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STRESS, COPING, AND DEPRESSION IN ADOLESCENTS:
A LONGITUDINAL ANALYSIS OF DATA FROM NATIONAL LONGITUDINAL
STUDY OF ADOLESCENT HEALTH

By

Xiaoyun Zhang

A DISSERTATION

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The Graduate College at the University of Nebraska
In Partial Fulfillment of Requirements
For the Degree of Doctor of Philosophy

Major: Human Sciences
(Child, Youth, and Family Studies)

Under the Supervision of Professors Yan Ruth Xia and Allison M. J. Reisbig

Lincoln, Nebraska

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STRESS, COPING, AND DEPRESSION IN ADOLESCENTS:
A LONGITUDINAL ANALYSIS OF DATA FROM NATIONAL LONGITUDINAL
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Xiaoyun Zhang, Ph.D.

University of Nebraska, 2013

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The study examined the relationships among stress, coping and depression using the public-use data from the first three waves of the National Longitudinal Study of Adolescent Health (Harris & Udry, 1994-2008). The total sample of 3844 participants aged from 11 to 27 was included in the analysis. Latent growth curve modeling was used to identify the developmental trajectories of depressive symptoms and stressful life events from age 12 to age 24, respectively; Latent growth curve modeling with two-construct parallel processes was used to examine the associations between stressful life events and depressive symptoms over time. Path analysis was used to test whether coping, including problem solving coping at Wave I, emotion-focused coping and unhealthy behavioral coping (i.e. substance use) at Wave II, mediated or moderated the association between stressful life events at Wave I and depressive symptoms at Wave III. The results showed that the average of depressive symptoms increased from early to middle adolescence, and then decreased from middle to late adolescence. Girls exhibited persistently higher levels of depression across the whole adolescence period than boys. Similar to the change patterns of

depressive symptoms, the average number of stressful life events also increased from early to middle adolescence, and then decreased from middle to late adolescence.

However, boys had persistently greater number of stressful life events than girls. In addition, the initial number of stressful life events was positively associated with the initial levels of depressive symptoms, whereas high initial number of stressful life events predicted slower increase of depressive symptoms over time, especially for girls. Furthermore, only emotion-focused coping was a significant mediator between earlier stressful life events and later depressive symptoms, and the effect was stronger in girls than in boys. Finally, unhealthy behavioral coping could reduce the adverse effect of earlier stressful life events on later depressive symptoms both in girls and boys. The limitations and contributions of the study as well as implications in the field of prevention and intervention are provided in the discussion.

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Chapter 1: Introduction

It has been well documented that stress is consistently associated with depressive symptoms (Grant et al., 2003; Ge et al. 1994; Connor-Smith & Compas, 2002; Meadows et al., 2006) and depressive disorders (see reviews from Kessler, 1997; Hammen, 2005), whereas not all people who experience stress develop depressed problems. Thus there must be certain mechanisms between stress and depression (see reviews from Compas, Connor-Smith, Saltzman, Thomsen & Wadsworth, 2001; Grant, et al., 2003; Hammen, 2005; Grant et al., 2006).

Researchers suggest that coping can both serve as the mediating and moderating roles (Grant et al., 2006). In the current literature, few studies have tested the associations between stress and depression over time using a longitudinal data with multiple time points. Likewise, little research has been conducted to examine both the mediating and moderating roles of coping in one study using data with three time points, either. The present study tried to bridge the gap employing the public-use data from National Longitudinal Study of Adolescent Health (Add Health, Harris & Udry, 1994-2008).

Adolescence is an important developmental period for understanding the nature and course of depressive symptoms and disorders (Compas, Ey, & Grant, 1993; Petersen et al., 1993). Many significant changes in depression problems occur during this period (Petersen et al., 1993). For example, the prevalence rates of depressive symptoms and disorders significantly increase during early adolescence compared to childhood, and by middle to late adolescence, the prevalence rates approach the levels

observed in adult population (e.g., Fleming & Offord, 1990; Nolen-Hoeksema & Girgus, 1994). However, researchers often use between-subject designs and cross-sectional data to examine the age effect of depression; Only a limited number of studies have examined the developmental trajectories of depressive symptoms during adolescence using data with multiple time points (Johnson, Whisman, Corley, Hewitt, & Rhee, 2012; Ge, Lorenz, Conger, Elder, & Simons, 1994; Ge, Natsuaki, & Conger, 2006; Meadows, Brown, & Elder, 2006; Meadows, 2007; Brown, Meadows, & Elder 2007; Adkins, Wang, Dupre, van den Oord, & Elder, 2009; Garber, Keiley, & Martin, 2002). In these studies, researchers have employed latent growth curve modeling with either age or wave as the time metric. The findings are not conclusive across the studies, with some suggesting a quadratic model while others indicating a linear model.

Stress has been studied intensively as an important risk factor for depression. The findings from both cross-sectional (e.g., Ng & Hurry, 2010) and prospective studies (e.g., Ge et al., 1994; Cole, Nolen-Hoeksema, Girgus, & Paul, 2006; Ge, Natsuaki, Neiderhiser, & Reiss, 2009; Adkins et al., 2009) support the significant association between stress and depression. Also, such associations exist regardless of types of stress, including aggregated stressful life events (e.g., Olsson, Nordström, Arinell, & Von Knorring, 1999; Burton, Stice, & Seeley, 2004; Rudolph, Flynn, Abaied, Groot, & Thompson, 2009), chronic stress (e.g., Rudolph et al., 2000), daily stressors (e.g., Hankin, Mermelstein, & Roesch, 2007) and specific stressors (e.g.,

conflict with parents in Lewinsohn, Gotlib, & Seeley, 1995; loss events in Sandler, Reynolds, Kliwer, & Ramirez, 1992; peer stress in Conley & Rudolph, 2009; maternal depression in Hammen, Brennan, & Le Brocque, 2011). Recently, researchers have tried to understand the longitudinal associations between stress and depressive symptoms using latent growth curve modeling (Ge et al. 1994; Johnson et al., 2012; Garber et al., 2002). Similar to modeling the developmental trajectories of depressive symptoms, the change patterns of stress have been modeled as well. However, these studies have yielded inconsistent results. For instance, Ge and his colleagues (1994) found a quadratic model (i.e., the number of stressful life events increased from early adolescence, while the rate of increase became slower after middle adolescence), whereas Johnson et al. (2012) did not find any significant changes of stress from age 9 to age 16. Furthermore, some studies found significant random effects of stress and depression (e.g., significant random intercept and random linear slope both for stress and depression in John et al., 2012), some did not (e.g., for boys, only random intercept significantly larger than 0 in Ge et al., 1994). Thus, the associations among random growth factors between stress and depressive symptoms are not conclusive in the current literature.

Recently, researchers suggest the importance of testing the mediating and moderating mechanisms between stress and psychopathology, including depression (see reviews from Compas, Connor-Smith, Saltzman, Thomsen & Wadsworth, 2001; Grant, et al., 2003; Hammen, 2005; Grant et al., 2006). Grant et al. (2006) identified

coping as a child-based mediator and moderator between stress and adolescent psychopathology in her systematic review. Child-based factors referred to personal characteristics of children, as opposed to family-based factors. However, only a few studies have tested the moderating role of coping between stress and depression (e.g., Blalock & Joiner, 2000; Ng & Hurry, 2011), and the number of studies that test the mediating role of coping are even fewer. Previous studies often use anxiety/depression syndrome (e.g., Connor-Smith & Compas, 2002; Wadsworth & Compas, 2002; Langrock, Compas, Keller, Merchant, & Copeland, 2002;) or total problems including both internalizing and externalizing problems as outcomes (e.g., Wadsworth, Paviv, Compas, & Connor-Smith, 2005). Researchers suggest that coping may serve as a mediator in children and adolescents, and serve as a moderator in adulthood (Wadsworth et al., 2004). More studies need to be conducted to test this hypothesis.

Furthermore, in current coping research, most researchers use questionnaires to measure coping and then classify them into different coping types, like active coping, problem solving coping and avoidance coping. Very few researchers conceptualize unhealthy behaviors as coping strategies. Unhealthy behaviors, like smoking, drinking and drug use, are often treated as outcome variables in the stress literature. The number of studies with unhealthy behaviors operationalized as coping strategies is limited. Stress is viewed as an important trigger for substance use and craving (Wills and Shiffman, 1985). Some researchers propose that such behaviors

may serve as coping to reduce feelings of depression, anxiety, and other psychological distress from stress (Wills & Filer, 1996; Khantzian, 1997). For example, substance use is viewed either directly to reduce distress (Khantzian, 1997) or reduce the effect of stress on psychological distress (Wills & Filer, 1996). In contrast, some other researchers propose that substance use increases psychological distress or exacerbates the negative effect of stress on psychological distress (Parrott, 1999). Most studies in this perspective use a single type of substance use, like cigarette smoking, as a coping strategy, and few studies have examined use of cigarettes, alcohol and other drugs combined as coping in the research literature of stress and depression.

In addition, gender differences have always been of interest to researchers in understanding stress, coping, depression and their relationships. It is well-established that depression problems, whether depressive symptoms or disorders, are observed higher in female adolescents and adults than males (Petersen et al., 1993; Ge et al., 1994; see Kuehner, 2003, for a review). Gender differences in the rates begin to emerge during early adolescence and become significant during middle adolescence to late adolescence (Nolen-Hoeksema & Girgus, 1994; Kuehner, 2003). For instance, Hankin and Abramson (2001) found that boys and girls became increasingly more depressed between the age of 15 and 18, but the increase was greater for girls than for boys. Also, adolescent girls experience higher levels of depressive symptoms than boys from the beginning of early adolescence, and the gap becomes the largest in middle adolescence (Ge et al., 1994). Similar to gender differences in depression,

gender difference also shows in stress exposure, coping strategies, and the relationships among stress, coping and depression. Fewer studies have tested gender differences in all of these aspects comprehensively. Thus, in the current study, gender differences were not only tested in the developmental trajectories of depressive symptoms, stressful life events, as well as in the longitudinal association between the two, but also in the mediating and moderating models of coping between stress and depression.

Definitions of Constructs

Definition of early, middle, and late adolescence. Adolescence is a hallmark period of transition between childhood and adulthood. It is characterized by significant changes in brain, hormones, physical, cognitive, and socio-emotional development (Evans & Seligman, 2005). Dahl (2004) has defined adolescence as beginning with the onset of puberty and ending with the achievement of adult roles and responsibilities. The age span of 10 to 24 years is often used as a working definition, and it is further developed into three sub-stages, including early adolescence, middle adolescence, and late adolescence (American Academy of Child and Adolescent Psychiatry, AACAP, 2008). Generally, early adolescence is approximately from 11 to 13 years of age. Middle adolescence is approximately from 14 to 18 years of age, and late adolescence is approximately from 19 to 24 years of age. However, the age range is only a guide due to several reasons, including individual differences in development, different facets of development occurring on

different time courses (e.g., hormonal changes occur during early adolescence, while some brain functions are completely developed by the end of late adolescence), and differences in cultural changes and countries (Evans & Seligman, 2005).

A number of dramatic and unique changes occur during adolescence. These changes contribute to increased risk of depression during this developmental period (Compas et al., 1993). During adolescence, puberty usually begins at about ages 10 to 12 in girls and 12 to 14 in boys (Hofman & Greydanus, 1997). For most adolescents, puberty involves breast budding and menstruation in girls and growth in testicles and penis, wet dreams, and deepening of voice in boys (AACAP, 2008). Adolescents who are unprepared for these physical changes may have difficulties. They may feel awkward about their self and body and worry about if they are normal (AACAP, 2008). Research findings suggest that early physically maturing girls and late maturing boys appear to be at increased risk for a number of problems including depression (Ge et al., 2001; Graber, Lewinsohn, Seeley, & Brooks-Gunn, 1997). Furthermore, as adolescents move from childhood to adolescence, they tend to have increased conflicts with their parents due to the drive for independence. Previous studies show that escalating parent-adolescent conflict predicted increases in adolescent internalizing symptoms (Rueter, Scaramella, Wallace, & Conger, 1999). At the same time, adolescents have increased time spent with peers, and peer relationships become especially important in their life. Peer difficulties, including perceived peer rejection, are significantly associated with self-reported depression in

adolescents (e.g., Panak & Garber, 1992; Prinstein & Aikins, 2004). Finally, from childhood to adolescence, reports of major stressful life events also increase for both boys and girls (Ge et al. 1994), and a clear empirical link exists between stress and depression in adolescents (e.g., Connor-Smith & Compas, 2002; Meadows et al., 2006). Thus, it can be expected that depression, including prevalence and severity, may increase during adolescence compared to childhood.

Definition of stress. Stress processes include three components, an internal state of the organism (strain), an external event (stressor) and an experience that arises from a transaction between a person and the environment (Mason, 1975). Strain refers to physiological, emotional and cellular reactions. For example, emotional reactions include negative affect, emotional numbing and lower positive affect. Stressor refers to trauma, life events, hassles/daily stressors, aversive physical environment, chronic role strain, and cumulative adversity. The third component focuses on how stress is perceived, including threat, harm, loss, challenge, or benign, and the severity of the stress (Aldwin, 2007).

Different researchers focus on different components when they conceptualize stress. Some researchers focus on the third component, i.e. the psychological perspective of stress. For example, Lazarus and his colleagues defined psychological stress as involving “a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well being” (Lazarus & Folkman, 1984, p.19). This definition

emphasizes individuals' appraisal of situations and evaluations of coping abilities (Cohen, Kessler, & Gordon, 1995). Although Lazarus' definition has been cited frequently in stress research in young people, most studies do not operationalize stress consistent with the definition (see Grant, et al., 2003, for a review). Other researchers focus on the environmental and objective aspect of stress, that is, the second component. For instance, Grant and her colleagues defined stress as "environmental events or chronic conditions that objectively threaten the physical and /or psychological health or well-being of individuals of a particular age in a particular society" (Grant et al., 2003, p. 449). In current research literature, a number of researchers use external events as stress, and use the experience that arises from a transaction between a person and the environment as the mediating or moderating mechanisms between stress and the first component, i.e., biological, physical or emotional outcomes. Likewise, in the current study, the aggregated external life events were used as the operationlized definition of stress.

Definition of coping. Usually, researchers view coping in two ways, as a style (person-based approach, dispositional), or as a process (environment-based approach, situational) (Carpenter, 1992; Lazarus, 1993). The style approach treats coping behaviors and activities as relatively stable in the process of dealing with stress; Personality characteristics determine coping activities (Carpenter, 1992; Lazarus, 1993; Aldwin, 2007). This approach has been criticized to be too broad and does not adequately explain intra-individual variations in specific contexts (Lazarus, 1993). In

contrast to coping style, the process approach emphasizes coping as an effort to manage changing stress and contexts (Carpenter, 1992; Lazarus, 1993). Lazarus and his colleagues suggest that coping is a process for individuals to resolve the source of stress and manage emotional reactions through regulating their thoughts and behaviors (Folkman & Lazarus, 1985; Lazarus, 1993). It is defined as “constantly changing cognitive and behavioral efforts to manage specific external or internal demands that are appraised as taxing or exceeding the resources of the person” (Lazarus & Folkman, 1984; p.142; Lazarus, 1993; p.237). The coping process approach has been criticized that it often ignores the larger framework of a person’s relating to the world (Lazarus, 1993). Ayers, Sandler, West, and Roosa (1996) measured both coping style and coping strategies in specific situations. They found moderate to high correlations between dispositional and situational coping subscales. It indicates that individual coping style may have an impact on the use of coping strategies in specific situations.

There are some other definitions which have been used in research with children and adolescents. Some researchers define coping as maintaining, augmenting, or altering control over the environment and the self (Weisz, Rothbaum, & Blackburn, 1984; Band & Weisz, 1988). Other researchers conceptualize coping within the framework of regulation (Skinner & Wellborn, 1994; Eisenberg, Fabes, & Guthrie, 1997; Compas et al., 2001). Coping refers to regulating the stressful situation and the

individual's emotion and behavior. No clear consensus has been attained in the definition of coping (Compas et al., 2001).

Much of the research in coping has proceeded with subtypes or dimensions of coping and without an explicit definition of coping. Partially due to lack of a clear definition of coping, there is also little agreement regarding dimensions and subtypes of coping (Compas, 1998; Compas, et al., 2001). Researchers have proposed different dimensions of coping based on coping's function (problem- vs. emotion-focused coping; e.g., Folkman & Lazarus, 1980), goals (primary vs. secondary control; e.g., Band & Weisz, 1988) or orientation (engagement vs. disengagement or approach vs. avoidance, e.g., Ebata & Moos, 1991; Causey & Dubow, 1992; Tobin, Holroyd, Reynolds, & Wigal, 1989). Studies in the field of children and adolescents have widely employed problem-focused and emotion-focused coping (see Compas et al., 2001, for a review). Problem-focused coping refers to a variety of strategies that an individual uses to change the circumstances, including information seeking, solutions generation, and actions taking to change the stressful events, while emotion-focused coping refers to an individual's efforts to alter their own experience of negative emotion, including emotion expression, support seeking from others, and avoidance from stressful sources (Lazarus & Folkman, 1984). Coping dimensions have been criticized of being too broad and places too many disparate coping strategies into the same category (Compas et al., 2001). Thus, subtypes of coping which compose the broad dimensions are proposed, including problem solving, cognitive restructuring,

emotional release, avoidance, alcohol or drug use, wishful thinking, social withdrawal, blaming others, seeking social support, use of religion, and other specific strategies (Compas et al., 2001). These specific strategies have been categorized into three or more than three subtypes, e.g., active coping, social support, distraction, and avoidance in Aysers and colleagues' study (Aysers, et al. 1996). Subtypes of coping have been identified conceptually based on a priori assumptions and tested by Explanatory Factor Analysis (EFA) or Confirmatory Factor Analysis (CFA) (Halstead, Johnson, & Cunningham, 1993; Ayers, et al., 1996; Compas, et al., 2001).

Researchers found that differentiating coping into subtypes increased the fitness of models compared to dividing it into two broad dimensions, e.g., problem-focused vs. emotion-focused coping (Ayers, et al. 1996; Connor-Smith et al. 2000). Thus, it is more practical to use subtypes of coping than to use coping dimensions in empirical research.

Specific types of coping strategies were used as the working definitions of coping in the current study, including problem solving, emotion-focused coping, and unhealthy behavioral coping. Problem solving coping refers to information searching, solution generation, solution comparison, and consequences analysis after carrying out the solutions when faced with a problem. Emotion-focused coping refers to avoidance and emotional release. Unhealthy behavioral coping refers to substance use including cigarette, alcohol, and illegal drug use, and it can be viewed as distraction

coping. The three types of coping were used because they cover most of the facets of coping except for seeking support.

Definition of depression. There are three levels of operationalizing depression during adolescence, including depressed mood, depressive syndrome, and depressive disorders (Angold, 1988; Compas et al., 1993; Petersen et al., 1993; Reinemann & Swearer, 2005). Depressed mood refers to feeling sad, unhappy or blue (Compas, et al., 1993; Petersen et al., 1993). It is often assessed using single item or scales designed specifically to assess depressed mood, and subscales from the existing literature. For example, the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) includes items like “Had the blues” and “Feel sad.” The common feature of the various scales is that they include lists of emotions and symptoms of the central feature of depressive disorders (Compas et al. 1993). Due to different populations, measures, and cut-offs used in different studies, the rates of adolescents who endorse depressed feelings vary across studies. Compas, Hinden, and Gerhardt (1995) conclude that at least 30%-40% of adolescents experience depressed mood at any one point in their development. Furthermore, the severity and frequency of depressed mood changes at different stages during adolescence. Petersen et al. (1991) found that reports of significant episodes of depressed mood (lasting two weeks or longer) increased from early adolescence to middle adolescence for both boys and girls.

Depressive syndrome refers to a constellation of emotions and behaviors that occurs together (Compas et al., 1993; Reinemann & Swearer, 2005). It is often measured using parent-report, teacher-report and self-report checklists. Higher sum scores mean higher level of depressive symptoms. Achenbach and his colleagues conducted the most extensive empirical research on the classification of child and adolescent psychopathology including depressive syndrome. They developed measures for parent-report (the CBCL, Achenbach, 1991a), teacher-report (the TRF, Achenbach, 1991b), and adolescent self-report (the YSR, Achenbach, 1991c). On the YSR, 6% of the non-clinical sample experience significant levels of depressed syndrome (the YSR, Achenbach, 1991c). The percentage is much higher (23%) in the referred sample (the YSR, Achenbach, 1991c). Moreover, empirical evidence has shown that the levels of Anxious/Depressed syndrome increase from childhood to adolescence, but remain relatively stable during adolescence (Achenbach, 1991d, 1991c).

Compared to the continuous nature of depressive syndrome, depressive disorder is a categorical diagnosis and refers to not only the presence of depressive syndrome but also the presence of significant levels of current distress and functional impairment in important areas (American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition-Text Revision, DSM-IV-TR, 2000). DSM-IV-TR provides a list of criteria and states that at least five symptoms must be identified to make a diagnosis. Although the criteria aim to diagnose

depression in adults, decades of research show that children and adolescents over the age of 9 do experience depressive symptoms associated with adult depression (see Nolen-Hoeksema & Girgus, 1994). That is, the criteria can be reliably applied to diagnose adolescents. The prevalence rates of depressive disorder range from 0.8 to 8% within a time period of 3 months to 12 months in the community samples of adolescents (Angold, Costello, & Erkanli, 1999). The lifetime prevalence of major depressive disorder in adolescence is much higher, which is from 15% to 20% and comparable to the rate in adults (Harrington, Rutter, & Fombonne, 1996; Kessler & Magee, 1994).

In the existing stress and depression literature, depressive symptoms and major depression have been widely used. Depressive symptoms checklists are easy to administer and are able to be surveyed in a large community sample. Researchers investigate the relationship between stress and the severity levels of depressive symptoms. The assessment of major depression is more labor-demanding and requires professional trainings in interviewers compared to depressive symptoms checklists. Researchers focus on comparing levels of stress between depressed and non-depressed adolescents, and the association between stress and course of depression, including severity, first episode, recurrent episode or episode recovery (see Kessler, 1997; Hammen, 2005; for reviews; Stroud, Davila, Hammen, & Vrshek-Schallhorn, 2011). In the current study, depressive symptoms were measured using nine selected items from the CES-D (Radloff, 1977).

Definition of mediator and moderator. A mediator refers to a third variable that conceptually and statistically accounts for the relation between a predictor and an outcome variable (Baron & Kenny, 1986). For example, considering coping as a mediator means that stress determines what coping strategies are used, and these coping strategies can explain the relation between stress and depression. Baron and Kenny (1986) proposed four classic steps to test whether a variable is a mediator: 1) the predictor is significantly associated with the outcome; 2) the predictor is significantly associated with the mediator; 3) the mediator is significantly associated with the outcome; and 4) the association between the predictor and outcome become insignificant or significantly reduced when the mediator is controlled. Multiple regression analysis is often employed in these steps. Recently, some advanced statistical procedures have been developed, i.e., testing indirect effects in structural equation modeling (Holmbeck, 1997). In addition, Preacher and Hayes (2008) developed the statistical procedures to test multiple mediators simultaneously using bootstrap approach.

A moderator refers to a third variable that affects the direction and/or strength of the relation between a predictor and an outcome variable (Baron & Kenny, 1986). For example, considering coping as a moderator means that coping increases or decreases the effect of stress on depression. A moderator is often the preexisting variable and refers to relatively stable characteristics of an individual (Wu & Zumbo, 2008), e.g., gender and race/ethnicity. Hierarchical multiple regression analysis or

Analysis of Variance (ANOVA) involving an interaction term (e.g., stress \times coping, gender \times stress) is often used in moderation analysis. Furthermore, Aiken and West (1991) suggested mean-centering of the predictor and moderator in order to reduce collinearity between the interaction and main effect. Recently, multiple group comparison analysis in structural equation modeling has been employed to test moderators like gender, age, and race (Grant et al., 2006).

Purpose of the Current Study

The purpose of the current study was to examine the relationships among stress, coping and depression over time using a broad conceptual model proposed by Grant and her colleagues (Grant et al., 2003, see Figure 1). To accomplish this objective, the current study first modeled the developmental trajectories of depressive symptoms and stressful life events separately from early adolescence to late adolescence. Second, the longitudinal associations between stressful life events and depressive symptoms were investigated. In the current study, the dynamic and interlocking reciprocal relationships between stressful life events and depressive symptoms were not tested due to the data only having three time points. Instead, the associations across random growth factors of stress and depression were tested. Gender differences were tested in both the developmental trajectories of depressive symptoms and stressful life events as well as their longitudinal associations. Third, the current study tested the mediating or moderating roles of coping strategies, including problem solving, emotion-focused coping and unhealthy behavioral coping, between

earlier stressful life events and later depressive symptoms. In addition, gender differences were also tested in these mediating or moderating roles of coping. The first three waves of data from the Add Health study (Harris & Udry, 1994-2008) were used to fulfill the research questions of interest. The Add Health data was selected due to its longitudinal characteristics. It had multiple time points and covered the whole age span of adolescence, which allowed researchers to investigate stress, coping, depression and their dynamic associations over time. Also, the Add Health study applied a complex survey design, and participants were from a nationally representative sample, thus the findings might have great strength to be generalized to the whole adolescent population.

Data from the current study may help researchers and practitioners understand the cause and course of depressive symptoms during adolescence. Specifically, findings may be used to help understand the longitudinal associations between stress and depression during adolescence. In addition, the present study contributes to the current literature with clarifying the function of coping strategies as one of the mechanisms (whether as mediator or moderator) between stress and depression. Finally, findings may also help practitioners develop prevention and intervention programs for youth who are experiencing and dealing with stressful life events in their current life.

Chapter 2: Theoretical Framework and Literature Review

Theoretical Framework

Transactional model of stress, coping and depression. Lazarus and Folkman (1984) propose a transactional model to understand the relations among stress, coping and adaptation. The model includes four components or stages. The first component is causal antecedents, including personal variables (e.g., beliefs and existential sense of control, etc.). The second component is the mediating process, including appraisal (i.e., primary, secondary, and reappraisal), coping (e.g., problem focused, emotion-focused, seeking and using social support, etc.). The third and fourth components include immediate effects (e.g., physiological changes, positive or negatives feelings, and quality of encounter outcome) and long-term effects (e.g., somatic health/illness, well-being and social functioning, etc.) (Lazarus & Folkman, 1984). The characteristics of this model include two points: 1) coping is a mediation process between stress and adaptation and 2) the model involves the time series effect and directional relations, that is, causal relations between stress and psychopathology. Seffge-Krenke' work provides substantial support for this transactional model using children and adolescent samples (see Lazarus, 1999).

Building on Lazarus and Folkman's transactional model, Grant et al. (2003) proposed a more empirical model of the role of stress in the etiology of adolescent psychopathology. The model includes at least four central propositions: "1) Stressors contribute psychopathology; 2) Moderators influence the relation between stressors

and psychopathology; 3) Mediators explain the relation between stressors and psychopathology; and 4) Relations among stressors, moderators, mediators and psychopathology are reciprocal and dynamic.” (Grant et al., 2003; see Figure 1).

Grant et al. (2003) listed a variety of moderators and mediators. Moderators include age, gender, social support and coping, and mediators include coping, cognitive attributions, and family processes. Grant and her colleagues (2006) have conducted a review of mediating and moderating effects between stressors and child and adolescent psychopathology. They classified the moderators and mediators into child-based (e.g., coping, self-esteem), family-based (e.g., social support, family conflict) and environment-based factors (e.g., peer environment). They concluded that the evidence of mediating effects between stress and psychopathology appeared more consistent than the evidence of moderating effects. Unfortunately, they did not differentiate psychopathological types. Thus, the mediating and moderating mechanisms between stress and depression are not clear. Furthermore, it is unclear whether coping is a mediator or a moderator or both.

Some empirical evidence supports the bidirectional associations between stress, mediators/moderators and depression. For example, depressed people generate more stressful life events than non-depressed people (see Grant, Compas, Thurm, McMahan, & Gipson, 2004, for a review; Hammen, 1991), especially those life events with interpersonal content (Hammen, 1991). In addition, Seiffge-Krenke (2000) conducted longitudinal research and found that a time-lagged effect of symptoms on

coping, that is, previous psychological symptoms could predict later withdrawal coping. More longitudinal studies should be conducted to test the bidirectional relations among stress, mediators/moderators and depression.

Literature Review

Overview of the relationships among stress, coping and depression.

The relationship between stress and depression. Due to the dramatic biological, psychological and social changes during adolescence, it may be especially stressful for individuals in this period (Compas et al., 1993). Andersen and Teicher (2008) reviewed that stress exposure during the development of the hippocampus and pre-frontal cortex in this developmental period may make adolescents more susceptible to depression. Correlations between self-reports or maternal reports of stressful life events and children's emotional/behavioral problems were found ranged from .20 to .40 (Compas & Phares, 1991), and stress generally account for around 15% of the variance in psychological symptoms (Compas, 1987).

Traditionally, researchers focus on examining the contribution of stress on depression. A significant number of studies have provided strong evidence that life stress is associated with increased risk of depression (see reviews, Kessler, 1997; Hammen, 2005; Mazure, 1998). The findings are consistent in both adults (see Hammen, 2005; Mazure, 1998) and adolescents (Ge et al., 1994; Meadows et al., 2006; Adkins et al., 2009; Stroud et al., 2011). Also, evidence strongly suggests that the significant association exists both in depressive disorders (Hammen, 2005; Stroud

et al., 2011) and depressive symptoms (Ge et al., 1994; Meadows et al., 2006; Adkins et al., 2009; Hankin et al., 2007). For example, Hammen (2005) summarized recent findings based on sound methods of stress assessment and novel designs, and concluded that stressful life events preceded most of major depression episodes. Specifically, severe events have greater impact on the first onset of depression episodes than recurrent episodes, whereas non-severe events have greater impact in individuals with a history of depression than in those without a history of depression (Stroud et al., 2011). Also, Findings show that stressful life events are also consistently associated with subsequent levels of depressive symptoms (Ge et al., 1994; Meadows et al., 2006; Hankin et al., 2007; Adkins et al., 2009; Boardman & Alexander, 2011).

Within the last 20 years, a still-growing interest has shifted towards the contribution of depression to the occurrence of stress (see Liu & Alloy, 2010, Hammen, 2006, for reviews; Hammen, 1991; Rudolph, Flynn, Abaied, Groot, & Thompson, 2009; Hammen, Brennan, & Le Brocque, 2011). Hammen (1991) used the term of “stress generation” to describe the phenomenon. She stated that to some degree, the condition, characteristics and behaviors of depressed people may serve to generate considerable stressful life events, particularly within interpersonal domains (Hammen, 1991). Empirical evidence has supported the stress generation model in children and adolescents regardless of depressive disorders (e.g., Harkness, Lumley, & Truss, 2008; Hammen, Brennan, & le Brocque, 2011) and depressive symptoms

(Cole et al., 2006; Harkness & Stewart, 2009; Eberhart, Auerbach, Bigda-Peyton, & Abela, 2011). For instance, Hankin et al. (2007) found that initial levels of depression could not only significantly predict the occurrence of independent stressors, but also contributed to increased occurrence of dependent stressors. Further, Harkness and Stewart (2009) tested the contribution of specific depressive symptoms on stress. They found that cognitive-affective symptoms of depression predicted subsequent higher levels of interpersonal life stress; whereas somatic symptoms predicted subsequent higher levels of non-interpersonal life stress (Harkness & Stewart, 2009). In addition, interpersonal stress was found as a mediator between the initial and later depressive symptoms in adolescent women (Rudolph et al., 2009). Thus, the stress generation model may help to explain the continuity of depression.

Recently, a few researchers began to test the longitudinal associations between stress and depression using data with stress and depression measured at multiple time points (Ge et al. 1994; Johnson et al. 2012). The initial levels of stress were found positively associated with the initial levels of depression, and the linear increase of stress were found positively associated with the linear increase of depression in the study of Ge et al. (1994). The findings suggest that the changing pattern of depressive symptoms might be paralleled with the changing pattern of stressful life events.

In summary, the relationship between stress and depression is reciprocal and bidirectional. The evidence is relatively more consistent in dependent stress and for girls than in independent events and for boys. The longitudinal association between

stress and depression may be paralleled; however a conclusion cannot be made due to the limited number of studies in the current literature.

The relationship between coping and depression. Researchers have great interest of investigating coping because research findings in coping help inform the development of prevention and intervention programs in depression (Compas et al., 2001; Sandler, Wolchik, MacKinnon, Ayers, & Roosa, 1997). Compas et al. (2001) reviewed that problem-focused coping or approach coping was found negatively associated with psychopathology in children and adolescents when stressors were perceived controllable, while they were positively associated with poorer adjustment when stressors were perceived beyond control. In contrast to coping that changes the situation, emotion-focused coping and secondary control coping, which focus on regulating individual selves were found positively related to better adjustment when stressors were perceived uncontrollable (Compas et al. 2001). For instance, previous research showed that secondary control coping (e.g., acceptance, distraction, cognitive restructuring) was related to lower levels of anxiety/depression in children of depressed parents (Langrock et al., 2002; Fear et al., 2009) and with chronic pain (Compas et al., 2006). Also, Jaser, Champion, Dharamsi, Riesing, and Compas (2011) found that adolescents of mothers with a history of depression reported significantly less use of primary control coping than those of mothers without a history of depression. However, in this study, both primary control coping and secondary control coping were positively related to positive mood and lower levels of depressive

symptoms (Jaser et al., 2011). Some other studies focus on the direct effects of coping on depression in children of divorce (Sandler, Tein, & West, 1994), in adolescents seeking pediatric emergency services (Horwitz, Hill, & King, 2011), in middle and late adolescent offenders (Ireland, Boustead, & Ireland, 2005), and population-based adolescents (e.g., Goodwin, 2006; Rafnsson, Jonsson, & Windel; 2006; Li, DiGiuseppe, & Froh, 2006;). The results showed that problem-focused coping (Li et al., 2006; Horwitz et al., 2011), distractive coping (Li et al., 2006), and task-oriented coping (Rafnsson et al. 2006) were associated with low levels of depression problems in adolescents, and emotion-focused coping (Ireland et al., 2005; Rafnsson et al. 2006; Goodwin, 2006; Horwitz et al., 2011) and ruminative coping (Li et al., 2006) were associated with high levels of depression problems.

Some researchers focus on the reverse relationship between coping and depression through the comparison of coping strategies used between depressed and nondepressed adolescents (e.g., Ebata & Moos, 1991; Spirito, Francis, Overholser, & Frank, 1996; Satija, Advani, & Nathawat, 1998; Dumont & Provost, 1999).

Depressed adolescents use not only more negative coping, such as avoidant cognitive coping strategies (Ebata & Moos, 1991, Satija, et al., 1998), social withdrawal and blaming others (Spirito et al., 1996), but also less positive coping, such as problem solving strategies and approaching behaviors (Satija et al., 1998), and social support and cognitive restructuring (Spirito et al., 1996). In addition, in a sample of population-based adolescents, Wierzbicki and Carver (1989) also found that as the

level of depression increased, cognitive coping, active behavioral coping strategies, and perceived helpfulness of coping all decreased.

However, cross-sectional studies cannot tell us the directionality between coping and depression. Only a few studies have examined the relationship between coping and depression longitudinally (e.g., Sandler, et al., 1994; Herman-Stahl, Stemmler, & Peterson, 1995). Sandler et al. (1994) found that active coping and distraction coping could negatively predict subsequent depression with the initial level of depression controlled. Seiffge-Krenke and Klessinger (2000) found that earlier avoidant coping style positively predicted later depression symptoms after controlling for later avoidant coping styles. However, in another study, seeking social support, as an active method of coping, could not predict one-year follow-up depression (Galaif, Sussman, Chou, & Wills, 2003). Wright, Banerjee, Hoek, Rieffe, and Novin (2010) tested the bidirectional relationship between coping and depression. They found that depression predicted decreased use of problem-solving, social support-seeking and distraction strategies subsequently, but earlier coping could not predict subsequent depression. Due to the dearth of the existing research in this area, a clear understanding of the directional relationship between coping and depression is not yet to be obtained.

As for unhealthy behavioral coping, evidence is mixed on the effectiveness of smoking on negative affect (see Kassel, Stroud, & Paronis, 2003, for a review). Some researchers found that smoking reduced immediate psychological distress (Kassel et

al., 2007), while others did not find the reductions in negative mood (Conlkin & Perkins, 2005), and some even found smoking increased the risk of subsequent depressive distress (Steuber & Danner, 2006; Rosario, Schrimshaw, & Hunter, 2011). As for drinking, some researchers found that drinking with motives to cope, is related to high levels of depression problems in adolescents (Rafnsson et al., 2006; Grant, Stewart, & Mohr, 2009). A few studies combine unhealthy behaviors together as behavioral coping strategies. Goodwin (2006) identified substance use (alcohol, drugs, and cigarettes) as a singular coping behavior in youth and found it positively related with the likelihood of depression in a national sample of school-aged youth. Escher, Delespaul, Romme, Buiks and van Os (2003) found that passive illness behavior coping, including self-medication and using alcohol and drugs, could significantly predict higher levels of subsequent depression among a sample of adolescents experiencing auditory hallucinations. However, Galaif et al. (2003) did not find the significant predictive effect of drug use on later depression in a population-based sample of adolescents. Thus, no conclusion can be made in the relationship between unhealthy behaviors as coping strategies and depression in adolescents.

In summary, in the current coping and depression literature, the amount of research is much more limited as compared to that in stress and depression. Further, in the existing studies, researchers use different types of coping and coping measures, thus it is difficult to compare the results across the studies. Finally, the results are inconsistent in the relationship between coping and depression. More studies should

be conducted with established and comparable coping measures (see Compas et al., 2001).

The moderating role of coping in the relationship between stress and depression. Coping has been identified both as a moderator and a mediator in the effect of stress on child and adolescent psychopathology (see Grant et al., 2006). Grant et al. (2006) reviewed that at least eight studies tested coping as a moderator, but the results were not consistent. Also, in those reviewed moderation analyses, very few used depression as an outcome. Among the limited number of studies, some support coping as a moderator between stress and depression (Sandler et al., 1994; Gonzales, Tein, Sandler & Friedman, 2001; Ng & Hurry, 2011), whereas some others do not (Davila, Hammen, Burge, Paley, & Daley, 1995). Ng and Hurry (2010) found that using problem solving and rejecting nonproductive coping were both protective factors against depression in the presence of stress in a sample of Chinese adolescents in Hong Kong. In contrast, Davila et al. (1995) tested whether interpersonal problem solving was a moderator between stress and depressive symptoms, but the moderating hypothesis was not supported. Furthermore, in Blalock and Joiner (2000), female undergraduate students with higher use of cognitive avoidance coping and higher stress displayed higher depressive symptoms, while behavioral avoidance coping strategies were not found to moderate the association between stress and depression. Another category of studies have tested coping as a moderator between stress and

anxiety/depression symptoms (Wagner & Compas, 1990; Wadworth & Compas, 2002; Wadworth et al., 2005), and the moderating role of coping have not been found.

Some researchers have investigated combined unhealthy behaviors as a moderator between stress and depression (Jackson, Knight, & Rafferty, 2010; Bordman & Alexander; 2011; Keyes, Barnes, & Bates, 2011). The results are mixed. Jackson et al (2010) and Bordman and Alexander (2011) found that unhealthy behaviors (i.e., drinking, smoking, and over eating) served as a protective factor between stress and depression in non-Hispanic African American adolescents but not in non-Hispanic Caucasian American adolescents. However, Keyes and colleagues did not find the protective effect of unhealthy behaviors either in African Americans or Caucasian Americans. Rosario et al. (2011) found that smoking even amplified the association between stress and one-year later depression in a sample of lesbian, gay, and bisexual youth. Thus, overall the research findings are not consistent in current literature.

The mediating role of coping in the relationship between stress and depression. In the Grant et al. (2006) review of mediation analysis, even far fewer studies used coping as a mediator and depression as an outcome. In the existing literature, although fewer studies have tested the mediation effects of coping, they have yielded consistent results, i.e., support for the mediation hypotheses (Grant et al., 2006). In Sandler et al. (1994), avoidant coping partially mediated the relationship between negative events and depression in children and early adolescents of divorce.

Dempsey (2002) also found that negative coping (i.e., avoidance, aggression, and internalizing behaviors) mediated in the relationship between violence exposure and depression in a sample of inner-city African American early adolescents. Sun, Buys, Stewart, and Shum (2011) found that active coping (i.e., recreational activities and social activities) mediated the relationship between stress and depression in a large sample of Australian university students. In addition, Goodkind, Ruffolo, Bybee and Sarri (2009) found that negative coping strategies (i.e., withdrawal and acting out coping) partially mediated the relationship between negative life events and depressive symptoms among girls in juvenile justice settings.

Another category of studies tested the mediating role of coping between stress and anxiety/depression or internalizing problems in adolescents (Wadsworth & Compas, 2002; McGee, Wolfe, & Olson, 2001; Langrock et al., 2002; Wadsworth et al., 2005; Jaser et al., 2007). For example, Wadsworth and Compas (2002) found that secondary control coping (i.e., positive thinking, cognitive restructuring, acceptance, and distraction) mediated economic strain and depression/anxiety symptoms. Further, primary (i.e., problem solving, emotional expression, and emotional modulation) and secondary control coping both could mediate the relationship between family conflict and depression/anxiety symptoms.

No studies have tested unhealthy behaviors coping as mediators. Unhealthy behavioral coping can be viewed as negative coping strategies or acting out coping

strategies. It is possible that this type of coping may serve as a mediator between stress and depression.

Gender differences in stress, coping, depression and their relationships.

Gender differences in stress exposure. A considerable number of studies have examined gender differences in stress exposure (Larson & Ham, 1993; Ge et al., 1994; Hastings, Anderson, & Kelley, 1996; Heubeck & O'Sullivan, 1998; Jose & Ratcliffe, 2004; Shih, Eberhart, Hammen, and Brennan, 2006; Hankin, et al., 2007; Seiffge-Krenke, et al., 2009). The findings show consistent patterns that girls report more interpersonal stressors, including the relationships with peers, romantic partners, and family members, whereas boys report more non-interpersonal stressors (e.g., Hankin, et al., 2007; Larson & Ham, 1993; Rudolph & Hammen, 1999). For instance, Larson and ham (1993) found that boys reported more negative school events than girls, while girls reported more negative friend events than boys. Also, Shih et al. (2006) found that adolescent girls were exposed to not only higher levels of interpersonal episodic stress, but also the total episode stress compared to boys. Furthermore, adolescent girls experience more hassles than boys (Hastings et al., 1996; Lai, Hamid, & Chow, 1996), especially more peer-related hassles (Seiffge-Krenke, et al., 2009), whereas boys experienced more school-related hassles (Heubeck & O'Sullivan, 1998).

Jose and Ratcliffe (2004) examined gender differences in reporting everyday stressors in a large sample of adolescents in New Zealand. They found that girls

reported higher levels of stressor frequency than boys between 12 and 17 years after controlling for socio-economic status. Specifically, girls and boys reported similar levels of stressor frequency at younger ages, but at the beginning of 13 years old, girls reported higher levels, and this gap decreased by 19 years old. Ge et al. (1994) also found that boys reported more stressful life events than girls before ages 12, but after the age of 13, girls reported more stressful life events than boys, especially between ages 13 and 15. This pattern parallels to some degree the change pattern of gender differences in depressive symptoms (Ge et al., 1994).

In summary, it appears consistent that girls report higher levels of stress, especially interpersonal stress, compared to boys. Also, the changes of stressful life events across gender may parallel the changes of depressive symptoms across gender. Thus, researchers have employed this evidence to propose the mediational-stress exposure model to explain gender differences in depression, that is, differences in the level of stress exposure help to explain the association between gender and depression.

Gender differences in coping. Males tend to show a preference for dealing with stress through external channels of expression or nonverbal behavior, such as acting out and substance abuse; however, females tend to develop a preference for dealing with stress by focusing within themselves, through rumination, or expression or discussion of their feelings with others (see Copeland & Hess, 1995; Broderick & Korteland, 2002). Some studies have investigated gender differences in coping in

adolescents (e.g., Seiffge-Krenke, 1993; Seiffge-Krenke et al., 2009; Copeland & Hess, 1995; Hampel & Petermann, 2005). Seiffge-Krenke (1993) found that adolescent girls sought advice, help and comfort from others more frequently than adolescent boys did. They tended to rely more on social networks, but at the same time, they worried more about the problem and tended to expect negative consequences more than boys did, regardless of the problem domains (Seiffge-Krenke, 1993). However, boys had more opportunistic attitudes, but tended to use drugs when they felt that the situation was uncontrollable (Seiffge-Krenke, 1993). Copeland and Hess (1995) also found that girls reported using more strategies of engaging social relationships and changing the actual situation or their thoughts than boys did, and boys used more strategies of avoiding problems, physical diversions and passive diversions, e.g. smoking and watching TV. Hampel and Petermann (2005) found that girls used increased maladaptive coping (i.e., rumination, resignation, and aggression) and decreased adaptive coping (i.e., minimization, distraction, positive self-instructions) from late childhood to adolescence. Due to a variety of coping types and measures used in different studies, it is difficult to compare the results across studies.

Some researchers suggest that the gender differences in coping may serve a role in gender differences in depression (Nolen-Hoeksema, 1991; Compas, Orosan, & Grant, 1993). Girls tend to use ruminative tasks to cope, while boys tend to use distracting tasks (Compas, et al., 1993; Broderick & Korteland, 2002). However,

researchers have rarely systematically tested gender differences in depression from the perspective of gender differences in coping.

Gender difference in depression. It has been well-established that female adolescents and adults are more likely to be depressed than male adolescents and adults (Nolen-Hoeksema, 1990; Nolen-Hoeksema & Girgus, 1994). The emergence of gender differences in depression occurs by early to middle adolescence, i.e., around 11 or 15 years old (Brooks-Gunn, 1991; Nolen-Hoeksema et al., 1991; Peterson et al., 1993; Nolen-Hoeksema & Girgus, 1994; Ge et al., 1994). Girls' depressive symptoms surged upward from age 13 to age 16, and declined from age 16 to 19, whereas boys' level of depressive symptoms not only continuously showed lower than girls' from age 13 to the beginning of late adolescence, but also appeared relatively flat from late childhood to the beginning of late adolescence (Ge et al., 1994). By the end of late adolescence, gender differences in the rates of depression approaches the levels observed in adults (Lewinsohn & Essau, 2002).

Many risk factors have been identified to explain the emergence of gender differences in adolescence, including biological changes (e.g., puberty transition in Ge, Conger, & Elder, Jr., 2001), personality characteristics (e.g., ruminative coping, Nolen-Hoeksema & Girgus, 1994), and stress (e.g., Ge et al., 1994; Rudolph, 2002). In the present review, only research within the stress-coping framework is included to explain gender differences in depression.

Gender difference in the relationship between stress and depression. Two conceptual models involving stress have been applied to explain gender differences in depression, i.e., the meditational-stress exposure model and the moderational-stress reactivity model (Hankin & Abramson, 1999; Rudolph, 2002). The meditational-stress exposure model views that girls experience more stressors than boys during adolescence, and as a result, girls become more depressed (see Hankin et al., 2007). The moderational-stress reactivity model views that girls are more likely to be depressed in response to stress than boys (see Hankin et al., 2007). Empirical evidence has supported either stress exposure (e.g., Rudolph & Hammen, 1999) or stress reactivity model (e.g., Marcotte, Fortin, Potvin, & Papillon, 2002) or both (Hankin et al., 2007; Shih, Eberhart, Hammen, & Brennan, 2006). Thus, both the models can partially help to explain gender differences in depression.

A number of studies have tested the meditational-stress exposure model in adolescents (Liu & Kaplan, 1999; Rudolph & Hammen, 1999; Rudolph, 2002; Hankin et al., 2007; Shih et al. 2006). The results are consistent that gender differences in depression are partially mediated by gender differences in stress exposure, especially in interpersonal events. For instance, Hankin et al (2007) found that all the stressors, including the overall stressors, interpersonal stressors, dependent stressors, independent stressors, family stressors, peer stressors, and romantic stressors, could mediate the relationship between gender and individual changes in depressive

symptoms, especially overall interpersonal stressors, which accounted for 31% of the association between gender and depressive symptoms over time.

The moderational-stress reactivity model has also been tested extensively, but the results are inconsistent. Some of them find that adolescent girls respond to general stressors with greater depression than boys (e.g., Ge et al., 1994; Ge, Conger, & Elder, 1996, Rudolph, 2002; Hankin et al., 2007), while others have not supported their moderation hypotheses (e.g., Larson & Ham, 1993; Wagner & Compas, 1990). Very few studies have tested both stress exposure and reactivity in one study (e.g., Hankin et al., 2007, Shih et al 2006). The two models have been both supported in Hankin et al. (2007). More studies using a variety of stress domains should be conducted in this field.

Gender difference in the relationship between coping and depression.

Compared to involving stress in explaining gender differences in depression, relatively fewer studies have tested coping in understanding gender differences in depression. It may be due to the reason that evidence of gender differences in coping has not been well-established. Another reason is that the definitions and instruments are far from agreement (Compas et al., 2001), which impedes the depth of research in the field.

As mentioned earlier, girls are more likely to use ruminative coping compared to boys, whereas boys are more likely to use distractive coping compared to girls (Nolen-Hoeksema, 1987; Compas et al., 1993). Li et al. (2006) found that ruminative

coping partially mediated the relationship between sex and depression, while problem-focused coping and distracting coping could not help to explain sex difference in depression. However, problem-focused coping and distractive coping significantly mediated the relationship between gender role (masculinity) and depression (Li et al., 2006). Broderick & Korteland (2004) did not find the mediating role of ruminative coping in a sample of early adolescents. Smith, McCullough, and Poll (2003) have reviewed religious coping and depression, and found that religious coping was slightly negatively associated with depressive symptoms. But gender did not moderate this association (Smith et al., 2003).

As for unhealthy behaviors combined as coping, three studies have tested the moderating role of coping between ethnic/race differences and depression, and no gender differences have been tested (Jackson et al., 2010; Bordman & Alexander; 2011; Keyes, Barnes, & Bates, 2011). Due to the dearth of studies in this field, more studies should be conducted testing the mediating and moderating role of coping in explaining gender difference in depression.

Gender difference in the relationships between stress, coping and depression.

To date, no researchers have tested gender differences in the mediating role or moderating role of coping in the relationship between stress and depression in adolescence. These were examined in the current study.

In summary, although researchers in the field of psychopathology argue the importance of understanding adolescent depression from a developmental perspective,

only a few studies have empirically examined the developmental trajectories of depression using latent growth curve modeling (Johnson et al., 2012; Adkins et al., 2009; Dekker et al., 2007; Ge et al., 2006; Ge et al., 1994; Garber et al., 2002). It is partly due to the limited number of longitudinal studies with at least three time points. Based on the findings of these studies, some researchers found that depressive symptoms increased from early adolescence to middle adolescence, and then decreased during late adolescence (e.g., Ge et al., 2006), while others suggested a linear decrease from late childhood to middle adolescence (Johnson et al., 2012, age 9 to 16). Additional studies employing the same analytic method, i.e., latent growth modeling, to examine the changing patterns of depression are needed. Likewise, even fewer numbers of studies have been conducted to estimate the changing pattern of stress in the current literature (Johnson et al., 2012; Seiffge-Krenke et al., 2009; Ge et al., 1994; Garber et al., 2002). Johnson et al. (2012) found that stressful life events did not vary over time from late childhood to middle adolescence. However, a significant increase from early adolescence to middle adolescence was found in Ge et al. (1994). In order to gain a clear picture of the changes of stressful life events, more studies should be conducted. Moreover, the longitudinal associations between stressful life events and depressive symptoms over time are not conclusive, either. Finally, to the author's knowledge, no studies have been conducted to test the roles of coping strategies simultaneously and test gender differences in the mediating and moderating roles of coping between earlier stress and later depression.

Research Questions and Hypotheses

The current study aimed to test the conceptual model of Grant et al. (2003) by investigating the relationships among stress, coping, and depression over time. The study first examined the developmental pattern of depressive symptoms from early adolescence to late adolescence (i.e., age 12 to age 24) and tested gender differences. Next, the developmental trajectory of stressful life events was also estimated from early adolescence to late adolescence in the current study. Furthermore, the current study examined the associations between stressful life events and depressive symptoms over time and tested gender differences in the two-construct process latent growth model. Finally, the study examined whether coping, including problem-solving, emotional-focused coping, and unhealthy behavioral coping, mediated or moderated the relationships between earlier stressful life events and later depressive symptom simultaneously, and test gender differences in the mediation and moderation models also.

Based on the review of research on stressful life events, depressive symptoms, and coping strategies in adolescents, the current study addressed the following research questions and hypotheses:

1. How did the average of depressive symptoms change from age 12 to age 24? Were there any gender differences in the developmental trajectories of depressive symptoms?

Hypothesis I: Average depressive symptoms would increase from early

adolescence (i.e., age 12 to 13) to middle adolescence (i.e., age 14 to 18), and then decrease from middle adolescence to late adolescence (i.e., age 19 to 24).

(Figure 2)

Hypothesis II: Female adolescents would have higher levels of average depressive symptoms than males across the whole adolescence period.

(Figure 2)

2. How did the average of stressful life events change from age 12 to age 24? Were there any gender differences in the developmental trajectories of stressful life events?

Hypothesis III: Stressful life events would increase from early adolescence to middle adolescence, and then to some degree decrease from middle adolescence to late adolescence. (Figure 5)

Hypothesis IV: Female adolescents would report higher number of average stressful life events than males across the whole adolescence period. (Figure 5)

3. What was the association between stressful life events and depressive symptoms over time? Were there any gender differences in the associations between stressful life events and depressive symptoms from age 12 to 24 years? (Figure 8)

Hypothesis V: Higher initial levels of stressful life events were positively associated with higher initial levels of depressive symptoms.

Hypothesis VI: Higher initial levels of stressful life events would have

greater increase in depressive symptoms over time.

Hypothesis VII: Higher initial levels of depressive symptoms would have greater increase in stressful life events over time.

Hypothesis VIII: Increases in stressful life events over time would parallel increases in depressive symptoms over time. (Figure 8)

Hypothesis IX: The association between stressful life events and depressive symptoms would be stronger for girls.

Due to only three valid time points, 2 was the potential highest order of fixed effect (i.e., fixed quadratic effect), and 1 was the potential highest order of random effect (random linear effect). It was hypothesized that both random intercept and linear effects of stressful life events and depressive symptoms were significantly larger than 0, that is, there were significant individual variations at the initial levels of stressful life events and depressive symptoms, and also there were significant individual differences at the linear slopes of the two constructs.

4. Did problem-solving coping at Wave I, emotion-focused coping, and unhealthy behavioral coping at Wave II mediate the relationship between stressful life events at wave I and depressive symptoms at Wave III simultaneously (Figure 9)? Did any gender differences show in the above mediating relationships?

Hypothesis X: Emotion-focused coping and unhealthy behavioral coping at Wave II would mediate the relationship between stressful life events at Wave I and depressive symptoms at Wave III, while problem-solving

coping at Wave I would not.

Hypothesis XI: The mediating role of emotion-focused coping between stress and depression would be stronger for girls, while the mediating role of unhealthy behavioral coping would be stronger for boys. No gender differences would show in the mediating role of problem-solving.

5. Did problem-solving coping at Wave I, emotion-focused coping, and unhealthy behavioral coping at Wave II moderate the relationship between stressful life events at Wave I and depressive symptoms at Wave III (Figure 10)? Were there any gender differences in the above moderating relationships?

Hypothesis XII: Problem-solving coping at Wave I would alleviate the relationship between stressful life events at Wave I and depressive symptoms at Wave III, while emotion-focused coping and unhealthy behavioral coping at Wave II would magnify the adverse effect of stressful life events at Wave I on depressive symptoms at Wave III.

Hypothesis XIII: Gender differences would not show in the moderating role of problem solving coping, while the moderating roles of emotion-focused coping would be stronger for girls, and the moderating roles of unhealthy behavioral coping would be stronger for boys.

Chapter 3: Methods

Participants

The data came from the Add Health (Harris & Udry, 1994-2008), which was a longitudinal study of a nationally representative sample of adolescents in grades 7-12 for 1994-1995 academic year in the United States. A sample of 132 schools, including 80 high schools and 52 feeder schools, was selected, and more than 90,000 students completed in-school questionnaires between September 1994 and April 1995. All students from the same schools were eligible for being selected into the in-home interview sample. A total sample of 20,745 adolescents was interviewed at home in the 1994-95 school year when the respondents were aged 10 to 20. The Add Health cohort was followed up from adolescence to young adulthood with three other in-home interviews. In-home interviews at Wave II were conducted between April and August in 1996, and the sample size was almost 15,000. The respondents were aged from 11 to 21 years. In-home interviews at Wave III were conducted between August 2001 and April 2002, and the sample size was 15,170. The respondents were aged from 18 to 28 years. The respondents' age range was from 24 to 32 years in the Wave IV data when they were interviewed in 2007 and 2008.

The current study used the public-use data. The sample size of participants who were all interviewed at Wave I, Wave II and Wave III was 3,844, which included 2076 girls (54%) and 1768 boys (Table 1). At Wave I, the average age was 15.03 (SD=1.62) with a range of 11 to 21 years; at Wave II, the average age was 15.95

(SD=1.62); and at Wave III, the average age was 21.40 with a range of 18 to 27 years.

Most participants were White (68%), 23.5% were African American, 10.9% were Hispanic, 4.0% were American Indian, 4.0% were Asian American, and 6.1% were from other racial or ethnic groups. When cluster and grand sample weight were considered, the percentages of each gender and ethnic group were slightly different from the ones without considering cluster and grand sample weight. See Table 1.

Procedures

In-home interviews at Wave I, II, III were conducted mostly at the respondents' homes. The interview lasted one to two hours long depending on the respondents' age and experiences. All the data were recorded on laptop computers instead of using paper questionnaires, in order to protect confidentiality. The interviewer read the less sensitive questions to the respondents and entered the respondents' answers. For sensitive topics, such as sexual behaviors, drug, and delinquent behaviors, the respondents entered their answers directly.

Measures

Stressful life events. The current study used the stressful life events list identified in the Add Health survey by Adkins et al. (2009). This additive index was to measure cumulative exposure to stressful life events (Adkins et al., 2009). The life events list only included those occurring within 12 months of the interview. Among these items, there were 24 items which could be attained from all the Wave I, II and III data. There were another 11 items which were included in the Wave I and II data

only, and another 10 items were only included in the Wave III data. If the life events happened during the past 12 months, it was coded as “1,” and if it did not happen at all or happened more than 12 months ago, it was coded as “0.” Each event was supposed to have the same impact on adolescents. The list of these stressful life events is included in Appendix A, and the information of missing values in Appendix D.

In the list of stressful life events, some items were directly asked in the survey. For example, “during the past 12 months, did any suicidal attempt result in an injury, poisoning, or overdose that had to be treated by a doctor or nurse?” Some items such as “death of parents” were calculated. If the interview date minus the date of the father’s death (mother’s death) was within one year, it would be coded as “1,” otherwise coded as “0.” For those cases either having their mother or father die within one year, it was coded as “1,” and otherwise coded as “0.” Likewise, some other items (e.g., suffered physical abuse in a romantic relationship) were calculated based on a series of questions. The questions included “For your first romantic partner, did he or she push or shove you?” If “yes,” “in what month and year did he or she first do this?” Similar to the calculation of “death of parents,” if the interview date minus the date of the event occurred was within one year, it was coded as “1.” There were two other questions which stated “...threaten you with violence...” and “...throw something at you...” If any event of the three events was reported to occur within one year, physical abuse was thought to happen in the relationship with first romantic

partner. The same questions were asked related to second romantic partner and third romantic partner. Thus, if any physical abuse events (threaten with violence, push, and throw something at you) occurred in any romantic relationships, it was coded as “1,” and otherwise coded as “0.” The sum of the scores was calculated and used in the analysis.

Coping. Problem solving coping was not measured at Wave II, thus the current study could only use problem solving coping at Wave I. It was measured using four items, including “When you have a problem to solve, one of the first things you do is to get as many facts about the problem as possible”; “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”; “When making decisions, you generally use systematic methods for judging and comparing alternatives”; and “After carrying out a solution to a problem, you usually try to analyze what went right and what went wrong.” They were measured in a 5-point scale, with 1=strongly agree to 5=strongly disagree. All the items were recoded into 1=strongly disagree to 5=strongly agree. In the full sample of Add Health, the scale was found internally consistent, with the Cronbach’s alpha of 0.74 (Brown et al., 2007). In the present sample, the Cronbach’s alpha was 0.75. The total scores were used in the analysis.

Emotion-focused coping was measured using three questions at Wave II, including “You usually go out of your way to avoid having to deal with problems in your life”; “Difficult problems make you very upset”; and “When making decisions,

you usually go with your “gut feeling” without thinking too much about the consequences of each alternative.” They were also measured using a 5-point scale, with 1=strongly agree to 5=strongly disagree. All the items were recoded into 1=strongly disagree to 5=strongly agree. The Cronbach’s alpha in the present sample was 0.45, which was low. The low internal consistency was consistent with previous studies related to coping measures (see Compas et al., 2001). Researchers have argued that traditional psychometric criteria may not be appropriate to apply to coping measures due to the nature of coping, e.g., highly specific and depending on situations (Compas, et al., 2001). The assumption of the Cronbach’s alpha is that a set of items is supposed to measure a single unidimensional latent construct (Cronbach, 1951). Thus, another explanation is that the set of items of the emotion-focused coping measure is not unidimensional. The total scores were used in the analysis.

Unhealthy behavioral coping was the sum of the score of standardized scores of six variables from the Wave II data set, including currently smoking, drinking, using marijuana, using cocaine, using inhalants, and using other types of illegal drugs (e.g., LSD, PCP, ecstasy, mushrooms, ice, heroin, or prescription medicines not prescribed for you). Currently smoking was measured using one question with “during the past 30 days, on how many days did you smoke cigarettes?” The answers ranged from 0 to 30. Current drinking was measured using one question with “during the past 12 months, on how many days did you drink alcohol?” The answers included “1=every day or almost every day,” “2=3 to 5 days a week,” “3=1 or 2 days a week,”

“4=2 or 3 days a month,” “5=once a months or less (3-12 times in the past 12 months),” “6=1 or 2 days in the past 12 months,” and “7=never.” The item was recoded reversely, i.e., “1=never” to “7=every day or almost every day.” It ranged from 0 to 6. Currently using marijuana was measured using one question with “during the past 30 days, how many times did you use marijuana?” It ranged from 0 to 200 times. Currently using cocaine was measured using the question of “during the past 30 days, how many times have you used cocaine?” It ranged from 0 to 30 times. Currently using inhalants was measured using the question of “during the past 30 days, how many times have you used inhalants?” It ranged from 0 to 10 times. Currently using other illegal drugs was measured using the question of “during the past 30 days, how many times have you used any of these types of illegal drugs (e.g., LSD, PCP, ecstasy, mushrooms, ice, heroin, or prescription medicines not prescribed for you)?” It ranged from 0 to 40 times. Standardized values of each variable were saved as a new variable. Standardized value was calculated using the formula of $Z = \frac{X - \bar{X}}{SD}$. Z is the standardized value, X is the data point of the variable, \bar{X} is the mean of the variable, and SD is the standard deviation of the variable. The Cronbach’s alpha was 0.40 for these six new variables, which was also low. It might be because participants only used one or two specific types of drugs instead of using most of them. Like other coping measures, low internal consistency was related to the nature of coping measures (e.g., Compas et al., 2001). The total scores of these six standard values ranged from -1.68 to 62.73.

All of the coping items of problem solving, emotion-focused, and unhealthy behavioral coping are listed in Appendix B, and the missing value information are reported in Appendix D.

Depressive symptoms. Depressive symptoms were measured using a 9-item scale derived from the 20-item Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The 20-item CES-D is composed of a number of physiological and psychological symptoms of depression. It includes four factors, Somatic-Retarded Activity, Depressed Affect, Positive Affect and Interpersonal Relations (Radloff, 1977). The scale has been validated in the samples of adolescents and young adults (Radloff, 1991). Meadows and colleagues (2006) found the same four factor structures with a 10-item scale (including the same 9 item in the current study and one different item) using the whole sample of the Add Health data, suggesting this 9-item scale measuring similar factor structures of depressive symptoms compared to the original 20-item scale. Also, the subset of depressive symptoms scale was both time-invariant and operated a similar manner for males and females (Meadows et al., 2006). The reliability of the nine-item scale is consistent across all the three waves of data using the whole sample of add health, with $\alpha=.79$, $.80$ and $.80$, respectively (Adkins et al., 2009). The nine items are listed Appendix C. Participants were asked how often they felt each item was true of themselves during the past week, with 0=never or rarely, 1=sometimes, 2=a lot of the time, and 3=most of the time or all of the time. The items of positive feelings were

coded reversely (e.g., enjoyed life). In the current study, the Cronbach's alpha was 0.79 in the Wave I data, 0.80 in the Wave II data, and 0.81 in the Wave III data, which were acceptable. The total scores were calculated and used in the analysis. The total scores at Wave I and Wave III both ranged from 0 to 25, and the total scores at Wave II ranged from 0 to 27. The missing value information is reported in Appendix D.

Analytic Plan

Descriptive statistics. The Add Health study employed a complex survey design. Schools (Clusters) were sampled first and then a certain number of students were chosen within each sampled school. Cluster sampling can skew the standard errors from the results of the statistical analyses, and standard errors can affect significant levels (Muthén & Satorra, 1995). Thus, researchers may have false conclusions without considering for clusters. Also, the Add Health study over-sampled some subpopulations like Chinese Americans and Cuban Americans. Probability weights should be used to generalize the results to the broader population when over-sampling method was used (Muthén & Satorra, 1995).. The Stata statistical program is easier to use and can incorporate the characteristics of sample design to avoid biased estimates and standard errors compared with traditional statistical software like SPSS and SAS (Chantala & Tabor, 1999). Therefore, Stata 11.0 was used in descriptive analyses. Means and standard deviations of each described variable in the part of measures were reported, including stressful life events at each

wave, depressive symptoms at each wave, stressful life events by age, depressive symptoms by age, problem-solving at Wave I, emotion-focused coping at Wave II, and unhealthy behavior coping at Wave II. Means were acquired by the command of SVY: MEAN, and standard deviations were acquired by the command of ESTAT SD after the SVY: MEAN command. Group means (male vs. female) were obtained using the command of SVY: MEAN, OVER (GROUP VARIABLE). Mean difference test was used to test gender differences in each variable by the survey command of TEST after the command of SVY: MEAN. F test statistics are reported in Table 2 and Table 3.

The SVY: TAB command was used to obtain percentages of each unhealthy behavior to which adolescents answered more than “0” and of each stressful life events to which adolescents answered “yes.” Gender differences were tested. Stata 11.0 reports two test statistics, including uncorrected chi-square and design-based F test. The latter “corrects for the survey design with the second-order correction of Rao and Scott (1984) and is converted into an F statistic” (http://www.stata.com/support/errata/i/stata11/svy_tab2.pdf). Design-based F statistics were reported in the current study. Due to a missing analytic weight variable in the public-use data, point estimation of correlation could not be attained using the command of correlation with aweights between each pair of variables. Thus, correlation matrix among stressful life events at Wave I, problem solving coping at Wave II, emotion-focused coping at Wave II, unhealthy behavioral coping at Wave II

and depressive symptoms at Wave III was reported using the SPSS statistical program.

Latent growth curve models (LGCM). Latent growth curve modeling was used to model the developmental trajectories for stressful life events (Figure 6) and depressive symptoms (Figure 3), respectively. This methodology has been advocated by researchers for investigating intra-individual and inter-individual variations in change over time (Kaplan, Kim, & Kim, 2009). The present study employed a cohort sequential design, which considered age cohorts within a particular time period (Bollen & Curran, 2006). For example, at Wave I of the study (1995), children in the sample were aged from 12 to 20. At Wave II of the study (1996), the age of children varied from 13 years to 21 years. There was an overlap of ages at each wave. An important challenge was whether to analyze data by data selection wave or by age at assessment. In the current study, similar to the studies of Adkins et al. (2009) and Ge et al. (2006), age at assessment was chosen as the unit of analysis, because analyzing the data by age at assessment was consistent with the goal of modeling the age trajectories of depressive symptoms and stressful life events. Analyzing the data by wave would ignore age variations within each wave.

The aims of the current study were to estimate the developmental trajectories of stressful life events (and depressive symptoms) from age 12 to age 24. *Mplus* takes a multivariate approach to growth modeling (Muthén & Muthén, 1998-2010), thus thirteen outcome variables of stress (also for depression) should be

created. Using the command of ARRAY in SAS statistical software, the first three waves of data were restructured to provide age-based measurements of stressful life events and depressive symptoms for conducting latent growth curve modeling. Each participant had one to three repeated measures at age-based stressful life events and depressive symptoms, and missing value was set on the rest of other age-based measurements. For example, a boy aged 12 at Wave I of the study could provide three data points of stressful life events (or depressive symptoms, etc.) at age 12, 13 (Wave II), and 18 (Wave III). At the other ages within the ranges 14-17 and 19-24, this person would not have valid data (because it was not observed), and thus resulting in missing data. Through this approach, thirteen new variables of stressful life events (i.e., stressful life events at age 12, stressful life events at age 13...stressful life events at age 24) and thirteen new variables of depressive symptoms (i.e., depressive symptoms at age 12, depressive symptoms at age 13...depressive symptoms at age 24) were created. The pattern of missing data was assumed as missing at random (Kaplan, 2008). *Mplus* statistical program could help deal with such data using full information maximum likelihood (FIML) estimation. Thus, the growth patterns of stressful life events and depressive symptoms could be estimated with the entire span of age twelve to age twenty-four, separately. Gender differences were tested as a predictor to latent growth factors with gender entered as a 0/1 dichotomous variable with 0 = female and 1 = male.

After the trajectories of stressful life events and depressive symptoms were modeled separately, latent growth curve model with two parallel processes was conducted to examine the associations among growth factors between stress and depression. Based on the hypotheses of V-VIII (Figure 8), the intercept of depressive symptoms was correlated with the intercept of stressful life events, and the linear slope of depressive symptoms was correlated with the linear slope of stressful life events. The linear slope of depressive symptoms was regressed on the intercept of stressful life events, and the linear slope of stressful life events was regressed on the intercept of depressive symptoms. Gender differences were tested adding the latent interactions between gender and the growth factors of stressful life events, i.e., gender \times the intercept, gender \times the linear slope, into the two-construct parallel processes model.

The mediation model. Problem-solving coping at Wave I, emotion-focused coping, and unhealthy behavioral coping at Wave II were tested simultaneously as multiple mediators between stressful life events at Wave I and depressive symptoms at Wave III. Four advantages have been described for specifying and testing a single multiple mediation model instead of separate simple mediation models (Preacher & Hayes, 2008). First, the overall mediating effects of a set of mediating variables can be tested with the involvement of multiple mediators within one model. For example, in the current study, the overall mediating effect of coping can be tested. Second, a single model with multiple mediators can tell us how much the mediating effect of

one specific variable is, conditionally on the presence of other mediators in the model. Third, the likelihood of parameter bias, which is due to omitted potential mediators, is reduced with the involvement of multiple mediators within one model. Fourth, researchers can contrast the magnitudes of each pair of specific mediating effects, and test competing theories against one another within one single model.

Delta method standard errors approach was used for assessing whether the total and specific indirect effects were significant or not, because TYPE=COMPLEX does not allow bootstrap approach in *Mplus*. The delta method is a method for computing confidence intervals for functions of maximum likelihood estimates. This method creates a linear approximation of a function and the variance of this approximation is used to compute the confidence interval (Xu & Long, 2005). Standardized estimates of the total and specific indirect effects were reported. Multiple-group analysis was conducted to test gender differences in the mediation model.

The moderation model. The moderating effects of problem solving at Wave I, emotion-focused, and unhealthy behavioral coping at Wave II were also tested simultaneously in one single model. The predictors, including stressful life events at Wave I, problem solving coping at Wave I, emotion-focused coping and unhealthy behavioral coping at Wave II, were mean-centered (i.e., each data point minus the mean of the variable) prior to forming cross-product terms in order to reduce multicollinearity between the main effects and the interaction effects (Aiken & West,

1991). Hierarchical multiple regression was conducted to test the moderation effects (Baron & Kenny, 1986). In the first step, the mean-centered variables of stressful life events and each coping strategy were entered into the model. In the second step, the interaction effects of stress \times problem solving coping, stress \times emotion-focused coping, and stress \times unhealthy behavioral coping were added into the model simultaneously. Multiple group analysis was conducted to test gender differences in the moderation model.

All analyses, including latent growth curve models, mediation models and moderation models, were conducted in *Mplus* (Muthén & Muthén, 1998-2010). *Mplus* has a number of advantages, including the management of missing data and non-independence data (Johnson et al., 2012). *Mplus* allows the use of all available observations using FIML (data in the current study had a considerable amount of missing data after the restructure), which treats data as missing at random (Arbuckle, 1996; Little, 1995). FIML is well-accepted and has been shown to provide more accurate estimates than other methods, i.e., listwise deletion, pairwise deletion, and data imputation (Muthén & Shedden, 1999; Schafer & Graham, 2002; Wothke, 2000). Due to a considerable amount of missing data, the COVERAGE option was set as 0 in all the analysis. The COVERAGE option is “used to specify the minimum acceptable covariance coverage value” (Muthén & Muthén, 1998-2010, p.439). In addition, data of the current study is non-independent due to cluster sampling and repeated measurement. *Mplus* takes into account non-independence of observations when

computing standard errors and chi-squares tests of model fit. Lastly, *Mplus* allows researchers to analyze the relationships among random effects (e.g., a two-construct process latent growth modeling of the study) and other latent variables within a single analysis model (Muthén & Muthén, 1998-2010).

Muthén and Muthén (1998-2010) introduce two approaches to analyze complex survey data in *Mplus*. One of the approaches is taking into account the stratification, cluster, and sampling weights when computing standard errors and chi-square tests of model fit (Muthén & Muthén, 1998-2010). TYPE=COMPLEX option of the ANALYSIS command in conjunction with CLUSTER and WEIGHT option of the VARIABLE command was specified to estimate the latent growth curve models using this approach. COMPLEX in the TYPE setting computes standard errors and a chi-square test of model fit taking into account the features of complex survey design (Muthén & Muthén, 1998-2010). The CLUSTER option is used to “identify the variables in the data set that contain clustering information” (Muthén & Muthén, 1998-2010, p.500). The WEIGHT option is “used to identify the variable that contains sampling weight information” (Muthén & Muthén, 1998-2010, p.501). Parameters were estimated by maximizing a weighted loglikelihood function, and a sandwich estimator (referred in Type=Complex in *Mplus*) was used to compute standard errors (Asparouhov, 2005). Based on the results of the preliminary analysis using this approach, the robust chi-square could not be computed due to low covariance coverage, although all the model estimation terminated normally. No model fit indices

could be attained from the output except for AIC (Akaike) and BIC (Bayesian). However, without model fit indices, i.e., chi-square test statistic, CFI, RMSEA, SRMR, it was difficult to tell whether the acquired model was adequate. Thus, this approach was not used to estimate the latent growth models for stressful life events and depressive symptoms.

The second approach can be obtained by specifying TYPE=TWOLEVEL option of the ANALYSIS command in conjunction with CLUSTER and/or WEIGHT option of the VARIABLE command. TWOLEVEL in the TYPE setting allows random intercepts and random slopes that vary across clusters (Muthén & Muthén, 1998-2010). This approach is to specify a model for each level of the multilevel data (i.e. individual level and cluster level) (Muthén & Muthén, 1998-2010). If using this approach, the latent growth model in the current study was actually a two-level growth model (three-level analysis, with time as the first level, individual as the second level, and cluster (i.e., school) as the third level). The public-use data did not give information of weight variable at cluster level, thus weight could not be taken into account in the analysis. Based on the results of the preliminary analysis using this method without taking into account weight, the robust chi-square test could be attained. Thus the current study used this approach to estimate the growth models for stressful life events and depressive symptoms. Chi-square, Comparative Fit Index (CFI; Bentler, 1990), Root Mean Square Error of Approximation (RMSEA, Browne & Cudeck, 1993), and Standardized Root Mean Square Residual (SRMR) were

reported as model fit indexes. A CFI greater than 0.95, RMSEA less than 0.06, and SRMR less than 0.08 indicates good model fit (Hu & Bentler, 1999).

However, due to heavy computation burden with three to five latent variables and latent interactions in multilevel modeling (Muthén & Muthén, 2009), TYPE=COMPLEX option of the ANALYSIS command in conjunction with CLUSTER and WEIGHT option of the VARIABLE command was used to estimate the two-construct parallel processes growth model. Likewise, it was difficult to determine whether the acquired models were adequate without model fit indices. Gender differences would be tested in the associations between stressful life events and depressive symptoms over time. Because the robust chi-square test statistics could not be computed using this method, chi-square difference test could not be conducted using multiple group analysis. Thus multiple group analysis would not be appropriate to be employed to test gender differences. As such, latent interactions (e.g., gender \times random intercept, gender \times random slope) were used to test gender differences.

In addition, in order to solve the problems of lack of model fit indices using TYPE=COMPLEX approach, a third approach, growth model with individually-varying times of observation, was employed to estimate the growth curve models using the original stress (i.e., stressful life events at Wave I, Wave II, and Wave III), depression variables (i.e., depressive symptoms at Wave I, Wave II, and Wave III) and age variables. TYPE=RANDOM combined with TYPE=COMPLEX of the ANALYSIS command in conjunction with CLUSTER, WEIGHT and TSCORES

option of the VARIABLE command was specified. However, the robust chi-square test could not be attained, either. This approach was not employed in the current study.

Finally, TYPE=COMPLEX option of the ANALYSIS command in conjunction with CLUSTER and WEIGHT option of the VARIABLE command was specified to test the mediation and moderation models. Maximum likelihood estimation with robust standard errors (MLR) was used as an estimator. Multiple group analysis was used to test gender differences. In multiple group analysis, chi-squares from the outputs cannot be used directly for difference testing with the MLR estimator in Mplus (Muthén & Muthén, 1998-2010). The Satorra-Bentler scaled chi-square differences should be used and were computed using the formula

$$F = \frac{(F_0 c_0 - F_1 c_1)(d_0 - d_1)}{c_0 d_0 - c_1 d_1} \quad (\text{Satorra \& Bentler, 2001}).$$

F is the Satorra-Bentler scaled chi-square test statistics, F_0 , c_0 , and d_0 are the chi-square, scaling correction factor, and degrees of freedom of the nested model, respectively; and F_1 , c_1 , and d_1 are the chi-square, scaling correction factor, and degrees of freedom of the comparison model. The nested model is the more restrictive model with more degrees of freedom than the comparison model. Chi-square, CFI, RMSEA, and SRMR were reported as model fit indices. Appendix E lists the research questions and selected model estimation methods.

Chapter 4: Results

Descriptive Analysis

Means and standard deviations of stress and depression by wave. Total, female and male means and standard deviations of stressful life events and depressive symptoms at each wave were reported in Table 2. The total means of depressive symptoms ranged from 4.53 to 5.60 across waves. The mean in the Wave II data was the highest, and the mean of Wave III was the lowest. The means of depression in females ranged from 5.03 to 6.38, and the means of depression in males ranged from 4.03 to 4.83. As expected, according to F test statistics, female adolescents reported higher levels of depressive symptoms than males at each wave, with $F(1, 131)=95.43$ for Wave I, $F(1,131)=135.54$ for Wave II, and $F(1,131)=38.88$ for Wave III, $p<.05$.

The total means of stressful life events ranged from 1.23 to 1.71 across waves, and they decreased from Wave I to Wave III. The means of stressful life events in females ranged from 1.14 to 1.44, and the means of stressful life events in males ranged from 1.32 to 1.98. The results of mean difference tests across gender showed that male adolescents reported more stressful life events than females at each wave, with $F(1,131)=66.13$ for Wave I, $F(1,131)=21.84$ for Wave II, and $F(1,131)=7.78$ for Wave III, $p<.05$.

Means and standard deviations of stress and depression by age. Means and standard deviations of depressive symptoms by age were calculated using the reconstructed data (see Table 3). Total, female, and male means were plotted, with

diamonds representing total, squares representing girls, and triangles representing boys, connected by lines. As shown in Figure 11, depressive symptoms increased from age 13 to age 17. After the age of 17, the level of symptoms decreased from 18 to 19 years, and then kept relatively even from age 19 to age 24. As expected, at the beginning of age 12, girls were more depressed than boys, and a gender pattern continued into age 24. The results of a mean difference test showed that gender differences were statistically significant from age 13 to age 23 (see Table 3). Specifically, girls' depressed feelings surged upward between ages 13 to 17, whereas the trend of boys' were relatively flat compared with girls' (see Figure 11). It was consistent with findings reported by Ge et al. (1994).

Similarly, means and standard deviations of stressful life events were also calculated using the reconstructed thirteen variables of stressful life events (see Table 3). Total, female and male means were plotted against age at assessment. As shown in Figure 12, the average number of stressful life events increased dramatically between ages 12 to 17 in both boys and girls. After age 17, a trend of stressful life events decreased by the aged of 20, and then kept relatively even in adolescents of 21-years-old to 24-years-old. However, it was unexpected that boys reported a higher number of stressful life events than girls consistently across the age span, with seven out of thirteen pairs of mean difference tests reaching a level of significance. The result was consistent with findings from mean difference tests by wave.

Means and standard deviations of coping. The total, female and male means and standard deviations of each coping were reported in Table 4. No significant gender differences were found in any coping strategies except for Marijuana use. Male adolescents ($M=2.74$, $SD=10.01$) reported significantly higher use of Marijuana during the past 30 days than females ($M=1.17$, $SD=5.54$), $p<.05$.

Percentages of unhealthy behavioral coping. The percentages of each unhealthy behavior on which adolescents did not answer “0” were reported in Table 5. During the 1995-996 school year, more than thirty percent of the adolescent population smoked cigarettes at least one day during the past 30 days, and more than forty-five percent drank alcohol during the past 12 months. Close to fifteen percent used marijuana, and more than one percent used cocaine during the past 30 days. Furthermore, close to one percent of the population used inhalants and more than three percent used any other illegal drugs during the past 30 days. In addition, gender differences were tested using 2×2 table chi-square tests. F value was the corrected Pearson chi-square test statistic adjusted by cluster and grand sample weights using the tabulate command in STATA software. According to the corrected chi-square statistics, females and males did not show significant differences in the percentages of committing any of these unhealthy behaviors.

Percentages of stressful life events' occurrence. The percentages of each stressful life event's occurrence at each wave were reported in Table 6. Gender differences were tested using 2×2 table chi-square tests. The corrected Pearson

chi-square test statistics (F value) were reported. At Wave I, more girls than boys reported “yes” at the six following stressful life events, including “suicide attempt resulting in injury” (0.76% vs. 0.14%), “relative committed suicide” (0.62% vs. 0.30%), “unwanted pregnancy” (0.10% vs. 0), “abortion, still birth or miscarriage” (0.12% vs. 0), “contracted a STD” (0.71% vs. 0.22%), and “was raped” (3.35% vs. 0). However, more boys reported having stressful life events related to violence (nine items) than girls, i.e., “saw violence” (6.53% vs. 4.28%), “threatened by a knife or gun” (8.16% vs. 3.21%), “was shot” (0.96% vs. 0.23%), “was stabbed” (3.54% vs. 1.23%), “was jumped” (8.51% vs. 2.61%), “threatened someone with a knife or gun” (3.22% vs. 1.11%), “shot/stabbed someone” (1.26% vs. 0.33%), “was injured in a physical fight” (5.93% vs. 2.45%), and “hurt someone in a physical fight” (12.99% vs. 5.15%). Furthermore, more boys reported experiencing the events of “had sex for money” (0.26% vs. 0.06%), “juvenile conviction” (0.32% vs. 0.07%), and “suffered a serious injury” (8.72% vs. 4.94%) than girls. For the other seventeen stressful life events, e.g., “skipped necessary medical care,” “ran away from home,” and “romantic relationship ended,” the results did not show gender differences in the percentages.

At Wave II, more female adolescents reported experiencing five of the stressful life events than males, including “unwanted pregnancy” (1.27% vs. 0), “abortion, still birth, or miscarriage” (0.74% vs. 0), “contracted a STD” (1.65% vs. 0.69%), “was raped” (1.15% vs. 0) and “ran away from home” (3.83% vs. 2.19%).

Similar to the results at Wave I, the nine stressful life events related to violence happened more frequently in males than in females. In addition, more boys reported than girls having stressful life events of “juvenile conviction” (0.4% vs. 0.06%), “was expelled from school” (1.32% vs. 0.65%), “suffered a serious injury” (8.50% vs. 5.74%), “father received welfare” (1.48% vs. 0.81%), and “non-romantic sexual relationship ended” (2.14% vs. 1.44%). For the other sixteen events, gender differences were not found.

At Wave III, more female adolescents reported having stressful life events of “abortion, still birth, or miscarriage” (1.94% vs. 1.26%), “contracted a STD” (5.82% vs. 2.13%), “received welfare” (6.29% vs. 1.43%), and “involuntarily dropped from welfare” (1.12% vs. 0.32%) than males. Similar to the results found at Wave I and II, more males reported having stressful life events related to violence, except for “shot/stabbed someone.” Also, more males reported “adult conviction” (1.39% vs. 0.22%), “entered full-time active military duty” (1.62% vs. 0.17%), and “discharged from the armed force” (0.66% vs. 0.17%) than females. No gender differences appeared in the other nineteen events.

Thus, from the percentages of occurrence of each of the stressful life events, male adolescents had a greater number of events on which they answered “yes” than girls. This could help to explain why the average number of stressful life events was higher in males than females across both wave and age.

Correlation matrix. Correlation analyses were conducted among stressful life events at Wave I, problem solving coping at Wave I, emotion-focused coping and unhealthy behavioral coping at Wave II, and depressive symptoms at Wave III. The results are reported in Table 7. As expected, stressful life events at Wave I were positively associated with depressive symptoms at Wave III ($r=.16$), emotion-focused coping ($r=.11$) and unhealthy behavioral coping at Wave II ($r=.26$), and were negatively associated with problem solving coping ($r=-.04$). Also, depressive symptoms at Wave III were negatively associated with problem solving coping ($r=-.04$), and positively associated with emotion-focused coping ($r=.16$) and unhealthy behavioral coping at Wave II ($r=.06$). In addition, problem solving coping was found negatively associated with unhealthy behavioral coping ($r=-.08$). No significant correlations were found between problem solving coping and emotion-focused coping, between emotion-focused coping and unhealthy behavioral coping.

Latent Growth Curve Models (LGCM)

Unconditional model for depression. The unconditional LGCM of depressive symptoms was estimated using TYPE=TWOLEVEL in the ANALYSIS command with CLUSTER option of the VARIABLE command in *Mplus*. The unconditional model refers to having no predictor included in the model. Due to only three valid time points each participant provided, the potential highest order of fixed effect should be quadratic (i.e., the number of time points minus 1) and the potential highest order of random effect (i.e., the number of time points minus 2) should be

linear in the model. At both the within-level and between-level parts of the model, the loadings on the latent intercept in the model were set to 1.0 at all time points. The growth factor was fixed at the number of years since age 12 for linear, and at linear age squared for quadratic (Figure 3). The error variance of each observed depression variable was estimated free at both the within-level and between-level parts of the model. A series of polynomial models were specified in order to select a best fit model. First, a fixed quadratic effect and random quadratic effect model was specified. The variance of the quadratic effect was a small negative value at the within-level part of the model. Next, the variance of quadratic effect was fixed as “0,” and a fixed quadratic effect and random linear effect model was attained. No error message showed in the output. The model had a great model fit with $\chi^2=179.61$, $df=157$, $p>.05$, $CFI=.99$, $RMSEA=.01$. It indicated a great model fit. However, $SRMR$ was 0.18 at the within level, and .25 at the between-level. It was larger than .08, suggesting a poor model fit.

At the between-level part of the model, only the variance of intercept was significant, and it was 0.83, $p<.05$. It indicated that there were significant individual variations in the initial levels of depression across schools. All of the other variance (i.e., the variance of linear slope and quadratic slope) was not significantly larger than 0, $p>.05$. Also, all of the covariance and residual variances were not significantly larger than 0, $p>.05$, either. This suggested that there were no significant differences in the latent growth factors, the relations between later factors and error variances of

observed variables across schools. The means of intercept, linear slope, and quadratic slope from the between-level model, and the variances of intercept, linear slope, and quadratic slope (fixed as 0 here) from the within-level model were reported.

As shown in Model 1 of Table 8, the mean intercept was 5.29, with a 95% CI of -1.77 to 12.35, $p < .05$, which indicated that the estimated mean of depressive symptoms was 5.29 at age 12, and it was significantly larger than 0. The variance of intercept was 12.99, $p < .05$, indicating that there were significant individual variations at the initial levels of depressive symptoms. The mean linear slope of 0.21 suggested that the levels of depressive symptoms increased from age 12, with a 95% CI of -0.11 to 0.53, and it was significantly larger than 0, $p < .05$. The random linear slope was 0.10, $p < .05$, suggesting that not all individuals' depressive symptoms increased at the same rate. Some adolescents even reported decreased depressed feelings from age 12. The mean quadratic slope was -0.03, and it was significantly lower than 0, $p < .05$, which indicated that the increase of depressive symptoms became slower over time. There were no individual variations in the decelerate rates due to an insignificant random quadratic effect. As expected, random intercept was negatively correlated with random linear slope, and the covariance was -.75, $p < .05$. It indicated that lower levels of initial depressive symptoms were associated with a higher increase in rate of depression. Figure 13 shows the predicted means of depressive symptoms across the age span of 12 to 24, which roughly match Figure 11.

Conditional model for depression. A conditional model refers to the growth model with one or more predictors. Gender as a predictor was added into the final unconditional model to predict the random intercept and random linear slope. The model had a good model fit, with $\chi^2=211.96$, $df=181$, $p>.05$. CFI=.99, RMSEA=.01. SRMR was .17 at the within-level, and .27 at the between-level. As shown in Model 2 of Table 8, gender significantly negatively predicted the random intercept ($b=-1.77$, $p<.05$), indicating that girls had higher levels of depressed feelings than boys at age 12. Also, gender differences were found in the variations of linear increase rate. It was unexpected that male adolescents' depressed feelings increased faster than female adolescents, which was inconsistent with previous findings (Ge et al., 1994). See Figure 13, which roughly matched the patterns in Figure 11, except for the higher increase rate for boys.

Unconditional model for stress. The unconditional LGCM of stressful life events was estimated using a similar process of modeling for depression. First, a fixed quadratic effect and random quadratic effect model was specified both in the within and between level model. The model could not be identified. The preliminary results showed that the variance of linear effect was a small positive value, and the variance of quadratic slope was a small negative value in the within-level model. Next, the variance of quadratic slope was fixed as "0." The model indices were $\chi^2=333.99$, $df=157$, $p<.05$, CFI=.90, RMSEA=.02. SRMR was .18 at the within-level, and .19 at the between-level, indicating a poor model fit. The variance of linear effect was a

small positive value (0.01). Thus the random effect was fixed as 0.01 in the next step.

In order to improve the model fit, the covariance among some residual variances of observed variables were estimated based on the information from model modification indices (i.e., SLE 16 with SLE 17, SLE 13 with SLE 14, SLE 15 with SLE 16).

Finally, a fixed quadratic effect and random intercept model was attained. The model had a good model fit, with $\chi^2=234.82$, $df=168$, $p<.05$, $CFI=.96$, $RMSEA=.01$.

However, SRMR was .22 at the within-level, and .31 at the between-level, which indicated a poor model fit.

In the between-level model, the results showed that only the variance of intercept was significantly larger than 0, $p<.05$. All the other variances and residual variances were not significantly larger than 0, $p>.05$. The means of intercept, linear slope, and quadratic slope from the between-level model, and the variances of intercept, linear slope, and quadratic slope from the within-level model were reported in Table 8.

As shown in Model 3 of Table 8, the mean of the intercept was 1.44, with 95% CI [-0.51-3.39], $p<.05$, indicating the initial number of stressful life events being significantly larger than 0. The variance of the intercept was 0.99, $p<.05$, which indicated that there were significant individual variations in the initial number of stressful life events. The mean of the linear slope was 0.11, $p<.05$, suggesting that the average number of stressful life events significant increased from age 12. The variance of the linear slope was 0.01, $p>.05$, indicating no individual variations in the

increase rates. The mean of the quadratic slope was -0.01 , $p < .05$, which indicated that the average increase rate of stressful life events became slower over time. There were no individual variations in the quadratic slope, with the variance value of 0. Figure 14 displays the changing pattern of stressful life events from age 12 to 24, which roughly matches Figure 12.

Conditional model for stress. Gender was added into the model as a predictor for random effects. Random linear effect and quadratic effect were estimated free step by step, because there might be some individual differences in linear and quadratic slopes after including gender into the model. The results showed that the variances of the linear and quadratic slopes were not statistically significant, with the random linear effect of 0.01 and the random quadratic effect of 0.00, $p > .05$. Thus the random linear effect was still fixed at 0.01 and the quadratic effect was fixed at 0 in the conditional model. Gender was added into the model to only predict the random intercept. As shown in Model 4 of Table 8, gender significantly predicted the intercept of stressful life events ($b = 0.31$, $p < .05$). Male adolescents reported a higher number of stressful life events than female adolescents at age 12. Figure 14 shows the trajectories of stressful life events in males and females. It roughly matches the patterns in Figure 12.

The longitudinal association between stress and depression. Due to computational burden with 3-5 latent variables and latent interactions in multilevel modeling using TYPE=TWOLEVEL, the two-construct parallel processes growth

modeling was conducted using TYPE=COMPLEX in conjunction with CLUSTER and WEIGHT variables. In the model, the random intercept of stressful life events was correlated with the random intercept of depressive symptoms, and the random linear slope of depressive symptoms was regressed on the random intercept of stress. The other parts of the proposed model (Figure 8) were ignored due to a lack of a random linear effect of stress. The results are shown in Model 1 of Table 9.

It was expected that the initial number of stressful life events was positively associated with the initial levels of depressive symptoms, and the covariance between the two was 2.08, $p < .05$. However, as unexpected, higher initial number of stressful life events predicted a lower increase of depressive symptoms over time, and the effect was -0.06, $p < .05$. In addition, the variance of the linear slope of depressive symptoms became insignificant after including stressful life events in the model, $p > .05$. See Figure 15.

Finally, gender differences were tested using the latent interactions, i.e., gender \times the random intercept of stressful life events. The association between the random intercept of stressful life events and the random intercept of depressive symptoms was not directional. However, the current study aimed to test whether the effect of initial levels of stressful life events on initial levels of depressive symptoms was different across gender, thus the random intercept of depressive symptoms was regressed on the random intercept of stressful life events in the model.

TYPE=RANDOM in the ANALYSIS command was added into the syntax due to

involving latent interactions. The result is shown in Model 2 of Table 9. The interaction effect between gender and the random intercept of stress significantly predicted the random intercept of depression, and the effect was -1.55 , $p < .05$. It suggested that the effect of stressful life events at age 12 on depressive symptoms at age 12 were significantly larger in female adolescents than males. The interaction effect between gender and the random intercept of stress could not significantly predict the random slope of depressive symptoms, and the effect was 0.07 , $p > .05$. See Figure 16.

The Mediation Model

In order to answer the fourth research question, a mediation analysis was conducted to test whether coping, including problem solving coping at Wave I, emotion-focused coping at Wave II, and unhealthy behavioral coping at Wave II could mediate the association between stressful life events at Wave I and depressive symptoms at Wave III. The whole model was a good fit, with $\chi^2=15.02$, $df=3$, $p < .05$; $CFI=.95$, $RMSEA=.03$, $SRMR=.02$. The standardized path coefficients are shown in Figure 17.

The standardized direct effect of stressful life events at Wave I to depressive symptoms at Wave III was $.14$, $p < .05$, which was still significant with three coping strategies included into the model. A higher number of stressful life events at Wave I predicted higher levels of depressive symptoms at Wave III. The standardized total indirect effects were 0.018 [$0.003, 0.032$], $p < .05$; only the indirect effect through

emotion-focused coping was statistically significant, and the indirect effect was 0.014, with 95% CI from 0.008 to 0.020, $z=4.377$, $p<.05$. The specific indirect effect of problem solving coping and unhealthy behavioral coping was 0.001[-0.001, 0.003], 0.002[-0.011, 0.016], respectively, $p>.05$.

A higher number of stressful life events at Wave I significantly predicted higher levels of emotion-focused coping at Wave II ($\beta=.10$, $p<.05$), and then higher levels of emotion-focused coping at Wave II predicted higher levels of depressive symptoms at Wave III ($\beta=.15$, $p<.05$). Also, stressful life events at Wave I positively predicted unhealthy behavioral coping at Wave II ($\beta=.25$, $p<.05$), while the association between unhealthy behavioral coping and depressive symptoms was not significant ($\beta=.01$, $p>.05$). In addition, stressful life events at Wave I did not significantly predict problem solving coping at Wave I ($\beta=-.03$, $p>.05$), whereas problem solving coping at Wave I negatively predicted depressive symptoms at Wave III ($\beta=-.04$, $p<.05$).

A multiple group analysis was conducted to test gender differences in the mediation model. First, the path coefficients, the intercepts, and residual variances were all set free across gender, $\chi^2=21.310$, $df=6$, $p<.05$, scaling correction factor =1.346, CFI=.957, RMSEA=0.04, SRMR=0.02. Second, the path coefficient from stressful life events at Wave I to depressive symptoms at Wave III was fixed equal across gender, $\chi^2=24.018$, $df=7$, $p<.05$, scaling correction factor =1.349, CFI=.952, RMSEA=0.04, SRMR=0.02. Based on the formula of $F = \frac{(F_{0co} - F_{1c1})(d_0 - d_1)}{c_{do} - c_{1d1}}$

(Satorra & Bentler, 1999; 2001), the Satorra-Bentler scaled chi-square difference (F) was 2.72, $df=1$, $p>.05$. Thus the comparison and nested model was not significantly different, and the nested model was attained due to the rule of parsimony. This model (with the path from stressful life events to depressive symptoms fixed equal across gender) became the comparison model in the next step of model specification. Third, the path coefficients from stressful life events at Wave I to problem solving coping at Wave I was fixed equal across gender, $\chi^2=23.354$, $df=8$, $p<.05$, scaling correction factor =1.401, CFI=.956, RMSEA=0.03, SRMR=0.02. The Satorra-Bentler scaled chi-square difference (F) was 0.18, $df=1$, $p>.05$. Based on the rule of parsimony, the nested model was attained. The path coefficients from stressful life events to problem solving coping at Wave I were not significantly different across gender. Similar procedures of model comparisons were conducted to compare all of the path coefficients across gender. The processes of model comparisons are provided in Table 10. The final model is shown in Figure 18. The path coefficients from stressful life events at Wave I to unhealthy behavioral coping at Wave II, from emotional-focused coping at Wave II to depressive symptoms at Wave III, and unhealthy behavioral coping at Wave II to depressive symptoms at Wave III were significantly different across gender, and all the other path coefficients were not. The final model had a good model fit, with $\chi^2=28.02$, $df=10$, $p<.05$, CFI=.95, RMSEA=.03, and SRMR=.02.

The association between stressful life events and unhealthy behavioral coping was significantly higher in females ($\beta=.33$, $p<.05$) than males ($\beta=.21$, $p<.05$). It

indicated that female adolescents used more unhealthy behavioral coping than males when they were faced with stress. Also, a stronger association between emotion-focused coping and depression was found in females ($\beta=.17$, $p<.05$) than in males ($\beta=.10$, $p<.05$). In addition, it was interesting that the directions of the associations between unhealthy behavioral coping and depression were opposite across gender, with $\beta=.05$ in females, and $\beta=-.04$ in males. However, they were both not statistically significant, $p>.05$.

Emotion-focused coping was a much stronger mediator between stressful life events and depression in females than in males. The standardized specific indirect effect through emotion-focused coping was 0.015, with 95% CI from 0.006 to 0.025, $z=4.12$, $p<.001$ for females; while for males, the standardized indirect effect was 0.012, 95% CI was from 0.004 to 0.015, $z=3.33$, $p<.01$. Problem solving was not a significant mediator both in males and females. The specific standardized indirect effect of problem solving coping was .001 [-.001-.003] in females, and .002 [-.002-.005] in males, $p>.05$. The two paths, i.e. stress \rightarrow problem solving coping and problem solving coping \rightarrow depression, did not show any gender differences. Unhealthy behavioral coping was not a significant mediator for either males or females. The specific indirect effect of unhealthy behavioral coping was .017 [-.007-.042] in females, and -.010 [-.028-.008] in males, $p>.05$.

The Moderation Model

Finally, problem solving coping at Wave I, emotion-focused coping at Wave II, and unhealthy behavioral coping at Wave II were tested as multiple moderators in the relationship between stressful life events at Wave I and depressive symptoms at Wave III. The results showed that the main effect of stressful life events was significant ($\beta=.12, p<.05$) which indicated that higher levels of earlier stress significantly predicted higher levels of later depressive symptoms. Also, the main effects of problem solving coping ($\beta=-.04, p<.05$) and emotion-focused coping ($\beta=.15, p<.05$) were significant. Higher use of problem solving coping significantly predicted lower levels of later depressive symptoms, while higher use of emotion-focused coping significantly predicted higher levels of later depressive symptoms. The main effect of unhealthy behavioral coping was not significant, with $\beta=.02, p>.05$. In addition, the three interaction effects, problem solving coping \times stressful life events ($\beta=.02, p>.05$), emotion-focused coping \times stressful life events ($\beta=-.03, p>.05$), and unhealthy behavioral coping \times stressful life events ($\beta=-.02, p>.05$), were not significant. Thus, the three coping methods were not significant moderators between stressful life events at Wave I and depressive symptoms at Wave III in the whole sample. See Figure 19.

Gender differences were tested using multiple group analysis. The path coefficients, the intercept and residual variance of depressive symptoms at Wave III were all estimated free across gender, and the model was set as a baseline model. Similar to the procedures of testing gender differences in the mediation model, the

seven path coefficients of the moderation model were fixed equally accordingly across gender step by step, and the Satorra-Bentler scaled chi-square differences were computed using the formula $F = \frac{(F0co-F1c1)(do-d1)}{codo-c1d1}$ at each step (Satorra & Bentler, 2001). The processes of model comparisons are shown in Table 11. The final model appears in Figure 20. It had a good model fit, with $\chi^2=5.81$, $df=5$, $p>.05$; CFI=.995, RMSEA=.009, and SRMR=.007.

Only the two paths, i.e., emotion-focused coping → depression and unhealthy behavioral coping → depression, were found to be significantly different across gender. Emotion-focused coping was found to be more strongly associated with depression in female adolescents ($\beta=.18$, $p<.05$) than male adolescents ($\beta=.10$, $p<.05$). Also, unhealthy behavioral coping positively predicted later depression in females ($\beta=.08$, $p<.05$), while it did not significantly predict depression in males ($\beta=-.03$, $p>.05$). Gender differences were absent in the main effects of problem solving and stress on depression.

Finally, the three interaction effects of stressful life events at Wave I × emotion-focused coping at Wave II, of stressful life events at Wave I × problem solving at Wave I, and of stressful life events at Wave I × unhealthy behavioral coping at Wave II were not significantly different across gender. The interaction effects of stressful life events × problem solving and of stressful life events × emotion-focused coping were not significant in both males and females, $p>.05$. The interaction effect of stress × unhealthy behavioral coping was significant in both

males ($\beta=-.03, p<.05$) and females ($\beta=-.04, p<.05$). The figures of the associations between stress and depression by unhealthy behavioral coping (lowest level, mean level, and one SD above mean level) were plotted both for males and females. See Figure 21.

For females, individuals who used higher levels of unhealthy behavioral coping at Wave II reported higher later depression consistently when they experienced earlier stressful life events, while as the number of stressful life events increased at Wave I, girls' depressive symptoms increased slower in those with higher levels of unhealthy behavioral coping compared to those with lower levels of unhealthy behavioral coping. Thus the gap of depression values between those with higher and lower unhealthy behavioral coping became smaller as the number of stressful life events increased. In contrast to female adolescents, individuals with higher unhealthy behavioral coping at Wave II reported lower levels of later depression compared to those with less use of unhealthy behavioral coping, and as stressful life events at Wave I increased, boys' depressive symptoms also increased slower in those who reported higher levels of unhealthy behavioral coping than those who reported lower levels of unhealthy behavioral coping. The gap of depression values between those with higher and lower levels of unhealthy behavioral coping became greater as the number of stressful live events increased. Therefore, unhealthy behavioral coping could reduce the adverse effect of stressful life events on

depressive symptoms in both males and females, although the main effect of unhealthy behavioral coping on depression was opposite across gender.

Chapter 5: Discussion

The current study has contributed to our understanding of the developmental trajectories of stressful life events and depressive symptoms during adolescence as well as their associations over time. It also examined the mediating and moderating roles of coping strategies between earlier stressful life events and later depressive symptoms. A latent growth curve approach was used to identify the trajectories of depressive symptoms and stressful life events, as well as their interlocking relationships between the two constructs. Furthermore, multiple mediators/moderators were tested simultaneously to examine the mediating/moderating mechanisms between stress and depression. It was both theoretically and methodologically important to the field of stress and depression in adolescence.

Results from the present analyses revealed several major findings. First, the average of depressive symptoms increased from early adolescence to middle adolescence, and then decreased from middle adolescence to late adolescence. Female adolescents exhibited persistently higher levels of depressive symptoms across the whole adolescence period than male adolescents. Second, similar to the change patterns of depressive symptoms, stressful life events also increased from early adolescence to middle adolescence, and then decreased from middle adolescence to late adolescence. However, male adolescents had persistently greater number of stressful life events than female adolescents. Third, the higher initial levels of stressful life events were positively associated with higher initial levels of

depressive symptoms. However, it was unexpected that higher initial levels of stressful life events predicted lower increase of depression over time, especially in females. Fourth, only emotion-focused coping was a significant mediator between earlier stressful life events and later depressive symptoms. Also, such mediating effect was much stronger in females than in males. Fifth, unhealthy behavioral coping could reduce the adverse effect of earlier stressful life events on later depressive symptoms in both males and females, although the main effects of unhealthy behavioral coping were opposite across gender. All of the findings of the current study are discussed in greater depth as follows.

Research Question 1: How Did the Average of Depressive Symptoms Change from age 12 to age 24? Were There any Gender Differences in the Developmental Trajectories of Depressive Symptoms?

The trajectories of depression. The results in the present study showed that the trajectory of depressive symptoms was curvilinear across the whole adolescence period, which was the same as the results found from the whole sample of the Add Health data (Adkins et al., 2009). Some other studies that also used the Add Health data, i.e., Chen, Haas, Gillmore, & Kopak (2011), Brown et al. (2007); Meadows et al. (2006), identified linear and declining trajectories. The difference was that the present study and the study of Adkins used age as a metric of time, while those studies used wave as a metric of time. As suggested, the trajectories of depression during adolescence may be curvilinear rather than linear when assessed at more frequent time

intervals (Ge et al., 1994; Hankin, Abramson, Moffitt, Silva, McGee, & Angell, 1998; Ge et al., 2006). Ge and colleagues (2006) used age as a metric of time (age 12 to age 23) to identify a curvilinear trajectory of depressive symptoms in a sample of 550 rural adolescents from a Midwestern State. They found that depressive symptoms increased from early to middle adolescence and then declined in late adolescence. Furthermore, the results of the current study are also consistent with previous findings targeted at the samples with alternative age spans. For example, some researchers found an increasing linear trajectory of depressive symptoms from early adolescence to middle adolescence (Cole et al., 2003; Garber et al., 2002) using adolescents' self-reported depressive symptoms. Mirowsky and colleagues conducted analyses using both cross-sectional and longitudinal data (age 18 and older) and found that depressive symptoms began to drop at the beginning of late adolescence (Mirowsky, 1996; Mirowsky & Kim, 2007).

From early adolescence to middle adolescence, boys and girls experience dramatic biological, psychological, and social-environment challenges, including body changes, increased conflict with parents, peer pressure, and worries about the future. Thus compared to preadolescents, adolescents experience higher level of stress (Larson & Ham, 1993; Rudolph and Hammen, 1999). These normative and nonnormative challenges increase the risk of depression during this period. In contrast, compared to early and middle adolescents, late adolescents or young adults have fully (for girls) or close to fully (for boys) developed physically. Also, they have developed

more mature abilities, such as thinking ideas through from beginning to end and ability to delay gratification, firmer sense of identity, increased emotional stability, increased independence and self-reliance, and establishing stable relationships (AACAP, 2008). These normative and positive changes may help to explain the decrease of depressive symptoms in late adolescence (Mirowsky & Ross, 1992; Schieman, Van Gundy, & Taylor, 2001, Ge et al. 2006).

In addition, the significant negative associations between the intercept and slope of depressive symptoms indicate that higher initial levels of depressive symptoms are associated with slower increases in symptoms over time. The result is consistent with the two previous findings by Ge et al. (1994) and Johnson et al. (2012). Regression toward the mean may help explain this phenomenon (Ge et al., 1994).

Gender difference. Consistent with previous findings (e.g., Adkins et al., 2009; Ge et al., 1994), female adolescents reported higher levels of depressive symptoms than male adolescents across the whole adolescent period. Gender differences began to emerge during early adolescence. However, it was unexpected that depressive symptoms increase relatively faster in males than in females from early adolescence, which is contrary to previous findings (Petersen et al., 1991; Ge et al., 1994; Hankin et al., 1998; Ge et al., 2001; Ge et al., 2006). Thus, the greatest gap in depression symptoms between males and females emerges during early adolescence in the current study, whereas previous findings suggest it emerging during middle adolescence (Ge et al., 1994; Petersen et al., 1991; Ge et al., 2006).

One study, in which the whole sample of the Add Health data were used, did not find gender differences in the linear change of depression (Adkins et al., 2009). In their analysis, they kept the random effect of the quadratic slope, which was not accurate due to only three valid time points of the data. Thus, the findings of higher linear slope in males than in females may represent the characteristics of the Add Health data. Given the strength of the data employed in the current study, this inconsistent finding deserves future investigation.

In addition, the gender gap is found to dramatically be narrowed during late adolescence. It is the same with the result in which the whole sample was used for analysis (Adkins et al., 2009). Ge et al. (2006) also found the narrowing gender gap during late adolescence compared to middle adolescence, but the gender gap was still substantial and persists into late adolescence in their study. As Adkins et al. (2009) explained that the limited age span has been used in the current study (no older than 24 years old), and the findings cannot be generalized into the ages after 24 years of age. It is expected that the gender gap may become larger at some point after 24 years of age when women begin to experience greater trade-offs and tensions from work and family than men (see Mirowsky, 1996).

Research Questions 2: How Did the Average of Stressful Life Events Change from age 12 to age 24? Were There Any Gender Differences in the Developmental Trajectories of Stressful Life Events from Early Adolescence to Late Adolescence?

The trajectories of stress. It was hypothesized that stressful life events would increase from early adolescence to middle adolescence, and then decrease from middle adolescence to later adolescence. The results of the current study support this hypothesis. The trajectories of stressful life events are curvilinear across the whole adolescence period. The number of life events increases from age 12 to age 17, and then begins to decrease from age 17 to age 24, which is consistent with the findings of previous cross-sectional studies (Larson & Ham, 1993; Rudolph and Hammen, 1999). In the current literature, three studies have employed latent growth curve modeling to estimate the developmental trajectories of stress using longitudinal data (Ge et al. 1994; Seiffge-Krenke et al. 2009; Johnson et al., 2012). In the study of Ge et al. (1994), they used the number of major stressful life events and plotted a curvilinear pattern of mean level of stress against age at assessment from age 9 to age 20, which revealed a similar pattern with the findings of the current study. In the study of Seiffge-Krenke et al. (2009), they used stress perception from various domains including parents, peers, romantic relationships, self, future, and leisure. They found that the average levels of stress perception did not significantly change from age 12 to age 15 while the average levels of stress decreased significantly from 15 years of age to 19 years of age. Also, no significant individual differences were found in the changes of stress perception (the variances of the slope in age 12 to age 15 and the slope in age 16 to age 19 were not significantly larger than 0). The results are different from the findings of the current study. Johnson et al. (2012) also used stress

perception from family, peers and school, and they found that stress did not change significantly from age 9 to age 16 (the mean of linear slope was not significantly larger than 0), whereas there were significant individual differences within the changes (the variance of linear slope was significantly larger than 0). The differences in the findings between the current study and Seiffge-Krenke et al. (2009) and Johnson et al. (2012) may be due to the different operational definitions of stress. In the current study, the number of major stressful life events has been used like the study of Ge et al. (1994), while the other two studies used stress perception of everyday hassles. In future studies, major life events and stress perception can be both measured at multiple time points and the developmental trajectories of stressful life events and stress perceptions both can be estimated. More studies can help researchers understand the differences between the change patterns of the two stress constructs and measurement methods (major life events vs. day hassles; or the number of life events vs. stress perception).

Pubertal onset has been applied to understand the developmental increase in the number of stressful life events during adolescence compared to childhood (Ge et al., 2001). That is, the numbers of stressful life events start to increase at the beginning of puberty (early adolescence) and reach the peak after the pubertal transition (middle adolescence). Puberty and transition, from early adolescence to middle adolescence, are often associated with emotional upheaval, drive for identity and independence (AACPA, 2008), which might occur as a result of adolescents'

taking a more active role of their life while their parents do less monitoring during this period. Thus adolescents may actively engage in more risky behaviors than preadolescents, which can contribute to the occurrence of negative stressful life events. Research shows that adolescents experience more dependent negative life events, while preadolescents experience more independent negative life events (Rudolph & Hammen, 1999). In the current study, most of the items used in the index are dependent and self-generated negative events (i.e., two out of three are dependent events, e.g., suicide attempt resulting in injury, contracted a STD, and items related to violence, etc.) rather than fateful and independent events (independent events are fewer than one third, e.g., death of a parent, death of a spouse, and death of romantic partner, etc.). Therefore, it is understandable that the number of dependent stressful life events increases from early adolescence to middle adolescence due to the relatively more active role taken by adolescents in their own life compared to their preadolescent counterparts. Similar to the drop of depressive symptoms during late adolescence, the drop in the number of stressful life events might be also explained by the physical, psychological and environmental characteristics of adolescents during this period. Late adolescents are more mature in physical appearance, emotional and behavioral abilities than their younger counterparts. Thus, they may reduce those risk-taking behaviors at this age. Also, their parents and other adults treat them more like young adults and give them more independence compared to those younger adolescents, which may help reduce a considerable number of conflicts between

adolescents and their social environmental contexts. Therefore, the number of stressful life events begins to decrease during late adolescence or young adulthood.

Gender differences. Contrary to most previous findings that female adolescents report more stress than male adolescents (e.g., Ge et al., 1994; Shih et al., 2006; Jose & Ratcliffe, 2004; Hastings, Anderson, & Kelley, 1996; Lai, Hamid, & Chow, 1996), male adolescents reported a higher number of stressful life events than females across the whole age span of 12 years to 24 years in the current study. The explanation is that a considerable number of events used in the index of stressful life events are related to violent and risk-taking behaviors, e.g., “saw violence,” “shot/stabbed someone.” Male adolescents tend to engage in more risk-taking and violent behaviors than female adolescents (Byrbes, Miller, & Schafer, 1999; Turner & McClure, 2003). The descriptive analysis of the current study has also shown that male adolescents reported “yes” on more items of stressful life events than females. Thus, the index of stressful life events in the present study captures stressful events more common to male adolescents than female adolescents.

Research Questions 3: What was the Association between Stressful Life Events and Depressive Symptoms Over Time? Were There any Gender Differences in the Associations between Stressful Life Events and Depressive Symptoms from Age 12 to Age 24?

The longitudinal association between stress and depression. It was hypothesized that a higher initial number of stressful life events was positively

associated with higher initial levels of depressive symptoms. The findings of the current study support this hypothesis, which is consistent with the findings of Ge et al. (1994) and Johnson et al. (2012). It was unexpected that greater initial number of stressful life events predicted slower increase of depressive symptoms in the current study, although the finding is consistent with the results of Ge et al. (1994).

Johnson et al. (2012) found that a greater initial level of stress predicted slower decline in depressive symptoms over time in girls. Due to scant research in this field, the associations between initial levels of stress and the linear changes of depression need further investigation.

Gender differences. It was hypothesized that the associations between stressful life events and depressive symptoms over time would be stronger in female adolescents than in male adolescents. The findings of the current study support this hypothesis. The association between the initial number of stressful life events and the initial level of depressive symptoms is stronger in females than in males. The result supports the moderational-stress reactivity model (see Hankin et al. 2007). Given the same stressful life events, adolescent girls respond to stress with greater depression than boys, which is consistent with previous findings (Hankin et al. 2007; Shih et al 2006; Ge et al. 1994; Ge et al., 1996, Rudolph, 2002). The results are interesting that girls are still more reactive to stress in depression, even in the stress domains that are more common to boys. As suggested, boys and girls may display different forms of emotional distress after experiencing stress. Girls express distress in depressive

symptoms, whereas boys express their distress in distraction ways, e.g., alcohol or drug use (Zahn-Waxler, Crick, Shirliff, & Woods, 2006; Nolen-Hoeksema & Corte, 2003). Specifically, Girls often worry much about the stressors and tend to expect negative consequences much more frequently than boys, whereas boys tend to evaluate the stressful situation more optimistically and tackle the problems only when they are immediately present (Seiffge-Krenke, 1993). If the problem is not easily to be solved, boys tend to forget it with alcohol and drugs (Seiffge-Krenke, 1993). Thus, although boys significantly report a higher number of stressful life events, they have not exhibited higher levels of depressive symptoms than girls.

Research Questions 4: Did Problem-Solving Coping at Wave I, Emotion-Focused Coping, and Unhealthy Behavioral Coping at Wave II Mediate the Relationship between Stressful Life Events at Wave I and Depressive Symptoms at Wave III Simultaneously? Did any Gender Differences Show in the Above Mediating Relationships?

The mediating role of problem solving coping. It was hypothesized that problem solving coping at Wave I would not mediate the association between stressful life events at Wave I and later depressive symptoms at Wave III. The current study supports the hypothesis. Stressful life events have been found to not be a significant predictor of current use of problem solving coping, either in female or male adolescents, which is consistent with a cross-sectional study of an insignificant path between life stress and active coping (problem solving plus help-seeking) (Zhang

et al. 2012). As suggested, when youth perceive stressors controllable and as a challenge, they tend to use more approach or problem-focused coping; whereas when they perceive stressors as threat, loss, or being uncontrollable, they tend to use more avoidance or emotion-focused coping (Ebata & Moos, 1994; Compas et al. 1988). Most of stressful life events in this study are threat and loss, which can be viewed as uncontrollable. It may help explain why stressful life events could not significantly predict current problem solving coping.

In addition, consistent with previous studies (see Compas et al. 2001, for a review; Piko, 2001), greater use of problem solving coping significantly predicted lower levels of depressive symptoms, even five years later. No gender differences have been found in the relationship. Thus, for both boys and girls, higher levels of problem solving coping can reduce later depressive symptoms.

The mediating role of emotion-focused coping. It was hypothesized that emotion-focused coping at Wave II would mediate the association between stressful life events at Wave I and depressive symptoms at Wave III. The finding supports the hypothesis, and is consistent with previous studies that found negative coping strategies are partial mediators between negative stressful life events and psychological distress (Zhang, Wang, Xia, Liu, & Jung, 2012; Sandler et al. 1994; Dempsey, 2002; Goodkind et al., 2009). Adolescents with earlier greater number of stressful life events tend to report increased use of emotion-focused coping subsequently, and in turn higher use of emotion-focused coping increase later

depressive symptoms. Most of the previous studies employ cross-sectional data, thus the directionality of the associations among the three concepts could not be determined. The current study has used longitudinal data with three-time points, and emotion-focused coping as one of the mediators was measured at Time 2, which meets the definition of mediator. Therefore, the findings have a great contribution in the current literature.

The unique strength of the current study is that it has compared the mediating effects of coping across gender. The mediating effect of emotion-focused coping is stronger in female adolescents than in male adolescents. When youth are faced with stressful life events, female and male adolescents tend to both use higher levels of emotion-focused coping, and there were no gender differences in the association between stressful life events and depressive symptoms. However, the relationship between emotion-focused coping at Wave II and depressive symptoms at Wave III is stronger in female adolescents than in male adolescents. That is, compared to male adolescents, higher levels of emotion-focused coping result in much higher levels of depression in female adolescents. Thus emotion-focused coping is especially harmful to female adolescents. The finding partially supports the socialization theory (Pearlin & Schooler, 1978), that is, women's greater vulnerability to stressful life events-illness outcomes, such as depression, is a result of socialization processes. They have been socialized to rely on passive and emotion-focused coping strategies to

a greater extent than men in dealing with stress, which lead to increased depressive symptoms.

The mediating role of unhealthy behavioral coping. The current study is the first study to test unhealthy behavioral coping as a mediator between earlier stressful life events and later depressive symptoms. It was hypothesized that these coping strategies could mediate the association between stress and depression. However, the findings do not support the hypothesis. Although adolescents who report a greater number of stressful life events at Wave I tend to use more cigarettes, alcohol or other drugs at Wave II, unlike problem solving coping and emotion-focused coping, unhealthy behavioral coping has not been found to significantly predict depressive symptoms five years later. It may be due to the large time gap between the measurement of unhealthy behavioral coping and depression. Previous studies found that substance use can predict depression concurrently (Goodwin, 2006) and depression subsequently within one year (Escher et al., 2003), but they do not find the significant relationship between substance use and depression with more than one-year follow up (Galaif et al. 2003). Also, adolescents are more likely to engage in risk-taking behaviors like substance use. As age and cognitive social abilities increase, they may decrease such risk-taking behaviors. Thus, the measurement of unhealthy behavioral coping was measured not as stably as problem solving and emotion-focused coping, which may be another reason that no significant relationship has been found between unhealthy behavioral coping and depression five years later.

Finally, from the results of gender comparisons, female adolescents who use more cigarettes, alcohol, or other drugs are more likely to report higher level of depressive symptoms five years later, whereas male adolescents who use more drugs tend to report lower level of depression. Thus, the insignificant association in the analysis of the whole sample may be due to the opposite associations between unhealthy behavioral coping and later depression across gender.

In the current study, adolescents who reported a greater number of stressful life events tended to use more substances one year later, which is consistent with previous studies (e.g., Galaif et al., 2003). Substance use can be viewed as avoidance coping (Moos & Schaefer, 1993), and the finding of the study supports that avoidant coping strategies would be more used when stressors are perceived uncontrollable (Ebata & Moos, 1994). It also supports that stress can be an important trigger for substance use (Grzywacz & Almeida, 2008, Hoffman & Su, 1998). It is interesting that female adolescents are more likely to use unhealthy behaviors to cope than male adolescents after experiencing major stressful life events. It is contrary to the argument that boys tend to use more distraction tasks to cope like substance use (Hoffmann & Su, 1998; Compas et al. 1993; Seiffge-Krenke, 1993). It also needs to mention that no gender differences have been found in the rates of any substance use in the current study. It is consistent with previous studies that female and male adolescents have similar rates of substance use (see Schwinn, Schinke, & Trent, 2010; Vaccaro & Wills, 1998). Also, several studies have found that women are more likely

to drink to cope with stress compared to men (Rice & Van Arsdale, 2010; Finney & Moos, 2005). Thus the finding needs further investigation.

Research Question 5: Did Problem Solving Coping at Wave I, Emotion-Focused Coping, and Unhealthy Behavioral Coping at Wave II Moderate the Relationship between Stressful Life Events at Wave I and Depressive Symptoms at Wave III? Were There Any Gender Differences in the Above Moderating Relationships?

The moderating role of problem solving coping. It was hypothesized that problem solving coping at Wave I would moderate the association between stressful life events at Wave I and depressive symptoms at Wave III. The finding of the current study does not support the hypothesis, either from the analysis of the whole sample or from gender comparisons. It is inconsistent with the findings of some previous studies (e.g., Ng & Hurry, 2010), while it is consistent with those of others (e.g., Davila et al., 1995; Zhang et al., 2012). Different findings may be due to different methods of stress and coping measurement across studies.

The moderating role of emotion-focused coping. It was hypothesized that emotion-focused coping at Wave II would magnify the effect of stressful life events at Wave I on depressive symptoms at Wave III. The present analysis does not support this hypothesis. It is consistent with previous findings of testing coping as a moderator between stress and anxiety/depression (e.g., Wadsworth & Compas, 2002; Wadsworth et al., 2005).

The moderating role of unhealthy behavioral coping. It was hypothesized that unhealthy behavioral coping at Wave II would magnify the effect of stressful life events at Wave I on depressive symptoms at Wave III. However, it was unexpected that higher use of unhealthy behavioral coping could alleviate the effect of earlier stress on five-year later depressive symptoms both in males and females. Female adolescents who reported higher use of substances tended to report higher levels of depression, but their depressive symptoms increased slower as the number of stressful life events increased compared to those who reported average and lower levels of substance use. In contrast, male adolescents who reported higher use of substances tended to report lower levels of depression, and their depressive symptoms also increased slower as the number of stressful life events increased compared to those who reported average and lower levels of substance use. Therefore the findings of the current study indicate that male adolescents are not more likely to use alcohol and drugs to cope with stress than females, but the impacts of drugs on emotional distress are not as large as those on females. The reason may be that girls may use substances to cope with the stresses of life while boys may use substances for sensation-seeking. One study found that women with both substance abuse disorders and anxiety disorders had lower sensation-seeking profiles than those with substance abuse alone, but the hypothesis was not supported in men (Scourfield, Stevens, & Merikangas, 1996). Future studies can test the hypothesis in population-based adolescents.

In addition, it is suggested that if substance use can ameliorate the adverse effect of stress on psychological distress, it should suppress the immediate effect of stress on depressive symptoms (Jackson et al. 2010), while in the long run, it will increase depressive symptoms. However, in the current study, the protective effect of unhealthy behavioral coping has been found in five years later both in males and females, although the effect is small. The finding needs investigation in future studies.

Limitations and Future Directions

There are some limitations in the present study. First, the developmental trajectories of depressive symptoms and stressful life events were identified from age 12 to age 24 using the longitudinal data with three time points. Although the data have been reconstructed into thirteen data points, a considerable number of missing values existed. In future research, depressive symptoms and stressful life events can be measured each year from early adolescence to late adolescence. The new measurement with more time points can help researchers understand the development of depression and stress more clearly during the whole adolescence period.

Second, latent growth models showed that there were significant individual variations at the initial levels and the linear changes of depression. It suggests that depressive symptoms of some adolescents increase from early adolescence, while others' may decrease. The studies of estimating developmental trajectories do not distinguish the subgroups of individuals who may have distinct longitudinal courses of depressive symptoms (Nagin, 1999). In future studies, researchers can identify

subgroups with distinct longitudinal profiles of depressive symptoms using a semi-parametric growth-mixture modeling method (Nagin, 1999). This may help identify possible different causes and consequences for adolescents with different development of depression over time (Dekker et al., 2007).

Third, two-construct parallel processes latent growth curve modeling has been conducted using TYPE=COMPLEX combined with CLUSTER and WEIGHT. The robust chi-square test statistic could not be computed, and model fit indices like CFI, RMSEA, and SRMR could not be attained and reported. Thus it is difficult to know whether the acquired models are adequate or not. Further effort is needed to find a more appropriate method to solve the problem.

Fourth, the conceptual model of Grant et al. (2003) indicates that the relationship between stress and depression is reciprocal, while the author only tested the directional relationship (i.e., stress \rightarrow depression) in the current study. It is because the data only have three actual time points. If researchers plan to test dynamic and reciprocal relationships between stress and association from age 12 to age 24, the data should have thirteen actual time points (see the ideal reciprocal model in Figure 22). Given the data used in the current study, researchers can divide the data into three age groups, i.e., early, middle, and late adolescence, and test dynamic and reciprocal relationships between stress and depression from early adolescence to middle adolescence or from middle adolescence to late adolescence in future studies (see the actual reciprocal model in Figure 22).

Fifth, the internal consistency scores are low for coping measures, especially for emotion-focused coping and unhealthy behavioral coping, which is due to non-unidimensional items in the measures. In future analyses, the two variables can be used as latent constructs in the models, which can consider the impact of measurement errors and increase statistical power. Also, problem solving coping and emotion-focused coping only have 3 to 4 items, which may not capture all the characteristics of the two ways of coping. The Add Health data are the existing data and have already been collected, thus some comprehensive coping measures can be used in future studies.

Sixth, in the present analysis, the negative effects of an accumulation of stressful life events have been examined. It is assumed that the cumulative nature of multiple stressors overwhelms individuals and adversely influences their emotional well-being, while the characteristics of given events were not considered (Tausig, 1982). However, the approach may obscure which types of events are particularly associated with changes in emotional distress (Kessler & Magee, 1994). An alternative approach is to disaggregate stressful life events, which is able to test the differential effects of life events with distinctive characteristics (Paykel, 1979). Also, each stressful life event may have various severities of impacts on individuals' well-being. For example, being shot/stabbed may be more stressful than skipping necessary medical care. Unlike the simple sum questionnaire responses used in the current study, item response theory (IRT) does not assume that each item is equally

difficult (Hambleton, Swaminathan, & Rogers, 1991). In future studies, researchers may use IRT to determine the differential effects of these stressful life events.

Seven, in the mediation and moderation analyses, the effect of age has not been considered, although the finding in the latent growth curve modeling indicates that age has an impact on stressful life events and depressive symptoms. Future analysis should include age effect in the model.

Finally, only gender differences have been tested in the associations between stressful life events, coping and depression over time. Racial/ethnicity differences have become special interest of the field (e.g., Adkins et al. 2009; Bordman & Alexander; 2011; Brown et al. 2007). Future research may investigate the impacts of gender, racial/ethnicity differences and their interactions.

Despite these limitations, the current study has identified developmental trajectories of depressive symptoms and stressful life events from early adolescence to middle and until late adolescence. It is one of the few existing studies that have investigated the change patterns of the two constructs, especially for the change patterns of stressful life events. Also, the present study is one of the few studies to test the longitudinal associations between stress and depression, and only two other studies have done so (Ge et al., 1994; Johnson et al., 2012). Most significantly, this is the first study to test gender differences in the mediating and moderating roles of coping on the association between earlier stress and later depression using longitudinal data. In addition, three different coping strategies have been tested as

mediators/moderators simultaneously within one single mediation model and one single moderation model. Therefore, the current study has contributions to the current literature both theoretically and methodologically.

Implications

The current study has identified the developmental trajectories of depressive symptoms and stressful life events from early adolescence through middle adolescence to late adolescence. The results indicate that average of depressive symptoms and stressful life events both reach peak from early adolescence to middle adolescence. Thus it suggests that adolescents at this age period are at increased risk of developing problems with depression. Practitioners can pay relatively greater attention to this population and develop specific prevention or intervention programs for youth at this age. Also, male adolescents reported persistently greater number of risk-taking stressful life events than females. Practitioners can help adolescents recognize the characteristics of physical, psychological and their interactions with social context during this age period, and help them reduce risk-taking behaviors, especially in males. In addition, girls reported higher levels of depressive symptoms than boys across the whole adolescence period, thus practitioners at school can design and deliver prevention programs for girls starting in 6th grade. Earlier education and prevention may help girls reduce or prevent the increase of depressed feelings through later period of adolescence.

From the mediation analysis, only emotion-focused coping has been found as a significant mediator between earlier stress and later depression. Earlier stress increases subsequent use of emotion-focused coping strategies, and then the latter increases later depressed problems. However, not all emotion-focused coping strategies are related to psychological maladjustment. Researchers find that emotion processing and emotion expression are associated with positive adjustment in certain stress situations, especially for women (Stanton, Kirk, Danoff-Burg, & Cameron, 2000; Stanton et al., 2000; Stanton, Danoff-Burg, Cameron, Ellis, 1994). Emotions are constantly present in our lives, and higher levels of emotional awareness can help us better understand ourselves and others, communicate more clearly with others, and then build more healthy and rewarding relationships (Segal, Smith, & Robinson, 2013). Also, emotional awareness is an effective coping skill to help individuals get motivated and make wise decisions (Segal, Smith, & Robinson, 2013). Likewise, emotion expression is good for personal well-being when he expresses feelings to someone who cares about his welfare (Clark & Finkel, 2004). Thus, prevention and intervention programs can be designed to teach youth about the adverse effects of negative emotion-focused coping strategies, such as emotion release and avoidance, and teach adolescents how to regulate emotions effectively. At the same time, parents, family life or school educators, and mental health practitioners, should also train youth how to recognize their moment to moment emotional experience and increase

the levels of emotional awareness, and then teach adolescents the clear and constructive ways of emotion expression.

In addition, the current study found that negative emotion-focused coping strategies were especially harmful for girls. Parents and teachers have sex-differentiated socialization practices for boys and girls in both obvious and subtle ways, e.g., clothes' color, toys choices, play activities, emotion expression, and expectations of achievements in subjects. Take as an example of emotion expression. Parents convey sex-differential attention to boys' and girls' expressions and then subtly encourage certain emotion expressions while discourage others (Fivush & Buckner, 2000). Researchers find that parents attend more to girls' sadness and anxiety than to boys', and attend more to boys' anger than to girls' (Chaplin, Cole, & Zahn-Waxler, 2005). Such gender socialization by parents is the foundation of later self-socialization (Maccoby & Jacklin, 1978). Thus, girls are socialized to focus more on their emotional distress than boys, while boys are often discouraged to express vulnerable emotions like sadness and fear (Eisenberg et al., 1999). The sex-differentiated socialization practices partly explain gender differences in child and adolescent psychopathology (Cole, Teri, & Zahn-Waxler, 2003). Therefore, parents, family life or school educators, and mental health practitioners, can educate boys and girls about gender differences in emotion awareness and expressions, and train them the ways of identifying different emotions and expressing at an appropriate level. For example, girls can be taught how they are socialized to cope relying more on

emotions than boys, while excessive emotion-based coping may have a harmful impact on their functioning. By contrast, boys can be taught how they are discouraged to display of their vulnerable emotions, and which make them block their true feelings. Such emotion denial or avoidance may cause behavioral and relationship problems and have negative influences on boys' overall well-being.

As expected, the finding of the current study supports that cognitive problem solving coping strategies are more adaptive than emotion-focused copings. Cognitive problem solving coping is a mental ability of identifying the problem, generating possible solutions, selecting the solution, and evaluating the consequences (Lazarus & Folkman, 1984). During the process of dealing with problems, problem solving skills include the ability of managing emotions. Benefits of such coping strategies are obvious. They can help solve problems, and then reduce a person's emotional distress. Also, emotion management can prevent a person act irrationally. In contrast to cognitive problem solving coping, emotion-based coping may have a harmful influence on a person's judgment of the problem, his coping ability, possible solutions, or consequences. A person may act irrationally under strong emotions, and then make his problems or situations worse. Cognitive problem solving coping skills are acquired abilities and trainable. Thus, parents, family life or school educators, and mental health practitioners can train youth problem solving coping skills in their various life domains, e.g., family, peer, school, jobs, and communities.

Finally, substance use appears to have different impacts on boys and girls. Substance use tends to relieve boys' depressed problems, while it tends to increase girls' emotional distress. It may be due to different motivations for substance use across gender. For example, girls may use substances to cope, but boys may use substances for sensation-seeking. Therefore, practitioners should design different prevention and intervention programs for substance use for boys and girls.

Conclusions

In sum, the findings in the current study support that adolescence is an important period of examining stress, coping, depression and their dynamic associations as well. Depressive symptoms and the number of stressful life events both reach peak by the end of middle adolescence, which can be one of the grounds for policymakers to implement prevention and intervention programs targeted youth at this age. Also, the study is one of the few studies which examine the associations among random growth factors between stress and depression, although the field needs further investigation. The current study provides certain important implications for future research. Furthermore, emotion-focused coping strategies serve as one of the mediating mechanisms between stress and depression, and the finding can help educators and practitioners design coping training programs. Finally, the finding of substance use reducing the adverse effect of stress on depression is unexpected and interesting, which also needs further investigation.

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Tables

Table 1 Sample Characteristics (N=3844).

	%	Range	M (SD)
Not considering Cluster and Weight			
Gender			
Girls	54.0		
Ethnic-racial group			
White	68.0		
African American	23.5		
Hispanics	10.9		
American Indian	4.0		
Asian American	4.0		
Others	6.1		
Considering Cluster and Weight			
Gender			
Girls	49.4		
Ethnic-racial group			
White	74.9		
African American	16.2		
Hispanics	11.8		
American Indian	3.9		
Asian American	3.4		
Others	6.5		
Age			
Wave I		11-21	15.03 (1.62)
Wave II		13-21	15.95 (1.62)
Wave III		18-27	21.40 (1.63)

Table 2 Means and Standard Deviations of SLE and CES-D by Wave

Variables	<u>Total</u>		<u>Female</u>		<u>Male</u>		F(1,131)
	Mean	SD	Mean	SD	Mean	SD	
SLE-I	1.71	1.94	1.44	1.72	1.98	2.05	66.13*
SLE-II	1.64	1.98	1.44	1.79	1.83	2.09	21.84*
SLE-III	1.23	1.49	1.14	1.43	1.32	1.52	7.78*
CES-D-I	5.52	4.11	6.22	4.60	4.83	3.51	95.43*
CES-D-II	5.60	4.23	6.38	4.79	4.83	3.53	135.54*
CES-D-III	4.53	4.06	5.03	4.61	4.03	3.44	38.88*

Note: * $p < .05$. SLE, stressful life events; CES-D, depressive symptoms. F value is the adjusted Wald test statistics using the test command in Stata.

Table 3 CES-D and SLE Means and Standard Deviations by Age

CES-D							
Age	Total		Female		Male		F(1,131)
	Mean	SD	Mean	SD	Mean	SD	
12	4.83	4.40	5.29	5.08	4.20	3.40	1.31
13	4.53	3.63	4.88	4.18	4.16	3.00	4.13*
14	4.95	3.85	5.62	4.44	4.25	3.10	46.59*
15	5.88	4.33	6.84	4.84	4.90	3.58	61.72*
16	5.83	4.22	6.77	4.72	4.90	3.51	58.88*
17	5.96	4.26	6.83	4.70	5.13	3.66	43.99*
18	5.72	4.28	6.26	4.60	5.24	3.95	11.60*
19	4.81	4.16	5.18	4.84	4.46	3.48	6.48*
20	4.79	4.08	5.50	4.73	4.06	3.26	9.97*
21	4.61	4.06	4.93	4.68	4.30	3.44	4.00*
22	4.48	4.15	4.96	4.56	4.01	3.68	6.80*
23	4.27	4.09	4.67	4.53	3.90	3.64	4.78*
24	4.83	4.12	5.49	4.64	4.38	3.69	2.66
SLE							
Age	Total		Female		Male		F(1,131)
	Mean	SD	Mean	SD	Mean	SD	
12	0.92	1.34	0.67	0.89	1.26	1.61	3.77
13	1.15	1.45	0.86	1.31	1.47	1.49	25.53*
14	1.39	1.74	1.27	1.79	1.51	1.68	3.77
15	1.73	1.94	1.60	1.81	1.86	2.02	5.75*
16	1.85	2.08	1.62	1.83	2.08	2.22	14.29*
17	1.94	2.09	1.67	1.74	2.19	2.31	17.05*
18	1.75	1.96	1.41	1.73	2.06	2.08	29.97*
19	1.42	1.87	1.13	1.54	1.68	2.04	14.04*
20	1.29	1.57	1.22	1.46	1.36	1.65	1.01
21	1.38	1.56	1.22	1.47	1.54	1.60	5.38*
22	1.22	1.52	1.14	1.43	1.31	1.58	2.09
23	1.11	1.38	1.06	1.33	1.15	1.41	0.53
24	1.26	1.36	1.19	1.41	1.30	1.32	0.40

Note: * $p < .05$. SLE, stressful life events; CES-D, depressive symptoms. F value is the adjusted Wald test statistics using the test command in Stata.

Table 4 Means and Standard Deviations of Coping

Variables	<u>Total</u>		<u>Female</u>		<u>Male</u>		F(1,131)
	Mean	SD	Mean	SD	Mean	SD	
PCOP-I	15.09	2.57	15.00	2.64	15.17	2.49	2.93
ECOP-II	9.90	2.27	9.93	2.39	9.87	2.15	0.45
UCOP-II							
Smoking	5.37	10.50	5.48	11.10	5.26	9.90	0.28
Drinking	2.06	2.44	2.12	2.62	2.01	2.74	1.25
Marijuana	1.97	15.71	1.17	5.54	2.74	10.01	4.34*
Cocaine	0.05	0.85	0.05	0.97	0.04	0.72	0.13
Inhalants	0.02	0.26	0.02	0.29	0.01	0.24	0.96
Others	0.17	1.78	0.17	1.88	0.17	1.67	0.01
Zucop	0.10	3.28	0.09	3.21	0.11	3.31	0.02

Note: * $p < .05$. PCOP, problem solving coping; ECOP, emotion-focused coping;

UCOP, unhealthy behavioral coping; Zucop, the sum of score of standardized

unhealthy behavioral coping strategies.

Table 5 Percentages of “Yes” in each unhealthy behavioral coping (%)

	Smoking	Drinking	Marijuana	Cocaine	Inhalants	Others
Female	16.81	22.14	6.90	0.51	0.53	1.57
Male	16.81	23.23	7.62	0.66	0.33	1.58
F(1,131)	0.12	0.34	0.70	0.56	1.66	0.01
Total	33.62	45.37	14.51	1.17	0.87	3.15

Note: * $p < .05$. Four cell percentages were reported in the output, gender (female vs. male) by unhealthy behaviors (No vs. Yes). The percentages in the two cells with unhealthy behaviors coded as “0=No” were not reported in the above table.

Table 6 Percentages of Each SLE Happened (%)

SLE	Wave I (1995)			F (1, 131)
	Total	Female	Male	
Death of a parent	0.53	0.26	0.27	0.004
Suicide attempt	0.90	0.76	0.14	15.75*
resulting in injury				
Friend committed	2.84	1.61	1.23	1.43
suicide				
Relative committed	0.92	0.62	0.30	4.93*
suicide				
Saw violence	10.81	4.28	6.53	16.11*
Threatened by a knife	11.37	3.21	8.16	45.53*
or gun				
Was shot	1.19	0.23	0.96	19.34*
Was stabbed	4.77	1.23	3.54	39.38*
Was jumped	11.13	2.61	8.51	118.22*
Threatened someone	4.33	1.11	3.22	26.78*
with a knife or gun				
Shot/stabbed someone	1.58	0.33	1.26	14.47*
Was injured in a	8.39	2.45	5.93	59.23*
physical fight				
Hurt someone in a	18.14	5.15	12.99	128.71*
physical fight				
Unwanted pregnancy	0.10	0.10	0	4.03*
Abortion, still birth or	0.12	0.12	0	5.15*
miscarriage				
Had a child adopted	0	0	0	NA
Death of a child	0	0	0	NA
Romantic relationship	30.35	15.33	15.02	0.48
ended				
Had sex for money	0.32	0.06	0.26	4.18*
Contracted a STD	0.94	0.71	0.22	8.17*
Skipped necessary	17.70	9.09	8.61	0.85
medical care				
Juvenile conviction	0.39	0.07	0.32	4.08*
Adult conviction	0.06	0	0.06	2.00
Served time in jail	0	0	0	NA
Was expelled from	1.92	0.66	1.25	3.82
school				
Suffered a serious	13.66	4.94	8.72	36.98*
injury				
Father received welfare	1.76	0.84	0.92	0.07
Mother received	8.98	4.24	4.74	0.55
welfare				

Was raped	3.35	3.35	0	93.73*
Ran away from home	7.61	4.01	3.60	0.63
Non-romantic sexual relationship ended	2.66	1.18	1.48	1.12
Suffered verbal abuse in a romantic relationship	3.61	1.89	1.72	0.34
Suffered physical abuse in a romantic relationship	1.63	0.94	0.70	1.55
Suffered verbal abuse in a non-romantic relationship	0.12	0.04	0.07	0.22
Suffered physical abuse in a non-romantic relationship	0.09	0.03	0.06	0.42
<u>Wave I (1996)</u>				
SLE	Total	Female	Male	F (1, 131)
Death of a parent	0.08	0.04	0.04	0.004
Suicide attempt resulting in injury	0.69	0.39	0.30	0.46
Friend committed suicide	3.10	1.79	1.31	3.49
Relative committed suicide	0.90	0.57	0.33	1.66
Saw violence	7.88	2.92	4.96	19.97*
Threatened by a knife or gun	9.69	2.16	7.53	87.86*
Was shot	1.08	0.18	0.91	13.68*
Was stabbed	3.68	0.88	2.80	37.58*
Was jumped	8.16	1.77	6.39	96.44*
Threatened someone with a knife or gun	4.48	1.09	3.38	35.46*
Shot/stabbed someone	1.62	0.31	1.31	29.43*
Was injured in a physical fight	3.82	1.59	2.23	3.91
Hurt someone in a physical fight	7.59	1.83	5.76	75.03*
Unwanted pregnancy	1.27	1.27	0	37.15*
Abortion, still birth or miscarriage	0.74	0.74	0	26.42*
Had a child adopted	0	0	0	NA
Death of a child	0	0	0	NA
Romantic relationship	31.20	15.58	15.63	0.16

ended				
Had sex for money	2.62	1.04	1.58	3.76
Contracted a STD	2.34	1.65	0.69	12.70*
Skipped necessary medical care	19.10	9.96	9.14	1.80
Juvenile conviction	0.46	0.06	0.4	7.63*
Adult conviction	0.19	0.02	0.17	3.81
Served time in jail	0.10	0	0.10	1.66
Was expelled from school	1.97	0.65	1.32	6.74*
Suffered a serious injury	14.24	5.74	8.50	18.14*
Father received welfare	2.29	0.81	1.48	4.89*
Mother received welfare	7.37	3.14	4.24	3.73
Was raped	1.15	1.15	0	29.18*
Ran away from home	6.02	3.83	2.19	14.68*
Non-romantic sexual relationship ended	3.58	1.44	2.14	6.25*
Suffered verbal abuse in a romantic relationship	12.35	6.59	5.76	1.95
Suffered physical abuse in a romantic relationship	5.80	3.13	2.68	1.48
Suffered verbal abuse in a non-romantic relationship	0.96	0.35	0.61	1.38
Suffered physical abuse in a non-romantic relationship	0.50	0.18	0.32	1.44
<u>Wave I (2001)</u>				
SLE	Total	Female	Male	F (1, 131)
Death of a parent	0.86	0.53	0.33	1.59
Suicide attempt resulting in injury	0.53	0.31	0.22	0.58
Friend committed suicide	2.88	1.31	1.57	0.56
Relative committed suicide	0.69	0.40	0.29	0.66
Saw violence	5.51	1.30	4.21	61.94*
Threatened by a knife or gun	6.70	1.42	5.28	64.61*
Was shot	0.50	0.05	0.45	13.75*

Was stabbed	1.11	0.30	0.81	6.84*
Was jumped	3.33	1.00	2.34	12.43*
Threatened someone with a knife or gun	1.28	0.22	1.06	16.24*
Shot/stabbed someone	0.39	0.11	0.29	2.68
Was injured in a physical fight	4.18	1.03	3.14	31.85*
Hurt someone in a physical fight	6.88	0.90	5.97	119.80*
Unwanted pregnancy	1.50	0.78	0.72	0.11
Abortion, still birth or miscarriage	3.20	1.94	1.26	5.40*
Had a child adopted	0	0	0	NA
Death of a child	0.03	0.03	0	1.65
Romantic relationship ended	10.91	5.38	5.53	0.06
Had sex for money	1.26	0.49	0.77	2.19
Contracted a STD	7.95	5.82	2.13	52.54*
Skipped necessary medical care	21.86	10.47	11.40	0.82
Juvenile conviction	0	0	0	NA
Adult conviction	1.61	0.22	1.39	31.66*
Served time in jail	0.25	0.04	0.21	2.94
Evicted from residence, cutoff service	18.59	9.22	9.37	0.01
Entered full-time active military duty	1.79	0.17	1.62	39.89*
Discharged from the armed force	0.83	0.17	0.66	9.64*
Cohabitation dissolution	9.76	5.32	4.45	3.19
Received welfare	7.71	6.29	1.43	105.47*
Involuntarily dropped from welfare	1.44	1.12	0.32	9.10*
Marriage dissolution	0.74	0.45	0.29	1.89
Baby had major health problems at birth	0.55	0.37	0.18	2.04
Death of a romantic partner	0.07	0.06	0.01	2.19
Death of a spouse	0.09	0.09	0	3.64

Note: * $p < .05$. Four cell percentages were reported in the output, gender (female vs. male) by SLE (Not happened vs. Happened). The percentages in the two cells with SLE coded as "0=No" were not reported in the above table.

Table 7 Correlation Matrix

	SLE-I	CES-D- III	PCOP-I	ECOP-II
SLE-I				
CES-D-Wave III	.16*			
PCOP-I	-.04*	-.04*		
ECOP-II	.11*	.16*	.01	
ZUCOP-II	.26*	.06*	-.08*	.03

Note: * $p < .05$. SLE, stressful life events; CES-D, depressive symptoms; PCOP, problem solving coping; ECOP, emotion-focused coping; ZUCOP, the sum of each standardized unhealthy behavior coping

Table 8 Parameter Estimates of Latent Growth Curve Models of CES-D and SLE

Parameter	<u>CES-D</u>		<u>SLE</u>	
	Model 1	Model 2	Model 3	Model 4
Intercept(α)	5.29*	5.24*	1.44*	1.43*
Linear slope(β)	0.21*	0.23*	0.11*	0.11*
Quadratic slope(β^2)	-0.03*	-0.03*	-0.01*	-0.01*
Gender				
(female=0) $\rightarrow\alpha$		-1.77*		0.31*
Gender $\rightarrow\beta$		0.09*		N/A
Gender $\rightarrow\beta^2$		N/A		N/A
<u>Variances</u>				
Variance (α)	12.99*	12.23*	0.99*	0.94*
Variance (β)	0.10*	0.10*	0.01	0.01
Variance (β^2)	0.00	0.00	0.00	0.00
<u>Model Fit Indices</u>				
Chi-Square	179.61	211.96	234.82	264.21
df	157	181	168	194
p-value	>.05	>.05	<.05	<.05
CFI	.99	.99	.96	.96
RMSEA	.01	.01	.01	.01
SRMR				
Within-level	.18	.17	.22	.21
Between-level	.25	.27	.31	.31

Note: * $p < .05$. SLE, stressful life events; CES-D, depressive symptoms

Table 9 Parameter Estimates of a Two Construct Process Growth Model between
CES-D and SLE

Parameter	Model 1	Model 2
Intercept(α_2)	5.26*	3.62*
Linear slope(β_2)	0.29*	-0.05
Quadratic slope(β_2^2)	-0.03*	-0.02*
α_1 with α_2	2.08*	N/A
$\alpha_1 \rightarrow \alpha_2$	N/A	2.67*
$\alpha_1 \rightarrow \beta_2$	-.06*	-0.09*
Gender (female=0) $\rightarrow \alpha_2$		-0.21
Gender $\rightarrow \beta_2$		0.02
Gender* $\alpha_1 \rightarrow \alpha_2$		-1.55*
Gender* $\alpha_1 \rightarrow \beta_2$		0.07
<u>Variances</u>		
Variance (α_2)	8.70*	7.56*
Variance (β_2)	0.01	0.11*
Variance (β_2^2)	N/A	N/A
<u>Model Fit Indices</u>		
Loglikelihood	-53671.496	-53418.720
df	13	18
AIC	107368.99	106873.440
BIC	107450.30	106986.012

Note: * $p < .05$. SLE, stressful life events; CES-D, depressive symptom

Table 10 The Processes of Mediation Model Comparisons across Gender

	χ^2	df	Scaling correctio n factor	CFI	RMSEA	SRMR	F	p
Baseline Model (all paths were estimated free)	21.310	6	1.346	.957	.04	.02		
Fix SLE-I to CES-D-III Equal	24.018	7	1.349	.952	.04	.02	2.72	.10
Fix SLE-I to PCOP-I Equal	23.354	8	1.401	.956	.03	.02	0.18	.67
Fix SLE-I to ECOP-II Equal	25.995	9	1.379	.952	.04	.02	2.60	.11
Fix SLE-I to ZUCOP-II Equal	33.172	10	1.794	.934	.04	.03	4.28*	.04
Fix PCOP-I to CES-D-III Equal	28.019	10	1.398	.949	.03	.02	2.12	.15
Fix ECOP-II to CES-D-III Equal	34.954	11	1.386	.932	.03	.03	7.33*	.01
Fix ZUCOP-II to CES-D-III Equal	38.322	11	1.293	.923	.04	.03	42.72*	6.33E-1 1

Note. * $p < .05$. SLE, stressful life events; CES-D, depressive symptom; PCOP, problem solving coping; ECOP, emotion-focused coping; ZUCOP; the sum of score of each standardized unhealthy behavioral coping.

Table 11 The Processes of Moderation Model Comparisons across Gender

	χ^2	df	Scaling correction factor	CFI	RMSEA	SRMR	F	p
Baseline model (all paths were estimated free)	0	0	1	1	0	0		
Fix SLE-I to CES-D-III Equal	2.156	1	1.433	.993	.025	.004	2.16	.14
Fix PCOP-I to CES-D-III Equal	3.908	2	1.535	.989	.022	.006	1.78	.18
Fix ZUCOP-II to CES-D-III Equal	8.889	3	1.299	.965	.032	.008	6.71*	.01
Fix ECOP-II to CES-D-III Equal	11.92	3	1.396	.947	.039	.01	9.52*	.002
Fix PCOP-I* SLE-I to CES-D-III Equal	4.127	3	1.566	.993	.014	.006	0.29	.59
Fix ECOP-II* SLE-I to CES-D-III Equal	4.447	4	1.508	.997	.008	.006	0.18	.67
Fix ZUCOP-II* SLE-I to CES-D-III Equal	5.813	5	1.267	.995	.009	.007	2.17	.14

Note. * $p < .05$. SLE, stressful life events; CES-D, depressive symptom; PCOP, problem solving coping; ECOP, emotion-focused coping; ZUCOP; the sum of score of each standardized unhealthy behavioral coping.

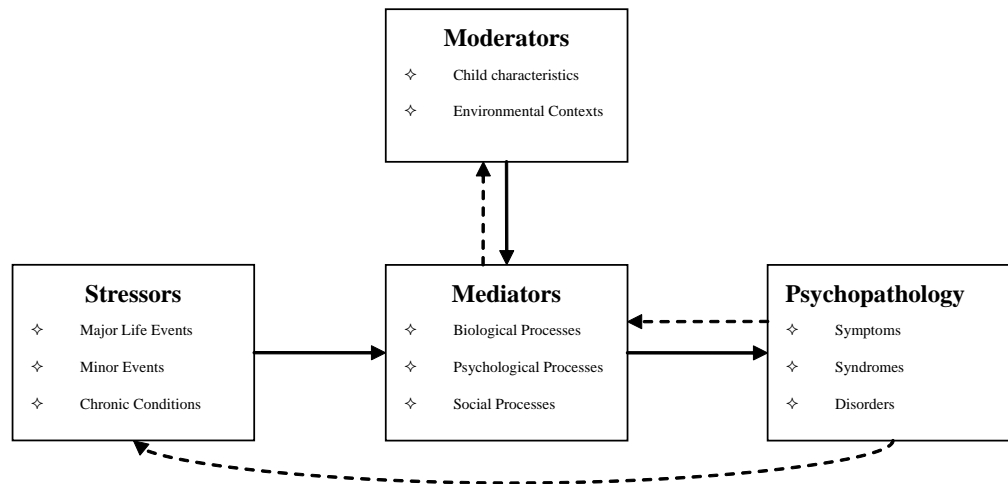


Figure 1. General conceptual model of the role of stressors in the etiology of child and adolescent psychopathology (Grant et al., 2003, p.452)

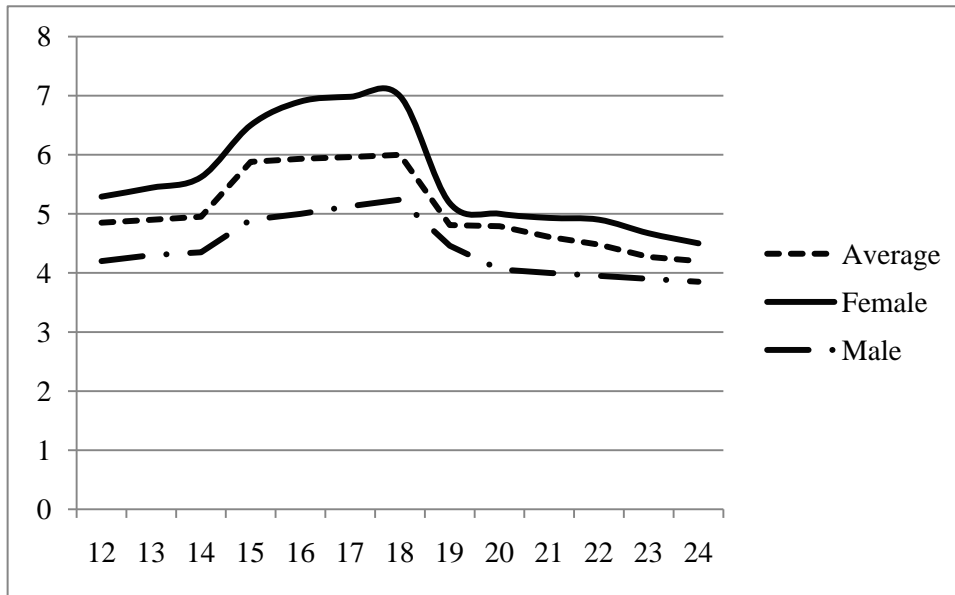


Figure 2. Proposed the changing patterns of depressive symptoms

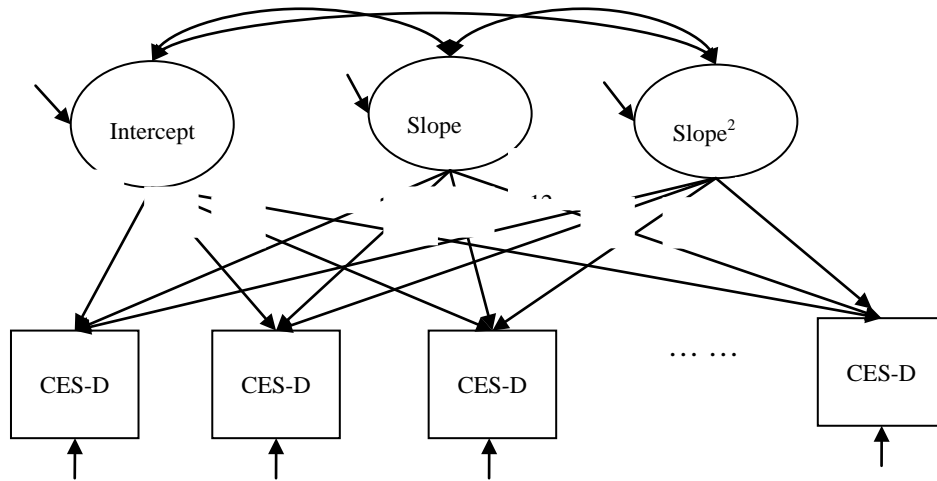


Figure 3. Proposed latent growth curve model for depression.

CES-D= Depressive Symptom

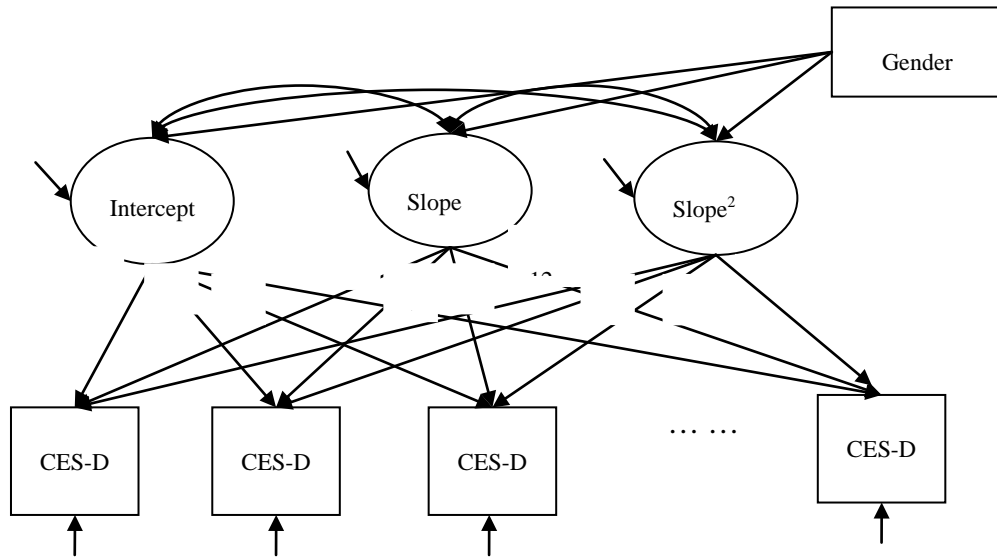


Figure 4. Proposed latent growth curve model for depression with gender as a predictor to growth factors.

CES-D=Depressive Symptom

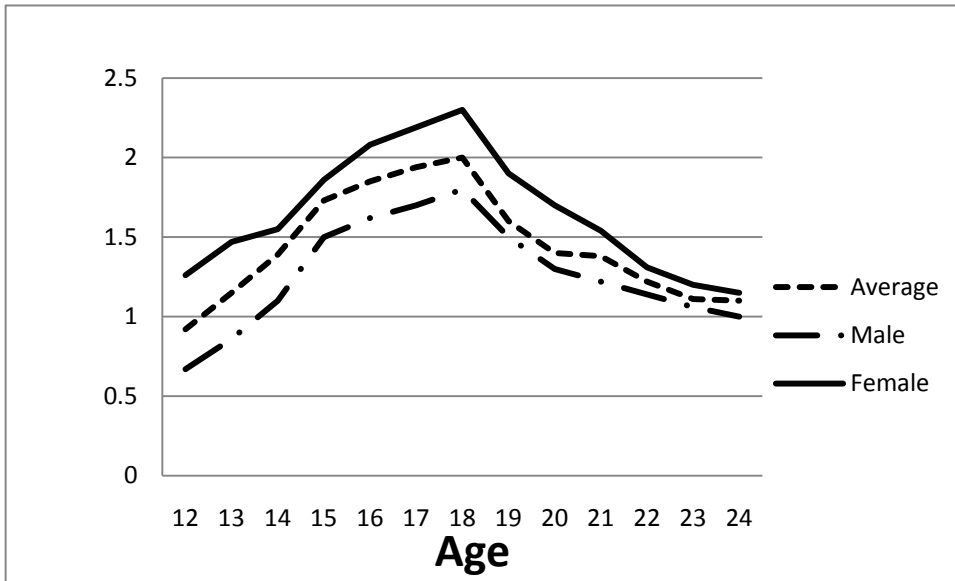


Figure 5. Proposed the changing patterns of stressful life events

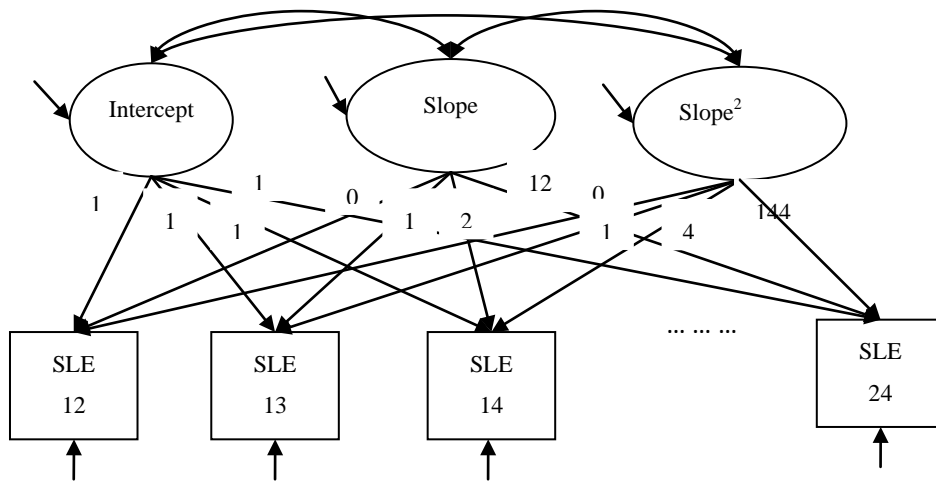


Figure 6. Proposed latent growth curve model for stressful life events.

SLE=Stressful Life Events

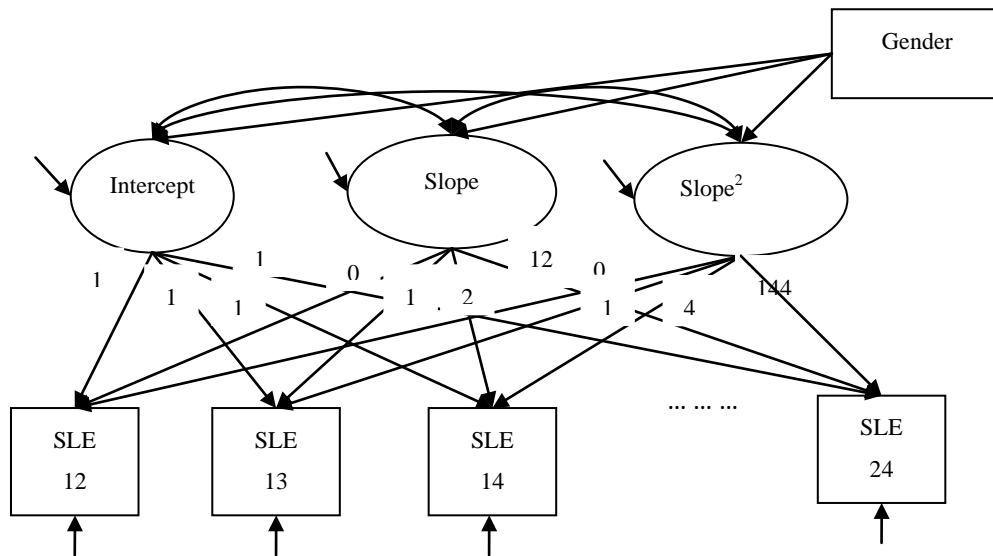


Figure 7. Proposed latent growth curve model for stressful life events with gender as a predictor to growth factors.

SLE= Stressful Life Events

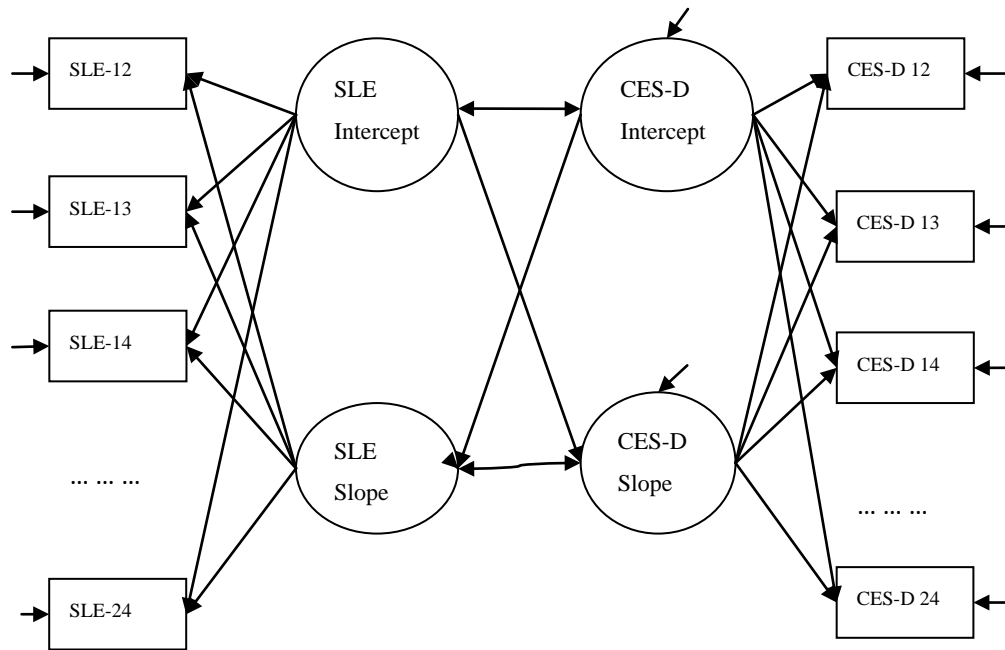


Figure 8. Proposed two construct process latent growth curve model between stressful life events and depressive symptoms.

SLE=Stressful Life Events CES-D=Depressive symptoms

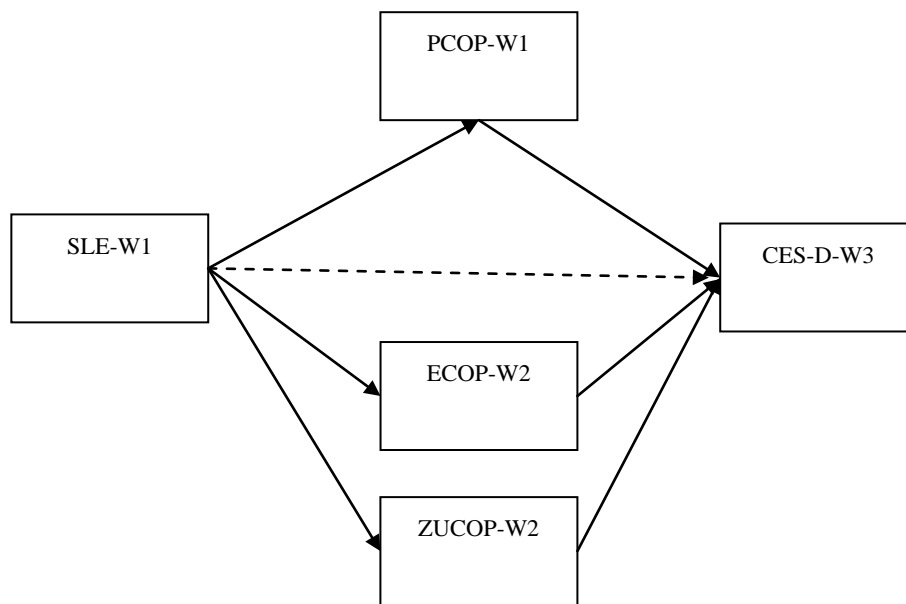


Figure 9. Proposed mediation model

SLE=Stressful Life Events, PCOP=Problem solving coping,
ECOP=Emotion-focused coping, ZUCOP=Standardized unhealthy behavioral coping,
CES-D=Depressive Symptom

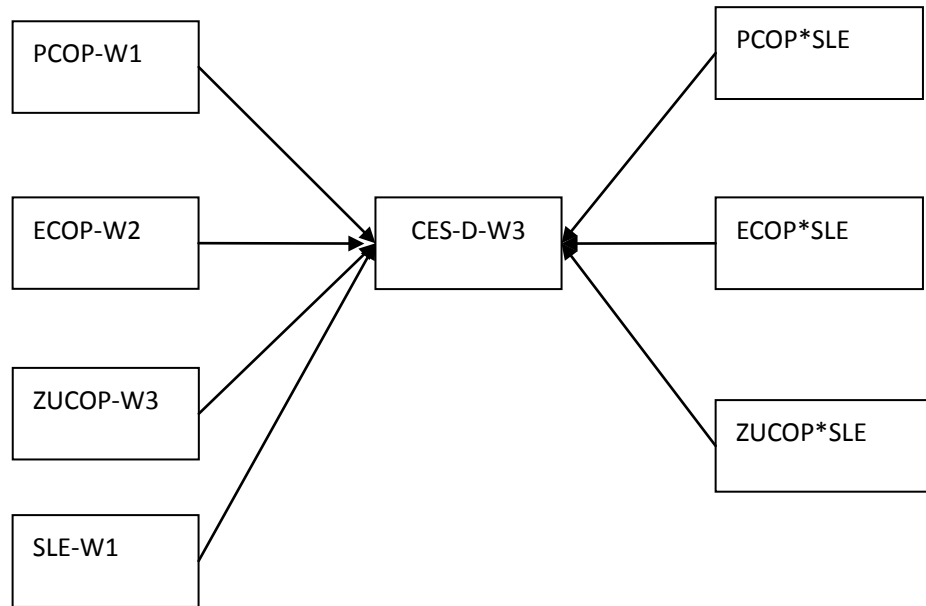


Figure 10. Proposed moderation model

SLE=Stressful Life Events, PCOP=Problem solving coping, ECOP=Emotion-focused coping, ZUCOP=Standardized unhealthy behavioral coping, CES-D=Depressive Symptom

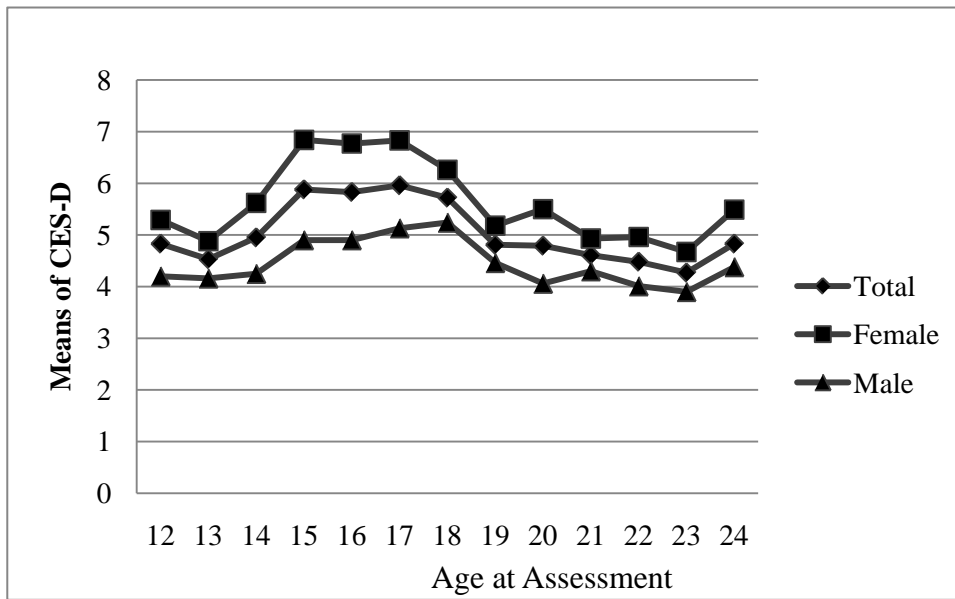


Figure 11. The observed means of depressive symptoms (CES-D) from age 12 to age 24 in total, female and male sample.

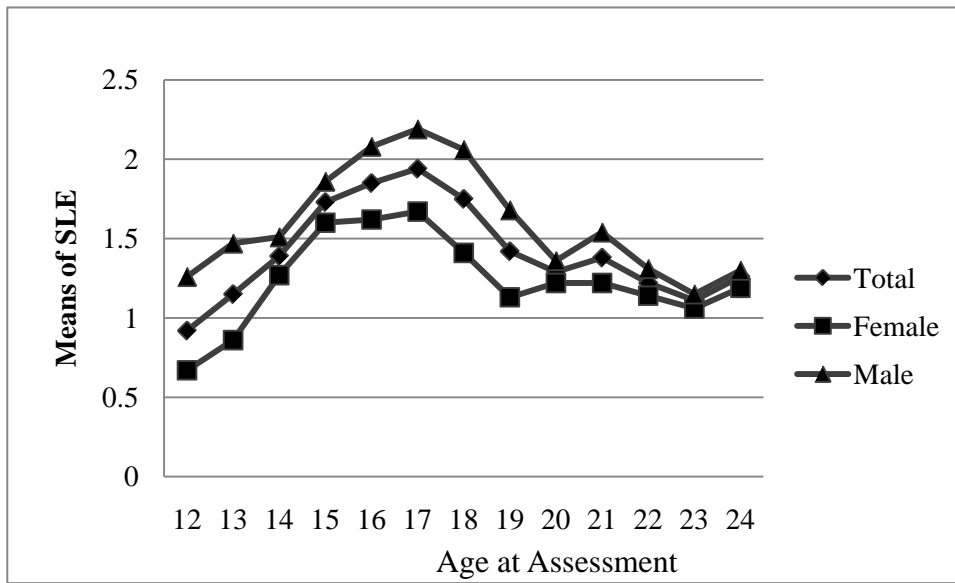


Figure 12. The observed means of stressful life events (SLE) from age 12 to age 24 in total, female and male sample.

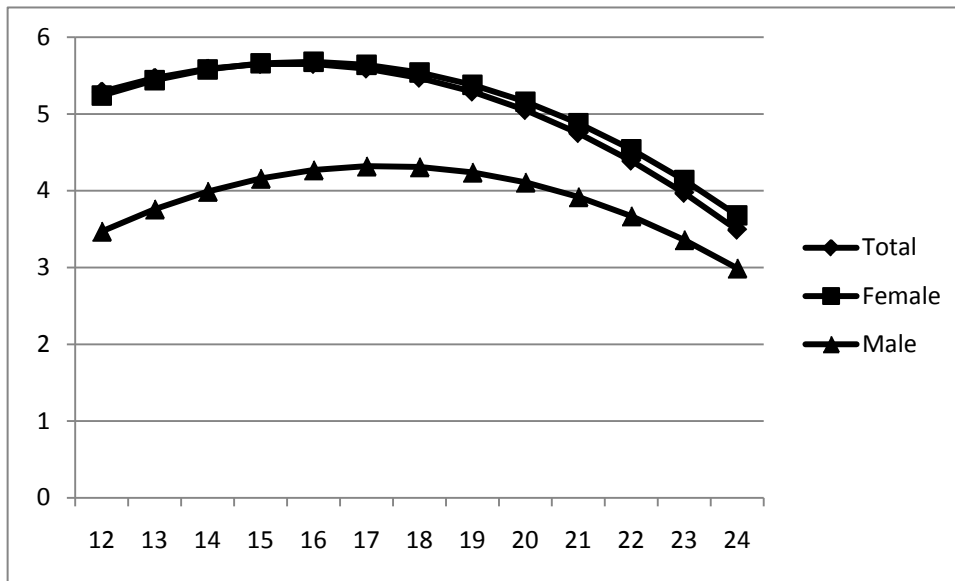


Figure 13. The predicted means of depressive symptoms (CES-D) from age 12 to age 24 in total, female and male sample.

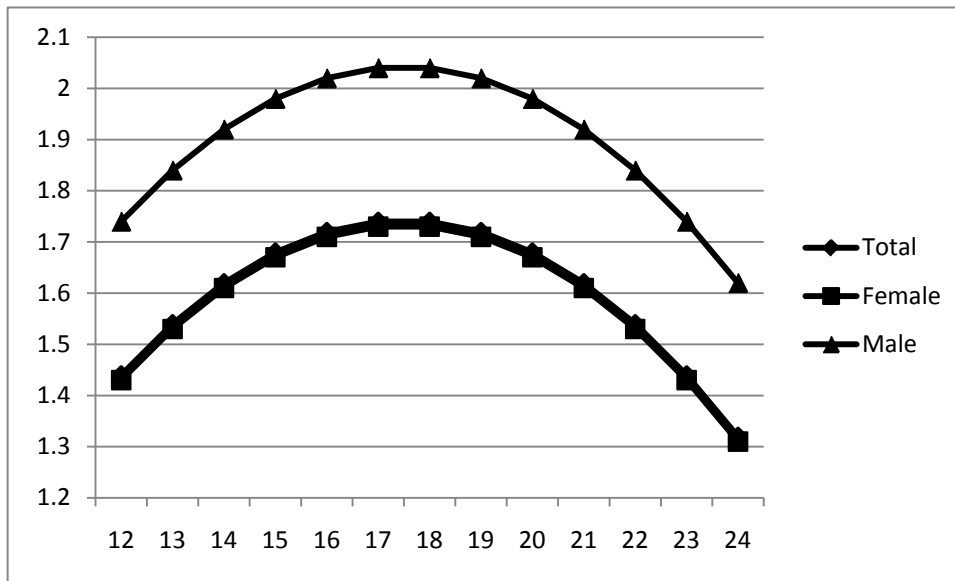


Figure 14. The predicted means of stressful life events (SLE) from age 12 to age 24 in total, female, and male sample.

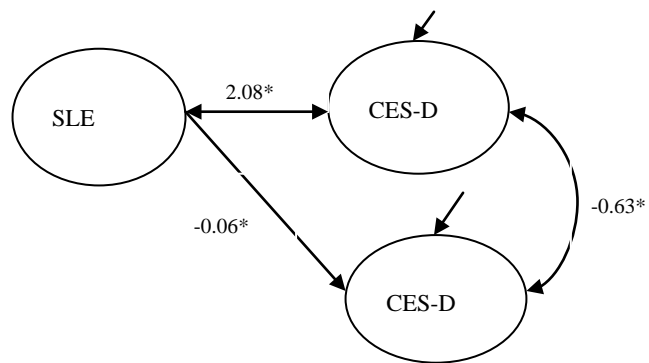
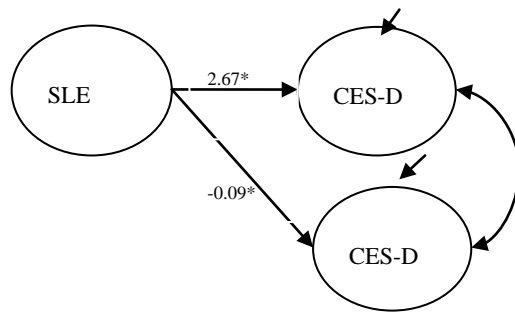
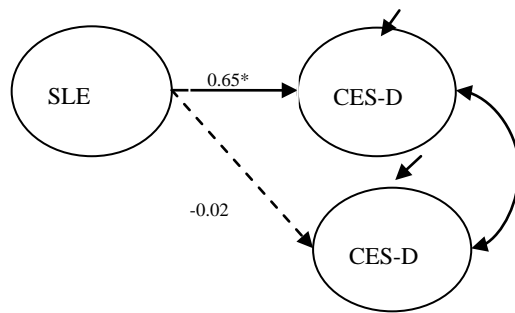


Figure 15. The two construct process latent growth model.

* $p < .05$; the values were unstandardized path coefficients. SLE, stressful life events; CES-D, depressive symptoms.



FEMALE



MALE

Figure 16. The two construct process latent growth model by gender.

* $p < .05$; the values were unstandardized coefficients. SLE, stressful life events; CES-D, depressive symptoms.

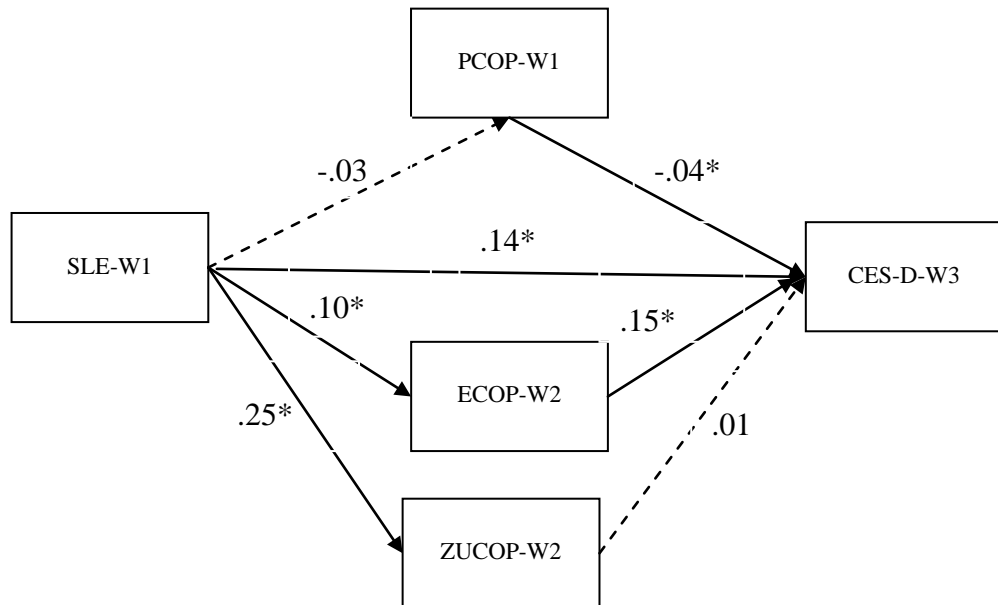


Figure 17. The mediation model with the whole sample

* $p < .05$; the values were standardized path coefficients. SLE, stressful life events; PCOP, problem solving coping; ECOP, emotion-focused coping; ZUCOP, the sum of score of each standardized unhealthy behavioral coping; CES-D, depressive symptoms.

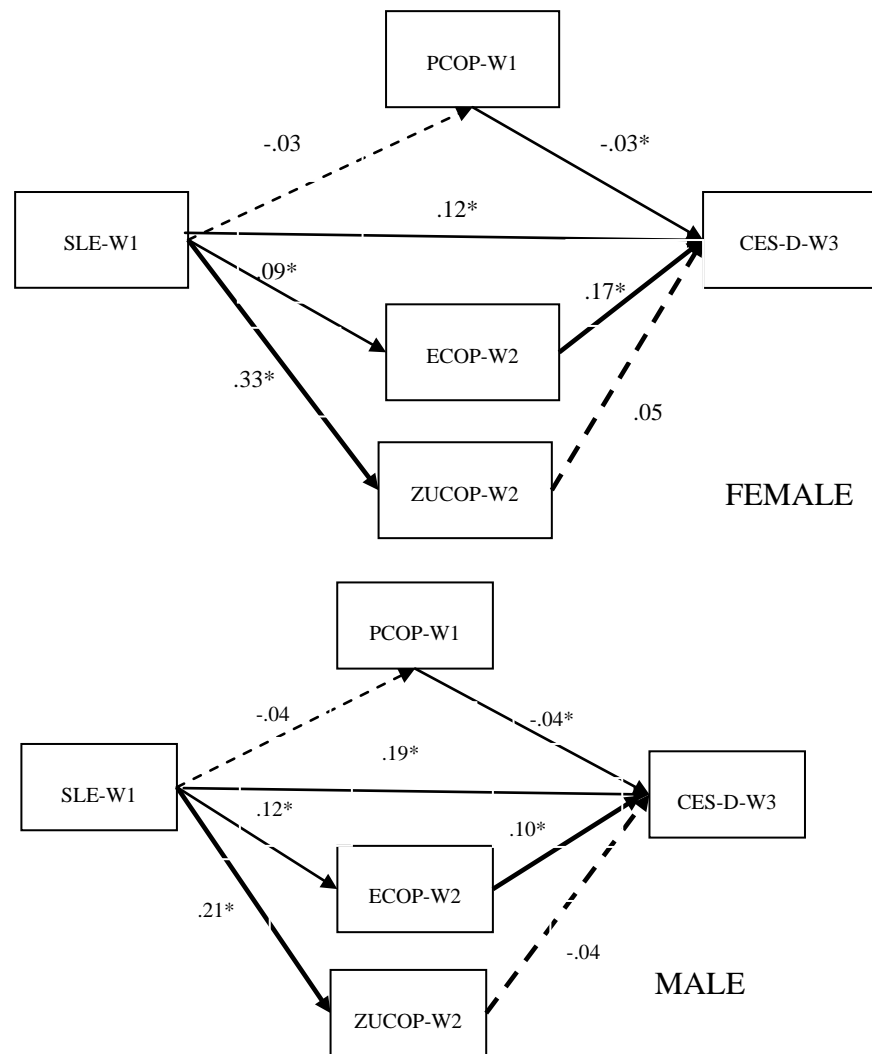


Figure 18. The mediation model by gender

* $p < .05$; the values were standardized path coefficients. The paths marked bold black were significantly different across gender.

SLE, stressful life events; PCOP, problem solving coping; ECOP, emotion-focused coping; ZUCOP, the sum of score of each standardized unhealthy behavioral coping; CES-D, depressive symptoms.

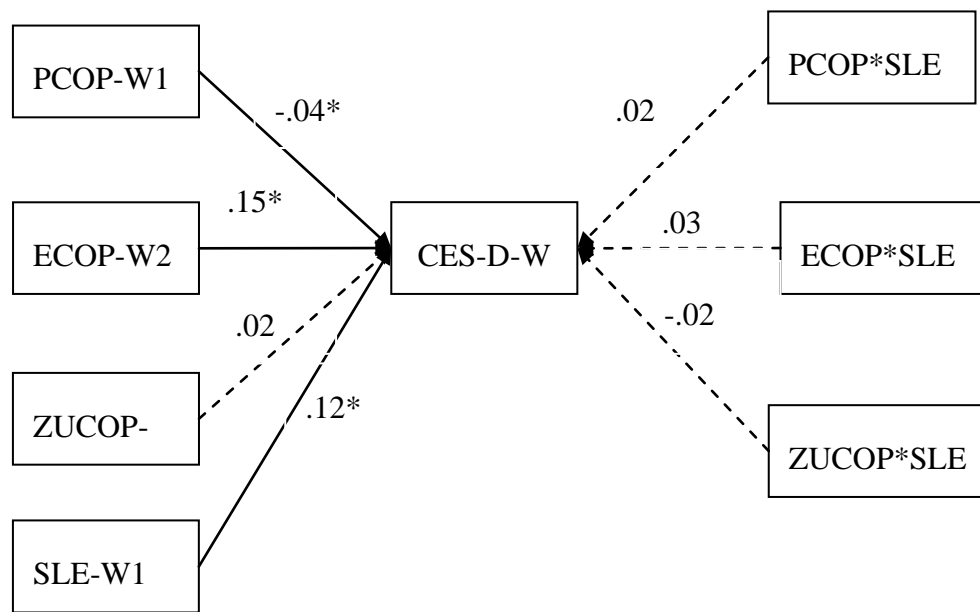


Figure 19. The moderation model with the whole sample

* $p < .05$; the values were standardized path coefficients. SLE, stressful life events; PCOP, problem solving coping; ECOP, emotion-focused coping; ZUCOP, the sum of score of each standardized unhealthy behavioral coping; CES-D, depressive symptoms.

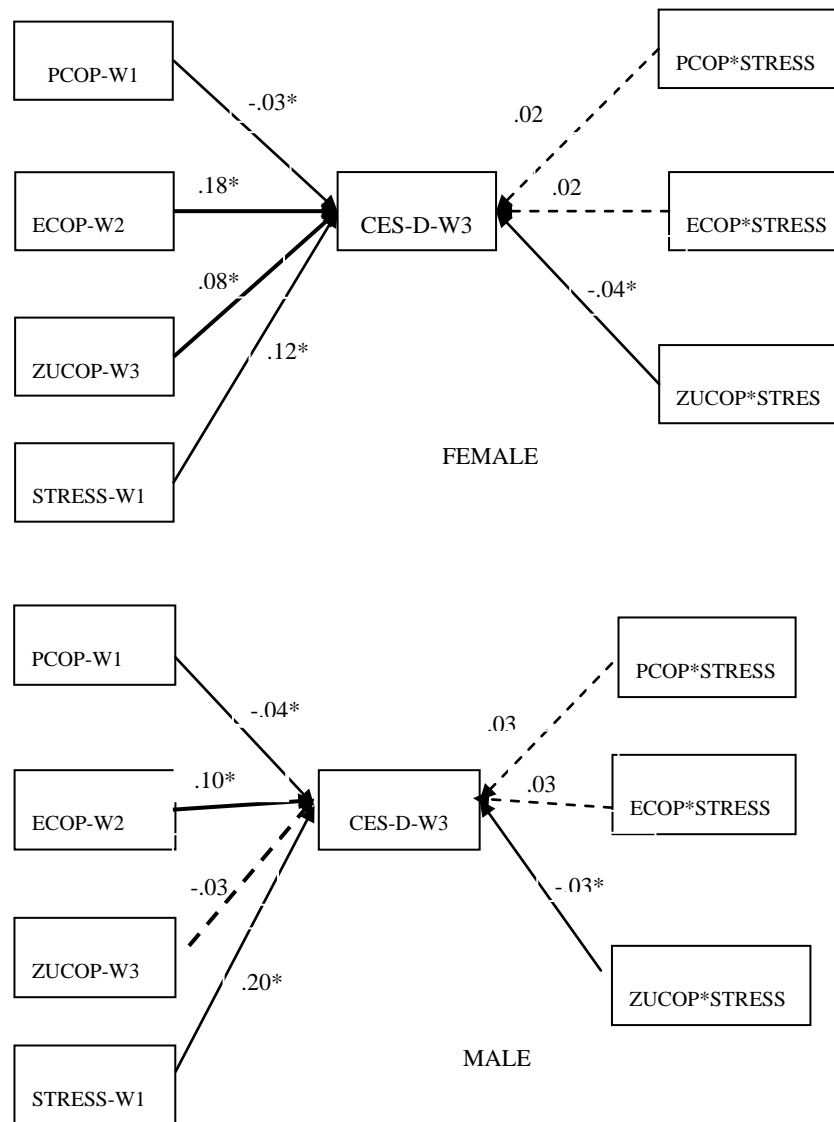


Figure 20. The moderation model by gender

* $p < .05$; the values were standardized path coefficients. The paths marked bold black were significantly different across gender. SLE, stressful life events; PCOP, problem solving coping; ECOP, emotion-focused coping; ZUCOP, the sum of score of each standardized unhealthy behavioral coping; CES-D, depressive symptoms.

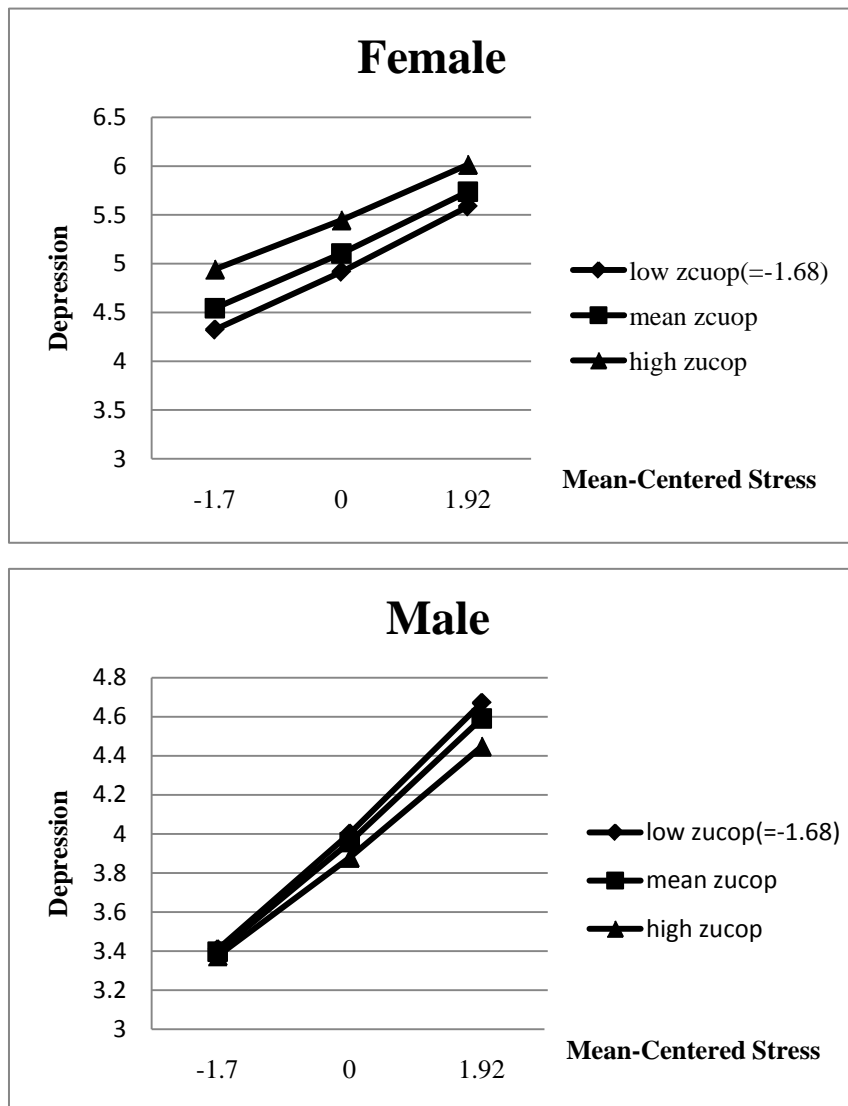
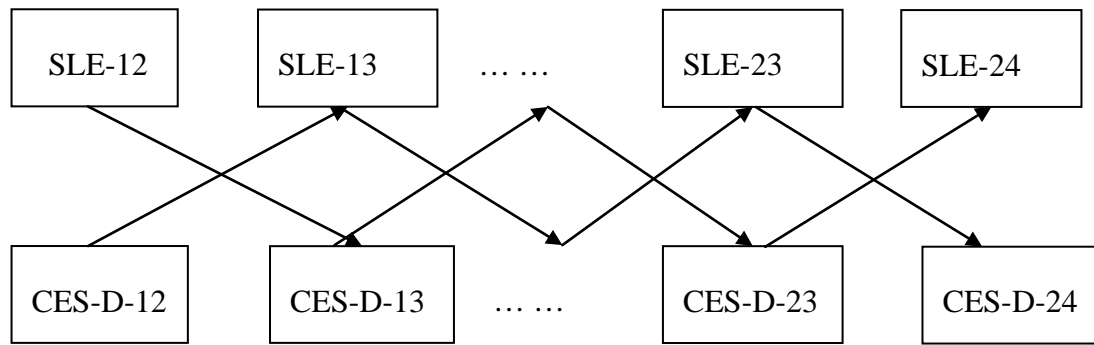
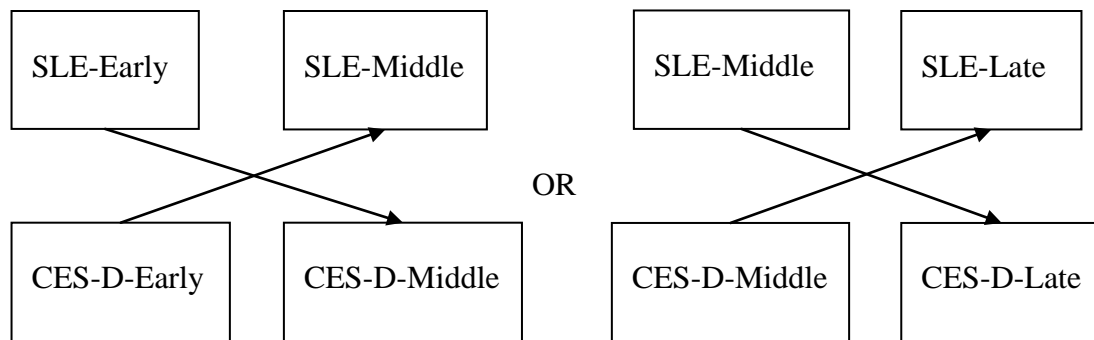


Figure 21. The relationship between stressful life events at Wave I (SLE-I) and depressive symptoms at Wave III (CES-D-III) by unhealthy behavioral coping at Wave II (the sum score of standardized unhealthy coping strategies, ZUCOP) in females and in males.

Problem solving coping at Wave I and emotion-focused solving at Wave II were set at mean level.



The ideal reciprocal model



The actual reciprocal model

Figure 22. The proposed ideal and actual reciprocal models in future studies. SLE, stressful life events; CES-D, depressive symptoms; Ad, adolescence.

Appendix A: List of Items in Stressful Life Events Index

Table A.1. List of Items in Stressful Life Events Index

Wave I, II and III Items	Wave I and II Items Only
Death of a parent	Was expelled from school
Suicide attempt resulting in injury	Suffered a serious injury
Friend committed suicide	Father received welfare
Relative committed suicide	Mother received welfare
Saw violence	Was raped
Threatened by a knife or gun	Ran away from home
Was shot	Non-romantic sexual relationship ended
Was stabbed	Suffered verbal abuse in a romantic relationship
Was jumped	Suffered physical abuse in a romantic relationship
Threatened someone with a knife or gun	Suffered verbal abuse in a non-romantic relationship
Shot/stabbed someone	Suffered physical abuse in a non-romantic relationship
Was injured in a physical fight	Wave III Items Only
Hurt someone in a physical fight	Evicted from residence, cutoff service
Unwanted pregnancy	Entered full-time active military duty
Abortion, still birth or miscarriage	Discharged from the armed force
Had a child adopted	Cohabitation dissolution
Death of a child	Received welfare
Romantic relationship ended	Involuntarily dropped from welfare
Had sex for money	Marriage dissolution
Contacted a STD	Baby had major health problems at birth
Skipped necessary medical care	Death of a romantic partner
Juvenile conviction	Death of a spouse
Adult conviction	
Served time in jail	

Note: see Adkins et al. (2009), p.59

Appendix B: List of Items in Coping

Table B.1 List of items in coping

Problem-solving coping
1. When you have a problem to solve, one of the first things you do is get as many facts about the problem as possible
2. 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
3. When making decisions, you generally use systematic methods for judging and comparing alternatives
4. After carrying out a solution to a problem, you usually try to analyze what went right and what went wrong
Emotion-focused coping
You usually go out of your way to avoid having to deal with problems in your life
Difficult problems make you very upset
When making decisions, you usually go with your “gut feeling” without thinking too much about the consequences of each alternative
Unhealthy behavioral coping
Currently smoking
Currently drinking
Currently using marijuana
Currently using cocaine
Currently using inhalants (Wave I and II) or crystal meth (Wave III)
Currently using other types of illegal drugs (e.g., LSD, PCP, ecstasy, mushrooms, ice, heroin, or prescription medicines not prescribed for you)

Appendix C: List of Items in CES-D

Table C.1. List of Items in CES-D

Bothered by things
Had the blues
Felt as good as other people
Trouble keeping mind focused
Felt depressed
Too tired to do things
Enjoyed life
Felt sad
Felt people dislike you

Appendix D: Missing Values

Missing Values and Respond Rates

Variables	Number of Missing Values	Percentage (%)
Stressful Life Events at Wave I	0	0
Stressful Life Events at Wave II	0	0
Stressful Life Events at Wave III	0	0
Problem Solving Coping at Wave I	51	1.33
Emotion-focused Coping at Wave II	24	0.62
Unhealthy Behavioral Coping at Wave II	0	0
Depressive Symptoms at Wave I	7	0.18
Depressive Symptoms at Wave II	3	0.08
Depressive Symptoms at Wave III	4	0.10

Appendix E Research Questions, Model Names and Selected Model Estimation Methods

Research Questions	Model Name	Method
How did the average of depressive symptoms change from age 12 to age 24?	Unconditional latent growth model	TYPE=TWOLEVEL combined with CLUSTER
Gender differences in the developmental trajectories of depressive symptoms	Conditional latent growth model	TYPE=TWOLEVEL combined with CLUSTER, gender as a predictor for random effect
How did the average of stressful life events change from age 12 to age 24?	Unconditional latent growth model	TYPE=TWOLEVEL combined with CLUSTER
Gender difference in the developmental trajectories of stressful life events	Conditional latent growth model	TYPE=TWOLEVEL combined with CLUSTER, gender as a predictor for random effect
How was the association between stressful life events and depressive symptoms over time?	Two-construct parallel processes latent growth model	TYPE=COMPLEX combined with CLUSTER and WEIGHT
Gender differences in the associations between stressful life events and depressive symptoms	Two-construct parallel processes latent growth model	TYPE=COMPLEX combined with CLUSTER and WEIGHT Latent interactions (I.e. gender \times random effects of stressful life events)
Did problem-solving coping at Wave I, emotion-focused coping, and unhealthy behavioral coping at Wave II mediate the relationship between stressful life events at wave I and depressive symptoms at Wave III simultaneously?	Path model	TYPE=COMPLEX combined with CLUSTER and WEIGHT

Gender differences in the mediation model	Path models by gender	TYPE=COMPLEX combined with CLUSTER and WEIGHT Multiple group analysis
Did problem-solving coping at Wave I, emotion-focused coping, and unhealthy behavioral coping at Wave II would moderate the relationship between stressful life events at Wave I and depressive symptoms at Wave III?	Path model	TYPE=COMPLEX combined with CLUSTER and WEIGHT Interactions (i.e., predictor × moderator)
Gender differences in the moderation model	Path models by gender	TYPE=COMPLEX combined with CLUSTER and WEIGHT Multiple group analysis