adults. In a study on children ages 2–17 years old whose mothers were serious mental disorder, Tebes, Kaufman, Adnopoz, and Racusin (2001) found that interrupted family processes such as parent-child dysfunctional interactions, parental distress, disruptions in parent-child bond, and familial stress were consistent and powerful predictors of child adaptation measured in terms of child problem behaviors and child competence.

Accumulation of risk factors. Although every risk factor is usually associated with negative outcomes, the extent to which and the severity risk factors influence on developmental outcomes are not equivalent. In fact, severity depends on the combination of risk factor, target population, and socio ecologic environments. For example, in a study on 1,235 children who lived in urban poverty, Fotso et al. (2009) reported that vulnerability was associated more with poverty and neighborhood characteristics than with orphanhood.

Risk factors seldom occur in isolation. An adverse health outcome results from a chain of events via a number of intermediary and concurrent causes. Generally, level of at-risk is due to exposure to multiple adversities over time. As a result, a negative outcome often comes from an accumulation of all risk factors a person faces with over long periods of lifetime. Cumulative risk measures are consistently better to explain variance in developmental outcomes than a single risk factor (Atzaba-Poria, Pike, & Deater-Deckard, 2004; Flouri & Kallis, 2007; Flouri, Tzavidis, & Kallis, 2010; Gerard & Buehler, 2004).

Risk and vulnerability. There is little difference in the term of risk and vulnerability. Some authors view that risk is a more appropriate term for groups whereas vulnerability is a term best suited for individuals (Gordon & Song, 1994; Masten, 1994). Others conceptualize that vulnerability is as at-risk of poor physical, psychological, or social health (Aday, 2001). Vulnerable person is likely to develop a negative health-related outcome when faced with adversity. Generally, vulnerability is usually considered as a result from exposures to risk. Thus, the concept of resilience and vulnerability may be at the opposite of a continuum, reflecting susceptibility to adversity at one end and neutral or positive consequences upon exposure to risks at the other (Rutter 1990).

Protective factors. Contrary to risk factors, protective factors are personal or environmental elements that protect individuals from risk agents by enhancing positive outcomes or by reducing negative outcomes. Most research has explored protective factors at three levels: individual attributes, family relations, and community networks.

Positive individual attributes include self-esteem, self-control, self-efficacy, ambition, confidence, intelligence, optimistic perspective, and coping skills. For example, Gerard and Buehler (2004) found that cumulative environmental risk including family detachment, family poverty, school detachment and neighborhood problems negatively affected on adjustment problems of adolescents. However, youth attributes as self-esteem are protective factors that compensated for these risk factors.

Family dysfunction is another source of risk factor for children and adolescents. Based on results from a study on middle-school students who were exposed to interparental conflict, Ghazarian and Buehle (2010) proposed a mechanism that protective factors moderate harmful effects of the risk factor. First, the findings showed a negative association between interparental conflict and academic achievement. Second, they found this association was partially mediated by the child's cognitive appraisals of self-blame and perceived threat. Last, they figured out that mother-child connectedness and maternal monitoring knowledge (mothers who monitor youth activities to gain knowledge about youth extracurricular and peer interactions) partially buffered the association between interparental conflict and youth self-blame and perceived threat.

With regard to negative effects of divorced family, a longitudinal study was conducted on children aged 8 to 15 years whose families had divorced within the past 2 years (Wolchik, Wilcox, Tein, & Sandler, 2000). The authors emphasized that parental divorce can have serious negative effects on child and adolescent functioning. However, children who reported high

acceptance and high consistency of discipline, measured as mother-child relationship, had the lowest levels of adjustment problems. In addition, children who and whose mothers participated in a randomized, experimental trial to modify risk factors and support resilience resources after parental divorce increased the adaptation outcomes over 8–15 years of follow-up (Wolchik et al., 2009)

Risk factors outside the family context appear a significantly adverse environment that interferes with the individual's achievement, especially in the transition to adulthood. A longitudinal study by Gorman-Smith, Henry, and Tolan (2004) on youths living in inner-city neighborhoods showed that exposure to community violence in mid-adolescence was related to perpetration of violence in late adolescence. However, the effect of neighborhood violence on the youth committing violent acts differed by family type. Youth in the high level of functioning family did not change in the odds of violent involvements associated with violence exposure, while those from moderately functioning family or struggling families significant increased probability of committing violent acts. The author explained that families with poor parenting practices and low levels of emotional cohesion were more likely to be exposed to community violence, thus increase the odds of youth violence.

Such research has evidenced that individual resilience buffers protective factors to help young people overcome the significant risk factors. The relationship among resilience and protective factors, vulnerability and risk factors are simply illustrated by Werner's definition: "Resilience and protective factors are the positive counterparts to both vulnerability, which denotes an individual's susceptibility to a disorder, and risk factors, which are biological or psychological hazards that increase the likelihood of a negative developmental outcome in a group of people" (Werner & Smith, 1992).

Social Support

Social support including parental, friend, and community supports is particularly important during adolescence because it is a time of transition when a young person must experience with physical, psychological, and social changes. There are strong evidences that positive social support during early adolescence remains long-term effects on health-related behaviors in later stages of life. In the recent study, Johnson, Giordano, Manning, and Longmore (2011) used data from the Toledo Adolescent Relationships Study, a longitudinal study on adolescents in Lucas County, Ohio. The authors reported that that early parental support reduced criminal offending behaviors of drug use and delinquency. The effect of this support extended into the late adolescence and young adulthood.

Another longitudinal study, the "Welfare, Children and Families: A Three-City Study", conducted in adolescents at risk of urban poverty. Following up a cohort of young adolescents aged 10 and 11 from baseline (2000/2001) to middle adolescents (2005/2006), Ghazarian and Roche (2010) found that social network support and parental engagement were associated with less youth delinquency during transitions into middle adolescence.

In the context of resilience, empirical research has examined resilience factors that buffer and moderate a variety of negative environmental effects. Low SES is one of the most popular risk factors in literature. In an epidemiological cohort of 1,116 five-year-old twin pairs, Kim-Cohen, Moffitt, Caspi, and Taylor (2004) revealed that maternal warmth, stimulating activities, and children's outgoing temperament were factors to promote resilience in children exposed to SES deprivation.

The Kauai study was one of the longest cohort studies that followed up participants from birth to adults. Werner and Smith (1982) found that resilient teenagers were associated with

emotional support from family (e.g., family with fewer children, with a space of two years or more between themselves and next their sibling, and presence of alternate caregivers other than the parents) and outside family (e.g., in church, close friends, or school). These social supports remained important role in establishing resilience in late adolescence and adulthood. Individuals with serious coping problems by age of 32 years were directly related to the disruptions of the family unit since early and middle childhood, involving loss or separation from a caregiver or loved one (Werner & Smith, 1992).

Health Risk Behaviors among Adolescents and Young Adults

Suicide and suicidal behaviors. It is common to think that suicide mostly occurred in the people who suffer from depression and other kinds of mental disorder. Because psychiatric and physical illnesses, functional impairment, and social isolation tend to increase with age, suicide rate tended to increase in the older adults. However, recent findings appear to challenge the traditional suicide model, that is, suicide rates have remarkably increased among adolescents and young adults but reduced in the older populations. Youth and adolescence suicide has emerged as a public health problem in the United States. The Healthy People 2020 still calls for the reduction of the rate of suicide attempts by adolescents as one of the national health objectives (U.S. Department of Health and Human Services, 2010).

Every year, more than one million people commit suicide worldwide. The CDC (2012) reported that suicides accounted for 1.3% of all deaths in the United States with about 37,000 fatal suicides annually. Suicide is the third leading cause of death for young people ages 10–19 years and the second leading cause of death among college age youth. For the group of people aged 15–24, suicide accounts for 12.3% or 5,000 of all deaths annually (CDC, 2010). More

teenagers and young adults died of suicide than from cancer, heart disease, AIDS, birth defects, stroke, pneumonia and influenza, and chronic lung disease combined (National Strategy for Suicide Prevention, 2006).

Improvements in medical techniques in addition to decreases in death associated with unintentional injuries, infectious diseases, cancer, and congenital anomalies led to substantial decreases in the overall annual death rate of adolescents from 1950 to 1993. However, during this period, the suicide rate among adolescents nearly tripled in the U.S., going from 4.5 to 13.2 per 100,000 (American Association of Suicidology, 2007). This increase in the suicide rate was thought to be attributable to an increase in alcohol and substance abuse and the increased availability of firearms over this period (Brent, 1987). Between 1991 and 2007, the percentages of high school students who reported attempting suicide (7% to 9%) and whose suicide attempts required medical attention (2% to 3%) remained rather constant. In fact, there has been a general decline in youth suicides since 2003 due to efforts of suicide interventions (National Center for Health Statistics, 2008).

Suicidal ideation is common in adolescents. Eaton et al. (2010) noted an alarming prevalence of suicidal behavior among adolescents. For example, 13.8% of high school students seriously considered attempting suicide, 10.9% of students made a specific plan to attempt suicide, 6.3% of students attempted suicide one or more times, and 1.9% of students made a suicide attempt that resulted in an injury, poisoning, or an overdose that had to be treated by a doctor or nurse. Marcenko, Fishman, and Freidman (1999) reported that 70% students admitted at least one incident of ideation or of taking action to end their life. Research has demonstrated that suicide ideation or attempt is likely to develop into an actual suicide in the future. Christiansen and Jensen (2007) found a completed suicide occurred four times more often among

suicide-attempters than among non-attempters. A study by Janine, Laura, and Ginley (2001) reported about eight attempted suicides to one completion. The ratio of suicide attempt to completion is higher among the young than in older adults. For example, Goldsmith, Pellmar, Kleinman, and Bunney (2002) estimated one suicide for every 100–200 attempts among adolescents as compared to one suicide for every four suicide attempts among adults aged 65 years or older. Therefore, study of attempters or ideators can provide important indicators uniquely contributing to an eventual suicide. Exploring nonfatal suicidal behaviors thus gives precious information of factors that lead youth to do harmful acts.

Violent behavior. Violence may occur in all stages of life, but most involves in the young populations. Youth violence affects not only on the victims, but on their families, friends, and communities as well. The harmful effects of violence not only limit injuries and death, but also broaden in term the quality of life such as disability and psychological harm. According to the CDC (2011a), homicide is the second leading cause of death among youth aged 10–24 years in the United States. A total of 5,764 adolescents died from homicide injuries in 2007, accounting for the age-adjusted rate of 8.8 per 100,000. Violence is also a major cause of nonfatal injuries in young populations with 661,983 victims, accounting for the rate of approximate 1.1 per 1,000 in 2010 (CDC, 2011a). In 2009, the Federal Bureau of Investigation (FBI) reported that 67,855 people under 25 years old were arrested for violent crime, accounting for 44.3% of all offenders arrested this year. Besides deaths and injuries, violence accounts for a large amount of costs for health, welfare services, as well as indirect costs due to missing work and decreased productivity. A report by the CDC (2011a) showed that over 41,000 physical assault injuries in young people were hospitalized in 2005, accounting for the cost of 752 million dollars. If taken cost for work lost into account, the total cost exceeded 3.5 billion dollars.

Violence often occurs in youths and adolescents. The 2009 Youth Risk Behavior Surveillance (YRBS), conducted biennially by the CDC, showed that about 32% of high school students reported being in a physical fight in the 12 months before the survey; nearly 6% reported taking a gun, knife, or club to school in the 30 days before the survey; and 20% reported being bullied on school property (Eaton et al., 2010).

A common conceptualization of violence has approached in the physical nature of violence acts. Violence or violent behavior is considered as "behavior by persons against persons that intentionally threatens, attempts, or actually inflicts physical harm" (Reiss & Roth, 1993, p. 35). Olweus (1999) stated "violence or violent behavior is aggressive behavior where the actor or perpetrator uses his or her own body or an object (including a weapon) to inflict (relatively serious) injury or discomfort upon another individual" (p. 12). These are criticized for being too narrow due to focusing only on the physical aspects of violence. However, non-physical acts as verbal aggression and psychological harassment, while not physically harmful, can cause serious emotional harm in those who are victimized (Aisenberg, Gavin, Mehrotra, & Bowman, 2011).

According to The World Health Organization violence is defined as "the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or a community, that either results in or has a high likelihood of resulting in injury, death or psychological harm, maldevelopment or deprivation" (Krug, Dahlberg, Mercy, Zwi, & Lozano, 2002). The definition includes various behaviors that cause mild physical harm such as bullying, slapping or hitting; and more physical harm such as robbery and assault (with or without weapons) leading to serious injury or even death. Such approach also involves acts resulting in emotional harms, for example, deprivation, psychological abuse, and neglect.

Due to many appropriate interventions aimed to prevent violence in youths, rates of violence have reduced in recent decades. According to the CDC (2011b), during 1991 to 2007, homicide rates among adolescents ages 10–24 years dropped from 15.6 deaths per 100,000 in 1991 to 9.1 deaths per 100,000 in 2007. However, homicide rate is still consistently higher in persons ages 10–24 years than in all ages combined (9.1 vs. 6.1 per 100,000).

Similarly, the FBI publishes an annual report the *Crime in the United States*, which provides the demographic characteristics of arrests. Based on this reports, number of arrests for violence crime has reduced in recent years. The juvenile arrest rates for violent crime in 2008 was 3.06 per 1,000, down 49% from its 1994 peak (Puzzanchera, 2009).

Substance use. Substance use is referred to as the consumption of alcohol, cigarette, marijuana, cocaine, inhalant, and other drugs. A maladaptive pattern of substance use is substance dependence and substance use disorders. The future Diagnostic and Statistical Manual of Mental Disorders (DSM-5), expected to release in May 2013, has proposed subsuming them under one new category called substance use disorders (American Psychiatric Association, 2012). According to the DSM-V, substance use disorder is characterized by preoccupation with obtaining and a narrowing of the behavioral repertoire towards excessive consumption, loss of control over consumption, and having tolerance and withdrawal syndromes. Substance use disorder leads to clinically significant impairment or distress, such as a failure to fulfill major role obligations at work, school, or home, and persistent social or interpersonal problems.

Substance use causes various adverse health-related outcomes. Cigarette smoking and other nicotine-containing tobacco products involve many chronic diseases and premature death, but do not cause gross impairment in function. Alcohol, similarly to cigarette, results in chronic diseases, premature death, and some degrees of impairment in function if used excessively. Most

illegal drugs such as cocaine, heroin, and marijuana damage individual's brain, heart and other organs, and cause severe impairment in functioning.

Smoking and smokeless tobacco uses are almost initiated and established during adolescence. In the United States, 18.9% of youths 16 to 17 year olds and 38.5% of young adults aged 21 to 25 years were current cigarette smokers (Substance Abuse and Mental Health Services Administration [SAMHSA], 2008). Eighty percent of adult smokers first become regular smokers before the age of 18 (CDC, 2010). More than 1/3 kids who ever try smoking a cigarette become regular, daily smokers before leaving high school. By the end of high school, 43.6% of all kids have tried smoking (Johnston, O'Malley, Bachman, & Schulenberg, 2011).

Unlike violence and suicidal behaviors, the harmful health effects of cigarette can last throughout smoker's life with high rate of morbidity and mortality. Each year, an estimated 443,000 people die prematurely from smoking or exposure to secondhand smoke, another 8.6 million live with a serious illness caused by smoking, and the total economic burden of smoking is approximately $193 billion (CDC, 2008).

Illegal drug uses such as cocaine, heroin, marijuana, amphetamine, methamphetamine, ecstasy, or ketamine. are more common in adolescence than other age groups. According to the SAMHSA (2008), the rates of illicit drug use were higher for young adults aged 18 to 25 (19.7%) than for youths aged 12 to 17 (9.5%) and adults aged 26 or older (5.8%). Similarly, alcohol was very common among adolescents and young adults. Rates of drinking were 29.0% of those aged 16 or 17 years, 50.7% of those aged 18 to 20, and 68.3% of those aged 21 to 25 years.

One of the most precise data providing information about substance uses among adolescents is the YRBS conducted by the CDC. Based on the 2009 YRBS, 46.3% of high school students in the United States had ever tried cigarette smoking and 26.0% of students were

current cigarette use. Seventy two percent of students had at least one drink of alcohol on at least one day during their life, and 24.2% of students had five or more drinks of alcohol in a row (binge drinking). Nearly thirty seven percent of students had ever used marijuana one or more times during their life and 2.1% of students had used a needle to inject any illegal drug into their body one or more times during their life (Eaton et al., 2010). In the view of youth, substances use comes to serve as a coping function to reduce stress and deal with negative affect events. The common reasons for consumption of alcohol and marijuana are to get high, to have a good time, to sleep, to deal with boredom, and to relax (Patrick et al., 2011).

Although the prevalence of these health-risk behaviors among adolescents has decreased in recent years, many young people continue to engage in behaviors that place them at risk for the leading causes of morbidity and mortality.

The Literature and the Current Research

This review of literature highlights several key themes important to understand the conceptualization of resilience and other psychological constructs related to resilience such as risk, risk factor, protective factor, and vulnerability. The review also emphasizes the important roles of social support on health-related problems among adolescents. Social support is also a very crucial factor to help adolescents and young adults overcome difficult and adverse events in their lives. In the dissertation, health risk behaviors consisted of suicide, violence, and substance uses. The review of literature presents the importance of the problem that harms the healthiness of people. The review also links resilience components such as risks, protective factors, and adversity to health risk behaviors. Evidences from previous theoretical and empirical research help the researcher develops the study design, conducts data analysis, and interprets the results.

CHAPTER 3: METHODS

Introduction

The purpose of the dissertation was to determine whether resilience status was stable across time, to examine the relationship between resilience scores and the resilience status, and to explore the effects of social support over a long period of lifetime.

This chapter starts with an overall design of the National Longitudinal Study of Adolescent Health (Add Health) study from which the data of my dissertation were derived. Next, the chapter presents a detailed description of all parameters used in analysis including the study sample, as well as the dependent, independent, and potential confounding variables. An introduction of statistical analysis methods employed in the next chapter is provided in this section. Finally, a discussion of ethical issues, strictly required in social science study, is placed on the end of this chapter.

Data Source

Study design. Data were derived from the public-use version of the National Longitudinal Study of Adolescent Health (Add Health). This longitudinal study was developed and coordinated by researchers at the Carolina Population Center, and funded by the National Institute of Child Health and Human Development and 17 federal agencies with the purpose of assessing the health of adolescents and their health-related behaviors. The Add Health cohort began in 1994 with a representative sample of adolescents from grades 7–12 in the United States. The participants were followed up into adulthood through four time-points of repeated interviews during 1994–2009.

The Add health survey has examined numerous aspects of adolescents' lives including general health, well-being, behaviors that promote health or are detrimental to health, and how social environments and behaviors in adolescents are linked to health and achievement outcomes in young adulthood. The data included vital areas such as chronic and disabling conditions, injury, mental health status, suicidal behaviors, health-service access and use, personality, physical activity, diet, substance use/abuse, violence, and sexual behavior (Harris et al., 2009).

Participants and sampling. Add Health used stratified, random sampling for all high schools in the United States. The criteria for selection were that schools had to include an 11th grade and had a minimum enrollment of 30 students. A total of 80 high schools were selected to be representative of the United States schools by a number of variables including urbanicity, (urban/suburban/rural), census region, school type (public/private/parochial), school size, and ethnic diversity. As such, school became the cluster identifier or primary sampling unit (Harris et al., 2009). The participating high school then was used to recruit one feeder school–the schools that included a 7th grade and sent at least five graduates to that high school. A total of 132 independent schools (some high schools spanned grades 7 through 12 and therefore a separate feeder school was not recruited) was selected; each school associated with one of 80 communities. Number of students per school varied from about 100 to more than 3,000 (Harris, 2011)

In-school survey. More than ninety thousand students in 7–12th grades from the selected schools completed a self-administered in-school questionnaire during 1994–1995. Each participant was provided an identification number to ensure that his/her name remained confidential. The questionnaire—required 45 minutes to finish—covered general descriptive information about parents, friends, school life, and a variety of health conditions and health-

related behaviors. School administrators also reported information about the school's characteristics, curriculum, and school services and programs. All students who participated in the in-school questionnaire were eligible for selection into the core (main) in-home samples (Harris et al., 2009).

In-home interviews. The core in-home interview's sample was created by stratified and random selection of students who completed or did not complete the in-school questionnaire. A total of 12,105 adolescents in the core sample, stratified by grade and sex, was representative of adolescents in grades 7–12 during the 1994–1995 school year in the United States. Then two supplemental samples were included to the study. First, the non-genetic supplement sample was generated by oversampling high parents' education Blacks; Cubans, Puerto Ricans, Chinese; and physically disabled students. Second, the genetic supplement sample was selected using sibling relationships such as twins, full siblings, half siblings, and unrelated adolescents living in the same household. The overall in-home interview's sample was 20,745 adolescents (Harris et al., 2009). In-home interviews were conducted in the participants and their parents separately.

Parental in-home interview. Eighty five percent of parents of the participating adolescents were interviewed at baseline. Parents completed a 40-minute, paper-and-pencil survey. The parental interview provided further information about the family context, heritable health conditions, education, employment, household income and economic assistance, parent-adolescent relationship, as well as adolescent's health status and health-related behaviors. There was only one in-home interview on parents at baseline.

Adolescent (adult) in-home interviews. Adolescent in-home interviews were conducted after parents or legal guardians and the adolescent signed in the written informed consent. There have been total four in-home repeated interviews conducted in the participants to date. The first

in-home interview (Wave I or baseline) was completed between September 1994 and April 1995. A total of 20,745 adolescents were interviewed in their homes using a Computer-Assisted Personal Interview (CAPI) or an Audio Computer-Assisted Self Interview (ACASI) for sensitive health status and health-risk behavior questions. Each survey took about 1 to 2 hours to complete. Participants were self-reported various domains of adolescence life including health, activities, school, relationships, behaviors, and beliefs.

The second wave (Wave II) was conducted between April and August 1996 on 14,738 adolescents. The Wave II sample was primarily drawn from participants in Wave I. However, Wave II sample did not involve 12th-grade and disabled adolescents. Original Wave I respondents were re-interviewed between August 2001 and April 2002 (Wave III). Respondents were between 18 and 26 years old at that time. A new "couples" sample including 1,507 romantic partners was recruited in the Wave III sample as their Add Health partner. The total Wave III sample included 15,197 young adults. Wave III data expanded some multiple domains of young adult life such as labor market, higher education, spousal relationship, parenting, civic participation, and community involvement. The fourth wave of in-home interviews (Wave IV) was conducted in 15,701 adults, from original baseline sample, between January 2008 and February 2009 when they were aged 24–32 and completed the transition to adulthood. Wave IV expanded the collection of biological data to understand the relationships between biological characteristics and health outcomes. The entire sample was collected DNA and indicators of cardiovascular health, metabolic syndrome, and immune functioning using noninvasive procedures (Harris, 2011).

The Research Sample

Data of the dissertation were parts of Add Health public-use data files relevant to health risk behaviors and resilience, including all four in-home interviews; and school interview, parent interview, and the contextual data at baseline. The public-use data sets consisted of one-half of the core sample, chosen at random, and one-half of the oversample of African-American adolescents with a parent who had a college degree at baseline. The total number of Wave I respondents in the public-use datasets was 6,504 with 5,800 variables (Udry, 1998). The public-use version of the Add Health data contained 4,834 respondents in Waves II, 4,882 respondents in Wave III, and 5,114 adults in Wave IV.

Depending on the purposes of study, Add Health data could be handled in either cross-sectional or longitudinal analyses. In cross-sectional models, data for both predicting and outcome variables are collected and analyzed at the same point in time. Cross-sectional data were also used to compute marginal or population-averaged parameters. There were four sets of cross-sectional data corresponding to four waves of repeated interviews. On the contrary, longitudinal models were mainly used to investigate changes in repeated measurements taken on individuals over time. The longitudinal data in the dissertation included only subjects who completed all four waves of in-home interviews. With regard to adjustment for the complex survey design, Add Health used different sampling weights for cross-sectional and longitudinal data to represent the national population. Cross-sectional sampling weights were separately applied to the corresponding cross-sectional data, while longitudinal sampling weights were determined by the data collected at the latest wave of repeated interviews (Wave IV in my dissertation).

Measures

Outcomes. The research outcomes were the presence of health risk behaviors including suicide, violence, and substance use. Outcomes in this study were dichotomous variables, coding for engagement and non-engagement in health risk behavior. On the other hand, resilience status was opposite to the health risk behaviors. Respondents who were absent from a particular health risk behavior were labeled as "resilient" to that behavior. These outcomes were examined for change over time. Items used to obtained outcome variables are listed in Table C.1, Appendix C. All items used to establish health risk behavior had to be identical across four waves of repeated interviews. This made comparisons across survey measurements meaningful and accurate.

Suicidal behavior. Suicidal behavior included ideation and attempt. Two questions were directly asked about the occurrence of suicidal behavior: "During the past 12 months, did you ever seriously consider attempting suicide?" and "During the past 12 months, how many times did you actually attempt suicide?" A score of 1 was assigned for either suicidal ideation or attempt of suicide. Respondents who had not thought about suicide and attempted suicide were coded 0.

Violence behavior. Participants were asked whether in the past 12 months preceding the surveys they pulled a knife or gun on someone, they shot or stabbed someone, someone pulled a knife or gun on them, and someone shot or stabbed them. Alpha reliability coefficients for the set of items were .72 at baseline, .75 in Wave II, .71 in Wave III, and .96 in Wave IV. A score of 1 in violent behavior meant that respondents involved in at least one such occasion. Otherwise, violence was coded 0.

Substance use. Substance use indicated the consumption of tobacco, alcohol or illicit drugs. Smoking was defined as having smoked 25 days or more of the 30 days preceding the survey (obtained from the question "During the past 30 days, on how many days did you smoke cigarettes?"). Alcohol drinking was defined as having one or more binge drink per month (obtained from the question "Over the past 12 months, on how many days did you drink five or more drinks in a row?"). Consuming illicit drugs meant that respondents ever used illegal substances such as marijuana, cocaine, or inhalants during 30 days preceding the survey (obtained from several questions, see Table C.1 in Appendix C for more details). Substance use was coded 1 if respondents had at least one of three types of above consumptions and zero otherwise.

Resilience status meant the lack of health risk behaviors. Due to variation in resilience across different domains of competence, resilience status was be broken down into particular health risk behaviors such as resilience on substance use, resilience on violence, and resilience on suicidal behaviors. For example, resilience on suicidal behaviors was defined as any participant who was coded 0 for suicide.

Adversity measures. Adverse living condition indicated that participating adolescents experienced significant risks or severe adversity in the early stages of life. Adversity was obtained by exploring respondents at baseline who reared in the negative conditions such as poverty, low mother's education, single parent, unemployed parent(s), disabled parent(s), intimate partner violence, parental alcohol use, not English as primary home language, and low SES community. Each adverse condition was a binary measure whose value was assigned 1 or 0.

Poverty. The respondent's family was in poverty if the family income was below the national poverty threshold for the year of 1994. This threshold, issued by the U.S. Census Bureau, varied depending on size of family and number of children. Participating adolescents in the school interview reported number of people living in their households. Based on such information, the poverty threshold was set for each family. In the parental interview, parent(s) reported the total 1994 family income before taxes. If total income was below the poverty threshold, the family was seen as poverty.

Low mother's education. This variable, obtained from the mother's self-report in the parental interview, indicated whether or not the respondent's mother (biological mother, stepmother, foster mother, or adoptive mother) had less than a high school diploma.

Single parent. This variable was derived from the household roster of the adolescent in-home interview. The participating adolescent described his/her detailed relationships up to 20 people in the household. Single parent meant that there was only one parent (biological or adoptive parent) was responsible for the raising of the respondent.

Unemployed parent(s). This variable, obtained from the parental interview, was to measure the parental employment status. Unemployed parent(s) indicated that the participant's mother or father was currently unemployed but looking for a job.

Disabled parent(s). This variable, obtained from the parental interview, indicated whether or not the respondent's mother or father was mentally or physically handicapped.

Intimate partner violence. This variable, obtained from the parental interview, meant that respondent's parents often (a lot) fought or argued each other.

Parental alcohol use. This variable was obtained from the parental interview. Parent(s) answered the question how often they drank alcohol and how many times they had five or more

drinks on one occasion. Parental alcohol use was coded 1 if the respondent's mother or father drank alcohol more than three days per week, or more than one binge drink (five or more drinks a row) per week.

Not English as primary home language. This variable was obtained from the question "What language is usually spoken in your home?" in the adolescent's in-home interview. A score of 1 was assigned to this variable if the participant spoke a language other than English at home

Disadvantaged community. Disadvantaged community was obtained from the contextual data. For each respondent, home location was identified and geocoded in order to link with the block group data from the 1990 Census of Population and Housing. The contextual data helped to assess most important characteristics of the places in which the participants lived. In the dissertation, disadvantaged community was coded 1 if the respondent lived in a location with at least two out of the five conditions: non-White modal race, separated or divorced modal marital status, high proportion of persons with income below the 1989 poverty threshold, high proportion of persons aged 25 years and over with no high school degree, and high unemployment rate.

Adversity score was constructed by summing all above negative conditions. The possible range for this measure was 0 to 9, but the actual range was 0 to 6. A cut-off of two was selected to generate an adversity subsample, that is, respondents who experienced two or more such adverse conditions at baseline were assigned to the adversity sample. The adversity sample included 1,861 respondents who are exposed to significant adversity at baseline. The follow-up adversity samples were 1,394 respondents at Wave II, 1,342 respondents at Wave III, and 1,413 respondents at Wave IV. Data structure is presented in the Figure 3.1

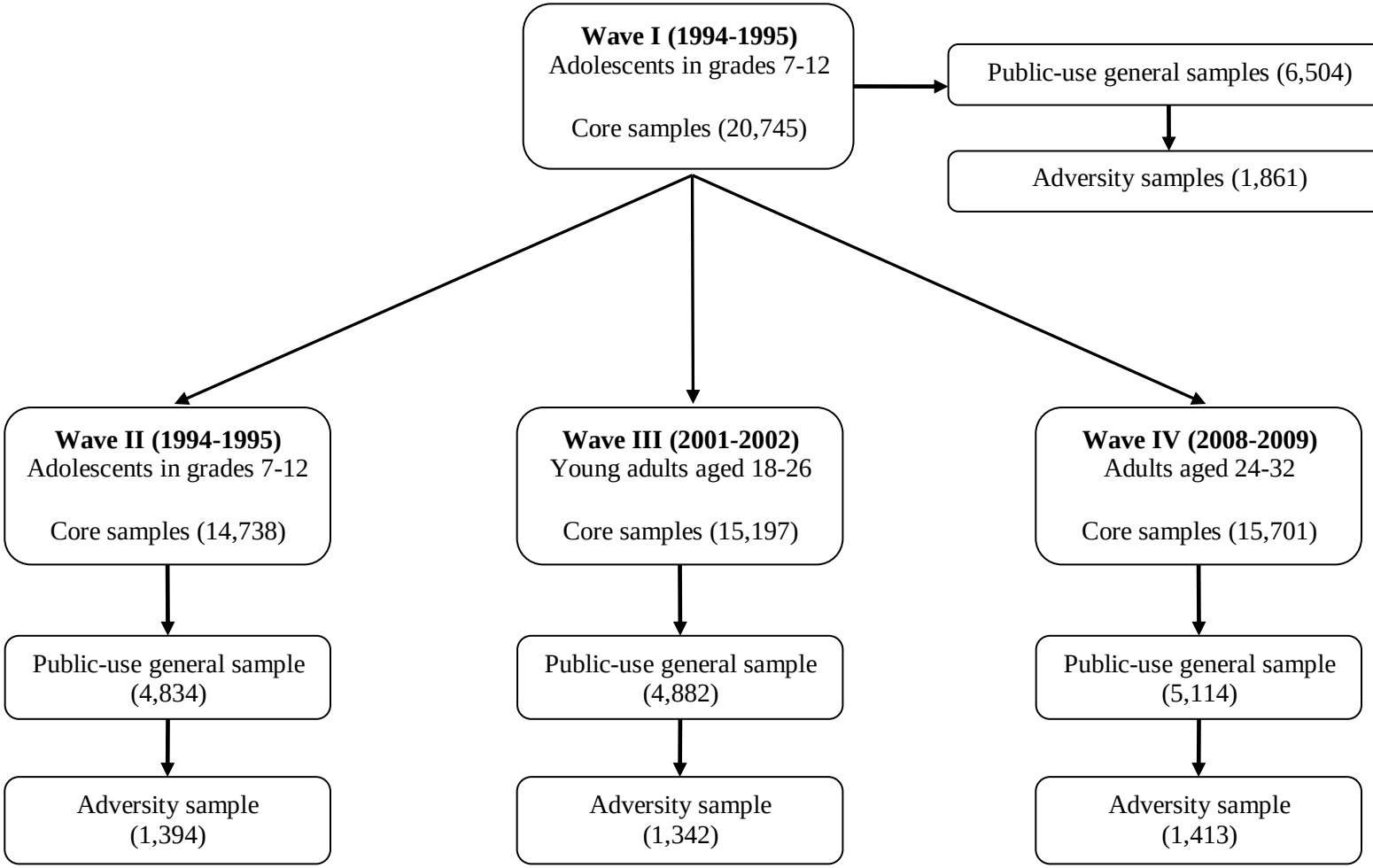

Figure 3.1. Data tree for the Add Health longitudinal design. This research used the public-use general samples and created adversity samples

Demographic measures. Socio-demographic variables obtained at baseline such as age, gender, grade, race/ethnicity, and family structure were taken into account to control their confounding effects.

Gender. Gender was a dichotomous variable. At baseline, interviewers confirmed that the respondent was male or female.

Age at base line. For each participating adolescent, baseline age was calculated by subtracting birthday from the date of Wave I interview. This was a continuous measure with mean and standard deviation of 15.96 and 0.11, respectively.

Time since baseline (or time). Time was measured as the period between the point in time of survey wave and baseline. Time was a continuous variable used in the longitudinal analysis. Time since baseline comprised of Wave II–baseline (M = 0.90 years, SD = 0.14), Wave III–baseline (M = 6.37 years, SD = 0.23), and Wave IV–baseline (M = 12.89 years, SD = 0.28).

In longitudinal analyses, "baseline age" was treated as a time-stationary variable, while "time since baseline" was considered as a time-varying measure. Age measured at baseline served as the fixed measure, indicating its effects due to different ages of the cohort participants entering the study. Time was referred to longitudinal or period effect. In addition, longitudinal age could be calculated by adding baseline age and time. Age and time, therefore, provide enough information about the cohort effect over time.

Race/ethnicity. In the baseline in-home interview, participating adolescents answered the question whether they were Hispanic or Latino background. If the participants answered "yes", they were coded as Hispanic. Otherwise, the participants then identified themselves as non-Hispanic White, Black or African American, American Indian or Native American, Asian or

Pacific Islander, and other. Race was broken down into six categories: non-Hispanic White, Asian Pacific, Black, Hispanic, Indian, and other. The dissertation used non-Hispanic White as the reference group.

Education. Participants reported their current grade at baseline. The Add Health recruited only adolescents in grades 7 to 12. Education was treated as categorical variable, coding "middle school" if participants were in Grade 7 and Grade 8, and "high school" otherwise.

Family structure. Family structure was a categorical variable. This variable was derived from the household roster of the baseline adolescent in-home interview. Participants described up to 20 persons living in their households. Information related to parents was selected to create the family structure variable. Family structure was coded as "biological parents" if both biological mother and biological father lived in the household. In case of the household with one biological parent and on stepparent, the family was coded as "stepparents". "Single parent" was defined as only one parent (biological or adoptive parent) responsible for the raising of the respondents. "Adoptive parents" were defined as families where the respondents were reared by both adoptive mother and father. For respondents who were not reared by parent(s), e.g., grant parent(s), or relative(s), family structure was categorized as "non-parent". The dissertation used biological parents as the reference group.

Measurement of the individual perceived resilience.

Construction of a Resilience Scale. Because Add Health was not specifically designed to explore individual resilience, the researcher selected items that measured aspects of perceived resilience. First, all items in the in-home interviews were carefully screened their content. Based on literature and the availability of the secondary database, the resilience scale was constructed

using items relevant to resilience attitudes. These items are scattered across many sections of the datasets such as feelings scale, neighborhood, protective factors, and personality and family sections. Respondents self-estimated their perceived conceptions about feeling, personal structure, self-control, ability to address life problems, and relationship with parents, peers and others. Unfortunately, most items related to the perceived resilience were not consistent through all four waves of the Add Health study. The dissertation, therefore, used items in baseline to construct the resilience scale.

A total of 35 items in the adolescent in-home interview at baseline were related to resilience (see Table C.2 in Appendix C). Generally, these items can be categorized into four categories: optimistic perspectives, emotional coping, problem-focused coping with difficult circumstances or stressful events, and ability to gain social support.

The "optimistic perspectives", or "optimistic" subscale, indicates acceptance of self and life, and positive future orientation. Eleven questions were used for this subscale. Participants scored about how much they enjoyed life, had lot of good qualities, had a lot to be proud of, liked themselves just the way they were, felt happy, felt as good as other people, felt they were doing everything just about right, and felt hopeful about the future; or felt sad, thought their life had been a failure, and felt life was not worth living.

There were two types of coping with difficult circumstances or stressful events: Emotional coping and problem-focused coping. "Emotional coping" consisted of seven questions. Participants scored how much they perceived that they were bothered by many things, could not shake off the blues, had trouble keeping their mind, were hard to get started doing things, went out of way to avoid problems, used "gut feeling" without thinking too much about the consequences when making decisions, and were very upset by difficult problems. In

"problem-focused coping", participants reported how they dealt with a problem. This subscale consisted of four questions. The higher scores indicated that the participants considered many facts about the problem, figured out many different ways to approach the problem, used a systematic method for judging and comparing alternatives, and analyzed what went right and what went wrong after carrying out a solution to a problem.

"Ability to gain social support", or "perceived social support" subscale, indicated the respondents perceived positive supports from family (parents, spouse and children) and supports outside family (friends, teachers, neighbors and others from communities the respondents lived). There were 13 items related to perceived social support. Participants scored how much they perceived parents, adults, people in family, teachers, and friends cared about them; they were happy with living in neighborhoods; they felt socially supported, loved, and wanted; and they felt lonely, unfriendly and disliked by others.

All above items were 4-point Likert items scored from 0 to 3, or 5-point Likert items scored from 1 to 5. The acquiescence bias, where participants tend to agree with any statement, often occurs in complex surveys. The Add Health used *reverse scoring* technique to avoid this type of bias (Miller & McIntire, 1994, p. 374). Items are asked in either favorable statements (e.g., you feel you are doing things just about right) or unfavorable statements (e.g., you felt that people disliked you), and scored in either ascending order (e.g., 0 = *never* to 3 = *most of the time*) or descending order (e.g., 5 = *strongly disagree* to 1 = *strongly agree*). Then, these raw scores were recoded so that a higher score indicates a higher positive behavior or a higher level of resilience. Score of 1 means the lowest level of resilience, whereas a score of 4 or 5 indicates the highest level of resilience. In order for correlation matrix to be more meaningful and comparable, scores then were transformed so that all items are same-point scales. Since very few participants

selected the lowest or highest score (score of 1 or 5) in 5-point items, such a value of score could be merged to its adjacent value. Therefore, all Likert type-items were 4-point without significant changes in their original distributions.

Validity and reliability.

Validity. Validity means that a psychological test measures and predicts what it claims to measure or predicts. In the dissertation, validity indicates how well the resilience scale measures individual perceived resilience. The content of all items of the resilience scale in the dissertation were closely similar with items found in other published tests such as Suicide Resilience Inventory-25 (Osman et al., 2004), Resilience Appraisals Scale (Johnson, Gooding, Wood, & Tarrier, 2010), Connor-Davidson Resilience Scale (Campbell-Sills & Stein, 2007; Connor & Davidson, 2003), and Resiliency Scales for Children and Adolescents (Prince-Embury, 2007).

In a previous study, Ali, Dwyer, Lopez, and Vanner (2010) chose 31 Add Health questions in Add Health Wave I to develop a resilience indices. Twenty-eight out of the 31 questions were chosen in the dissertation. Using exploratory factor analysis, these 31 questions were reduced to three, mutually exclusive, underlying, latent indices: overall-resilience, self/family-resilience, and self-resilience. The authors found that adolescents who had higher resilience scores were less likely to engage in smoking, drinking alcohol, and using illegal drugs.

At baseline, Add Health applied 19 items from the Center for Epidemiologic Studies Depression Scale to measure depression (Radloff, 1977) and six items from the Rosenberg's Self-Esteem Scale to assess self-esteem (Rosenberg, 1965). Of 35 items used to construct the research's Resilience Scale, 15 were originally from depression and six from self-esteem measures. In fact, resilience is related consistently and significantly to symptoms of depression and levels of self-esteem.

Many evidences have proven that increase in resilience scores leads to decrease in symptoms of depression. For instance, three subscales of Connor-Davidson Resilience Scale including self-confidence and optimism, being decisive and solution-focused, and seeking challenges and being persistent were most strongly negatively associated with depression measured by the Zung Selfrating Anxiety and Depression Scales (Bitsika, Sharpley, & Peters, 2010). In another study to explore the association between the Resilience Scale for Adolescents and the Depression Anxiety Stress Scales, Odin Hjemdal, Vogel, Solem, Hagen, and Stiles (2011) found that lower scores on levels of depression predicted higher resilience scores.

My dissertation used all six items from the Rosenberg Self-Esteem Scale to construct the Resilience Scale. Research has shown that Rosenberg Self-Esteem Scale is strongly correlated to various resilience measures in various settings, for example, the Resilience Scale and its short version in Japanese university psychology students (Nishi, Uehara, Kondo, & Matsuoka, 2010), the Connor-Davidson Resilience Scale in Korean youths and adults (Baek, Lee, Joo, Lee, & Choi, 2010), and the Resilience Scale in Swedish adults (Nygren, Randström, Lejonklou, & Lundman, 2004).

Reliability. Internal consistency was the one of the methods to indicate reliability of the resilience scale and its subscales. Internal consistency means different test items are measuring the same psychological attribute or trait. Cronbach's alpha coefficients were 0.88 for the overall Resilience Scale, 0.81 for Optimistic Perspectives subscale, 0.62 for Emotional Coping subscale, 0.74 for Problem-Focused Coping subscale, and 0.82 for Perceived Social Support subscale (see Table 3.1). According to the Nunnally's rule-of-thumb, an acceptable Cronbach’s alpha can be as low as 0.60 (Nunnally & Bernstein, 1994). Therefore, the overall resilience scale and its subscales were internally consistent.

Table 3.1

Mean, Standard Deviation of Items and Cronbach's Alpha of Resilience Scales at Baseline

Subscales and items (overall Cronbach's alpha = .88)	*M (SD)*
Optimistic Perspectives (Cronbach's alpha = .82)	
1. Had a lot of good qualities	3.28 (0.64)
2. Had a lot to be proud of	3.31 (0.70)
3. Liked themselves just the way they were	3.03 (0.92)
4. Enjoyed life	3.24 (0.86)
5. Felt sad	3.44 (0.68)
6. Felt as good as other people	2.93 (1.00)
7. Felt doing everything just about right	2.77 (0.86)
8. Felt hopeful about the future	2.84 (0.99)
9. Felt happy.	3.13 (0.81)
10. Thought your life had been a failure	3.79 (0.54)
11. Felt life was not worth living	3.84 (0.49)
Emotional Coping (Cronbach's alpha = .62)	
1. Bothered by things that usually don't bother	3.51 (0.69)
2. Could not shake off the blues, even with help from family and friends	3.62 (0.70)
3. Had trouble keeping your mind	3.19 (0.81)
4. Hard to get started doing things.	3.38 (0.68)
5. Went out of your way to avoid having to deal with problems in life	2.81 (0.99)
6. Used "gut feeling" without thinking the consequences when making decisions	2.94 (1.03)
7. Upset when dealing with difficult problems	2.43 (0.96)
Problem Focused Coping (Cronbach's alpha =.74).	
1. Got as many facts about the problem as possible when solving a problem	2.84 (0.83)
2. Thought many different ways to solve the problem	2.98 (0.74)
3. Used a systematic method for judging when making decisions	2.64 (0.85)
4. Analyzed right and wrong after carrying out a solution to a problem	2.80 (0.81)
Perceived Social Support (Cronbach's alpha =.82)	
1. Felt socially accepted	3.10 (0.74)
2. Felt loved and wanted	3.30 (0.70)
3. Felt disliked by others	3.58 (0.65)
4. Felt unfriendly by others	3.60 (0.63)
5. Felt lonely	3.54 (0.71)
6. Felt parents care about	3.80 (0.55)
7. Felt that the people in family cares about	2.64 (0.95)
8. Felt that family have fun together	2.77 (0.96)
9. Felt that family pays attention to	2.94 (0.90)
10. Felt adults care about	3.39 (0.80)
11. Felt teachers care about	2.59 (0.92)
12. Felt that friends care about	3.25 (0.78)
13. Happy with living in the neighborhood	2.95 (0.95)

Note. Most items were recoded into a 4-point scale that the greater scores indicated the higher perception of resilience

Measures of actual social supports. Since the resilience scale contained many items related to perceived social supports, another set of variables was generated to measure social supports that participants actually had. There are three levels of social support including support from family, support from school and friends, and support from community. Because social context changes with age, the Add Health was designed to obtain most important indicators for social context at that time the survey took place. In family support, for example, when respondents moved toward adulthood, parental support could become less important than supports from their spouse and kids. Therefore, items for the support from family varied from wave to wave. Most items in Wave III and IV—when respondents were in adulthood, were different from items in Wave I and II—when respondents were adolescents. My research used only parent-adolescent relationship at baseline to assess the support from family. Items related to support from school and friends—represented by number of friends, and support from community—represented by number of attending to religious services, remained the same across all waves of the Add Health data, thus were used in all waves of repeated interviews.

Parental support.

Parental involvement was to measure the relationship between adolescents and their parents. Each participant was asked whether he/she shared activities or communications with parents during four weeks preceding the surveys. There were two sets of 10 yes/no-questions for mother and father including going shopping, playing a sport, attending a religious event, attending a cultural event, and working on a school project together. The score was generated by summing all activities or communications. A previous research showed that the Cronbach's alpha coefficients were .55 for mother and .57 for mother (Nowlin & Colder, 2007). Not surprisingly, the reliability was unsatisfied because preferable activities and communications

vary from family to family. Furthermore, in each family, one activity is usually independent of others. In order for this variable to be able to employ in adolescents with single parent, scores were computed for mother and father separately, and the higher score was used. The range of this measure was 0 to 10

Parental control was another variable to assess the relationship between adolescents and parents. The participating adolescents answered seven yes/no-questions of whether their parents let them made own decisions about the people they hang around with, the time they must be home on weekend nights, wearing, eating, watching television, television programs, and time for going to bed (see Table C.3 in Appendix C for more details). Parental control score was equal to the sum of items the participant answered "yes". The Cronbach's alpha for internal consistency for this measure was .63 and the range was 0 to 7 (Nowlin & Colder, 2007). Again, each item was not necessarily related to others because parents often have different favorable types to control children.

Friend support. Support from friends in the dissertation was indicated by peer popularity or peer networks, that is, measuring the extent to which how much the participant connect to the friendship networks. Friend support was generated using number of close friends the participant had. At baseline and Wave II, each participant was asked to nominate up to five male friends and five female friends. Close friend was defined as a person with whom the participant hang out or went somewhere, talked on the telephone, discussed a problem, or spent time in weekend during the past seven days.

In the Wave III interview, participants identified how many current close friends among ten friends when they were in school. However, these questions were administered only to respondents who were in Grades 7 or 8 at baseline. To expand friend support for all participants,

number of shared activities was derived from the question "In the past seven days, how many times did you just hang out with friends, or talk on the telephone for more than five minutes?" To maximize sample size, the higher score was chosen between number of close friends and number of shared activities. In the Wave IV interview, number of close friends was simply derived from one question "How many close friends do you have?" with the instruction that close friends meant people whom the participant felt at ease with, could talk to about private matters, and could call on for help.

Finally, friend support was scored in a numerical value from 1 to 4 as follows: 1= *no close friend*, 2 = *one to two close friends*, 3 = *three to five close friends*, and 4 = *six or more close friends*.

Religious services. Religion was an indicator to assess support from community. Two items were used to construct this variable: the frequency that the respondents attended in regular worship services and the frequency that they took part in special religious activities such as Bible classes, retreats, small groups, or choir. Alpha coefficients for the set of two items were .69 at baseline, .70 at Wave II, .73 at Wave III, and .78 at Wave IV, indicating that this scale was good in term of internal consistency. Frequencies of the items then were averaged. Religion was assigned a numerical value as the followings: 1 = *never*, 2 = *less than once a month*, 3 = *once a month or more but less than once a week*, and 4 = *once a week or more*.

All scales of actual social support were coded in that a higher score means higher level of social supports. Table 3.2 presents descriptive analysis of predictors and Figure 3.2 presents relationships between independent and dependent variables as described above.

Table 3. 2

Descriptive Analysis of Independent Variables

Variables	Type	*M*	*SD*	Range	
				Actual	Possible
Adversity	Time-stationary	1.14	1.12	0.0 - 6.0	0 - 9
Time since baseline (years)					
Wave 2–baseline	Time-varying	0.90	0.14	0.3 - 2.3	
Wave 3–baseline	Time-varying	6.37	0.23	5.7 - 8.0	
Wave 4–baseline	Time-varying	12.89	0.28	11.6 - 14.4	
Resilience Scale					
Optimistic	Time-stationary	3.24	0.47	1.0 - 4.0	1 - 4
Problem Focused Coping	Time-stationary	2.82	0.61	1.0 - 4.0	1 - 4
Emotional Coping	Time-stationary	3.13	0.46	1.1 - 4.0	1 - 4
Perceived Social Support	Time-stationary	3.19	0.45	1.3 - 4.0	1 - 4
Total	Time-stationary	3.09	0.34	1.6 - 4.0	1 - 4
Actual social supports					
Parental control W1	Time-stationary	5.15	1.56	0.0 - 7.0	0 - 7
Parental involvement W1	Time-stationary	4.10	1.98	0.0-10.0	0-10
Friend support W1	Time-varying	3.16	0.87	1.0 - 4.0	1 - 4
Friend support W2	Time-varying	3.15	0.86	1.0 - 4.0	1 - 4
Friend support W3	Time-varying	3.17	0.98	1.0 - 4.0	1 - 4
Friend support W 4	Time-varying	3.01	0.79	1.0 - 4.0	1 - 4
Religion W1	Time-varying	2.75	1.21	1.0 - 4.0	1 - 4
Religion W2	Time-varying	2.72	1.22	1.0 - 4.0	1 - 4
Religion W3	Time-varying	2.29	1.05	1.0 - 4.0	1 - 4
Religion W4	Time-varying	2.27	1.07	1.0 - 4.0	1 - 4

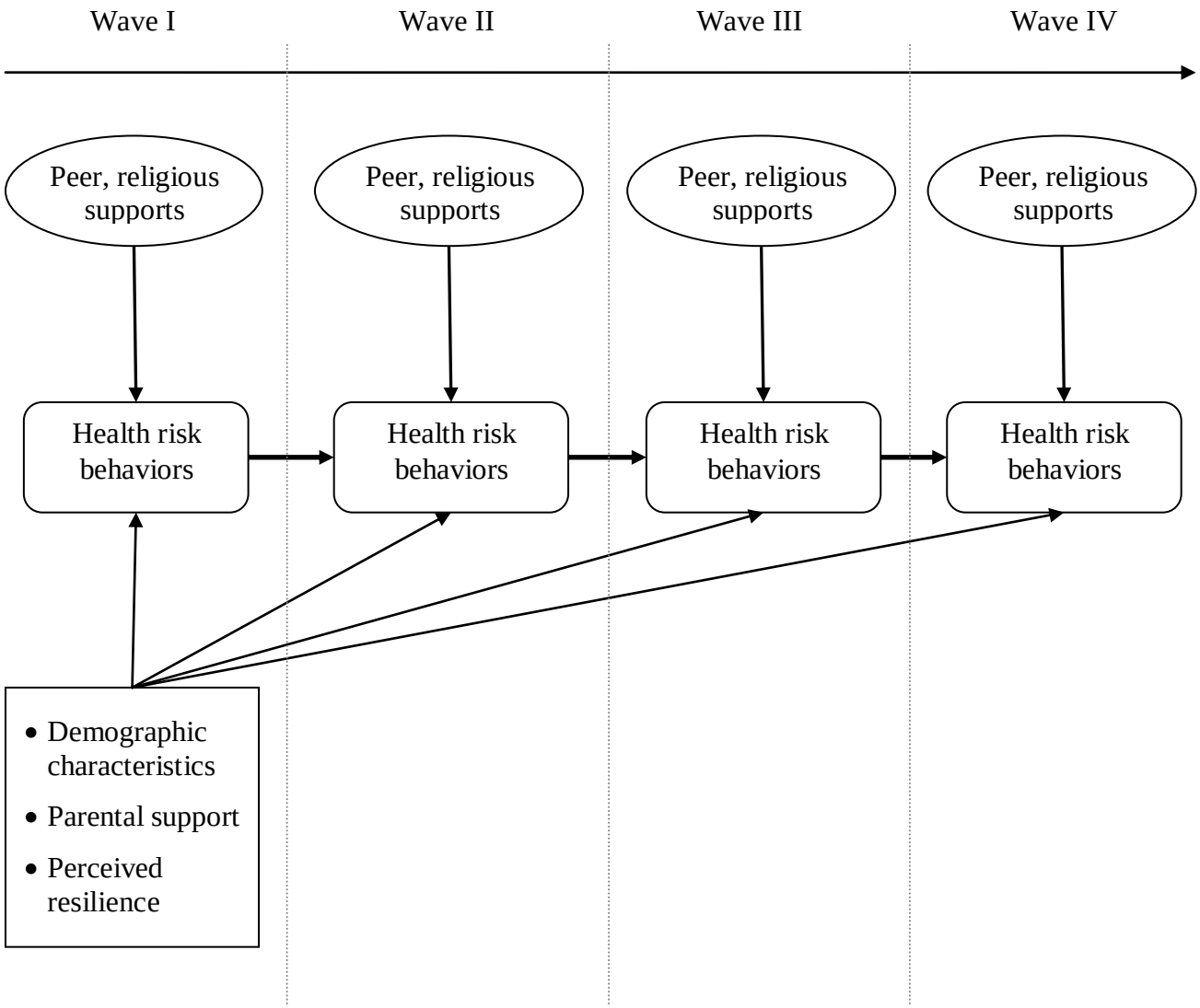

Figure 3.2. Relationship between health risk behaviors and predictors during transition from adolescence to adulthood. Actual social supports including peer and religious supports are time-varying variables. Parental support, perceived resilience, and demographic characteristics measured at baseline (Wave I) are time-stationary variables

Data Analysis

Significance is set at α level = .05. All analyses were performed using the statistical software package SAS version 9.2.

Missing value. Missing values are unavoidable in longitudinal studies. There are two sources of missing in Add Health. First, participants did not respond or skipped some particular questions. The second source was due to absence of respondents at interview waves. The former, called *item non-response,* considered as missing data within independent variables. In the Add Health data sets, this type of missingness took on less than 5% of total data points and thus tradition methods such as case deletion, mean substitution, and regression do not lead to serious biases (Graham, 2009; Schafer, 1999). Missing values in demographic variables such as age, gender, grade, race, and family structure were treated using listwise deletion method—observations with missing data were simply omitted and the analyses were done on the complete datasets without much concern about biased results. However, when compositing variables, e.g., perceived resilience scale, statistical software packages either delete any item with missing score or treat the missing value as zero. The results could potentially be misleading. Substituting a mean for the missing data was an appropriate method to deal with the issue. In this case, only value of a composite variable was coded as missing if all item's values were missing altogether. Similarly, since each survey wave took place during relatively short duration compared to the total follow-up time, missing values of the time since baseline variable were simply imputed by replacing with the means at point in time of wave in the longitudinal analysis.

Wave non-response, also simply called *non-response* in this dissertation, occurred when participants were absent from one or more survey waves. Non-response is always a major challenge for the analysis of longitudinal studies because there is usually a considerably large

amount of missingness over time. Non-response could occur in any Add Health wave except baseline. The pattern of missing data is presented in Table 3.3. The proportion of missing data was 34.55% at the second, 33.22% at the third, and 27.18% at the fourth wave of interviews. Approximate 51% of the core-sample presented in all four waves of the Add Health longitudinal study. Result in Table 3.3 showed that missing observations belonged to the arbitrary pattern in which non-response could occur in any waves after baseline.

Table 3.3

Pattern of Missing Responses

Pattern	Wave I (1995)	Wave II (1996)	Wave III (2001–2002)	Wave IV (2008–2009)	N	%
1	O	O	O	O	3,342	51.38
2	O	O	O	−	502	7.72
3	O	O	−	O	582	8.95
4	O	O	−	−	408	6.27
5	O	−	O	O	866	13.31
6	O	−	O	−	172	2.64
7	O	−	−	O	324	4.98
8	O	−	−	−	308	4.74
N observed	6504	4,834	4,882	5,114		
N missing	0	1,670	1,622	1,390		
% missing	0	34.55	33.22	27.18		

Note. O = Observed, − = Missing

Assumption of missing data mechanism is very important in analysis with missing data. Rubin (1976), and Little and Rubin (1987) defined three unique types of missing data mechanisms. First, missing completely at random (MCAR) occurs when missing values on a variable are not dependent on either the value of this variable or the value of any other variable that is observed in the dataset. In other words, the observed and unobserved data can be considered as random samples from a complete data. Under MCAR, dropping subjects in an incomplete set of measures does not lead to significant biases except reducing the sample size

The second type of missing data mechanisms is missing at random (MAR). This type of missing occurs when missing values on a variable do not depend on the observed values of this variable itself after controlling for another variable. Although the observed and unobserved data do not come from a random sample of the complete data, the distribution of missing values in the incomplete dataset is the same as the distribution of the corresponding observed values in the complete dataset. As a result, missing values can be validly predicted by using the observed data (Fitzmaurice, Laird, & Ware, 2004, pp. 381-384).

Third, if data are not missing at MCAR or MAR, they are classified as Missing Not at Random (MNAR). Often referred to as nonignorable or informative missingness, MNAR occurs when the missing values depend on the value of a variable that may itself be missing. This type of missing mechanism is the most difficult to analysis because the missing values are not predictable from values of the observed dataset.

Previous research on Add Health data showed that non-response tended to occur in male and non-White participants (Brownstein et al., n.d.), or in participants who enrolled at baseline in earlier grades (Chantala, Kalsbeek, & Andraca, n.d.). Thus, the missing data mechanism in the Add Health longitudinal may not be MCAR. Most research based on observed data assumes

missing data at MAR rather than MNAR. Unfortunately, there has not been any statistical method to distinguish missing data at MAR or MNAR to date. My dissertation assumed that the missing data within the items of interest and the non-response across points in time were missing at random. Such an assumption allowed this research to use methods of treating missing data based on incomplete datasets such as multiple imputation (Scheffer, 2002).

Multiple imputation (MI) emerged as a useful and flexible method to treat missing data in recent years. MI, proposed by Rubin (1976; 1987) is a method to fill missing values based on Maximum Likelihood Estimation. Application of the technique requires three steps: imputation, analysis, and pooling. First, each missing value is replaced by several plausible values based on existing data. MI generates *m* filled-in-datasets that contain the uncertainty and variability of the imputed data. Then each complete data set is separately analyzed to create *m* different values of parameter estimates and their standard errors. Finally, the results from the *m* complete data sets are combined to produce a single pooled estimate of the complete-data parameters as well as the estimate of the standard errors. MI appeared to be a most powerful approach to deal with relatively large number of missing data like Add Health. For MAR data, MI performed well up to 25% missingness, and adequately with 50% missingness imputation. (Scheffer, 2002).

Rubin (1987, p. 114) showed that the relative efficiency of an estimate based on *m* imputations is approximately:

$$\mathrm{RE} = \left(1 + \frac{\gamma_0}{\mathrm{m}}\right)^{-1}$$

Where γ_0 is the fraction of missing information and *m* is number of imputation. Fraction of missing information is usually equal to or less than the non-response rate (Rubin, 1987; Wagner, 2010). The non-response rates were moderate, from about 27 to 35% in cross-sectional data sets and 49% in the longitudinal data. Based on the above equation, nine imputation

replicates could yield an accurate efficiency (RE > .95). The dissertation performed multiple imputation using PROC MI and PROC MIANALYZE components of SAS 9.2 to generate nine imputed data sets, and pool parameter estimates that were subsequently used in the longitudinal analyses. Methods of treating missing data used in this research are reported in Table 3.4.

Adjusting for complex survey design. The use of sample weights for survey data analysis helps to produce correct and unbiased point estimates of population parameters. The Add Health study utilized complex survey designs with the aim to represent the adolescent's population in the United States. Thus, indicators for complex survey design including *cluster* and *weight* were taken into account in data analysis. The results were adjusted for cluster and weight variables, for example, weighted proportion instead of crude proportion.

Descriptive analysis. Descriptive analysis summarily described the research measures. It included univariate and bivariate analysis for the dependent and independent variables used in further inferential analysis models.

Univariate analysis. Frequency analysis was used for categorical and dichotomous demographic variables such as gender, race, grade and family structure. A frequency table was created to report the number of sample demographics and the weighted percentage adjusted for survey complex design. Interval and ratio demographic variables such as age, time and adversity score were examined using described central tendency (e.g., mean) and variability (e.g., range and standard deviation)

Table 3. 4

Number and Percentage of Missing values and Methods to Treat Missing data

Variables	Item non-response	Wave non-response	Total missing n (%)	Treatment of missing
Age [a]	3	0	3 (0.05)	No
Gender [a]	1	0	1 (0.02)	No
Grade	167	0	167 (2.57)	No
Race/ethnicity [a]	7	0	7 (0.11)	No
Family structure [a]	14	0	14 (0.22)	No
Adversity [a]	355	0	355 (5.46)	Multiple imputation
Time : Wave 2 to baseline	2	1,670	1,672 (25.71)	Mean substitution
Time : Wave 3 to baseline	1	1,622	1,623 (24.95)	Mean substitution
Time : Wave 4 to baseline	3	1,390	1,393 (21.42)	Mean substitution
Optimistic [a]	13	0	13 (0.2)	Mean substitution
Problem Focused Coping [a]	14	0	14 (0.22)	Mean substitution
Emotional Coping [a]	49	0	49 (0.75)	Mean substitution
Perceived Social Support [a]	12	0	12 (0.18)	Mean substitution
Parental control [a]	167	0	167 (2.57)	Multiple imputation
Parental involvement [a]	142	0	142 (2.18)	Multiple imputation
Friend support Wave 1	0	0	0 (0)	No
Friend support Wave 2	0	1,670	1,670 (25.68)	Multiple imputation
Friend support Wave 3	19	1,622	1,641 (25.23)	Multiple imputation
Friend support Wave 4	48	1,390	1,438 (22.11)	Multiple imputation
Religion Wave 1	8	0	8 (0.12)	No
Religion Wave 2	5	1,670	1,675 (25.75)	Multiple imputation
Religion Wave 3	37	1,622	1,659 (25.51)	Multiple imputation
Religion Wave 4	1	1,390	1,391 (21.39)	Multiple imputation
Suicide Wave 1	69	0	69 (1.06)	No
Suicide Wave 2	35	1,670	1,705 (26.21)	Multiple imputation
Suicide Wave 3	131	1,622	1,753 (26.95)	Multiple imputation
Suicide Wave 4	40	1,390	1,430 (21.99)	Multiple imputation
Violence Wave 1	44	0	44 (0.68)	No
Violence Wave 2	24	1,670	1,694 (26.05)	Multiple imputation
Violence Wave 3	31	1,622	1,653 (25.42)	Multiple imputation
Violence Wave 4	11	1,390	1,401 (21.54)	Multiple imputation
Substance use Wave 1	6	0	6 (0.09)	No
Substance use Wave 2	0	1,670	1,670 (25.68)	Multiple imputation
Substance use Wave 3	1	1,622	1,623 (24.95)	Multiple imputation
Substance use Wave 4	0	1,390	1,390 (21.37)	Multiple imputation

Note. [a] Measured at baseline. No treatment means analyses were based on listwise deletion

Bivariate analysis. Associations within predictors or dependent variables were examined using bivariate analysis. Pairwise correlation matrix among all three types of health risk behaviors along with four repeated measurements (waves) was calculated. Since the outcomes were binary variables, Phi's correlations were used to explore the associations. On the other hand, Pearson's correlations among continuous independent variables were calculated to estimate their intercorrelations.

Analysis by specific research question. The following statistical analytic procedures are employed and organized by the research questions and hypotheses.

Question 1. Would resilience statuses measured by the engagement in health risk behaviors be static and stable, or dynamic and changeable?

Hypothesis 1.1. Rates of health risk behaviors would significantly vary from wave to wave in cross-sectional samples.

Cross-sectional weighted proportions for each dependent variable (health risk behavior), also called point prevalence, were separately calculated at points in time of the Add Health waves. Point prevalence is the number of cases at a particular time divided by the total number of people in the population of interest adjusted for complex survey design. In this case, point prevalence was calculated at all time-points: Wave I (1994–1995), Wave II (1996), Wave III (2001–2002), and Wave IV (2008–2009).

According to Add Health design, cross-sectional data sets for three waves after baseline were differently weighted to represents the same population as the Wave I sample (Brownstein et al., n.d.; Chantala et al., n.d.). In other words, data were already adjusted for both complex

survey design and non-response missingness. Therefore, such point prevalence was adequately used to compute population estimates without treating missing data.

Because each wave is representative of some age-specific sectors of the U.S. population, such as middle adolescents, young adults, or adults, changes in health risk behaviors implicate that resilience status varies in age-specific populations.

Graphs of the weighted rate against time were created to show visually a population trajectory of the cohort of adolescents in grades 7–12 over a 13-year-period.

Hypothesis 1.2. There would be a remarkably large number of individuals changing from non-engaging to engaging in health risk behaviors and vice versa over time in the longitudinal sample.

Descriptive analyses were conducted in the longitudinal sample. Again, sampling weights incorporating a non-response adjustment was created to compensate for data missing at a time-point of interview (Chantala, 2006). Changes in health risk behaviors were calculated in each respondent between two adjacent waves of interview, as well as between Wave IV and baseline. Three types of changes were: (a) the same—the respondent did not change his/her health risk behavior, (b) more resilient or positive change—the respondent changed from engagement to non-engagement in a health risk behavior, and (c) more vulnerable or negative change—the respondent changed from non-engagement to engagement in a health risk behavior. Weighted rates of such changes were calculated and the graphs of changes against time showed visually the individual trajectory over time.

Hypothesis 1.3. The trajectory (pattern of change) of engaging in health risk behaviors would be identical for both the general and the adversity sample.

Population point prevalence in cross-sectional data sets and individual change rates in the longitudinal data were broken down into the adversity and the non-adversity sample. Differences in parameters of interest between two samples were detected by using Rao-Scott chi-square method. In complex survey design, Rao-Scott chi-square analysis is a design-adjusted version of the Pearson chi-square test with adjustment for the design effect. The Rao-Scott chi-square (χ^2_{RS}) is computed as the following equation:

$$\chi^2_{RS} = \chi^2/\lambda$$

Where χ^2 is the Pearson chi-square based on the estimated overall total and λ is the design correction for complex survey design (Rao & Scott, 1981) .

Question 2. Would the resilience scale predict resilient status?

Hypothesis 2.1. Resilience scores would be concurrently associated with health risk behaviors at baseline of the Add Health study.

Multiple logistic regressions were applied in analysis of relationship between resilience scores and three dependent variables at baseline: suicide, substance uses and violence. For each type of health risk behavior, the research applied three nested logistic regression models. The first model included only demographic predictors. Then four resilience subscales were added in Model 2. Last, actual social support such as parental involvement, parental control, friend support, and support from community were entered in the third model.

Likelihood ratio test based on the chi-square approach was used to evaluate and compare the model fit. However, chi-square statistics are heavily affected by sample size. With a large

sample size, as the Add Health data, most such goodness-of-fit tests tend to be significant even a small difference. Another approach was application of Pseudo-R^2. Unlike in ordinary least squares regression that R^2 is representative of an approximate variance in the outcome accounted for, Pseudo-R^2 in logistic regression models—interpreted as a predictive strength of association—can be used to evaluate goodness-of-fit. Value of Pseudo-R^2 reflects the overall improvement in fit over the intercept model (the model without covariates). Different types of methods to calculate Pseudo-R^2 are proposed by many authors such as Efron, McKelvey and Zavoina, McFadden, Cox and Snell, or Nagelkerke. This research used McFadden's Pseudo-R^2 to assess the model fit. The formula, based on estimated likelihood ($\hat{L}$), is

$$R^2 = 1 - \frac{ln\hat{L}(M_{full})}{ln\hat{L}(M_{intercept})}$$

Where: $ln\hat{L}(M_{full})$ is the log likelihood of the full model and $ln\hat{L}(M_{intercept})$ is the log likelihood of the model without predictors.

Hypothesis 2.2. Resilience scores measured at baseline would be prospectively associated with health risk behaviors over time.

This hypothesis was tested by applying longitudinal analyses. The longitudinal Add Health applied repeated measurements of the same variables from the same individuals at different points in time (wave). Hence, longitudinal analyses must take the within-subject associations among repeated measures into account. This research used *marginal models for binary responses* in analyses of the longitudinal data. The marginal model assumes that the model for the mean response depends only on the covariates of interest (Fitzmaurice et al., 2004). The interpretation of a parameter does not depend on the individuals but rather is valid for the whole population. Therefore, parameters from marginal models are also called population-

averaged parameters. One of the advantages is that the marginal model does not require distributional assumptions for the responses, e.g., multivariate distribution (Fitzmaurice et al., 2004, p. 295). Under avoiding distributional assumptions for responses, Liang and Zeger (1986) proposed a method to estimate the regression parameters of marginal model, called the *Generalized Estimating Equations* (GEE). This method is the extension of generalized linear model for longitudinal data analysis but not based on maximum likelihood estimation. The essential idea behind the GEE approach is that the repeated measurements of responses (outcomes) are dependent which the value of responses in the early measurements may affect its value later. Therefore, correlations among values for a given subject across repeated measurements are taken into account. Liang and Zeger gave an innovative solution by assuming specific working correlation structures for the repeated measurements. They suggested different types of working correlation structures including independence, m-dependence, exchangeable, and autogressive. Estimated parameters are different upon different working correlation structures applied in the GEE model.

Carey, Zeger, and Diggle (1993) proposed an alternative method to account for the association among responses, named the *alternating logistic regressions (ALR) algorithm*. The ALR algorithm uses log odds ratios to model the association between pairs of responses instead of correlation structures in the ordinary GEE. In addition, since the responses in this study are binary, correlation is not the most appealing metric for association. Therefore, unstructured pairwise odds ratios are a more natural measure of association among repeated binary measurements (Fitzmaurice et al., 2004, p. 307).

The marginal expected response (or the probability of success) of the i^{th} individual on the survey wave j^{th}, μ_{ij} , depends on the covariates (X_{ij}), though a link function:

$$g(\mu_{ij}) = X'_{ij}\beta$$

Where g is the logit link function, given by:

$$g(\mu_{ij}) = \log\left(\frac{\mu_{ij}}{1-\mu_{ij}}\right)$$

X_{ij} include time-stationary covariates whose values do not change throughout the duration of the longitudinal study, and time-varying variables whose values change over time.

The within-subject association among repeated responses is assumed to have an unstructured pairwise log odds ratio pattern

$$\log OR(Y_{ij}, Y_{ik}) = \alpha_{jk}$$ (Fitzmaurice et al., 2004)

There were two logistic GEE models used in the longitudinal data analysis to address the hypothesis. The first model included only demographic variables such as age, gender, race, grade, and family structure at baseline. The second logistic GEE model used demographic variables and perceived resilience scores. Because GEE is not likelihood-based method, the Quasi-likelihood under the Independence model Criterion (QIC) statistic is applied to evaluate the goodness-of-fit. QIC, proposed by Pan (2001), defined as Q + 2p, where *Q* is the quasi-likelihood and *p* is the number of parameters in the model. An advantage of using QIC is that models are not necessarily nested to compare them. Among different logistic GEE models, one with the smaller QIC statistic is better fit. GEE analyses were conducted in SAS 9.2 using PROC GENMOD with a REPEATED statement.

Question 3. Would actual social supports have positive effects on resilient status?

Hypothesis 3.1. Actual social supports would be concurrently associated with health risk behaviors at points in time of Add Health interviews.

Bivariate odds ratio between each health risk behavior and each type of actual social support was calculated from logistic regressions at each wave of Add health data. Such odds ratios were adjusted for demographic variables including age, gender, grade, race, and family structure.

Hypothesis 3.2. Actual social supports would be prospectively associated with health risk behaviors over a 13-year-period of Add Health longitudinal study.

This hypothesis was tested along with hypothesis 2.2. After conducting the second GEE logistic model, actual social support variables including parental involvement, parental control, friend support, and religious support were added to generate the Model 3. Therefore, the third model consisted of demographic variables, perceived resilience scores, and actual social support variables. The effect of actual social support from the full GEE model can be broken down into two types. The between-subject effect or cross-sectional effect was assigned to parental support that measure only at baseline. On the other hand, the within-subject effect or longitudinal effect was assigned to friend support and religious support that collected at all four different waves of Add Health data.

Human Subjects

This proposed research received Institutional Review Board (IRB) approval from the University of Arkansas prior to data collection and data analysis. According to the University policy, all human subjects' research needs to be approved by the IRB with the purpose of reducing and minimizing any risk to human subject participants.

According to the Add Health design, all information to identify the participants was confidential and anonymous. All participants were asked to enter the surveys voluntarily and signed the informed consent along with their parents or guardians. The public-use version of Add Health database provided information without name of any participant or characteristic that could identify any participant. Each participant was assigned a respondent identifier number that appears in the secondary database. There was also no comment of researchers or participants shown in the data sets.

The proposal of this dissertation was examined under the expedited review process in which the protocol was reviewed and approved by a single, voting member of the IRB. The initial approval was issued for a maximum period of one year, and modified and extended to the second year by the researcher's request (see Appendix D).

CHAPTER 4: RESULTS

The purpose of this research was to explore the stability of resilience status and to examine the effects of individual resilience scores and social support on resilience status over a long period of lifetime. The result section begins with preliminary analyses including a description of demographic characteristics and bivariate analyses to obtain associations among repeated outcomes as well as among predictors. Then, main results of analyses are followed by the research questions and hypotheses. Next, the final models comprising only significant independent variables are created to analyze the cross-sectional and longitudinal effects of predictors on health risk behaviors. The patterns of behavioral change over time are modeled and presented by graphical charts.

Preliminary Analysis

Descriptive statistics. Demographic characteristics were described by raw frequencies, ranges, weighted percentages, weighted means, and weighted standard deviations (see Table 4.1 for categorical variables and Table 4.2 for continuous variables). Distributions of male and female participants were nearly identical for both general and adversity samples. The proportion of high school participants in adversity sample was lower than that in general sample (62.13% vs. 65.82%), however, the difference was not significant, Rao-Scott $\chi^2(1) = 1.89$, $p = .169$. There was a significantly higher proportion of non-White in adversity sample (weighted percentage = 58.04%) than that in general sample (weighted percentage = 31.84%), Rao-Scott $\chi^2(5) = 617.35$, $p < .001$. More than half of adversity sample was lived in families with single parent (50.46%) while more than half of general participants were reared by both biologic parents (51.21%). The

difference in family structure between two samples was significant, Rao-Scott $\chi^2(5) = 774.55$, $p < .001$. Concerning the age cohort, participating adolescents at baseline were from 11.42 to 21.33 years old, and the means age for both samples were virtually the same, $M = 15.96$, $t(131) = 0.45$, $p = .650$. Similarly, means age of participants from the general and adversity cohorts were almost identical and not significant in Wave II to Wave IV.

Table 4.1

Demographic and Descriptive Characteristics of Participants at Baseline in the U.S. Population and the Adversity Population

Characteristics	General sample (*N*= 6,504)		Adversity sample (*N*=1,861)		χ^{2a}	*p*
	n	Weighted percent	*n*	Weighted percent		
Gender						
Male	3,147	50.83	866	49.17	2.42	.122
Female	3,356	49.18	995	50.83		
Grade						
Middle school	1,971	34.18	594	37.87	1.89	.169
High school	4,366	65.82	1,186	62.13		
Race/ethnicity						
Asian Pacific	209	2.86	62	3.45	617.35	<.001
Black	1,507	15.39	662	27.78		
Hispanic	743	12.20	417	24.54		
Indian	44	0.66	26	1.39		
Other	48	0.73	16	0.89		
White	3,946	68.16	676	41.96		
Family structure						
Non Parent	597	8.62	198	10.59	774.55	<.001
Single Parent	1,684	24.71	985	50.46		
Adopt parents	92	1.48	7	0.43		
Step parents	899	13.98	190	10.91		
Biologic parents	3,232	51.21	481	27.62		

Note. [a] Rao-Scott chi-square was used to compare adversity vs. non-adversity sub-samples.

Table 4.2

Descriptive Analysis of Age Cohort in the General and the Adversity Samples

Age cohort	General sample		Adversity sample		t [b]	p
	Weighted *M (SD)*	Range	Weighted *M (SD)*	Range		
at baseline	15.96 (0.11)	11.42–21.33	15.96 (0.16)	12.08–21.33	0.45	.650
at Wave II	16.44 (0.11)	12.50–21.92	16.51 (0.15)	13.08–21.92	1.07	.284
at Wave III	22.31 (0.12)	18.33–28.00	22.31 (0.16)	18.33–28.00	0.48	.634
at Wave IV	28.83 (0.12)	24.42–33.92	28.84 (0.16)	24.75–33.92	0.55	.583

Note. [b] *t*-statistics to detect differences in mean ages between two samples were obtained from a survey regression with adversity as an independent variable. Statistics was calculated without treatment of missing values.

Bivariate analysis. Because of large sample size, correlation analysis often gives significant results even though two variables are lowly correlated. The value of association thus is more important than the significance in this case. This dissertation focused on presenting values of correlation coefficients instead of emphasizing on the aspects of significance.

Table 4.3 presents the associations among three types of health risk behavior across four waves of the Add Health study. Most pairwise correlations were small to moderate. The correlation matrix provided two main sources of information: (1) correlations among repeated measures of a particular health risk behavior over time and (2) correlations among different types of health risk behavior at a single occasion (wave). Generally, correlations in the former were higher than those in the later were. In addition, measures of a health risk behavior were highest correlated between two adjacent waves. For example, correlations for suicide, violence, and substance use between Wave I and Wave II were .34, .43 and .54, respectively. Different health

risk behaviors were rather poorly correlated at one single occasion. For instance, pairwise correlations between suicide and violence at Wave I to Wave IV were .11, .11, .09, and .01, respectively. Not surprisingly, different outcomes measured at different occasions were lowest correlated.

Intercorrelations among pairs of main independent variables used in further analyses ranged from .01 to .68 (see Table 4.4). Higher correlations were found among time-varying variables in which measures were repeated over time. Like dependent variables, highest pairwise correlations were found among repeated measure of a particular predictor at adjacent waves. For example, intercorrelations of religious support between Wave I–Wave II, Wave II–Wave III, and Wave III–Wave IV were .68, .46, and .56, respectively. However, repeated measures of friend support were not highly dependent (correlations were ranged from .07 to .31).

For independent variables obtained only at baseline (time-stationary variables), resilience subscales were moderately correlated each other. Pairwise correlation coefficients were .52 for optimistic–emotional coping, .59 for optimistic–perceived social support, and .43 for emotional coping–perceived social support. Baseline age was moderately correlated to parental control (r = .35) but poorly correlated to others (ranging from .01 to .14). Other associations among the predictors were either positively or negatively weak (see Table 4.4).

Table 4.3

Phi's Correlation Matrix among Binary Dependent Variables

Variables	Suicide				Violence				Substance use			
	Wave I	Wave II	Wave III	Wave IV	Wave I	Wave II	Wave III	Wave IV	Wave I	Wave II	Wave III	Wave IV
Suicide W1	-											
Suicide W2	.34*	-										
Suicide W3	.13*	.14*	-									
Suicide W4	.18*	.11*	.20*	-								
Violence W1	.11*	.03	.03*	.03	-							
Violence W2	.08*	.11*	.02	.05*	.43*	-						
Violence W3	.02	.02	.09*	.03	.18*	.19*	-					
Violence W4	.01	-.02	.04*	.01	.07*	.06*	.07*	-				
Substance use W1	.15*	.11*	.04*	.04*	.19*	.18*	.04*	.01	-			
Substance use W2	.15*	.14*	.02	.05*	.16*	.20*	.07*	.01	.54*	-		
Substance use W3	.07*	.07*	.12*	.04*	.06*	.07*	.12*	-.01	.27*	.31*	-	
Substance use W4	.07*	.06*	.09*	.08*	.10*	.07*	.10*	.01	.26*	.27*	.48*	-

Note. *Significance at .05 level

Table 4.4

Pearson's Correlations Matrix among Continuous Independent Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Age at baseline	-															
2. Adversity score	.05*	-														
3. Optimistic	-.07*	-.14*	-													
4. Problem Coping	.02*	.05*	.23*	-												
5. Emotional Coping	-.06*	-.15*	.52*	.07*	-											
6. Perceived Social Support	-.14*	-.12*	.59*	.24*	.43*	-										
7. Parental control	.35*	-.06*	.04*	-.01	.05*	-.02	-									
8. Parental involvement	-.09*	-.08*	.15*	.08*	.03*	.19*	-.02	-								
9. Friend support W1	.03*	-.02	.03*	.01	-.05*	.02	.12*	.08*	-							
10. Friend support W2	-.06*	-.09*	.05*	-.03*	-.01	.04*	.08*	.05*	.31*	-						
11. Friend support W3	-.14*	-.09*	.09*	.07	.05*	.08*	.02	.09*	.10*	.08*	-					
12. Friend support W4	-.02	-.15*	.14*	.03*	.12*	.14*	.05*	.12*	.07*	.07*	.16*	-				
13. Religious support W1	-.10*	-.09*	.13*	.07*	.09*	.16*	-.10*	.21*	-.05*	-.05*	.03*	.03*	-			
14. Religious support W2	-.12*	-.07*	.13*	.07*	.08*	.16*	-.11*	.19*	-.06*	-.05*	.03	.06*	.68*	-		
15. Religious support W3	-.01	-.05*	.10*	.05*	.06*	.13*	-.06*	.15*	-.07*	-.07*	.03*	.05*	.43*	.46*	-	
16. Religious support W4	.04*	-.01	.06*	.07*	.05*	.11*	-.07*	.12*	-.06*	-.09*	-.02	.02	.36*	.36*	.56*	-

Note. *Significance at .05 level

Analysis Followed by Research Questions

Research question 1. Would health risk behaviors be static or dynamic?

Hypothesis 1.1: Rates of health risk behaviors would significantly vary from wave to wave in cross-sectional samples, and Hypothesis 1.3: Trajectories of health risk behaviors would be identical for both general and adversity samples.

Table 4.5 presents weighted prevalence rates of health risk behaviors of suicide, violence and substance use in cross-sectional samples. Results from the general sample showed that point population prevalence rates from Wave I to Wave IV were 12.91%, 11.16%, 6.63% and 6.44% for suicidal behavior; 16.10%, 13.33%, 6.74%, and 15.59% for violent behavior; and 28.92%, 32.82%, 53.47%, and 51.85% for substance use, respectively. Opposite to measures of health risk behavior, prevalence rates of resilience status were high on the suicide domain (from 87.1% to 93.7%) and the violence domain (from 83.9% to 93.3%), and moderate on substance use domain (from 48.2% to 71.1%).

There were some differences in the outcome's percentages between adversity and non-adversity samples. Generally, people who lived in negative conditions in the early stages of life had higher proportions of having suicide and violent behaviors, but lower rates of substance use compare to those in the non-adversity sample. However, the differences were obviously significant for the violence domain. Violence rates were significantly higher in adversity samples than in non-adversity samples at baseline (21.84% vs. 13.69%), Wave II (18.40% vs. 11.08%), and Wave III (8.02% vs. 6.36%). On the contrary, substance use was significantly lower in adversity sample than in non-adversity sample at Wave III only (48.09% vs. 55.31%). Other comparisons of health risk behaviors between two samples were not statistically significant.

Table 4.5

Weighted Point Prevalence and Standard Errors of Health Risk Behaviors over Four Cross-Sectional Waves of the Add Health Study

	Suicide		Violence		Substance uses	
Wave	%	SE	%	SE	%	SE
			Entire sample			
I	12.91	0.49	16.10	0.91	28.92	1.25
II	11.16	0.55	13.33	0.87	32.82	1.50
III	6.63	0.47	6.74	0.43	53.47	1.45
IV	6.44	0.40	15.59	0.62	51.85	1.23
			Adversity sample			
I	13.07	0.93	21.84[a]	1.42	29.39	1.70
II	10.92	0.95	18.40[a]	1.35	31.22	2.27
III	7.06	0.91	8.02[a]	0.74	48.09[a]	2.37
IV	7.15	0.76	16.96	1.08	49.55	2.20
			Non-adversity sample			
I	12.61	0.56	13.69[a]	0.81	27.79	1.35
II	11.45	0.65	11.08[a]	0.84	33.22	1.70
III	6.39	0.57	6.36[a]	0.51	55.31[a]	1.49
IV	6.28	0.45	14.87	0.69	52.31	1.22
			Males			
I	10.09[b]	0.59	22.18[b]	1.29	31.53[b]	1.43
II	7.97[b]	0.64	19.36[b]	1.42	35.00[b]	1.68
III	6.39	0.64	10.54[b]	0.79	62.27[b]	1.68
IV	5.88	0.53	16.63[b]	0.91	59.87[b]	1.52
			Females			
I	15.80[b]	0.84	9.86[b]	0.81	26.22[b]	1.40
II	14.40[b]	0.87	7.18[b]	0.63	30.58[b]	1.80
III	6.88	0.65	2.85[b]	0.38	44.43[b]	1.72
IV	7.00	0.54	14.53[b]	0.72	43.65[b]	1.45

Note. [a, b] Group weighted percentages with the same subscript within a time-point sharing a common letter were significantly different at .05 level based on Rao-Scott χ^2 test

Another comparison was conducted to detect differences in the point prevalence by gender. Female adolescents significantly reported suicidal ideation and attempt more than male counterparts (Wave I–II) did; the differences did not occur in young adults and adults (Wave III–

IV). On the other hand, males significantly had higher prevalence of violent and substance use behaviors than females for all measurement occasions. These results indicated that adversity did not influence on resilience status as much as gender did (see Table 4.5).

Since substance use indicated the respondents participated in at least one type of substances, the prevalence of substance use was very large. Point prevalence rates for each type of substance uses such as cigarette smoking, alcohol drinking, and using illicit drugs were more meaningful. The population prevalence of regular smoking increased from about 12% in adolescents to over 26% in adults. Heavy drinking of alcohol increased from about 18% in adolescents to over 35% in adults. Illegal drug uses increased from about 15% to 24% during the transition adolescence to adulthood (see Table 4.6). Again, the role of gender was more important than adversity to yield differences in the prevalence of substance use.

Graphs of point prevalence are presented in the Figure 4.1. Suicidal behaviors tended to reduce over time. The pattern of change in violent involvement was U-shaped, which the higher point prevalence was found in adolescence and adulthood. Substance use remarkably increased during the transition from adolescence to young adulthood (Wave III) and slightly reduced after that (Wave IV). The most obvious differences in the trajectory of behavioral change were found between males and females. The patterns of such changes were not much different when comparing adversity to non-adversity samples.

Table 4.6

Weighted Prevalence and Standard Errors of Substance Use's Types over Four Cross-Sectional Waves of Add Health study

Wave	Smoking		Alcohol drinking		Illegal drug use	
	%	*SE*	%	*SE*	%	*SE*
			Entire sample			
I	12.28	0.93	18.04	0.93	14.87	0.75
II	14.80	1.04	19.97	1.17	16.57	0.88
III	26.09	1.12	35.24	1.46	24.00	0.96
IV	26.52	1.11	32.34	1.15	19.37	0.82
			Adversity sample			
I	11.05	1.21	17.52	1.25	17.13[a]	1.28
II	13.41	1.73	16.41[a]	1.42	17.68	1.48
III	26.25	2.19	27.49[a]	1.73	22.95	1.78
IV	28.44	2.08	26.27[a]	1.48	21.96	1.69
			Non-adversity sample			
I	12.03	0.96	17.39	1.07	13.85[a]	0.81
II	14.98	1.33	21.09[a]	1.47	16.22	0.94
III	25.69	1.06	38.24[a]	1.68	24.31	1.02
IV	25.46	1.10	34.74[a]	1.24	18.59	.94
			Males			
I	12.29	0.96	21.47[b]	1.29	15.63	0.89
II	14.30	1.05	23.73[b]	1.59	17.30	1.10
III	27.95[b]	1.23	45.38[b]	1.97	28.95[b]	1.31
IV	28.49[b]	1.34	40.53[b]	1.58	23.66[b]	1.17
			Females			
I	12.26	1.17	14.50[b]	0.90	14.08	0.91
II	15.31	1.39	16.12[b]	1.18	15.82	1.08
III	24.18[b]	1.48	24.82[b]	1.35	18.93[b]	1.08
IV	24.52[b]	1.31	24.03[b]	1.17	14.98[b]	0.92

Note. [a, b] Groups weighted percentages with the same subscript within a time point sharing a common letter were significantly different at .05 level based on Rao-Scott χ^2 test

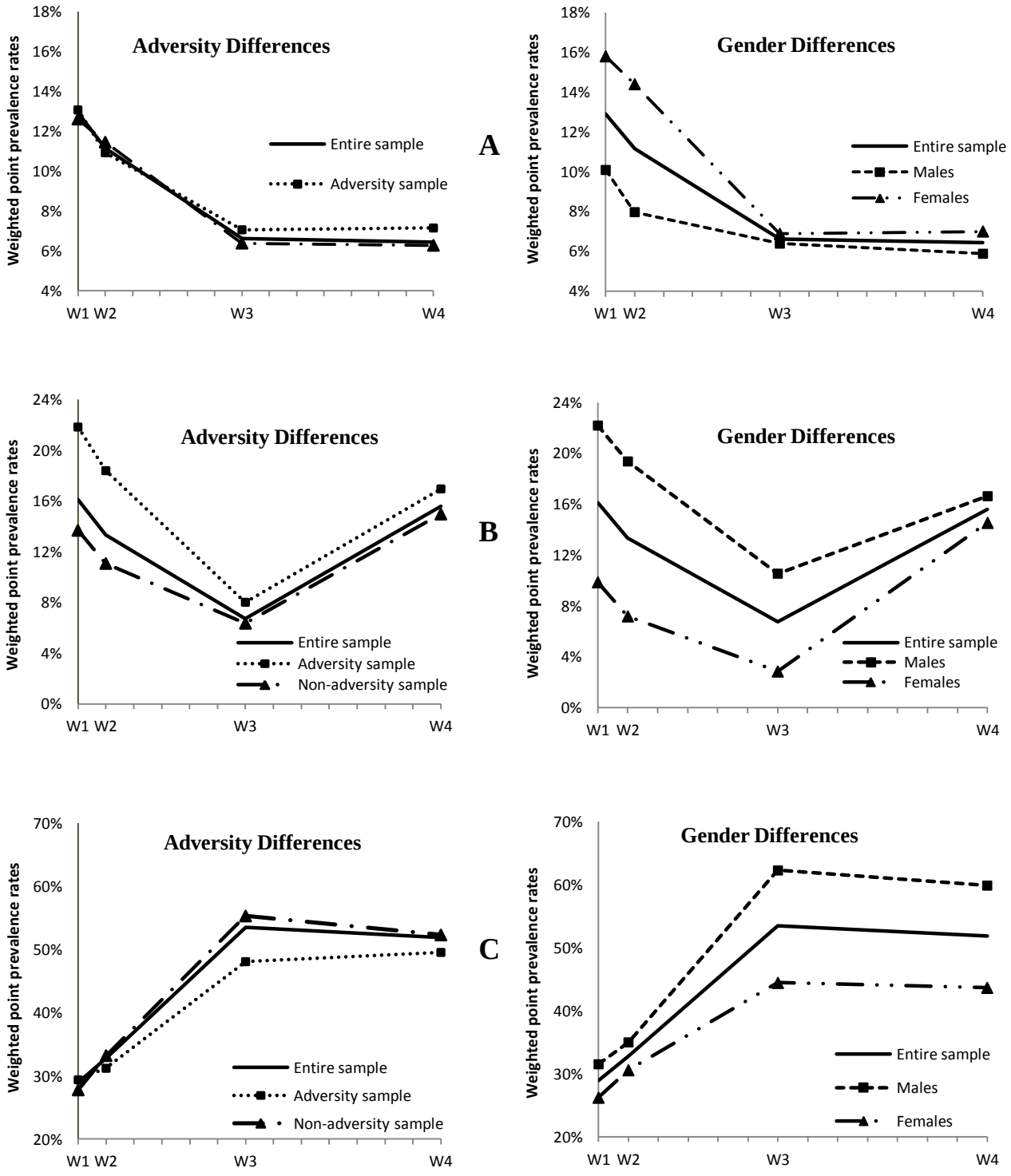

Figure 4.1. Weighted point prevalence rates of health risk behavior over time by adversity and gender differences. (A) suicidal behavior, (B) violent behavior, and (C) substance use behavior.

The results support the hypothesis that resilience varied in waves of Add Health study. Point prevalence rates of suicidal reduced over time, indicating that at population level, resilience on suicide increased with age. Otherwise, when reaching to young adulthood (Wave III), a remarkably large number of participants increased in consuming some types of substance including cigarette, alcohol, and illicit drugs (became less resilient), and then reduced a little. The trajectory of violent behavior was U-shaped with the lowest point prevalence at Wave III, indicating resilience on violence changed nonlinearly over time.

The results also somewhat support the hypothesis that the patterns of change would identical for both general and adversity samples. Most prevalence rates were not significantly different in two samples. Adversity sample had significantly higher violent prevalence rates from Wave I to Wave III and a lower prevalence of substance use in Wave III than non-adversity sample. Using gender as a reference comparison, the results implicate that adversity played a modest effect on resilience status on health risk behaviors.

Hypothesis 1.2: There were remarkable individual changes from non-engaging to engaging in health risk behaviors and vice versa over time in the longitudinal sample, and hypothesis 1.3: The trajectories (patterns of change) of individual's engagement in health risk behaviors were identical for both general and adversity samples.

Patterns of individual change in health risk behaviors over time included no change, more resilience, and more vulnerability. More resilience means that an individual changed positively from engagement to non-engagement in a particular health risk behavior, whereas more vulnerability indicates the opposite change.

Table 4.7 presents patterns of individual change in health risk behaviors over time. Results, adjusted for longitudinal complex survey design, indicated that majority of participants did not change their health risk behaviors over a long period of lifetime. About 85–90% of participants did not change suicidal behavior, 70–85% did not change violent behavior, and 55–80% of participants did not change substance use behavior over time.

Generally, during the transition from adolescence to adulthood, more people became resilient than vulnerable on suicidal behavior. On the contrary, there were much more people who engaged in substance use than those who quitted. The biggest change occurred during Wave II and Wave III when adolescents became young adults. With regard to violence, number of people who changed their behavior to more resilient was approximately equal to number of those who changed to more vulnerable over a period of 13 years (four Add Heath waves).

However, the overall behavioral changes over a 13-year-period (between Wave I and Wave IV) were not so different from these changes between two adjacent waves. The overall change in suicidal behaviors was 14.75%, while such changes between Wave I–Wave II, Wave II–Wave III, and Wave III–Wave IV were 15.07%, 15.23%, and 9.67%, respectively. The similar results were found in pattern of change in violent behaviors. The sudden increase in substance use occurred during Wave II and Wave III, contributing to the large overall change toward vulnerability.

Like the trajectories of health risk behavior at population level, the patterns of behavioral change in individual level were not remarkably different between adversity and general samples. The pattern of change in suicide was almost identical for both populations. People in adversity sample had less negative changes in substance use behavior than those in non-adversity sample, e.g., 26.86% vs. 32.45% during Wave II–Wave III and 29.71% vs. 37.12% over 13 years.

Table 4.7

Patterns of Change in Risk Behaviors over Time in the Longitudinal Sample (N=3342)

	% change W1–W2	% change W2–W3	% change W3–W4	% total change W1–W4
		Suicide		
Entire sample				
Positive change	8.48	9.77	5.22	11.02
Negative change	6.59	5.46	4.46	3.73
Not change	84.93	84.77	90.33	85.25
Adversity sample				
Positive change	8.27	10.23	5.34	11.77
Negative change	6.64	5.60	5.33	4.38
Not change	85.10	84.17	89.33	83.85
Non-adversity sample				
Positive change	8.44	9.64	4.95	10.58
Negative change	6.57	5.21	4.23	3.49
Not change	84.99	85.14	90.82	85.93
		Violence		
Entire sample				
Positive change	8.30	9.74	5.87	11.78
Negative change	5.56	5.02	13.49	11.66
Not change	86.14	85.24	80.64	76.56
Adversity sample				
Positive change	10.94[a]	14.39[a]	6.72	16.62
Negative change	7.15[a]	5.28[a]	16.34	13.13
Not change	81.91[a]	80.33[a]	76.94	70.25
Non-adversity sample				
Positive change	7.26[a]	8.03[a]	5.50	9.85
Negative change	5.07[a]	4.92[a]	12.43	11.20
Not change	87.67[a]	87.05[a]	82.07	78.95
		Substance use		
Entire sample				
Positive change	5.70	7.56	15.05	7.43
Negative change	12.97	30.97	12.05	35.12
Not change	81.33	61.47	72.90	57.45
Adversity sample				
Positive change	7.28	10.57[b]	13.41	9.11[b]
Negative change	11.83	26.86[b]	13.15	29.71[b]
Not change	80.89	62.57[b]	73.44	61.18[b]
Non-adversity sample				
Positive change	5.17	6.49[b]	15.87	6.81[b]
Negative change	13.43	32.45[b]	11.92	37.12[b]
Not change	81.40	61.06[b]	72.21	56.07[b]

Note. Percentages of changes were adjusted for complex survey design. Positive change means more resilient and negative change means more vulnerable. [a, b] Groups with the same subscript within a duration sharing a common letter were significantly different at .05 level based on Rao-Scott χ^2 test.

Adolescents who lived in adverse life conditions (Wave 1 and Wave II) tended to change violent behavior (became more resilient or more vulnerable) more than those who did not. In other words, violence in non-adversity sample was more stable than adversity sample (proportion of no change were 87.67% in non-adversity sample vs. 81.91% in adversity sample between Wave I and Wave II).

Figure 4.2 graphically shows the dynamic of behavioral change among individual over time. Results from the graphs indicated that majority of participants remained their behaviors over time, and the patterns of change in adversity sample were not considerably different from those in non-adverse participants.

In sum, the findings could not support the hypothesis that resilience status on health risk behaviors varied over time at individual level. In spite of small proportions of people who changed from non-engaging to engaging in some types of health risk behavior and vice versa, majority of participants remained their behaviors over time. The long-term changes (between Wave I and Wave IV) were not so different from these changes between two adjacent waves, indicating that: (1) resilience status fluctuated over the transition during adolescence to adulthood—an individual might have a positive or negative health risk behavior at different points in time; and (2) individual resilience appeared to be stable when viewed over long period of lifetime but instable if seen in consecutive points in time.

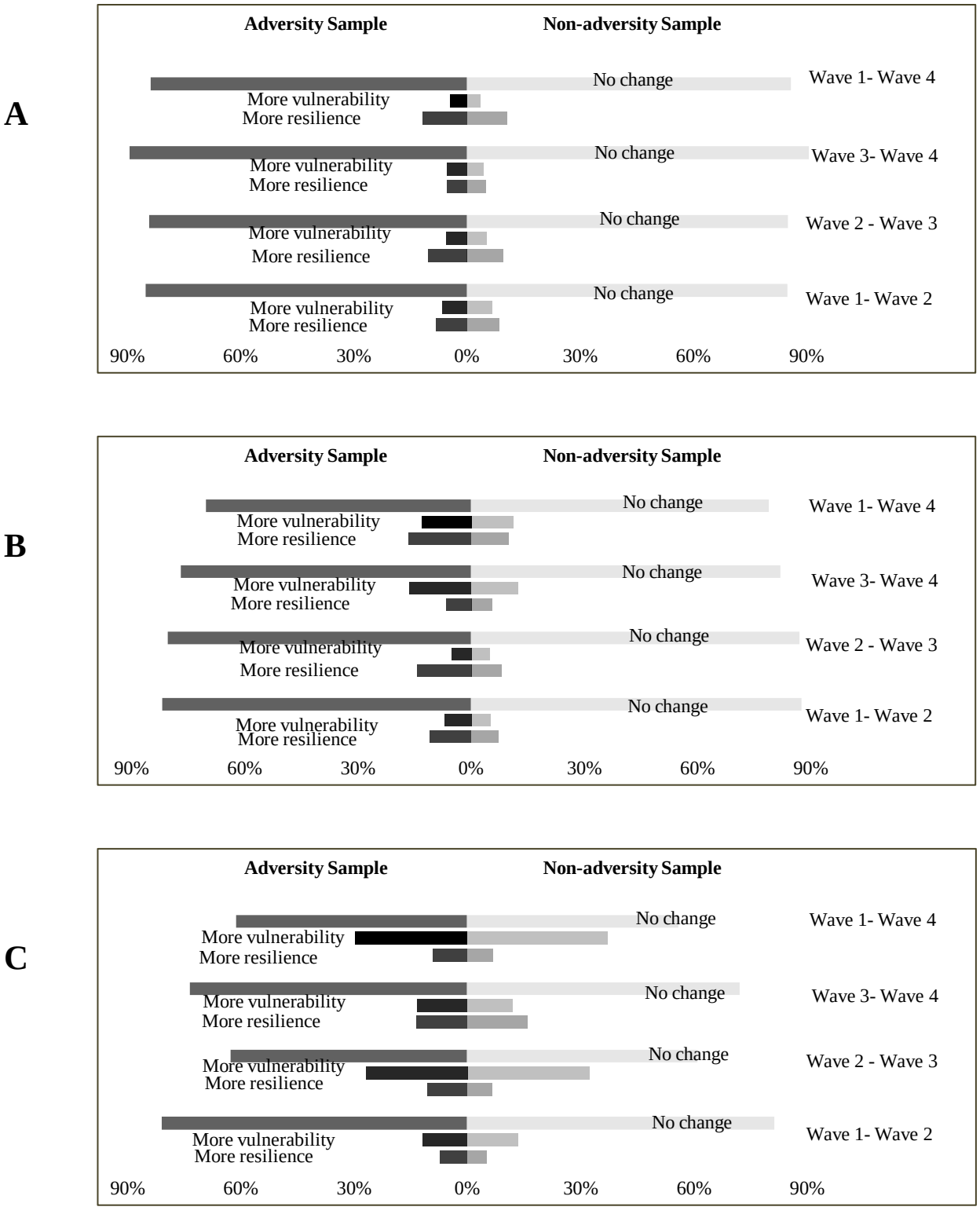

Figure 4.2. Patterns of trend in individual resilience status over time. (A) suicidal behavior, (B) violent behavior, and (C) substance use behavior.

Research question 2. Would the resilience scale predict resilient status?

Hypothesis 2.1: Resilience scores were concurrently associated with health risk behaviors at baseline of the Add Health study.

Three nested logistic regression models were applied for each type of health risk behavior. The first model contained only demographic predictors, the second had additional four resilience subscales, and the full model included actual social supports. Because of small proportion of missing data from item non-response, analyses were conducted in the completed data sets.

Suicide. All three models were significant on the likelihood ratio goodness-of-fit, indicating the model-predicted values were significantly different from observed values (see Table 4.8). However, due to large sample size, likelihood models are often significant in spite of a very small difference. Pseudo-R^2 may be meaningful to compare model fit. The model with only demographic variables had very small Pseudo-R^2 (about 2%). When adding perceived resilience subscales, the second model had remarkable improvement of the model fit with an incremental Pseudo-R^2 of 15%. The Pseudo-R^2 in the full model was almost equal to that in the second model, indicating that actually social supports provided a little improvement to predict suicidal behaviors.

School grade and family structure were significant in the demographic model but not in the full model. Results from the second model were almost the same as the full model. Therefore, the full model was used to present the findings. Females had approximate 1.5 times more likely than males to have suicidal ideation or attempt (*OR* = 1.43, 95% CI = [1.20, 1.71], $p < .001$). African Americans had significantly lower odds of feeling suicide than non-Hispanic Whites, *OR* = 0.68, 95%CI = [0.54, 0.87], $p = .002$. With regard to resilience subscales, adolescents who felt optimistic, had emotional coping pattern, and perceived social supports

inside and outside family were very strong protective factors to prevent suicidal behaviors. Although problem-focused coping was significant, the strength of association was positively borderline (*OR* = 1.18, 95%CI = [1.02, 1.37], *p* = .027). Of actual social supports, parental involvement influenced negatively and religion influenced positively on preventing suicidal behaviors. However, these effects were of small magnitude. Age, adversity, other races than Black, and family structure were not significantly associated with suicide.

Violence. Table 4.9 presents results from three logistic regression models to predict violence among adolescents at baseline. The demographic, the second, and the full models accounted for 7.17%, 10.88% and 11.40% of incremental improvement over the intercept model, respectively. In spite of significance in the Model 1 and 2, age was not significantly contributing to the Model 3. The full logistic regression model showed that female adolescents were one-third times less likely to involve in any violent situation than male counterparts (*OR* = 0.30, 95%CI = [0.25, 0.35], *p* < .001), while Blacks and Hispanics had a higher chance of getting into violence. Participants who did not live with any parent increased the risk of violent involvement than those whose family structure was biological parents (*OR* = 1.56, 95%CI = [1.19, 2.04], *p* < .001).

With regard to adversity, one score increase in negative condition of living was associated with 16% increase in risk of violence (*OR* = 1.16, 95%CI = [1.07, 1.25], *p* < .001). Regarding to perceived resilience scale, one score increase in emotional coping were two-third times less likely to involve in a violent occasion (*OR* = 0.63, 95%CI = [0.52, 0.75], *p* < .001), and one score increase in perceived social support reduced 55% risk of being involved a violence (*OR* = 0.45, 95%CI = [0.36, 0.55], *p* < .001). Parental involvement slightly increased the violent risk and increase in number of close friends was associated with violent behaviors.

Table 4.8

Results of three Logistic Regression Models for Predicting Suicidal Behaviors at Baseline

Parameters	Model 1			Model 2			Model 3		
	OR	95% CI	Wald	*OR*	95% CI	Wald	*OR*	95% CI	Wald
Age baseline	1.00	[0.93, 1.07]	0.04	0.97	[0.89, 1.04]	-0.92	0.97	[0.89, 1.05]	-0.84
Middle school	0.75	[0.57, 0.97]	-2.18*	0.86	[0.65, 1.14]	-1.05	0.89	[0.67, 1.19]	-0.78
High school	-	-	-	-	-	-	-	-	-
Females	1.73	[1.48, 2.03]	6.77**	1.49	[1.25, 1.77]	4.48**	1.43	[1.20, 1.71]	3.98**
Males	-	-	-	-	-	-	-	-	-
Asian Pacific	1.19	[0.79, 1.78]	0.82	0.82	[0.52, 1.28]	-0.89	0.88	[0.56, 1.38]	-0.54
Black	0.61	[0.50, 0.76]	-4.44**	0.63	[0.50, 0.80]	-3.87**	0.68	[0.54, 0.87]	-3.13**
Hispanic	0.90	[0.70, 1.17]	-0.77	0.81	[0.62, 1.08]	-1.43	0.82	[0.62, 1.09]	-1.35
Indian	2.17	[1.06, 4.44]	2.12*	1.97	[0.90, 4.34]	1.69	1.97	[0.88, 4.41]	1.66
Other races	0.78	[0.30, 2.01]	-0.51	0.85	[0.31, 2.33]	-0.32	0.81	[0.27, 2.40]	-0.38
White	-	-	-	-	-	-	-	-	-
Non parent	1.35	[1.01, 1.80]	2.04*	0.89	[0.65, 1.22]	-0.71	0.97	[0.69, 1.36]	-0.17
Single parent	1.24	[1.01, 1.53]	2.02*	1.04	[0.83, 1.30]	0.31	1.01	[0.80, 1.27]	0.07
Adopt parents	1.80	[1.04, 3.13]	2.09*	1.30	[0.70, 2.40]	0.82	1.34	[0.73, 2.47]	0.93
Step parents	1.19	[0.94, 1.51]	1.43	0.94	[0.73, 1.22]	-0.44	0.91	[0.70, 1.18]	-0.71
Biologic parents	-	-	-	-	-	-	-	-	-
Adversity	1.06	[0.97, 1.15]	1.32	0.94	[0.86, 1.03]	-1.41	0.94	[0.86, 1.03]	-1.30
Resilience scale									
Optimistic				0.37	[0.30, 0.47]	-8.57**	0.37	[0.29, 0.46]	-8.59**
Emotional coping				0.51	[0.42, 0.62]	-6.62**	0.54	[0.44, 0.66]	-5.97**
Problem coping				1.17	[1.02, 1.36]	2.16*	1.18	[1.02, 1.37]	2.20*
Social support				0.32	[0.25, 0.40]	-9.75**	0.30	[0.23, 0.38]	-10.01**
Actual support									
Parental control							1.02	[0.96, 1.08]	0.53
Parental involve							1.08	[1.04, 1.13]	3.52**
Friend support							1.04	[0.92, 1.17]	0.60
Religion							0.89	[0.82, 0.97]	-2.66**
Goodness-of-fit	LL = -2,199.4, R^2 = .02**			LL = -1,869.5, R^2 = .17**			LL = -1,831.7, R^2 = .17**		

Note. *OR* = odds ratio; CI = confidence interval, LL= Log likelihood, R^2=Pseudo R-squared

*significance at .05 level, **significance at .01 level

Table 4.9

Results of three Logistic Regression Models for Predicting Violent Behaviors at Baseline

Parameters	Model 1			Model 2			Model 3		
	OR	95% CI	Wald	*OR*	95% CI	Wald	*OR*	95% CI	Wald
Age baseline	1.09	[1.03, 1.17]	2.74**	1.08	[1.01, 1.15]	2.18*	1.05	[0.98, 1.12]	1.34
Middle school	1.01	[0.79, 1.29]	0.08	1.08	[0.84, 1.38]	0.62	1.07	[0.84, 1.38]	0.55
High school	-	-	-	-	-	-	-	-	-
Females	0.35	[0.30, 0.40]	-13.76**	0.31	[0.26, 0.36]	-14.62**	0.30	[0.25, 0.35]	-14.48**
Males	-	-	-	-	-	-	-	-	-
Asian Pacific	0.94	[0.60, 1.46]	-0.29	0.84	[0.53, 1.31]	-0.78	0.86	[0.54, 1.35]	-0.66
Black	1.67	[1.41, 1.99]	5.82**	1.76	[1.47, 2.10]	6.18**	1.89	[1.57, 2.29]	6.68**
Hispanic	1.46	[1.16, 1.84]	3.26**	1.45	[1.15, 1.83]	3.09**	1.47	[1.16, 1.86]	3.15**
Indian	1.32	[0.59, 2.98]	0.68	1.11	[0.48, 2.61]	0.25	1.10	[0.46, 2.62]	0.22
Other races	1.57	[0.70, 3.51]	1.11	1.70	[0.75, 3.87]	1.26	1.79	[0.76, 4.22]	1.32
White	-	-	-	-	-	-	-	-	-
Non parent	1.85	[1.45, 2.37]	4.91**	1.62	[1.26, 2.09]	3.75**	1.56	[1.19, 2.04]	3.20**
Single parent	1.35	[1.12, 1.64]	3.09**	1.25	[1.03, 1.52]	2.21*	1.18	[0.97, 1.44]	1.68
Adopt parents	1.58	[0.86, 2.87]	1.48	1.30	[0.70, 2.41]	0.83	1.31	[0.71, 2.43]	0.85
Step parents	1.20	[0.96, 1.51]	1.61	1.09	[0.86, 1.37]	0.72	1.06	[0.84, 1.34]	0.50
Biologic parents	-	-	-	-	-	-	-	-	-
Adversity	1.18	[1.10, 1.27]	4.54**	1.13	[1.05, 1.22]	3.30**	1.16	[1.07, 1.25]	3.76**
Resilience scale									
Optimistic				0.91	[0.75, 1.12]	-0.90	0.89	[0.72, 1.09]	-1.13
Emotional coping				0.60	[0.50, 0.71]	-5.74**	0.63	[0.52, 0.75]	-5.15**
Problem coping				0.96	[0.85, 1.09]	-0.59	0.97	[0.85, 1.10]	-0.51
Social support				0.46	[0.38, 0.57]	-7.44**	0.45	[0.36, 0.55]	-7.48**
Actual support									
Parental control							1.05	[1.00, 1.11]	1.87
Parental involve							1.05	[1.01, 1.09]	2.39*
Friend support							1.25	[1.13, 1.38]	4.27**
Religion							1.05	[0.98, 1.12]	1.34
Goodness-of-fit	LL = -2,431.4, R^2= .07 **			LL = -2,328.5, R^2= .11 **			LL = -2,265.2, R^2 = .11 **		

Note. *OR* = odds ratio; CI = confidence interval, LL= Log likelihood, R^2=Pseudo R-squared

*significance at .05 level, **significance at .01 level

Substance use. Chi-squared goodness-of-fit was significant in all logistic models, indicating there were some differences between observed and model-predicted values (see Table 4.10). There was a little improvement in fit based on R-squared in Model 3 over Model 1 and Model 2. In the full model, all demographic factors were significantly related to substance use behaviors such as age at baseline, education, race/ethnicity, and family structure. Adversity did not significantly influence on substance use. Two out of four resilience subscales were significantly associated with substance use including emotional coping (*OR* = 0.47, 95%CI = [0.40, 0.55], p < .001) and perceived social support (*OR* = 0.55, 95%CI = [0.46, 0.66], p < .001). Parental control and friend support slightly increased the risk of using substances while religion was a significant protective factor for this behavior (*OR* = 0.74, 95%CI = [0.70, 0.79], p < .001).

The final models included predictors that were significant and had relatively large effect sizes (odds ratio) in at least one of the above full models. The final logistic regression models consisted of age, gender, race, family context, friend support and religious support. Due to all resilience subscales were significant in at least one health risk behavior, total resilience score was used in the final model instead of subscales (see Table 4.11). In general, odd ratios improved a little bit from the original full models, especially for demographic variables. However, effect sizes of the total resilience scale were remarkably stronger than its subscales. For example, the odds of having suicidal behaviors was reduced 14 times for an additional score that the participant reported (*OR* = 0.07, 95%CI = [0.06, 0.09], *p* < .001). There was an exception in actual support which religion on violence changed from non-significance (in the full model) to significance (in the final model). The magnitude of this change, however, was rather small. Friend support increased the risk of getting into violence and using substances while religion was a protective factor for all health risk behaviors.

Table 4.10

Results of three Logistic Regression Models for Predicting Substance Use Behaviors at Baseline

Parameters	Model 1			Model 2			Model 3		
	OR	95% CI	Wald	*OR*	95% CI	Wald	*OR*	95% CI	Wald
Age baseline	1.31	[1.24, 1.38]	9.72**	1.32	[1.25, 1.40]	9.78**	1.25	[1.18, 1.33]	7.43**
Middle school	0.70	[0.57, 0.87]	-3.25**	0.75	[0.61, 0.94]	-2.55*	0.75	[0.60, 0.94]	-2.48*
High school	-	-	-	-	-	-	-	-	-
Females	0.75	[0.67, 0.85]	-4.60**	0.69	[0.61, 0.79]	-5.64**	0.70	[0.61, 0.79]	-5.36**
Males	-	-	-	-	-	-	-	-	-
Asian Pacific	0.42	[0.29, 0.62]	-4.37**	0.34	[0.23, 0.51]	-5.26**	0.38	[0.25, 0.57]	-4.69**
Black	0.31	[0.26, 0.37]	-12.98**	0.30	[0.25, 0.36]	-13.10**	0.36	[0.30, 0.44]	-10.49**
Hispanic	0.64	[0.53, 0.79]	-4.24**	0.61	[0.50, 0.76]	-4.55**	0.63	[0.51, 0.79]	-4.12**
Indian	0.90	[0.45, 1.82]	-0.29	0.81	[0.39, 1.71]	-0.55	0.77	[0.36, 1.64]	-0.68
Other races	0.66	[0.33, 1.35]	-1.12	0.74	[0.35, 1.55]	-0.79	0.75	[0.34, 1.65]	-0.72
White	-	-	-	-	-	-	-	-	-
Non parent	2.03	[1.62, 2.54]	6.17**	1.77	[1.41, 2.24]	4.83**	1.67	[1.29, 2.16]	3.92**
Single parent	1.63	[1.38, 1.92]	5.87**	1.52	[1.28, 1.79]	4.83**	1.35	[1.14, 1.61]	3.43**
Adopt parents	1.11	[0.66, 1.86]	0.41	0.91	[0.53, 1.54]	-0.37	0.94	[0.55, 1.61]	-0.23
Step parents	1.70	[1.41, 2.04]	5.69**	1.56	[1.30, 1.89]	4.68**	1.42	[1.17, 1.72]	3.58**
Biologic parents	-	-	-	-	-	-	-	-	-
Adversity	1.09	[1.02, 1.16]	2.47*	1.04	[0.97, 1.11]	1.00	1.04	[0.97, 1.12]	1.14
Resilience scale									
Optimistic				0.94	[0.78, 1.11]	-0.75	0.91	[0.76, 1.09]	-1.04
Emotional coping				0.47	[0.40, 0.55]	-9.68**	0.47	[0.40, 0.55]	-9.37**
Problem coping				0.87	[0.78, 0.97]	-2.48*	0.90	[0.81, 1.01]	-1.80
Social support				0.53	[0.45, 0.64]	-6.87**	0.55	[0.46, 0.66]	-6.25**
Actual support									
Parental control							1.12	[1.07, 1.18]	4.90**
Parental involve							1.01	[0.98, 1.05]	0.79
Friend support							1.33	[1.22, 1.45]	6.38**
Religion							0.74	[0.70, 0.79]	-9.15**
Goodness-of-fit	LL = -3,166.2, R^2 = .09**			LL = -3,005.2, R^2 = .13**			LL = -2,865.7, R^2 = .15**		

Note. *OR* = odds ratio; CI = confidence interval, LL= Log likelihood, R^2=Pseudo R-squared

*significance at .05 level, **significance at .01 level

Table 4.11

Results of Final Logistic Regression Models for Predicting Health Risk Behavior at Baseline

Parameters	Suicide			Violence			Substance use		
	OR	95% CI	Wald	*OR*	95% CI	Wald	*OR*	95% CI	Wald
Age baseline	1.03	[0.99, 1.08]	1.33	1.07	[1.03, 1.12]	3.38**	1.37	[1.32, 1.42]	16.72**
Females [a]	1.51	[1.28, 1.77]	4.98**	0.31	[0.27, 0.37]	-15.21**	0.70	[0.62, 0.79]	-5.81**
Asian Pacific [b]	1.02	[0.68, 1.54]	0.11	0.91	[0.60, 1.40]	-0.41	0.40	[0.27, 0.58]	-4.76**
Black [b]	0.72	[0.58, 0.89]	-3.03**	2.07	[1.75, 2.45]	8.39**	0.39	[0.32, 0.46]	-10.88**
Hispanic [b]	0.87	[0.68, 1.12]	-1.09	1.67	[1.36, 2.07]	4.79**	0.68	[0.56, 0.82]	-3.95**
Non parent [c]	0.90	[0.68, 1.20]	-0.71	1.74	[1.38, 2.20]	4.67**	1.75	[1.42, 2.18]	5.13**
Single parent [c]	1.00	[0.82, 1.21]	-0.03	1.46	[1.23, 1.74]	4.38**	1.49	[1.29, 1.73]	5.30**
Step parents [c]	0.95	[0.75, 1.21]	-0.38	1.19	[0.96, 1.48]	1.60	1.42	[1.19, 1.70]	3.89**
Total resilience	0.07	[0.06, 0.09]	-21.44**	0.27	[0.22, 0.34]	-12.10**	0.27	[0.22, 0.32]	-14.27**
Friend support	1.04	[0.93, 1.16]	0.71	1.26	[1.15, 1.39]	4.83**	1.38	[1.28, 1.50]	7.90**
Religion	0.92	[0.85, 0.99]	-2.23*	0.92	[0.86, 0.98]	-2.42*	0.73	[0.69, 0.78]	-10.41**
Goodness-of-fit	LL=-2,128.2 R^2=0.13**			LL = -2,558.8 R^2=0.10**			LL = -3,242.1 R^2=0.15**		

Note. *OR* = odds ratio, CI = confidence interval, LL = Log likelihood, R^2= Pseudo R-squared. [a] Reference group = Males, [b] Reference group = White, Indian, and other races combined, [c] Reference group = adopt and biological parents combined. *p < .05, **p < .01.

Conclusion: Findings from the logistic regressions support the hypothesis that resilience scale could concurrently predict resilience status. Participating adolescents who had higher scores significantly reduced the risk of engagement in health risk behaviors, or in other words, became more resilient.

Hypothesis 2.2: Resilience scores measured at baseline were prospectively associated with health risk behaviors over time.

My dissertation set up three Generalized Estimating Equations (GEE) Logistic models to explore effects of predictors on health risk behaviors over time. Like bivariate logistic regressions, the first GEE model contained only demographic information, the second was added four resilience subscales, and the full models included demographic predictors, resilience scores, and actual social supports.

Cross-sectional and longitudinal information were indicated by two variables: age at baseline and time since baseline. Age at baseline, measuring cross-sectional effect or between-subject effect, was used as a confounder to control the cohort effect because participants entered the study at different ages at baseline. On the other hand, time since baseline was used to assess the longitudinal or within-subject effect because participants were measured repeatedly overtime. Two interaction terms: Age*Time and Age*Time-squared were included in the demographic model. However, these interactions were not significant with very small estimated coefficients. Other independent variables fixed at baseline such as demographics, resilience scale, and parental support provided between-subject information, while predictors repeatedly measured through time such as friend and religious supports were used to explore within-subject effects.

Suicidal behaviors. Results of three GEE models for predicting suicidal behaviors over time were presented in table 4.12. Goodness-of-fit using Quasi-likelihood under the Independence model Criterion (QIC) showed that the full model was the best fit because of its lowest value (13,981.70). All within-subject associations were significant, thus the GEE assumption of dependence among repeated responses was satisfied. The pairwise marginal odds ratios over time were relatively large, from 1.85 to 5.12, indicating strong positive associations

among indicators of suicidal behaviors at the four measurement waves. These within-subject associations were especially strongest in adjacent pairwise waves.

Family structure was significant in the demographic model but not in others. Most estimated coefficients from the second and the third models were very similar, so the full model was used to present results. For adolescents participating at baseline, one year increase in age at that time-point reduced 6% the risk of having suicidal ideation and attempt (*OR* = 0.94, 95%CI = [0.89, 0.99], $p = .011$). However, the longitudinal effect was much stronger. For each year increase in age over time, the risk of suicidal behaviors reduced by 22% (*OR* = 0.78, 95%CI = [0.75, 0.82], $p < .001$). Time-squared was significant, indicating that the pattern of change was quadratic rather than linear.

Among time-stationary predictors, family structure, grade and adversity were not significant. Blacks participants were less likely to have suicidal idea or attempt (*OR* = 0.75, 95%CI = [0.64, 0.87], $p < .001$) while Indian Americans were more likely to develop this behavior than White counterparts (*OR* = 1.67, 95%CI = [1.00, 2.77], $p = .049$). Females had 25% higher risk of suicide than males (*OR* = 1.25, 95%CI = [1.12, 1.41], $p < .001$).

Since resilience scale was time-stationary predictors, this variable could be used to assess the between-subject effect. For one score increase in optimistic subscale, the population average odds of having any suicidal behavior reduced by half (*OR* = 0.53, 95%CI = [0.46, 0.62], $p < .001$) over time. An additional emotional coping score contributed to an average 35% risk reduction of having suicidal behaviors (*OR* = 0.65, 95%CI = [0.56, 0.75], $p < .001$). Higher perceived social support scores significantly lowered the risk of suicidal behaviors (*OR* = 0.46, 95%CI = [0.40, 0.54], $p < .001$).

Table 4.12

Results of three Logistic GEE Models for Predicting Suicidal Behaviors over Time

Parameters	Model 1				Model 2				Model 3			
	β	*OR*	[95% CI]	Wald	*β*	*OR*	[95% CI]	Wald	*β*	*OR*	[95% CI]	Wald
Intercept	-2.82			-6.59**	4.32			8.33**	4.27			8.02**
Age baseline	0.04	1.04	[0.99, 1.09]	1.60	-0.06	0.94	[0.90, 0.99]	-2.24*	-0.06	0.94	[0.89, 0.99]	-2.53*
Time	0.81	2.25	[1.61, 3.13]	4.79**	-0.22	0.80	[0.77, 0.83]	-10.28**	-0.25	0.78	[0.75, 0.82]	-11.00**
Time squared	-0.06	0.94	[0.92, 0.97]	-4.48**	0.01	1.01	[1.01, 1.02]	6.83**	0.01	1.01	[1.01, 1.02]	7.48**
Middle school	-0.07	0.94	[0.79, 1.11]	-0.75	0.05	1.05	[0.88, 1.25]	0.52	0.06	1.06	[0.89, 1.27]	0.69
High school	-	-	-	-	-	-	-	-	-	-	-	-
Female	0.38	1.46	[1.31, 1.64]	6.59**	0.24	1.27	[1.14, 1.43]	4.14**	0.23	1.25	[1.12, 1.41]	3.92**
Male	-	-	-	-	-	-	-	-	-	-	-	-
Asian Pacific	-0.02	0.98	[0.73, 1.31]	-0.13	-0.26	0.77	[0.59, 1.02]	-1.82	-0.21	0.81	[0.62, 1.07]	-1.48
Black	-0.39	0.68	[0.59, 0.79]	-5.06**	-0.35	0.71	[0.61, 0.82]	-4.53**	-0.29	0.75	[0.64, 0.87]	-3.76**
Hispanic	-0.14	0.87	[0.71, 1.05]	-1.45	-0.23	0.79	[0.65, 0.96]	-2.37*	-0.21	0.81	[0.67, 0.99]	-2.12*
Indian	0.66	1.94	[1.16, 3.23]	2.54*	0.53	1.70	[1.02, 2.85]	2.03*	0.51	1.67	[1.00, 2.77]	1.96*
Other races	0.07	1.07	[0.56, 2.04]	0.22	0.17	1.19	[0.59, 2.37]	0.49	0.17	1.18	[0.60, 2.34]	0.48
White	-	-	-	-	-	-	-	-	-	-	-	-
Non Parent	0.29	1.34	[1.09, 1.64]	2.85**	0.02	1.02	[0.84, 1.24]	0.19	0.00	1.00	[0.82, 1.23]	0.04
Single Parent	0.16	1.18	[1.01, 1.37]	2.11*	0.04	1.04	[0.90, 1.22]	0.55	0.02	1.02	[0.87, 1.19]	0.24
Adopt parents	0.33	1.39	[0.93, 2.07]	1.62	0.07	1.07	[0.71, 1.63]	0.34	0.08	1.09	[0.72, 1.64]	0.39
Step parents	0.23	1.26	[1.07, 1.48]	2.76**	0.10	1.11	[0.94, 1.31]	1.20	0.08	1.08	[0.92, 1.28]	0.93
Biologic parents	-	-	-	-	-	-	-	-	-	-	-	-
Adversity	0.05	1.05	[0.99, 1.11]	1.61	-0.03	0.97	[0.92, 1.03]	-0.99	-0.02	0.98	[0.92, 1.03]	-0.81

Table 4.12. *Results of three Logistic GEE Models for Predicting Suicidal Behaviors over Time (continued)*

Parameters	Model 1				Model 2				Model 3			
	β	OR	[95% CI]	Wald	*β*	OR	[95% CI]	Wald	*β*	OR	[95% CI]	Wald
Resilience scale												
Optimistic					-0.62	0.54	[0.46, 0.63]	-7.92**	-0.63	0.53	[0.46, 0.62]	-8.09**
Emotional Coping					-0.45	0.64	[0.55, 0.74]	-6.07**	-0.43	0.65	[0.56, 0.75]	-5.79**
Problem Coping					0.10	1.10	[0.99, 1.22]	1.86	0.10	1.11	[1.00, 1.23]	1.91
Social Support					-0.75	0.47	[0.41, 0.55]	-9.98**	-0.77	0.46	[0.40, 0.54]	-10.05**
Actual social support												
Parental control									0.03	1.03	[0.99, 1.07]	1.46
Parental involvement									0.04	1.04	[1.01, 1.08]	2.66**
Friend support									0.05	1.05	[0.99, 1.12]	1.56
Religion									-0.10	0.90	[0.86, 0.95]	-3.72**
Within-subject association												
W1-W2	2.02	7.51	[6.21, 9.09]	20.87**	1.63	5.12	[4.18, 6.27]	15.87**	1.62	5.07	[4.13, 6.22]	15.66**
W1-W3	1.11	3.05	[2.34, 3.96]	8.33**	0.63	1.89	[1.41, 2.53]	4.26**	0.61	1.85	[1.38, 2.47]	4.11**
W1-W4	1.37	3.94	[3.11, 4.99]	11.34**	0.96	2.61	[2.02, 3.36]	7.43**	0.95	2.58	[2.00, 3.32]	7.29**
W2-W3	1.14	3.14	[2.28, 4.32]	7.18**	0.95	2.58	[1.86, 3.57]	5.78**	0.93	2.52	[1.82, 3.49]	5.66**
W2-W4	0.90	2.46	[1.80, 3.38]	5.67**	0.65	1.91	[1.37, 2.67]	3.85**	0.62	1.86	[1.32, 2.61]	3.62**
W3-W4	1.76	5.81	[4.05, 8.33]	9.80**	1.65	5.18	[3.56, 7.54]	8.85**	1.63	5.12	[3.51, 7.47]	8.71**
			QIC = 15,028.39				QIC = 14,014.96				QIC = 13,981.70	

Note. All models were used Alternating Logistic Regressions to fit. Missing data were imputed nine times. Model 1 included two non-significant interactions: Time*Age and Time-squared*Age. *OR* = odds ratio; CI = confidence interval; QIC = Quasi-Likelihood Under Independence Model Criterion. *p < .05, **p < .01.

Violent behaviors. The full GEE model with all time-varying and time-stationary predictors was the best fit over the demographic and the second models, QIC = 18,541.21 (see Table 4.13). The cohort effect (age at baseline) was not as significant as the longitudinal effect (time since baseline). There was a strong non-linear longitudinal age effect on the prevalence of violence (time: *OR* = 0.69, 95%CI = [0.66, 0.71], $p < .001$ and time-squared: *OR* = 1.03, 95% CI = [1.03, 1.03], $p < .001$). Among demographic predictors, females were less likely to be involved in a violent occasion compared to males, *OR* = 0.50, 95%CI = [0.45, 0.55], $p < .001$. Blacks, Hispanics, non-parent, single parent, and stepparents were positively associated with violent behaviors as compared to their reference groups.

With regard to resilience scale, one score increase in emotional coping and perceive social support reduced the risk of getting into violence by 28% (*OR* = 0.72, 95%CI= [0.65, 0.80], $p < .001$) and 37% (*OR* = 0.63, 95%CI = [0.56, 0.72], $p < .001$), respectively.

Substance use behaviors. In Table 4.14, goodness-of-fit tests indicated that the full model (QIC= 30,816.61) was better than the model without actual social support and the demographic model. Cohort age at baseline was not significant, but longitudinal age was a significant and quadratic relationship with substance use behaviors. However, participants who were in middle school at baseline had a lower risk of using substance, *OR* = 0.89, 95%CI = [0.79, 0.99], $p = .03$ than those in high school, indicating that the cohort age had a certain effect. Like suicidal and violent behaviors, Blacks or Hispanics, and those who lived in the family with non-parent, single parent, or stepparents at baseline were significantly higher risks of substance use. Participants who lived in adverse conditions at baseline were not significantly different from those who lived in normal condition. Of resilience subscales, emotional coping, problem-focused coping, and perceived social support were inversely associated with the risk of substance use.

Table 4.13

Results of three Logistic GEE Models for Predicting Violent Behaviors over Time

Parameters	Model 1				Model 2				Model 3			
	β	OR	[95% CI]	Wald	β	OR	[95% CI]	Wald	β	OR	[95% CI]	Wald
Intercept	-3.30	0.04	[0.02, 0.07]	-9.11**	0.19	1.20	[0.56, 2.61]	0.47	0.01			0.01
Age baseline	0.10	1.10	[1.06, 1.15]	4.52**	0.03	1.03	[0.99, 1.07]	1.43	0.02	1.02	[0.98, 1.07]	1.16
Time	0.46	1.59	[1.13, 2.23]	2.67**	-0.35	0.70	[0.68, 0.73]	-18.85**	-0.38	0.69	[0.66, 0.71]	-19.03**
Time squared	-0.03	0.97	[0.95, 1.00]	-2.06*	0.03	1.03	[1.02, 1.03]	19.16**	0.03	1.03	[1.03, 1.03]	19.52**
Middle school	0.02	1.03	[0.89, 1.18]	0.35	0.08	1.08	[0.93, 1.25]	1.05	0.09	1.09	[0.94, 1.26]	1.19
High school	-	-	-	-	-	-	-	-	-	-	-	-
Female	-0.66	0.52	[0.47, 0.57]	-13.65**	-0.69	0.50	[0.46, 0.55]	-14.29**	-0.70	0.50	[0.45, 0.55]	-14.23**
Male	-	-	-	-	-	-	-	-	-	-	-	-
Asian Pacific	-0.14	0.87	[0.64, 1.19]	-0.86	-0.19	0.82	[0.60, 1.13]	-1.23	-0.17	0.85	[0.62, 1.16]	-1.06
Black	0.35	1.42	[1.25, 1.61]	5.53**	0.35	1.42	[1.26, 1.61]	5.60**	0.39	1.48	[1.31, 1.68]	6.20**
Hispanic	0.22	1.24	[1.07, 1.44]	2.81**	0.19	1.22	[1.05, 1.41]	2.56 *	0.21	1.24	[1.07, 1.44]	2.82**
Indian	0.52	1.68	[1.02, 2.79]	2.03*	0.43	1.54	[0.92, 2.58]	1.67	0.44	1.55	[0.93, 2.58]	1.67
Other races	0.41	1.51	[0.90, 2.52]	1.58	0.44	1.55	[0.93, 2.60]	1.69	0.44	1.56	[0.94, 2.58]	1.73
White	-	-	-	-	-	-	-	-	-	-	-	-
Non parent	0.48	1.62	[1.38, 1.89]	6.08**	0.40	1.48	[1.27, 1.73]	5.01**	0.39	1.48	[1.27, 1.73]	4.95**
Single parent	0.20	1.22	[1.08, 1.39]	3.13**	0.15	1.16	[1.02, 1.31]	2.32*	0.13	1.14	[1.01, 1.29]	2.07*
Adopt parents	0.29	1.33	[0.91, 1.97]	1.47	0.18	1.19	[0.81, 1.76]	0.90	0.17	1.19	[0.81, 1.76]	0.88
Step parents	0.22	1.25	[1.09, 1.43]	3.16**	0.17	1.19	[1.03, 1.36]	2.44*	0.16	1.17	[1.02, 1.35]	2.31*
Biologic parents	-	-	-	-	-	-	-	-	-	-	-	-
Adversity	0.11	1.12	[1.06, 1.18]	4.33**	0.09	1.09	[1.04, 1.15]	3.46**	0.10	1.10	[1.05, 1.16]	3.72**

Table 4.13. *Results of three Logistic GEE Models for Predicting Violent Behaviors over Time (continued)*

Parameters	Model 1				Model 2				Model 3			
	β	OR	[95% CI]	Wald	*β*	OR	[95% CI]	Wald	*β*	OR	[95% CI]	Wald
Resilience scale												
Optimistic					0.05	1.05	[0.92, 1.19]	0.72	0.03	1.03	[0.91, 1.17]	0.47
Emotional Coping					-0.34	0.71	[0.64, 0.79]	-6.45**	-0.33	0.72	[0.65, 0.80]	-6.23**
Problem Coping					0.01	1.01	[0.93, 1.09]	0.12	0.01	1.01	[0.93, 1.09]	0.15
Social Support					-0.45	0.64	[0.57, 0.73]	-7.02**	-0.46	0.63	[0.56, 0.72]	-7.08**
Actual social support												
Parental control									0.02	1.02	[0.98, 1.06]	0.99
Parental involvement									0.03	1.03	[1.00, 1.05]	2.12*
Friend support									0.09	1.09	[1.04, 1.15]	3.40**
Religion									-0.05	0.95	[0.91, 0.99]	-1.98*
Within-subject association												
W1-W2	2.21	9.14	[7.63,10.94]	24.13**	2.13	8.39	[6.97,10.09]	22.69**	2.11	8.27	[6.87, 9.95]	22.42**
W1-W3	1.15	3.17	[2.53, 3.97]	10.02**	1.04	2.83	[2.25, 3.57]	8.86**	1.05	2.85	[2.26, 3.58]	8.95**
W1-W4	0.31	1.36	[1.13, 1.64]	3.32**	0.22	1.24	[1.03, 1.51]	2.25*	0.22	1.25	[1.03, 1.52]	2.31*
W2-W3	1.20	3.33	[2.62, 4.23]	9.86**	1.12	3.07	[2.41, 3.91]	9.14**	1.12	3.06	[2.41, 3.89]	9.15**
W2-W4	0.22	1.25	[0.98, 1.60]	1.82	0.16	1.17	[0.90, 1.53]	1.23	0.16	1.17	[0.90, 1.53]	1.22
W3-W4	0.38	1.47	[1.08, 2.00]	2.51*	0.39	1.48	[1.10, 2.00]	2.64*	0.40	1.49	[1.11, 2.01]	2.68**
		QIC = 18,926.35			QIC = 18,573.62				QIC = 18,541.21			

Note. All models were used Alternating Logistic Regressions to fit. Missing data were imputed nine times. Model 1 included two non-significant interactions: Time*Age and Time-squared*Age. *OR* = odds ratio; CI = confidence interval; QIC = Quasi-Likelihood Under Independence Model Criterion. *p < .05, **p < .01.

Table 4.14

Results of three Logistic GEE Models for Predicting Substance Use Behaviors over Time

Parameters	Model 1				Model 2				Model 3			
	β	OR	[95% CI]	Wald	β	OR	[95% CI]	Wald	β	OR	[95% CI]	Wald
Intercept	-5.10			-16.06**	1.53			4.50**	1.75			5.20**
Age baseline	0.28	1.32	[1.27, 1.37]	14.77**	0.05	1.05	[1.02, 1.08]	3.01**	0.03	1.03	[1.00, 1.07]	1.88
Time	1.54	4.67	[3.85, 5.67]	15.83**	0.24	1.28	[1.25, 1.30]	23.86**	0.17	1.18	[1.16, 1.20]	15.41**
Time squared	-0.08	0.93	[0.91, 0.94]	-10.49**	-0.01	0.99	[0.99, 0.99]	-17.92**	-0.01	0.99	[0.99, 0.99]	-11.76**
Middle school	-0.19	0.83	[0.74, 0.93]	-3.29**	-0.12	0.89	[0.80, 1.00]	-2.02*	-0.12	0.89	[0.79, 0.99]	-2.14*
High school	-	-	-	-	-	-	-	-	-	-	-	-
Female	-0.48	0.62	[0.57, 0.67]	-12.47**	-0.51	0.60	[0.56, 0.65]	-13.32**	-0.49	0.61	[0.57, 0.66]	-12.80**
Male	-	-	-	-	-	-	-	-	-	-	-	-
Asian Pacific	-0.72	0.49	[0.39, 0.61]	-6.33**	-0.80	0.45	[0.36, 0.56]	-7.01**	-0.72	0.49	[0.39, 0.61]	-6.44**
Black	-0.97	0.38	[0.34, 0.42]	-19.30**	-0.98	0.00	[0.00, 0.00]	-19.45**	-0.84	0.00	[0.00, 0.00]	-16.67**
Hispanic	-0.46	0.63	[0.55, 0.72]	-6.84**	-0.49	0.61	[0.54, 0.70]	-7.40**	-0.43	0.65	[0.57, 0.74]	-6.67**
Indian	0.24	1.28	[0.83, 1.96]	1.11	0.17	1.19	[0.80, 1.76]	0.87	0.14	1.15	[0.77, 1.71]	0.70
Other races	-0.38	0.68	[0.46, 1.02]	-1.86	-0.33	0.72	[0.47, 1.09]	-1.54	-0.24	0.78	[0.52, 1.18]	-1.16
White	-	-	-	-	-	-	-	-	-	-	-	-
Non Parent	0.43	1.53	[1.32, 1.78]	5.60**	0.35	1.42	[1.22, 1.65]	4.59**	0.31	1.37	[1.18, 1.59]	4.17**
Single Parent	0.27	1.32	[1.18, 1.47]	4.81**	0.23	1.26	[1.13, 1.41]	4.19**	0.18	1.20	[1.08, 1.34]	3.28**
Adopt parents	0.05	1.06	[0.75, 1.48]	0.31	-0.07	0.93	[0.66, 1.30]	-0.43	-0.05	0.95	[0.69, 1.32]	-0.29
Step parents	0.34	1.41	[1.26, 1.58]	5.82**	0.29	1.34	[1.20, 1.50]	5.07**	0.24	1.27	[1.14, 1.42]	4.20**
Biologic parents	-	-	-	-	-	-	-	-	-	-	-	-
Adversity	0.01	1.01	[0.97, 1.06]	0.42	-0.02	0.98	[0.94, 1.03]	-0.76	-0.02	0.98	[0.94, 1.03]	-0.71

Table 4.14. *Results of three Logistic GEE Models for Predicting Substance Use Behaviors over Time (continued)*

Parameters	Model 1				Model 2				Model 3			
	β	OR	[95% CI]	Wald	*β*	OR	[95% CI]	Wald	*β*	OR	[95% CI]	Wald
Resilience scale												
Optimistic					0.02	1.02	[0.91, 1.15]	0.40	0.00	1.00	[0.89, 1.13]	0.06
Emotional Coping					-0.51	0.60	[0.55, 0.66]	-10.54**	-0.51	0.60	[0.55, 0.66]	-10.71**
Problem Coping					-0.12	0.88	[0.83, 0.95]	-3.60**	-0.11	0.89	[0.84, 0.96]	-3.26**
Social Support					-0.30	0.74	[0.66, 0.83]	-5.32**	-0.26	0.77	[0.69, 0.86]	-4.54**
Actual Social Support												
Parental control									0.05	1.05	[1.03, 1.08]	3.99**
Parental involve									0.01	1.01	[0.99, 1.03]	1.17
Friend support									0.19	1.21	[1.17, 1.26]	10.28**
Religion									-0.34	0.71	[0.68, 0.73]	-19.06**
Within-subject association												
W1-W2	2.44	11.49	[9.90, 13.3]	32.35**	2.39	10.92	[9.40, 12.6]	31.56**	2.21	9.14	[7.87, 10.6]	29.11**
W1-W3	1.17	3.24	[2.81, 3.73]	16.36**	0.93	2.52	[2.21, 2.88]	13.86**	0.90	2.47	[2.16, 2.82]	13.42**
W1-W4	1.11	3.04	[2.65, 3.47]	16.18**	0.83	2.30	[2.03, 2.61]	13.06**	0.81	2.25	[1.98, 2.56]	12.29**
W2-W3	1.13	3.10	[2.69, 3.57]	15.80**	0.97	2.65	[2.31, 3.04]	14.13**	0.94	2.55	[2.22, 2.94]	13.17**
W2-W4	1.04	2.82	[2.34, 3.40]	11.40**	0.86	2.36	[1.98, 2.82]	9.91**	0.81	2.26	[1.90, 2.68]	9.61**
W3-W4	1.72	5.56	[4.79, 6.47]	23.00**	1.73	5.64	[4.85, 6.55]	23.14**	1.63	5.08	[4.33, 5.97]	20.50**
			QIC = 32,126.14				QIC = 31,870.03				QIC = 30,816.61	

Note. All models were used Alternating Logistic Regressions to fit. Missing data were imputed nine times. Model 1 included two non-significant interactions: Time*Age and Time-squared*Age. *OR* = odds ratio; CI = confidence interval; QIC = Quasi-Likelihood Under Independence Model Criterion. *p < .05, **p < .01.

In summary, the results in logistic GEE models support the hypothesis that resilience scale prospectively predicted resilience status on the domain of health risk behaviors. Emotional coping, and perceived social support subscales were significantly inversely associated with all indicators of health risk behaviors while optimistic and problem-focused coping significantly influenced on some of the indicators.

Research question 3. Would actual social supports positively influence resilient status?

Hypothesis 3.1: Actual social supports were concurrently associated with health risk behaviors at points in time of Add Health interviews.

Bivariate logistic regressions for predicting health risk behaviors were employed to each predictor of actual social supports including parental control, parental involvement, friend support, and religion support at waves of Add Health interviews. Age, gender, grade, race, family structure, and adversity were taken into account to adjusting confounding effects. Table 4.15 presents cross-sectional effects from the bivariate odds ratios. Parental control and parental involvement had no effect or very small effects on the adolescents' health risk behaviors at baseline. With regard to friend support, having more close friends increased the risk of health risk behaviors in some measurement occasions such as suicide (Wave III and IV), violence (baseline), and substance use (all waves). Religion was strongly a protective factor to keep participants from participating in health risk behaviors at all measurement occasions. For example, one score increase in religious support reduced the risk of substance use at Wave IV by 54% (OR = 0.46, 95%CI = [0.43, 0.50], $p < .001$).

Table 4.15

Results of Bivariate Odds Ratios from Logistic Regressions for Predicting Health Risk Behaviors by Actual Social Support

Parameters	Suicide		Violence		Substance use	
	OR	95% CI	*OR*	95% CI	*OR*	95% CI
Wave I						
Parental control	0.98	[0.93, 1.04]	1.06	[1.01, 1.11]*	1.13	[1.08, 1.18]**
Parental involvement	0.97	[0.93, 1.01]	1.00	[0.97, 1.04]	0.95	[0.92, 0.98]**
Friend support	1.07	[0.96, 1.19]	1.30	[1.18, 1.43]**	1.37	[1.26, 1.48]**
Religion	0.81	[0.75, 0.87]**	0.85	[0.80, 0.91]**	0.68	[0.64, 0.72]**
Wave II						
Friend support	0.95	[0.79, 1.14]	1.15	[0.97, 1.37]	1.19	[1.05, 1.35]**
Religion	0.87	[0.79, 0.95]**	0.86	[0.79, 0.94]**	0.73	[0.68, 0.77]**
Wave III						
Friend support	1.16	[1.01, 1.33]*	1.01	[0.89, 1.15]	1.37	[1.29, 1.47]**
Religion	0.70	[0.59, 0.84]**	0.77	[0.65, 0.91]**	0.53	[0.49, 0.58]**
Wave IV						
Friend support	0.65	[0.56, 0.75]**	0.97	[0.88, 1.07]	1.07	[0.99, 1.16]
Religion	0.65	[0.56, 0.75]**	1.03	[0.94, 1.13]	0.46	[0.43, 0.50]**

Note. Bivariate odds ratios were adjusted for baseline age, gender, grade, race, family structure, and adversity. *OR* = odds ratio; CI = confidence interval, * significance at .05, **significance at .01

Hypothesis 3.2: Actual social supports were prospectively associated with health risk behaviors over the 13 year-period of Add Health longitudinal study.

The above full logistic GEE models contained predictors of actual social support (see Tables 4.12–4.14). Like bivariate analysis, although significant in some occasions, parental control and parental involvement played a modest role in participant's health risk behaviors over time (*OR*s from 1.01 to 1.05). Having one additional close friend contributed to 9% increase in the risk for getting into a violence (*OR* = 1.09, 95%CI = [1.04, 1.15], $p < .001$), and increased the risk of substance use by 21%, (*OR* = 1.21, 95%CI = [1.17, 1.26], $p < .001$). On the other hand,

religion significantly reduce the probability of having suicidal behavior (*OR*= 0.90, 95%CI = [0.86, 0.95], $p < .001$), getting into violence (*OR* = 0.95, 95%CI = [0.91, 0.99], $p < .001$), and using substances (*OR* = 0.71, 95%CI = [0.68, 0.73], $p = .049$) over a 13-year period.

In summary, parental support, indicated by parental control and parental involvement, had very small effects to predict the participant's health risk behaviors. Friend support, indicated by number of close friends, increased the probability of health risk behaviors in some occasions. On the contrary, religious support had significant cross-sectional and longitudinal effects of risk reduction on the averaged population over time.

Final GEE Model

Based on the results of previous analyses, the research proposed a final logistic GEE model to predict each health behavior. Only predictors that was significant and had meaningful effect size (odds ratio) in at least one of the full GEE models were included in the final models. Total resilience score was included in the final model instead of its subscales (see Table 4.16). The results showed strong within-subject associations among repeated measures of health risk behaviors. An additional score increase in the total resilience scale significantly reduced the risk of having suicidal behaviors by 82% (*OR* = 0.18, 95%CI = [0.16, 0.22], $p < .001$), getting into violence by 49% (*OR* = 0.51, 95%CI = [0.44, 0.59], $p < .001$), and using substance by 54% (*OR* = 0.46, 95%CI = [0.41, 0.52], $p < .001$). With regard to the actual social support, having more friends was a risk factor for suicide (*OR* = 1.06 , 95%CI = [1.00, 1.13], $p = .048$), violence (*OR* = 1.10, 95%CI = [1.05, 1.15], $p < .001$), and substance use (*OR* = 1.22, 95%CI = [1.18, 1.26], $p < .001$); while religion was a strong protective factor against suicide (*OR* = 0.91, 95%CI = [0.86, 0.95], $p < .001$) and substance use (*OR* = 0.71, 95%CI = [0.69, 0.74], $p < .001$).

Table 4.16

Final GEE Models for Predicting Health Risk Behaviors over Time

Parameters	Suicide		Violence		Substance	
	OR	95% CI	*OR*	95% CI	*OR*	95% CI
Age baseline	0.96	[0.93, 1.00]*	1.02	[1.00, 1.05]	1.07	[1.05, 1.09]**
Time	0.78	[0.75, 0.82]**	0.69	[0.67, 0.72]**	1.18	[1.15, 1.20]**
Time squared	1.01	[1.01, 1.02]**	1.03	[1.03, 1.03]**	0.99	[0.99, 0.99]**
Female	1.34	[1.19, 1.50]**	0.50	[0.46, 0.55]**	0.62	[0.57, 0.67]**
Male	-	-	-	-	-	-
Asian Pacific	0.87	[0.66, 1.15]	0.88	[0.66, 1.17]	0.47	[0.38, 0.60]**
Black	0.76	[0.65, 0.88]**	1.60	[1.43, 1.79]**	0.44	[0.40, 0.48]**
Hispanic	0.86	[0.72, 1.04]	1.34	[1.16, 1.55]**	0.64	[0.56, 0.72]**
Indian	1.75	[1.06, 2.87]*	1.75	[1.08, 2.83]*	1.11	[0.75, 1.64]
White and other races	-	-	-	-	-	-
Non Parent	1.07	[0.87, 1.32]	1.53	[1.31, 1.78]**	1.38	[1.20, 1.59]**
Single Parent	1.05	[0.91, 1.21]	1.29	[1.14, 1.45]**	1.20	[1.10, 1.32]**
Step parents	1.12	[0.94, 1.34]	1.21	[1.06, 1.39]**	1.29	[1.15, 1.45]**
Biologic and adopt parents	-	-	-	-	-	-
Total resilience score	0.18	[0.16, 0.22]**	0.51	[0.44, 0.59]**	0.46	[0.41, 0.52]**
Actual social support						
Friend support	1.06	[1.00, 1.13]*	1.10	[1.05, 1.15]**	1.22	[1.18, 1.26]**
Religion	0.91	[0.86, 0.95]**	0.95	[0.91, 1.00]	0.71	[0.69, 0.74]**
Within-subject association						
W1-W2	5.58	[4.50, 6.91]**	8.80	[7.33, 10.6]**	9.40	[8.13, 10.8]**
W1-W3	2.05	[1.55, 2.72]**	2.93	[2.28, 3.75]**	2.61	[2.28, 2.98]**
W1-W4	2.95	[2.26, 3.85]**	1.33	[1.09, 1.62]**	2.38	[2.07, 2.74]**
W2-W3	2.60	[1.91, 3.54]**	3.14	[2.38, 4.16]**	2.67	[2.31, 3.10]**
W2-W4	2.05	[1.44, 2.91]**	1.32	[1.04, 1.67]*	2.42	[2.08, 2.82]**
W3-W4	5.05	[3.71, 6.88]**	1.56	[1.13, 2.14]**	5.18	[4.48, 5.98]**
Goodness-of-fit	QIC = 13870.34		QIC = 18726.50		QIC = 31927.79	

Note. All models were fitted using alternating logistic regressions. *OR* = odds ratio; CI = confidence interval; QIC = Quasi-Likelihood under Independence Model Criterion. *p < .05, **p < .01.

Modeling the Pattern of Behavioral Change

Three brief GEE models contained baseline age (age), time since baseline (time) and time-squared were used to model patterns of behavioral change over time. Adversity was considered as a between-subject effect. Based on the estimated coefficients (see Table 4.17), the equations for predicting the probability of a health risk behavior over time were

The probability of suicidal behaviors:

$$= \frac{e^{-1.718 - .016*\text{age} - .194*\text{time} + .01*\text{time}^2 + .049*\text{adverse} - .011*\text{adverse}*\text{time} + .001*\text{adverse}*\text{time}^2}}{1 + e^{-1.718 - .016*\text{age} - .194*\text{time} + .01*\text{time}^2 + .049*\text{adverse} - .011*\text{adverse}*\text{time} + .001*\text{adverse}*\text{time}^2}}$$

The probability of violent behaviors:

$$= \frac{e^{-2.611 + .042*\text{age} - .290*\text{time} + .024*\text{time}^2 + .248*\text{adverse} - .036*\text{adverse}*\text{time} + .002*\text{adverse}*\text{time}^2}}{1 + e^{-2.611 + .042*\text{age} - .29*\text{time} + .024*\text{time}^2 + .248*\text{adverse} - .036*\text{adverse}*\text{time} + .002*\text{adverse}*\text{time}^2}}$$

The probability of substance use:

$$= \frac{e^{-2.282 + .081\text{age} + .278*\text{time} - .015*\text{time}^2 + .03*\text{adverse} - .044*\text{adverse}*\text{time} + .003*\text{adverse}*\text{time}^2}}{1 + e^{-2.282 + .081\text{age} + .278*\text{time} - .015*\text{time}^2 + .03*\text{adverse} - .044*\text{adverse}*\text{time} + .003*\text{adverse}*\text{time}^2}}$$

Table 4.17

Logistic GEE Models for Predicting Patterns of Behavioral Change over Time

Parameters	Suicide		Violence		Substance use	
	β	Wald	*β*	Wald	*β*	Wald
Intercept	-1.718	-6.45**	-2.611	-12.64**	-2.282	-13.54**
Age baseline	-0.016	-0.99	0.042	3.30**	0.081	7.68**
Time	-0.194	-6.69**	-0.290	-11.77**	0.278	21.41**
Time squared	0.010	4.26**	0.024	12.56**	-0.015	-16.67**
Adversity	0.049	1.54	0.248	9.42**	0.030	1.27
Adversity*Time	-0.011	-0.60	-0.036	-2.43*	-0.044	-5.27**
Adversity*Time squared	0.001	0.61	0.002	1.68	0.003	4.70**

Note. * $p < .05$, ** $p < .01$

Using mean age of cohort participant at baseline (about 16 years), the graphs of change in risk behaviors for 16-year-old adolescents, for example, are presented in Figure 4.3. All risk behaviors were nonlinearly changed over time with the obvious turning points at Wave III of Add Health interviews. The estimated changes in suicidal and violent behaviors appeared to follow U-shaped or J-shaped curves. In contrast, the probability of using substances reached the peak at Wave III and reduced after that. There were very small differences in risk behaviors between adversity and non-adversity samples.

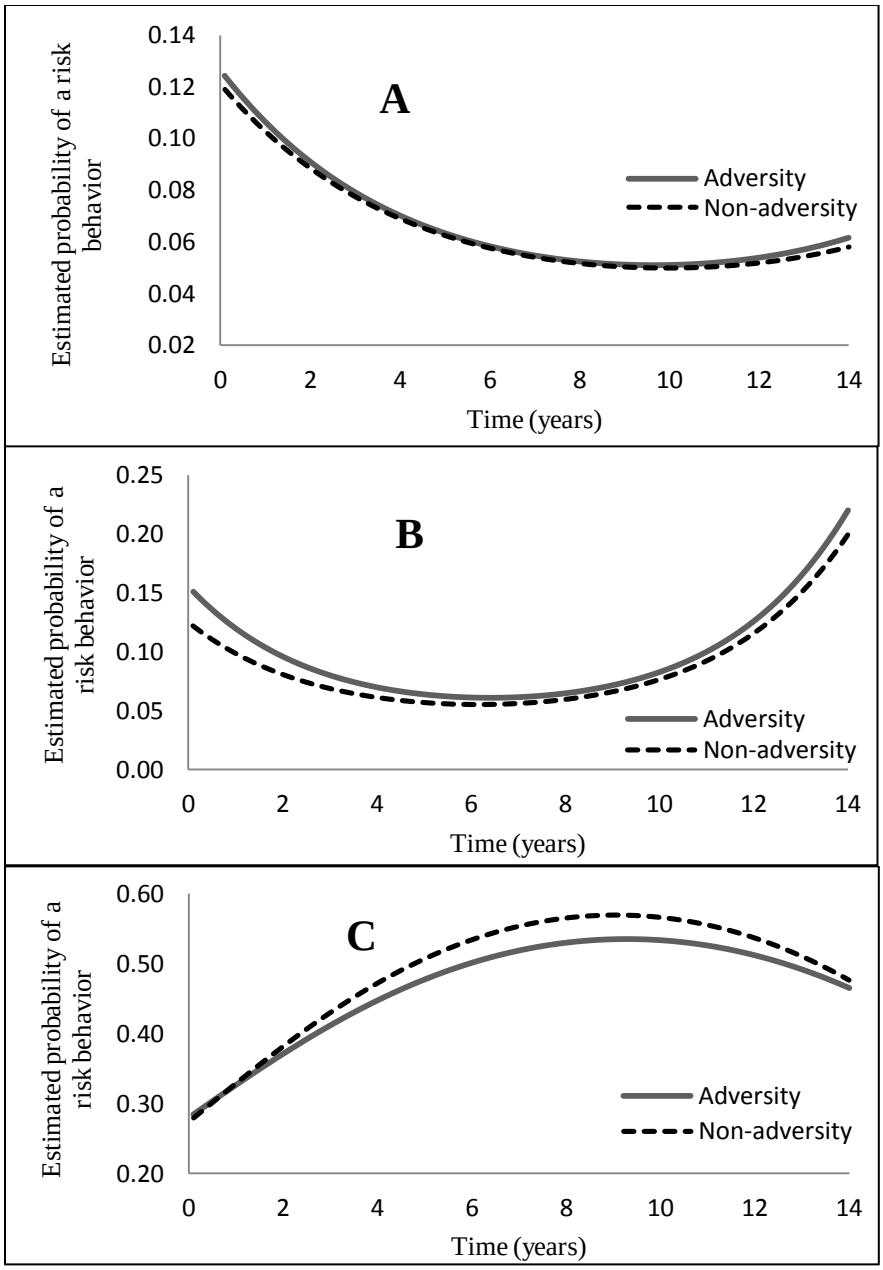

Figure 4.3. Estimated Probability of health risk behaviors over time for 16-year-old adolescents who experienced adversity and non-adversity at and prior to baseline. (A) suicidal behavior, (B) violent behavior, and (C) substance use behavior.

CHAPTER 5: DISCUSSION

The purpose of this study was to extend the existing literature about the stability of resilience status, and to examine the cross-sectional and longitudinal effects of individual resilience scores and social support on resilience status over a long period of lifetime. The expectation is that individual resilience on the domains of health risk behaviors would be dynamic and instable during the transition from adolescence to adulthood. It is also expected that the resilience scale and actual social supports would play as protective factors for resilience status over time.

Point Prevalence of Health Risk Behaviors

In literature, the definitions of competence for resilience are very general and vague, for example, "worked well, played well, loved well, and expected well" (Garmezy, 1976) or "confidant, competent, and caring" (Werner & Smith, 1992). Due to variation in definition and conceptualization of the adversity and competence, there is lack of consensus regarding criteria to establish resilience. In the dissertation, resilience was defined as the absence of health risk behaviors of suicide, violence and substance use.

Suicidal behaviors. The findings of this study showed that the point prevalence rates of suicidal ideation and attempt gradually reduced over time from 12.91% at baseline to 6.44% at Wave IV. Female adolescents had significantly higher rates of suicidal behaviors than male counterparts did (Wave I and II). However, the gender difference was not significant for young adults and adults (Wave III and IV). Broken down into race/ethnicity, Indian Americans have a higher probability and African Americans have a lower probability of suicidal behaviors than

non-Hispanic Whites over time. This finding was consistent with others results. For examples, two surveys using national database were used as comparisons with the dissertation findings. The first source was from the 1997 Youth Risk Behavior Surveillance (YRBS) conducted by the CDC in high school students in 1997, of which population and time were nearly similar to the Wave II of Add Health interviews. The prevalence of making a suicide plan during the 12 months preceding the survey was 15.73%, with the higher rate for females (20.0%) than males (12.2%), and lower rate for Blacks (12.5%) than Whites (14.3%) (Kann et al., 1998). The second source was from the National Survey on Drug Use and Health conducted by the SAMHSA in U.S. adults aged 18–29 during 2008–2009, the same duration and population as the Wave IV of Add Health interviews. The results showed that the prevalence of suicidal thought and attempt, were 5.7% and 1.0%, respectively, and that difference in rates between males and females were not significant (Crosby, Han, Ortega, Parks, & Gfroerer, 2011).

Violent behavior. Age-specific prevalence for violence followed a U-shaped curve, with the lowest rate at Wave III when participants just became young adults (18–26 years old). Since the dissertation was designed to obtained health risk behaviors consistent throughout all waves of Add Health interviews, only items remained their contents in all four repeated measurements were used to construct the outcome variables. Criteria for establishing violent behaviors in the study thus differed from previous research. As a result, the dissertation findings cannot compare to others. However, the pattern of change was consistent with other prior reports. For example, violent prevalence was greatest in the second decade of life, ranging from about 8% to 20% between the ages of 12 and 20—similar to Wave I and II Add Health samples, and lower in the group aged 20–30 years—similar to Wave III and IV Add Health samples (Office of the Surgeon General, 2001).

An interesting finding was that the proportion of getting into violence increased again when participants completely became adults (30 years old or more). A possible explanation is that a majority of participants were married or lived with their spouses at that age. They could take intimate partner violence into account. The violence rate thus could be overestimated compared to previous Add Health waves. Another reason for that phenomenon is due to the socio-structural trend at this duration. Using data from the National Center for Juvenile Justice, Puzzanchera (2009) revealed that the youth violent crime rates were highest in 1993–1996 (at the same time of Add Health Wave I and II), reduced to minimum peak in 2002–2004 (at the same time of Add Health Wave III), and increased again since 2006. Therefore, the violent pattern of change in the Add Health cohort participants could reflect the national trend for this behavior.

Substance use behaviors. The results showed that the prevalence for total substance use was very high, especially for young adults and adults. Prevalence rates by specific types of substance use—much lower than total substance use rate, could provide more meaningful and comparable information. The findings were somewhat consistent with other sources. For example, data from the 1997 YRBS—the same population and time of Add Health Wave I and II, reported that 16.7% of high school student smoked cigarettes over 20 days per month while the dissertation found that 14.80% student grades 8–12 smoked cigarettes 25 days or more during the 30 days preceding the Wave II survey. However, the 1997 YRBS reported very high prevalence of alcohol drinking and illegal dug using, for example, 33.4% of students drank five or more drinks of alcohol on at least one occasion and 26.2% used marijuana one or more times during the 30 days preceding the survey. The dissertation found lower rates such as 19.97% for heavy drinking and 16.57% for current illegal drug use. The differences in rates may be due to differences in survey settings.

Data from the SAMHSA indicated that prevalence of daily or almost daily smoking among 18–25 year-old persons was 30.6% in 2002 (the same Add Health sample at Wave III), and among 26–34 year-old persons was 25.8% in 2009 (the same Add Health sample at Wave IV). Consistent with these findings, the dissertation found 26.09% of participants smoked 25 days or more per month in Wave III and 26.52% in Wave IV. Results for alcohol drinking and illicit drug use were almost similar to SAMHSA's reports.

The patterns of change were not unique among different types of substance use. While smoking tended to increase with age, alcohol drinking and illegal drug use were highest at young adults (Wave III) and tended to reduce when participants completely became adults (Wave IV). These patterns of change were consistent with prior research. Johnston, O'Malley, Bachman, and Schulenberg (2009) reported that substance use often begins in adolescence and reaches a peak (around ages 21–26 for binge alcohol drinking and 18–22 for marijuana) before declining in adulthood. In a cohort study on 206 at-risk, fourth grade boys, Kerr, Capaldi, Owen, Wiesner, and Pears (2011) found that the trajectories of tobacco smoking, alcohol drinking and marijuana using peaked at the age of 22 years, and then gradually decreased thereafter.

Change in social context in the transition to adulthood is the most possible explanation for the pattern of behavioral change. When participants merged into adulthood (at Wave IV), most of them were married and had child(ren). At that time, they had to be responsible not only for themselves but for every member of their own family. Being married or having a close relationship with spouse and becoming a parent were protective factors for substance use in adulthood. There are many explanations for role of marriage and parenthood on substance use. Following parenthood, one usually reduces the consumption of substances, especially cigarette, because of the concerns about the negative effects of passive smoking on the children. Other

pressures come from spouses, friends, doctors, costs of smoking, and anti-smoking campaigns in society. All changes in social context make participants decrease their use of substances when they move to adulthood.

Important changes in social context often happen during the transition from adolescence to adulthood. Most turning points in which health risk behaviors remarkably change occur in early adulthood (corresponding to Add Health Wave III when participants aged 18–26 years). The research findings were consistent with many past studies that the social role of being a spouse and later a parent serves as a turning point that curbs substance consumption. A study by Austin and Bozick (2012) using Add Health data from Wave I and Wave III found that marriage significantly decreased the likelihood binge drinking (*OR* = 0.29) and marijuana use (*OR* = 0.40) in young adulthood. Another study by Kerr et al. (2011) also reported that marriage was associated with a lower frequency of substance use and becoming fathers strongly decreased the level of alcohol use and slightly reduced the frequency of tobacco and marijuana use.

The pattern of change in smoking, drinking, and using illegal drug can results from changes in reasons for substance use. In a longitudinal study, a cohort of 12th-grade students were followed up to ages 30 years, Patrick et al. (2011) revealed that the age-related reasons for substance uses changed over time. Reason for binge drinking (e.g., like to relax, to sleep, and because it tastes good) and reasons for marijuana use (e.g., to get high, to relax, and to decrease the effects of other drugs) significantly increased with age while other reasons (e.g., to seek deeper insights or to increase the effects of some other drug) decreased with age.

Implication for resilience. Resilience statuses are opposite to health risk behaviors. Based on results from descriptive analysis, resilience on suicide tended to increase whereas resilience on substance use decreased with age, and resilience on violence followed quadratic curve over time. Generally, resilience statuses among cohort participants over 13 years were rather high on the domains of health risk behavior. For instance, resilience rates were from 87.1% to 93.7% for suicide, from 83.9% to 93.3% for violence, from 48.2% to 71.1% for substance use. As expected, at population level resilience status was instable over time because point prevalence rates of risk behaviors considerably varied from wave to wave. The trajectories of such resiliencies were curvilinear rather than simply linear with a remarkable bend observed at Wave III when participants merged into early adulthood. Therefore, resilience was the dynamic process rather than the personality trait.

Opposite to expectation, trajectories of health risk behaviors at individual level indicated that a majority of participants maintained their behaviors. About 85–90% of participants did not change suicidal behavior, 70–85% remained violent behavior, and 55–80% did not change substance use behavior over time. In general, during transition toward adulthood, more youths became resilient than vulnerable on the domains of suicide and violence. On the contrary, point prevalence rates of substance use tended to increase through time, indicating that resilience on substance use reduced with age. A remarkably large number of participants consumed some types of substance including cigarette, alcohol, and illicit drugs (became less resilient on this domain). Another unexpected was that the overall behavioral changes through the 13-year-period (between Wave I and Wave IV) were not so different from these changes between two adjacent waves, obviously seen in suicidal and violent behaviors. This results indicated that a number of participants engaged in a particular health risk behavior while others quitted this behavior at the

same time. Such information can lead to conclusions: (1) individual resiliency can fluctuate during the transition from adolescence to adulthood in that an individual might have a positive or negative health risk behavior at different points in time; and (2) individual resiliency appears to be stable when viewed over a long period of lifetime but instable if seen in consecutive points in time.

The findings also support somewhat the popular conception that resilience is a dynamic process rather than a personal trait. Resilience and vulnerability may take turn each other during transition to adulthood. However, in the long run, individual resiliency on health risk behaviors appears to be rather stable according to the following evidences. First, majority of participants remained their old behaviors over a 13-year period. Second, resilience statuses on health risk behavior were relatively high in both general and adversity samples. Third, trends in resiliency generally followed curvilinear patterns over time, which a remarkable bend occurred at Wave III.

In addition, the findings support the literature that resilience varies in different domains of competence. The prevalence and trajectories of all three types of health risk behaviors explored in the dissertation were multiform. Suicidal behaviors decreased with age, violent behaviors were lowest at Wave III while substance use was highest at this time-point. Therefore, the dissertation examined separately each type of health risk behaviors instead of combining them together. Other health risk behaviors that were not involved in this study, for example, behaviors toward sexual safety, dietary, and physical activity, will differ from each other in term of point prevalence and pattern of change during the transition to adulthood. Not surprisingly, other competences, outside the scope of health-related behaviors such as school grades, employment, marriage, or parenting, will also vary across human life span.

Resilience Scale and Resilience Status

The resilience scale was constructed using available items in the Add Health data sets to measure the perceived individual resilience. The items were related to emotional aspects of resilience attributes. On the other hand, resilience status was the lack of health risk behaviors at measurement occasions. The results demonstrated that high resilience score was a strong predictor of preventing health risk behaviors at a given point in time or over time. Resilience score thus also predicted the probabilities of suicidal, violent and substance use behaviors concurrently and prospectively. The findings were consistent with prior research. For example, perceived resilience score was significantly predicted suicidal ideation (Cleverley & Kidd, 2001), suicidal attempt (Roy, Sarchiapone, & Carli, 2007), lifetime violent events (Nrugham, Holen, & Sund, 2010), and substance use (Ali et al., 2010).

All four subscales were importantly contributing to the cross-sectional and longitudinal effects, but not equally significant among different types of risk behavior. Increase in score in emotional coping with stress or difficult situation and perceived social support significantly reduced the odds for all health risk behaviors, while optimistic perspectives was a protective factor for suicidal behavior, and problem-focused coping was the protective factor for substance use in the longitudinal analyses. These findings implicate that emotional attributes are more dominant and remain long-term effects on health risk behaviors over time.

The resilience scale in this study had acceptable reliability and validity. The internal consistency of reliability was good for total scale (Cronbach's alpha =.88) and acceptable for subscales (Cronbach's alphas were from .62 to .82). In addition, this scale was valid to capture construct of resilience attributes. Among 35 items used to construct the resilience scale, 15 were originally from depression and six from self-esteem measures. There have been strong evidences

demonstrating that resilience score is highly negatively correlated to depression scores (Bitsika et al., 2010; Hjemdal et al., 2011) and positively correlated to self-esteem scores (Baek et al., 2010; Nishi et al., 2010; Nygren et al., 2004).

A large number of scales are developed to measure resilience construct in various populations of interest. While many resilience measurements in literature are mainly applied in adversity populations such as mental disorders, parental mental disorders, patients suffered from chronic disease, poverty, and natural disasters or wars, some are used for general population (e.g., the Ego Resiliency 89 Scale). Such scales are used as screening tool to detect personal protective factors and predict positive outcomes when the subject will be exposed to significant disadvantages. Due to variation in operationalization and conceptualization, the constructs of resilience vary from scale to scale. As a result, dimensions and subscales differ widely in these measurements. Usually, items in different scales were closely similar in meaning although they are different in expression. In addition, one item can be found in different scales under different subscale's names. For example, the item "when you are attempting to find a solution to a problem, you usually try to think of as many different ways to approach the problem as possible" in the dissertation could be expressed as "I usually think carefully about something before acting" in the Ego Resiliency 89 Scale (Block & Kremen, 1996), "under pressure, focus and think clearly" in the trust/Tolerance/Strengthening Effects of Stress subscale of the Connor-Davidson Resilience Scale (Connor & Davidson, 2003), or "I can usually look at a situation in a number of way" in Self-Reliance subscale of the Resilience Scale (Wagnild & Young, 1993). With regard to the content of items, subscales of the proposed resilience scale in the dissertation can be related to subscales or dimensions in other published measurements, as the following:

Optimistic perspectives:

- Personal Competence in the Connor-Davidson Resilience Scale (CD-RISC) by Connor and Davidson (2003).
- Meaningful Life in the Resilience Scale (RS) by Wagnild and Young (1993).
- Sense of Mastery scale in the Resiliency Scales for Children and Adolescents (RSCA) by Prince-Embury (2007).
- Personal Competence in the Resilience Scale for Adults (RSA) by Friborg et al. (2003) and in the Resilience Scale for Adolescents (READ) by Hjemdal et al. (2006).
- Ego-resilience in the Ego Resiliency 89 Scale (ER89) by Block and Kremen (1996).

Emotional coping:

- Acceptance of Change and Secure Relationships in the CD-RISC.
- Emotional Reactivity scale in the RSCA.
- Personal Competence in the RSA.
- Ego-resilience in the ER89.
- Perseverance in the RS.
- Emotion Coping in the Resilience Appraisals Scale (RAS) by Johnson et al. (2010).

Problem-focused:

- Trust/Tolerance/Strengthening Effects of Stress in the CD-RISC
- Personal Structure in the RSA.
- Structured Style in the READ.
- Self-Reliance in the RS.
- Situation Coping in the RAS.

Social support

- Sense of Relatedness scale in the RSCA.
- Family Coherence and Social Support in the RSA.
- Family Cohesion and Social Resources in the READ.
- Social Support in the RAS.

Given such information, the resilience scale developed by the authors based on available items from Add Health data could be reliable and valid to predicted resilience status concurrently and prospectively. The proposed resilience scale in the dissertation was a good measurement tool to predict a resilient individual on the domain of health risk behaviors.

Social Support

This dissertation explored both perceived social support and actual social support. Perceived social support or emotional social support was examined as an element with resilience scale that measure emotional aspects of protective factors. Emotion can be directly measured by individual self-report. On the other hand, actual social supports are more complex and difficult to be captured because there are various sources of supports from inside and outside family context. In addition, types of support usually change over time. For instance, supports from teachers are particularly important during childhood and adolescence but have little or no impact on adults. Furthermore, levels of social support are challenge to measure. For example, peer support in this study was measured using number of close friends. However, one or two best close friends may actually have more impacts than all the rest together.

During adolescence, social relationships are transformed in the way that adolescents develop intimate relationship outside of their family. They spend less time with family members

as parents and siblings than with peers. The role of peers, school context, and other social factors become increasingly important. The effect of social context outside of the family is more crucial during the transition to adulthood. Changes in social context are the most factor influent on the likelihood of using substance in a number of ways. Thus, the role of parents and teachers is not as important as the impact from friends. After graduating from high school, young adults enter college, get job, or enroll military services. Such social environment changes led them to be exposed to new risk and protective factors.

Parental support. Inconsistent with some prior research that parental support has long-term effects on risk behaviors (Ghazarian & Buehler, 2010; Reimuller, Shadur, & Hussong, 2011; Windle et al., 2011), the dissertation did not find such effects at a given time-point or over time. In fact, parental involvement and parental control significant increased the risk of engaging in some types of risk behaviors. However, the magnitudes of association were, in spite of significance, rather small. This implicates that social support inside family play a modest effect on the development of risk behaviors during the transition to adulthood.

Peer support. Contrary to expectation, actual friend support, measured using number of close friends, increased the risk of getting into violence and using substances. During the transition to adulthood, the role of peer becomes more prominent. Behaviors of young adults are thus strongly influenced by their peers. They tend to make friend with those whose behaviors are more similar to theirs. As a result, if an individual ever engages in violent occasion or uses substances, he/she tends to participant in violent gangs or makes friend with substance users. In turn, those close friends support and encourage him/her to maintain and develop the risk behaviors. Johnston et al. (2009) reported that a relative high proportion of young adults made friend with drug users, for example, 80% of 12th-grade students and 67% of adults aged 27–30

had at least some friends who used some kinds of illicit drug. According to the authors' explanation, social environment directly influence on adolescents during the transition to adulthood through: (a) peer group's norms about substance use, (b) amount of exposure to substance through friends, and (c) availability of drugs.

The results of this dissertation were consistent with prior findings that having more close friends increased the risk of unhealthy behaviors. In a longitudinal study to examine the relationship between life-events and alcohol use, Veenstra et al. (2007) found that subject who received more actual social support was associated with a higher level of alcohol drinking after experiencing a negative life-event. Peer substance users have a direct effect on adult addictive behaviors. Brook, Zhang, Finch, and Brook (2010) pointed out that adults whose friends used tobacco, marijuana, and other illicit drugs were themselves more likely to engage in these behaviors. The authors explained that peer behaviors result in the adult's perception that smoking is a normative behavior. Smoking status also results from a social learning process in which members of a peer group model, encourage, and reinforce substance uses. Sharma, Grover, and Chaturvedi (2008) found that number of close friends significantly positively correlated with interpersonal violence among college adolescents. The explanation is that having a bigger social network and interacting with a larger number of close friends can increase the chances of disagreements or disputes aggravating into fights.

Religious support. As expected, religious support was used to measure community support. Using number of attending to religious services including regular worship services and special religious activities, the dissertation found a very strong effect of religion on protecting individuals from health risk behaviors. This finding was consistent with previous research.

Robertson, Xu, and Stripling (2010) explained that individual used religion to cope with stress when faced with adverse and traumatic events.

In the dissertation, the effects of actual social support were not as strong as the effects of perceived social support. This finding may be due to differences in measurement of these variables. Participants could estimate the perceived social support based on their experiences and emotions. However, few items from some activities and events might not reflect the overall social support that the participants actually had. Thus, the actual social support in this study may be underestimated. A similar finding was reported in a study on 125 women and 232 men living with HIV/AIDS. Perceived social support was a significantly predictive of better mental health while the effect of actual receiving social support was minimal (McDowell & Serovich, 2007).

In sum, actual social support was not as good as perceived social support to predict resilience status. Only religiousness was significantly associated with a reduction in health risk behaviors. Parental support and friend support did not prevent participants from engagement in health risk behaviors.

Adversity

Although resilience is referred to as ability that an individual deals with adversity and difficult events in lifetime, the dissertation examined resilience in both general and adversity samples. The results showed that the point prevalence and the trajectories of resilience status over time were nearly identical for both samples. When adding adversity score at baseline into longitudinal analysis, the between-subject effect of adversity was not significantly contributing to the probability of health risk behaviors, as compared to other demographic factors such as age, gender, and race/ethnicity. These results implicates that (a) the pattern of coping to adverse life

conditions is a common characteristic for every individual rather than for those who suffer to difficult lifetime and (b) adversity is dynamic and changeable over points in lifetime. For example, poverty may occur in some periods of household, low SES community can be over if the family moves to other locations, or parental unemployment is often temporal. Thus, adversity may influence in certain time-points of life instead of remaining long-term effects through time. According to the Developmental-Contextual Model of Resilience, exposure to adversity in early stages of life such as childhood or early adolescence do not necessarily predict negative development outcomes in the later stages (Schoon, 2011). A longitudinal study by Seery, Holman, and Silver (2010) revealed that relationship between health outcomes and adversity was U-shaped quadratic. Participants with a history of some lifetime adversity reported better mental health and well-being outcomes than those with no or a high history of adversity.

Adversity, in this study, was not associated with most domains of resilience. It may be due to summing negative conditions together to construct the adversity scores. Probably, some adverse condition had stronger negative effects than others did. For example, intimate partner violence from parents could have more proximal effect than not English as language at home, or parental drinking had more impact than parental unemployment did. In addition, some negative conditions could not be considered as adversity for particular subgroups, for instance, not English at home is not the adversity in case of Asian households. Another explanation is from the challenge model (Fergus & Zimmerman, 2005; Schoon, 2011). According to the model, the association between a risk and an outcome is curvilinear. When exposed to no, few, or many adverse life conditions, individuals tend to display negative outcomes. However, when exposed to moderate adversity, they are likely to reduce negative outcomes or to increase positive outcomes. Dealing with enough adversity lead them to practice and enhance problem-solving

skills, or to seek external resources of support. In addition, being lived and reared under a couple of negative life conditions in the early stages of life can inoculate adolescents to the adversity. Participating adolescents in the adversity sample would need more efforts to deal with a problem in the early life stages than those in the non-adversity sample would. Therefore, the experience would help them confront with problems and gain competence in the later stages of life. Future research should explore effects of specific adverse conditions on health risk behaviors. Such approaches may find a significant association between adversity and health behaviors.

Data Analysis

While descriptive statistics described the sample and provided results about point prevalence and the patterns of behavioral change over time, inferential statistics examined relationships among variables to test hypotheses and draw conclusions from sets of data. Two main approaches were applied in the data analysis: (a) traditional logistic regression model to explore outcomes and predictors at the same time and (2) GEE models to assess the between-subject effects and within-subject effects of predictors on repeated measures of outcomes over time. In the dissertation, the majority of important findings was drawn from GEE analyses. Both approaches explored data from three nested models; the full model with all predictors was the best fit. Then, a final model was set up for each health risk behavior. Ideally, all predictors in the final model should be significant. Results from such models would provide more exact and meaningful information. However, final models in this research included some non-significant predictors, e.g., the final GEE model for predicting suicidal behaviors contained family structure and the final GEE model to predict violence contained age at baseline. Reasons for use of non-significant covariates are the following. First, baseline age and family structure were important

demographic predictors. Although not statistically significant, they could give information about the direction and magnitude of relationships that are useful in research and practice. Second, such variables were taken into account to control for their possible confounding effects. Third, when adding a non-significant predictor, the coefficients and the significances of all predictors of interest did not change much. For example, when added an additional non-significant family structure, odds ratio for resilience score in the final GEE model for predicting suicidal behaviors changed from 0.181, 95% CI = [0.154, 0.213] to 0.183, 95% CI = [0.155, 0.215]. Therefore, the author decided to keep these predictors in order to make the analysis and presentation uniform.

Limitations

This dissertation may include certain limitations. First, the survey's data were obtained on self-reported data. Because thoughts are more likely to be falsely remembered than events, therefore, participants could misreport or misremember when answering questions related to events or behaviors in the past.

Second, this study examined suicidal behaviors such as ideation or attempt rather than the actual completed suicide. Suicidal behaviors may give indirect estimation about actual suicide in adolescents. Hospital based data will provide more valuable information about risk factors of actual suicide, but most such data have small sample sizes that could generalize suicidal information at national level.

Third, the resilience scale in this research may face with the problems of construct validity because of no gold standard for establishing a resilience measurement. Furthermore, Add Health was not specifically designed for construct indicators of resilience. Items used to develop the resilience measurement scale were primarily to measure protective factors, personality,

feelings scale, and mental health in the Add Health data sets. However, the data were rich with indicators that were similar to items used in the published resilient scales. Future longitudinal research should be designed to obtain directly and specifically resilience attributes.

Fourth, the outcomes in this study were repeatedly measured over four waves of interviews. Only items remaining their content were chosen to measure risk behaviors. Thus, measures at different waves might not be identical because of different settings. Participants might score an item differently depending on the interview settings. For example, given the same behavior, a sensitive question to measure this behavior could be reported at high score or low score, or skipped depending on paper-pencil interview, computer-assisted interview, or telephone interview. In addition, the in-home interview questionnaires varied from wave to wave. Future research should apply a standard method that can obtain the exact information under different research settings.

Last, one limitation would be due to data analysis. Predictors of interest such as the resilience scale and social supports were not uniformly used in the longitudinal GEE analyses that could result in differences in interpretations of the results. Resilience scale was the time-stationary predictor that only measured the between-subject effect, whereas social supports were both time-stationary and time-varying predictors that measured the between-subject and within-subject effects. The dissertation could not assess the within-subject effects of resilience scale and parental support because these variables were only obtained at baseline. However, these variables were not fixed characteristics such as gender and race that remain stable through lifetime. In fact, resilience scale and parental support often altered across time depending on the human developmental process and environmental contexts. Therefore, treating these variables as "time-invariant" could lead to misinterpret the findings.

Strengths of the Study

Despite the weaknesses, this dissertation has some strength that may balance to the above limitations. Because the secondary database used for analysis was large and representative of the national population, the findings from this dissertation can considerably generalize the prevalence of health risk behaviors among adolescent and young adult populations. With regard to the cross-sectional and longitudinal samples, the findings can reflect the trends in health risk behaviors during among adolescents and young adults during 1995–2009 in the United States.

Missing data due to non-response is always a problem for longitudinal analysis, but unavoidable. Missing values in the longitudinal Add Health study were considerably large. Results based on analyzing completed data would be severely biased. Such biases would lead to threats to external validity due to incorrect estimates of populations of interest. The dissertation treated missing values by using multiple imputation under the assumption of missing at random (MAR). Multiple imputation is one of the most method to address the large missing data (Scheffer, 2002). With nine imputations, the efficiency of unbiased estimators exceeded 95%. Therefore, results presented in the dissertation were certainly unbiased.

Other strength was that the analysis conducted in both cross-sectional and longitudinal samples adjusted for the complex survey design. Especially, the research applied GEE method for longitudinal analyses. This approach provided information about the between-subject and within-subject effects of predictors over time.

Implication

The findings from the dissertation may suggest implications for research, practice, and policy. The results may extend some knowledge of the resilience process. Studying in the domain of health risk behaviors, this dissertation supports the current concept that resilience is a

dynamic process rather than a personality trait. Although resilience status was dynamic over time, however, it appeared to be rather stable when viewed over a long period of lifetime. In the domain of health risk behaviors, individuals often fluctuate in their resilience status, changing from resilient to vulnerable and vice versa. However, a majority of population may sustain its good or bad health behaviors over a long periods. Thus, transition to adulthood is very important for adolescents to shape their permanent behaviors in the future. Interventions at the period are necessary to change behaviors or to keep adolescents from involving in harmful behaviors.

Although resilience status is changeable, resilience scale that measure the perceived and emotional resilience attributes was significantly associated with the probability of health risk behaviors. Consistent with previous research, this finding indicates the resilience scale can use to screen the ability of a person to keep their healthy behaviors or not to fall in risk behaviors when faced with adverse environments.

Another implication is that resilience-based intervention should increase the positive outcome by increasing emotion attributes and social supports. Fortunately, these factors can be managed through training programs. Training interventions such as self-esteem, self-efficacy, emotional copping skill, and problem-focused copping skill should be employed to increase resilience at individual or community level. Such interventions should train to improve the individual's ability to gain social supports from family, friend, and community help individuals.

Adversity did not play an important role in resilience process in the dissertation, implicating that resilience is the ability for every person to deal with stressful or adverse events. Resilience-based intervention can be implemented in both at-risk and non-at-risk populations. Intervention programs should train people ability, skill, and confidence to face with difficult and stressful events rather than avoid adversity.

Summary

- The findings of the dissertation showed that point prevalence rates of health risks behaviors remarkably varied from baseline to Wave IV of the Add Health interviews, indicating that resilience status could fluctuate during the transition from adolescence to adulthood. However, when viewed over a long period of lifetime, individual resiliency on health risk behaviors appears to be rather stable and predictable under specific patterns of change.
- The resilience scale was constructed using available items in Add Health data sets to measure the perceived individual resilience. Both total score and its subscales predicted concurrently and prospectively the probabilities of suicidal, violent and substance use behaviors.
- Both perceived and actual social supports were significantly associated with the probability of health risk behaviors. Perceived social supports, examined as an element with resilience scale, had positive effects on resilience status. Actual social support diversely influenced on development of health risk behaviors over time. Parental support had little or no effect on resilience status, support from friends appeared to increase the risk to engage in some risk behaviors, while religious support was a strong protective factor for health risk behaviors at a point in time or over time.
- Participants who were exposed to adverse life condition at and prior to baseline were almost not different in term of resilience from those from general population. This implicates that resilience is a common characteristic to manage with negative and difficult events for every individual rather than adversity population.

REFERENCE

Aday, L. A. (Ed.). (2001). *At risk in America: The health and health care needs of vulnerable populations in the United States* (2nd ed.). San Francisco, CA: Jossey-Bass.

Aisenberg, E., Gavin, A., Mehrotra, G., & Bowman, J. (2011). Defining violence. In T. I. Herrenkohl, E. Aisenberg, J. H. Williams & J. M. Jenson (Eds.), *Violence in context: Current evidence on risk, protection, and prevention*. New York, NY: Oxford University Press.

Ali, M. M., Dwyer, D. S., Lopez, A., & Vanner, E. A. (2010). Adolescent propensity to engage in risky behaviors: The role of individual resilience. *International Journal of Environmental Research and Public Health, 7*(5), 2161–2176. doi: 10.3390/ijerph7052161

American Association of Suicidology. (2007). *Facts about suicide in the U.S.A.* Retrieved from http://www.suicidology.org

American Psychiatric Association. (2012). DSM-5 development: Substance use disorder. Retrieved from http://www.dsm5.org/ProposedRevisions/Pages/proposedrevision.aspx ?rid=431

Anthony, E. J. (1974). The syndrome of the psychologically vulnerable child. In E. J. Anthony (Ed.), *The child in his family: Children at Psychiatric Risk, Vol 3* (pp. 3-10). New York, NY: Wiley.

Arrington, E. G., & Wilson, M. N. (2000). A re-examination of risk and resilience during adolescence: Incorporating culture and diversity. *Journal of Child and Family Studies, 9*(2), 221–230.

Atzaba-Poria, N., Pike, A., & Deater-Deckard, K. (2004). Do risk factors for problem behaviour act in a cumulative manner? An examination of ethnic minority and majority children through an ecological perspective. *Journal of Child Psychology and Psychiatry, 45*(4), 707–718.

Austin, E., & Bozick, R. (2012). Sexual orientation, partnership formation, and substance use in the transition to adulthood. *Journal of Youth and Adolescence, 41*(2), 167–178.

Baek, H.-S., Lee, K.-U., Joo, E.-J., Lee, M.-Y., & Choi, K.-S. (2010). Reliability and validity of the Korean version of the Connor-Davidson Resilience Scale. *Psychiatry Investigation, 7*(2), 109–115.

Bartone, P. T. (2007). Test-retest reliability of the Dispositional Resilience Scale-15, a brief hardiness scale. *Psychological Reports, 101*(3), 943–944.

Beaver, K. M., Mancini, C., DeLisi, M., & Vaughn, M. G. (2011). Resiliency to victimization: the role of genetic factors. *Journal of Interpersonal Violence, 26*(5), 874–898.

Bitsika, V., Sharpley, C. F., & Peters, K. (2010). How is resilience associated with anxiety and depression? Analysis of factor score interactions within a homogeneous sample. *German Journal of Psychiatry, 13*(1), 9–16.

Block, J., & Kremen, A. M. (1996). IQ and ego-resiliency: Conceptual and empirical connections and separateness. *Journal of Personality and Social Psychology, 70*(2), 349–361.

Brent, D. A. (1987). Correlates of the medical lethality of suicide attempts in children and adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 26*(1), 87–91.

Brook, J. S., Zhang, C. S., Finch, S. J., & Brook, D. W. (2010). Adolescent pathways to adult smoking: Ethnic identity, peer substance use, and antisocial behavior. *American Journal of Addictions, 19*(2), 178–186.

Brownstein, N., Kalsbeek, W. D., Tabor, J., Entzel, P., Daza, E., & Harris, K. M. (n.d.). Non-Response in Wave IV of the National Longitudinal Study of Adolescent Health. Retrieved February 2nd, 2012, from http://www.cpc.unc.edu/projects/addhealth/data /guides/W4_nonresponse.pdf

Campbell-Sills, L., & Stein, M. B. (2007). Psychometric analysis and refinement of the Connor–Davidson resilience scale (CD-RISC): Validation of a 10-item measure of resilience. *Journal of Traumatic Stress, 20*(6), 1019–1028.

Carey, V., Zeger, S. L., & Diggle, P. (1993). Modelling multivariate binary data with alternating logistic regressions. *Biometrika, 80*(3), 517–526. doi: 10.1093/biomet/80.3.517

Center for Disease Control and Prevention. (2010). *Suicide: Facts at a glance*. Retrieved from http://cdc.gov/violenceprevention/pdf/Suicide_DataSheet-a.pdf

Center for Disease Control and Prevention. (2012). *Suicide: Facts at a glance*. Retrieved from http://www.cdc.gov/ViolencePrevention/pdf/Suicide_FactSheet_2012-a.pdf

Centers for Disease Control and Prevention. (2008). Smoking-attributable mortality, years of potential life lost, and productivity losses—United States, 2000–2004. *Morbidity and Mortality Weekly Reports, 57*(45), 1226–1228.

Centers for Disease Control and Prevention. (2010). Tobacco use among middle and high school students—United States, 2000–2009. *Morbidity and Mortality Weekly Reports, 59*(33), 1063–1068.

Centers for Disease Control and Prevention. (2011a). *Web-based Injury Statistics Query and Reporting System (WISQARS) [online]*. National Center for Injury Prevention and Control. Retrieved from www.cdc.gov/injury/wisqars/index.html

Centers for Disease Control and Prevention. (2011b). *Youth violence: National Statistics. Homicide trends in homicide rates, United States, 1991–2007.* Retrieved from http://www.cdc.gov/violenceprevention/youthviolence/stats_at-a_glance/hr_trends.html

Chantala, K. (2006). Guidelines for analyzing Add Health data. Retrieved from http://www.cpc.unc.edu/projects/addhealth/data/guides/wt-guidelines.pdf

Chantala, K., Kalsbeek, W. D., & Andraca, E. (n.d.). Non-Response in Wave III of the Add Health Study. Retrieved February, 2012, from http://www.cpc.unc.edu/projects /addhealth/data/guides/W3nonres.pdf

Christiansen, E., & Jensen, B. F. (2007). Risk of repetition of suicide attempt, suicide or all deaths after an episode of attempted suicide: A register-based survival analysis. *Australian and New Zealand Journal of Psychiatry, 41*(3), 257–265.

Cleverley, K., & Kidd, S. A. (2001). Resilience and suicidality among homeless youth. *Journal of Adolescence, 34*(5), 1049–1054.

Cole, S. W., Arevalo, J. M. G., Manu, K., Telzer, E. H., Kiang, L., Bower, J. E.,…Fuligni, A. J. (2011). Antagonistic pleiotropy at the human IL6 promoter confers genetic resilience to the pro-inflammatory effects of adverse social conditions in adolescence. *Developmental Psychology, 47*(4), 1173–1180.

Connor, K. M., & Davidson, J. R. (2003). Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). *Depression and Anxiety, 18*(2), 76–82.

Crosby, A. E., Han, B., Ortega, L. A., Parks, S. E., & Gfroerer, J. (2011). Suicidal thoughts and behaviors among adults aged ≥18 years—United States, 2008-2009. *MMWR Surveillance Summaries, 60*(13), 1–22.

Davey, M., Eaker, D. G., & Walters, L. H. (2003). Resilience processes in adolescents: Personality profiles, self-worth, and coping. *Journal of Adolescent Research, 18*(4), 347–362. doi: 10.1177/0743558403018004002

Davis, M. C. (2009). Building emotional resilience to promote health. *American Journal of Lifestyle Medicine, 3*(1 suppl 60S–63S). doi: 10.1177/1559827609335152

Eaton, D. K., Kann, L., Kinchen, S., Shanklin, S., Ross, J., Hawkins, J.,…Wechsler, H. (2010). Youth risk behavior surveillance—United States, 2009. *Morbidity and Mortality Weekly Reports, 59*(5), 1–142.

Erikson, E. H. (1950). *Childhood and Society*. New York, NY: Norton.

Federal Bureau of Investigation. (2009). *Crime in the United States*. Retrieved from http://www2.fbi.gov/ucr/cius2009/data/table_65.html

Fergus, S., & Zimmerman, M. A. (2005). Adolescent resilience: A framework for understanding healthy development in the face of risk. *Annual Review of Public Health, 26,* 399–419.

Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2004). *Applied longitudinal analysis*. Hoboken, NJ: John Wiley & Sons.

Flouri, E., & Kallis, C. (2007). Adverse life events and psychopathology and prosocial behavior in late adolescence: Testing the timing, specificity, accumulation, gradient, and moderation of contextual risk. *Journal of the American Academy of Child and Adolescent Psychiatry, 46*(12), 1651–1659.

Flouri, E., Tzavidis, N., & Kallis, C. (2010). Adverse life events, area socioeconomic disadvantage, and psychopathology and resilience in young children: The importance of risk factors' accumulation and protective factors' specificity. *European Child and Adolescent Psychiatry, 19*(6), 535–546.

Fotso, J. C., Holding, P. A., & Ezeh, A. C. (2009). Factors conveying resilience in the context of Urban poverty: The case of orphans and vulnerable children in the informal settlements of Nairobi, Kenya. *Child and Adolescent Mental Health, 14*(4), 175–182.

Fraser, E., & Pakenham, K. I. (2008). Evaluation of a resilience-based intervention for children of parents with mental illness. *Australian and New Zealand Journal of Psychiatry, 42*(12), 1041–1050.

Friborg, O., Hjemdal, O., Rosenvinge, J. H., & Martinussen, M. (2003). A new rating scale for adult resilience: what are the central protective resources behind healthy adjustment? *International Journal of Methods in Psychiatric Research, 12*(2), 65–76.

Garcia, C. (2009). Conceptualization and measurement of coping during adolescence: A review of the literature. *Journal of Nursing Scholarship, 42*(2), 166185.

Garmezy, N. (1973). Competence and adaptation in adult schizophrenic patients and children at risk. In S. R. Dean (Ed.), *Schizophrenia: The first ten Dean Award lectures* (pp. 163–204). New York, NY: MSS Information Corporation.

Garmezy, N. (1976). *Vulnerable and invulnerable children: Theory, research, and intervention. Master lectures on developmental psychology*. Washington, DC: American Psychological Association.

Garmezy, N., Masten, A. S., & Tellegen, A. (1984). The study of stress and competence in children: A building block for developmental psychopathology. *Child Development, 55*(1), 97–111.

Gerard, J. M., & Buehler, C. (2004). Cumulative environmental risk and youth maladjustment: The role of youth attributes. *Child Development, 75*(6), 1832–1849.

Ghazarian, S., & Buehler, C. (2010). Interparental conflict and academic achievement: An examination of mediating and moderating factors. *Journal of Youth and Adolescence, 39*(1), 23–35.

Ghazarian, S., & Roche, K. (2010). Social support and low-income, urban mothers: Longitudinal associations with adolescent delinquency. *Journal of Youth and Adolescence, 39*(9), 1097–1108.

Goldsmith, S. K., Pellmar, T. C., Kleinman, A. M., & Bunney, W. E. (Eds.). (2002). *Reducing suicide: A national imperative*. Washington, DC: National Academy Press.

Gorman-Smith, D., Henry, D. B., & Tolan, P. H. (2004). Exposure to community violence and violence perpetration: The protective effects of family functioning. *Journal of Clinical Child and Adolescent Psychology, 33*(3), 439–449.

Graham, J. W. (2009). Missing data analysis: Making it work in the real world. *Annual Review of Psychology, 60*(1), 549–576. doi: doi:10.1146/annurev.psych.58.110405.085530

Harris, K. M. (2011). Design Features of Add Health. Retrieved from http://www.cpc.unc.edu/projects/addhealth/data/guides/design/paper/WI-IV.pdf

Harris, K. M., Halpern, C. T., Whitsel, E., Hussey, J., Tabor, J., Entzel, P., & Udry, J. R. (2009). The National Longitudinal Study of Adolescent Health: Research design. Retrieved from http://www.cpc.unc.edu/projects/addhealth/design

Hjemdal, O., Friborg, O., Stiles, T., Martinussen, M., & Rosenvinge, J. (2006). A new rating scale for adolescent resilience. Grasping the central protective resources behind healthy development. *Measurement and Evaluation in Counseling and Development, 39*, 84–96.

Hjemdal, O., Vogel, P. A., Solem, S., Hagen, K., & Stiles, T. C. (2011). The relationship between resilience and levels of anxiety, depression, and obsessive-compulsive symptoms in adolescents. *Clinical Psychology and Psychotherapy, 18*(4), 314–321.

Houston, S. (2010). Building resilience in a children's home: Results from an action research project. *Child and Family Social Work, 15*(3), 357–368.

Jabeen, H., Johnson, C., & Allen, A. (2010). Built-in resilience: Learning from grassroots coping strategies for climate variability. *Environment and Urbanization, 22*(2), 415–431. doi: 10.1177/0956247810379937

Jacelon, C. S. (1997). The trait and process of resilience. *Journal of Advanced Nursing, 25*(1), 123–129.

Jaffee, S. R., Caspi, A., Moffitt, T. E., Polo-Tomas, M., & Taylor, A. (2007). Individual, family, and neighborhood factors distinguish resilient from non-resilient maltreated children: A cumulative stressors model. *Child Abuse and Neglect, 31*(3), 231–253.

Janine, M. Z., Laura, D. L., & Ginley, M. (2001). Adolescent health risk profiles: The co-occurrence of health risks among females and males. *Journal of Youth and Adolescence, 30*(6), 707–728.

Johnson, J., Gooding, P. A., Wood, A. M., & Tarrier, N. (2010). Resilience as positive coping appraisals: Testing the schematic appraisals model of suicide (SAMS). *Behaviour Research and Therapy, 48*(3), 179–186.

Johnson, W., Giordano, P., Manning, W., & Longmore, M. (2011). Parental-child relations and offending during young adulthood. *Journal of Youth And Adolescence, 40*(7), 786–799.

Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E. (2009). *Monitoring the future national survey results on drug use, 1975–2008: Volume II, College students and adults ages 19–50*. Bethesda, MD: NIH Publication No. 05-5728, National Institute on Drug Abuse.

Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E. (2011). *Monitoring the future national survey results on drug use, 1975–2010: Volume I, Secondary school students*. Ann Arbor: Institute for Social Research, the University of Michigan.

Kann, L., Kinchen, S. A., Williams, B. I., Ross, J. G., Lowry, R., Hill, C. V,…Kolbe, L. J. (1998). Youth Risk Behavior Surveillance—United States, 1997. *Morbidity and Mortality Weekly Reports, 47*(SS-3), 1–89.

Kerr, D. C. R., Capaldi, D. M., Owen, L. D., Wiesner, M., & Pears, K. C. (2011). Changes in at-risk American men's crime and substance use trajectories following fatherhood. *Journal of Marriage and Family, 73*(5), 1101–1116.

Kim-Cohen, J., Moffitt, T. E., Caspi, A., & Taylor, A. (2004). Genetic and environmental processes in young children's resilience and vulnerability to socioeconomic deprivation. *Child Development, 75*(3), 651–668.

Krug, E. G., Dahlberg, L. L., Mercy, J. A., Zwi, A. B., & Lozano, R. (2002). *World report on violence and health*. World Health Organization. Retrieved from http://whqlibdoc.who.int/hq/2002/9241545615.pdf

Liang, K.-Y., & Zeger, S. L. (1986). Longitudinal data analysis using generalized linear models. *Biometrika, 73*(1), 13-22. doi: 10.1093/biomet/73.1.13

Little, R. A., & Rubin, D. B. (1987). *Statistical analysis with missing data*. New York, NY: John Wiley & Sons.

Luthar, S. S., & Cicchetti, D. (2000). The construct of resilience: Implications for interventions and social policies. *Development and Psychopathology, 12*(4), 857–885.

Luthar, S. S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: A critical evaluation and guidelines for future work. *Child Development, 71*(3), 543–562.

Luthar, S. S., & Zelazo, L. B. (2003). Research on resilience: An integrative review. In S. S. Luthar (Ed.), *Resilience and vulnerability: Adaptation in the context of childhood adversities*. New York, NY: Cambridge University Press.

MacKay, A. P., & Duran, C. (2008). *Adolescent health in the United States, 2007*. DHHS publication. Retrieved from http://www.cdc.gov/nchs/data/misc/adolescent2007.pdf

Marcenko, M. O., Fishman, G., & Freidman, J. (1999). Reexamining adolescent suicidal ideation: A developmental perspective applied to a diverse population. *Journal of Youth and Adolescence, 28*(1), 121–138.

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

Masten, A. S. (2007). Resilience in developing systems: Progress and promise as the fourth wave rises. *Development and Psychopathology, 19*(3), 921–930.

Masten, A. S., Burt, K. B., Roisman, G. I., Obradovic´, J., Long, J. D., & Tellegen, A. (2004). Resources and resilience in the transition to adulthood: Continuity and change. *Development and Psychopathology, 16*(4), 1071–1094.

McDowell, T. L., & Serovich, J. M. (2007). The effect of perceived and actual social support on the mental health of HIV-positive persons. *AIDS Care, 19*(10), 1223–1229.

McWhirter, J. J., McWhirter, B. T., McWhirter, A. M., & McWhirter, E. H. (1995). Youth at risk: Another point of view. *Journal of Counseling and Development, 73*(5), 567–569.

Merrell, K. W. (2010). Linking prevention science and social and emotional learning: The Oregon Resiliency Project. *Psychology in the Schools, 47*(1), 55–70.

Miller, L. A., & McIntire, S. A. (1994). *Foundations of psychological testing: A practical approach* (second ed.). Thousand Oaks, CA: SAGE Publications.

National Center for Health Statistics. (2009). Health, United States, 2008 with chartbook. Hyattsville, MD: DHHS Publication No. 2009-1232.

National Strategy for Suicide Prevention. (2006). *Suicide among the young*. Retrieved from http://mentalhealth.samhsa.gov/suicideprevention/

Nishi, D., Uehara, R., Kondo, M., & Matsuoka, Y. (2010). Reliability and validity of the Japanese version of the Resilience Scale and its short version. *BMC Research Notes, 3*, 310–310.

Nowlin, P. R., & Colder, C. R. (2007). The role of ethnicity and neighborhood poverty on the relationship between parenting and adolescent cigarette use. *Nicotine and Tobacco Research, 9*(5), 545–556.

Nrugham, L., Holen, A., & Sund, A. M. (2010). Associations between attempted suicide, violent life events, depressive symptoms, and resilience in adolescents and young adults. *Journal of Nervous and Mental Disease, 198*(2), 131–136.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (Third ed.). New York, NY: McGraw-Hill.

Nygren, B., Randström, K. B., Lejonklou, A. K., & Lundman, B. (2004). Reliability and validity of a Swedish language version of the Resilience Scale. *Journal of Nursing Measurement, 12*(3), 169–178.

Office of the Surgeon General, U.S. Public Health Service. (2001). *Youth violence: A report of the Surgeon General*. Retrieved from http://www.surgeongeneral.gov/library /youthviolence/report.html

Olsson, C. A., Bond, L., Burns, J. M., Vella-Brodrick, D. A., & Sawyer, S. M. (2003). Adolescent resilience: A concept analysis. *Journal of Adolescence, 26*(1), 1–11.

Olweus, D. (1999). Sweden. In P. K. Smith, Y. Morita, J. Junger-Tas, D. Olweus, R. Catalano & P. Slee (Eds.), *The nature of school bullying: A cross-national perspective*. London, England: Routledge.

Pan, W. (2001). Akaike's information criterion in generalized estimating equations. *Biometrics, 57*, 120–125.

Patrick, M. E., Schulenberg, J. E., O'Malley, P. M., Maggs, J. L., Kloska, D. D., Johnston, L. D., & Bachman, J. G. (2011). Age-related changes in reasons for using alcohol and marijuana from ages 18 to 30 in a national sample. *Psychology of Addictive Behaviors, 25*(2), 330–339.

Pines, M. (1975). In praise of "invulnedrables". *APA Monitor, 7*.

Prince-Embury, S. (2007). *Resiliency scales for children and adolescents: Profiles of personal strength*. San Antonio, TX: Harcourt Assessment.

Puzzanchera, C. (2009). Juvenile Arrests 2008. Washington, DC: U.S. Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention.

Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385–401.

Rao, J. N. K., & Scott, A. J. (1981). Theanalysis of categorical data from complex sample surveys: Chi-squared tests for goodness of fit and independence in two-way tables. *Journal of the American Statistical Association, 76*(374), 221–230.

Reimuller, A., Shadur, J., & Hussong, A. M. (2011). Parental social support as a moderator of self-medication in adolescents. *Addictive Behaviors, 36*(3), 203–208.

Reiss, A., & Roth, J. A. (1993). *Understanding and preventing violence*. Washington, D.C: National Academy Press.

Resnick, G., & Burt, M. R. (1996). Youth at risk: Definitions and implications for service delivery. *American Journal of Orthopsychiatry, 66*(2), 172–188.

Resnick, M. D., Bearman, P., Blum, R. W., Bauman, K. E., Harris, K. M., & Jones, J. (1997). Protecting adolescents from harm: Findings from the National Longitudinal Study of Adolescent Health. *Journal of the American Medical Association, 278*, 823–832.

Richardson, G. E. (2002). The metatheory of resilience and resiliency. *Journal of Clinical Psychology, 58*(3), 307–321.

Richardson, G. E., Neiger B, Jensen S, & Kumpfer K. (1990). The resiliency model. *Health Education, 21*, 33–39.

Robertson, A. A., Xu, X., & Stripling, A. (2010). Adverse events and substance use among female adolescent offenders: Effects of coping and family support. *Substance Use and Misuse, 45*(3), 451–472.

Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.

Roy, A., Sarchiapone, M., & Carli, V. (2007). Low resilience in suicide attempters. *Archives of Suicide Research, 11*(3), 265–269.

Rubin, D. B. (1976). Inference and missing data. *Biometrika, 63*(3), 581–592. doi: 10.1093/biomet/63.3.581

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York, NY: John Wiley & Sons.

Rutter, M. (1979). Maternal deprivation, 1972–1978: New findings, new concepts, new approaches. *Child Development, 50*(2), 283–305.

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

Schafer, J. L. (1999). Multiple imputation: A primer. *Statistical Methods in Medical Research, 8*(1), 3-15.

Scheffer, J. (2002). Dealing with missing data. *Research Letters in the Information and Mathematical Sciences, 3*, 153–160.

Schoon, I. (2011). Temporal and contextual dimensions to individual positive development: A developmental-contextual systems model of resilience. In M. Ungar (Ed.), *The social ecology of resilience: A handbook of theory and practice* (pp. 143–156). New York, NY: Springer.

Seery, M. D., Holman, E. A., & Silver, R. C. (2010). Whatever does not kill us: Cumulative lifetime adversity, vulnerability, and resilience. *Journal of Personality and Social Psychology, 99*(6), 1025–1041.

Sharma, R., Grover, V. L., & Chaturvedi, S. (2008). Risk behaviors related to inter-personal violence among school and college-going adolescents in South Delhi. *Indian Journal of Community Medicine, 33*(2), 85–88.

Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The Brief Resilience Scale: Assessing the ability to bounce back. *International Journal of Behavioral Medicine, 15*(3), 194–200.

Substance Abuse and Mental Health Services Administration. (2008). *Results from the 2007 National Survey on Drug Use and Health: National findings*. Rockville, MD. Retrieved from http://oas.samhsa.gov/copies.cfm

Tebes, J. K., Kaufman, J. S., Adnopoz, J., & Racusin, G. (2001). Resilience and family psychosocial processes among children of parents with serious mental disorders. *Journal of Child and Family Studies, 10*(1), 115–136.

Titus, C. S. (2006). *Resilience and the virtue of fortitude. Aquinas in dialogue with the psychosocial sciences*. Washington, DC: Catholic University of America Press.

U.S. Department of Health and Human Services. (2010). *Healthy People 2020*. Retrieved from http://www.healthypeople.gov/hp2020/default.asp

Udry, J. R. (1998). The National Longitudinal Study of Adolescent Health Waves I & II, 1994–1996. Retrieved from http://www.cpc.unc.edu/projects/addhealth/data/publicdata

Ungar, M., Liebenberg, L., Boothroyd, R., Kwong, W. M., Lee, T. Y., Leblanc, J.,…Maknach, A. (2008). The study of youth resilience across cultures: Lessons from a pilot study of measurement development. *Research in Human Development, 5*(3), 166–180.

Vanderbilt-Adriance, E., & Shaw, D. (2008). Conceptualizing and re-evaluating resilience across levels of risk, time, and domains of competence. *Clinical Child and Family Psychology Review, 11*(1), 30–58.

Veenstra, M. Y., Lemmens, P. H., Friesema, I. H., Tan, F. E., Garretsen, H. F., Knottnerus, J. A., & Zwietering, P. J. (2007). Coping style mediates impact of stress on alcohol use: A prospective population-based study. *Addiction, 102*(12), 1890–1898.

Wagner, J. (2010). The fraction of missing information as a tool for monitoring the quality of survey data. *Public Opinion Quarterly*. doi: 10.1093/poq/nfq007

Wagnild, G. M., & Young, H. M. (1993). Development and psychometric evaluation of the Resilience Scale. *Journal of Nursing Measurement, 1*(2), 165–178.

Werner, E. E., & Smith, R. S. (1982). *Vulnerable but invincible: A longitudinal study of resilient children and youth*. New York, NY: McGraw-Hill.

Werner, E. E., & Smith, R. S. (1992). *Overcoming the odds: High risk children from birth to adulthood*. Ithica, NY: Cornell University Press. .

Windle, G., Bennett, K., & Noyes, J. (2011). A methodological review of resilience measurement scales. *Health and Quality of Life Outcomes, 9*(8), 1–18.

Wolchik, S. A., Schenck, C. E., & Sandler, I. N. (2009). Promoting resilience in youth from divorced families: Lessons learned from experimental trials of the new beginnings program. *Journal of Personality, 77*(6), 1833-1868.

Wolchik, S. A., Wilcox, K. L., Tein, J.-Y., & Sandler, I. N. (2000). Maternal acceptance and consistency of discipline as buffers of divorce stressors on children's psychological adjustment problems. *Journal of Abnormal Child Psychology: An official publication of the International Society for Research in Child and Adolescent Psychopathology, 28*(1), 87–102.

World Health Organization. (2003). Surveillance of noncommunicable disease risk factors. *Fact sheet No.273.* Retrieved from http://www.who.int/mediacentre/factsheets/2003/fs273/en/

APPENDIX A

Description of the Published Resilience Measures

Scales	Authors	Construct measured	Purpose of measures	# items	Dimensions or subscales	Target population
The Connor–Davidson Resilience Scale	Connor and Davidson (2003)	Resilience is viewed as a measure of successful stress coping ability.	Developed for clinical practice as a measure to assess treatment response.	25 five-point - Likert items	Factor analysis yielded five subscales: personal competence, trust/tolerance /strengthening effects of stress, acceptance of change, control, and spiritual influences.	Adults
Resiliency Scales for Children and Adolescents	Prince-Embury (2007)	Resilience was measured using personal attributes related to resilience. The scales focus on personal strengths, as well as vulnerability.	Originally used in clinical practice to screen the personal resiliency and vulnerability characteristics in children and youth.	64 five-point - Likert items	Three stand-alone global scales and ten subscales.	Children and adolescents aged 9-18 years
Resilience Scale for Adults	Friborg et al. (2003)	To examined psychological and personal protective factors among psychosocial disorders.	Originally used in clinical and health psychology as an assessment tool of protective factors important to prevent psychological disorders.	37 items	Factor analysis yielded five dimensions: personal competence, social competence, family coherence, social support, and personal structure.	Adults
Resilience Scale for Adolescents	Hjemdal et al. (2006)	To assess the protective personal, family, and social resources, to understand stress adaptation.	The purpose of the scale was to develop and test a valid instrument for measuring adolescent resilience.	39 five-point - Likert items	Good fit for five factors: personal competence, social competence, family cohesion, social resources, and structured style.	Adolescents aged 13-15 years
Child and Youth Resilience Measure	Ungar et al. (2008)	To examine what differences in culture influence in the measure of resilience.	develop a culturally and contextually relevant measure of child and youth resilience.	28 five-point - Likert items	Four domains: individual, relational, community and culture.	Child and Youth aged 13-23 years

Scales	Authors	Construct measured	Purpose of measures	# items	Dimensions or subscales	Target population
Ego Resiliency 89 Scale	Block (1996)	To measure ego-resiliency, referred as a stable personality characteristic.	The authors take the perspective that resilience is a personal quality that reflects the ability to cope with stress.	14 four-point - Likert items	No subscale	Young adults (18 and 23)
Resilience Scale	Wagnild and Young (1993)	Resilience as a positive personality characteristic that enhances individual adaptation.	Screening personal attributes associated with resilience.	25 and 14 seven-point - items	Five dimensions : equanimity, perseverance, self-reliance, meaningful life, and existential aloneness.	Adults
Dispositional Resilience Scale	Bartone (2007)	To measure personality trait of hardiness.	Screening individual psychological hardiness.	15 four-point - Likert items	Three subscales, with 5 items each: commitment, control, challenge.	Adults
Resilience Appraisals Scale	Johnson, et al. (2010)	To measure the individual characteristics of self-appraisals.		12 five-point - Likert items	Three subscales, with 4 items each emotion coping, situation coping, and social support.	Young adults
Resilience indices	Ali, Dwyer, Lopez, and Vanner (2010)	Three level of resilience personal, family, and community. Each contributes to an individual's overall resilience.	High scores in resilience indices reduced risk addition behaviors.	31 items from the Add Health data at Wave I	Exploratory factor analysis yielded three exclusive factor: overall-resilience, family-resilience, and self-resilience.	Adolescents
Brief Resilience Scale	Smith et al. (2008)	Resilience was considered as the ability of bouncing back or recover from stress.	The BRS is a reliable tool of assessing resilience and obtaining information about people coping with health-related stressors.	Six 5-point items	No subscale	Adults

APPENDIX B

Resilience Models

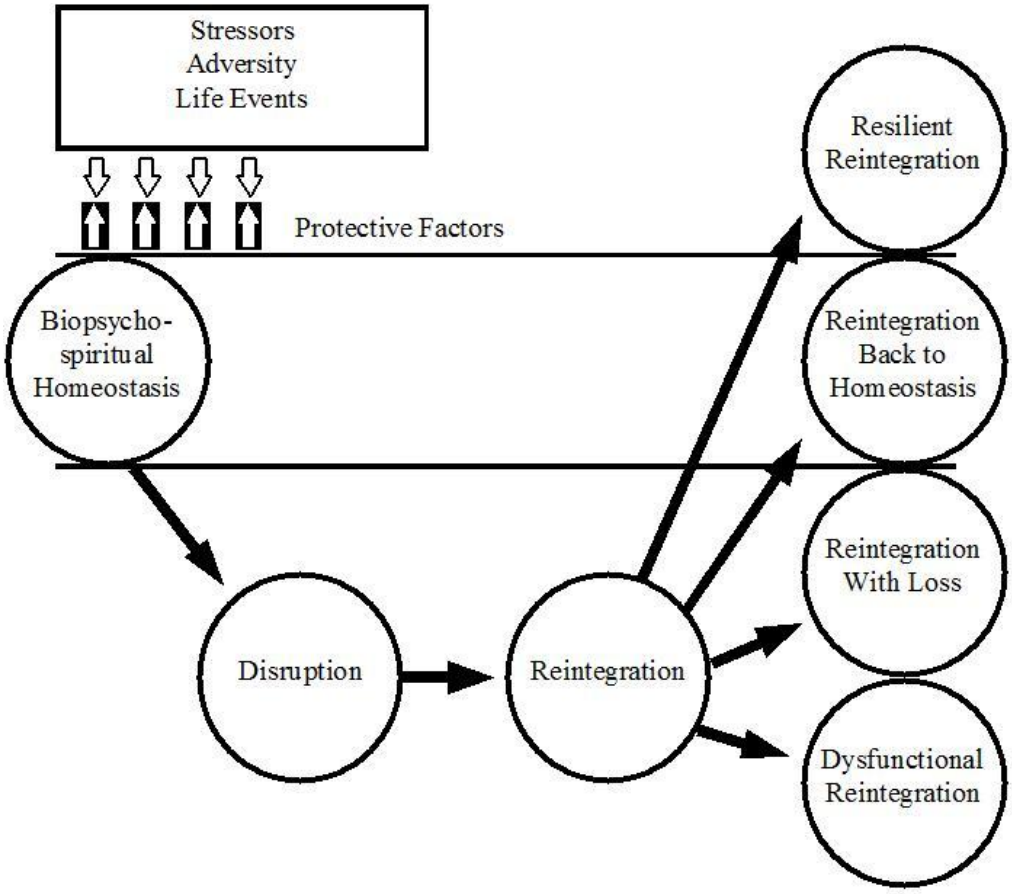

Figure B.1. The Richardson's resiliency model. Adapted from "The metatheory of resilience and resiliency" by Richardson, G. E., 2002, *Journal of Clinical Psychology, 58*(3), p.311.

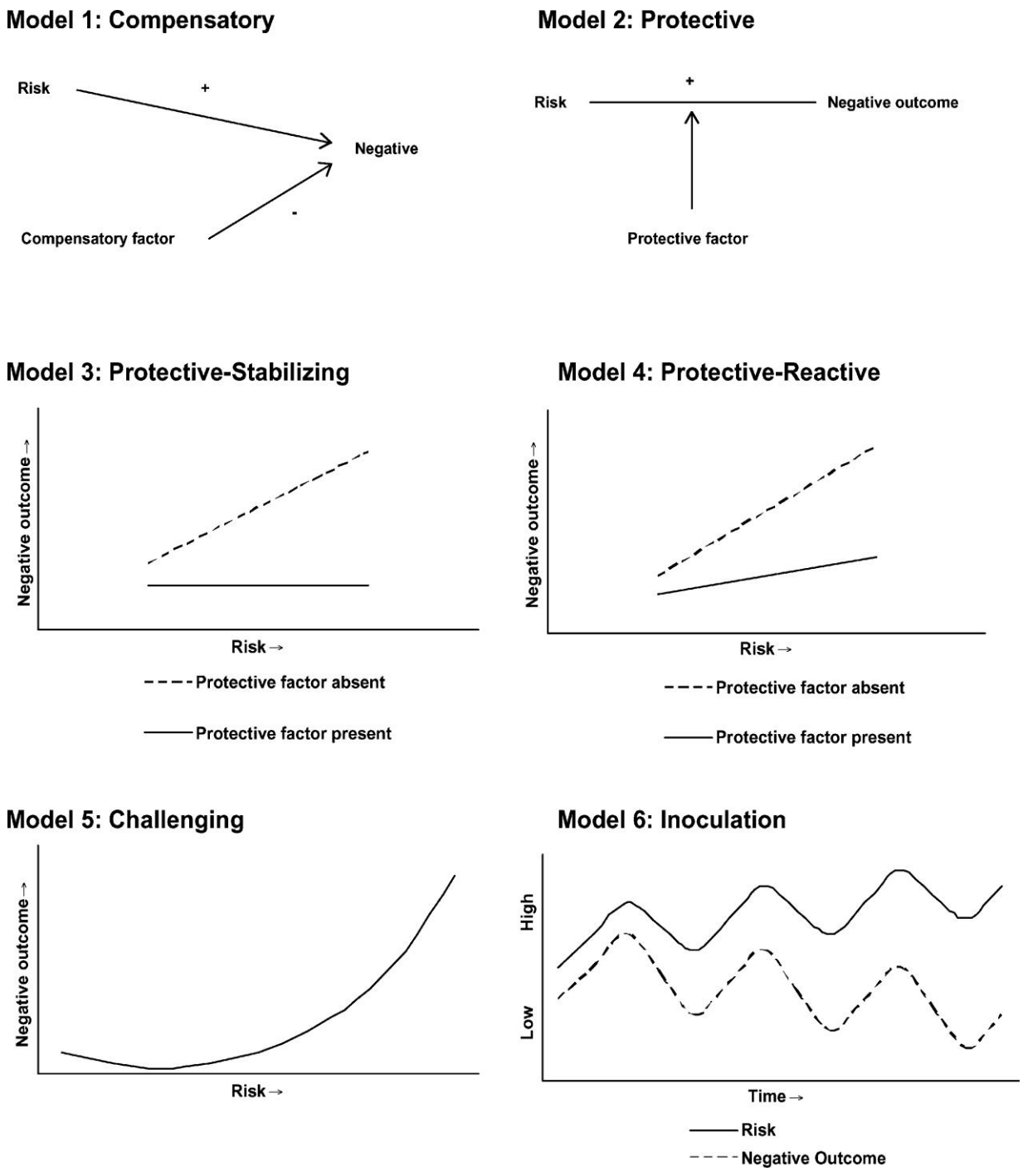

Figure B.2. Models of resilience. Adapted from "Adolescent resilience: A framework for understanding healthy development in the face of risk" by Fergus, S. and Zimmerman, M. A, (2005), *Annual Review of Public Health, 26*, p. 402

APPENDIX C

Items in the Add Health Data Used to Form Composite Scales

Table C.1.

Items Used to Measure Outcome Variables

Health risk behaviors	Wave I	Wave I	Wave I	Wave I	Scoring
Suicide					
1. During the past 12 months, did you ever seriously think about committing suicide?	H1SU1	H2SU1	H3TO130	H4SE1	Yes/no
2. During the past 12 months, how many times did you actually attempt suicide?	H1SU2	H2SU2	H3TO131	H4SE2	0 to 4
Violence					
• During the past 12 months, someone pulled a knife or gun on you.	H1FV2	H2FV2	H3DS18B, H3DS18C	H4DS15	0 to 1 or 2
• During the past 12 months, someone shot or stabbed you.	H1FV3, H1FV4	H2FV3, H2FV4	H3DS18D, H3DS18E	H4DS16	0 to 1 or 2
• During the past 12 months, you pulled a knife or gun on someone.	H1FV7	H2FV6	H3DS18H	H4DS19	0 to 1 or 2
• During the past 12 months, you shot or stabbed someone.	H1FV8	H2FV7	H3DS18I	H4DS20	0 to 1 or 2
Substance use					
1. During the past 30 days, on how many days did you smoke cigarettes?	H1TO5	H2TO5	H3TO7	H4TO5	0 to 30
2. Over the past 12 months, on how many days did you drink five or more drinks in a row?	H1TO17	H2TO21	H3TO40	H4TO37	1 to 7 , or 0 to 6
3. During the past 30 days, how many times did you use marijuana?	H1TO32	H2TO46	H3TO110	H4TO71	0 to 900, or 0 to 6
4. During the past 30 days, how many times did you use cocaine?	H1TO36	H2TO52	H3TO113		0 to 888
5. During the past 30 days, how many times did you use inhalants?	H1TO39	H2TO56			0 to 789
6. During the past 30 days, how many times did you use any of these types of illegal drugs?	H1TO42	H2TO60	H3TO119		0 to 900
7. During the past 30 days, how many times have you used crystal meth?			H3TO116		0 to 300
8. During the past 30 days, on how many days did you use favorite drug?				H4TO99	0 to 6

Table C. 2

Items Used to Construct the Resilience Scale at Baseline

Items	Item #	Scoring
1. You have a lot of good qualities	H1PF30	1 to 5
2. You have a lot to be proud of	H1PF32	1 to 5
3. You like yourself just the way you are	H1PF33	1 to 5
4. You enjoyed life	H1FS15	0 to 3
5. You felt sad	H1FS16	0 to 3
6. You felt that you were just as good as other people	H1FS4	0 to 3
7. You feel you are doing everything just about right	H1PF34	1 to 5
8. You felt hopeful about the future	H1FS8	0 to 3
9. You felt happy.	H1FS11	0 to 3
10. You thought your life had been a failure	H1FS9	0 to 3
11. You felt life was not worth living	H1FS19	0 to 3
12. You were bothered by things that usually don't bother you.	H1FS1	0 to 3
13. You felt that you could not shake off the blues, even with help from your family and your friends.	H1FS3	0 to 3
14. You had trouble keeping your mind on what you were doing.	H1FS5	0 to 3
15. It was hard to get started doing things.		0 to 3
16. You usually go out of your way to avoid having to deal with problems in life	H1PF14	1 to 5
17. When making decisions, you usually go with your "gut feeling" without thinking too much the consequences of each alternative.	H1PF16	1 to 5
18. Difficult problems make you very upset.	H1PF15	1 to 5
19. When you have a problem to solve, one of the first things you do is get as many facts about the problem as possible.	H1PF18	1 to 5
20. When you are attempting to find a solution to a problem, you usually try to think of as many different ways to approach the problem as possible.	H1PF19	1 to 5
21. When making decisions, you generally use a systematic method for judging and comparing alternatives.		1 to 5
22. After carrying out a solution to a problem, you usually try to analyze what went right and what went wrong.	H1PF21	1 to 5
23. You feel socially accepted	H1PF35	1 to 5
24. You feel loved and wanted	H1PF36	1 to 5

Table C.2.

Items Used to Construct the Resilience Scale at Baseline (continued)

Items	Item #	Scoring
25. You felt that people disliked you	H1FS17	0 to 3
26. People were unfriendly to you	H1FS14	0 to 3
27. You felt lonely	H1FS13	0 to 3
28. How much do you feel that adults care about you?	H1PR1	1 to 5
29. How much do you feel that your teachers care about you?	H1PR2	1 to 5
30. How much do you feel that your parents care about you?	H1PR3	1 to 5
31. How much do you feel that your friends care about you?	H1PR4	1 to 5
32. How much do you feel that people in your family understand you?	H1PR5	1 to 5
33. How much do you feel that you and your family have fun together?	H1PR7	1 to 5
34. How much do you feel that your family pays attention to you?	H1PR8	1 to 5
35. On the whole, how happy are you with living in your neighborhood?	H1NB6	1 to 5

Table C. 3

Items Used to Construct Parental Support Scales at Baseline

Items	Variable	Scoring
Parental involvement :		
Which of the things listed on this card have you done with your mother/father in the past 4 weeks?		
1. Gone shopping	H1WP17A	Yes/no
2. Played a sport	H1WP17B	Yes/no
3. Gone to a religious service or church-related event	H1WP17C	Yes/no
4. Talked about someone you're dating, or a party you went to	H1WP17D	Yes/no
5. Gone to a movie, play, museum, concert, or sports event	H1WP17E	Yes/no
6. Had a talk about a personal problem you were having	H1WP17F	Yes/no
7. Had a serious argument about your behavior	H1WP17G	Yes/no
8. Talked about your school work or grades	H1WP17H	Yes/no
9. Worked on a project for school	H1WP17I	Yes/no
10. Talked about other things you're doing in school	H1WP17J	Yes/no
Parental control :		
Do your parents let you make your own decisions about:		
1. The time you must be home on weekend nights?	H1WP1	Yes/no
2. The people you hang around with?	H1WP2	Yes/no
3. What you wear?	H1WP3	Yes/no
4. How much television you watch?	H1WP4	Yes/no
5. Which television programs you watch?	H1WP5	Yes/no
6. What time you go to bed on week nights?	H1WP6	Yes/no
7. What you eat?	H1WP7	Yes/no

APPENDIX D

University of Arkansas Institutional Review Board (IRB)

LETTER OF APPROVAL

120 Ozark Hall • Fayetteville, Arkansas 72701 • (479) 575-2208 • (479) 575-3846 (FAX)
Email: irb@uark.edu

Research Support and Sponsored Programs
Institutional Review Board

March 11, 2011

MEMORANDUM

TO:	Chuong Nguyen Hong Bart Hammig
FROM:	Ro Windwalker IRB Coordinator
RE:	New Protocol Approval
IRB Protocol #:	11-01-405
Protocol Title:	*The Role of Individual Resilience in Health Risky Behaviors among Adolescents and Young Adults: A Longitudinal Study*
Review Type:	☐ EXEMPT ☒ EXPEDITED ☐ FULL IRB
Approved Project Period:	Start Date: 03/11/2011 Expiration Date: 03/10/2012

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Compliance website (http://www.uark.edu/admin/rsspinfo/compliance/index.html). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

If you wish to make *any* modifications in the approved protocol, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 120 Ozark Hall, 5-2208, or irb@uark.edu.

APPENDIX D. PROJECT MODIFICATION FROM IRB

UNIVERSITY OF ARKANSAS

Office of Research Compliance
Institutional Review Board

April 12, 2012

MEMORANDUM

TO:	Chuong Nguyen Hong Bart Hammig
FROM:	Ro Windwalker IRB Coordinator
RE:	PROJECT MODIFICATION
IRB Protocol #:	11-01-405
Protocol Title:	*Individual Resilience, Social Support, and Health Risk Behaviors in Adolescents and Young Adults: Study on Cross-Sectional and Longitudinal Samples*
Review Type:	☐ EXEMPT ☒ EXPEDITED ☐ FULL IRB
Approved Project Period:	Start Date: 04/12/2012 Expiration Date: 03/10/2013

Your request to change the title of the referenced protocol has been approved by the IRB. **This protocol is currently approved for 66,000 total participants.** If you wish to make any further modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

Please note that this approval does not extend the Approved Project Period. Should you wish to extend your project beyond the current expiration date, you must submit a request for continuation using the UAF IRB form "Continuing Review for IRB Approved Projects." The request should be sent to the IRB Coordinator, 210 Administration.

For protocols requiring FULL IRB review, please submit your request at least one month prior to the current expiration date. (High-risk protocols may require even more time for approval.) For protocols requiring an EXPEDITED or EXEMPT review, submit your request at least two weeks prior to the current expiration date. Failure to obtain approval for a continuation *on or prior to* the currently approved expiration date will result in termination of the protocol and you will be required to submit a new protocol to the IRB before continuing the project. Data collected past the protocol expiration date may need to be eliminated from the dataset should you wish to publish. Only data collected under a currently approved protocol can be certified by the IRB for any purpose.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

210 Administration Building • 1 University of Arkansas • Fayetteville, AR 72701
Voice (479) 575-2208 • Fax (479) 575-3846 • Email irb@uark.edu

VITAE

Chuong Nguyen

Education

University of Arkansas, Fayetteville, Health science, Ph.D.

University of California, Berkeley, Maternal and Child Health, M.P.H. 2003.

University of Medicine and Pharmacy, Ho Chi Minh City, Primary Specialist of Pediatrics 1999.

University of Medicine and Pharmacy, Ho Chi Minh City, M.D 1994.

Experience

01/09-present **University of Arkansas, Fayetteville, Community Health Promotion, Ph.D.**

03/06-12/08. **Head of Professional Unit**
Department of Health Services, Binh Duong Province.

- Manage and implement national health programs, such as reproductive health care, family planning, childhood vaccination, prevention of HIV/AIDS, malaria, tuberculosis and Dengue fever.
- Train and educate local people and medical workers about health problems and disease prevention.
- Secretary of many local projects such as project of HIV/AIDS prevention, project of improving capacities for diseases prevention system, injury prevention...

11/94 - 6/01 **Medical Doctor**
Department of Pediatrics, Binh Duong Hospital, Vietnam.

- Diagnosis and treatment of patients, monitoring of outpatients.
- Researched on the treatment for Dengue fever, malaria and pesticide poisoning.
- Mentored students from the Medical University of Ho Chi Minh City
- Participated in many health strategies in local area: childhood malnutrition, breast-feeding, vaccination, reproductive health, HIV education.

Publication

Management and treatment of 500 patients with severe Dengue fever in Binh Duong hospital, Binh Duong hospital magazine, 1997

Secondary prevention of the Rheumatic fever in Binh Duong province, Binh Duong hospital magazine, 2004

Risk factors for nosocomial infections in the neonatal unit, Binh Duong hospital, Binh Duong hospital magazine, 2007

Membership

Membership of APHA (American Public Health Association)

Membership of ASHA (American School Health Association)

Membership of Pediatrics Association of Ho Chi Minh City