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LIFE STRESS, APPROACH COPING, AND HEALTH-RISK BEHAVIORS IN TAIWANESE ADOLESCENTS

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ABSTRACT

The purposes of this study were to investigate the effects of perceived daily life stress on selected health-risk behaviors and to examine the moderating function of approach coping in a sample of 722 Taiwanese adolescents. Life stress from personal, family, peer, school, and community was investigated. The selected health-risk behaviors were risky driving, cigarette smoking, beverage drinking, illicit drug use, and attempted suicide.

This is a cross-sectional survey study. The sample was non-randomly selected from two senior high schools. Data were collected by using self-administrated questionnaires. The reliability and validity of the instruments was evaluated by internal consistency and confirmatory factor analysis. The subjects were classified into three coping groups. Structural equation modeling was used to test a hypothesized model of life stresses on health-risk behaviors and to examine the moderating function of approach coping for three coping groups.

The study had two main findings. First, different sources of life stresses are correlated with different health-risk behaviors. The relationships between life stresses and health-risk behaviors were demonstrated in the low coping group more than in the medium and the high coping groups, indicating the low coping group is most vulnerable. However, either positive or negative correlations appeared, indicating that the moderating function of approach coping may be effective within group in some situations.

Secondly, the moderating effects of approach coping were not consistently demonstrated among the relationships between life stresses and health-risk behaviors. Three methodological reasons (the way of classifying coping groups, not enough items of the Approach Coping Scale, and global use versus situational use of the Approach Coping Scale) and two theoretical reasons

(the effectiveness of approach coping strategies and gender-differences on approach coping) are considered for the mixed evidences in this study.

The results of the study implicate that health promotion programs should be addressed to the needs of adolescents for the goal of promoting adolescents' health behaviors. Moreover, more researches are needed for further understanding of the relationships between life stress and health-risk behaviors and the moderating effects of approach coping. Recommendations for development in practice, research, and theory are discussed.

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CHAPTER ONE

INTRODUCTION

Adolescence is a transitional period characterized by significant changes in biological, cognitive, and psychosocial development. Early psychologists, using biological theory, asserted that adolescents would go through a "storm and stress" period, a time of rebellion and behavioral experimentation. Adolescents would begin internalizing problem behavior such as depression or externalizing problem behavior such as substance abuse during this period. However, recent theorists have emphasized the effects of person-context interaction on adolescent development. Some psychologists have proclaimed that these behaviors are a signal or an outcome of overloaded stress that adolescents experience daily within the contexts of their lives, rather than a result of dysfunctional adolescent development (Hurrelmann & Lösek, 1990; Schulerrberg, Maggs, & Hurrelmann, 1997; Seiffge-Krenke, 1998; Berk, 1996). The primary interest of this study was to investigate the effects of perceived daily life stress on selected health-risk behaviors in a sample of Taiwanese adolescents.

Background

The present study focused on two research problems. The first problem was: What are the contexts of stressors for Taiwanese adolescents? Generally, adolescent stress was studied within the personal, family, school, or peer contexts, and the macro-social context was usually not addressed. Although the fundamental concerns about the sources of stressors for adolescents were consistent, it was still recommended that macro-social changes might indirectly influence adolescent health and should not be ignored (Noack & Kracke, 1997; Seiffge-Krenke, 1998). The factors within the macro-social system that have been considered as sources of stressors include

crime, pollution (Kanner, Coyne, Schaeger, & Lazarus, 1981), war, living under dangerous and insecure conditions, and disaster (Seiffge-Krenke, 1998).

In Taiwan, a few studies have investigated adolescent stress from personal, peer, family, or school context (Chaing, 1993; Jiang, 1991; Li & Yen, 1998; Tsou, 1997). Tsou (1997) first studied adolescents' perceptions of stress in community context. In his study, adolescents' perception of stress from these stressors was significantly correlated to overall health status. Other sources of stress reported by Tsou (1997) included personal and school stressors. He found that the stressors originating from the social environment, school, family, peers, also contributed to the negative health of Taiwanese adolescents.

In the last few years, Taiwan has experienced a rapidly changing society. Changes and controversies in social, political, and economic issues, the frequency of natural disasters, and adjustments to the quality of life at the neighborhood-level are occurring more often than ever before. The impact of these forces is unknown. In the present study these events as community stressors were examined along with stressors originating from school, family and interpersonal sources.

Additionally, it is not known whether or not an adolescent's perception of stress contributes to health risk behaviors. Although some nationwide surveys indicated a high prevalence rate for health-risk behaviors among adolescents, whether this is a manifestation of stress was not made clear. Chou (1999) reported that substance abuse by Taiwanese adolescents age 12 to 18 declined from 1992 to 1995, then increased from 1996 to 2000, and that initiation of substance abuse by 12 year olds has increased. This increase was primarily due to substance abuse among female adolescents (Department of Health, 2000). Furthermore, the first leading cause of death (e.g., injury including motor vehicle accidents) and the third leading cause (e.g., completed suicide)

have declined in 15-24 year olds in Taiwan, but they still rank high compared to other countries. Also, motor vehicle crashes in 15-25 year old males and females ranked 3rd and 4th, respectively, among 47 developed countries, while suicide mortality in 15-24 year old males and females ranked 41st and 39th (Lu et al., 1996). These data indicate that Taiwanese society needs to pay more attention to adolescent health behaviors.

Although a few researchers have studied the changes in adolescent health and health behaviors, the relationship of stress to health-risk behaviors such as substance abuse, suicide, or risky driving in Taiwan is not understood. Li (1995) compared the adverse health behaviors in two groups: high stress and low stress, in a sample of adolescents in Hualien, Taiwan. The risk ratio for smoking, drinking, or eating betel nuts in the high stress group is 1.33 times higher than the low stress group. Also, the risk ratio for dangerous driving behavior by the high stress group was 1.18 times higher. There was no statistically significant difference for smoking, drinking, and eating betel nuts behaviors between the high stress and the low stress groups. An additive score of stress from different contexts was used, thus, it was not possible to distinguish and compare the effects of stressors from each context on outcome behaviors. In the current study the relationships between perception of stress from different sources of stress and health-risk behaviors were studied. Moreover, the previous researchers usually used general health status (e.g., somatic symptoms, anxiety, insomnia, social dysfunction, and severe depression) as the outcome variables in the stress study (Tsou, 1997; Chaing, 1993; Jiang, 1991), whereas the focus of this study was risky driving, substance abuse, and attempted suicide. Furthermore, the difference in risky driving behaviors between Western and Taiwanese societies is that most adolescents in Taiwan use a motorcycle as their primary vehicle rather than an automobile. Accordingly, this study concentrated on risky motorcycle driving.

Finally, to better understand the stress process, the present study involved approach coping as a possible moderator of stress. Approach coping is the effort that an individual makes toward a stressful situation (Ebata & Moos, 1991). Sandin, et al. (1998) reported in a review of the literature that stress and adjustments had only moderate associations, and they recommended that mediators or moderators should be examined for illustrating the stress process.

The theoretical framework for this study is presented in Figure 1. It was hypothesized that stressors form different contexts, including personal, family, peer, school, and community, were related to each of health-risk behaviors, including risky driving, cigarette smoking, alcoholic beverage drinking, substance use, and attempted suicide. In Figure 1, the ellipses represent latent construct measured by multiple indicators and the rectangles represent observed variable measured by a single indicator. The asterisks represent the structural coefficients to be estimated. For the clarity of the figure, the vectors of errors in the structural model and measurement model are not diagrammed in the figure.

Research Questions

The main purpose of this study was to test the effects of life stress on health-risk behaviors in a sample of Taiwanese adolescents. It had three research questions:

1. What are the sources of stress for adolescents, what are the approach coping strategies they draw on, and what are the health-risk behaviors they engage in?
2. Does approach coping have moderating effects on health-risk behaviors?
3. Are life stresses related to health-risk behaviors?

Hypotheses

This study had two research hypotheses:

1. The relationships between life stress and health-risk behaviors are smaller in the high coping group than in the medium coping group. The relationships between life stress and health-risk behaviors for both high and medium coping groups are smaller than that in the low coping group.

2. The effect of stressors, including personal, family, peer, school, and community stress, will be positively correlated with health-risk behaviors, including risky driving, cigarette smoking, alcoholic beverage drinking, substance use, and attempted suicide.

Significance of the Study

To support the goal of promoting adolescents' health behaviors in Taiwan, understanding the phenomena of adolescent stress is a fundamental step. Studies in Western society have emphasized the effects of stressors on adolescent health-related behaviors, such as substance abuse (Rhodes & Jason, 1990), unsafe driving (Irwin, 1993), and suicide (Sandin, et al., 1998). However, only a few researchers have investigated the relationships between life stress, substance use, suicide, and risky driving behaviors in Taiwan. How do adolescents perceive their daily lives? What are the stressors contributing to their health-risk behaviors? Do adolescents' approach coping methods moderate the effects of stressors on health-risk behaviors? This study was an attempt to answer these questions and contribute to future intervention and current theories.

The contribution of the present study is to advance the understanding of the relationship between stress, coping, and health-risk behaviors in adolescents by employing confirmatory factor analysis and structural equation modeling. First, previous researchers who studied

adolescent stress usually used exploratory factor analysis in identifying the possible structure underlying a diverse set of stressors (Tsou, 1997; Chaing, 1993). However, these studies were limited in that they did not attempt to test the empirical adequacy of the stress measures. In this study the factor structures of the instruments were examined by confirmatory factor analysis. Thus, the pattern of observed variables fitting under the latent variable is identified as well as the degree of fit.

Moreover, structural equation modeling, which combines strategies of regression, path analysis, and confirmatory factor analysis to analyze data, was used. Structural equation modeling allows the researcher to evaluate an entire hypothesized multivariate model including measurement model (delineating the relationships between observed indicators and latent variables) and structural model (delineating the relationships between latent exogenous and endogenous variables). The advantage of this method is that it can separate measurement error from observed scores and assess how well the latent constructs are measured. Also, this method provides both precise estimates of direct effects and indirect effects of the independent variables on all dependent variables (Hayduk, 1987; Musil, Jones, & Warner, 1998). Thus, the use of structural equation modeling to examine the interactive effects of life stress and approach coping on health-risk behaviors simultaneously provides better estimates of true relationship between variables and expands the understanding of phenomena of stress and health-risk behaviors.

Limitations

This study was conducted under the following limitations:

1. A convenience sample that was non-randomly selected from the research sites was used. Also, those who dropped out of school were not included in the study. Therefore, generalization of the results to these adolescents should be applied with caution.

2. A cross-sectional research design might lessen the explanation for causality between predictors and outcome variables.

3. Full disclosure may be limited when a self-reported questionnaire is used due to subjects' fear of disclosure. The questions concerning health-risk behaviors might be sensitive for some adolescents. For example, they might not answer the questions concerning driving and substance use behaviors since these behaviors violate the school regulations.

Definition of Terms

Adolescents

Adolescents refer to senior high school students aged 15-18 years old.

Approach Coping

Coping is behavioral and cognitive efforts to deal with demands that are appraised as exceeding the individual's resources (Lazarus & Folkman, 1984). Approach coping refers to the cognitive and behavioral strategies used actively to diminish the effects of a stressor (Ebata & Moos, 1991).

Health-Risk Behaviors

Health-risk behaviors refer to any behavior that would compromise physical and psychosocial aspects of adolescent health. Three dimensions of health-risk behaviors were investigated in this study:

1. Risky driving refers to adolescents' reckless behaviors of driving a motorcycle that may result in accidents or physical injury.

2. Substance use refers to the consumption of cigarettes, alcoholic beverages, inhalant glue, and other illicit drugs.

3. Attempted suicide refers to whether adolescents have tried to kill themselves.

Life stress

Life stress refers to individual's perception of lack of resources for dealing with stressful situations that may result in mental and physical threats (Lazarus & Folkman, 1984). This study measured adolescents' subjective evaluations of disturbed levels of life events from five sources: personal, peer, family, school, and community context.

CHAPTER TWO

LITERATURE REVIEW

Studies on adolescent life stress, coping strategies, and health-risk behaviors in Taiwan and in Western society were reviewed. This chapter includes four sections: (1) adolescent life stress, (2) coping strategies, (3) health risk behaviors, and (4) summary.

Adolescent Life Stress

Theoretical Perspectives

Stress processes have been interpreted from different disciplinary perspectives such as biology, psychology, or sociology (Vingerhoets & Marcelissen, 1988). A frequently used theory in the study of adolescent stress is transactional theory of stress proposed by Lazarus and Folkman during 1960-1980. Transactional theory of stress emphasizes the individuals' subjective evaluation on person-environment interaction. From this perspective, stress arises when individuals appraise the interaction of person and environment as exceeding the individuals' resources (e.g., coping or social support), and then compromising the person's well-being. As the stressors (e.g., events or situations that may stimulate stress) exist, the individuals would appraise their relevance to them; in other words, whether the stressors meant any harm, loss, threat, or challenge to them. If the stressors create negatively stressful feelings for the individuals, then they would engage in changing events or situations that are not necessarily desirable. Such efforts by individuals for dealing with stress are referred to as coping (Lazarus & Folkman, 1984).

From the perspective of psychology, adolescence is a transitional period from childhood to adulthood. Modern psychologists assert that in addition to physical changes and uncertainties about the future the development of adolescents is affected by their social and cultural influences

(Berk, 1996). Frydenberg (1997) pointed out that the adolescents are affected by their interaction with environments, including the school (e.g., school type, location, organization, and curriculum), the home (e.g., environment and family relationships), the peer group (e.g., interpersonal relationships with friends), and the broader community (e.g., cultural content and norms in the local community and the larger world community). Garrison (1956) proposed that the community influences the behavior and development of adolescents in three ways. First, the adolescents have to show the behavior patterns that the community teaches to them. Secondly, the adolescents learn the manner, morals, and life's value from the answers of the community as they question about it. Thirdly, the adolescents learn their ways of judgment from the community's cultural content. Therefore, to understand the processes of stress, researchers should pay attention to the macro-environment's as well as the microenvironment's influences for the development of adolescence to be understood.

In Taiwan, the studies on adolescent life stress primarily focused on the self, family, peer, and school. Few questions related to the community context were classified into other contexts. For example, Jiang (1991) explored that the junior high school students felt stressful about the social security not being well. This item was classified into physical-psychological life events. Chaing (1993) used same way of classification and discovered similar finding in a sample of senior high school students. Tsou (1997) used eight items related to transportation, air, water, and noise pollution, crime, environmental contamination, lack of hygiene in restaurants, and cultural content were used to measure community stressors. It found that the community stress as well as personal and school stress significantly contributed to maladaptation in overall health status in a sample of senior high school students. In his study, school, family, and personal

stressors were the main sources of stress for the adolescents, next were the peer and community stressors.

Methodological Issues

Objective versus subjective stress. Although there are no consistent ways for defining stress, previous studies have measured two types of stress: objective stress and subjective stress. Objective stress is conceptualized as discrete environmental events, chronically stressful conditions, or major life events, such as natural disasters, living in poverty or violent environments, or the loss of a significant loved one. For example, Homes and Rahe's (1967) Social Readjustment Rating Scale is a measure of objective stress. Under this approach, subjects are asked to choose the stressors happening to them from a checklist of life events. Each event has a standardized score. As a result, the subjects will get a total score representing stress strength of life events to them.

Some researchers criticized objective stress measurement because of its lack of emphasizing individual differences on stress evaluation and added the use of subjective stress measurement (Cohen et al., 1983). Cohen et al.'s (1983) Perceived Stress Scale, which measures the frequency of an individual's psychological and physical responses to stress, is a measure of subjective stress. However, under this approach, the sources of stress are unknown. Another approach for measuring subjective stress involves the assessment of individuals' perceptions of stressful feelings on different sources of stressors. For example, Compas et al.'s (1987) Adolescent Perceived Events Scale measures the desirability and impact of a list of life events. This approach is consistent with the assertions of transactional theory of stress.

Some instruments measure individuals' perceptions of stress from a checklist combining major life events and daily hassles together. However, researchers reported that major life events

function through daily hassles on human health and that daily hassles have more significance and direct effects on health-related outcomes than other stressors do (Compas et al., 1985; Wagner, Compas, & Howel, 1988). Accordingly, to understand the effects of daily hassles and major life events separately on adolescent health might have more utility.

Nature of stress. The nature of stressful events has been investigated by assessing their frequency, desirability, or controllability (Swearingen & Cohen, 1985). However, the method most frequently used is assessment of the respondents' subjectively perceived intensity of stressors (e.g., slightly stressful or very stressful). Kohn and Milrose (1993) claimed that measuring intensity of stressors implies negative outcomes to stress, therefore, they suggested measuring the frequency of stressors instead. However, asking how often the stressful events happen or how often the respondents have stressful feelings about some identified events is limited to measuring individual stress levels indirectly. Therefore, it is still reasonable to use intensity measures of stress.

In Taiwan, some instruments measuring intensity of stress used a Likert scale (e.g. "0 = never happens" "1 = happens but not stressful" "2 = slightly stressful" "3 = …" and so on) that cannot be logically interpreted (Chaing, 1993; Jiang, 1991; Li & Yen, 1998; Tsou, 1997). For example, one subject may experience ten different daily hassles but feel no stress whatsoever, and still get 10 points using the Likert scale; another may experience only three daily hassles but feel slightly stressful, and then score 6 points. The experience of the latter subject is more meaningful than the former for representing stress level. Therefore, the score for "happens but not stressful" should be equal to zero or "0" instead of "1".

Confounded items. Some stress measures included questions that directly assess adolescent health, which may cause confounding problems. For example, asking adolescents

how often they experience stressful feelings about the event "I want to run away from home" (Li & Yen, 1998) could be a response to stress rather than a stress indicator. When researchers relate stress to health-related outcomes, the relationship between stress and the outcome is unknown (Kohn & Milrose, 1993). Therefore, researchers should carefully design their instruments for stress and health outcomes and avoid such confounding problems.

Coping Strategies

Coping is the effort individuals exert to change stressful situations or feeling over a period of time. These efforts include cognitive, behavioral, or emotional responses, which are used when individuals appraise their resources to be less than the demands. Theorists have different notions on coping. One emphasizes that coping strategies are situation-specific; that these change over the course of a stressful transaction (Lazarus & Folkman, 1984). Based on this approach, researchers would ask how individuals respond to a specific stressor during a particular time. Another proposes that coping, or so-called coping styles may be used across situations; that it is dispositional (Seiffge-Krenke, 1998). Based on this approach, researchers would ask how individuals respond when they have problems. Research findings support both viewpoints. Sandler, Tein, and West (1994) used a global measure of coping strategies in their study. They found that coping strategies were related to some types of adjustment. Therefore, they asserted that this type of measure did not assess how well coping efforts responded to a specific stressful event. In another study, Carver, Scheier, Weintranb (1989) found that eleven of fourteen subcategories of coping styles and coping strategies were significantly associated. They questioned that coping strategies might involve individual dispositions. Furthermore, Wills and Filer (1996) compared the response-based method asking how much does one use a coping response when one has a problem (coping styles) with the intention-based method asking how

one will respond to a given type of problem. According to their findings, assessment method for coping strategies is not a substantial issue because the results were generally the same.

Categories of Coping

Lazarus and Folkman (1984) categorized coping into problem-focused and emotion-focused coping. Problem-focused coping refers to the strategies one uses to change the distressed person-environment relationship by acting on the environment or oneself. Emotion-focused coping refers to the strategies one uses to modify either the stressful relationship with the environment or the relational meaning of what is happening. The disadvantage of problem-emotion model of coping is that it is composed by active/passive or useful/useless strategies. For example, denial and seeking emotional support could be classified under emotion-focused coping. However, they might result in different consequences.

Another two-category approach is approach-avoidance or active-passive coping. Approach coping refers to the cognitive and behavioral strategies used directly toward a stressor, whereas avoidance coping refers to the strategies used to move away from a stressor (Ebata & Moos, 1991). The approach-avoidance model of coping is much broader than the problem-emotion model of coping. For example, seeking guidance or support is a cognitive strategy that could be considered emotion-focused because it is an active attempt to deal with situation. On the other hand, denying a problem, which is emotion-focused in a passive way, is an avoidance coping method. Therefore, the function of coping is more consistently defined in the approach-avoidance model of coping (Ebata & Moos, 1994).

Recently, some researchers used factor analysis to classify coping strategies for children and adolescents. Based on findings, they suggest that coping may have more than two dimensions. These dimensions may include active coping or approach coping, avoidant coping,

emotional coping, acceptance coping, distraction coping, wishful thinking, or seeking support (Ayers, Sandler, & Twohey, 1998). Other researchers, based on a review of literature, concluded that maladaptive coping, such as emotional venting or behavioral avoidance, could predict negative adjustments, whereas adaptive coping, such as problem solving and rational expressions, could predict positive adjustments (Fields & Prinz, 1997).

Approach Coping as a Buffer of Stress

The concepts underlying approach coping include logical analysis, positive reappraisal, seeking guidance and support, and problem solving. Whereas avoidance coping includes cognitive avoidance, acceptance or resignation, seeking alternative rewards, and emotional discharge (Moos, 1997). Ebata and Moos (1991) investigated the coping-distress relationship in four groups of adolescents: healthy controls, those with rheumatic disease, conduct disorder, and depression. They discovered that those with conduct disorder and depression used more avoidance coping methods and that particularly depressed youth used less approach coping methods than all of the other groups. Hernman-Stahl, Stemmler, and Petersen's study (1995) supported these results. They classified adolescents into those who used approach and avoidance coping. The adolescents who used approach coping reported less depression than adolescents who used avoidance coping. They also reported that adolescents who changed from avoidance to approach coping significantly decreased the depressed symptoms.

The role of coping in the stress process has been conceptualized as a mediator as well as a moderator. A mediating function of coping, intervening the effects of stress on health-related outcome, is negatively correlated with mal-adaptation. Coping also functions as a moderator in that the health-related outcome is more positive after the stressful events occur than it would be without coping (Lazarus, 1990; Lazarus & Folkman, 1984; Weaton, 1985).

Previous studies support both roles of coping in the stress process. For example, Sandler, Tein, and West (1994) explored the relationship between stress, coping, and psychological symptoms in a group of children from divorced parents. They found that active coping could moderate the effects of negative events on conduct problems but not on depression or anxiety. Another study supported the mediating function of coping. Moreover, in a sample of 164 inner city minority adolescents problem-focused coping was found to moderate the effects of stress on behavioral problems for females (Weist, Freedman, Paskewitz, Proescher, & Flaherty, 1995). Another study supported the mediating function of coping. In a sample of 446 employed high school students neither active coping nor avoidance coping had moderating function; whereas both coping styles had mediating function: active coping was negatively associated and avoidance coping was positively correlated with both drinking and smoking behaviors (Frone & Windel, 1997). No matter what buffering function of coping investigated in the previous studies, the findings suggested that adolescents adopting more approach coping methods were better prepared to adjust to their current situation.

Health-Risk Behaviors

Stress is a significant risk factor contributing to negative outcomes of adolescent health and development. Lazarus and Folkman (1984) proposed that individuals under stress would present adaptation in three dimensions: functioning in work and social living, morale or life satisfaction, and somatic health. For adolescents, Cheng (1999) proposed that the negative outcomes of life stress include four dimensions: physical, cognitive, behavioral, and emotional dimension. First, the indicators of stress in physical dimension include changes in vital signs and hormones, e.g., heart rate, blood pressure, and epinephrine. Second, the influence of high stress to adolescents' cognitive ability includes the decreases in the capability of learning and memory. Third, as to the

behavioral dimension, high stress may result in adolescents' aggressive behaviors, risky driving, substance use, and suicidal behavior. Finally, the emotional responses to high stress may include frustration, illusion, anxiety, and low self-esteem.

Coping has been considered the mechanism that buffers the effects of stress on health-related outcomes. The relationships between life stress, coping, and health-risk behaviors are presented in this section. The studies on adolescent health-risk behaviors, including risky driving, substance abuse, and attempted suicide, that have been gained attention recently in Taiwan's society were reviewed.

Risky Driving

Risky driving behaviors of adolescents have been investigated in Western society. Researchers have focused on the automobile and driving behaviors, such as seat belt use, driving at high speeds, or driving and drinking. The main difference between Taiwan and Western society is that most adolescents use motorcycles as their primary vehicle rather than an automobile. Accordingly, in this study risky driving of motorcycles is included.

Li (1995) investigated health-risk behaviors in a sample of 1,195 senior high school students in Hualien, Taiwan, and found that risky driving, smoking, and alcohol drinking were popular in this sample. In 1,141 valid questionnaires, 22% of the male students and 1.6 % of the female students smoked everyday, and 6.1% of males and 0.9% females drank alcohol everyday. Moreover, the prevalent rates of hazardous motorcycling behavior were high (e.g., 79% for driving without a valid license and 70.9% for motorcycling in the fast lane), even though the respondents recognized such behavior as dangerous (Yen & Li, 1997). They also found that some variables such as ethnicity, schools, self-acceptance, neurotic traits, and perceived support

were important factors contributing to stress levels (Li & Yen, 1998). However, they did not analyze the relation between stress levels and risky driving behaviors.

Substance Abuse

The relationship between stress, coping, and substance abuse has been intensively investigated. Rhodes and Jason (1990) proposed a social stress model of substance abuse. They stated that stress would increase the probability of risk for substance abuse, whereas a better social network, social competence, or resources would moderate the effects of stress on substance abuse. They tested their model using a sample of high school students. Stress referred to the number of stressful life events the students experienced. The students who had poorer family relationships had higher levels of drug usage. However, the relationship of stress to drug abuse was not statistically significant in their study. Byrne and Mazanov (1999) measured perceived stress from different contexts (e.g., school, family, personal, and interpersonal) in a sample of 2,625 Australia adolescents from 14 to 18 years old. They examined whether the relationships between stress and substance use is general or limited to a particular type of stressor. Their findings showed that stress from the context of interaction with opposite sex was not significantly correlated with any substance use behaviors for females. For males, stress from the contexts of school performance, uncertain future, and interaction with opposite sex were not significantly correlated with any substance use behaviors. However, no moderator or mediator was examined in this study.

The studies reviewed supported that life stress relates to the onset and increase in substance abuse and that coping mechanisms act as protective factors against substance abuse. Wills (1986) found that stress and coping had an interactive function on substance abuse in 675 junior high school students. The students, who employed more active coping methods such as cognitive,

behavioral, adult support, and physical exercise coping, reported less substance abuse compared to those who did not. However, Wills and Filer (1996) reported that the moderating function of active coping for stress-substance use relationship was not consistently found. They indicated that active coping will buffer the effects of stress when it reduces the effects of avoidance coping and suggested that one might need to further examine whether the interaction of coping mechanisms has effects on stress-substance use behavior relationships.

Attempted Suicide

Generally, suicidal behavior is conceptualized as having three dimensions: (1) suicidal ideation; or one's thoughts about killing oneself; (2) suicide attempts; or one's intentional self-inflicted behaviors; (3) and completed suicide; or self-inflicted death (Sandin et al., 1998). Psychologists have suggested that the prevalence rate of suicide is higher in modern adolescents than that in the past decades since adolescents face more life stress today than before (Berk, 1996). Although the present study focused on attempted suicide behaviors, studies of suicidal ideation on adolescents were also reviewed.

Adcock and Nagy (1991) investigated the relationship between incidence of stress, depression, and suicidal attempts in a sample of 3,893 public high school students. They found that adolescents who have difficulty coping with stress were at risk for depression and suicide. Moreover, those who were exercising various types of risk-taking behaviors, such as alcohol consumption and sexual intercourse, were at greater risk than abstainers. In a sample of 425 students aged 14 to 18 year old, Huff (1999) examined the predictive function of recency (e.g. time since stress was first felt) and degree of stress. They found that both the recency and degree of stress could predict the recency of suicidal ideation (accounting for 68% of the variance) or degree of suicidal ideation (accounting for 80% of the variance).

Studies on adolescent suicidal behaviors in Taiwan have similar findings to those conducted in Western societies. Hwu (1992) indicated that the increase of negative life events was correlated with the increase of hopelessness and suicidal intentions in a sample of junior and senior high school students. Chang and Hwu (1993) investigated the relationship among psychosocial factors (e.g., life stressors, self-control, and social relation) and mental health (e.g., depression, suicidal ideation, and suicidal attempts) in a sample of junior college students. They reported that adolescents who had more life stressors had higher scores of depression and more suicidal ideations. However, good social relationship was a moderator for this effect. Furthermore, they also found that there were gender differences in life stressors since female adolescents had higher scores for depression, suicidal ideation, and suicidal attempts. In a qualitative study, Ou and Yu (1996) interviewed five junior high school students to explore the dynamics of suicidal ideation. They found that the changes to outside environment (e.g., family and peer relations, school lives, and feelings about society) made the subjects feel vulnerable, and as negative life events continued to occur; this lead them to suicidal ideation. The participants reported some factors that weaken ideation were a decrease in negative experiences, changing perceptions due to specific events, time effects, resistance against suicidal effects, and the presence of one or more coping mechanisms (Ou & Yu,1996).

Sandin et al. (1998) examined the relationship between negative life events and adolescent suicidal behavior by reviewing literature. They found that negative life events were effectively but moderately correlated with suicidal behaviors. However, they noted that the effects of mediating and moderating factors to the stress process were ignored among their reviewed studies. Also, the studies they reviewed paid less attention to daily hassles and chronic life events than major life events. Therefore, the current study advanced the understanding of relationships

between life stress and attempted suicide in two ways: involving approach coping as a moderator and measuring minor life stressors.

Summary

In summary, adolescent stress was usually investigated under the contexts of personal, family, peer, and school stress. In addition to these contexts, this study included community as additional source of stress. These sources of stress were shown to be important sources of adolescent stress.

Methodological issues in measuring stress were also reviewed. Subjective feelings on daily hassles were reported to have more predictive power for health-related outcomes than objective assessment of an individual's major life events. The problem with interpretation of response options indicated a need to re-score the response option "It happened but I did not feel stressful at all" equal to zero to obtain a rational stress response. Also, the literature indicated that the measure of stress should eliminate daily hassles with confounding problems that indicate consequences of stress.

The theoretical perspective that life stress contributes to health-related outcomes was well supported in a number of studies (Adcock & Nagy, 1991; Byrne & Mazanov, 1999). However, the relationships between life stress and health-related outcomes should be examined while taking into account the possible moderating effect of coping strategies.

Finally, researchers have reported that the differences in demographic factors might explain why adolescents develop different behaviors (Santrock, 1996; Heaven, 1996). Thus, variables such as school type, gender, age, grade, educational program, ethnicity, parental marriage, and parental income should be included in studies on sources of adolescent since these variables could reflect the differences in personal and environmental background of adolescents.

CHAPTER THREE

METHODS

A cross-sectional survey design was used for this study. Data were collected by using self-administrated questionnaires. The methods used in this study will be described in this chapter, including: (1) protection of subjects, (2) context of the research site, (3) selection of the subjects, (4) instrument development, (5) process of data collection, and (6) plan of data analysis.

Protection of Subjects

To ensure the protection of human rights under research, the study was reviewed by the University of Cincinnati Institutional Review Board. Permission to conduct the study (see Appendix A) was obtained from the principles and the presidents of the Parents' Association of the respective research sites after fully explaining the purposes and processes of the study.

Consent was formalized by obtaining signatures from the subjects before data were collected. The purpose, process, risk and benefits of the study were explained before the survey, and the participants were told that they could choose to withdraw their participation, without penalty, at any time during the survey. Only those adolescents who consented by providing their signatures were included in the survey for this study. The consent form is in Appendix B.

To protect the privacy of the participants, the teachers or faculties of the schools were not present in the classrooms during data collection. No personal identification was included on the questionnaire or in any written reports. Only the investigator had access to the questionnaires and the raw data. To protect against feelings of discomfort that might arise from answering some of the questions, students were provided information regarding counseling centers for adolescents. There were no direct benefits to the participants beyond knowing that their involvement in this survey could contribute to future studies and interventions with regards to their age group.

Context of Research Sites

Taiwan is an island located in Eastern Asia. Taiwanese are mainly classified into two populations: aborigine or non-aborigine. The aborigines, including ten tribes (Atayal, Amis, Bunun, Puyuma, Yami, Paiwan, Rukai, Tsou, Thao, and Saisiyat), refer to the people whose ancestors are the original inhabitants of Taiwan. The non-aborigines, including three subpopulations (Hakka, Hokien, and Mainlanders), refer to the people whose ancestors are immigrants from China. The differences between aborigines and non-aborigines in traditional culture (e.g., religion, language, clothing, and eating), health behaviors (e.g., smoking and drinking), and health status are the research focuses for many investigators in Taiwan.

This study was performed in Hualien, a long and narrow county located in eastern Taiwan. The increase in disasters occurring in Taiwan influences the quality of life for Taiwanese. During 2000 to 2001 years, 16 typhoons directly or indirectly impacted the Taiwan area. Between January 2002 to April 2002, 125 earthquakes of the magnitude 2.7 to 6.8 occurred in Taiwan, 49 earthquakes of the magnitude 4.2 to 6.8 were located in Hualien (Central Weather Bureau, 2002). Hualien covers a total area of 4,628.5714 square kilometers, has a population of about 353,044 people, and is noted for its agriculture and tourism. Although it is the largest county in Taiwan, its development in transportation, economy, and public services is slower compared to other counties.

In Hualien County there are eleven senior high schools: six vocational schools, two general schools, and three schools affiliated with the comprehensive educational program or similar programs. Two schools (a private and a public school) of the third type participated in this study. The private school is located in Hualien City in the northern area of Hualien County, whereas the public school is located at Yu-Li Township in the southern area of Hualien County. The

population density of Hualien City is about 26.7 times than that of Yu-Li. The distance between the two schools is about 100 kilometers. During the 2001 school year, 1,970 students (1,125 males and 845 females) from all over of Hualien County attended the private school, whereas the public school had 796 students (392 males and 404 females) mostly from the southern part of Hualien County. For the students in the public school, 50.8% were female and about 54.7% of the total attended vocational educational programs (Ministry of Education, 2002). In the private school, male students were the majority (57.1%) and those enrolled in vocational educational programs comprised about 75% (see Table 1).

Selection of Subjects

Target Population

The target population of this study was high school students in Taiwan. Students in both a private and a public senior high school in Hualien, Taiwan were the accessible population for this study. The participants from the selected schools, who were from 15 to 18 years old and who agreed to participate, are included in this study.

Sample of Formal Survey

The subjects were Taiwanese adolescents aged from 15-18 years old, who attended both public and private high school consisting of three education systems (general high education, vocational high education, and comprehensive high education) in Hualien, Taiwan during the 2001 school year.

The sample was non-randomly selected through stratified cluster sampling using class as a unit (see Table 1). Sample size for this study was calculated based on effect size, alpha, Beta, and number of variables. Approximately 200 subjects were needed for each of three (high, medium, and low) coping groups to achieve the minimum statistical power (power = .82 at α

level = .05). Based on the consideration of gender ratio and availability, twenty-one classes were selected into the survey. The sample for the pilot study was excluded in the formal survey.

Table 1

Characteristics of sample schools

	Private school (n=1970)				Public school (n=796)			
Grade	Male	Female	Class	Sample class	Male	Female	Class	Sample class
				General program				
First	34	39	2	1	11	28	1	1
Second	45	49	2	1	9	18	1	1
Third	50	38	2	1	29	35	3	1
				Vocational program				
First	129	126	13	2	71	66	5	1
Second	273	197	13	2	46	70	5	1
Third	318	203	13	2	92	90	7	1
				Comprehensive program				
First	17	56	2	1	70	52	4	1
Second	40	43	2	1	64	45	4	1
Third	33	49	2	2	0	0	0	0
Total	1125	845	51	13	392	404	30	8

Note. The values represent number of male and female students, number of classes sample classes.

Instrument Development

The questionnaire used in this study included measures of demographic information, life stress, approach coping, and health-risk behaviors (see Appendix C). A response time frame of one month was adopted in order to obtain a more accurate recall data (Hahn & Smith, 1999). Each measurement is described in the following sections.

The Questionnaire

Demographic variables. The demographic factors included eight variables: school type (private or public), gender (male or female), age (15 to 18 years old), grade in school (first to third grade, or 10 to 12 grade in the USA), educational program, ethnicity, parental marriage, and parental income.

Program type includes general, vocational, and comprehensive educational programs. They cannot be combined since these programs are different in their educational goals and program content. Accordingly, this variable was coded as three dummy variables. The program that had lowest mean score in each of scales was treated as control group. The relative effects of the other two educational programs on different sources of stress and health-risk behaviors were compared to the control group.

The options for ethnicity include aborigine (both or one of adolescents' parents is aborigine) and non-aborigine (both parents are non-aborigine). The options for parental marriage include married and other (separation, cohabitation, re-married, or widower or widow). Parental income is parents' average salary for a month, the options includes less than 30000, 30000-60000, more than 60000 New Taiwan dollars, and unknown.

Life stress. Life stress was measured by using a self-designed Adolescent Life Stress Scales including a personal stress scale, a peer stress scale, a family stress scale, a school stress

scale, and a community stress scale. Items (1, 4, 7, 10, 28, 30, 35, 37, 39, and 43) were taken from a Chinese instrument, the Inventory of High-School Students' Life Experiences (Tsou, 1997). Based on a review of the literature in Western society (Kanner et al., 1981; Seiffge-Krenke, 1998), additional questions such as occurrence of earthquakes, political issues between Republic of China and People's Republic of China, and social-economic-political issues in Taiwan were added to reflect the recent changes in society.

Each of the scale was comprised of 10 items measuring adolescents' subjective feelings to minor life events or daily hassles:

1. Personal stress refers to stress about body image, individual traits, expectations of self, and decisions about the future.

2. Peer stress refers to stress about relationships with peers including friends, classmates, and the opposite sex.

3. Family stress refers to stress about relationships with family members, family financial problems, and health problems of family members.

4. School stress refers to stress from studies, relationships with teachers, school activities, and school atmosphere.

5. Community stress refers to stress about crime, pollution, political atmosphere, transportation, and disasters (e.g., earthquakes).

Respondents were asked to indicate how stressful they felt about these events or hassles over the past 30 days in relation to each item from "It didn't happen to me or It happened, but I didn't feel stressful at all" to "It happened, and I felt extremely stressful." All 50 questions were scored using a 5-point Likert scale (e.g., 0-1-2-3-4). Possible scores of each scale ranged from 0 to 40. A higher score indicated the higher stress as perceived by the respondent.

Approach coping. The investigator developed the Approach Coping Scale of 8 items to measure respondent's logical analysis, positive reappraisal, problem solving, and seeking guidance/support using previous researchers' concepts (Ebata & Moos, 1991; Moos, 1997). A scale of 8 items measured approach coping methods used by the adolescents during the past 30 days when they felt stressed. For example, questions concerning "seeking guidance or support" were presented as "I got advices from someone" or questions concerning logical analysis were written as "I thought about the alternatives for solving my problems". The response options were scored using a 5-point Likert scale from "0 = I never used this method" to "4 = I always used this method". Possible scores ranged from 0 to 32. Higher scores indicated the higher use of approach coping by a respondent.

It is conceptualized as a buffer in the stress process. Therefore, in this study respondents were categorized into three coping groups (e.g., high, medium, and low) according to their average scores on the Approach Coping Scale. The moderating effect of approach coping was examined among the three groups.

Coping groups. The subjects were categorized into three (high, medium, and low) coping groups according to the average scores in the coping scale (see Appendix 1, Table 1). In order to have similar number of subjects in the low and the high coping groups, these average scores were recoded: Average scores, 0-0.49, were coded as "0 = never used"; scores, 0.5-1.49, were coded as "1 = rarely used"; scores, 1.5-2.49, were coded as "2 = occasionally used", scores, 2.5-3.49, were coded as "3 = often used"; and scores, 3.5-4, were coded as "4 = always used" these approach coping skills. Then, subjects who were recoded into "never used" or "rarely used" were classified into low coping group (n = 185), those who were "occasionally used" were

classified as medium coping group (n =340), and those who were “often used” or “always used” were classified into high coping group (n = 197).

Health-risk behaviors. This study focused on investigating health-risk behaviors including risky driving, substance abuse, and attempted suicide. The Health-Risk Behaviors Scale measured respondents’ risky driving, attempted suicide, and substance use. Twelve items of the former two behaviors were selected and modified from Youth Risk Behavior Surveillance Survey System Questionnaire (Center of Disease Control, 2001). The investigator added three items concerning cigarette smoking, alcoholic beverage drinking, and illicit drugs use. The subjects were asked to compare the occurrence of their health-risk behavior in the last 30 days with that of past behavior.

1. A scale of 7 items measured risky driving (e.g., “The number of days you rode a motorcycle over the speed limit or raced for fun of it” and “The number of days you rode a motorcycle in the fast lane.”). All the response options were scored by a 5-point Likert scale from “0 = It never occurred” to “4 = It was much more than usual.” The possible scores ranged from 0 to 28.

2. Three items measured the consumption of cigarettes, alcoholic beverages, and illicit drugs (e.g., “The number of days you smoked cigarettes.” “The number of days you drank alcoholic beverages.”, and “The number of days you used any illicit drug or substance such as glue, amphetamine, FM2, marijuana, or cocaine.”). All the response options were scored using a 5-point Likert scale from “0 = It never occurred” to “4 = It was much more than usual.” The possible scores for each item ranged from 0 to 4.

3. A scale of 6 items measured attempted suicide (e.g., “The number of times you actually tried to kill yourself?” and “The number of times you seriously considered attempting suicide.”).

All the response options were scored by a 5-point Likert scale from “0 = It never occurred” to “4 = It was much more than usual.” The possible scores ranged from 0 to 24.

The reliability and validity of the instruments were evaluated through expert analysis and pilot testing using a sample of adolescents from the population. Results were analyzed for internal consistency, content validity, and construct validity. The results are presented as follows:

Content Validity

The process of establishing the initial content validity involved determining content domains, sampling and generating items, and assimilating items into a useful form. A panel of 12 experts evaluated the content validity of the instrument. Four of the experts were nursing teachers, one a psychiatric doctor, two students (one male and one female adolescent), two experienced teachers of student affairs, and one researcher (also a school counselor). The experts were asked to answer three questions: “How do you rate the representation of this item to this concept?” “How would you revise this item?” and “What items do you think should be deleted or added?” For the first question, they were asked to score in relation to each from “1 = this item is not representative”, “2 = this item needs a major revision in order to be representative”, “3 = this item needs a minor revision in order to be representative”, and “4 = this item is representative”. The index of content validity is the proportion of experts who rated items as representative with a score of 3 or 4. A new scale should achieve a minimum index of 0.8 (Grant & Davis, 1997).

All of the content validity indices of the Approach Coping Scale and the Health-risk Behavior Scales were greater than 0.8. In the Adolescent Life Stress Scales of 50 items, 7 items received the content validity index of lower than 0.8. Item “The positions or environment of part-time jobs was not good enough in my neighborhood.” was substituted for “The hygiene of restaurants was not good enough in my neighborhood.” For the other six items with index less

than 0.8, the wording was revised. Specifically, they were item 8 of the Personal Stress Scale, item 22 and 23 of the Peer Stress Scale, and item 45, 46, 49, and 50 of the Community Stress Scale. These items were not reevaluated for validity.

Pilot Testing

A pilot study was conducted in a selected private school. The purpose of the pilot study was to test the clarity and readability of the wording and to check the process of administrating the questionnaire. Reliability and validity analysis of the instruments were also examined. Two classes (one general education and one vocational education) were non-randomly selected to participate in the pilot study. Sixty-one of sixty-five questionnaires provided sufficient information to be included in the analysis.

The pilot study sample included 38 males (62.3% of the sample) and 23 females (37.7% of the sample), who were all in second grade. All of the students selected who were enrolled in vocational educational programs were male. About 75.4% of them were 16 years old and 86.9% were non-aborigines. The majority (80.3%) reported that their parents were still married. Two students (3.3%) did not know the average income of their parents; therefore, an "unknown" option was added in the formal survey. A table further describing the sample can be found in Appendix 2, Table 2.

The internal consistency coefficients (Cronbach's alpha) of the instruments ranged from 0.7927 for the Personal Stress Scale to 0.9659 for the Attempted Suicide Scale (see Appendix 3, Table 3). The construct validity of the instruments was preliminarily evaluated through exploratory factor analysis. There was more than one factor under the items for each scale except the measure of attempted suicide. Further evaluation of the degree to which the scales were measuring the concepts was needed. Thus, confirmatory factor analysis was used to improve the

construct validity for each scale in the formal study. The means and standard deviations for each of the scales for the pilot data can be found in Appendix 3, Table 3.

Internal Consistency

The internal consistency coefficient for the scales used in the research, ranged from .8161 for the Personal Stress Scale to .8663 for the Attempted Suicide Scale. The results of exploratory factor analysis indicated that there was more than one factor underlying each scale except the Risky Driving Scale and the Attempted Suicide Scale.

After implementing confirmatory factor analysis, some of items were deleted for each scale. The internal consistency coefficients of the revised scales ranged from .7797 for the Approach Coping Scale to .8965 for the Attempted Suicide Scale.

The Cronbach's alpha of the Approach Coping Scale decreased from .8276 after deleting 2 items. For the other scales, the Cronbach's alpha coefficients all remained over .8. The revised scales were used to answer the research questions and test the research hypotheses. The comparison of the internal consistency coefficients for the original scales and for the revised scales is presented in Table 2.

Construct Validity

Confirmatory factor analysis was used to examine the construct validity of the revised scales in the formal study prior to data analysis. This resulted in deletion of some items to achieve a non-significant chi-square value for each scale, which demonstrated that the data fitted the hypothesized model. The decision to delete items was based on the standardized loading, normalized residual, modification index, and the theoretical meaning of the items. Standardized loading refers to the observed indicator's correlation with the latent variable, and also can be interpreted as the square root of the indicator's reliability. It is suggested that the

Table 2

Means, standard deviations, number of items (n), and reliability (Cronbach's α) of life stress, approach coping, and health-risk behavior scales

Life scale	Mean	SD	α (n)
	Original scale		
Personal stress	12.27	6.62	.82 (10)
Family stress	11.64	7.61	.83 (10)
Peer stress	7.78	6.99	.84 (10)
School stress	14.68	8.21	.87 (10)
Community stress	10.18	8.06	.87 (10)
Approach coping	15.54	6.14	.83 (10)
Risky driving	2.96	3.94	.82 (7)
Attempted suicide	1.51	10.26	.87 (6)
	Revised scale		
Personal stress	8.85	4.89	.81 (6)
Family stress	5.65	4.63	.81 (5)
Peer stress	2.75	3.40	.83 (4)
School stress	9.89	5.23	.82 (6)
Community stress	5.75	5.38	.81 (7)
Approach coping	11.59	4.61	.78 (6)
Risky driving	2.09	3.13	.83 (5)
Attempted suicide	0.98	2.40	.90 (4)

individual item's reliability is better for correlations over .70. Also, the absolute values of normalized residual were less than 2 and no modification index appeared, which indicated a fit model for the data (Mueller, 1996). Also, the strength of the relationship between the latent variable and the observed indicator was estimated by how significant the t-values were and how high the variances (R^2) in the indicator explained by the latent variables were.

The results of confirmatory factor analysis showed that these criteria were achieved and the *t*-values for the loadings and residuals of the selected items were all significant ($p < 0.01$). The individual item's reliability of some items was lower than .70; however, because of the theoretical meaning of the item to the latent construct, they were retained. Therefore, these revised scales were applied to test hypotheses. The results of confirmatory factor analysis for each scale are discussed in the following sections:

Personal Stress Scale. For the Personal Stress Scale, items (1, 2, 4, and 5) that regarded physical development during adolescence were excluded (see Appendix 4, Table 4). The items reflecting cognitive development, including judging and communicating, were included. The revised scale had items with loadings ranging from .48 to .74 and the explained variances ranged from 23% to 54%. The overall fit index indicated that the data fitted the model ($\chi^2 / df = 13.69/9$, p value = 0.13).

The factor loading for the item 3, "The ability of expression or communication was not good enough", was .49, which indicated the reliability of individual item was lower than .70. However, this item represented the individual's confidence in communicating, related to other cognitive development items (e.g. "I did not understand myself" or "My thoughts were often different from the others'"). Therefore, this item was retained in the scale.

The final number of the Personal Stress Scale was six. Each item was scored using a 5-point Likert scale (e.g., 0-1-2-3-4). Possible scores of this scale ranged from 0 to 24. A higher score indicated the higher personal stress as perceived by the respondent.

Family Stress Scale. For the Family Stress Scale, items (11, 15, 16, 17 and 20) representing parents-child relationships were included (see Appendix 5, Table 5). The revised scale had items with loadings ranging from .64 to .73, which indicated the individual item's reliability ranged from .80 to .85. Also, the explained variances ranged from 41% to 54%. The overall fit index indicated that the data fit the model ($\chi^2/df = 9.69/5$, p value = 0.09).

The final number of the Family Stress Scale was five. Each item was scored using a 5-point Likert scale (e.g., 0-1-2-3-4). Possible scores of this scale ranged from 0 to 20. A higher score indicated the higher family stress as perceived by the respondent.

Peer Stress Scale. Only four items in the peer stress scare were retained (see Appendix 6, Table 6). They were items 27 to 30, which described the peer's interpersonal relationship with friends and classmates. These items had loadings ranged from .70 to .79 (individual item's reliability was .84 to .89) and the explained variances ranged from 49% to 72%. The overall fit index indicated that the data fitted the model ($\chi^2 / df = 2.11/2$, p value = 0.35).

The final number of the Peer Stress Scale was four. Each item was scored using a 5-point Likert scale (e.g., 0-1-2-3-4). Possible scores of this scale ranged from 0 to 16. A higher score indicated the higher peer stress as perceived by the respondent.

School Stress Scale. Six items concerning study and learning were included in the School Stress Scale (see Appendix 7, Table 7). They were items 31, 35, 37, 38, 39, and 40. Item 31 had a loading of .53 and described competition in school, including academic grades, which was related to the academic performance context rather than the environmental context of the

school such as rules, physical facilities, teacher behaviors and available extra-curricular activities. Because of the theoretical meaning of the item, it was included in the scale. Items in the scale had loadings ranged from .53 to .75 (individual item's reliability was .73 to .85) and the explained variances ranged from 28% to 56%. The overall fit index indicated that the data fitted the model (χ^2 / df = 10.93/9, p value = 0.28).

The final number of the School Stress Scale was six. Each item was scored using a 5-point Likert scale (e.g., 0-1-2-3-4). Possible scores of this scale ranged from 0 to 24. A higher score indicated the higher school stress as perceived by the respondent.

Community Stress Scale. For the Community Stress Scale, seven items (41, 42, 43, 44, 47, 48, and 50) were included (see Appendix 8, Table 8). These items concerned the quality of life in neighborhood, including physical and psychosocial ecology. The scale revised had items with loadings ranged from .39 to .75 and the explained variances ranged from 15% to 57%. The overall fit index indicated that the data fitted the model (χ^2 /df = 21.87/14, p value = 0.08). Two items, item 1 and item 10, had factor loadings lower than .50. The chi-square value was decreased and non-significance (p = .39) without these items. However, to capture the community life in recent Taiwan's society, they were retained in the scale.

Taiwan's population density is second highest among all countries in the world. People's contact is not avoidable. Item 1, ("My neighbors were not friendly enough"), was retained on the scale because it reflected the interpersonal situation in the neighborhood. Item 10, "The political issues between R.O.C. and P.R.O.C. were disturbing", reflected the adolescents' feeling of insecurity and uncertainty for macro-environment. The political issues have persisted for over fifty years. In 1996, P.R.O.C. tried to manipulate the process of first popular election for R.O.C.

president; it threw bombs outside of Taiwan. Since then, the tension between two countries continually rises, potentially influencing psychological health in youth.

In Ou's (1996) qualitative study of suicidal ideation among Taiwanese adolescent, a third-grade junior high student stated that: "I thought about getting reincarnated in another country... say we are the citizens of R.O.C., but where is the R.O.C." (p. 163). A study investigating the "misery index" of life among 838 Taiwanese students reported that the first highest rated item was "the grim future of the nation", which was third highest rated item in the preceding year (To Sun Public Foundation, 2001). Previous studied found that study was the primary sources of stress for adolescents because "testocracy" (the idea of thinking nothing but entering a higher school) is popular in Taiwan's society. However, the study of To Sun Public Foundation pointed out the society has been changed: The strains from society and politics are more than that from family, school, and opposite sex for Taiwanese adolescents today. Therefore, item 10 "The Political issues between ROC and PROC were disturbing." was also retained on the scale.

The final number of the Community Stress Scale was seven. Each item was scored using a 5-point Likert scale (e.g., 0-1-2-3-4). Possible scores of this scale ranged from 0 to 28. A higher score indicated the higher community stress as perceived by the respondent.

Approach Coping Scale. Two items were deleted in the Approach Coping Scale, item 6 of seeking guidance/support and item 7 of positive reappraisal (see Appendix 9, Table 9). The loadings of the remaining items ranged from .45 to .70 and the explained variances ranged from 20% to 50%. The overall fit index indicated that the data fit the model (χ^2 / df = 4.49/9, p value = 0.88).

Both item 3 “Discuss your problem with someone” (factor loading = .45, individual reliability = .67) and item 6 “Get advice from someone” (factor loading = .53, individual reliability = .73) measured the concept of “seeking guidance/support”. If deleted the item 3 and item 7, the overall fit index was decreased to χ^2 / df = 8.92/9, p value = 0.44). Therefore, item 3 was retained.

In addition, if item 2 “Think how your problems could change your life for the better” is deleted, the overall fit index was increased (χ^2 / df = 1.38/5, p value = 0.92). However, the reliability for 5-item scale was decreased from .779 to .725. The chi-square values did not suffer increment because of these items; therefore, they were retained in order to extend the meaning of approach coping.

The final number of the Approach Coping Scale was six. Each item was scored using a 5-point Likert scale (e.g., 0-1-2-3-4). Possible scores of this scale ranged from 0 to 24. A higher score indicated the more approach coping strategies as adopted by the respondent.

Risky Driving Scale. In the Risky Driving Scale, two items were deleted: item 2 of wearing helmet behavior and item 7 of co-riding with someone who drank beverages (see Appendix 10, Table 10). The loading of the other items ranged from .51 to .84 and the explained variances ranged from 26% to 71%.

The overall fit index indicated that the data fitted the model (χ^2 / df = 7.42/5, p value = 0.21). The final number of the Risky Driving Scale was five. Each item was scored using a 5-point Likert scale (e.g., 0-1-2-3-4). Possible scores of this scale ranged from 0 to 20. A higher score indicated the more risky driving behaviors as adopted by the respondent.

Attempted Suicide Scale. The Attempted Suicide Scale retained four items that described the extent of attempting suicide. Item 1 and item 6 were deleted in the Attempted

Suicide Scale (see Appendix 11, Table 11). Item 1 concerned about severe depression and item 16 concerned about outcome of attempted suicide. The loading of the other items ranged from .76 to .89 and the explained variances ranged from 62% to 79%. The overall fit index indicated that the data fitted the model (χ^2 / df = 0.31/2, p value = 0.86). The final number of the Attempted Suicide Scale was four. Each item was scored using a 5-point Likert scale (e.g., 0-1-2-3-4). Possible scores of this scale ranged from 0 to 16. A higher score indicated the more attempted suicide behaviors as adopted by the respondent.

In summary, combining the findings from descriptive analyses and confirmatory factor analyses, items were retained or deleted. In some cases where the results showed that the respondents had high response rates of feeling stressful were deleted. This does not indicate that these were not sources of stress for adolescents, but rather, these items did not reflect the theoretical meaning of the concepts as well as those retained in the study. They may however reflect other underlying factors of stress.

Process of Data Collection

The survey was completed during school hours. Each of the principals assigned a faculty member to serve as a coordinator and assist the investigator in their school. The coordinators helped schedule the time for administrating the questionnaires and informed the class advisors and participating students about the study before survey.

The coordinators left the classroom prior to administration of the survey. The investigator explained the research purposes of the study and answered the questions after introducing herself. Informed consents were obtained. The average time for completion of the questionnaire was twenty minutes. After the survey, the investigator collected and stored the informed consents and the questionnaires in a locked storage case. To preserve the confidentiality, no personal

identifiers were included on the survey forms.

Plan of Data Analysis

In this section, the management of missing data and data analysis are described.

Missing Data

Before testing the research hypotheses, the mean of each item was substituted for any missing data under each item measured. The mean substitution was preferable to the median because the distribution of the items was reasonably random (Polit, 1996).

Descriptive Analysis

The first research question of this study was: What are the sources of stress for adolescents, approach coping strategies they draw on, and health-risk behaviors they engaged in? To answer this question, descriptive analysis through frequencies, percentage, means, and standard deviations was conducted to present a description of sample characteristics and of each scale for all subjects. In addition, the Chi-square test was used to compare differences on demographic characteristics between three coping groups. A *t*-test was used to compare differences on approach coping between male and female students. Also, bivariate correlation analysis (Pearson's correlation coefficient) was conducted to describe the overall relationships between life stresses, health-risk behaviors, and approach coping.

Structural Equation Modeling

Structural equation modeling is used to answer research question 2 and 3. The research question 2 is: Are life stresses related to health-risk behaviors? It was hypothesized that the effect of stressors, including personal, family, peer, school, and community stress, would be positively correlated with health-risk behaviors, including risky driving, cigarette smoking, alcoholic beverage drinking, substance use, and attempted suicide.

The research question 3 is: Does approach coping have moderating effects on health-risk behaviors? It was hypothesized that the effect of stressors would be attenuated at higher levels of approach coping, that is, the relationship between life stress and health-risk behavior is smaller in the high coping group than in the medium coping group than in the low coping group.

A hypothesized structural model was proposed (see Figure 1). This model delineated that the different sources of stress were related to each health-risk behavior. Additionally, the subjects were classified into three coping groups in order to test the moderating effect of approach coping. In Figure 1, the ellipse represents a latent construct measured by multiple observed variables and the rectangle represents an observed variable of a single item. The asterisks are the structural coefficients to be estimated. For the clarity of the figure, the vectors of errors in the structural model and measurement model are not diagrammed in the figure. The following procedure was used to assess the degree that data fit the hypothesized structural model. First, a composite of observed variables and the Cronbach's alpha (α) coefficient for the composite were computed for each stress scale and health-risk behavior scale. The measurement error for each composite was fixed to $(1-\alpha) \times$ variance of the composite corrected for fallibility (unreliability) of composite measure. This allowed the structural parameters to be estimated without bias originating from the unreliability of their variable measures.

Second, to test the interactive effects between types of stress and approach coping, the relationships among demographics, types of stress, and health risk behaviors were estimated for each of three levels of approach coping (e.g., high, medium, and high). The parameters were estimated by using the method of maximum likelihood, based on the correlation matrix and standard deviations of the observed variables for each coping group (see Appendix 12, Table 12

to Appendix 14, Table 14). The overall fit of the structural equation model was estimated by chi-square difference test.

Third, two initial models were tested. The first model, an additive model, assumed that the corresponding coefficients for the effects of the types of stress on health risk behaviors were same among the three coping groups. The second model, an interactive model, assumed that the corresponding coefficients for the effects of the types of stress on health risk behaviors were different among the three coping groups. Chi-square difference test was used to assess data-model fit between the two models. If there was a significant improvement in chi-square for the interactive model, then the effects of stress were conditional on levels of approach coping; on the contrary, if there was no significant improvement, the effects of stress and approach coping were treated as additive model.

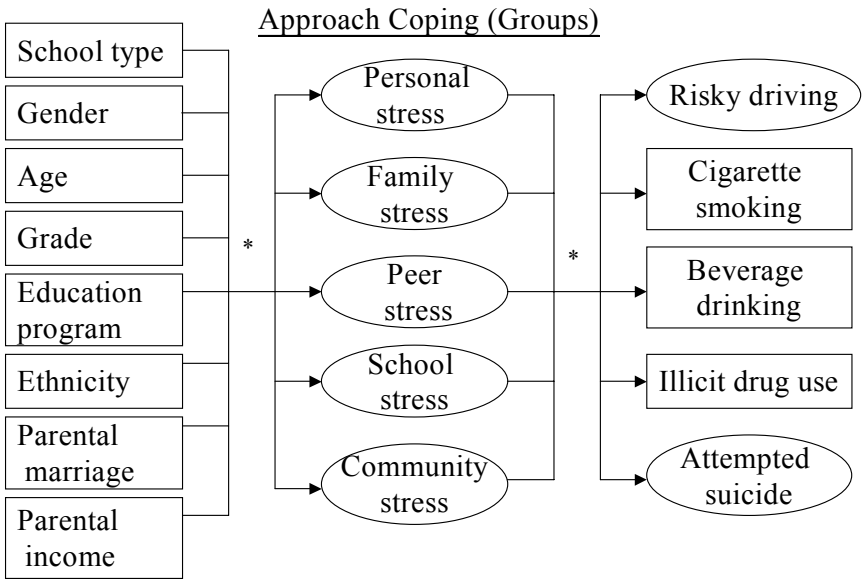

Figure 1. A hypothesized model of life stress effects on health risk behaviors. The ellipses mean latent construct and the rectangles mean observed measured variable. The asterisks represent the paths to be estimated.

CHAPTER FOUR

FINDING

The findings of the study are presented in this chapter, which is divided into five sections: (1) sample characteristics, (2) research question one, (3) final model, (4) research question two, and (5) research question three.

Sample Characteristics

A total of 751 subjects were selected from the research sites. The study included 722 completed questionnaires in the analysis. Among 722 respondents, approximately 51% were female. The majority of the subjects were aged 16 years (36.6%) or 17 years (36.4%). Only 10% reported their age as 18 years. About 46% attended a vocational educational program. The percentage of general program students (26.7%) was similar to that of comprehensive program students (27.65%). The percentage of students in the first grade (35.3%) was similar to that in the third grade (35.5%). For the subject who reported one or both of parents as aborigine (27.6%), their ethnicity was categorized as aborigine. The remaining subjects (72.4%) were classified into non-aborigines. The majority of subjects (78.1%) reported that their parents were still married. About 21.9% reported their parental marriage status as separation, divorced, re-married, cohabitation, and widower (or widow). There were 21.9% of the subjects who didn't know their parents' income. The estimated values replaced for this response were calculated through multiple regression. The subjects' parental income was classified into three groups: high (over 60,000 New Taiwan (NT) dollars, 33%), medium (30,000 to 60,000 NT dollars, 51%), and low (Less than 30,000 NT dollars, 15.7%). In Table 3, the sample characteristics are presented.

Table 3

Sample characteristics

	Private (*n* = 516)		Public (*n* = 206)		Total (*n* = 722)	
Demographic variable	*n*	%	*n*	%	*n*	%
Gender						
Male	268	51.9	86	41.7	354	49.0
Female	248	48.1	120	58.3	368	51.0
Age						
15 years	80	15.5	45	21.8	125	17.3
16 years	188	36.4	74	35.9	262	36.3
17 years	197	38.2	66	32.1	263	36.4
18 years	51	9.90	21	10.2	72	10.0
Grade						
First	174	33.7	81	39.3	255	35.3
Second	151	29.3	60	29.1	211	29.2
Third	191	37.0	65	31.6	256	35.5
Program						
General	112	21.7	81	39.3	193	26.7
Vocational	254	49.2	76	36.9	330	45.7
Comprehensive	150	29.1	49	23.8	199	27.6

Table 3 (Continued).

	Private (*n* = 516)		Public (*n* = 206)		Total (*n* = 722)	
Demographic variable	*n*	%	*n*	%	*n*	%
Ethnicity						
Aborigine	149	28.9	50	24.3	199	27.6
Non-aborigine	367	71.1	156	75.7	523	72.4
Parental marriage						
Married	411	79.7	153	74.3	564	78.1
Other	105	20.3	53	25.7	158	21.9
Parental income						
Low	167	32.4	74	35.9	241	33.4
Medium	268	51.9	100	48.1	368	50.9
High	81	15.7	32	15.5	113	15.7

Data from 29 (20 were from private and 9 were from public schools) subjects were discarded due to failure to complete the questionnaire. Among these subjects one did not provide any other personal information. The other 28 subjects included 16 males and 12 females. They were aged from 15 to 17 years old. Eleven of them were at their third grade, eight were second grade, six were first grade, and three were unknown. Twelve of them attended vocational program, ten attended general program, five attended comprehensive program, and one was unknown. Ten of them were aborigines, fifteen were non-aborigines, and three were unknown.

Sample description by demographic characteristics and coping groups

In this section, a description of the sample's characteristics on sources of life stress, approach coping, and health-risk behaviors by each demographic variable and a description of sample characteristics by coping groups are presented as follows.

School type. The sources of reported stress are same for both public and private schools (see Appendix 15, Table 15). They were ranked in decreasing percentage as school, personal, family, community, and peer context. The proportion of the subjects in public school (93%) reporting school stress was slightly more than that in the private school (92%). However, the percentage of the subjects in private school was more than the public school in reporting perceived stress from the other sources. In the private school, approximately 91% of the subjects reported personal stress, 82% reported family stress, 72% reported community stress, and 62% reported peer stress. In the public school, about 90% of the subjects reported personal stress, 79% reported family stress, 70% reported community stress, and 51% reported peer stress.

The percentage of the public school students (98%) who adopted approach coping in the past 30 days was slightly more than that of private school students (97%). The percentage of the private school students reporting risky driving (32%), cigarette smoking (27%), alcoholic beverage drinking (28%), and substance use (2%) was more than that reported by the public school students. However, the subjects of both schools reported the same percentage of attempted suicide (20%). Approximately 57% of the public school students and 47% of the private school students reported that they never engaged in any of the health-risk behaviors.

Gender. The sources of reported stress are different for males and females. The percentage of stress for each of the five sources of stress for males was school (91%), personal (87%), family (81%), community 72%), and peer (59%); for the female subjects, it was: personal

(94%), school (93%), family (81%), community (70%), and peer (58%) (see Appendix 16, Table 16).

Approach coping was used more frequently by females (98%) than males (96%). On the other hand, males reported more frequency in risky driving (38%), cigarette smoking (33%), alcoholic beverage drinking (32%), and substance use (3%) than females. However, female subjects reported more frequency in attempted suicide (24%) than the male subjects (16%). Overall, approximately 41% of the male and 58% of the female reported that they never engaged in any of the health-risk behaviors.

Age. The subjects were classified into four age groups: 15, 16, 17, and 18 year olds. For all age groups, the reported sources of stress, in descending order, were ranked in identical order as: school, personal, family, community, and peer context (see Appendix 17, Table 17). As to the percentage of each source of stress, the 17 year olds reported more perceived stress from personal (95%) and peer (50%) than other age groups, the 15 year olds reported more perceived stress from family (80%) and community (62%) than other age groups, and the 18 year olds reported more perceived stress from school (97%) than other age groups.

Approximately 99% of the 18 year olds reported using approach coping within the past 30 days. The 17 year olds had the lowest reported percentage for using approach coping (93%), whereas both 15 and 16 year olds had similar reported percentage for using approach coping (97%).

The 18 year olds reported more percentage in risky driving (47%), cigarette smoking (34%), and alcoholic beverage drinking (32%) than the other age groups. The 15 year olds reported more percentage in substance use (2%) and attempted suicide (29%). Approximately 53% of the 16 year olds and only 39% of the 18 year olds never engaged in any of the health-risk behaviors.

Grade. The sources of reported stress are different for various grade groups. The subjects in the first and second grade reported perceived stress from five sources in same rank (see Appendix 18, Table 18). The percentage for the sources of stress in the first grade was: school (91%), personal (89%), family (85%), community (73%), and peer (57%); that for the second grade was: school (92%), personal (88%), family (80%), community (71%), and peer (61%). Those who in the third grade reported perceived stress from five sources with different rank: personal (94%), school (93%), family (77%), community (70%), and peer (59%).

The subjects in the second grade (95%) adopted approach coping in the past 30 days less than those in the first and third grade (98%). The subjects in the third grade reported more frequency in risky driving (35%), cigarette smoking (29%), alcoholic beverage drinking (30%), and substance use (2%) than those in the first and second grade. The subjects in the first grade reported more frequency in substance use (2%) and attempted suicide (25%), and in that they never engaged in any of the health-risk behaviors (53%).

Educational program. The sources of reported stress are different for various education groups. The subjects in the general, vocational, comprehensive educational program reported perceived stress from five sources in the same rank (see Appendix 19, Table 19). They were school, personal, family, community, and peer. The percentage of the subjects in the comprehensive educational program reported more perceived stress from family (83%), peer (63%), and community (73%) than other groups.

The subjects who attended a comprehensive educational program (99%) adopted approach coping in the past 30 days more than those who attended a general (97%) and vocational educational program (95%). The subjects of vocational educational program reported more frequency in risky driving (35%), cigarette smoking (28%), and alcoholic beverage drinking

(27%) than those of general and comprehensive educational program. The subjects of comprehensive educational program reported more frequency in substance use (3%) and attempted suicide (25%). The subjects of general educational program (53%) reported more frequency in that they never engaged in any of the health-risk behaviors.

Ethnicity. The sources of reported stress are different for various ethnic groups. The ranks for five sources that the aboriginal subjects reporting perceived stress were: school (93%), personal (86%), family (84%), community (76%), and peer (61%); for the non-aboriginal subjects, it was: personal (92.3%), school (91.7%), family (79%), community (69%), and peer (58%) (see Appendix 20, Table 20).

The percentage of aboriginal subjects (96%) who adopted approach coping in the past 30 days was slightly less than that of non-aboriginal subjects (97%). The aboriginal subjects reported more frequency in risky driving (43%), cigarette smoking (32%), alcoholic beverage drinking (35%), substance use (4%), and attempted suicide (21%) than non-aboriginal subjects. Approximately 55% of the non-aboriginal subjects and only 38% of the aboriginal subjects reported that they never engaged in any of the health-risk behaviors.

Parental marriage. The sources of reported stress are different for the groups with various parents' marriage status. The subjects with married parents reported perceived stress from school (92%), personal (90%), family (80%), community (71%), and peer (59%). Also, 96% of them reported using approach coping in the past 30 days. The subjects with non-married parents reported perceived stress from personal (92%), school (91%), family (85%), community (72%), and peer (59%). Also, 99% of them reported using approach coping in the past 30 days (see Appendix 21, Table 21).

The subjects with not-married parents reported more frequency in risky driving (37%),

cigarette smoking (30%), alcoholic beverage drinking (35%), substance use (3%), and attempted suicide (23%) than those with married parents. Approximately 53% of the subjects with married parents and only 39% of the subjects with not-married parents reported they never engaged in any of the health-risk behaviors.

Parental income. The subjects were classified into three income groups according to parents' monthly average income: low, medium, and high-income group. The sources of reported stress are different for the various income groups. The high-income group reported more frequency in personal (94%) and school (94%) stress than other sources of stress. The major source of stress for the medium-income group was school (95%), whereas personal stress (94%) was the major stress for low-income group.

The low-income group reported using approach coping in the past 30 days (98%) slightly more than the high and the medium-income groups (97%). The low-income group reported more frequency in risky driving (32%) and alcoholic beverage drinking (31%) than the medium and the high-income groups (see Appendix 22, Table 22). The high-income group reported more frequency in cigarette smoking (25%) than the low and the medium-income groups. The high and the low-income groups had same reported frequency in substance use (2%). The high and the low-income groups reported more frequency in attempted suicide (21%) than the medium-income group (15%). Approximately 61% of the subjects in the medium-income group, 49% in the low-income group, and 48% in the high-income group reported they never engaged in any of the health-risk behaviors.

Sample characteristics by coping groups. The sample characteristics on demographic variables by coping groups are presented in Appendix 23, Table 23. Whether there was a relationship between each of eight demographic variables and the three coping groups was

examined by chi-square test. The non-significant chi-square values indicated that there were no relationships between them, except the relationship between the education programs and the three coping groups existed (χ^2 / df = 21.5/4, p value < .05). The percentages of the subjects attending vocational education program in the low (54%) and the medium (49%) coping groups were more than those in the high coping group (33%). Also, the percentage of the subjects attending comprehensive education program (37%) was more than that in the low and the medium coping groups (24%). That is, the three coping groups significantly differed in relation to the subjects who attended various educational programs.

Research Question One

The first research question of this study was: What are the sources of stress for adolescents, approach coping strategies they draw on, and health-risk behaviors they engaged in? To answer this question, descriptive analyses of each scale are presented by all subjects and by the three coping groups. Raw data for each item were presented in Appendix 24, Table 24 to Appendix 32, Table 32.

Stress scales

The percentages of the subjects reporting perceived stress from each source of stress (including the original options from "Felt slightly stressful" to "Felt extremely stressful") were analyzed. The percentages for all subjects (n = 722) reporting the sources of stress, in descending order, were: school (94%), personal (92%), family (70%), community (57%), and peer (49%). The mean scores of stress intensity for five sources of stress, in descending order, were: school (mean = 1.73, SD = .93), personal (mean = 1.56, SD = .87), family (mean = 1, SD = 1.00), community (mean = .80, SD = .86), and peer (mean = .74, SD = .94).

The percentages of the subjects reporting perceived stress from each source of stress were analyzed by three coping groups (see Table 4). The sources of stress reported by the low coping group were slightly different from that reported by the medium and the high coping groups. The major sources of stress for the three coping groups were school, personal, and family contexts. Next to these contexts, the low coping group reported peer stress more than community stress, whereas the medium and the high coping groups reported community stress more than peer stress.

Approach coping

Only 3% of the subjects (n = 722) reported that they never used any of the approach coping strategies listed in this study. The majority of the subjects (97%) reported they adopted these approach coping strategies from "rarely used" to "always used" in the past 30 days. The mean score of responses on the Approach Coping Scale was 2.01 (SD = 0.83), indicating that on the average the subjects used these approach coping methods "occasionally".

The percentages of the subjects using approach coping strategies were different among three coping groups (see Table 4). In the low coping group (n = 185), 11.9% of the subjects reported that they "never" used and 88.1% reported that they "rarely" used the approach coping strategies listed in this study. In the medium coping group (n = 340), all subjects "occasionally" used the approach coping strategies. In high coping group (n = 197), 91.9% of the subjects "often" used and 8.1% "always" used the approach coping strategies.

Table 4

Descriptive analysis of stress, approach coping, and health-risk behaviors by coping groups

	Coping Groups		
	Low (n = 185)	Medium (n = 340)	High (n = 197)
Reported perceived tress			
Personal	89.7%	94.1%	90.9%
Family	62.7%	71.2%	75.6%
Peer	43.8%	51.2%	49.7%
School	90.8%	95.0%	94.4%
Community	40.5%	62.6%	64.0%
Adopted approach coping strategies	88.1%*	100%**	100%***
Engaged in any of health-risk behaviors			
Risky driving	32.4%	29.1%	25.9%
Cigarette smoking	30.8%	23.2%	17.3%
Beverage drinking	28.6%	24.7%	24.9%
Illicit drug use	2.2%	1.8%	1.0%
Attempted suicide	22.6%	21.2%	16.2%
Never have any of health- risk behaviors	44.9%	51.8%	51.3%

Note. * In low coping group, 88.1% of the subjects "rarely" used approach coping strategies.

** In medium coping group, all subjects "occasionally" used approach coping strategies.

*** In high coping group, 91.9% of the subjects "often" used and 8.1% "always" used approach coping strategies.

Health-Risk Behaviors

Three types of health-risk behaviors were investigated: risky driving, substance use, and attempted suicide. The percentages of the subjects ever engaging in health-risk behaviors (including the original options "It occurred less than before", "It occurred as same as usual", and "It occurred much more than before") were analyzed.

Approximately 29% of the subjects (n = 722) reported that they ever engaged in risky driving. The percentage next to the risky driving was alcoholic beverage drinking (26%), cigarette smoking (24%), and attempted suicide (20%). Only 1% of the subjects reported they ever used illicit drugs. The mean scores of the responses on the Health-Risk Behavior Scales were: risky driving (mean = .38, SD = .68), cigarette smoking (mean = .44, SD = .89), alcoholic beverage drinking (mean = .35, SD = .70), and illicit drug use (mean = .03, SD = .22) attempted suicide (mean = .28, SD = .66).

The percentages of engaging in health-risk behaviors reported by the three coping groups were different (see Table 4). The subjects in the low coping group reported engaging in any of the health-risk behaviors more than those in the medium coping group; also, the subjects in the medium reported engaging in any of the health-risk behaviors, except the cigarette smoking, more than those in the high coping group. The percentage (51.8%) of the subjects in the medium coping group reporting that they never engaged in any of the health-risk behaviors was more than that in the high (51.3%) and the low (44.9%) coping groups.

All the three coping groups reported risky driving as the major health-risk behavior they engaged in (32.4% for low coping group, 29.1% for medium coping group, 25.9% for high coping group). Next to risky driving, the low coping group (n = 185) reported cigarette smoking (30.8%) more than alcoholic beverage drinking (28.6%), whereas the medium (n = 340) and the

high coping (n = 197) groups reported alcoholic beverage drinking (24.7% for medium coping group, 24.9% for high coping group) more than cigarette smoking (23.2% for medium coping group, 17.3% for high coping group). Moreover, approximately 22.6% of the subjects in the low coping group, 21.2% of those in the medium coping group, and 16.2% of the subjects in the high coping group reported they engaged in attempted suicide. The last health-risk behavior the subjects reported they engaged in was illicit drug use (2.2% for low coping group, 1.8% for medium coping group, 1.0% for high coping group).

Bivariate Correlations between Measures

The relationships between stress, approach coping, and health-risk behaviors within whole sample are presented in this section. Pearson's correlation matrix analyzing bivariate associations for these variables is presented in Table 5.

Each source of stress was positively correlated with each other. The Pearson's correlation coefficients were all larger than 0.3 ($p< 0.05$). Also, the relationships between health-risk behaviors were all significantly positive ($p< 0.05$), but only the correlation coefficients between risky driving and cigarette smoking ($r = .47$), alcoholic beverage drinking ($r = .48$), and illicit drug use ($r = .30$) as well as the correlation coefficient between cigarette smoking and alcoholic beverage drinking ($r = .43$) were larger than .3.

Not all sources of stress were correlated with the frequency of engaging in health-risk behaviors. Frequency of risky driving behaviors was positively correlated with higher levels of family, school, and community stress. Smoking behavior was correlated with family and school stress. Drinking behavior was correlated with personal and family stress. Illicit drug use behavior was only correlated with community stress, and attempted suicide behaviors were correlated with all sources of stress. However, only the correlation coefficients between attempted suicide and

personal (r = .31), family (r = .35), peer (r = .29), and school stress (r = .28) were about or larger than .3.

Approach coping was positively correlated with four sources of stress (family, peer, school, and community and negatively correlated with cigarette smoking ($p < .05$). The correlations between them were, however, trivial ($r < .3$).

Table 5

Pearson's correlation matrix of life stresses, approach coping, and health-risk behaviors (n = 722)

	1	2	3	4	5	6	7	8	9	10	11
1. Personal stress	1										
2. Family stress	0.44*	1									
3. Peer stress	0.45*	0.48*	1								
4. School stress	0.58*	0.48*	0.43*	1							
5. Community stress	0.34*	0.40*	0.51*	0.51*	1						
6. Risky driving	0.07	0.09*	0.02	0.14*	0.13*	1					
7. Cigarette smoking	0.05	0.15*	0.02	0.09*	0.02	0.47*	1				
8. Beverage drinking	0.08*	0.11*	0.05	0.06	0.01	0.48*	0.43*	1			
9. Illicit drug use	0.06	0.01	0.02	0.00	0.08*	0.30*	0.08*	0.24*	1		
10. Attempted suicide	0.31*	0.35*	0.29*	0.28*	0.23*	0.11*	0.13*	0.15*	0.17*	1	
11. Approach coping	0.04	0.11*	0.12*	0.15*	0.23*	-0.05	-.12*	-0.05	0.03	-0.03	1

* $p < 0.05$.

Since the Pearson's correlation coefficients only provide the information on relationship between two variables and do not consider measurement errors, further analyses by structural equation modeling are discussed in the following sections of hypotheses testing.

The Final Model

To answer the research question two (Does approach coping have stress-moderating effects on health-risk behaviors?) and the research question three (Are life stresses related to health-risk behaviors?), structural equation modeling was conducted to test a hypothesized model of life stress effects on health-risk behaviors (see Figure 1). This section presents the overall descriptions on the final model, including (1)interactive versus additive model, (2) loadings and measurement errors, (3) explained and unexplained variances, (4) effects of demographic variables on health-risk behaviors (5) effects of demographic variables on life stresses, and (6) evaluation of the final model.

Interactive versus Additive Model

The moderating function of approach coping was examined by testing both an additive and interacting model. The overall model fit index for the additive model indicated the data did not fit this model (χ^2 / df = 449.73/342, p value = 0.00008). The overall fit index was improved for interactive model (χ^2 / df = 15.18/16, p value = 0.51163). The next step was to examine whether the difference between two models was significant. The difference of chi-square and degree of freedom was calculated: χ^2 = 434.55 and df = 326. The equation: [Z = $\sqrt{2\chi^2}$ - ($\sqrt{2}$ df – 1)] converted both values to a standard Z score equal to 3.97, which indicated the difference between two models was significant ($p < 0.001$), indicating that the moderating function of approach coping should be considered in the model. Therefore, the interactive model was

considered the initial model to answer research question 2 and 3 (also, to test hypothesis 1 and 2).

The next step was to test for a difference of parameter estimates between the three coping groups. For example, the parameter estimate of personal stress for predicting risky driving was –0.18 (t = -1.55) for low coping group, and –0.07 (t = -0.85) for medium coping group, and 0.23 (t = 1.93) for high coping group. The parameters of the low and the medium coping groups were fixed as the same value. Next the comparison of the high coping group and the combined low and medium groups was conducted by re-running the structural equation modeling. The improved non-significant chi-square indicated a better data-model fit. Structural equation

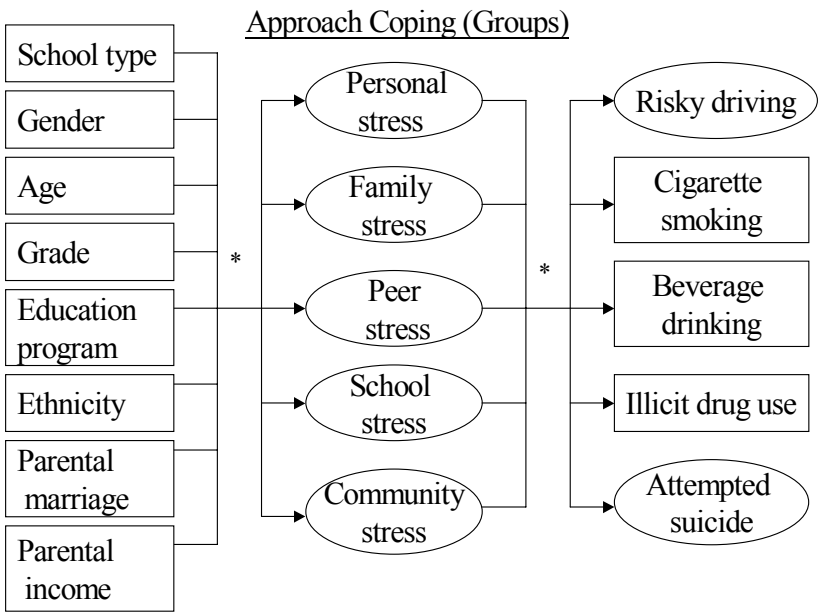

Figure 1. A hypothesized model of life stress effects on health-risk behaviors. The ellipses mean latent construct and the rectangles mean observed measured variable. The asterisks represent the paths to be estimated.

modeling was repeatedly run for each exogenous variable to achieve better fit. The overall fit index (*p*-value for chi-square) ranges from 0 (bad fit) to 1 (perfect fit). Although the changes of chi-square value for each test was very small, the chi-square value of the final model reached 93.58 without significance (d*f* = 161, *p* value = 1), indicating that the final model fit the data very well.

Loadings and Measurement Errors

Appendix 33, Table 33 listed the loadings of latent construct on the observed variables. Each of the eight demographic variables and the three substance use variables was measured by using a single indicator; therefore, their loadings were assumed to be perfect, which is equal to 1. The loadings of latent constructs (each of life stresses, approach coping, risky driving, and attempted suicide) on their indicators were all over .90, indicating that the relations between the latent constructs and their indicators were good. The standardized measurement errors for observed variables were all low ranging from .13 to .22 in the low coping group; .10 to .18 in the medium coping group; and .08 to .25 in the high coping group. This indicated that the degree that the instruments were measuring the intended latent construct was high.

Explained and unexplained variances

Unlike regression analysis or analysis of covariance assuming the measure is perfect, structural equation modeling takes errors into account in the equation. The explained variances (squared R) accounted for by the equation and the unexplained variances (unstandardized and standardized structural errors) for the health-risk behaviors are listed in Appendix 34, Table 34 and those for the life stresses were listed in Appendix 35, Table 35.

Most of the equations showed reasonable explanations for the health-risk behaviors in the three coping groups (see Appendix 34, Table 34). For the low coping groups, the explained

variances for the health-risk behaviors ranged from 13.1% (alcoholic beverage drinking) to 38.3% (attempted suicide); for the medium coping groups, they ranged from 2.4% (illicit drug use) to 30.1% (attempted suicide); and for the high coping group, they ranged form 6.4% (cigarette smoking) to 23.1% (attempted suicide). Among the three coping groups, the highest explained variance was 38.3% for attempted suicide in the low coping group, next to it were: 36.1% for cigarette smoking in the low coping group, 30.1% for attempted suicide in the medium coping group, 28.3% for risky driving in the medium coping group, 23.1% for attempted suicide in the high coping group as well as 22.8 % for illicit drug use in the low coping group, and 21% for risky driving in the low coping group. However, the unexplained variances showed that each health-risk behaviors were explained by other factors not included in this study.

In addition, the explained variances that eight demographic variables accounted for each of stresses raged from 2.4% to 12.6%, which was low (see Appendix 35, Table 35), indicating that the intensity of life stresses the adolescents perceived was influenced by factors other than the eight demographic variables included in the study.

Effects of Demographic Variables on Health-Risk Behaviors

In this section, the effects of demographic variables on each health-risk behavior are presented by the results of structural equation modeling. Appendix 36, Table 36 listed the regression coefficients (*b*), and *t* value of demographic variables on health-risk behaviors.

Risky driving. Demographic variables, including gender, grade, educational program, ethnicity, and parental income were significantly correlated with risky driving behaviors. Male students tended to have more risking driving behaviors in all coping groups (low coping group: $b = -1.36$, $p < .01$; medium coping group: $b = -1.36$, $p < .01$; high coping group: $b = -.80$, $p < .05$). In addition, the low coping group was affected by grade level. The students in higher grades tended

to have more risky driving behavior in the low coping group (b= .69, p< .01). The relative effect of educational program indicated that the low coping group (b= 1.52, p< .05) and the medium coping group (b= .95, p< .05) in the vocational program were affected more than those in the comprehensive program and those in the general program (low coping group: b= 1.20, p>.05; medium coping group: b= .64, p> .05). The effect of ethnicity was found for both low and medium coping groups (b= -0.83, p< .01); aboriginal students tended to have more risky driving than non-aboriginal students. The low coping group was affected by parental income (b= .79, p< .05), the students whose parents had higher income tended to have more risky driving behaviors.

Cigarette smoking. School type, gender, age, educational program, ethnicity, and parental marriage were significantly correlated with cigarette smoking behavior. The low coping group was affected by school type. The adolescents who attended public school tended to smoke on more days in the recent 30 days (b= .78, p< .01) in low coping group. Male students tended to have more cigarette smoking behaviors in all coping groups (low coping group: b= -0.61, p< .01; medium coping group: b= -0.33, p< .01; high coping group: b= -.24, p< .05). The effect of age was found in medium coping group; the students who were older tended to have more smoking behavior (b= .48, p< .01). The low coping group (b= .73, p< .01) and the medium coping group (b= .29, p< .05) were affected more by comprehensive program than vocational program (low coping group: b= .42, p< .05, medium coping group: b= .27, p< .05). The effect of ethnicity was found for the low coping group (b= -0.35, p< .05); aboriginal students tended to have more smoking behavior than non-aboriginal students did. The low coping group was affected more by parental marriage (b= .34, p< .01); the adolescents, whose parental marriage status was divorce, separation, or re-married, tended to have more cigarette smoking behaviors.

Alcoholic beverage drinking. Gender, educational program, ethnicity, parental marriage, and parental income were significantly correlated with alcoholic beverage drinking behavior. For the medium and the high coping groups male tended to drink beverages on more days (b = -.11, p< .05). The medium group was affected more by vocational program (b= .18, p< .05) than comprehensive program (b= .07, p> .05). The effect of ethnicity was found for the low (b = -0.32, p< .01) and the medium coping group (b= -0.19, p< .05). The medium coping group was affected more by parental marriage (b= .24, p< .01); the adolescents, whose parental marriage status was divorce, separation, or re-married, tended to have more above health-risk behaviors. The low coping group was affected by parental income (b= .79, p< .05); the students whose parents that had higher income tended to involve in more alcoholic beverage drinking.

Illicit drug use. Ethnicity and parental income were significantly correlated with illicit drug use. In low coping the aboriginal students tended to have more illicit drug use behavior than non-aboriginal students did (b= -0.10, p< .05). Also, the low coping was affected by parental income more than the other groups (b= .09, p< .01); the students whose parents that had higher income tended to involve in more illicit drug use.

Attempted suicide. Gender, ethnicity, parental marriage, and parental income were significantly correlated with attempted suicide behaviors. The low and the medium coping groups were more affected by gender. Female students tended to have more suicide attempts than male students did in the low and the medium coping groups (b = .69, p< .01). For the low coping group aboriginal students tended to have more suicidal attempts than non-aboriginal students did in his study (b= -.90, p< .05). The medium coping group was affected more by parental marriage (b= .72, p< .05); the adolescents whose parental marriage status was divorce, separation, or re-married, tended to have more above health-risk behaviors. The low coping group was affected

by parental income more than the other groups attempted suicide (b= 1.04, p< .01); the students whose parents that had higher income tended to involve in more above health-risk behaviors.

Effects of Demographic Variables on Life Stresses

In this section, the effects of demographic variables on each life stresses are presented by the results of structural equation modeling. Appendix 37, Table 37 listed the regression coefficients (b), and t value of demographic variables on health-risk behaviors.

Personal stress. Gender, educational program, ethnicity, and parental income were significantly correlated with personal stress. Females perceive more stress from personal context than males in the low coping group (b= 1.77, p< .01); on the contrary, males perceive more stress in the medium coping group (b= -.89, p< .05). Grade level affected personal stress more for the low coping group; the students in higher grade tended to perceive more stress from personal context in the low coping group (b= .84, p< .05). Comprehensive program (b= 2.24, p< .01) affected more personal stress than general program (b= 1.49, p>.05) for the high coping group. Ethnicity affected more personal stress (b= 1.80, p< .05) for the low coping group; non-aboriginal students tended to perceive more personal and family stress. Parental income affected personal stress more for the medium coping group (b= -.76, p< .05) and the high coping group (b= -.89, p< .05); the students whose parents that had higher income perceived less stress from personal context.

Family stress. School type, gender, age, and ethnicity were significantly correlated with family stress. School type affected family stress more for the low coping group. The private school students tended to perceive more stress from family context than the public school students in the low coping group (b= -1.45, p< .05). Female students tended to perceive more stress from family context (b= 1.24, p< .05) for the high coping group. Age affected the family

stress for the medium coping group; the students who were younger tended to perceive more stress from family (b= -.79, p< .01). Ethnicity affected family stress more for the low coping group; non-aboriginal students tended to perceive more family stress (b= 1.67, p< .05).

Peer stress. School type, gender, educational program, ethnicity, and parental income were significantly correlated with peer stress. School type affected peer stress for all groups; the private school students perceive more stress from peer stress (low coping group: b= -0.70, p< .01; medium coping group: b= -0.70, p< .01; high coping group: b= -1.23, p< .05). Female students tended to perceive more stress from peer context (b= .82, p< .05) for the high coping group. Also, the high cooping group was affected by age; the older students in the high coping group tended to perceive more stress (b= .873, p< .05). Comprehensive program (b= 1.40, p< .01) had more effects on peer stress than vocational program (b= 1.02, p< .05) for medium coping group. Ethnicity affected peer stress more for the medium coping group; non-aboriginal students tended to perceive more peer stress for the medium coping group (b= 1.13, p< .01). Parental income affected peer stress more for the medium coping group (b= -.82, p< .01); the students whose parents that had higher income perceived less stress from peer context.

School stress. Gender, age, education, and ethnicity were significantly correlated with school stress. Female students in the low coping group tended to perceive more stress from school (b= 1.50, p= < .05). Age affected school stress for the medium coping group; the students who were younger tended to perceive more stress from school (b= -.808, p< .01). General program (b= 2.63, p< .01) affected more school stress than comprehensive program (b= 0.15, p>.05) for the low coping group. Ethnicity affected school stress more for the medium coping group (b= -1.04, p< .05); aboriginal students perceived more stress from school than non-aboriginal students did.

Community stress. Grade, educational program, ethnicity, parental marriage, and parental income were significantly correlated with community stress. Grade affected community stress more for the low and the medium coping groups. The students in lower grade tended to perceive more stress from community (b= -0.82, p< .01). Vocational program (b= 1.72, p< .05) affected more community stress than comprehensive program (b= 1.01, p>.05) for the low coping group. Aboriginal students perceived more stress from school and community contexts than non-aboriginal students did (b= -2.43, p< .01). Parental marriage affected community stress more for the medium coping group. The students, parental marriage status was married, tended to perceive more community stress (b= -1.49, p< .05). Parental income affected community stress more for the medium and the high coping groups (b= -1.15, p< .01); the students whose parents that had higher income perceived less stress from community context.

Evaluation of the final model

For clarity of the figure, the final model that delineated the relationships between stress and health-risk behaviors is shown separately for the three coping groups in Figure 2 to Figure 4. In addition to the non-significant value of chi-square (one of absolute fit indices), as compared with criteria of model fit (Mueller, 1996), the other absolute fit indices, incremental fit indices, and parsimonious fit indices for global model indicating that the data fit the final model well (see Appendix 38, Table 38). Also, the indices of model fit for each group model, including root mean square residua (RMR), standardized RMR, and goodness-of-fit index, indicated that the data fit each group model (see Appendix 39, Table 39).

In the final model, the relationship between exogenous and endogenous variables was estimated by the unstandardized regression coefficients (b) and the strength (accuracy of prediction) of the relationship between the variables was estimated by how high the structural

coefficients (β and γ) were as well as how high the explained variance (R^2) was. A line from an exogenous or from an endogenous variable to an endogenous variable illustrated there was a significant relationship between the two variables. The non-significant relationships are not shown in the figures, but the estimated values of the parameters are listed in Table 6, Appendix 36, Table 36, and Appendix 37, Table 37. Table 6 presents the unstandardized regression coefficients (b), t values, and structural coefficients (β) of the sources of stress on the health-risk behaviors. Appendix 36, Table 36 presents the unstandardized regression coefficients (b), t values, and structural coefficients (γ) of the demographic variables on the health-risk behaviors and Appendix 37, Table 37 presents the unstandardized regression coefficients (b), t values, and structural coefficients (γ) of the demographic variables on each of life stresses.

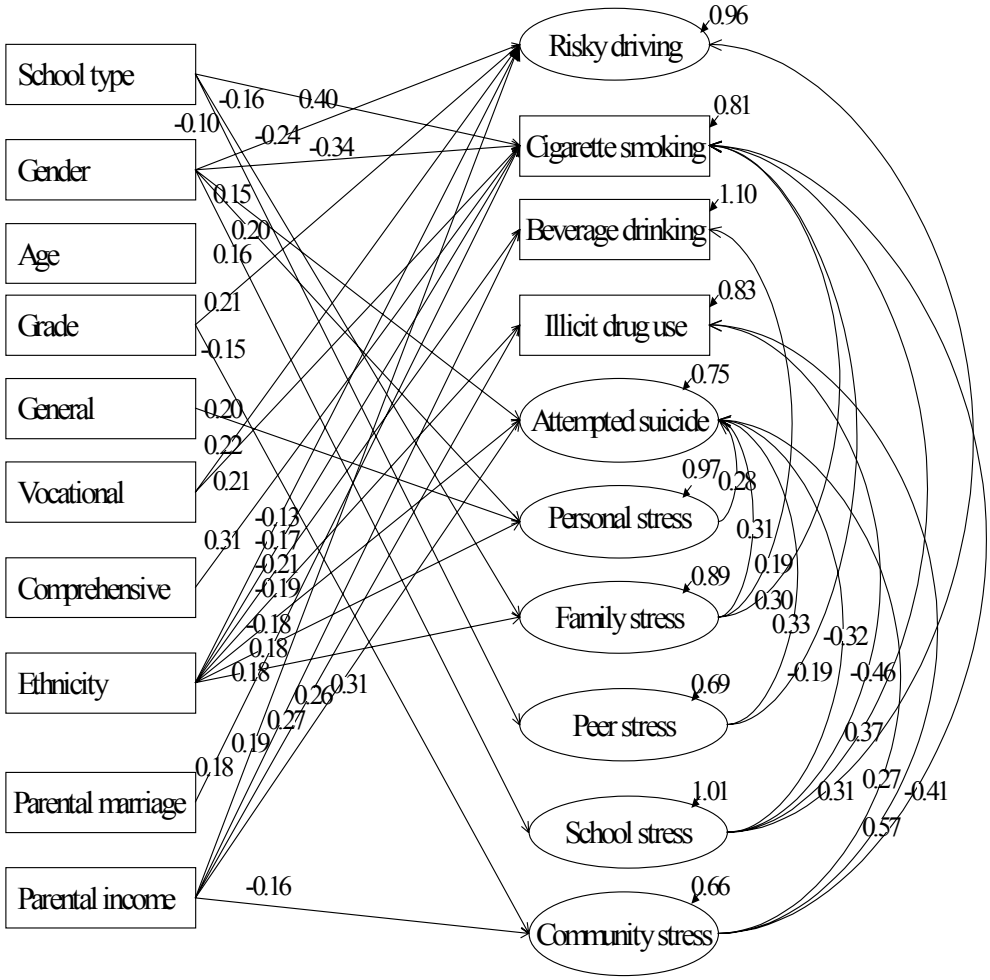

Figure 2. Final model of life stress effects on health-risk behaviors for low approach coping group.

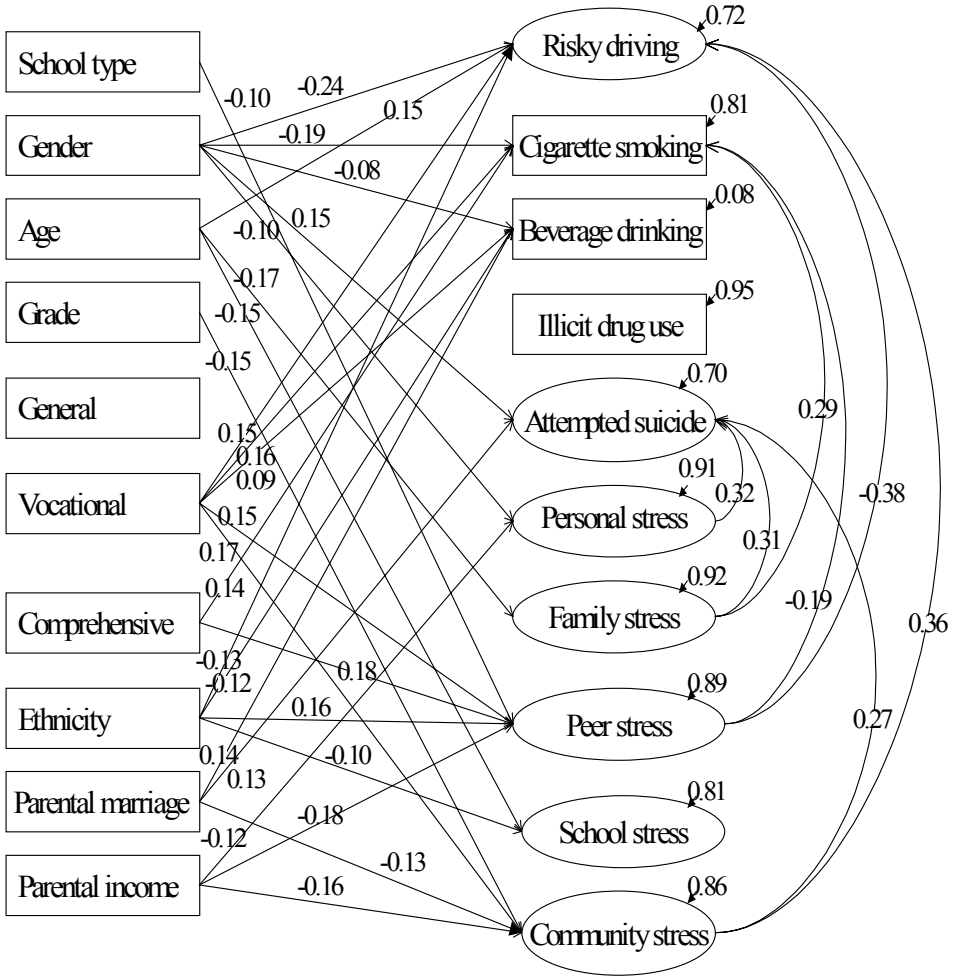

Figure 3. Final model of life stress effects on health-risk behaviors for medium approach coping group.

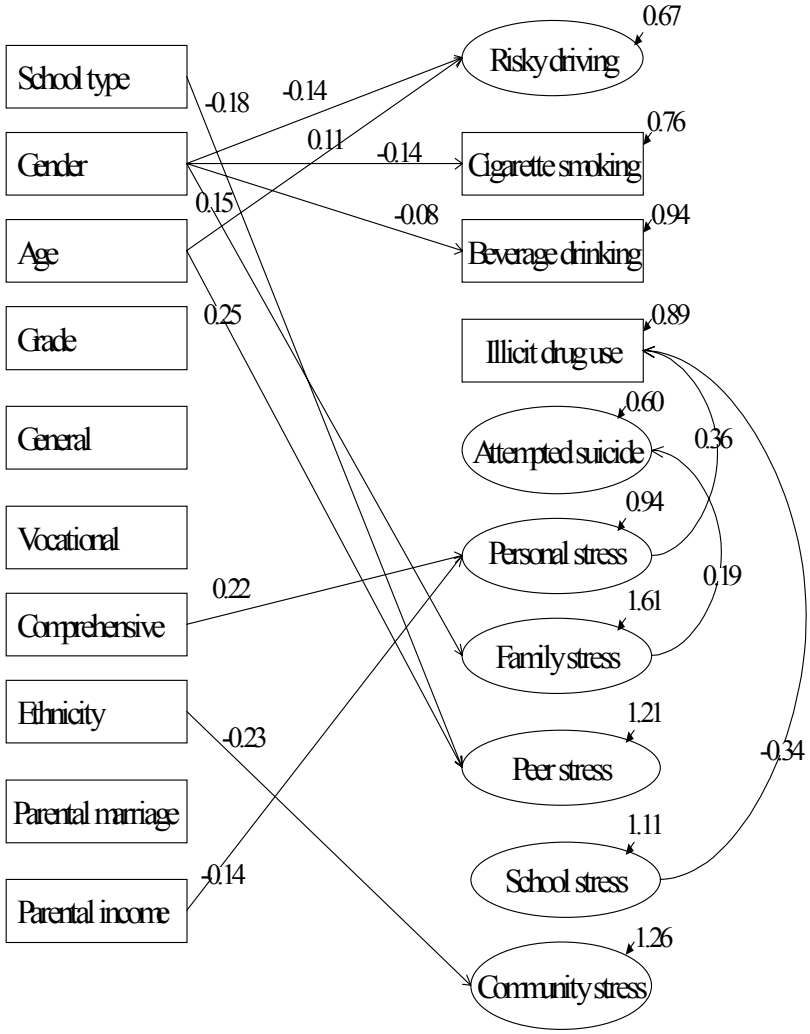

Figure 4. Final model of life stress effects on health-risk behaviors for high approach coping group.

Research Question Two

The research question 2 is: Does approach coping have stress-moderating effects on health-risk behaviors? It was hypothesized in this study that the relationships between life stresses and health-risk behaviors are smaller in the high coping group than in the medium coping group. Also, it hypothesized that the relationships between life stresses and health-risk behaviors for both high and medium coping groups are smaller than that in the low coping group.

The results of structural equation modeling indicated that the second hypothesis was only partially supported. The stress-moderating effects of approach coping were not consistently demonstrated among the relationships between life stresses and health-risk behaviors. Even if the interactive effects of stress and approach coping were found, they may not show the moderating effects. The study found that the correlation coefficients between life stresses and health-risk behaviors were smaller in the low coping group or the medium coping group than those in the high coping group. That is, as the life stress increased, the subjects who were in the high coping group reported health-risk behavior more than those who were in the medium or the low coping group.

Six patterns of stress-approach coping interaction appeared in this study (see Table 6). First, the moderating effects of approach coping existed in some relationships of stress-risk behavior. These relationships presented the hypothesized pattern that stress level and involvement in risk behaviors were positively associated, and the effect of stress was lessened and non-significant when the level of approach coping increased. They were the relationship between school stress (low coping group: $b = 0.19$, $p < .05$; medium and high coping group: $b = 0.07$, $p > .05$), community stress (medium coping group: $b = 0.22$, $p < .05$; high coping group: $b = 0.11$, $p > .05$), and risky driving, the relationship between family stress (low and medium coping group: $b =$

0.06, $p < .05$; high coping group: $b = 0.01$, $p > .05$), school stress (low coping group: $b = 0.07$, $p < .05$; medium and high coping group: $b = 0.02$, $p > .05$), and cigarette smoking, the relationship between family stress and alcoholic beverage drinking (low coping group: $b = 0.03$, $p < .05$; medium and high coping group $b = 0.00$, $p > .05$), the relationship between community stress and illicit drug use (low coping group: $b = 0.03$, $p < .05$; high coping group: $b = 0.01$, $p > .05$), as well as the relationship between family stress and attempted suicide (low and medium coping group: $b = 0.17$, $p < .05$; high coping group: $b = 0.10$, $p > .05$).

The relationship between community stress and attempted suicide presented the second pattern of stress-approach coping interaction. The relationships between community stress and attempted suicide in the low and the medium coping groups were positive and significant ($b = 0.13$, $p < .05$), and that in the high coping group the relationship was negative and non-significant ($b = -0.01$, $p > .05$), indicating that adolescents who used less approach coping and perceived more community stress had a higher suicidal score than adolescents who used more approach coping did and that approach coping buffered the effects of community stress on attempted suicide for adolescents who used more approach coping.

Contrary to expectations, the third pattern of stress-approach coping showed that stress level and involvement in risk behaviors were positively associated but the effect of stress was stronger in the higher approach coping group. Adolescents with a high score on life stress were also high on health-risk behaviors at higher level of approach coping, indicating that approach coping did not have moderating function but exacerbate the effects of stress for some situations. Two relationships presented this pattern: personal stress and illicit drug use (low coping group: $b = 0.01$, $p > .05$; high coping group: $b = 0.02$, $p < .05$) as well as personal stress and attempted suicide (low coping group: $b = 0.15$, $p < .05$; medium coping group: $b = 0.17$, $p < .05$).

Adolescents who had higher levels of personal stress tended to have more illicit drug use and attempted suicide even though they adopted more approach coping.

The fourth pattern was that stress level and involvement in risk behaviors were negatively associated in the three coping groups; however, as the perceived stress increased the adolescents at the lower level of approach coping reported less risk behaviors than adolescents at the higher level of approach coping. This pattern appeared in the relationship between peer stress and driving behavior (medium coping group: b = -0.35, p< .05; high coping group: b = -0.05, p>.05) as well as the relationship between peer stress and cigarette smoking (low and medium coping group: b = -0.05, p< .05; high coping group: b = -0.01, p> .05). Adolescents in the low and the medium coping groups tended to report less risky driving and smoking behaviors than those in the high coping group as the stress level increased, indicating that there were no moderating effects of approach coping for peer stress-risky driving and peer stress-smoking relationships. The relationship between school stress and illicit drug use also presented this pattern. The relationships between school stress and illicit drug use were all statistically significant in the low and the high coping groups (b = -0.02, p< .05), also indicating that there was no moderating effect of approach coping.

The fifth pattern was that the relations between stress level and involvement in risk behaviors were negative in the low coping group but it was positive in higher coping group. The relationship between community stress and cigarette smoking presented this pattern (low coping group: b = -0.08, p< .05; medium and high coping group: b = 0.01, p> .05). Adolescents in the low coping group perceived more community stress but had less smoking behavior. Whereas those in the medium and the high coping groups had more smoking behavior as they perceived more community stress; though the relationships for both groups were not statistically significant,

it indicated that there were no moderating effects of approach coping for the community stress-cigarette smoking relationship.

The last pattern was that mixed effects existed among three coping groups. It appeared in the relation between peer stress and attempted suicide. In low coping group, the relationship was positive and significant ($b = .24$, $p < .05$). Compare the low coping group with the medium coping group ($b = -.13$, $p > .05$) or high coping group ($b = .15$, $p > .05$), the moderating effect of approach existed. However, comparison between the medium coping group and the high coping group, the stress effect was larger in the high coping group though the effects were not significant for both groups.

Table 6

Unstandardized correlation coefficients (b) and standardized structural coefficients (β) of life stresses on health-risk behaviors for three coping groups.

	Personal			Family			Peer			School			Community		
	b	*t*	*β*	*b*	*t*	*β*	*b*	*t*	*β*	*b*	*t*	*β*	*b*	*t*	*β*
Risky driving															
L										0.19	3.83	0.31			
M				0.10	1.71	0.15	-0.35	-4.43	-0.38	0.07	1.61	0.11	0.22	4.22	0.36
H				0.09	1.29	0.13	-0.05	0.53	0.06	0.07	1.61	0.11	0.11	1.87	0.19

Table 6 (continued).

	Personal			Family			Peer			School			Community		
	b	*t*	*β*	*b*	*t*	*β*	*b*	*t*	*β*	*b*	*t*	*β*	*b*	*t*	*β*
Cigarette smoking															
L				0.06	2.87	0.30	-0.05	-2.85	-0.19	0.07	2.99	0.37	-0.08	-3.32	-0.41
M				0.06	3.79	0.29	-0.05	-2.85	-0.19	0.02	1.25	0.08	0.01	0.49	0.03
H				0.01	0.30	0.03	-0.01	-0.41	-0.04	0.02	1.25	0.08	0.01	0.49	0.03
Alcoholic beverage drinking															
L	0.02	1.89	0.10	0.03	2.28	0.19									
M	0.02	1.89	0.10	0.00	0.49	0.03									
H	0.01	1.11	0.09	0.00	0.49	0.03									
Illicit drug use															
L	0.01	1.74	0.24				0.01	1.09	0.13	-0.02	-2.73	-0.46	0.03	4.00	0.57
M				0.00	1.13	0.07									
H	0.02	2.19	0.36	-0.01	-1.40	-0.16	-0.01	-0.76	-0.09	-0.02	-2.22	-0.34	0.01	1.50	0.18
Attempted suicide															
L	0.15	2.02	0.28	0.17	4.28	0.31	0.24	2.59	0.33	-0.15	-2.02	-0.32	0.13	3.01	0.27
M	0.17	3.04	0.32	0.17	4.28	0.31	-0.13	-1.80	-0.17	-0.04	-0.70	-0.09	0.13	3.01	0.27
H				0.10	1.96	0.19	0.15	1.84	0.20				-0.01	-0.13	-0.01

Note. The empty cells mean that there are no effects of stress on health-risk behavior for that group. The *t* values which are larger than 1.96 are significant at 0.05 level. L means low coping group, M means medium coping group, and H means high coping group.

In summary, the moderating effects of approach coping existed in the relationships between family stress and all health-risk behaviors, indicating that the subjects might effectively use these approach coping strategies to deal with the stressful events in the family context. However, the approach coping might not be effective to deal with personal stress since the subjects reported more illicit drug use and attempted suicide in the higher coping group than in the lower coping group. Also, the approach coping could be partially effective in dealing with the peer, school, and community stress since the stress-moderating effects only existed in some of the stress-risk behavior relationships in peer, school, and community contexts.

Research Question Three

The research question 3 is: Are life stresses related to health-risk behaviors? It was hypothesized in this study that the effect of stressors, including personal, family, peer, school, and community stress, will be positively correlated with health-risk behaviors, including risky driving, cigarette smoking, alcoholic beverage drinking, substance use, and attempted suicide.

The results of structural equation modeling indicated that different health-risk behaviors were correlated with different sources of stress for the three coping groups. The relationships between stress and health-risk behaviors existed in the low coping group more than that in the medium coping group; also, the relationships existed in the medium coping group more than that in the high coping group. However, not all relationships were positive (see Figure 2 to Figure 4). The strength (β) and direction (positive or negative) of the relationships are presented for the three coping groups as follows:

Low Coping Group

Stress from peer context was correlated with risky driving (β = .31). Four sources of stress, including family (β = .30), peer (β = -.19), school (β = .37), and community stress (β = -.41),

were correlated with smoking behavior. Only family stress was correlated with drinking behavior (β = .19). Two sources of stress, including school (β = -.46) and community (β = .57), were correlated with illicit drug use. All sources of stress were correlated with attempted suicide: personal (β = .28), family (β = .31), peer (β = .33), school (β = -.32), and community (β = .27).

Medium Coping Group

The sources of stress were correlated with risky driving, smoking, and attempted suicide in the medium coping group. Stress from peer (β = -.38) and community (β = .36) was correlated with risky driving. Two sources of stress, including family (β = .29) and peer (β = -.19), were correlated with smoking behavior. Three sources of stress were correlated with attempted suicide: personal (β= .32), family (β = .31), and community (β = .27).

High Coping Group

The sources of stress were correlated with illicit drug use and attempted suicide in the high coping group. Stress from personal (β = .36) and school (β = -.34) were correlated with illicit drug use. Stress from family (β = .19) was correlated with attempted suicide.

CHAPTER FIVE

DISCUSSION

A discussion of the findings is presented in this chapter, which is divided into four sections: (1) research question one, (2) research question two, (3) research question three, and (4) effects of the demographic variables.

Research Question One

The first research question of this study was: What are the sources of stress for adolescents, approach coping strategies they draw on, and health-risk behaviors they engaged in?

Stress scales

Previous studies suggest that adolescents perceive stress from personal, family, peer, and school contexts more than macro-social context. However, the current study found that school and self were the major sources of stresses for most respondents and that the least significant source of stress was community context for the low coping group and peer context for the medium and the high coping groups. The sample adolescents did not ignore their macro-environment; rather, most of them perceived more community stress than peer stress. However, the low average score on the stress intensity for each stress scale showed that on the average the subjects perceived "slightly" stress from these contexts.

The current study analyzed data by three coping groups, which is different from previous studies. However, the findings of the current study were similar to Chaing's (1993). In her study, 714 senior high school students in Kouhsiung, Taiwan reported that the most disturbing events for them were concerned with their study, learning, and future. Also, the only one item related to macro-environment: The environmental pollution demolishes the quality and security of life, was the eighth highest rated stressful event for adolescents. However, this item was included in

personal stress in her study. Tsou (1997) also reported adolescents' perceptions of stress in community context. The community stressors included air pollution, water pollution, noise, crime, environmental contamination, lack of restaurant hygiene, and low quality of life in the neighborhood. The average scores for community stress were higher than scores for peer stress. In the current study adolescents were also affected by community stress from their neighborhoods and macro-environment.

Compared to previous studies (Chaing, 1993; Tsou, 1997), however, the average intensity of perceived stress was low. This difference in average intensity may be due to either the differences in measurement, resilience of sample adolescents to these stressors or that there were other stressors not measured in the study.

Approach Coping Scale

The sample in this study reported high frequency in adopting coping strategies including logical analysis, problem solving, positive reappraisal, and seeking support/guidance. However, they used these coping strategies only “occasionally”, indicating that the respondents used other coping strategies not measured on this scale. Also, the reported frequency on the item 4 of problem solving (see Appendix 29, Table 29) was low, indicating that they do not have active behavior to manage problems.

Health-Risk Behavior Scales

The percentages of the subjects ever engaging in risky driving, alcoholic beverage drinking, cigarette smoking, and attempted suicide were high in this study. However, the subjects reported that they had these risky behaviors in the past 30 days less than before. The findings on each risky behavior are discussed as follows:

Risky driving. The percentage that the subjects of the three coping groups reported engaging in risky driving behaviors in this study was lower than that reported by Yen and Li's (1997). Yen and Li (1997) investigated health-risk behaviors in Hualien City in 1994, and found that more than 60% of 1,152 high school students had hazardous motorcycling behaviors such as not getting a license to operate a motorcycle, motorcycling in the fast lane, not wearing a helmet, and motorcycling at high speed. However, in this study less than 50% of students reported these behaviors. Among the three coping groups, the low coping group was most susceptible to this risk behavior.

The possible reason is that the traffic laws regarding motorcycling behaviors have been established and well enforced in recent years. The regular monitoring of adolescents' driving behaviors by policemen may have decreased the rate of risky driving behaviors.

Substance use. The percentage that the subjects reported engaging in cigarette smoking behavior was high in this study. In 1994, 11.4% of 1,141 high school students in the Hualien area reported they were current smokers (Li, Tsai, Hsiao, & Chen, 1995). Chang (2001) reported that 24% of 892 senior high school students In Taipei City ever smoked a cigarette. In this study, 24% of the subjects (n = 722) and 32.4% of the subjects in the low coping group (n = 185) reported that they ever smoked. This is a significant increase over the Li, Tsai, Hsiao & Chen study and the Chang study.

Chang (2001) also reported that 26% of the sample adolescents ever drank alcoholic beverage drinking and 6.8% ever drank 5 or more drinks in the past 30 days. In this study 28.6% of the subjects in the low coping group ever drank alcoholic beverage drinking. This is a slightly increase over the Change study. However, since the way of scaling is different, the comparison in how many percentages of the subjects drank 5 or more drinks in the past 30 days is difficult.

In this study, approximately 1% of the subjects in the high coping group (n = 197) and over 2% of the subjects in the low coping group (n = 185) ever used illicit drugs. However, in Chang's study (2001), only few subjects reported they used marijuana (3 subjects), glue (3 subjects), illicit drugs (1 subject) and medicine (3 subjects).

Despite of the smoking prevention program implemented by the Department of Health and the Ministry of Education in Taiwan in the past five years, the percentages of the subjects reporting substance use in this study were still more than that in the previous studies. Especially among the three coping groups, the low coping group was most susceptible to cigarette smoking, alcoholic beverage drinking, and illicit drug use.

Attempted suicide. A high percentage of the subjects reported attempting suicide was found in this study and the other surveys. In the current study, approximately 20% of the subjects (n = 722) engaged in attempting suicide in the past 30 days. Among the three coping groups, the low coping group was most susceptible to this risk behavior.

Compared to the previous studies, the researcher found that regardless of Eastern or Western society, in urban or rural areas, adolescents reported similar percentages in suicide behavior and ideation. For examples, Chang (2001) reported that 21.5% of the sample adolescent considered suicide and 10.9% tried to suicide. About 5.6% of them actually attempted suicide and about 0.8% needed to be treated by a doctor in the past one year. Moreover, Kann, et al. (2000) found in a nationwide survey including 15,349 high school students in United States that 19.3% of students had seriously considered attempting suicide, 14.5% had made a specific plan to attempt suicide, and 2.6% being treated because of suicide in the past 12 months.

To sum up, the subjects in the low coping group were most susceptible to all kinds of health-risk behaviors. The percentages of the subjects reported ever engaging in health-risk

behaviors were mostly over that in the previous studies. However, it is difficult to directly compare the present findings with the previous studies, since this study used a different way of scaling (the study asked the subjects compared the occurrence of the behaviors in the past 30 days with that in the past) and the previous study generally asked the frequency of the behaviors in the past 30 days). Moreover, that the study used multiple items to measure a health-risk behavior is different from that previous studies measured a health-risk behavior by a single item. Therefore, studies similar to the present study should be implemented in similar population in various areas in Taiwan.

Research Question Two

The research question 2 is: Does approach coping have stress-moderating effects on health-risk behaviors? It was hypothesized in this study that the relationships between life stresses and health-risk behaviors are smaller in the high coping group than in the medium coping group. Also, it hypothesized that the relationships between life stresses and health-risk behaviors for both high and medium coping groups are smaller than that in the low coping group. Six patterns of stress-coping interaction were found. Five interpretations for the mixed evidence of the stress-moderating hypothesis were considered for this study: three are methodological and two are theoretical.

The first interpretation is a methodological issue related to the classification of coping groups. The subjects who reported they “rarely” used the approach coping strategies were classified into the low coping groups. The subjects who reported they “occasionally” used the approach coping strategies were classified into the medium coping groups. The subjects who reported they “often” or “always” used the approach coping strategies were classified into the

high coping groups. The cut-off point was 1.5 between the low and the medium coping groups and 2.5 between medium and high coping.

The medium coping group in this study was composed of 340 subjects. Among them, 100 subjects obtained scores ranged from 1.5 to 1.67, which was close to the low coping group. Also, scores for 53 subjects in the medium coping group (score = 2.33) and for 55 subjects in the high coping group (score = 2.5) were also very close. The marginal difference might cause mixed effects of stress-coping interaction in some situations, for example, the last pattern of interaction (the subjects in the low coping group reported more health- risk behavior than those in the medium and the high coping groups, whereas the subjects in the medium coping group reported less health-risk behavior than those in the high coping group).

The second interpretation is methodologically concerned with of the items in the Approach Coping Scale. Moos (1997) conceptualized approach coping skills as four domains: logical analysis, positive reappraisal, seeking guidance/support, and problem solving. Each domain is measured using six items. In this study, however, after testing for validity and reliability, the Approach Coping Scale used in this study used only six items to measure four types of approach coping skills. This may have been insufficient to represent the domain of approach coping behaviors. Therefore, it may be necessary to include more items on approach coping scale for the future studies.

The third interpretation is also methodological, in that the stress-moderating function of approach coping was not found for the personal stress and peer stress. However, family stress was moderated through approach coping for smoking, drinking, and attempted suicide behaviors. The question about which situations approach coping is, or is not, effective in relation to different source of stress, needs to be further examined. The study adopted a global measure of

coping strategies; however, the subjects were not asked to respond in relation to each source of stress, they were only asked about their customary coping behaviors. Therefore, it is a limitation for this study to conclude under what situation the approach coping would be more effective. Future studies may use global measure of coping across situations or use situational measure to help interpret the effectiveness of coping skills.

The fourth interpretation is theoretical in nature and concerned the function of Approach Coping Scale. That is, approach coping may not work effectively for every situation. Ebata and Moos (1994) declared that problem solving and logical analysis were highly correlated. However, the adjustment might not be effective if individuals simply think about the problem but take no action to change the situation. In this study, the adolescents were found to use more logical analysis skills than problem solving skills. It might be that less use of active actions, including problem solving and seeking guidance, reduced the effectiveness of approach coping. In the future studies, the interaction of logical analysis and problem solving could be examined for their stress-moderating function. Also, health professionals need to assess what adolescents have done to deal with their problem in addition to assess how they think about the problem.

Further more, some researchers claimed that avoidance coping skills are more effective than approach coping skills in some situations. Holahan and Moos (1998) asserted that avoidant coping might be effective at the onset of a stressor. Also, Wills and Filer (1996) asserted that the moderation function of avoidance coping was more consistent than that of active coping. Therefore, the function of avoidance coping skills needs to be compared in the future study.

Finally, part of the inconsistent stress-moderating effects might be due to the interaction effect between gender and approach coping. Pearlin and Schooler (1978) proposed the socialization theory, which delineates the relationship among gender, stress, coping, and

depression. This theory hypothesizes that females are taught to use more passive or emotion-focused coping skills during socialization processes and thus females are more vulnerable than males to stressful life events. Several studies on stress and coping found that males used more logical analysis and problem-solving behaviors than females, but females used more social support than males did; also, females used more emotional venting and males used more substance to avoid stressors (Carver, Scheier, & Weomtraib, 1989). However, not all studies on adolescent stress showed gender differences in coping skills (Williams & Lisi, 2000).

In this study, the mean scores of the 6-item approach coping scale for male and female adolescents were 11.16 (SD= 4.78) and 12.01 (SD= 4.40); there was a significant difference between two mean scores (t = -2.47, p< .05). Only one item measuring seeking guidance /support on the approach coping scale that showed gender-difference (t = 7.35, p< .01). On this item, males had a mean score equal to 1.44 (SD= 1.13) and females had 2.07 (SD= 1.17). That females seek more guidance/support than males was supported in this study.

However, there were no gender differences in either of the two items for logical analysis, the two items for problem-solving, or the one item for positive re-appraisal. Therefore, whether the gender-differences in coping skills and the effectiveness of coping skills cause the inconsistent results of stress moderating in this study should be further examined. Also, the socialization theory of gender, stress, coping, and depression might need to revise its proposition regarding males using more problem solving skills than females.

Research Question Three

The research question 3 is: Are life stresses related to health-risk behaviors? This study hypothesized that the effect of stressors, including personal, family, peer, school, and community stress, will be positively correlated with health-risk behaviors, including risky driving, cigarette smoking, alcoholic beverage drinking, substance use, and attempted suicide.

That stress was related to risky driving in the low and the medium coping groups was found, which a previous study did not find (Li, 1995). The adolescents with higher life stress and lower approach coping skills in this study would engage in more risky driving behaviors. Moreover, the percentage of the subjects reported cigarette smoking was highest among three substance use behaviors in the low coping group; also, that was second high in the medium and the high coping groups. Cigarette smoking was related to more sources of stress than alcoholic beverage drinking and illicit drug use, indicating that cigarette may be easily available for adolescents. Furthermore, adolescents who perceived more stress from different sources were more likely to have suicidal attempts. This finding was consistent with the previous studies on depression, suicidal ideation, and suicidal attempts (Chang & Hwu, 1993; Huff, 1999; Hwu, 1992) in that the increases in negative life events would increase the negative psychological adjustment.

That the different sources of stress had varied effects on outcomes was also reported in previous studies (Byrne & Mazanov, 1999). This study supported the idea that the phenomenon of stress is universal, but different types of stressors have diverse effects for individuals; especially, the subjects in the low coping group were most susceptible to any of the health-risk behaviors.

However, some of the relationships between sources of stress and health-risk behaviors were negative, indicating that approach coping may be effective for certain sources of stress

within each coping group. For example, in the low coping group adolescents might smoke cigarettes for changing adverse feelings originating from family and school stressors but not for those from peer and community stressors because the effectiveness of approach coping were varied for these sources of stress within this group.

In this study, stress from adolescents' macro-environment had effects on more health-risk behaviors than other sources of stress did. Stress from either school or community context affected four types of health-risk behavior, except drinking behavior. The strength of the relationship between community stress and illicit drug use was the highest one among all stress-risk behavior relationships (β= 0.569). These findings support the assertions that adolescents' health-related behaviors are influenced by their macro-environment (Noack & Kracke, 1997; Seiffge-Krenke, 1998)

Finally, there was a significant bivariate relation between personal stress and alcoholic beverage drinking. However, this relationship was not found among the coping groups after considering the effect of stress-coping interaction in the structural equation modeling analysis. On the contrary, some relationships did not appear in the Pearson's correlation analysis, but were found significant in structural equation modeling analysis. They were the relationships between peer stress, community stress, and smoking behavior, as well as, the relationships between personal stress, school stress, and illicit drug use. These findings support the assertion of moderator effects on the stress process (Lazarus, 1990; Lazarus & Folkman, 1984; Weaton, 1985). This finding supports the conclusion that using bivariate correlation analysis without considering other factors such as moderators and measurement errors does not have sufficient information for interpretations of the results.

Effects of the Demographic Variables

Although similar studies like the current study are rare and the comparisons of different research findings are limited, there were some important findings on the effects of the demographic variables from this study. First, the finding that students attending private school perceived more peer stress than those attending public school. The private school is located in a urban area, whereas the public school is located in a rural area, thus, it may be either the atmosphere in school or culture surrounding the schools are influencing differences in adolescents' perceived stress from peers.

Second, gender had the most consistent effects across the coping groups; many health-risk behaviors and sources of stress were gender-related. Females perceived stress from more contexts and had more suicide attempts, whereas males perceived less stress and had more health-risk behaviors. These findings were consistent with a previous study (Seiffge-Krenke, 1998).

Third, aboriginal students tended to engage in more health-risk behaviors. However, non-aboriginal students perceived higher stress from all, except community, contexts than aboriginal students did. Another study also found similar results in a sample of adolescents in Hualien (Li & Yen, 1998). In the current study, the mean scores on approach coping scale for aboriginal students (mean = 11.48, SD = 4.63) and non-aboriginal students (mean = 11.64, SD = 4.60) were not significantly different ($p > .05$).

Aborigines' health behaviors and health status are a salient issue in Taiwan. A study of secondary data analysis indicated that most standardized mortality ratios of death causes of aborigines were higher than that of non-aborigines in 1999 (Wu, Lu, & Chang, 2001). The major reason for their high mortality related to an unhealthy lifestyle. The findings of this study

indicated aboriginal students might not be as vulnerable to these stressors, implies that health education about health and discovering other sources of stressors for them is important. On the contrary, most of non-aboriginal students in the low and the medium coping groups maintained less health-risk behaviors than aboriginal students even though they perceived more stress. That teaching more coping strategies and exploring how they response to stress may be more appropriate for this group.

Finally, previous studies on adolescents in Taiwan usually included students of vocational and general educational programs as their sample. This study involved an additional type of program, comprehensive educational program. The findings showed that general program students perceived stress from study (school stress), that comprehensive program students were vulnerable to some sources of stress. Also, vocational program students perceived more community stress and engaged in more health-risk behaviors.

The three types of educational programs have different educational goals for students. The goal for students attending general program is preparation for entry into college or university. "Testocracy" is popular in Taiwan's society. Taiwanese students perceive stress from study, especially general high school students, who must spend a significant amount of time studying in order to achieve in school. Students attending vocational program are trained for employment. Their grades in junior high school were mostly at a lower level. These students may focus more on social life than school life. They may spend more time in community than in study and learn health-risk behavior from the community more than those attended the other educational programs. The students attending comprehensive program receive both types of curriculums, which let them delay decisions about a future career. However, the comprehensive educational

system has been established for only 6 years in Taiwan. Therefore, the characterization and adaptation of these students is less known and needs to be further investigated.

CHAPTER SIX

CONCLUSION, IMPLICATION, AND RECOMMENDATION

Conclusion

The primary goal of this study was to examine the relationships of stress and health-risk behaviors and the moderating effects of approach coping. The study had three research questions: (1) What are the sources of stress for adolescents, approach coping strategies they draw on, and health-risk behaviors they engaged in? (2) Does approach coping have stress-moderating effects on health-risk behaviors? and (3) Are life stresses related to health-risk behaviors?

For the research question one, the study found:

1. The descending order of the five sources of stress that the total sample reported perceived stressful was: school, person, family, community, and peer. For the sample adolescents, the main sources of stress were study and learning, the changes in psychosocial development during adolescence, and the parent-child relationship, security and quality of life in the macro-environment, and interpersonal relationships among friends. The findings were different from the previous studies in that peer context was not the major source of stress for this sample.

The sources of stress reported by the three coping groups were slightly different from that by the total sample. The three coping groups reported school, person, and family contexts as the major sources of stress. The low coping group reported peer stress more than community stress. Whereas the medium and the high coping groups perceived more stress from a community context than from a peer context. Finally, the mean scores of stress intensity reported by the total sample and the three copings groups were low for each stress scale, indicating that the sample adolescents were resilient or that there were other stressors not included in the study.

2. The majority of the subjects adopted approach coping strategies to manage stressful events in the past 30 days. The strategies included logical analysis, problem solving, seeking support/guidance, and positive re-appraisal; but these strategies were used only "occasionally", indicating that adolescents may use other coping strategies not included in the study. That gender-differences on approach coping was found in the study. However, there were no differences between males and females on logical analysis, problem solving, and positive re-appraisal. The difference was only found in that female adolescents used guidance/support more than male adolescents.

3. Three types of health-risk behaviors were investigated: risky driving, substance use, and attempted suicide. The descending order of the health-risk behaviors that the total sample reported was: risky driving, cigarette smoking, alcoholic beverage drinking, attempted suicide, and illicit drug use. The majority of the subjects reported that they engaged in these behaviors in the recent 30 days less than before. However, the percentages of the adolescents reporting they ever engaged in any of the health-risk behaviors were still more than that in the previous studies.

The health-risk behaviors that the three coping groups were susceptible to were slightly different. Risky driving was the major health-risk behavior for the three coping groups. Alcoholic beverage drinking was the second one for the medium and the high copings, whereas cigarette smoking was that for the low coping group. Attempted suicide and illicit drug use were the fourth and fifth risk behaviors for the three coping groups. Moreover, the percentages of the subjects in the low coping group reporting that they ever engaged in any of the health-risk behaviors were higher than that in the medium and the high coping groups. That is, the low coping group was most susceptible to any of the health-risk behaviors.

For the research question two: Does approach coping have stress-moderating effects on health-risk behaviors? The study found that the moderating effects of approach coping were not consistent for each stress-risk behavior relationship. Similar to previous studies, the theoretical stress-moderating function of approach coping was not supported for every situation in this study. The interpretations for the mixed evidence of the stress-moderating hypothesis for this study were considered as methodological and theoretical.

The methodological reasons included (1) that the way of classifying coping groups may have produced some of the mixed evidence, (2) that the 6-items of the Approach Coping Scale may have been insufficient to represent the domain of approach coping behaviors, and (3) that the Approach Coping Scale should be used as a situational measure in order to assess its effectiveness. The theoretical reasons included (1) that approach coping strategies may be not effective and avoidant coping strategies may be effective in some situations, and (2) that gender-differences on approach coping may produce interaction effect between gender and approach coping so that the moderating effects of approach coping on life stress were varied in some situations.

For the research question three: Are life stresses related to health-risk behaviors? The study found that varied sources of stress would have different associations with health-risk behaviors. The findings of the study included:

1. Life stresses were related to risky driving, providing evidence for the conclusion that adolescents engaged in risky driving when experiencing feelings of stress. Cigarette smoking was related to more sources of stress than other substance use behaviors. All sources of stress were related to attempted suicide, indicating that adolescents who perceived more sources of stress tended to have more suicidal attempts.

2. The direction of the relationships between stresses and health-risk behaviors was either positive or negative, indicating that approach coping may function differently for sources of stress within each coping group.

3. Compared the results of Pearson's correlation analysis to the results of structural equation modeling, the study supported the assertion that researchers investigating stress processes should consider the function of moderators.

The findings related to the use of confirmatory factor analysis and structural equation modeling are discussed as follows:

1. The study adopted confirmatory factor analysis to sample items that were more representative of a latent construct and to further improve the meaning of a latent construct. Each of the scales in this study was demonstrated its data-model fit. Some items deleted from the original stress scales did not reflect the theoretical meaning of the concepts as well as those retained in the study; however, they may reflect other underlying factors of life stress.

2. Structural equation modeling allowed for examination of several variables simultaneously so that the study included 82 observed variables and sampled enough subjects to examine the relationships between life stress, approach coping, and health-risk behaviors. The study found the subjects different in life stresses and health-risk behaviors by the eight demographic variables in the study; especially those in the low coping group were influenced by school type, gender, ethnicity, and education program.

3.Structural equation modeling assumes that the measure is not perfect and provides information on error variances and explained variances; therefore, the researcher could get the results that were more close to the reality and recognize how well the demographic variables and the life stresses explained the health-risk behaviors. This method also provided the indices of

data-model fit, thus the researcher could evaluate how well the model could provide a theoretically consistent set of findings. The overall fit index (*p*-value for chi-square) ranges from 0 (bad fit) to 1 (perfect fit). The non-significant chi-square values (χ^2 / df = 93.58/161, *p* value = 1.00) showed that the final model fit the data very well in this study.

Implication and Recommendation

The study examined the effects of life stress on health-risk behaviors in a sample of Taiwanese adolescents who were classified into three coping groups. The results of the study implicate that health promotion programs should be addressed to the needs of adolescents for the goal of promoting adolescents' health behaviors. Moreover, more researches are needed for further understanding of the relationships between life stress and health-risk behaviors and the moderating effects of approach coping. The implications of the study, followed by the recommendations, for development in practice, research, and theory are discussed as follows.

Practice

Implications and recommendations for practice are discussed as follows:

1. School context was the major source of stress followed by personal, family, community, and peer context for the total subjects, implicating that Taiwanese adolescents primary perceived stress from study. Therefore, health promotion program addressing adolescent stress should address at minimum the school stressors. Also, educational policy makers and school educators should continually assess what are adolescents' perceptions from education system and school environment that are related to study.

For example, learning and study are the major concerns for the sample adolescents in this study. Health educators should work together with teachers to assess adolescents' needs for learning skills or their perceptions for competitions of study. Also, health educators may use peer

groups of study in health promotion program to support adolescents and to teach them alternative learning techniques.

Moreover, school stressors other than learning and study should be assessed. For example, the Ministry of Education in Taiwan has executed an Educational Reform Action Program for few years; however, new admission system is not well established. A few newspapers from adolescent students indicate that they are not yet to adapt to changes in educational policy. The Ministry of Education and school educators should systematically assess how well adolescents understand the educational policy and what are their needs for career development.

2. Although the previous studies generally suggest that adolescents are primarily influenced by their peer groups, one unique finding of the study was that most adolescents perceived stress from community more than peer context. Therefore, considering the changing society of Taiwan, rather than ignore the influences of community environment on adolescents, health educators should realize that Taiwanese adolescents need to be prepared to function in a changing political and economic environment and to learn to address local community issues.

Health educators should adopt an interdisciplinary approach using community resources to work with adolescent. The community resources may include teachers, parents, non-profit civic groups, religious organizations, and local government. The interdisciplinary team can empower adolescents with the skills to identify and seek solutions to the concerns about ‘community’. Thus, adolescents’ would learn to be active citizens from participation in discussing and understanding about their community.

3. The percentages of the subjects engaging in risky driving, substance use, and attempted suicide in this study were more than that in the previous studies in spite of efforts made by the health providers. How the previous prevention programs work is under consideration in Taiwan.

Therefore, in order to ensure the cost-effectiveness of health education and promotion programs, health providers should continuously assess adolescents' needs for health promotion programs and integrate evaluation plans into each program.

4. The descending order of the health-risk behaviors the total subjects reported was risky driving, alcoholic beverage drinking, cigarette smoking, attempted suicide, and illicit drug use in this study, implicating the main concerns of future health promotion programs. However, it does not mean that attempted suicide and illicit drug use were the least important health-risk behaviors for adolescents. In this study, not all sources of stress were correlated with the frequency of engaging in health-risk behaviors. Therefore, health providers should assess all possible sources of stress and health-risk behaviors of adolescents and plan intervention programs that are to meet the adolescents' needs.

For example, although attempted suicide was the fourth health-risk behavior in this study, the percentage of the subjects engaging in attempted suicide was higher than that in the previous studies. Therefore, health providers should particularly notice that those who have multiple sources of stress and prevent their intentional injuries in advance.

5. In this study, the relationship between the source of stress and the health-risk behavior may be either positive or negative. Approach coping may be effective in some situations within each coping group. Therefore, nurses, counselors, and educators should simultaneously assess the existence and the effectiveness of multiple coping strategies adolescents have used. Providing various strategies and continuing assessment of changes in adolescents' coping efforts may be more effective than insisting in adopting one type of coping strategies.

6. Although the subjects in the low coping group reported perceived stress less than those in the medium and the high coping groups. The low coping group was most susceptible to any of

the health-risk behaviors. Also, the relationships between the sources stress and the health-risk behaviors were demonstrated in the low coping groups more than in the medium and the high coping groups. Therefore, health promotion programs should give priority to adolescents who use less approach coping to manage stressful emotion.

7. The subjects were different in sources of stress and health-risk behaviors by demographic variables in the current study; especially those in the low coping group were affected by school type, gender, ethnicity, and education program. Thus, needs assessment for health promotion programs should be directed to specific subpopulation of adolescents so that the programs can be effective.

In general, limited by the resources for intervention programs, these programs were implemented for different types of students. However, the findings of this study showed that gender, educational program, and ethnicity made varied effects. The dissimilarity among the students attending the different types of schools indicated that they have different needs for health education and promotion programs. Therefore, school nurses and educators designing interventions for adolescents' health promotion should consider the characteristics of target adolescents. That is, aboriginal versus non-aboriginal students, females versus males, or students with different educational goals need different intervention programs.

Research

Implications and recommendations for research are discussed as follows:

1. In this study, the intensity of stress on each stress scale and the utilization on approach coping strategies reported by the subjects were low, implicating that there were other stressors or coping strategies not included on the stress scales or that the sample adolescents were resilient.

Therefore, researchers should continually develop assessment tools for sources of stress and coping strategies. Also, subjects in the study were from Hualien, which is a rural area in Taiwan. Researchers should perform similar studies to the present study in other areas in Taiwan to investigate whether adolescents in this area are more resilient than those in urban areas or whether sources of stress are different for adolescents from different areas.

2. The function of the approach coping is theoretically proposed to buffer the stress effects on negative outcomes. However, similar to some previous studies, the moderating effects of approach coping were not demonstrated for every situation in this study. That is, mixed evidences for the moderating effect of approach coping were found. Therefore, the function of the approach coping in theory should be further examined through more researches.

First, in order to have stronger explanations for effectiveness of coping strategies in relation to a specific source of stress, the use of situation-specific coping measures is necessary. Future study could ask how often adolescents use approach coping in relation to each source of stresses, for example, “How often did you use any of logical analysis to deal with personal stressors?”

Second, further studies may investigate multiple coping strategies within a study, and examine other mediator or moderator variables such as self-efficacy or social support. The study examined moderating function of approach coping only. Future studies may include avoidant coping to examine stress-buffering function or to compare its function with approach coping. Furthermore, researchers may include other coping resources such as self-efficacy or social support to expand the understanding of stress processes.

Third, the nature of cross-sectional research design limited the manifestation of causal relationship between variables. Longitudinal analysis is suggested to investigate that the relation between the onset of stress and the function of coping strategies.

Fourth, some demographic variables, such gender, ethnicity, and educational program had effects on many sources of stress and health-risk behaviors. To explore extra-stressors and coping strategies for specific groups of adolescent, interview, focus groups, qualitative research strategies were suggested. Also, applying these strategies to understand how adolescents' perception of community stressors affects their psychological or behavioral adjustment may be useful.

Finally, this study adopted a convenience sample; the generalization of the results should be applied with caution. Also, rare similar models in the literature the current model could be compared with. Therefore, systematic replication and cross-validation are needed to advance more understanding of stress-coping-risk behavior process.

Theory

The study did not support the socialization theory, which proposes males adopt problem-solving and logical analysis more than females. Therefore, the proposition that gender-differences on approach coping needs to be further examined and the theory may need to be revised.

The socialization theory proposes that gender-differences on approach coping are because of socialization processes. Since the theory is developed in 1978, which is far from today, changes in society's attitudes on gender-differences should be considered into theory. Researchers may use meta-analysis study to synthesize the results from previous studies and to compare the differences between male and female adolescents on use of approach coping. Otherwise, researchers may conduct a survey directly asking adolescents that to what extent they are encouraged to use different approach coping strategies when they are under a stressful events.

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Appendix A1. Permission from research site A.

University of Cincinnati
Consent Form

Title of the study: Life stress, approach coping, and health risk behaviors in Taiwanese adolescents
Principle investigator: Shoajen Perng, Doctoral student, College of Nursing, University of Cincinnati, Ohio, U.S.A.

Dear School Principle/President of Parents' Association:

The purpose of the study is to better understand the effects of life stress on adolescents' health behaviors and how they cope with stress. All about 800 students will be invited to participate in the survey. The investigator will select about 600 students from your school. They will take about 20 minutes to respond to a questionnaire in their classrooms. The questionnaire and the definitions of the terms are attached (See Appendix A). The human right for the participants is respected. Each participant should give his/her consent with signature (See Appendix B).

The approval and support from you are appreciated.

Shoa-Jen Perng

CONSENT BY SCHOOL PRINCOPLE/PRESIDETN OF PARENTS' ASSOCIATION

I have read the information provided above and the principle investigator has explained the research process. I agree Shoa-Jen Perng to perform her study of "LIFE STRESS, APPROACH COPING, and HEALTH RISK BEHAVIORS IN TAIWANESE ADOLESCENTS" in this school. After it is signed, I will receive a copy of this consent form.

Hwang Eng Jyi _____ 2001. 6. 21
Signature of School Principle — Date

_____ _____
Signature of President of Parents' Association — Date

Shoa-Jen Perng _____ 2001. 6. 26
Signature of Investigator — Date

Appendix A2. Permission from research site B.

University of Cincinnati
Consent Form

Title of the study: Life stress, approach coping, and health risk behaviors in Taiwanese adolescents
Principle investigator: Shoajen Perng, Doctoral student, College of Nursing, University of Cincinnati, Ohio, U.S.A.

Dear School Principle/President of Parents' Association:

The purpose of the study is to better understand the effects of life stress on adolescents' health behaviors and how they cope with stress. All about 800 students will be invited to participate in the survey. The investigator will select about 200 students from your school. They will take about 20 minutes to respond to a questionnaire in their classrooms. The questionnaire and the definitions of the terms are attached (See Appendix A). The human right for the participants is respected. Each participant should give his/her consent with signature (See Appendix B).

The approval and support from you are appreciated.

Shoa-Jen Perng

CONSENT BY SCHOOL PRINCOPLE/PRESIDETN OF PARENTS' ASSOCIATION

I have read the information provided above and the principle investigator has explained the research process. I agree Shoa-Jen Perng to perform her study of "LIFE STRESS, APPROACH COPING, and HEALTH RISK BEHAVIORS IN TAIWANESE ADOLESCENTS" in this school. After it is signed, I will receive a copy of this consent form.

Chang-Shen Chang — 2001. 6. 26.
Signature of School Principle — Date

Pan Fu Min — 2001. 6. 26.
Signature of President of Parents' Association — Date

Shoa-Jen Perng — 2001. 6. 26
Signature of Investigator — Date

Appendix B. Inform consent .

UNIVERSITY OF CINCINNATI

Consent Form

Title of the study: Life stress, approach coping, and health risk behaviors in Taiwanese adolescents

Principle investigator: Shoajen Perng, Doctoral student, College of Nursing, University of Cincinnati, Ohio, U.S.A.

INTRODUCTION

Before agreeing to participate in this study, it is important that the following explanation of the proposed procedures be read and understood. It describes the purpose, procedures, risks, and benefits of the study. It also describes the right to withdraw from the study at any time. It is important to understand that no guarantee or assurance can be made as to the results of the study.

DESCRIPTION OF THE STUDY

The purpose of the study is to better understand the effects of stress on your health behaviors and how you cope with stress. About 600 students will be invited to participate in the survey. You will be asked to respond to a questionnaire, which will take about 20 minutes of your time. The survey will be given in your classrooms by investigator herself. The faculty of your school will not be present during the time you are answering the questions, and will not be given any information you provided during the survey. The questionnaires will be stored in a locked storage space in investigator's personal office. The investigator is the only person who can access the data. All the questionnaires will be destroyed once the data analysis is finished and the research report is completed.

POTENTIAL RISKS AND BENEFITS

By the participating in this survey, you provide your personal information about adolescent life stress, coping, and health risk behaviors. The results may help health providers better understand the stresses of adolescents and give direction to possible interventions that will help adolescents better cope with the stresses.

The potential risk of participating this survey is that you might feel uncomfortable about answering some of the questions. You might also fear that your information will be given to your teachers, friends or family. You are free to withdraw from the study at anytime. The results will be reported only about adolescents in general and no information about you will be shared with anyone.

CONFIDENTIALITY

Strict confidentiality will be maintained at all times throughout the course of the research process unless disclosure is required by law. No identifying information will be on the questionnaire. Only the investigator will have direct access to this information. Reports at scientific meetings or in scientific journals will not include any information, which identifies you as a participant in this study.

COSTS AND PAYMENTS

There is no monitory payment for participating in the study, and there is no cost to you.

RIGHTS TO WITHDRAW FROM THE STUDY

You may leave portions of the survey blank or turn in a blank survey. You may choose to not participate or to stop participation in the study at any times without penalty. If you choose not to participate, the information collected about you will be destroyed.

CONTACT WITH INVESTIGATOR

If I have question about the research and research subjects' rights, I can contact the principle investigator, Shoajen Perng (Phone: 8572158 #403, e-mail: jen@tccn.edu.tw) or Dr. Linda Sue Davis (Phone: 0021-513-5585280, e-mail: DAVISLS@UCMAIL.UC.EDU). Also, I can contact my class adviser/school principle and ask him/her help to contact the investigator.

VOLUNTARY CONSENT BY PARTICIPANT

I have read the information provided above. I voluntarily agree to participate in the study of "LIFE STRESS, APPROACH COPING, and HEALTH RISK BEHAVIORS IN TAIWANESE ADOLESCENTS". By completing the questionnaire, I indicate my consent to participate in the study. After the consent is signed, I will receive a copy of this consent form.

Signature of Subject/Legal Representative	Date
Signature of Investigator	Date

Appendix C. The questionnaire.

Instruction Page

Adolescent Life Stress Questionnaire

The purpose of this survey is to help health care professionals to understand your life stress, coping strategies, and health-related behaviors. The investigator is a doctoral student, Shoa-Jen Perng studying at University of Cincinnati, U.S.A. for her doctoral dissertation. Your cooperation is very valuable and important to the outcome of the study. Your participation is appreciated.
DO NOT write your name on this survey. The answers you give will be kept private.
You may leave portions of the survey blank or turn in a blank survey.
Please answer the questions based on what you really do.

Thank you very much for your help.
Shoa-Jen Perng

By completing this questionnaire, I indicate my consent to participate in the survey. If I have worries or difficulties that make me feel stressful, with the exception of counseling services in school, I could ask for help from the following counseling centers:

I. Hualien Life Line Association
Address: 34, Ming-Kuo Road, Hualien City
Telephone: 833-9595

II. Chinese Fund for Children and Families/Taiwan
Address: 75, Chung-Hsing Road, Hualien City
Telephone: 823-6005

III. Eastern Youth-Volunteer Organization
Address: 2, Shang-Shian Street, Hualien City
Telephone: 862-7007

VI. Hualien Teacher Chang. Department of counseling guidance
Address: 40-11, Kung-Yuan Road, Hualien City
Telephone: 832-6180

Please use a checkmark to indicate your answer.

1. In what type of school are you ?
- ☐ A. Private
- ☐ B. Public

2. What is your sex?
- ☐ A. Male
- ☐ B. Female

3. What is your full age?
- ☐ A. 15 years old
- ☐ B. 16 years old
- ☐ C. 17 years old
- ☐ D. 18 years old or older

4. In what grade are you?
- ☐ A. First grade
- ☐ B. Second grade
- ☐ C. Third grade

5. In what program are you?
- ☐ A. General program
- ☐ B. Vocational program
- ☐ C. Comprehensive program

6. What is your parents' ethnicity?
- ☐ A. Both parents are Aboriginal tribe.
- ☐ B. Both parents are not Aboriginal tribe.
- ☐ C. Either father or mother is Aboriginal tribe.

7. What is your parents' marriage status?
- ☐ A. Married
- ☐ B. Divorced or separation
- ☐ C. Re-married
- ☐ D. Widower or widow
- ☐ E. Cohabitation
- ☐ F. Others

8.On the average, how much do your parents earn totally for a month?
- ☐ A. Less than NT $ 30,000
- ☐ B. Between NT $ 30,000 and $ 60,000
- ☐ C. Between NT $ 60,000 and $ 90,000
- ☐ D. Between NT $ 90,000 and $ 120,000
- ☐ E. More than NT $ 120,000
- ☐ F. Unknown

In this section, you will find a list of worries and difficulties that adolescents of your age have identified as their problems. Among these there will be certainly some that apply to you personally and some that hardly apply or not at all. Please indicate spontaneously how stressful the problems were for you **during the past 30 days**.

0 means "It didn't happen to me" or "It happened, but I didn't feel stressful at all".
1 means "It happened, and I felt slightly stressful".
2 means "It happened, and I felt moderately stressful".
3 means "It happened, and I felt quite stressful".
4 means "It happened, and I felt extremely stressful".

Please use circle to indicate an appropriate answer.

During the past 30 days, how did you feel about the following situations?	not stressful at all	slightly stressful	moderately stressful	quite stressful	extremely stressful
1. My appearance or figure was not good enough.	0	1	2	3	4
2. My health or physical agility was not good enough.	0	1	2	3	4
3. The ability of expression or communication was not good enough.	0	1	2	3	4
4. Puberty changes (acnes or sexual impulse) were present.	0	1	2	3	4
5. I was confused about my gender.	0	1	2	3	4
6. I didn't know how to plan my future career.	0	1	2	3	4
7. I didn't understand myself.	0	1	2	3	4
8. My thoughts were often different from the others'.	0	1	2	3	4
9. I was struggling to meet my own standards of my performance.	0	1	2	3	4
10. I was confused about the meaning of my life.	0	1	2	3	4

	not stressful at all	slightly stressful	moderately stressful	quite stressful	extremely stressful
11. There were arguments between me and my families.	0	1	2	3	4
12. There were arguments between my parents and the other families.	0	1	2	3	4
13. My parents did not get along with each other.	0	1	2	3	4
14. My parents cared too much for my marks in school.	0	1	2	3	4
15. The parenting style of my parents was authoritative.	0	1	2	3	4
16. My parents didn't listen to me.	0	1	2	3	4
17. My parents disapproved of my friends.	0	1	2	3	4
18. One of my family member had health problems.	0	1	2	3	4
19. My family had financial problems.	0	1	2	3	4
20. I didn't have privacy at home.	0	1	2	3	4
21. I didn't have boy friend/girl friend.	0	1	2	3	4
22. I did not know how to deal with the opposite sex.	0	1	2	3	4
23. I was afraid of losing my boyfriend/girlfriend.	0	1	2	3	4
24. I was making pretenses to please others.	0	1	2	3	4
25. Compared to my friends/classmates, I didn't have enough pocketmoney.	0	1	2	3	4
26. I didn't have a real friend to whom I could talk personal problems.	0	1	2	3	4

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	not stressful at all	slightly stressful	moderately stressful	quite stressful	extremely stressful
27. I was taken advantage by or threaten by my friends/classmates.	0	1	2	3	4
28. My friends/classmates criticized and disapproved of me.	0	1	2	3	4
29. It was difficult to approach others.	0	1	2	3	4
30. Some friends/classmates asked me to do things I didn't like.	0	1	2	3	4
31. The competitions (e.g. academic grades or group/class competitive activities) were high in school .	0	1	2	3	4
32. The arrangement of extracurricular activities in the school could not meet my needs.	0	1	2	3	4
33. The school rules were strict/the punishment was not fair.	0	1	2	3	4
34. The facilities of my school could not satisfy my needs.	0	1	2	3	4
35. I didn't adjust to some teachers' teaching methods.	0	1	2	3	4
36. I didn't adjust to how some of teachers treated students.	0	1	2	3	4
37. The materials I studied were difficult.	0	1	2	3	4
38. My grade wasn't good enough.	0	1	2	3	4
39. There was too much homework and too many examinations.	0	1	2	3	4
40. I didn't know how to learn effectively.	0	1	2	3	4
41. My neighbors were not friendly enough.	0	1	2	3	4

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	not stressful at all	slightly stressful	moderately stressful	quite stressful	extremely stressful
42. The issues of domestic violence, unemployment, and substance abuse occurred in my neighborhood.	0	1	2	3	4
43. The issues of environmental pollution (e.g. water, air, noise, or garbage) occurred in my neighborhood.	0	1	2	3	4
44. It was not convenient for medical care, shopping, or arts exhibition in my neighborhood.	0	1	2	3	4
45. The public services of my neighborhood was not good enough (e.g. libraries, gym, transportation, safety facilities, water/electric supply).	0	1	2	3	4
46. The positions or environment of part-time jobs was not good enough in my neighborhood .	0	1	2	3	4
47. The crime rate was high in my neighborhood.	0	1	2	3	4
48. The weather or natural disaster (e.g. storm, typhoon, earthquake) destroyed the living quality and safety of the neighborhood.	0	1	2	3	4
49. The social, economic, and political issues in my country were disorderly.	0	1	2	3	4
50. The political issues between R.O.C. and P.R.O.C. were disturbing.	0	1	2	3	4

Appendix 1, Table 1

Cut-off score on the Approach Coping Scale for three coping groups

Average score	*f*	%	Recoded score	*f*	%	Coping groups	*f*	%
0.00	9	1.25	0	22	3	Low	185	26
0.17	5	0.69						
0.33	8	1.11						
0.50	11	1.52	1	163	23			
0.67	18	2.49						
0.83	13	1.80						
1.00	32	4.43						
1.05	1	0.14						
1.17	46	6.37						
1.33	40	5.54						
1.43	2	0.28						
1.50	44	6.09	2	340	47	Medium	340	47
1.67	56	7.76						
1.70	1	0.14						
1.83	55	7.62						
2.00	67	9.28						
2.17	63	8.73						
2.26	1	0.14						

Appendix 1, Table 1 (continued).

Average score	*f*	%	Recoded score	*f*	%	Coping groups	*f*	%
2.33	53	7.34						
2.50	55	7.62	3	181	25	High	197	27
2.67	47	6.51						
2.83	28	3.88						
3.00	20	2.77						
3.17	14	1.94						
3.33	17	2.35						
3.50	7	0.97	4	16	2			
3.67	5	0.69						
4.00	4	0.55						
Total	722	100		722	100		722	100

Appendix 2, Table 2

Sample characteristics by gender (pilot study)

	Male(n=38)		Female(n=23)		Total(n=61)	
	n	*%*	*n*	*%*	*n*	*%*
Age						
16 years	27	44.30	19	31.10	46	75.40
17 years	10	16.40	2	3.30	12	19.70
18 years	1	1.60	2	3.30	3	3.90
Program						
General	15	24.60	23	37.70	38	62.30
Vocational	23	37.70	0	0	23	37.70
Ethnicity						
Non-aborigine	33	54.10	20	32.80	53	86.90
Aborigine	4	6.50	4	6.50	8	13.10
Parental marriage						
Married	31	50.80	18	29.50	49	80.30
Others	7	11.50	5	8.50	12	19.70
Parental income						
< 30000	9	14.70	7	11.50	16	26.20
30000-60000	20	32.80	7	11.50	27	44.30
>60000	8	13.10	8	13.10	16	26.20
Unknown	1	1.60	1	1.60	2	3.30

Appendix 3, Table 3

Means, standard deviations, reliability (Cronbach's α), and number of items (n) of stress, approach coping, and health-risk behavior scales (pilot study)

Scale	*M*	*SD*	*α*	*n*
Personal stress	10.08	6.52	0.79	10
Family stress	10.16	7.33	0.84	10
Peer stress	6.63	6.71	0.87	10
School stress	13.40	7.56	0.82	10
Community stress	8.05	7.63	0.90	10
Approach coping	16.07	6.57	0.85	8
Risky driving	3.02	3.83	0.83	7
Attempted suicide	0.79	2.90	0.97	6

Appendix 4, Table 4

Standardized factor loadings, residuals, and overall fit index of items on the Personal Stress Scale

	Original scale items		Revised Scale items			
	Loading	Residual	Loading	*t*	Residual	*t*
1. Appearance or figure	0.51	0.74				
2. Physical agility	0.45	0.80				
3. Ability of expression	0.54	0.70	0.48	6.58	0.77	9.33
4. Puberty changes	0.34	0.89				
5. Gender	0.39	0.85				
6. Future career	0.58	0.54	0.74	10.99	0.46	7.41
7. Understanding of myself	0.69	0.52	0.70	10.30	0.51	7.89
8. Thoughts	0.59	0.65	0.55	7.65	0.70	9.05
9. Standards of performance	0.67	0.55	0.70	10.24	0.52	7.93
10. Meaning of life	0.65	0.57	0.69	10.05	0.53	8.04
Overall fit index						
χ^2	86.33		13.69			
df	35		9			
p	0		0.13			

Appendix 5, Table 5

Standardized factor loadings, residuals, and overall-fit index of items on the Family Stress Scale

	Original scale items		Revised scale items			
	Loading	Residual	Loading	*t*	Residual	*t*
11. Arguments (me and my families')	0.67	0.55	0.64	9.20	0.59	8.42
12. Arguments (parents and other families)	0.54	0.71				
13. My parents did not get along	0.51	0.74				
14. Cared for my marks	0.53	0.72				
15. Authoritative parenting style	0.70	0.51	0.69	10.09	0.53	7.94
16. Didn't listen to me	0.72	0.47	0.73	10.92	0.46	7.35
17. Disapproved of my friends	0.64	0.59	0.70	10.22	0.51	7.85
18. Families' health problems	0.36	0.87				
19. Family's financial problems	0.40	0.84				
20. Privacy at home	0.65	0.57	0.68	9.9	0.54	8.06
Overall-fit index						
χ^2	137.70		9.69			
df	35		5			
p	0		0.09			

Appendix 6, Table 6

Standardized factor loadings, residuals, and overall fit index of items on the Peer Stress Scale

	Original scale items		Revised scale items			
	Loading	Residual	Loading	*t*	Residual	*t*
21. No boy/girl friend	0.43	0.82				
22. Deal with the opposite sex	0.49	0.76				
23. Losing boy/girl friend	0.45	0.8				
24. Making pretenses to others	0.60	0.64				
25. Pocket money less than friends	0.45	0.80				
26. No close friend	0.61	0.63				
27. Be taken advantage by friends	0.65	0.58	0.73	10.97	0.46	7.50
28. Be criticized by friends	0.73	0.47	0.79	12.10	0.38	6.40
29. How to approach others	0.75	0.43	0.72	10.81	0.48	7.62
30. Do things I didn't like	0.68	0.54	0.70	10.42	0.51	7.89
Overall fit index						
χ^2	155.97		2.11			
df	35		2			
p	0		0.35			

Appendix 7, Table 7

Standardized factor loadings, residuals, and overall fit index of items on the School Stress Scale

	Original scale items		Revised scale items			
	Loading	Residual	Loading	*t*	Residual	*t*
31. High competitions	0.49	0.76	0.53	7.41	0.72	9.19
32. Extracurricular activities	0.59	0.65				
33. School rules	0.62	0.62				
34. School facilities	0.68	0.54				
35. Teaching methods	0.71	0.49	0.54	7.55	0.71	9.16
36. Teachers' behaviors	0.64	0.59				
37. Difficult materials	0.59	0.65	0.69	10.22	0.52	8.14
38. Grade not good enough	0.66	0.57	0.75	11.40	0.44	7.37
39. Homework and examinations	0.64	0.59	0.67	9.91	0.55	8.30
40. How to learn effectively.	0.67	0.55	0.74	11.27	0.45	7.47
Overall fit index						
χ^2	195.09		10.93			
df	35		9			
p	0		0.28			

Appendix 8,Table 8

Standardized factor loadings, residuals, and overall fit index of items on the Community Stress Scale

	Original scale items		Revised scale items			
	Loading	Residual	Loading	*t*	Residual	*t*
41. Neighbors not friendly	0.43	0.82	0.47	6.46	0.78	9.49
42. Violence, unemployment	0.64	0.59	0.74	11.26	0.46	7.87
43. Environmental pollution	0.62	0.61	0.74	11.42	0.45	7.77
44. Medical care, shopping	0.74	0.46	0.54	7.63	0.71	9.25
45. Public services	0.75	0.44				
46. Part-time jobs	0.66	0.57				
47. High crime rate	0.64	0.59	0.75	11.65	0.43	7.62
48. Weather or natural disaster	0.68	0.53	0.73	11.14	0.47	7.95
49. Social-economic-political issues in R.O.C.	0.58	0.67				
50. Political issues (R.O.C. and P.R.O.C.)	0.54	0.70	0.39	5.35	0.85	9.65
Overall fit index						
χ^2	329.19		21.87			
df	35		14			
p	0		0.08			

Appendix 9, Table 9

Standardized factor loadings, residuals, and overall fit index of items on the Approach Coping Scale

	Original scale items		Revised scale items			
	Loading	Residual	Loading	*t*	Residual	*t*
1. Different ways to solve	0.64	0.59	0.70	10.02	0.51	7.51
2. Change your life for the better	0.60	0.64	0.58	8.01	0.66	8.67
3. Discuss with someone	0.49	0.76	0.45	5.97	0.80	9.34
4. Make a plan and take action	0.63	0.61	0.64	8.94	0.60	8.22
5. Causes/consequences	0.71	0.50	0.71	10.24	0.50	7.33
6. Get advice	0.53	0.72				
7. A chance of personal growth	0.68	0.53				
8. Change yourself	0.63	0.61	0.60	8.27	0.65	8.56
Overall fit index						
χ^2	66.95		4.49			
df	20		9			
p	0		0.88			

Appendix 10, Table 10

Standardized factor loadings, residuals, and overall fit index of items on the Risky Driving Scale

	Original scale items		Revised scale items			
	Loading	Residual	Loading	*t*	Residual	*t*
1. Over the speed limit	0.80	0.37	0.78	12.31	0.39	7.30
2. Without helmet	0.44	0.80				
3. Without a license	0.71	0.50	0.68	10.25	0.54	8.55
4. Without stop when the light turned red	0.71	0.49	0.71	10.90	0.49	8.25
5. Back and forth around other mobiles	0.81	0.34	0.84	13.70	0.29	5.85
6. After drinking alcohol beverages	0.51	0.74	0.51	7.19	0.74	9.41
7. Co-rode with someone who drank	0.42	0.83				
Overall fit index						
χ^2	42.49		7.42			
df	14		5			
p	0		0.21			

Appendix 11, Table 11

Standardized factor loadings, residuals, and overall fit index of items on the Attempted Suicide Scale

	Original scale items		Revised scale items			
	Loading	Residual	Loading	*t*	Residual	*t*
1. Felt serious depression	0.78	0.39				
2. Considered suicide seriously	0.91	0.17	0.89	15.45	0.21	5.76
3. Made a plan for suicide	0.81	0.34	0.83	13.95	0.31	7.43
4. Actually tried to kill yourself	0.76	0.42	0.76	12.79	0.38	8.21
5. The extent of suicide	0.81	0.34	0.81	13.29	0.35	7.92
6. Treated by a doctor	0.29	0.92				
Overall fit index						
χ^2	26.95			0.31		
df	9			2		
p	0			0.86		

Appendix 12, Table 12

Pearson's correlation matrix of demographic variables, life stresses, and health-risk behavior variables (Low coping group, n=185)

	1	2	3	4	5	6	7	8	9	10
1. School type	1.00									
2. Gender	0.14	1.00								
3. Age	-0.09	-0.12	1.00							
4. Grade	-0.10	-0.02	0.79*	1.00						
5. General	0.15*	-0.09	-0.10	-0.01	1.00					
6. Vocational	-0.04	-0.02	0.01	-0.04	-0.58*	1.00				
7. Comprehensive	-0.09	0.11	0.09	0.06	-0.30*	-0.61	1.00			
8. Ethnicity	0.07	0.09	0.01	0.03	0.18*	-0.12	-0.03	1.00		
9. Parental marriage	0.00	-0.01	-0.10	-0.07	-0.03	-0.05	0.09	0.08	1.00	
10. Parental income	-0.03	-0.10	0.08	0.09	0.29*	-0.18*	-0.07*	0.15	-0.06*	1.00
11. Personal stress	-0.09	0.17*	0.00	0.08	0.11	-0.13	0.05	0.22*	0.06	0.03
12. Family stress	-0.15*	-0.05	0.01	0.04	0.03	-0.03	0.00	0.18*	-0.04	0.10
13. Peer stress	-0.15*	0.11	-0.02	-0.05	-0.02	-0.07	0.10	0.04	0.01	-0.05
14. School stress	-0.09	0.11	-0.02	-0.03	0.18*	-0.13	-0.02	0.15*	-0.04	0.03
15. Community stress	-0.10	0.03	-0.12	-0.17*	-0.01	-0.03	0.04	0.01	0.03	-0.22*
16. Risky driving	-0.14	-0.22*	0.17*	0.21*	-0.09	0.07	0.00	-0.12	0.05	0.14
17. Cigarette smoking	-0.19*	-0.24*	0.20*	0.16*	-0.18*	0.02	0.16*	-0.11	0.13	0.04
18. Beverage drinking	-0.11	-0.12	0.09	0.07	-0.07	0.01	0.06	-0.14	0.04	0.21*
19. Illicit drug use	-0.08	-0.09	-0.10	-0.06	-0.08	-0.01	0.09	-0.18	0.11	0.09
20. Attempted suicide	-0.04	0.19*	-0.01	0.00	-0.02	-0.12	0.16*	-0.04	0.03	0.18*
SD	0.42	0.50	0.87	0.86	0.42	0.50	0.43	0.45	0.39	0.67

* $p < 0.05$

Appendix 12, Table 12 (continued).

	11	12	13	14	15	16	17	18	19	20
1. School type										
2. Gender										
3. Age										
4. Grade										
5. General										
6. Vocational										
7. Comprehensive										
8. Ethnicity										
9. Parental marriage										
10. Parental income										
11. Personal stress	1.00									
12. Family stress	0.37*	1.00								
13. Peer stress	0.44*	0.41*	1.00							
14. School stress	0.60*	0.47*	0.45*	1.00						
15. Community stress	0.38*	0.26*	0.37*	0.52*	1.00					
16. Risky driving	0.05	0.15*	0.10	0.17*	0.00	1.00				
17. Cigarette smoking	-0.04	0.19*	-0.02	0.05	-0.13	0.40*	1.00			
18. Beverage drinking	0.02	0.19*	0.09	0.08	-0.08	0.55*	0.49*	1.00		
19. Illicit drug use	0.09	0.05	0.16*	0.04	0.21*	0.25*	0.04	0.28*	1.00	
20. Attempted suicide	0.31*	0.32*	0.39*	0.26*	0.21*	0.25*	0.07	0.30*	0.32*	1.00
SD	5.19	4.50	2.90	5.50	4.56	3.47	1.00	0.78	0.23	2.65

* $p < 0.05$

Appendix 13, Table 13

Pearson's correlation matrix of demographic variables, life stresses, and health-risk behavior variables (Medium coping group, n= 430)

	1	2	3	4	5	6	7	8	9	10
1. School type	1.00									
2. Gender	0.07	1.00								
3. Age	-0.08	-0.12*	1.00							
4. Grade	-0.05	-0.03	0.77*	1.00						
5. General	0.15*	0.00	-0.13*	-0.05	1.00					
6. Vocational	-0.18*	-0.12*	0.15*	0.11	-0.60*	1.00				
7. Comprehensive	0.05	0.13*	-0.04	-0.07	-0.35*	-0.55*	1.00			
8. Ethnicity	0.02	-0.15*	0.00	-0.01	0.19*	-0.06	-0.12*	1.00		
9. Parental marriage	0.03	0.00	-0.04	-0.05	-0.13*	0.13*	-0.01	-0.22*	1.00	
10. Parental income	-0.09	-0.16*	0.03	0.06	0.23*	-0.18*	-0.03	0.27*	-0.27	1.00
11. Personal stress	0.03	-0.09	0.01	0.02	-0.03	-0.01	0.04	-0.03	-0.02	-0.08
12. Family stress	-0.02	0.01	-0.13*	-0.09	-0.08	0.00	0.08	-0.07	0.03	-0.04
13. Peer stress	-0.06	-0.03	-0.05	-0.04	-0.15*	0.06	0.08	0.09	-0.06	-0.11*
14. School stress	0.02	0.00	-0.14*	-0.09	0.06	-0.06	0.01	-0.10	-0.02	-0.05
15. Community stress	-0.05	-0.05	-0.12*	-0.13	-0.13*	0.11*	0.00	-0.12*	-0.04	-0.14*
16. Risky driving	-0.04	-0.23*	0.13*	0.08	-0.13*	0.13*	-0.01	-0.21*	0.12*	0.00
17. Cigarette smoking	0.00	-0.18*	0.09	0.09	-0.18*	0.12*	0.05	-0.12*	0.11*	0.02*
18. Beverage drinking	-0.09	-0.09	0.06	0.07	-0.14*	0.15*	-0.03	-0.17*	0.19*	-0.06*
19. Illicit drug use	-0.08	-0.04	0.02	-0.02	-0.07	0.02	0.06	-0.10	0.00	-0.03
20. Attempted suicide	0.02	0.06	-0.07	-0.09	0.00	-0.03	0.04	-0.03	0.11*	-0.04*
SD	0.46	0.50	0.87	0.84	0.45	0.50	0.43	0.45	0.42	0.67

* $p < 0.05$

Appendix 13, Table 13 (continued).

	11	12	13	14	15	16	17	18	19	20
1. School type										
2. Gender										
3. Age										
4. Grade										
5. General										
6. Vocational										
7. Comprehensive										
8. Ethnicity										
9. Parental marriage										
10. Parental income										
11. Personal stress	1.00									
12. Family stress	0.47*	1.00								
13. Peer stress	0.44*	0.45*	1.00							
14. School stress	0.54*	0.52*	0.38*	1.00						
15. Community stress	0.29*	0.40*	0.52*	0.48*	1.00					
16. Risky driving	0.04*	0.14	-0.02*	0.15*	0.22	1.00				
17. Cigarette smoking	0.11*	0.23	0.05*	0.14*	0.12	0.55*	1.00			
18. Beverage drinking	0.12	0.08	0.06	0.04	0.07	0.41*	0.40*	1.00		
19. Illicit drug use	0.04	0.07	0.02	0.04	0.08	0.29*	0.11*	0.18*	1.00	
20. Attempted suicide	0.34*	0.40*	0.23*	0.33*	0.29*	0.08	0.20*	0.05	0.17*	1.00
SD	4.73	4.51	3.33	4.78	5.12	3.12	0.87	0.65	0.22	2.41

* $p < 0.05$

Appendix 14, Table 14

Pearson's correlation matrix of demographic variables, life stresses, and health-risk behavior variables (High coping group, n=197)

	1	2	3	4	5	6	7	8	9	10
1. School type	1.00									
2. Gender	0.08	1.00								
3. Age	0.00	-0.10	1.00							
4. Grade	-0.04	-0.04	0.81*	1.00						
5. General	0.24*	0.05	-0.06	-0.07	1.00					
6. Vocational	-0.02	-0.03	0.07	0.03	-0.46	1.00				
7. Comprehensive	-0.21*	-0.02	-0.01	0.04	-0.50*	-0.54*	1.00			
8. Ethnicity	0.07	0.02	-0.02	0.07	0.08	-0.06	-0.05	1.00		
9. Parental marriage	0.15*	0.00	0.16*	0.15*	-0.14*	0.13	0.09	-0.02	1.00	
10. Parental income	0.05	-0.04	0.00	0.05	0.18*	-0.13	-0.13	0.10	-0.19*	1.00
11. Personal stress	-0.09	0.13	0.02	0.03	-0.01	-0.16	0.11	-0.02	0.00	-0.11
12. Family stress	-0.11	0.14*	-0.10	-0.09	-0.05	-0.07	0.10	-0.01	-0.04	0.05
13. Peer stress	-0.18*	0.09	0.02	-0.03	-0.14*	0.01	0.16*	-0.02	-0.06	-0.08
14. School stress	-0.11	0.10	-0.08	-0.08	-0.05	-0.05	0.08	-0.06	-0.08	-0.11
15. Community stress	-0.08	-0.05	-0.08	-0.08	-0.07	0.01	0.07	-0.19*	-0.05	-0.09
16. Risky driving	-0.15*	-0.21*	0.12	0.07	-0.03	0.00	0.03	-0.17*	-0.01	0.01
17. Cigarette smoking	-0.13	-0.16*	0.08	0.04	-0.03	0.08	-0.01	-0.05	0.01	0.00
18. Beverage drinking	-0.07	-0.09	0.01	0.04	0.07	-0.01	-0.07	-0.07	-0.04	0.09
19. Illicit drug use	-0.01	-0.10	0.00	0.02	-0.01	0.08	-0.04	-0.10	-0.05	-0.11
20. Attempted suicide	0.02	0.16*	-0.12	-0.11	-0.08	-0.02	0.10	0.05	-0.10	-0.06
SD	0.46	0.49	0.90	0.82	0.45	0.48	0.81	0.43	0.42	0.69

* $p < 0.05$

Appendix 14, Table 14 (continued).

	11	12	13	14	15	16	17	18	19	20
1. School type										
2. Gender										
3. Age										
4. Grade										
5. General										
6. Vocational										
7. Comprehensive										
8. Ethnicity										
9. Parental marriage										
10. Parental income										
11. Personal stress	1.00									
12. Family stress	0.47*	1.00								
13. Peer stress	0.49*	0.54*	1.00							
14. School stress	0.63*	0.41*	0.46*	1.00						
15. Community stress	0.40*	0.45*	0.56*	0.51*	1.00					
16. Risky driving	0.16*	-0.01	0.04	0.13	0.18*	1.00				
17. Cigarette smoking	0.06	0.05	0.04	0.11	0.08	0.40	1.00			
18. Beverage drinking	0.10	0.08	0.03	0.10	0.05	0.50*	0.42*	1.00		
19. Illicit drug use	0.05	-0.10	-0.07	-0.08	0.02	0.40*	0.08	0.29*	1.00	
20. Attempted suicide	0.27*	0.34*	0.35*	0.25*	0.21*	-0.03	0.08	0.13	0.00	1.00
SD	4.90	4.89	3.88	5.59	6.11	2.78	0.79	0.68	0.22	2.13

* $p < 0.05$

Appendix 15, Table 15

Sample characteristics by school type

	School type	
	Private (n=516)	Public (n=206)
Reported perceived tress		
Personal	92%	91%
Family	71%	68%
Peer	53%	39%
School	94%	94%
Community	58%	56%
Adopted approach coping	97%	98%
Engaged in any of health-risk behaviors		
Risky driving	32%	22%
Cigarette smoking	73%	16%
Beverage drinking	28%	21%
Illicit drug use	2%	1%
Attempted suicide	20%	20%
Never have any of health-risk behaviors	47%	57%

Appendix 16, Table 16

Sample characteristics by gender

	Male (n=354)	Female (n=368)
Reported perceived tress		
Personal	90%	94%
Family	68%	71%
Peer	45%	53%
School	94%	94%
Community	28%	58%
Adopted approach coping	96%	98%
Engaged in any of health-risk behaviors		
Risky driving	38%	20%
Cigarette smoking	33%	14%
Beverage drinking	32%	20%
Illicit drug use	3%	1%
Attempted suicide	16%	24%
Never have any of health-risk behaviors	41%	58%

Appendix 17, Table 17

Sample characteristics by age

	Age			
	15 (n=125)	16 (n=262)	17 (n=263)	18 (n=72)
Reported perceived tress				
Personal	91%	89%	95%	94%
Family	80%	71%	67%	61%
Peer	48%	48%	50%	44%
School	93%	93%	94%	97%
Community	62%	60%	52%	56%
Adopted approach coping	97%	97%	93%	99%
Engaged in any of health-risk behaviors				
Risky driving	21%	27%	30%	47%
Cigarette smoking	19%	18%	29%	34%
Beverage drinking	23%	21%	29%	32%
Illicit drug use	2%	1%	1%	1%
Attempted suicide	29%	21%	14%	22%
Never have any of health-risk behaviors	51%	53%	49%	33%

Appendix 18, Table 18

Sample characteristics by grade

	School grade		
	First (n=255)	Second (n=211)	Third (n=256)
Reported perceived tress			
Personal	91%	89%	97%
Family	78%	65%	66%
Peer	50%	49%	48%
School	92%	94%	95%
Community	60%	58%	54%
Adopted approach coping	98%	95%	98%
Engaged in any of health-risk behaviors			
Risky driving	22%	31%	35%
Cigarette smoking	18%	24%	29%
Beverage drinking	23%	25%	30%
Illicit drug use	2%	1%	2%
Attempted suicide	25%	20%	15%
Never have any of health-risk behaviors	53%	49%	47%

Appendix 19, Table 19

Sample characteristics by education program

	General (n=193)	Vocational (n=330)	Comprehensive (n=199)
Reported perceived tress			
Personal	94%	90%	93%
Family	65%	71%	73%
Peer	42%	48%	57%
School	96%	92%	95%
Community	52%	56%	64%
Adopted approach coping	97%	95%	99%
Engaged in any of health-risk behaviors			
Risky driving	19%	35%	30%
Cigarette smoking	13%	28%	27%
Beverage drinking	20%	27%	25%
Illicit drug use	1%	2%	3%
Attempted suicide	19%	18%	25%
Never have any of health-risk behaviors	61%	46%	46%

Appendix 20, Table 20

Sample characteristics by ethnicity

	Aborigine (n=199)	Non-aborigine (n=523)
Reported perceived tress		
Personal	90%	93%
Family	73%	69%
Peer	46%	50%
School	95%	93%
Community	66%	54%
Adopted approach coping	96%	97%
Engaged in any of health-risk behaviors		
Risky driving	43%	24%
Cigarette smoking	32%	20%
Beverage drinking	35%	22%
Illicit drug use	4%	1%
Attempted suicide	21%	20%
Never have any of health-risk behaviors	38%	55%

Appendix 21, Table 21

Sample characteristics by parental marriage

	Parental marriage	
	Married (n=564)	Other (n=158)
Reported perceived tress		
Personal	92%	92%
Family	69%	73%
Peer	50%	46%
School	94%	93%
Community	57%	58%
Adopted approach coping	96%	99%
Engaged in any of health-risk behaviors		
Risky driving	27%	37%
Cigarette smoking	22%	30%
Beverage drinking	23%	35%
Illicit drug use	1%	3%
Attempted suicide	19%	23%
Never have any of health-risk behaviors	53%	39%

Appendix 22, Table 22

Sample characteristics by parental income

	Parental income		
	High (n=241)	Medium (n=368)	Low (n=113)
Reported perceived tress			
Personal	94%	90%	94%
Family	70%	70%	69%
Peer	54%	46%	46%
School	94%	95%	91%
Community	62%	55%	55%
Adopted approach coping	97%	97%	98%
Engaged in any of health-risk behaviors			
Risky driving	28%	29%	32%
Cigarette smoking	25%	23%	24%
Beverage drinking	27%	23%	31%
Illicit drug use	2%	1%	2%
Attempted suicide	21%	21%	15%
Never have any of health- risk behaviors	48%	61%	49%

Appendix 23, Table 23

Sample characteristics by three coping groups

	Coping group					
	Low	Medium	High	χ^2	*df*	*p*
School type						
Private	77%	70%	68%			
Public	23%	30%	32%	4.46	2	0.11
Gender						
Male	53%	50%	44%			
Female	47%	50%	56%	3.08	2	0.21
Age						
15 years	16%	20%	14%			
16 years	35%	38%	35%			
17 years	39%	35%	37%			
18 years	10%	8%	14%	9.28	6	0.16
Grade						
First	35%	39%	80%			
Second	26%	29%	32%			
Third	39%	32%	39%	6.81	4	0.15

Appendix 23, Table 23 (continued).

	Coping group					
	Low	Medium	High	χ^2	*df*	*p*
Program						
General	22%	27%	30%			
Vocational	54%	49%	33%			
Comprehensive	24%	24%	37%	21.50	4	0.03
Ethnicity						
Aborigine	27%	29%	25%			
Non-aborigine	73%	71%	75%	0.91	2	0.64
Parental Marriage						
Married	81%	77%	77%			
Other	19%	23%	23%	1.28	2	0.53
Parental Income						
Low	37%	32%	32%			
Medium	49%	52%	50%			
High	14%	16%	17%	4.13	6	0.66

Appendix 24, Table 24

Percents, means, and standard deviations of items on the Personal Stress Scale

		1	2	3	4	5	6	7	8	9	10
Felt stressful	%	65.0	67.7	64.9	65.0	19.3	87.5	68.2	62.5	91.7	80.9
Felt no stressful	%	35.0	32.3	35.1	35.0	81.7	12.5	31.8	37.5	9.3	19.1
M		1.04	1.05	1.08	1.02	0.31	1.99	1.20	0.99	1.90	1.70
SD		1.03	0.99	1.05	1.03	0.78	1.22	1.15	1.03	1.15	1.25
n		721	718	716	720	721	719	720	722	719	719

Note. “Felt stressful” means “It didn’t happen to me or It happened, but I didn’t feel stressful at all”. “Felt no stressful” means the original options from “Felt slightly stressful” to “Felt extremely stressful”.

Appendix 25, Table 25

Percents, means, and standard deviations of items on the Family Stress Scale

		11	12	13	14	15	16	17	18	19	20
Felt stress	%	69.6	50.8	45.5	75.8	54.5	71.3	50.7	61.7	73.5	47.4
Felt no stress	%	30.4	49.2	54.5	24.2	45.5	28.7	49.3	38.3	26.5	52.6
M		1.24	0.93	0.76	1.55	1.00	1.47	1.02	1.14	1.62	0.92
SD		1.15	1.18	1.04	1.27	1.18	1.29	1.28	1.18	1.35	1.21
n		720	718	719	722	721	722	718	716	717	722

Note. “Felt stressful” means “It didn’t happen to me or It happened, but I didn’t feel stressful at all”. “Felt no stressful” means the original options from “Felt slightly stressful” to “Felt extremely stressful”.

Appendix 26, Table 26

Percents, means, and standard deviations of items on the Peer Stress Scale

		21	22	23	24	25	26	27	28	29	30
Felt stress	%	33.2	50.5	48.6	52.4	48.9	44.6	27.1	46.0	40.8	45.7
Felt no stress	%	66.8	49.5	51.4	47.6	51.1	55.4	72.9	54.0	59.2	54.3
M		0.56	0.82	1.08	0.83	0.90	0.83	0.48	0.83	0.68	0.76
SD		0.97	1.15	1.38	1.01	1.17	1.16	0.97	1.13	1.04	1.06
n		722	721	722	718	720	720	720	720	721	720

Note. “Felt stressful” means “It didn’t happen to me or It happened, but I didn’t feel stressful at all”. “Felt no stressful” means the original options from “Felt slightly stressful” to “Felt extremely stressful”.

Appendix 27, Table 27

Percents, means, and standard deviations of items on the School Stress Scale

		31	32	33	34	35	36	37	38	39	40
Felt stress	%	73.1	54.6	65.0	58.4	77.6	74.3	86.4	82.5	82.4	85.3
Felt no stress	%	26.9	45.4	35.0	41.6	22.4	25.7	13.6	17.5	17.6	14.7
M		1.39	0.94	1.31	1.05	1.59	1.48	1.87	1.51	1.68	1.86
SD		1.19	1.14	1.32	1.20	1.27	1.28	1.21	1.11	1.22	1.27
n		722	721	721	722	719	719	720	718	720	721

Note. “Felt stressful” means “It didn’t happen to me or It happened, but I didn’t feel stressful at all”. “Felt no stressful” means the original options from “Felt slightly stressful” to “Felt extremely stressful”.

Appendix 28, Table 28

Percents, means, and standard deviations of items on the Community Stress Scale

		41	42	43	44	45	46	47	48	49	50
Felt stress	%	29.70	30.20	35.00	55.50	56.10	65.60	33.50	46.10	80.20	69.10
Felt no stress	%	70.30	69.80	65.00	44.50	43.90	34.40	66.50	53.90	19.80	30.90
M		0.50	0.59	0.61	1.09	1.13	1.42	0.61	0.81	1.88	1.54
SD		0.92	1.07	1.03	1.26	1.28	1.38	1.09	1.11	1.39	1.39
n		721	721	721	722	719	721	722	718	718	719

Note. “Felt stressful” means “It didn’t happen to me or It happened, but I didn’t feel stressful at all”. “Felt no stressful” means the original options from “Felt slightly stressful” to “Felt extremely stressful”.

Appendix 29, Table 29

Percents, means, and standard deviations of items on the Approach Coping Scale

	1	2	3	4	5	6	7	8
Never used %	3.90	19.20	17.50	14.30	7.20	12.10	11.20	9.60
Used %	96.10	80.80	82.50	85.70	92.80	87.90	88.80	90.40
M	2.18	1.55	1.76	1.66	2.29	2.12	2.13	2.16
SD	0.99	1.09	1.19	1.08	1.17	1.12	1.22	1.18
n	721	719	722	722	721	719	722	722

Note. “Never used” means adolescents “never used” this coping skill. “Used” means adolescents “rarely used”, “occasionally used”, “often used”, or “always used” this coping skill.

Appendix 30, Table 30

Percents, means, and standard deviations of items on the Risky Driving Scale

		1	2	3	4	5	6	7
Never	%	72.90	64.80	54.20	76.50	76.20	92.70	74.90
Less	%	19.80	23.70	25.30	14.50	14.50	5.40	18.30
Same	%	4.80	7.80	9.90	5.10	5.80	1.00	4.20
More	%	2.50	3.80	10.60	3.90	3.50	1.00	2.60
M		0.38	0.52	0.84	0.38	0.38	0.11	0.36
SD		0.74	0.85	1.18	0.81	0.82	0.45	0.73
n		722	722	718	722	722	722	722

Note. “Never” means “It never occurred”, “Less” means “It occurred less than before”, “Same” means “It occurred as same as usual”, and “More” means “It occurred much more than before”.

Appendix 31, Table 31

Percents, means, and standard deviations of items on the substance use behaviors

		Cigarette smoking	Beverage drinking	Illicit drug use
Never	%	76.50	74.10	98.30
Less	%	10.10	19.90	1.00
Same	%	6.40	2.50	0.40
More	%	7.00	3.50	0.30
M		0.48	0.36	0.03
SD		1.03	0.75	0.27
N		722	719	717

Note. “Never” means “It never occurred”, “Less” means “It occurred less than before”, “Same” means “It occurred as same as usual”, and “More” means “It occurred much more than before”.

Appendix 32, Table 32

Percents, means, and standard deviations of items on the Attempted Suicide Scale

		1	2	3	4	5	6
Never	%	69.50	79.50	87.40	89.80	82.70	97.10
Less	%	20.70	13.30	7.80	7.30	11.20	2.20
Same	%	4.50	3.30	1.90	1.40	3.10	0.00
More	%	5.30	3.90	2.90	1.60	3.10	0.70
M		0.48	0.33	0.22	0.15	0.28	0.04
SD		0.89	0.78	0.70	0.53	0.74	0.29
n		721	722	722	722	721	722

Note. “Never” means “It never occurred”, “Less” means “It occurred less than before”, “Same” means “It occurred as same as usual”, and “More” means “It occurred much more than before”.

Appendix 33, Table 33

Loadings of latent constructs on, and measurement errors of observed variables for each coping group

Observed variables	Loadings of latent constructs	Standardized (standardized) measurement errors		
		Low coping	Medium coping	High coping
Personal stress	0.90	5.21(0.22)	4.33(0.18)	4.66(0.19)
Family stress	0.90	3.76(0.18)	3.77(0.18)	4.33(0.21)
Peer stress	0.91	1.46(0.13)	1.92(0.17)	2.61(0.23)
School stress	0.90	5.59(0.21)	4.23(0.16)	5.79(0.22)
Community stress	0.90	3.86(0.14)	4.88(0.18)	6.94(0.25)
Risky driving	0.91	2.05(0.21)	1.67(0.17)	1.32(0.14)
Attempted suicide	0.95	0.73(0.13)	0.60(0.10)	0.47(0.08)

Appendix 34, Table 34

Total variances, unexplained variances, *t* value for unexplained variances, and explained variances (R^2) on health-risk behaviors for each coping group

Coping group	Variances: Total	Variances: unexplained	*t*	R^2
		Risky driving		
Low	9.707	7.665	7.46	0.210
Medium	8.038	5.767	9.53	0.283
High	6.269	5.327	7.78	0.150
		Cigarette smoking		
Low	0.996	0.637	8.79	0.361
Medium	0.761	0.641	12.65	0.158
High	0.636	0.595	9.87	0.064
		Beverage drinking		
Low	0.609	0.529	9.52	0.131
Medium	0.424	0.386	12.99	0.089
High	0.463	0.452	9.00	0.024
		Illicit drug use		
Low	0.055	0.043	8.44	0.228
Medium	0.049	0.0486	13.01	0.016
High	0.050	0.0454	9.24	0.097

Appendix 34, Table 34 (Continued).

Coping group	Variances Total	Variances Total	t	R^2
		Attempted suicide		
Low	6.400	3.948	7.44	0.383
Medium	5.278	3.687	10.46	0.301
High	4.081	3.139	8.83	0.231

Note. The *t* values which are larger than 1.96 are significant at 0.05 level.

Appendix 35, Table 35

Total variances, unexplained variances, *t* value for unexplained variances, and explained variances (R^2) on life stresses for each coping group

	Variances			
Coping group	Total	unexplained	*t*	R^2
		Personal stress		
Low	21.434	18.734	7.51	0.126
Medium	18.011	17.574	10.45	0.024
High	19.649	18.11	7.88	0.079
		Family stress		
Low	16.211	15.281	7.71	0.057
Medium	16.645	15.925	10.54	0.043
High	19.298	18.407	7.98	0.046
		Peer stress		
Low	6.831	6.540	7.85	0.043
Medium	9.296	8.436	10.62	0.093
High	12.400	11.482	8.07	0.074
		School stress		
Low	24.470	22.244	7.68	0.091
Medium	18.747	17.797	10.52	0.051
High	25.176	24.150	7.00	0.041

Appendix 35, Table 35 (Continued).

Coping group	Variances: Total	Variances: unexplained	t	R^2
		Community stress		
Low	16.231	14.952	7.64	0.078
Medium	21.709	19.466	10.42	0.103
High	30.153	28.529	7.96	0.054

Note. The *t* values which are larger than 1.96 are significant at 0.05 level.

Appendix 36, Table 36

Unstandardized correlation coefficients (*b*) and standardized structural coefficients (*γ*) of demographic variables on health-risk behaviors for three coping groups

	School type			Gender			Age			Grade			General		
	b	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*
Risky driving															
L				-1.36	-5.45	-0.24				0.69	2.95	0.21			
M				-1.36	-5.45	-0.24	0.48	2.91	0.15						
H	-0.59	-1.58	-0.09	-0.80	-2.39	-0.14	0.36	1.97	0.11						
Cigarette smoking															
L	0.78	6.23	0.40	-0.61	-4.86	-0.34									
M	0.07	0.86	0.04	-0.33	-3.86	-0.19	0.02	0.31	0.02	0.08	1.15	0.08			
H	-0.17	-1.43	-0.09	-0.24	-2.24	-0.14	0.10	1.01	0.10	-0.05	-0.52	-0.05			
Beverage drinking															
L				-0.13	-1.32	-0.09									
M				-0.11	-2.03	-0.08									
H				-0.11	-2.03	-0.08									
Illicit drug use															
L															
M															
H															

Appendix 36, Table 36 (Continued).

	School type			Gender			Age			Grade			General		
	b	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*
							Attempted suicide								
L	0.50	1.38	0.10	0.69	3.47	0.15							-0.20	-0.43	-0.03
M				0.69	3.47	0.15							0.23	0.79	0.04
H	0.56	1.73	0.11	0.42	1.50	0.09							-0.32	-0.88	-0.07

Note. The *t* values which are larger than 1.96 are significant at 0.05 level. The empty cells mean that there are no effects of stress on health-risk behavior for that group. L means low coping group, M means medium coping group, and H means high coping group.

Appendix 36, Table 36 (Continued).

	Vocational			Comprehensive			Ethnicity			P marriage			P income		
	b	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*
							Risky driving								
L	1.52	2.40	0.22	1.20	1.65	0.15	-0.83	-2.79	-0.13	0.57	1.94	0.08	0.79	2.29	0.19
M	0.95	2.35	0.15	0.64	1.40	0.09	-0.83	-2.79	-0.13	0.57	1.94	0.08	0.16	0.98	0.05
H	1.03	1.60	0.15	0.78	1.02	0.10	-0.64	-1.71	-0.10	0.32	0.82	0.04	0.16	0.98	0.05
							Cigarette smoking								
L	0.42	2.40	0.21	0.73	3.54	0.31	-0.35	-2.46	-0.17	0.38	2.65	0.18			
M	0.27	2.37	0.16	0.29	2.25	0.14	-0.06	-0.81	-0.03	0.09	1.13	0.04			
H	0.07	0.50	0.04	-0.10	-0.70	-0.06	-0.06	-0.81	-0.03	0.09	1.13	0.04			
							Beverage drinking								
L	0.21	1.42	0.13	0.28	1.64	0.15	-0.32	-2.79	-0.21	0.07	0.62	0.04	0.28	3.71	0.27
M	0.18	2.12	0.09	0.07	0.67	0.04	-0.19	-2.53	-0.12	0.24	2.94	0.14	0.05	1.13	0.05
H	-0.04	-0.32	-0.03	-0.12	-1.00	-0.09							0.05	1.13	0.05
							Illicit drug use								
L	0.00	0.76	0.07	0.01	1.16	0.11	-0.10	-2.53	-0.19				0.09	3.36	0.26
M	0.02	0.74	0.05	0.04	1.03	0.07	-0.03	-1.56	-0.07						
H	0.00	0.71	0.06	0.00	-0.50	-0.04	-0.03	-1.56	-0.07				-0.03	-1.19	-0.08

Appendix 36, Table 36 (Continued).

	Vocational			Comprehensive			Ethnicity			P marriage			P income		
	b	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*
							Attempted suicide								
L				0.70	1.67	0.11	-0.90	-2.27	-0.18				1.04	3.97	0.31
M				0.13	0.45	0.02	0.39	1.79	0.08	0.72	2.52	0.13			
H				0.15	0.44	0.03	0.39	1.79	0.08	-0.48	-1.43	-0.09			

Note. The *t* values which are larger than 1.96 are significant at 0.05 level. The empty cells mean that there are no effects of stress on health-risk behavior for that group. L means low coping group, M means medium coping group, and H means high coping group.

Appendix 37, Table 37

Unstandardized correlation coefficients (*b*) and standardized structural coefficients (*γ*) of demographic variables on life stresses for three coping groups

	School type			Gender			Age			Grade			Vocational		
	b	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*
							Personal Stress								
L	-1.22	-1.58	-0.13	1.77	2.69	0.20	-0.43	-1.33	-0.09	0.84	1.93	0.16			
M				-0.89	-2.15	-0.10	-0.43	-1.33	-0.09	0.39	1.14	0.07			
H	-0.68	-0.94	-0.07				0.44	1.55	0.09						
							Family Stress								
L	-1.45	-2.12	-0.16										-0.25	-0.30	-0.03
M							-0.79	-2.94	-0.17				0.73	1.24	0.08
H	-1.01	-1.42	-0.11	1.24	2.17	0.15							-0.22	-0.25	-0.02
							Peer Stress								
L	-0.70	-2.61	-0.10	0.70	1.87	0.11				-0.21	-0.97	-0.06	-0.26	-0.49	-0.05
M	-0.70	-2.61	-0.10				-0.30	-1.50	-0.09				1.02	2.34	0.15
H	-1.23	-2.30	-0.18	0.82	1.95	0.13	0.87	2.10	0.25	-0.71	-1.63	-0.19	0.74	1.04	0.09
							School Stress								
L	-1.49	-1.83	-0.14	1.50	2.49	0.16									
M							-0.81	-2.84	-0.15						
H	-0.99	-1.23	-0.10	0.66	1.15	0.07									

Appendix 37, Table 37 (Continued).

	Gender														
	School type						Age			Grade			Vocational		
	b	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*
	Community Stress														
L	-1.07	-1.56	-0.10							-0.82	-3.32	-0.15	0.31	0.28	0.02
M	-0.59	-1.30	-0.06	-0.62	-1.39	-0.07	-0.29	-0.80	-0.05	-0.82	-3.32	-0.15	1.72	2.52	0.17
H	-0.59	-1.30	-0.06				-0.43	-0.65	-0.08	0.25	0.36	0.05	-0.95	-1.10	-0.10

Note. The *t* values which are larger than 1.96 are significant at 0.05 level. The empty cells mean that there are no effects of stress on health-risk behavior for that group. L means low coping group, M means medium coping group, and H means high coping group.

Appendix 37, Table 37 (Continued).

	General			Comprehensive			Ethnicity			P marriage			P income		
	b	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*
							Personal Stress								
L	1.54	1.60	0.12	0.67	0.73	0.06	1.80	2.51	0.18	1.02	1.47	0.10			
M	0.14	0.21	0.01	0.66	1.02	0.06				-0.55	-1.01	-0.05	-0.76	-2.15	-0.12
H	1.49	1.66	0.14	2.24	2.70	0.22							-0.89	-2.07	
							Family Stress								
L				-0.26	-0.27	-0.21	1.67	2.53	0.18						
M				1.20	1.73	0.11	-0.46	-0.94	-0.05						
H				0.90	1.03	0.09									
							Peer Stress								
L				0.33	0.52	0.05									
M				1.40	2.77	0.18	1.13	3.07	0.16	-0.69	-1.77	-0.09	-0.82	-3.48	-0.18
H				1.24	1.78	0.16				-0.26	-0.52	-0.04			
							School Stress								
L	2.63	2.59	0.20	0.15	0.15	0.01	1.05	1.48	0.10						
M	0.78	1.20	0.07	0.18	0.27	0.02	-1.04	-2.06	-0.10	-0.71	-1.62	-0.06	-0.42	-1.24	-0.06
H	0.26	0.25	0.02	1.00	1.05	0.09				-0.71	-1.62	-0.06	-0.90	-1.75	-0.13

Appendix 37, Table 37 (Continued).

	General			Comprehensive			Ethnicity			P marriage			P income		
	b	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*	*b*	*t*	*γ*
							Community Stress								
L				0.62	0.55	0.05							-1.15	-4.04	-0.16
M				1.01	1.30	0.08	-1.05	-1.74	-0.10	-1.49	-2.46	-0.13	-1.15	-4.04	-0.16
H				-0.39	-0.40	-0.04	-2.43	-3.32	-0.23				-0.47	-0.92	-0.07

Note. The *t* values which are larger than 1.96 are significant at 0.05 level. The empty cells mean that there are no effects of stress on health-risk behavior for that group. L means low coping group, M means medium coping group, and H means high coping group.

Appendix 38, Table 38

Indices of model fit for the final model with three groups

Index	Criteria	Results
Absolute fit indices		
Chi-square	Non-significant (p> .05)	93.58 df = 161 p = 1
Chi-square/df	< 5 (< 3 preferable)	0.58
Root mean square error of approximation (RMSEA)	< 0.8 (< 0.5 preferable)	0.00
p-value for test of close fit (RMSEA < 0.05)	> 0.8	1.00
Incremental fit indices		
Norm fit index	> 0.9	0.97
Non-normed fit index	> 0.9	1.06
Parsimonious fit indices		
Parsimonious normed fit index	> 0.5	0.31
Comparative fit index	> 0.9	1.00
Incremental fit index	> 0.9	1.02
Relative fit index	> 0.9	0.92
Critical N	> 200	1538.26

Appendix 39, Table 39

Indices of model fit for each group in the final model

		Coping groups		
Index	Criteria	Low	Medium	High
Root mean square residual (RMR)	< 0.08	0.20	0.06	0.13
Standardized RMR	< 0.05	0.03	0.02	0.03
Goodness-of-fit index	> 0.90	0.98	0.99	0.98