DISSERTATION

INDIRECT EFFECTS OF GENDER ON ILLNESS BEHAVIOR THROUGH PSYCHOSOCIAL FACTORS AND PERCEIVED STRESS

Submitted by

Jenifer J. Thomas, M.S.

Department of Psychology

In partial fulfillment of the requirements

For the degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Spring 2008

UMI Number: 3321318

Copyright 2008 by
Thomas, Jenifer J.

All rights reserved.

INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

UMI®

UMI Microform 3321318
Copyright 2008 by ProQuest LLC.
All rights reserved. This microform edition is protected against unauthorized copying under Title 17, United States Code.

ProQuest LLC
789 E. Eisenhower Parkway
PO Box 1346
Ann Arbor, MI 48106-1346

Copyright by Jenifer J. Thomas 2008

All Rights Reserved

COLORADO STATE UNIVERSITY

March 25, 2008

WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY JENIFER J. THOMAS ENTITLED INDIRECT EFFECTS OF GENDER ON ILLNESS BEHAVIOR THROUGH PSYCHOSOCIAL FACTORS AND PERCEIVED STRESS BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

Committee on Graduate work

Charles O. Davidshofer, Ph. D.

Jennifer J. Harman, Ph. D.

Tracy L. Nelson, Ph. D., M. P. H.

Richard M. Suinn, Ph. D.

Advisor: Evelinn A. Borrayo, Ph. D.

Department Head: Ernest L. Chavez, Ph. D.

ABSTRACT OF DISSERTATION

INDIRECT EFFECTS OF GENDER ON ILLNESS BEHAVIOR THROUGH PSYCHOSOCIAL FACTORS AND PERCEIVED STRESS

Gender differences that have been found in illness behavior, such as reporting symptoms and utilization of health services, can be partially explained by social, psychological, and/or behavioral factors (Denton & Walters, 1999; Denton, Prus, & Walters, 2003). The indirect influence of gender through such factors may further explain differences in illness behavior. The purpose of this study was to determine how the effect of gender on illness behavior may be influenced by social support satisfaction, perceived health status, coping skills, and perceived stress by testing various path models. Secondary analysis of previously collected data from 303 college students were used. A confirmatory factor analysis was performed to test indicators of the underlying latent variables (i.e. social support satisfaction, coping skills, and perceived stress). Four path models tested the patterns of effects between the latent variables. The main findings of the final model show the relationship between gender and illness behavior was influenced by three paths of indirect effects through multiple factors. The first was the combined influence of gender, greater use of total coping skills, greater social support satisfaction, low perceived stress, and good perceived health status on less reported illness behavior. The second was the combined influence of gender, greater use of total coping skills, greater social support satisfaction, and low perceived stress on less reported illness behavior. The third was the combined influence of gender, high perceived stress, and poor perceived health status on more reported illness behavior. The use of multiple health-related factors may provide a more complete picture of how gender and psychosocial factors influence

illness behavior. Future studies should consider testing separate models by gender to better understand how the direction of the variables of interest impact illness behavior differently among men and women.

Jenifer J. Thomas
Psychology Department
Colorado State University
Fort Collins, CO 80523
Spring 2008

ACKNOWLEDGEMENTS

I would like to thank my dissertation committee, Dr. Chuck Davidshofer, Dr. Jennifer Harman, Dr. Tracy Nelson, and Dr. Richard Suinn, for taking the time to work with me on this project, as well as for their guidance and support throughout my graduate training. I would like to especially thank my advisor, Dr. Evelinn Borrayo, for her belief in my ideas and abilities, and her support and encouragement for me to pursue this degree. I would also like to thank her for all of the guidance she has provided for me regarding my academic career and my future goals.

Finally, I would like to thank my friends and family for their love, understanding, and support during this journey. I have been so fortunate to be surrounded by such wonderful and caring people. I would particularly like to thank Chris and Rylee for their patience and constant support for me to pursue my dreams. I would not have been able to finish this project or my graduate training without them.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter I: Introduction

During the past thirty years, there has been an increased interest in preventing disease and death through behavioral changes in lifestyle and health screening activities (Glanz, Lewis, & Rimer, 1997). The central concern and ultimate aim of health promotion and education is to encourage positive changes in health-related behavior among individuals. Health-related behavior refers to the determinants, correlates, and consequences of the actions of individuals, groups, and organizations that impact health status. According to Kasl and Cobb (1966a; 1966b), there are three categories of health-related behavior: Preventive, sick-role, and illness behavior. Preventive health behavior is any activity an individual engages in for the purpose of preventing and detecting illness. Sick-role behavior is a set of defined roles, norms, and expectations of behavior for an individual who is ill to engage in for the purpose of getting well. Illness behaviors are activities individuals engage in when they feel ill, wish to define a health state, and/or discover a potential remedy (Herbert & Cohen, 1994; Straub, 2003).

Illness behaviors are not necessarily objective measures of illness that reflect organic conditions (i.e., physical examination); they also include subjective assessments that result in symptom recognition, symptom reporting, and health care seeking. Research on illness behavior focuses on how these subjective assessments lead individuals to behave or engage in certain health-related activities (Kasl & Cobb, 1966a). Different patterns of health-related activities can be understood through the direct or indirect influence (or effects) of factors such as gender, psychosocial factors, and perceived stress. Direct

effects are the presumed effect of one variable on another (Kline, 2005). Indirect effects involve one or more intervening variables presumed to transmit some of the causal effect of prior variables onto subsequent variables. Understanding how these health-related activities are directly and indirectly influenced is important because it could lead to the creation of health promotion and education programs that can more effectively motivate individuals to seek proper and timely health care/treatment.

To further the understanding of variations in illness behavior, research has focused on the direct relationship of gender. That is, the differences in illness behavior among women and men (Sobel, 1987). It has been found that women are more likely to seek medical and psychological services than men (Cockerham, 2007; Crawford & Unger, 2000; Straub, 2003). This distinction may be the result of biological risks for diseases by gender but may be related to gender differences in psychosocial factors linked to health. Health-related psychosocial factors that have been found to vary by gender include social support (Rosario, Shinn, Morch, & Huckabee, 1988), perceived health status (Denton & Walters, 1999), coping styles (Rosario et al., 1988; Straub, 2003), and perceived stress (Greenglass & Noguchi, 1996; McDonough & Walters, 2001; Silverman, Eichler, & Williams, 1987). This suggests an indirect effect of psychosocial factors; the differences in illness behavior among women and men are explained through one or more intervening psychosocial factors (Sobel, 1987). The examination of indirect relationships can produce a more comprehensive understanding about how various factors affect patterns of illness behavior than examining direct effects alone.

Explanations for gender differences found in illness behavior could be expanded by the added influence of stress (Barnett, Biener, & Baruch, 1987; Matud, 2004). High

levels of perceived stress have been found to be related to high numbers of medical visits (Miranda, Perez-Stable, Munoz, Hargreaves, & Henke, 1991; Pilisuk, Boylan, & Acredolo, 1987). In addition, women and men are subjected to different forms of stress and cope with stress in different ways (Crawford & Unger, 2000). Gender differences in health-related psychosocial factors, such as coping skills (Moos & Schaefer, 1993), that impact stress level may help to explain gender variability in illness behavior. This suggests a possible chain of factors influencing illness behavior: Gender affects illness behavior through the psychosocial factors that affect perceived stress. These factors are interrelated and an examination of the complexity of the relationship is necessary to further understand variations in health-related behavior.

The purpose of this study is to further the research on illness behavior by examining the determinants of such behavior in models of complex relationships; specifically those including gender, psychosocial factors, and perceived stress. An examination of illness behavior specific to college students (e.g., self-report of visits to the doctor) could aid in an understanding of how and under what circumstances students evaluate their health status and consequently use health services. This may perhaps impact the provision and structuring of health services on college campuses. For example, the health education and health promotion services provided on college campuses could offer information about how and when to seek professional care for specific physical symptoms. In college, individuals are on their own for the first time and often adopt behaviors and lifestyles that impact their present and future health and wellness status (Sax, 1997). Additional exploration of the influencing factors on health-related behaviors could provide

information to structure early interventions for college students, as well as knowledge regarding the future healthcare utilization patterns and needs of these graduates.

Influences on Illness Behavior

Illness behavior includes the varying ways in which individuals respond to their body and internal states, define and interpret symptoms, make attributions, and take action through various sources of informal and formal care (Cockerham, 2007; Mechanic, 1995; Risor, 2006). Research conducted to understand individual differences in illness behavior tends to focus on how microsociological (including social psychological and socio-cultural), economic, geographic, sociodemographic, and social network models influence these behaviors (Young, 2004). Microsociological models include the interactions between physician and patient, as well as the effect of cultural differences on these interactions. Economic models include the economic resources related to illness behavior. Geographic models refer to the closeness and convenience of services. Sociodemographic models include variables such as age, gender, education, socioeconomic status, and race/ethnicity. Social networks models are those that consist of family, friends, and co-workers. A comprehensive understanding of illness behavior can be accomplished by considering the combined impact of the above processes.

To elaborate upon the definition of illness behavior, Mechanic (1978) described these processes at four different levels of investigation. The first level includes dispositional factors such as gender (Cockerham, 2007). The second level includes psychosocial factors such as social support (Pilisuk et al., 1987), perceived health status (Miilunpalo, Vuori, Oja, Pasanen, & Urponen, 1997), coping (Ingledew, Hardy, & Cooper, 1997; Soderstrom, Dolbier, Leiferman, & Steinhardt, 2000), and perceived stress (Miranda et

al., 1991). The third level includes the process of attribution and decision making such as attention and learning (Mahon, Yarcheski, & Yarcheski, 1993; Pennebaker, 2000) and perceived severity of the symptoms (Bury, 2005). The fourth level includes the structure of the health delivery system and the interactions between the individual and the health care system. Although these levels contain several important facets of illness behavior, Mechanic (1978) did not specifically define the interplay among the different levels (Risor, 2006). To further this approach to illness behavior research, the current study will consider the interaction between the first level (dispositional factor of gender) and the second level (psychosocial factors of social support, perceived health status, coping, and perceived stress).

Psychosocial influences on illness behavior. Research has explored a range of psychological and social factors that influence illness behavior. For instance, symptom reporting has been found to be associated with individual's attention and learning. Attention to internal experiences tends to increase when the environment lacks meaningful and relevant information and thus attention to internal states can impact symptom reporting. Research has shown individuals who live alone (Mahon et al., 1993) and who are bored during experimental situations (Pennebaker, 1982) report more physical symptoms. Learning experiences also influence where and how individuals pay attention to their bodies and thus notice symptoms (Pennebaker, 2000). For example, cancer patients who became sick (i.e., vomited or gagged) upon having chemotherapy at the hospital or treatment center re-experienced these symptoms upon seeing the same medical setting later on (Challis & Stam, 1992). Symptom reporting has also been found to be associated with personality traits. Individuals with personality traits such as

neuroticism (Costa & McCrae, 1985) and pessimism (Scheier & Bridges, 1995) tend to report more physical symptoms.

Other psychosocial factors found to be related to illness behavior include social support, perceived health status, coping, and perceived stress. Research has shown that high levels of social support are associated with lower medical utilization rates (Pilisuk et al., 1987). Subjective perception of poor health also has been found to be a strong predictor of increased physician visits for men and women (Miilunpalo et al., 1997). The inability to adapt to or cope with difficult life circumstances can intensify the experience of physical symptoms and poor health outcomes (Connor-Smith & Compas, 2004; Ingledew et al., 1997; Moos & Schaefer, 1993; Soderstrom et al., 2000). High perceived stress levels have been found to be related to high numbers of medical visits (Miranda et al., 1991; Pilisuk et al., 1987). Investigative approaches to illness behavior should continue to consider these psychosocial factors but should also take into account the possibility of interactions among each of them.

Gender and Illness Behavior

Research concerned with illness behavior has addressed sociodemographic variables such as gender (Straub, 2003; Young, 2004). For example, it has been found that women use health services at a greater rate and have a higher rate of hospital admissions (National Center for Health Statistics, 2005). Starting in adolescence, women visit their physicians more than men do even when reproductive and sex-specific diagnoses visits are not included (Verbrugge, 1985). The study by Verbrugge, for example, found visits to physicians for ages 15-44 were 1,631 male and 2,209 female, ages 45-64 were 2,461 male and 3,053 female, and ages 65 and over were 3,438 male and 4,107 female.

Illness behavior distinctions could be due to health-status differences among men and women. In general, women have higher rates of illness at all ages, although men die younger (Broom, 2005; McDonough & Walters, 2001; Verbrugge, 1985). Women experience higher rates of painful and nonfatal conditions (i.e., migraine headaches and arthritis) throughout life while men experience higher rates of conditions and risk factors (i.e., alcohol abuse and dangerous occupations) which contribute to higher probability of death. For example, the Verbrugge study found incidents of arthritis (per 1,000) for ages 15-44 were 4% male and 6% female, ages 45-64 were 19% male and 31% female, and ages 65 and over were 36% male and 50% female. On the other hand, the study found death rates due to accidents (per 100,000) were 0.06% male and 0.02% female. Women experience higher rates of acute conditions (i.e., respiratory and digestive conditions) at all ages, however with chronic health conditions (i.e., chronic bronchitis) the gap between men and women becomes smaller with age. In the same Verbrugge study, incidents of acute respiratory conditions (per 1,000) for ages 15-44 were 10% male and 12% female, and ages 45-64 were 6% male and 7% female. Incidents of chronic bronchitis (per 1,000), on the other hand, for ages 15-44 were 2% male and 4% female, and ages 45-64 were 3% male and 4% female.

Different health care utilization rates for men and women may be the result of biological risks for diseases by gender but many may be related to stress and social factors, such as the social inequalities (i.e., access to health care) and/or environmental factors (i.e., occupation type), associated with being male or female (Broom, 2005; Bury, 2005; Cockerham, 2007; Crawford & Unger, 2000; Straub, 2003). Stress as a basis for gender differences in health may be the result of differences in social roles (Ross & Bird,

1994) and reactivity to stress (Miller & Kirsch, 1987). For instance, women might report more health problems due to the higher demands, obligations, and stress related to their social roles. However gender distinctions in types of reported stressors (i.e., social network events for women and economic stressors for men), measurement of stress (i.e., patterns of exposure to life events), and interpersonal relationships (i.e., family based roles and work stress) make the relationship between gender, stress, and health very complex (McDonough & Walters, 2001).

Social inequalities for women include limited access to quality health care (Winkleby, Jatulis, Frank, & Fortmann, 1992) due to lower paid jobs and lower household incomes (Bird & Rieker, 1999). For instance, in 2006 the median usual weekly earnings of full-time wage and salary workers for women were 80% of the earnings for men (U. S. Department of Labor, 2007). For men, poorer health is related to risks of illness and injury due to more dangerous occupations, household tasks, and recreation pursuits (Verbrugge, 1985). For example, in 1998 the rates of nonfatal occupational injuries treated in emergency room departments were higher for males than females in all age groups (Department of Health and Human Services, 2002). However, these factors alone do not completely explain why women are more likely than men to seek treatment. Limited access to care for women would suggest less frequent utilization of health services and higher risk of illness and injury for men would suggest more frequent utilization of health services. It is possible that the relationship between gender and illness behavior is more complex and involves other intervening factors.

Influence of gender and stress on illness behavior. The physiological changes that result from psychological stress can influence an individual's susceptibility to disease,

which can then lead to poor health status and increased utilization of health care services. Stress or emotional distress can be translated into the experience of physical symptoms such as backaches, chest pain, headaches, and abdominal pain when there is no physical cause (Cummings, 1991; Mechanic, 1972; Quill, 1985). Different stressors, or environmental factors, can produce different combinations of autonomic activation and hormonal changes (Maier, Watkins, & Fleshner, 1994). These in turn may impact immunity in various ways and produce an array of health outcomes. It has also been found that health is negatively affected by stress when it leads to or is associated with poor health practices (Herbert & Cohen, 1993), negative life events (Fisher, 1996; Holmes & Rahe, 1967; Kiecolt-Glaser et al., 1984), negative emotional states (Cohen et al., 1995; Maier et al., 1994), low social support (Cohen & Wills, 1985), poor coping skills (Connor-Smith & Compas, 2004; Ingledew et al., 1997; Moos & Schaefer, 1993; Soderstrom et al., 2000), and hostile and angry personality traits (Straub, Grunberg, Street, & Singer, 1990). Perceived stress has been found to account for individual variability in illness behavior with high perceived stress levels related to high numbers of medical visits (Miranda et al., 1991; Pilisuk et al., 1987). Perceived stress is a distinct factor in the study of illness behavior due to its known impact on health and its connection to psychosocial factors that influence illness behavior.

Perceived stress has also been found to vary by gender. Women report more chronic stress (i.e., social life, relationship, child, family health, and job) than men (McDonough & Walters, 2001), report more significant stress than men (Greenglass & Noguchi, 1996; Silverman et al., 1987), and evaluate threatening circumstances as more stressful than men do (Miller & Kirsch, 1987). More women than men report believing that stress has

had an effect on their health status (Frankenhaeuser, 1991) and report higher distress related to physical symptoms (Benham, 2006). Various factors may influence whether a situation is more or less stressful depending on one's gender (Baum & Grunberg, 1991). The different forms of stress for men and women and different coping strategies for stress could be accounted for by differences in social factors, such as socialization and gender roles (Matud, 2004; Rosario et al., 1988). The traditional gender role for men specifies autonomy, assertiveness, and goal orientation, the traditional gender role for women specifies dependence, affiliation, and emotional expressiveness. Therefore, men may use problem-focused coping styles and women may use social support networks in managing stressful situations. In the study of relationships between stress and illness behavior, known gender differences in such factors, (i.e., stress, symptom reporting, and/or care seeking) are often stated but not examined as major influencing factors in the study design (i.e., Cohen et al., 1995; Cohen, Tyrrell, & Smith, 1993; Kiecolt-Glaser et al., 1984). For example, the Cohen, Tyrrell, and Smith study considered gender as one of the standard control variables that "might provide alternative explanations for the relation between stress and illness" (p. 133) and did not examine the role of gender.

The influence of gender and stress might further explain distinctions in college students' health and illness. For example, it has been found that female students, as compared to male, report higher stress levels (Hall, Chipperfield, Perry, Ruthig, & Goetz, 2006; Hudd et al., 2000) and more health problems (Wade, Pevalin, & Vingilis, 2000). In a study of stress and physical symptom reports in college students, Benham (2006) found significant gender differences on perceived stress and distress related to reported physical symptoms. Specifically, women reported higher perceived stress and higher distress

related to physical symptoms than men. Significant gender differences were not found in reported instances of physical symptoms for men and women. The gender distinctions found in distress related to physical symptoms, but not to reported instances of symptoms, could have occurred because perceived stress may transmit the influence of gender on physical symptom report. Wolfson (2002) examined the effect of stress and other psychosocial factors (i.e., emotional suppression and attention to mood) on illness behavior in college students during the course of a semester and found the trend of symptom reporting was different for males and females over time. Over the semester, men increased in reports of symptoms experienced. Women, on the other hand, exhibited an increase in the beginning of the semester but a decrease during the last part of the semester in report of symptoms experienced. Female students also reported significantly more perceived stress over time. However, the combined influence of stress and illness behavior was not the focus of the study and therefore not considered.

The above findings could be broadened by an examination of combined effects and the addition of other psychosocial factors related to stress and health. A study by Matheny, Ashby, and Cupp (2005) of gender differences in stress, coping, and illness in graduate students found women reported more illness, and reported greater coping resource use and effectiveness than males. Women were significantly higher on the specific coping types of stress monitoring, structuring, social support, and flexibility. Men were higher on acceptance, physical fitness, and wellness, but this was not a significant difference. It was also found that the effectiveness of coping resources contributed to less illness for both genders. The results could be extended by considering whether certain coping types influence illness differently for men and women.

In summary, studies that investigate the influence of various factors (including psychosocial) on illness and related behaviors in college students have not often included gender differences as a potential explanation for variation. The differences in perceived stress and distress related to reported physical symptoms found by Benham (2006) on participant gender, for example, were statistically controlled for in the analyses; which prohibited a full understanding of the nature and influence of gender on the health outcomes of interest. In an examination of the relationship of psychosocial factors (i.e., stress, social support, negative social exchange) to health symptoms in college students, Edwards, Hershberger, Russell, and Markert (2001) found women reported more physical symptoms than men. Physical symptom report was the outcome of interest in the multiple regression analysis but gender was not included as a predictor variable and the authors did not report whether gender was statistically controlled for in the analysis. To more fully understand how gender influences illness behavior, this variable needs to be analyzed within multifaceted models that focus on the factors (i.e., psychosocial factors related to health) that transmit the influence of gender on health-related behavior. In addition, the impact of perceived stress may possibly be the connection between gender, psychosocial factors, and illness behavior because of its distinct relationship to these variables.

Influence of Psychosocial Factors and Gender on Illness Behavior

As stated previously, there are multiple factors that influence illness behavior and studies have examined the impact of psychosocial factors, such as social support, perceived health status, and coping skills. Research has shown the benefit of social support on health. Individuals with social support have faster recovery and fewer medical

complications (Magni, Silvestro, Tamiello, Zanesco, & Carl, 1988), lower mortality rates (Williams, Wiebe, & Smith, 1992), less distress in the face of terminal illness (Varni, Setoguchi, Rappaport, & Talbot, 1992), and lower vulnerability to illness (Berkman & Syme, 1994). Social support is distinctive among men and women (Rosario et al., 1988; Treharne, Lyons, & Tupling, 2001). Specifically, women report more social support and larger social networks than men. This difference may be attributed to gender specific socialization and roles. In general, the establishment, maintenance, and utilization of social relationships differ with men socialized to be self-reliant and independent and women socialized to express emotions and seek support (Stokes & Wilson, 1984; Straub, 2003). As women report more social support, their health may then benefit due to the fact that social support has a protective effect on health. In fact, the association between social support and better health has been found to be twice as large for women (Denton & Walters, 1999). Due to these known distinctions, social support is an important factor to include when examining the effects of gender on health. The influence of greater social support on reported illness behavior may have a stronger positive effect for women as compared to men.

It has been suggested that negative health perceptions have a harmful effect on physical health. For example, healthy men and women (as diagnosed by physician) with poor self-perceived health have been found to report more somatic symptoms compared to individuals whose actual health status (as diagnosed by physician) corresponded with their perceived health status (Olfson, Gilbert, Weissman, Blacklow, & Broadhead, 1995). Subjective perception of poor health has also been found to be a strong predictor of increased physician visits for men and women (Miilunpalo et al., 1997). However, gender

distinctions have been found in health status; women perceive their health to be worse than men (Denton & Walters, 1999). Goldstein, Siegel, and Boyer (1984) examined the associations of self-rated health to health-related behavior, including utilization of health services, and found women to rate their health as poorer than men. The authors statistically controlled for gender in the analysis to remove its influence on the variables being examined. Gender as a contributing factor could have provided further explanation of associations between health status and the health-related behaviors of interest. In addition, the influence of poor perceived health status on reported illness behavior may have a stronger negative effect for women as compared to men.

Research has considered the association between various coping strategies and health. For example, Soderstrom et al (2000) found that greater use of avoidant coping strategies (i.e., withdrawal, denial, and disengagement) was associated with more reported symptoms of illness. Connor-Smith and Compas (2004) found disengagement coping (i.e., avoidance and denial) was significantly associated with more reported physical symptoms as well. On the other hand, active coping and interpersonal support have been found to be associated with fewer reported physical symptoms (Ingledew et al., 1997). The types of coping strategies used by men and women tend to differ. It has been found that women report greater use of avoidant coping strategies than men (Soderstrom et al., 2000). In addition, women are more likely to use emotion-focused behaviors (such as reducing or managing the emotional distress that is associated with the situation) and men are more likely to use problem-focused behaviors (such as problem solving or doing something to alter the source of the stress; i.e., Pearlin & Schooler, 1978; Stone & Neale, 1984). Similar to social support, these distinctions can be attributed to socialization and

social roles (Rosario et al., 1988; Straub, 2003). Specifically, through socialization women are encouraged to seek help from others and men are encouraged to take action. Coping strategy use can impact health but the type of skill utilized may depend on gender. Therefore, the influence of coping strategy use on reported illness behavior may be affected by coping skills that are distinct for men and women.

Influences of Gender, Psychosocial Factors, and Perceived Stress on Illness Behavior

Previously discussed health-related and gender distinctions in perceived stress, social support, perceived health status, and coping suggest the potential for a compounded connection between gender, psychosocial factors, perceived stress, and illness behavior. For example, health is negatively affected by stress when it leads to or is associated with low social support (Cohen & Wills, 1985) and poor coping skills (Connor-Smith & Compas, 2004; Moos & Schaefer, 1993). Studies have investigated whether health care utilization rates and symptom report vary as a function of stress and various psychosocial factors, as well as gender distinctions in these rates.

Pilisuk et al. (1987) studied the impact of life stress, social support, and health on medical utilization rates for patients over the age of 40 at a major HMO over five years. The authors found that clinic visits were associated with increasing age, higher stress levels, and lower levels of social support in the first two years of the study. The predictors of clinic utilization were also examined by gender. As could be expected, women used outpatient services more than men in all the years studied. Also, as expected for both women and men, high social support buffered the impact of stress on clinic utilization. With high social support, increased stress was associated with low number of clinic visits. These findings emphasize the inclusion of perceived stress and social

support in illness behavior research, but due to the gender differences found in utilization, also suggest the inclusion of gender as an additional explanatory variable.

Miranda et al. (1991) used a volunteer sample of primary care patients at a university outpatient clinic to examine the relationship of factors such as somatization and stressful life events to outpatient visits. Results found that both somatization and stressful life events were related to a greater number of medical visits for all participants. It has been found that individuals who are likely to attribute ambiguous bodily symptoms to physical causes, or somatizers, are more likely to seek treatment for symptoms (Mechanic, 1972). In addition, the interaction between somatization and high stress was related to greater number of medical visits. Based on existing evidence, it could be expected that women would more likely seek treatment (National Center for Health Statistics, 2005; Pilisuk et al., 1987); however, the authors did not find gender to be associated with number of medical visits, or somatization and stressful events. This inconsistency could be explained by considering the possibility that other psychosocial factors (such as social support and coping style) may transmit some of the influence of gender and stress or that these factors may have a collective, or compound, influence on treatment seeking behavior.

Mathis and Lecci (1999) studied the influence of psychosocial factors (i.e., hardiness and negative affectivity) on total number of health center visits during a semester for undergraduate students. Hardiness (stress buffering traits such as commitment, challenges, and control) was found to be associated with more health center visits. However, after statistically controlling for negative affectivity (expressing feelings of anger, contempt, shame, fear, and depression), as the amount of hardiness traits

increased, the number of health center visits decreased. Because high stress has been found to be related to increased physician visits (Miranda et al., 1991; Pilisuk et al., 1987), it is consistent that stress buffering traits such as hardiness would have a positive impact on such illness behavior. Again, gender differences in treatment seeking could be expected (National Center for Health Statistics, 2005; Pilisuk et al., 1987) but the results of this study did not report whether these differences were examined on number of health center visits or any of the factors hypothesized to affect number of health center visits. As the sample was mostly female, this may have influenced the overall results. Research on the variability in illness behavior due to stress has established an association; however, a more complete explanation involves additional elements such as gender and psychosocial factors.

In more recent attempts to examine this complex relationship, research on the relationship between stress and health has placed emphasis on examining the role and influence of moderators and mediators on this relationship (i.e., Blalock & Joiner, 2000; Connor-Smith & Compas, 2004; Dixon & Reid, 2000). A previous examination of the data for the current study by Thomas (2006) found support for known moderators that affect the relationship between stress and illness, such as coping and social support, but the results were not consistently in the direction that was expected (this will be discussed further in the next section). Consequently, it is possible that social support, perceived health status, and coping affect perceived stress rather than the other way around. For example, individuals report less stress and better adaptation to life's challenges when they perceive high levels of social support (Fleming, Baum, Gisriel, & Gatchel, 1982) and use approach coping styles (Moos & Schaefer, 1993). Additionally, it is important to

consider perceived stress as a possible mediator, and not just as a predictor, in illness behavior research.

A study of gender specific models of psychosocial factors related to stress and health by Hall et al. (2006) examined perceived stress as a potential mediator between perceived control (primary and secondary) and health among male and female college students. Overall, females had significantly higher perceived stress, illness symptoms, and illness behaviors. The results for males indicated that lower stress levels mediated the relationship between primary perceived control (attempts to change the environment) and better overall self-reported health status as well as fewer illness symptoms. Also for males, both primary and secondary perceived control (psychological adjustment to the environment) were directly related to lower illness-related behaviors. For females, it was found that lower stress levels mediated the relationship between secondary perceived control and better overall self-reported health status as well as fewer illness symptoms. Neither primary nor secondary perceived control was directly related to health outcomes for females. Therefore, perceived stress was examined as a potential mediator between perceived control and health, but the type of perceived control (primary or secondary) that was mediated by stress was different by gender. This provides support for the importance of considering gender differences in psychosocial factors related to health. In addition, the influence of stress was relevant in the models for both genders even though females were significantly higher in perceived stress. These results suggest that psychosocial factors related to health function differently for men and women and provide evidence for examining distinct models of illness behavior for men and women.

This also demonstrates the importance of considering perceived stress as a mediator in the relationship between psychosocial factors and health.

Psychosocial factors associated with changes in stress level for men and women may help to explain variability in illness behavior. Women and men are subjected to different forms of stress and cope with stress in different ways (Crawford & Unger, 2000). Subsequently, high perceived stress levels related to illness behavior such as high numbers of medical visits (Miranda et al., 1991; Pilisuk et al., 1987) may be due to complex associations among variables rather than simple relationships. Gender differences on perceived stress were found in the previous examination of this data (Thomas, 2006) and may have been due to varying social support satisfaction, perceived health status, and coping skills for men and women. Therefore, illness behavior in this sample may be influenced by an indirect relationship between gender and perceived stress through psychosocial factors. This suggests a possible chain of factors influencing illness behavior: Gender affects illness behavior through psychosocial factors that affect perceived stress. The gender differences found in illness behavior, psychosocial factors, and perceived stress are interrelated and an examination of the complexity of the relationship is necessary to further understand variations in behavior related to health.

Preliminary Study: Moderators of Stress and Illness Behavior

A study of the moderating influence of psychological stress on various illness behaviors in college students by Thomas (2006) was conducted to explore the extent to which stressful life events, individual psychological characteristics, perceived health status, and health behaviors moderate the effects of perceived stress on illness behavior during a semester. This study found support for previous research on the known

moderator factors of stress and illness; such as coping (Moos & Schaefer, 1993) and social support (Cohen & Wills, 1985) and for the inclusion of perceived health status in such research. Results indicated that the relationship between perceived stress and illness behavior was affected by avoidant coping, social support dissatisfaction, and perceived health status. However, further investigation is needed to more fully understand the complexity of these relationships.

This study found significant mean differences for gender on one illness behavior, self-reported visits to the doctor in the past six months. As expected, females reported a higher number of self-reported doctor visits (Crawford & Unger, 2000; National Center for Health Statistics, 2005). However, gender distinctions were not found on other illness behaviors. It is possible that gender affected illness behavior through other factors related to health (such as avoidant coping, social support dissatisfaction, and perceived health status). Females also reported higher perceived stress and this has been found previously in other research (Greenglass & Noguchi, 1996; Silverman et al., 1987). However, as perceived stress was the predictor variable in the Thomas (2006) sample, the gender difference may have influenced all of the moderating relationships. The influence of gender in this sample requires further examination.

An interaction effect demonstrated that perceived stress and psychosocial factors affected illness behaviors differently. For example, on self-reported visits to the doctor, individuals with high perceived stress and poor perceived health status reported fewer numbers of doctor visits. On the other hand, for self-reported illness without a doctor visit, the relationship between high perceived stress and more illness without a doctor visit was due to three different levels of perceived health status (excellent, very good, and

poor). Poor perceived health status was not expected to affect both fewer visits to the doctor and more illness without a doctor visit, as research has found it to be related to increased utilization rates only (Miilunpalo et al., 1997). The interaction of perceived stress and perceived health status affects different illness behaviors distinctly but may also lead to the hypothesis that the direction of the relationship may be reversed; perceived health status may influence the amount of stress experienced.

Expected and unexpected influences of psychosocial factors were found on the same illness behavior. The relationship between high perceived stress and more incidents of self-reported illness without a doctor visit was due to perceived health status (excellent, very good, and poor), to low social support dissatisfaction, and to high avoidant coping. This relationship was not expected for social support, as research has found low social support satisfaction to be related to more illness (i.e., Cropley & Steptoe, 2005; Straub, 2003; Treharne et al., 2001), but was as expected for avoidant coping (i.e., Connor-Smith & Compas, 2004; Ingledew et al., 1997). Again, this may be due to the distinctiveness of the illness behavior but may also be due to a reversal in the direction of the relationship.

The current study further examines the relationships tested in the Thomas (2006) study. Gender differences in illness behavior and perceived stress suggest that an additional examination of gender in a multifaceted model of illness behavior is needed. The Thomas database could be further analyzed by considering how the differences in illness behavior are influenced by gender through the psychosocial factors that are known to have an influence on health; such as coping, social support, and perceived health status. The indirect influence of gender as a result of these psychosocial factors may

provide additional clarification of the variability in illness behavior for college students in the Thomas sample.

Summary and Statement of the Problem

Research on illness behavior, such as reporting symptoms and utilization of health services, focuses on understanding the reasons individuals do or do not engage in health related activities when attempting to define health states (Kasl & Cobb, 1966a). This is important to examine because successful treatment and knowledge of diseases depends on individual initiative to seek treatment. Research investigating illness behavior might need to focus on more complex relationships in order to discern the mechanisms through which various components influence illness behavior. Previous literature suggests gender, coping skills, social support satisfaction, perceived health status, and perceived stress may have separate and collective, or compound, influences on illness behavior.

Illness behaviors are distinct for men and women (Cockerham, 2007; Crawford & Unger, 2000; Straub, 2003). Gender differences that have been found in illness behavior can be explained by social, psychological, and/or behavioral factors related to health (Denton & Walters, 1999; Denton, Prus, & Walters, 2003). Psychosocial factors have been found to influence the patterns and expression of illness (Fleming et al., 1982; Pilisuk et al., 1987) but how gender differences might impact such expression still needs further investigation. This suggests gender might be an important factor in the study of illness behavior. Although research considers gender differences on each psychosocial and/or health-related factor in preliminary analyses as a way to describe the sample, it is often overlooked as an important part in complex models of illness behavior.

To expand upon the findings of the preliminary study (Thomas, 2006) and to further understand the complexity of the influence of gender, psychosocial factors, and perceived stress on illness behavior, the indirect processes related to illness behavior necessitate further exploration. As social support, perceived health status, coping, and perceived stress have an important influence on health and illness behavior and are found to vary by gender, such factors may intervene in the relationship between gender and illness behavior. This study will provide additional insight into variations in illness behavior among college students.

Through an expanded statistical analysis of the Thomas (2006) raw data, the current study examined the impact of variation in psychosocial factors and perceived stress among men and women on illness behavior. Gender is assumed to have an effect on illness behavior, psychosocial factors, and perceived stress due to multifaceted relationships that still need to be investigated. Thus, to provide a more complete understanding of the influence of gender, the indirect effects of gender on illness behavior through psychosocial factors and perceived stress were considered. In this study, illness behavior includes self-report of: number of visits to a health care provider, number of instances of illness without visits to a health care provider, number of instances of missed class due to illness, and number of instances of missed work due to illness. The first purpose of this study was to determine how the effect of gender on illness behavior may be mediated by social support satisfaction, perceived health status, coping skills, and perceived stress. A second purpose was to test two models of indirect effects through multiple factors, or compound indirect effects models. First, where the effect of gender differences in social support satisfaction, perceived health status, and

coping skills on illness behavior are mediated by perceived stress. Second, where the effect of gender differences in perceived stress on illness behavior are mediated by social support satisfaction, perceived health status, and coping skills. Prior to conducting the proposed analyses, an examination of the extent to which individual indicators (found through principal component analysis) measure the psychosocial factors that may influence illness behavior was performed.

Research Questions and Proposed Models

1. A confirmatory factor analysis was conducted prior to testing the full structural regression models. A principal component analysis was performed to find the items with the highest factor loadings on the respective factors of social support satisfaction, coping skills, and perceived stress in this sample. All factors in this model (gender, illness behavior, social support satisfaction, perceived health status, coping skills, and perceived stress) were allowed to covary with each other and no causal relationships between factors were analyzed (See Figure 1).
2. Indirect effects of gender were considered by testing a mediation model. Specifically, how gender affects illness behavior through social support satisfaction, perceived health status, coping skills, and perceived stress (See Figure 2).
3. Multiple indirect effects of gender on illness behavior were considered by testing two models that examined the distinct influence of perceived stress. These models are referred to as "compound" models because they explored the collective influence of multiple factors on illness behavior. The compound indirect effects model tested how gender differences in social support satisfaction, perceived health status, and coping skills on illness behavior were mediated by perceived stress (See Figure 3). The

alternative compound indirect effects model was tested by considering alternative directionality of relationships between psychosocial factors and perceived stress. Specifically, how gender differences in perceived stress on illness behavior were mediated by social support satisfaction, perceived health status, and coping skills (See Figure 4).

Chapter II: Method

Study Design

The present study involves secondary analysis of data collected for a study on the moderators of the stress/illness relationship. The goal of this study was to test the fit of several proposed models with data collected from a sample of undergraduate college students. This information was obtained through self-report questionnaires in an on-line survey during the last week of the 2005 fall semester at Colorado State University.

Power Analysis

For structural equation modeling techniques, complex models require large samples (Kline, 2005). Although there are not absolute standards in the literature about the relation between sample size and path model complexity, it is suggested that a realistic ratio of the number of cases to the number of free parameters be 10:1. MacCallum, Browne, and Sugawara (1996) provide a framework for the assessment of fit in covariance structure models and discuss the determination of minimum sample size required to achieve a given level of power in hypothesis testing. In general, the authors suggest that adequately powerful tests of fit can be conducted on models with moderate sample size if degrees of freedom are high. Initially, the confirmatory factor analysis model was examined separately for each gender. The number of free parameters combined with the small number of male participants was insufficient for testing a separate model for each gender. However, it was determined that conducting the analysis with one model was acceptable for a preliminary examination of these complex paths.

The preliminary analysis section discusses the procedures used as an attempt to balance the measurement model for each gender.

In the process of identification, degrees of freedom for tested models are determined (Kline, 2005). The degrees of freedom for the confirmatory factor analysis model (refer to the first hypothesis; see Figure 1) was 122. The degrees of freedom for the first structural regression model (refer to hypothesis two; see Figure 2) was 122. For the second structural regression model (refer to hypothesis three; see Figure 3), the degrees of freedom was 122. For the third structural regression model (refer to hypothesis three; see Figure 4), the degrees of freedom was 122. The minimum sample size to achieve power of .80 with a specified alpha level of .05 for 100 degrees of freedom is 132 for test of close fit (null value of root mean square error of approximation (RMSEA) = .05, alternative value of RMSEA = .08) and 178 for test of not-close fit (null value of RMSEA = .05, alternative value of RMSEA = .01) (MacCallum et al., 1996). In this study, data from 303 participants was available.

Participants

Data were collected from 345 participants and 303 provided complete data, therefore forty-two cases were removed from the sample. Sociodemographic information and complete surveys were obtained from the 303 students. The respondents were on average 19 years old (range 17-33 years), mostly female (70% female vs. 30% male), single (92% single vs. 5% other, 3% living with partner, and <1% married), and Anglo (89% Anglo/White vs. 4% Hispanic/Latino(a)/Mexican American, 2.3% Asian American/Pacific Islander, 2% Black/African American, 1.3% Other, 1% International student, and .3% Native American/American Indian). Academically, respondents had on

average 14 credits (range 2 to 21 credits) and were mostly freshman (51% freshman vs. 19% sophomore, 17% senior, and 12% junior). The employment status of respondents (i.e., Do you currently work?) was 56% not working and 43% working. With regard to healthcare services, 55% reported utilizing the University Health Services only, 22% reported utilizing both the University Health Services and off campus health services, and 21% reported utilizing off campus health services only.

Procedures

Participant recruitment. Students were recruited from the PY100 research participant pool and other undergraduate psychology courses. Instructors' permission was obtained to distribute flyers about the study in an effort to recruit potential participants. The incentive for participation included a pass for one free mind/body session or cycling class at the Student Recreation Center and/or a coupon for $5 off any massage at the Student Recreation Center. As an added incentive, each participant was eligible for a drawing to receive a free spring semester mind/body pass at the student recreation center, a certificate for a free one hour massage at the student recreation center, and a variety of four gift certificates. Some undergraduate psychology instructors offered students extra credit for their participation.

Students read and signed a consent form outlining the purpose of the study and were asked to consent for access to information from health center records for the semester during which the study was to be conducted (see Appendix A). A total of twenty assessment times were scheduled to accommodate twenty subjects per period. Participants were allotted one 60 minute time period to complete the consent process and were allowed to choose the most convenient time. Each assessment session was

monitored in person by the investigator and an undergraduate research assistant and took approximately 25 minutes.

The surveys were administered on-line through the Student Voice survey package utilized by the university. Participants provided an email address during the consent process and the survey was sent to them at that address. Participants could complete the survey at any time during the last week of the 2005 fall semester (December 5-9). Participants were asked to complete all of the scales in the questionnaire (see detailed description of each scale under the measures section). Each questionnaire took approximately between 10-15 minutes to complete, and the entire survey took approximately between 30-60 minutes to complete. There were three versions of the survey (A, B, and C) with different ordering of the questionnaires within the survey to control for order effects.

Measures

Sociodemographic information. Information regarding age, gender, ethnicity, living situation, years in school, grade point average, major area of study, work status, insurance coverage, and place of received health care was obtained from each participant during the consent process (see Appendix B). In addition, the participant information sheet contained information for creating each participant identification code. This code contained the last two digits of participant social security number/the last two digits of participant phone number/participant birth date. Participants were instructed to enter this code at the beginning of the on-line survey.

Illness behavior. Illness behavior was assessed at the end of the semester by self-report on four measures. The Health Outcomes Survey asked participants to report on the

number of illness behaviors during the past month: number of visits to a health care provider, number of instances of illness without visits to a health care provider, number of instances of missed class due to illness, and number of instances of missed work due to illness (see Appendix C). This scale was created for a previous study (Thomas, 2006) and the alpha reliability was .80.

Social support satisfaction. Social support was measured by the Social Support Questionnaire Short Form (SSQSR) (Sarason, Sarason, Shearin, & Pierce, 1987) which is used to measure the perceived availability of social support as well as the appraisal of the support (see Appendix D). The SSQSR consists of six items that describe a variety of situations and individuals respond to two parts of the item. First, individuals are asked to list up to nine available others that they feel they can turn to in times of need (number score). Second, individuals are asked to rate degree of satisfaction with the perceived support on a 6-point Likert scale from "very dissatisfied" to "very satisfied" (satisfaction score). Research has shown that it is a reliable and valid measure of social support (Brown & Schutte, 2006) and there is support for its use in research with college students (Steptoe & Wardle, 2001; Treharne et al., 2001). The alpha reliabilities for both number and satisfaction scores are acceptably high, ranging from .90 to .93 (Sarason et al., 1987). Evaluations of validity show the satisfaction score to be negatively correlated with loneliness (-.59 and -.60), depression (-.19 and -.47), and anxiety (range from -.17 to -.55) (Sarason et al., 1987). The alpha reliability for this scale in the current sample was .80.

Perceived health status. Participants were asked to provide a health history (see Appendix E). This questionnaire was developed by and is used in the Human Performance Clinical/Research Laboratory in the Department of Health and Exercise

Science at Colorado State University and has been modified for the purpose of this study. A measure of perceived health status asked participants to rate their overall health at the present time as either: excellent, very good, good, fair, poor, or very poor. The use of this single item has been shown to be a valid measure of health status (Bowling, 2005).

Coping. Strategies to cope with stress were measured by the Brief COPE inventory (Carver, 1997) which is used to assess a range of coping responses in an abbreviated format (see Appendix F). Individuals were asked to rate 28 items on a 4-point scale of what they generally do and feel when experiencing stressful events. The Brief COPE inventory consists of fourteen dimensions of coping; self-distraction, active coping, denial, substance use, use of emotional support, use of instrumental support, behavioral disengagement, venting, positive reframing, planning, humor, acceptance, religion, and self-blame. Research has shown that the Brief COPE is a reliable and valid measure of coping strategies (Norlander, Von Schedvin, & Archer, 2005) and there is support for its use in research with college students (Devonport & Lane, 2006; Pritchard & Wilson, 2003). The alpha reliabilities for this scale are acceptable and range from .50 to .90 (Carver, 1997). The Brief COPE is a shorter measure based on the COPE inventory (Carver, Scheier, & Weintraub, 1989) and a major advantage of its use is the reduction of participant burden. The alpha reliability for this scale in the current sample was .79.

Perceived stress. The Perceived Stress Scale (PSS) was used to measure levels of perceived stress (see Appendix G). This 14-item scale was developed by Cohen, Kamarck, and Mermelstein (1983) to measure levels of perceived stress and the degree to which respondents find their lives unpredictable, uncontrollable, and overloading. Respondents are asked how often they felt or thought in a certain way on a 5-point scale,

ranging from *never* to *very often*. Research has shown that the PSS is a reliable and valid measure of self-reported stress (Cohen et al., 1993) and there is support for its use in research with college students (Burns, Carroll, Drayson, Whitham, & Ring, 2003; Deckro et al., 2002). Coefficient alpha reliabilities range from .84 to .86 (Cohen et al., 1983; Cohen et al., 1993), and the test-retest correlation at a two day interval was .85. Evaluations of validity show small to moderate correlations with impact of life event scores (range of .24 to .49). The PSS has been shown to be a statistically significant predictor of physical symptomology (range of .52 to .70) and changes in utilization of health services (.20) (Cohen et al., 1983). Although significant, these small to moderate correlations suggest other variables may clarify the relationship between stress and health outcomes. The alpha reliability for this scale in the current sample was .87.

Methods of Analyses

Preliminary analyses. Data were entered into the Statistical Package for the Social Sciences (SPSS) via a text file and were checked for accuracy and errors by the researcher and undergraduate assistants. Before a matrix summary of the data was created for structural equation modeling (SEM) procedures, the data were carefully screened for potential problems (Kline, 2005). First, estimation methods in SEM assume multivariate normality. That is, all the univariate distributions are normal, the joint distribution of any pair of the variables is bivariate normal, and all bivariate scatterplots are linear and homoscedastic. Frequency distributions and normal probability plots of observed and latent variable totals were inspected to detect distribution normality. Examination of frequency distributions revealed negative skew (most of the scores above the mean) for social support satisfaction and positive skew (most of the scores below the mean) for

illness behaviors. Frequency distributions were also inspected for the presence of outliers and cases with extreme outliers. The social support satisfaction frequency distribution revealed two cases with extreme outliers (less than eight) and they were deleted. This improved the normality of the distribution. In addition, the illness behavior frequency distributions revealed four cases with extreme outliers (greater than fifteen) that were deleted. Distributions examined after deleting the outliers revealed positive skew (most of the scores below the mean) for the illness behavior items. In an attempt to remedy the skewed distribution, a base10 logarithm transformation was conducted but the positive skew remained. Therefore, the illness behavior items were dichotomized (0 = no reported illness behaviors and 1 = one or more reported illness behaviors).

Second, missing data were examined. Thirteen cases were missing the sociodemographic information and were dropped from the analysis due to inability to link the questionnaire to the on-line survey data. An analysis of missing data found no data missing for the social support satisfaction, perceived health status, coping, perceived stress items, and 14 instances of missing data for gender. The majority of occurrences of missing data in this dataset were in the illness behavior items; 39 cases for number of visits to a health care provider, 27 cases for number of instances of illness without visits to a health care provider, 23 cases for number of instances of missed class due to illness, and 24 cases for number of instances of missed work due to illness. There are reasons why missing data may occur and there are different ways of handling missing data (Byrne, 2005; Kline, 2005). Data may be "missing completely at random" which assumes the occurrence of missing values is independent of unobserved values and observed values of all other variables in the data. This is a strong assumption about the nature of

randomness in the data (Kline, 2005). Data may be "missing at random" which assumes the occurrence of missing values may be random but can be linked to observed values of other variables in the data (Byrne, 2005). Missing data may be "nonignorable" which assumes the occurrence of missing values is due to an existing dependency between the missing data and the values that are present. It is best to make an effort to understand the nature of the underlying data loss. The occurrences of missing data in this sample are most likely "missing at random" because it is possible that the instances were missing by chance but, it is not obvious that the missing values were independent of other items in the dataset. The method that the AMOS computer program uses to handle missing data is based on maximum likelihood estimation. The advantages of using maximum likelihood estimation are that the estimates are statistically consistent, efficient, and asymptotically unbiased. In addition, maximum likelihood estimates yield standard error estimates and provide a method for testing hypotheses.

Third, it is very possible that the latent variables in this study are related and may measure the same concept. Multicollinearity occurs when intercorrelations between variables are so high that certain mathematical operations are impossible or unstable (Kline, 2005). Symptoms of high multicollinearity include a substantial R^2 for the equation but statistically insignificant coefficients, regression coefficients which change greatly when independent variables are dropped or added to the equation, and suspicion about the magnitude or sign of the coefficients. Collinearity also has adverse effects on the accuracy of computations due to rounding errors (Pedhazur, 1997). The tolerance ($1-R^2$) is calculated by computer programs to guard against these errors and the smaller the tolerance, the greater the problems from rounding errors. The preferred method of

examination is to regress each independent variable on all the other independent variables. When any of the R^2 from the equations is near 1.0, there is high multicollinearity. The analysis of multicollinearity included regression analyses yielding R^2 values ranging from .126 to .175. The variance inflation factor (VIF) indicates the inflation of the variance of b as a consequence of the correlation between the independent variables (Pedhazur, 1997). A high VIF, greater than 10, indicates greater correlation between the independent variables (Cohen, Cohen, West, & Aiken, 2003). The regression analyses yielded VIF values only ranging from 1.064 to 1.195. Therefore, problems with multicollinearity were not found.

Finally, relative variances were considered. Problems in SEM can occur in covariance matrices that are ill scaled where the ratio of the largest to the smallest variance is greater than about 10 (Kline, 2005). The estimation methods used in SEM are iterative and the goal is to derive better estimates at each stage to improve the overall fit of the model to the data and find a stable solution. A failure of this process can occur when variances of observed variables are very different in magnitude and the estimates do not converge to stable values. In order to address possible problems with relative variance, the variable variances were examined. The ratio of the largest variance ($s^2 = 12.61$) to the smallest variance ($s^2 = 0.21$) was greater than 10. Therefore, the variable with the smallest variance (gender) was rescaled by multiplying each data point by a constant (five) prior to conducting the path analyses. This changed the mean and variance, but not the correlation with other variables. Once preliminary analyses were complete but prior to conducting the path analyses, the correlation matrix including all variables of interest was examined. This examination provided information about the relationship of gender to the

latent and outcome variables as well as the possible covariances to include in the path models. Gender was significantly, yet weakly, associated to all the latent and outcome variables. In addition, most, but not all, of the psychosocial variables were interrelated and all but one psychosocial variable was significantly associated with the outcome variable. These findings supported previous literature but also suggested the potential for indirect relationships.

Statistical analysis. Structural equation modeling (SEM) is a confirmatory approach to the analysis of a particular set of relationships among hypothetical constructs. The relationships under study are represented by a series of structural equations and the relationships can be modeled in a diagram. The model is tested in a concurrent analysis of all variables to determine the extent to which the hypothesized model is representative of the data. A model with adequate goodness of fit provides evidence for plausible relations among variables. The AMOS computer program (Byrne, 2005) was used to conduct structural regression models, a synthesis of path and measurement models. The hypothesized models were derived from the literature review on the relationship of gender with health and stress. The paths originating from gender to illness behavior, social support satisfaction, perceived health status, coping, and perceived stress reflected findings in the literature review previously mentioned. The evaluation of model identification and consequent estimation was performed for each part (path and measurement) of the structural regression model.

The specification of structural regression models follows the basic rationale of specification in path analysis and confirmatory factor analysis (Kline, 2005). The specification issues for path models consist of deciding the variables to include in the

model, how to measure the constructs, the directionalities of presumed casual effects, the complexity of the model, and the status of each model parameter. The specification issues for confirmatory factor analysis include the choice between unidimensional versus multidimensional measurement and hierarchical relations among the factors. These decisions on model specification should be guided by previous literature, as well as the researcher's experience and judgment. As with path models, structural regression models assume that the measured exogenous factors and disturbances of the endogenous factors are uncorrelated. The factors and measurement errors are independent and every latent variable in the model must have a determined scale (Byrne, 2005). The scale requirement is fulfilled by constraining one factor loading parameter in each set of factor loadings. For example, one of the regression paths leading from each factor to a set of observed indicators is assigned a fixed value. AMOS automatically assigns the value of 1.0 to the lower regression path of each set. This fixed parameter is termed a reference variable.

A model is identified if it is theoretically probable to obtain a unique estimate of each parameter (Kline, 2005). Identification of structural regression models should be evaluated separately for the structural and measurement components. In order for the structural portion of a structural regression model to be identified, the measurement portion must first be identified. For the structural regression model to be identified, two necessary conditions must be met. First, the number of free parameters (the total number of variances and covariances of exogenous variables plus the direct effects of the factors on the indicators) must be less than or equal to the number of observations [$v\ (v + 1)/2$]. Second, every latent variable must have a scale. However, meeting the necessary requirements does not guarantee the model is identified. There is a sufficient condition

that applies to standard confirmatory factor analysis models. If a standard model with a single factor has at least three indicators, the model is identified. If a standard model with two or more factors has at least two indicators per factor, the model is identified.

One confirmatory factor analysis model and three structural regression models were tested in this study. The confirmatory factor analysis model is identified (refer to hypothesis one page 27; see Figure 1). The number of free parameters, 67, is less than the number of observations, 189, for 122 degrees of freedom and every latent variable has a scale. The structural regression models are identified (refer to hypotheses two and three page 27 ad 28). For the first structural regression model (see Figure 2) the number of free parameters, 67, is less than the number of observations, 189, for 122 degrees of freedom and every latent variable has a scale. For the second structural regression model (see Figure 3) the number of free parameters, 67, is less than the number of observations, 189, for 122 degrees of freedom and every latent variable has a scale. For the third structural regression model (see Figure 4) the number of free parameters, 67, is less than the number of observations, 189, for 122 degrees of freedom and every latent variable has a scale.

A confirmatory factor analysis was conducted prior to testing the full structural regression model. In confirmatory factor analysis, there is a distinction between indicators and the underlying factors that the indicators are assumed to measure (Kline, 2005). In this model, the factors simply covary with each other and no causal relationships between factors are analyzed. In this study, the confirmatory factor analysis helped to determine the measurement portion of the model and the direction of relationships between variables in the path model. The observed variables in the proposed

model (gender and perceived health status) each have a one item indicator. The latent variables in the model (illness behavior, social support satisfaction, coping, and perceived stress) are measured by instruments with reliable and valid indicators of that specific construct.

The measurement portion of the structural regression model was established by determining the indicators to use in measuring each construct by identifying which items to use for each indicator (Byrne, 2005). To identify which items were used as indicators, a principal component analysis (for the full sample and by gender) was conducted to find the four items with the highest factor loadings on that construct. Four items were chosen for simplicity in the model. The latent variable of illness behavior included all four indicators (self-report on the number of illness behavior during the past month: number of visits to a health care provider, number of instances of illness without visits to a health care provider, number of instances of missed class due to illness, and number of instances of missed work due to illness). The items with highest factor loadings on the constructs of social support satisfaction, coping, and perceived stress were different for females and males and two strategies were used to identify items. First, the four items with the highest loadings for each gender were examined and the common items were identified. Next, the items with reasonably high and close loadings for both males and females were identified. For social support satisfaction, three common items (male range of .74 to .79; female range of .87 to .91) and one item with reasonably high and close loadings (male of .83; female of .83) were used. For coping, the items on dimensions of coping with support in the illness behavior literature and the highest loadings were identified. The items for coping dimensions on use of emotional support (male range of .80 to .86;

female range of .79 to .80) and use of instrumental support (male range of .77 to .81; female range of .83 to .85) were used. For perceived stress, two common items (male range of .76 to .89; female range of .78 to .86) and two items with reasonably high and close loadings (male range of .75 to .76; female range of .72 to .79) were used.

The model estimation methods of path models and confirmatory factor analysis models are the same in structural regression models (Kline, 2005). The principle of maximum likelihood used to derive the parameter estimates in path models assumes that the estimates maximize the likelihood that the data were drawn from the population of interest. The method of maximum likelihood estimation is iterative; the computer derives an initial solution and conducts cycles of calculations to improve these estimates. The improvement occurs as the overall fit of the model to that data becomes better from step to step. The maximum likelihood estimates are path coefficients in path models and are interpreted as regression coefficients. These path coefficients are interpreted as the effects on endogenous variables from other variables presumed to directly cause them. The direct, indirect, and total effects among factors are determined by using the principles of effects decomposition of path analysis, a summary of all estimated direct, indirect, and total effects in the model. Direct effects are the hypothesized effects of one variable on another. Indirect effects involve one ore more intervening variables and are estimated as the product of the direct effects that comprise them. Total effects are the sum of all direct and indirect effects of one variable on another. In confirmatory factor analysis when indicators are specified to measure one factor, as in this model, standardized factor loadings are interpreted as estimated correlations.

The central theme in SEM is the extent to which the model adequately describes the sample data (Kline, 2005). The model assessment involves examining the adequacy of parameter estimates and the model as a whole (Byrne, 2005). First, parameter estimates were evaluated for size and sign that may be inconsistent with theory and standard errors that are excessively large or small. Next, the statistical significance of parameter estimates was considered. Nonsignificant parameter estimates can be considered unimportant in the model and were deleted in order to present the most parsimonious model.

Examination of model fit also involves examining goodness of fit and conducting specification searches (Byrne, 2005). The overall Chi Square value and significance level is determined and a nonsignficant Chi Square value indicates a good fitting model. However, this statistic is sensitive to sample size and other indexes of fit were examined as well. Other model fit indexes that were inspected include root mean square error of approximation (RMSEA), comparative fit index (CFI), and the parsimony-adjusted normed fit index (PNFI). An RMSEA less than or equal to .05 indicates close approximate fit, between .05 and .08 indicates reasonable error approximation, and greater than or equal to .10 suggests poor fit. A CFI value greater than .90 indicates reasonably good model fit. Many fit indices improve just by adding paths whether they make sense or not. The PNFI is an index of parsimony which is based on the normed fit index (NFI) but includes a penalty for lack of parsimony. For PNFI, there is no accepted cut-off level for a good model but when comparing nested models the model with the lower PNFI is better.

If the fit of the hypothesized model is inadequate, a specification search can be conducted to identify sources of lack of fit in the model. The residuals were examined to reveal evidence of misfit in the model. Standardized residuals represent the estimates of the number of standard deviations the observed residuals are from the zero residuals that would exist if model fit were perfect. Large standardized residuals (greater than 2.58) represent significant discrepancy in covariance. Modification indexes also provide evidence of misfit in the model and are provided for each fixed parameter specified. This value represents the expected drop in overall Chi Square value if the parameter were to be freely estimated. However, these indexes were not utilized in this analysis because AMOS cannot provide modification indices with incomplete data.

Once the fit of the structural model was determined to be adequate, the decision to respecify and reestimate the model was made. The parameter estimates for specific effects were interpreted for meaningfulness (Kline, 2005) and the possibility that respecification may lead to an overfitted model was considered (Byrne, 2005). For any structural equation model, there may be many comparable variations. If the initial model did not fit the data very well, the model was respecified and model fit was reevaluated.

Chapter III: Results

Preliminary Analyses

Gender differences. Means and standard deviations, by gender, for the latent variables (illness behavior, social support satisfaction, coping, and perceived stress) and the observed variable of perceived health status are presented in Table 1. In addition, independent samples t-tests were conducted. Gender differences were found on illness behavior, social support satisfaction, perceived health status, coping skills, and perceived stress. Female students reported greater illness behavior, $t(247) = -3.08$, $p = <.01$; greater social support satisfaction, $t(294) = -2.55$, $p = <.01$; poorer perceived health status, $t(294) = -3.17$, $p = <.01$; greater use of total coping skills (emotional and instrumental support), $t(294) = -6.14$, $p = <.01$; and greater perceived stress, $t(294) = -3.53$, $p = < .01$.

Correlations. Correlations and covariances for the total sample are presented in Table 2. Correlations by gender are presented in Table 3. For males, one significant correlation was found. Perceived stress was negatively correlated with social support satisfaction, $r(91) = -.32$, $p < .01$. For females, several significant correlations were found. Illness behavior was positively correlated with perceived health status, $r(176) = .31$, $p < .01$, and perceived stress, $r(176) = .26$, $p < .01$. The psychosocial variables were interrelated with significant negative correlations between social support satisfaction and perceived health status, $r(205) = -.24$, $p < .01$, and perceived stress, $r(205) = -.23$, $p < .01$. Significant positive correlations were found between social support satisfaction and total coping skills (emotional and instrumental support), $r(205) = .17$, $p < .01$, use of emotional

support, $r(205) = .18$, $p < .01$, and use of instrumental support, $r(205) = .15$, $p < .05$, as well as between perceived health status and perceived stress, $r(205) = .33$, $p < .01$. Due to the very high correlations between emotional and instrumental support types of coping skills, total coping skills was used in the structural equation models.

Structural Equation Modeling Analyses

Confirmatory factor analysis model. In structural regression models, it is suggested that a 2-step modeling approach is used (Anderson & Gerbing, 1988). First, to address the first research question, a confirmatory factor analysis (CFA) was tested where all factors were allowed to covary with each other and no causal relationships between factors were analyzed (see Figure 1). The overall Chi Square value and significance level suggested the initial CFA as a poor fitting model, $X^2(122) = 229.93$, $p < .01$. All items loaded significantly on the constructs they were intended to measure. Three covariances were not significant (between social support satisfaction and illness behavior; coping and perceived stress; coping and perceived health status) and were removed. This change resulted in a significant Chi Square value as well, $X^2(125) = 234.39$, $p < .01$. Other fit indices indicated the trimmed CFA as a reasonably good fitting model (RMSEA = .05, CFI = .94, and PNFI = .64). All items loaded significantly on the constructs they were intended to measure and all parameter estimates and covariances were statistically significant. The Chi Square difference test was not significant, $X^2_{difference}(3) = 4.46$, $p > .05$, indicating this trimmed model was a better fit for the data (see Figure 5). The figure shows correlations among constructs in the model as well as the variable disturbances (uppercase *D*), which represent all causes of a variable that are omitted from the model.

The disturbance values reported are unstandardized. Second, paths were added to test the hypothesized models for research questions two and three.

Mediation model. To address the second research question, a mediation model was tested in which the effect of gender on illness behavior was indirectly influenced by social support satisfaction, perceived health status, coping, and perceived stress (see Figure 2). These indirect effects are the products of the direct effects of gender on the psychosocial factors and the psychosocial factors on illness behavior. Initially, the overall Chi Square value was significant indicating a poor fit, $X^2(122) = 229.93, p < .01$. A poor fitting model needs to be revised and simplified by eliminating or adding paths, and the model fit re-evaluated. Respecification is guided by statistical criteria and relevant theory. Respecification, or revision, of this model included removing two non-significant paths (between social support satisfaction and illness behavior; coping and illness behavior) and two non-significant covariances (between coping and perceived stress; coping and perceived health status). The path between gender and illness behavior was nonsignificant but was not removed in order to examine the mediator effect in the trimmed model. This change resulted in a significant Chi Square value as well, $X^2(126) = 234.94, p < .01$. All parameter estimates and covariances were statistically significant, except for the direct path between gender and illness behavior. This pattern of results (statistically significant indirect effects but not direct effects) represents the strongest demonstration for a mediator effect assuming correct directionality specifications (Baron & Kenny, 1986; Kline, 2005). The statistical significance of the simple indirect (mediator) effects was estimated with the Sobel test (Sobel, 1986) in the current and subsequent models. In order to conduct the Sobel test, the indirect effect (the product of

the regression coefficients between paths), is divided by the standard error of the indirect effect to yield a critical ratio that is compared with the critical value from the standard normal distribution appropriate for a given alpha level. The Chi Square difference test was not significant, $X^2_{difference}(4) = 5.01, p > .05$, indicating this trimmed model was a better fit for the data.

To achieve a parsimonious model, the model was then trimmed by removing the direct path from gender to illness behavior. This change resulted in a significant Chi Square value, $X^2(127) = 237.54, p < .01$. All remaining parameter estimates and covariances were statistically significant. The statistical significance of reduction or improvement in overall fit as paths were added and removed was examined with the Chi Square difference test. This is the difference between the Chi Square values of two hierarchical models estimated with the same data (Kline, 2005). The Chi Square difference test between the previous and final trimmed model (or, the last revised model with the best fit) was not significant, $X^2_{difference}(1) = 2.6, p > .05$, indicating this final trimmed model improved the fit for the data. Also, the Chi Square difference test between the original (the model including all paths) and final trimmed model was not significant, $X^2_{difference}(5) = 7.61, p > .05$, indicating the final trimmed model was a better fit for the data (see Figure 6). The figure shows direct effect path coefficients between constructs in the model as well as the variable disturbances (uppercase *D*), which represent all causes of a variable that are omitted from the model. The disturbance values reported are unstandardized. Other fit indices indicated the final trimmed model a reasonably good fitting model (RMSEA = .05, CFI = .94, and PNFI = .65).The fit indices comparison of this analysis appears in Table 4.

The standardized factor loadings of the variables (standardized regression coefficients between factor and indicator in the measurement portion) in this model appear in Table 5. The direct effects (or standardized structural path regression coefficients) from gender and on illness behavior appear in Table 6. Gender had a significant positive direct effect on social support satisfaction ($\beta = .16, p < .01$), perceived health status ($\beta = .18, p < .01$), coping ($\beta = .35, p < .01$), and perceived stress ($\beta = .23, p < .01$) but not on illness behavior. Being female predicted greater social support satisfaction, poor perceived health status, greater use of total coping skills, and high perceived stress.

The direct, indirect, and total effects within this trimmed model appear in Table 7. The direct effects are the regression coefficients between variables and the indirect effects are the product of the regression coefficients between two or more paths. For example, the table shows a direct effect of gender on perceived health status (.18) and an indirect effect of gender on illness behavior via perceived health status (.06). The total effects are the sum of all direct and indirect effects of one variable on another. For example, the total effect of gender on illness behavior (.11) was the sum of indirect effects through perceived health status (.06) and perceived stress (.05). This final model (see Figure 6) shows the relationship between gender and illness behavior was mediated by perceived health status ($\beta = .06, p < .05$) and perceived stress ($\beta = .05, p < .05$). These are significant indirect effects, as estimated with the Sobel test (Sobel, 1986), at $p < .05$. Women reported more illness behavior due to poor perceived health status and high perceived stress.

Compound indirect effects model. To address the third research question, a compound indirect effects model was tested in which the effect of gender on illness behavior was

influenced by perceived stress due to gender differences in social support satisfaction, perceived health status, and coping (see Figure 3). A compound indirect effects model is one that includes the total of multiple indirect effects (products of the direct effects) of gender on illness behavior. The overall Chi Square value was significant, indicating a poor fit, $X^2(122) = 229.93, p < .01$. Respecification of this model included removing the non-significant direct effects (between gender and illness behavior, social support satisfaction and illness behavior; coping and illness behavior) and one non-significant covariance (between perceived health status and coping). This change resulted in a significant Chi Square value as well, $X^2(126) = 237.39, p < .01$. The Chi Square difference test was not significant, $X^2_{difference}(4) = 7.46, p > .05$, indicating this model was a better fit for the data. However, a non-significant path between coping and perceived stress remained and was removed. This change resulted in a significant Chi Square value, $X^2(127) = 238.25, p < .01$. The Chi Square difference test was not significant, $X^2_{difference}(1) = .86, p > .05$, indicating an improvement in fit for the data. All parameter estimates and covariances were statistically significant.

To test whether coping mediated the relationship between gender and perceived stress, the path between gender and perceived stress was removed and the path between coping and perceived stress was added back in. This change resulted in a significant Chi Square value, $X^2(127) = 245.36, p < .01$. The Chi Square difference test between this and the model prior to this change was significant, $X^2_{difference}(1) = 7.97, p < .01$, indicating no improvement in model fit. This model was not retained and the model prior to the change was considered the final trimmed model. The Chi Square difference test between the original and final trimmed model was not significant, $X^2_{difference}(5) = 8.32, p > .05$,

indicating the final trimmed model improved the fit for the data (see Figure 7). The figure shows direct effect path coefficients between constructs in the model as well as the variable disturbances (uppercase *D*), which represent all causes of a variable that are omitted from the model. The disturbance values reported are unstandardized. Other fit indices indicated the final trimmed model a reasonably good fitting model (RMSEA = .05, CFI = .93, and PNFI = .65). The fit indices comparison of this analysis appears in Table 4.

The standardized factor loadings of the variables (standardized regression coefficients between factor and indicator in the measurement portion) in this model appear in Table 8. The direct effects (or standardized structural path regression coefficients) from gender, on perceived stress, and on illness behavior appear in Table 9. As in the previous model, gender had a significant positive direct effect on social support satisfaction ($\beta = .16, p < .01$), perceived health status ($\beta = .18, p < .01$), coping ($\beta = .35, p < .01$), and perceived stress ($\beta = .22, p < .01$) but not on illness behavior. Being female predicted greater social support satisfaction, poor perceived health status, greater use of total coping skills, and high perceived stress.

The direct, indirect, and total effects within this trimmed model appear in Table 10. For indirect effects through two or more mediators in the current and future models, the statistical significance was estimated as suggested by Cohen and Cohen (1983). That is, if all component unstandardized path coefficients were statistically significant at the same level of alpha, then the whole indirect effect was taken as significant at that level of alpha. Gender was found to have an indirect effect on illness behavior along two paths through multiple factors. This final model (see Figure 7) shows the relationship between

gender and illness behavior was influenced by perceived stress due to gender distinctions in social support satisfaction and perceived health status. First, gender (female) predicted greater social support satisfaction ($\beta = .16, p < .01$), which corresponded to low perceived stress ($\beta = -.04, p < .05$), which in turn corresponded to less reported illness behavior ($\beta = -.01, p < .05$). This was a significant indirect effect, as estimated with the Sobel test (Sobel, 1986), at $p < .05$. Women reported less illness behavior due to greater satisfaction with social support that lowered perceived stress. Second, gender (female) predicted poor perceived health status ($\beta = .18, p < .01$), which corresponded to high perceived stress ($\beta = .05, p < .01$), which in turn corresponded to more reported illness behavior ($\beta = .01, p < .05$). This was a significant indirect effect, as estimated with the Sobel test (Sobel, 1986), at $p < .05$. Women reported more illness behavior due to a poor perception of health that increased stress levels. The relationships between gender and illness behavior and between social support satisfaction and illness behavior seemed to be mediated by perceived stress but the indirect effects were not statistically significant. Coping did not have a significant direct or indirect effect on perceived stress or illness behavior.

Alternate compound indirect effects model. Also to address the third research question and to test the direction of influence for perceived stress in the previous model, an alternate compound indirect effects model was tested where the effect of gender on illness behavior was mediated by social support satisfaction, perceived health status, and coping due to gender differences in perceived stress (see Figure 4). As stated previously, the compound indirect effects are the total of multiple indirect effects (products of the direct effects) of gender on illness behavior. The overall Chi Square value was significant indicating a poor fit, $X^2(122) = 229.93, p < .01$. Respecification of this model included

removing the non-significant direct paths (between gender and illness behavior; gender and perceived health status) and one non-significant covariance (between perceived health status and coping). This change resulted in a significant Chi Square value as well, $X^2(125) = 233.96, p < .01$. The Chi Square difference test was not significant, $X^2_{difference}(3) = 4.03, p > .05$, indicating this model was a better fit for the data. However, non-significant paths between social support satisfaction and illness behavior, coping and illness behavior, and coping and perceived stress, remained.

Based on findings from the compound indirect effects model, paths were removed one at a time. First, the path between coping and perceived stress was removed because coping did not have a significant effect on perceived stress in the earlier model. This change resulted in a significant Chi Square value, $X^2(126) = 234.33, p < .01$. The Chi Square difference test was not significant, $X^2_{difference}(1) = .37, p > .05$, indicating an improvement in fit. However, two non-significant paths remained (between social support satisfaction and illness behavior; coping and illness behavior) and were considered separately. The path between coping and illness behavior was removed first because coping did not have a significant effect on illness behavior in the earlier model. This change resulted in a significant Chi Square value, $X^2(127) = 237.48, p < .01$. The Chi Square difference test was not significant, $X^2_{difference}(1) = 3.15, p > .05$, indicating an improvement in fit. However, the path between social support satisfaction and illness behavior was not significant. Next, the path between coping and illness behavior was added back in and the path between social support satisfaction and illness behavior was removed to see if the coping/illness behavior path improved the model. This change resulted in a significant Chi Square value, $X^2(127) = 235.76, p < .01$. All parameter

estimates and covariances were statistically significant. The Chi Square difference test was not significant, $X^2_{difference}(1) = 1.43, p > .05$, indicating this final trimmed model was a better fit for the data. The Chi Square difference test between the original and final trimmed model was not significant, $X^2_{difference}(5) = 5.83, p > .05$, indicating the final trimmed model improved the fit for the data (see Figure 8). The figure shows direct effect path coefficients between constructs in the model as well as the variable disturbances (uppercase *D*), which represent all causes of a variable that are omitted from the model. The disturbance values reported are unstandardized. Other fit indices indicated the final trimmed model as a reasonably good fitting model (RMSEA = .05, CFI = .94, and PNFI = .65). The fit indices comparison of this analysis appears in Table 4.

The standardized factor loadings of the variables (standardized regression coefficients between factor and indicator in the measurement portion) in this model appear in Table 11. The direct effects (or standardized structural path regression coefficients) from gender, from perceived stress, and on illness behavior appear in Table 12. Gender had a significant positive direct effect on social support satisfaction ($\beta = .25, p < .01$), coping ($\beta = .24, p < .01$), and perceived stress ($\beta = .35, p < .01$) but not on perceived health status or illness behavior. Being female was related to greater social support satisfaction, greater use of coping skills, and high perceived stress. Perceived stress had a significant positive direct effect on perceived health status ($\beta = .38, p < .01$) and illness behavior ($\beta = .19, p < .05$) and negative direct effect on social support satisfaction ($\beta = -.32, p < .01$), but not on coping. High perceived stress was related to less social support satisfaction, poor perceived health status, and more reported illness behavior.

The direct, indirect, and total effects within this trimmed model appear in Table 13. Gender influenced illness behavior along one path through multiple factors. This final model (see Figure 8) shows the relationship between gender and illness behavior was influenced by perceived health status due to gender distinctions in perceived stress. Gender was found to have an indirect effect on illness behavior with gender (female) predicting high perceived stress ($\beta = .35, p < .01$), which corresponded to poor perceived health status ($\beta = .13, p < .01$), which in turn corresponded to more reported illness behavior ($\beta = .04, p < .01$). This was a significant indirect effect, as estimated with the Sobel test (Sobel, 1986), at $p < .01$. Women reported more illness behavior due to the experience of high stress that lowered subjective health status. The relationship between gender and perceived health status was mediated by perceived stress ($\beta = .13, p < .01$), as estimated with the Sobel test (Sobel, 1986). In addition, the relationship between gender and illness behavior was mediated by coping ($\beta = .04, p < .05$). The relationship between gender and illness behavior seemed to also be mediated by perceived stress but this indirect effect was not statistically significant.

Combined compound indirect effects model. A combined indirect effects model was tested that included significant direct and indirect effects from the two previous models (compound indirect effects and alternative compound indirect effects models; see Figure 9). This model was a combination of identified multiple indirect effects (products of the direct effects) of gender on illness behavior from the two models. This combined model was tested to determine whether the effect of gender on illness behavior was mediated by perceived health status, coping, and perceived stress. In addition, this model tested the effect of gender on illness behavior as influenced by perceived stress through gender

differences in social support satisfaction and perceived health status. For this combined model, respecification was guided by estimated significance level changes, directionality, and parameter estimate size. The overall Chi Square value was significant indicating a poor fit, $X^2(126) = 233.08, p < .01$. However, all parameter estimates and covariances were significant. Respecification of this model included removing the covariance between social support satisfaction and coping and adding a path from social support satisfaction to coping. This change resulted in a significant Chi Square value as well, $X^2(126) = 234.53, p < .01$. This change did not affect the degrees of freedom between the models and a Chi Square difference test could not be conducted. To test the directionality of the relationship between social support satisfaction and coping, another model was tested with a path from coping to social support satisfaction. This change resulted in a significant Chi Square value, $X^2(126) = 234.53, p < .01$, however the path from gender to social support satisfaction was no longer significant. This path was removed and resulted in a significant Chi Square value, $X^2(127) = 235.28, p < .01$. All parameter estimates and covariances were significant and the value of the estimate between coping and social support satisfaction increased as compared to the previous model. The Chi Square difference test between the original and this trimmed model was not significant, $X^2_{difference}(5) = 2.20, p > .05$, indicating this trimmed model improved the fit for the data.

To examine the directionality of the relationship between perceived health status and perceived stress, the path from perceived health status to perceived stress was removed and a path from perceived stress to perceived health status was added. This change resulted in a significant Chi Square value, $X^2(127) = 236.00, p < .01$. All parameter estimates and covariances were significant and the value of the estimate between

perceived stress and perceived health status increased as compared to the previous model. The Chi Square difference test between the original and this trimmed model was not significant, $X^2_{difference}(5) = 2.92$, $p > .05$, indicating this trimmed model improved the fit for the data. To determine the final trimmed model, parameter estimate sizes in the two models were compared. The estimates for the path between gender and coping, and between perceived stress and illness behavior did not change. The estimate for the path between gender and perceived health status decreased slightly. The estimates for the paths between gender and perceived stress, social support satisfaction and perceived stress, perceived health status and illness behavior, coping and illness behavior, coping and social support satisfaction, and perceived stress and perceived health status increased slightly. Therefore, this model was retained as the final trimmed model (see Figure 10). The figure shows direct effect path coefficients between constructs in the model as well as the variable disturbances (uppercase *D*), which represent all causes of a variable that are omitted from the model. The disturbance values reported are unstandardized. Other fit indices indicated the final trimmed model a reasonably good fitting model (RMSEA = .05, CFI = .94, and PNFI = .65). The fit indices comparison of this analysis appears in Table 4.

The standardized factor loadings of the variables (standardized regression coefficients between factor and indicator in the measurement portion) in this model appear in Table 14. The direct effects (or standardized structural path regression coefficients) from gender, from perceived stress, and on illness behavior appear in Table 15. Gender had a significant positive direct effect on perceived health status ($\beta = .13$, $p < .05$), coping ($\beta = .36$, $p < .01$), and perceived stress ($\beta = .27$, $p < .01$) but not on social support satisfaction

or illness behavior. Being female was related to poor perceived health status, greater use of total coping skills, and high perceived stress. Perceived stress had a significant positive direct effect on perceived health status ($\beta = .30, p < .01$) and illness behavior ($\beta = .19, p < .05$). High perceived stress predicted poor perceived health status and more reported illness behavior.

The direct, indirect, and total effects within this trimmed model appear in Table 16. This final model (see Figure 10) shows that gender influenced illness behavior along three paths through multiple factors. First, gender (female) predicted greater use of total coping skills ($\beta = .36, p < .01$), which corresponded to greater social support satisfaction ($\beta = .08, p < .01$), which corresponded to low perceived stress ($\beta = -.02, p < .01$), which corresponded to good perceived health status ($\beta = -.07, p < .01$), which in turn corresponded to less reported illness behavior ($\beta = -.002, p < .01$). This was a significant indirect effect, as estimated with the Sobel test (Sobel, 1986), at $p < .01$. Women reported less illness behavior due to the greater use of total coping skills that improved satisfaction with social support. This satisfaction with social support lowered stress and improved subjective health status. Second, gender (female) predicted greater use of total coping skills ($\beta = .36, p < .01$) which corresponded to greater social support satisfaction ($\beta = .08, p < .01$), which corresponded to low perceived stress ($\beta = -.02, p < .01$), which in turn corresponded to less reported illness behavior ($\beta = -.004, p < .05$). This was a significant indirect effect, as estimated with the Sobel test (Sobel, 1986), at $p < .05$. Women reported less illness behavior due to the greater use of total coping skills that improved satisfaction with social support. This satisfaction with social support lowered stress levels. Third, gender (female) predicted high perceived stress ($\beta = .27, p < .01$), which corresponded to

poor perceived health status ($\beta = .08, p < .01$), which in turn corresponded to more reported illness behavior ($\beta = .02, p < .01$). This was a significant indirect effect, as estimated with the Sobel test (Sobel, 1986), at $p < .01$. Women reported more illness behavior due to the experience of high stress that lowered subjective health status. The relationship between gender and illness behavior was mediated by coping ($\beta = .05, p < .05$), as estimated with the Sobel test (Sobel, 1986). The relationship between gender and illness behavior seemed to also be mediated by perceived health status and perceived stress but the indirect effects were not statistically significant.

Summary. In the first set of analyses, a confirmatory factor analysis (CFA) procedure was conducted to test the indicators presumed to measure the underlying latent variables of interest. In the final CFA, all items loaded significantly on the constructs they were intended to measure and all parameter estimates and covariances were statistically significant. Covariations were not found between social support satisfaction and illness behavior, between coping and perceived stress, or between coping and perceived health status.

Once the measurement model was attained, three hypothesized structural regression models (mediation, compound indirect effects, and alternative compound indirect effects) were specified and compared. The final model (combined compound indirect effects) was retained by considering the significant constructs and relationships from previous models. The main findings of this final model show the relationship between gender and illness behavior was influenced by three compound indirect effects. The first was the combined influence of gender, greater use of total coping skills, greater social support satisfaction, low perceived stress, and good perceived health status on less reported illness behavior.

The second was the combined influence of gender, greater use of total coping skills, greater social support satisfaction, and low perceived stress on less reported illness behavior. The third was the combined influence of gender, high perceived stress, and poor perceived health status on more reported illness behavior.

In this final model, direct and mediated relationships were also found. Gender (being female) was directly related to poor perceived health status, greater use of total coping skills, and high perceived stress. Greater social support satisfaction was directly related to low perceived stress. Poor perceived health status was directly related to more reported illness behavior. Greater use of total coping skills was directly related to greater social support satisfaction and more reported illness behavior. High perceived stress was directly related to poor perceived health status and more reported illness behavior. The relationship between gender and illness behavior was mediated by coping.

Chapter IV: Discussion

Examination of indirect relationships and effects through multiple factors, or compounded relationships, can produce more comprehensive inferences about factors affecting patterns of illness behavior than direct effects alone. The present study investigated both indirect and combined relationships and went a step further to investigate if their effects varied by gender. As stated previously, the composition of the sample was insufficient for testing separate models for each gender. However, the analysis was conducted with all participants as a preliminary examination of these complex paths. Through the use of structural equation modeling, evidence was found to support the importance of gender, psychosocial factors, and stress in the study of illness behavior. By testing various models and hypothesized relationships, results of this study indicated that the significant effects on illness behavior were found only for women and the associations among variables were complex.

Mediation model. This model demonstrated that women experienced more reported illness behavior due to poor perceived health status and high perceived stress. The relationship between gender and illness behavior was not affected by social support satisfaction or coping. In addition, women reported greater social support satisfaction, poor perceived health status, greater use of coping skills, and high perceived stress but not increased illness behavior.

As projected, poor perceived health status was influenced by gender (being female), and poor perceived health status was associated with more reported illness behavior

above and beyond the effect of gender on illness behavior. In general, women have been found to rate their health as poor when compared to men (Goldstein et al., 1984). In turn, poor perceived health has been found to be associated with increased physician visits (Miilunpalo et al., 1997). Also as expected, perceived stress was higher among women and high perceived stress was associated with more reported illness behavior. In the literature, women tend to report more significant stress than men (Greenglass & Noguchi, 1996; Silverman et al., 1987) and high perceived stress levels have been found to be associated with increased physician visits (Miranda et al., 1991; Pilisuk et al., 1987).

Contrary to projection, the relationship between gender and illness behavior was not mediated by social support satisfaction or coping. Gender distinctions have been found in social support (Rosario et al., 1988; Treharne et al., 2001) and coping (Straub, 2003) and in this model gender was significantly associated with both constructs. However, neither social support satisfaction nor coping was associated with illness behavior, directly or indirectly, although these factors have been found to correspond to poor health outcomes (Berkman & Syme, 1994; Ingledew et al., 1997; Soderstrom et al., 2000).

The combined effect of gender, social support satisfaction, and coping on health may be more suitable for other health outcomes. For example, previous research on the association between coping strategies and health has focused on symptom report rather than behavior related to illness (i.e., Ingledew et al., 1997; Soderstrom et al., 2000). In addition, it is possible these constructs are related to illness behavior by way of other factors related to health, such as perceived stress. For example, women report higher distress related to physical symptoms more often than men (Benham, 2006). It has also been found that individuals who perceive high levels of social support feel less stress

(Fleming et al., 1982) and individuals who use approach-type coping styles are likely to adapt better to life stressors (Moos & Schaefer, 1993). Other combined effects of psychosocial factors, such as these, on illness behavior should be considered.

The unexpected findings could also be related to how social support satisfaction and coping were measured. For model simplicity, only four items that were selected to be common for both genders were chosen to represent each construct. In preliminary analysis, the items with highest factor loadings were different for females and males and the decision to find common items was made to have relatively equal representation in the construct. This may have limited the potential for gender distinctions in relationships with other constructs. Although the chosen items had the highest factor loadings on each particular construct, more items may have been better at capturing the effect of the constructs. Constructs like social support satisfaction and coping may be related in this sample. The coping style items that loaded highest on the coping construct were use of emotional support and use of instrumental support, which could also be considered types of social support. Significant positive correlations were found between social support satisfaction and both coping types in the model; however, the strength of the association was very weak. Therefore, while social support and coping factors in this study appear to be related, they remained as distinct constructs. An association between social support and coping was not analyzed because this mediation model did not make assumptions about their relationship. However, the lack of a simple indirect effect for social support and coping in this first model provided additional support for testing more complex relationships in the other hypothesized models. Studies have found that individuals who report greater social support satisfaction also report greater use of adaptive coping

strategies when faced with stressful situations (DeLongis & Holtzman, 2005; Manne & Zautra, 1989). Both constructs, social support and coping, are important in describing health outcomes and it appears that it is important to consider the nature of the association between these constructs in health research. In this study, the association of social support and coping between other constructs, as well as between each other, was explored in later models.

Compound indirect effects model. This model demonstrated that women reported less illness behavior as their satisfaction with social support increased when faced with greater perceived stress. Women also reported more illness behavior as their perceived health status increased when they perceived greater stress. Similar to the mediation model, women had greater social support satisfaction, poor perceived health status, greater use of coping skills, and high perceived stress but did not report higher illness behavior.

The unique contribution of this model beyond the mediation model was the inclusion of social support satisfaction as an influential factor. In this model, women reported less illness behavior due to the experience of greater satisfaction with social support that lowered stress which was anticipated based on previous research. Gender distinctions have been found in social support (Rosario et al., 1988; Treharne et al., 2001). Use of social support has been found to be related to low perceived stress (Cohen & Wills, 1985) which has been found to be associated with fewer physician visits (Miranda et al., 1991; Pilisuk et al., 1987).

This model also presented the combined impact of perceived health status and perceived stress on illness behavior. Women reported more illness behavior due to the

significant poor perceived health status associated with high perceived stress. The associations between gender and perceived health status (Goldstein et al., 1984) and between perceived stress and illness behavior (Miranda et al., 1991; Pilisuk et al., 1987) were expected based on previous literature and the preceding mediation model.

A connection between perceived health status and stress has been examined in previous research but the effect of these two constructs on illness behavior is inconsistent. For example in a study of emotional distress in physically healthy individuals who perceive poor physical health, participants reported a variety of anxiety symptoms and physicians corroborated their report by noting symptoms of stress and anxiety in those participants (Olfson et al., 1995). Their findings suggest an association between poor perceived health status and high perceived stress, which was also found in the current model. Olfson and colleagues also found that participants with poor perceived health status reported high numbers of physical symptoms, such as fatigue and headache, as well as greater number of missed days of work or school due to mental health problems. In that study, the combined effect of perceived health status and stress on these illness behaviors was not examined. In the preliminary study of the moderating influence of psychological stress on various illness behaviors in college students (Thomas, 2006), it was found that individuals who experienced high stress and a poor perception of health reported both fewer numbers of doctor visits and higher numbers of illness without a doctor visit. However, in that study the combined effect originated from perceived stress. In the current study, which utilized the same data, the link was examined from the opposite direction (beginning with perceived health status). The association between

perceived health status and perceived stress, and the subsequent influence on health requires further investigation.

In the mediation model, coping did not have an indirect effect on illness behavior. In this model, coping was not directly or indirectly related to perceived stress or illness behavior although it was associated with gender. It is possible that the lack of effect of coping beyond gender suggests it may be related to social support satisfaction, as previously discussed, or may have a different association with perceived stress. For example, the association between coping and perceived stress may be reversed; perceived stress may affect use of coping skills. It is also possible that social support satisfaction and coping have a similar or combined effect on illness behavior; however, this model did not examine the association between these constructs and illness behavior.

Alternative compound indirect effects model. To further explore the relationship among constructs in this study, it was important to consider different relationships among variables by testing alternate models. The alternative compound indirect effects model tested the direction of influence for perceived stress in the model. This model found that women reported more illness behavior because they perceived greater stress due to a perception that their health is worse off. Indirect effects were not found through other psychosocial variables. Similar to the previous models, women reported greater social support satisfaction, greater use of coping skills, and high perceived stress. Unlike the previous models, gender was not associated with the perception of good health. Instead, women reported poor perceived health status as a result of high perceived stress. Similar to the previous models, gender was not directly related to illness behavior. In the current model, women reported more illness behavior due to greater use of total coping skills.

The impact of perceived stress was also tested in this model and high perceived stress was related to less social support satisfaction, poor perceived health status, and more reported illness behavior.

The unique contribution of this model was relationships among gender, perceived health status, perceived stress, and illness behavior. In contrast to the two previous models, gender was not directly related to perceived health status even though distinctions among men and women have been found (Goldstein et al., 1984). In this model, gender and perceived health status were linked by perceived stress. Specifically, women reported more illness behavior due to the poor perception of health that was associated with high perceived stress. This entire effect, in which the influence of gender originated from perceived stress rather than perceived health status, was slightly stronger than in the previous compound indirect effects model (.04 compared to .01). The Thomas (2006) study that examined moderator effects with the same data also found that the relationship between high perceived stress and illness behavior was influenced by poor perceived health status. However, gender distinctions were not explored in that study.

It was also found in this model that women reported more illness behavior when they used coping skills more often. Physical symptom report and poor health outcomes have been found to be related to the inability to cope with situations judged to exceed one's personal resources (Connor-Smith & Compas, 2004; Ingledew et al., 1997; Moos & Schaefer, 1993; Soderstrom et al., 2000), which suggests the possibility that greater use of coping skills could be related to fewer reported illness behaviors. As stated previously, the coping strategies utilized in the models were use of emotional support and use of instrumental support. Because women report more social support and larger social

networks (Rosario et al., 1988; Treharne et al., 2001), it is possible that the support received was encouragement to seek treatment for an illness. It is interesting to note that in contrast to previous models, as coping became a main factor in this alternative compound indirect effects model, social support satisfaction was not a main factor in this model when it was in the previous model. Again, it is possible that social support satisfaction and coping have a combined effect in this sample due to their association.

The main goal for this alternative compound model was to test the arrangement of perceived stress in relation to the other constructs. However, when constructs are measured concurrently, as in this study, the directions of effect in path analysis require clear rationale (Kline, 2005). The literature on associations between stress and illness-related behavior suggest that illness can be the source of stress and that stress can be the source of illness (Cohen, 1995). In addition, it has been found that health is negatively affected by stress when it leads to or is associated with a variety of psychosocial factors including low social support (Cohen & Wills, 1985) and poor coping skills (Connor-Smith & Compas, 2004; Ingledew et al., 1997; Moos & Schaefer, 1993; Soderstrom et al., 2000). Due to the cross-sectional nature of the data, it was possible that the paths to or from perceived stress were not the same for all psychosocial factors in the model. Therefore, it was important to investigate a final model that tested theoretically supported interrelationships among psychosocial factors that could further explain the effects on illness behavior for this sample. Specifically, to include relationships that were supported in previous models and to examine relationships based on the literature that could provide further clarification.

Combined compound indirect effects model. A combined model was tested that included significant direct and indirect paths from the two previous models (compound indirect effects and alternative compound indirect effects). This combined model shows gender related to illness behavior by way of three paths. Similar to the previous models, women reported poor perceived health status, greater use of total coping skills, and high perceived stress but gender was not related to illness behavior. However, women reported more illness behavior due to greater use of total coping skills as in the preceding alternate indirect effects model. Unlike previous models, gender was not associated with social support satisfaction. However in this model, greater use of total coping skills predicted greater social support satisfaction which predicted low perceived stress. Similar to the previous alternate indirect effects model, high perceived stress predicted poor perceived health status and both were associated with more reported illness behavior.

The unique contribution of this model beyond previous models was the inclusion of all constructs as significant factors and the discovery of three combined indirect effects. Through the model fitting and respecification procedures, various associations and trends amongst constructs were tested. Interestingly, the first and second combined effects in this model incorporated the majority of constructs and illustrated relationships that resulted in less illness behavior for females. In the first path, women experienced less illness behavior when they reported a perception of good health that appeared to be linked to lower stress levels. Lower stress seemed to be influenced by the satisfaction with social support that they derived from greater use of coping skills. The second path involved the same constructs as the previous path, but excluded perceived health status. Women reported less illness behavior due to the experience of lower stress. This low

stress resulted from the greater satisfaction with social support received from use of coping skills. The total effect for the second path was slightly stronger than the effect from the first path (-.004 compared to -.002, see Table 16) and most likely due to the fact that fewer constructs were involved.

A distinctive contribution of these paths involving multiple factors was that the relationship between social support satisfaction and coping skills was addressed. Unlike any previous models, both constructs had an important impact in the current model and this was due to their association. As discussed previously, research has found an association between social support satisfaction and use of coping strategies, but this relationship is not easily conceptualized (Gore, 1985). Individuals who feel supported in their efforts to cope may experience an increase in satisfaction with support and coping efforts (DeLongis & Holtzman, 2005). Although both directions were tested in the current model, a stronger association was found from greater use of total coping skills onto greater social support satisfaction. Coping responses can play a role in consequent support processes. Holtzman, Newth, and DeLongis (2004) found that individuals who used distancing as a coping strategy for pain management reported greater disappointment in support. It is possible that active types of coping, such as those utilized in the current study (use of emotional support and use of instrumental support), may increase the likelihood of received support and resulting satisfaction with support.

The impact of the association between social support and coping strategies on health has been explored in other studies. Diong et al. (2005) examined the interrelationships of anger, stress, perceived social support, and coping strategies along with their relationship to health and found that satisfaction with social support predicted active and reappraisal

types of coping. However, this interrelationship did not impact stress or physical illness. In the current study, this connection had a beneficial influence on illness behavior for females. The greater satisfaction with social support and greater use of coping strategies for females lowered perceived stress levels, enhanced perceived health status, and subsequently produced fewer reported illness behavior. Although it has been found that women are more likely than men to use health services (Cockerham, 2007; National Center for Health Statistics, 2005) and experience greater illness episodes (Broom, 2005; McDonough & Walters, 2001; Verbrugge, 1985), the combined influence of the psychosocial factors related to health may have a considerable positive impact on illness behavior for women. In fact, the simple indirect effects through perceived health status, coping, and perceived stress showed an increase in reported illness behavior for females.

The third path in this model found women reported more illness behavior due to the perception of poor health that resulted from the experience of high stress. This finding was consistent with previous literature which indicates an association between gender and perceived health status as well as between perceived stress and illness behavior (Goldstein et al., 1984; Miranda et al., 1991; Olfson et al., 1995; Pilisuk et al., 1987). This effect was also observed in the previous alternative compound indirect effects model. However, the total effect in this model was not as strong as in the preceding model (.02 compared to .04).

The combined compound indirect effects model was the final model retained in this study. It extended previous research on distinctions in illness behavior but was limited by the strength of the total effects coefficients. Although statistically significant, the associations were very weak. The sample used in this study may have been adequate for

the simple indirect effects (mediators) but may not have been sufficient for multiple indirect effects that involved more than two variables. Another limitation of the final model was the lack of endorsement for any indirect effects for males. The small number of male participants was insufficient for testing two separate models, one for each gender. However, conducting the analysis with one model allowed for a preliminary examination of these complex paths. In an attempt to create some balance within the model, the measurement portion included items that loaded highly for both genders and not just the sample as a whole. Future research on such multifaceted models should involve a larger sample size and separate models for males and females in order to discern the effects of these factors for both genders.

The overall results of this study support previous research on the gender distinctions found in psychosocial factors associated with health. In addition, it expands the understanding of the way in which these psychosocial factors are related to illness behavior. The final model retained (combined indirect effects model) provides evidence for the protective benefit of greater use of total coping skills, greater social support satisfaction, low perceived stress, and good perceived health status on fewer reported illness behavior for female students. In contrast, the model also indicated the potential damaging effect of high perceived stress and poor perceived health status on more reported illness behavior for female students. Overall and contrary to previous research, gender was not directly related to illness behavior in this sample. Instead, illness behavior was affected by gender through other variables. This suggests that future research would further explain gender distinctions in health and illness behavior by considering indirect and complex relationships.

Illness behavior might be related to use of and access to health care services. Thus, an understanding of overall perceptions of wellness and related illness behavior for college students could impact how college health services are presented and provided for students. For example, education and intervention for students regarding behaviors that impact health as well as education on the interrelationships of psychosocial factors, such as social support, coping strategies, and stress, to these behaviors would be an important component of health education on college campuses. In addition, health educators should consider that these interrelationships and the resulting impact on health could be different for male and female students. This suggests the possibility of customized health interventions and messages by gender. For example, findings from this study suggest that female students would benefit from health messages that emphasize the stress reduction and health benefits that result from utilizing social support type coping skills. Although, male students also endorsed the use of emotional and instrumental support coping skills and this could be explored further. For instance, a more detailed understanding of the circumstances in which male students use these coping skills could provide opportunities to encourage male students to seek needed services if they are not or to recognize the health benefit of these coping skills.

Confirmatory factor analysis. To reduce the effect of measurement error in this study, a confirmatory factor analysis (CFA) procedure was conducted to test if the indicators presumed to measure the underlying latent variables of interest were indeed measuring them. Most research uses multiple items to assess an underlying characteristic and these items are combined or expressed in a meaningful way. Often, a total score is used which minimizes the importance of individual items. Instead, this approach presupposes the

items are equally important in determining the total score (Streiner & Norman, 2003). This potential problem may contribute to unexpected and differing associations found in the study of moderating and mediating effects on illness behavior. The decision of how to use items on a particular scale can affect how the underlying construct relates to other variables as well. The use of structural equation modeling allowed for the examination of various interrelationships. Explanations for variations in illness behavior are complex and, as shown in this study, involve numerous factors. Future illness behavior research should consider the use of such statistical techniques in order to discern the complexities in explaining illness behavior. In addition, other factors related to gender and health, such as age and economics (Young, 2004), could be included in future models because these may be more relevant for populations other than college students.

Limitations and Contributions

There are several limitations to this study. Even though the path models made assumptions about the direction of relationships between constructs, the cross sectional nature of this study makes inferences of causal relationships inappropriate. In the future, the use of a prospective design would further support likely directions of causality. When constructs are measured concurrently, relationships between the constructs could be reciprocal in nature. For example, associations between stress and illness behavior may be related more to illness causing stress rather than stress causing illness (Cohen, 1995) and individuals who receive support for coping efforts may experience an increase in coping efforts and subsequent satisfaction with support (DeLongis & Holtzman, 2005). Future models could include and test possible reciprocal relationships. In addition, data collection occurred during the week before final exams when students are under greater

stress. Student recall of past incidents of illness behavior may have been biased by their current mental state as negative affectivity may influence the self-report of symptoms and illness (Mathis & Lecci, 1999; Watson & Pennebaker, 1989) and the results may be an overestimate of reported illness behavior.

In the current study, the measured illness behavior items were found to be reliable but making use of the data obtained was complicated. The on-line survey prevented most instances of missing data however; the majority of occurrences were for the illness behavior items. It is possible that the survey itself allowed participants to leave items blank or to respond to only parts of the items. Also, most of the illness behavior item scores were below the mean (highly skewed) and several transformations were attempted in order to properly use the items. In the end, the items were dichotomized and this may have been an oversimplification of the health outcome. Four illness behavior items were used to represent the construct in the path models. Upon inspecting the items loadings to the respective factor, it was observed that the range was large for the illness behavior items (range of .35 to .88) which suggested that one item may have been more important in determining illness behavior in this sample. The "missed class due to illness" item, which had the highest factor loading, may be the relevant illness behavior in this sample because of the circumstances of college life and suggests that illness behavior outcomes should be context specific. The measurement of illness behavior is a complex issue that future research should continue to explore.

As reported in the previous study (Thomas, 2006), data collection presented some challenges. The sociodemographic information was collected in person and the questionnaires were completed on-line. Several cases were removed from analysis

because the sociodemographic information and on-line survey could not be linked. Although the on-line survey was convenient for the participants, the administration presented some challenges. Some participants contacted the co-investigator that they had not received the survey. It is possible that the survey was considered "SPAM" by their email service provider and was placed in another folder. Student Voice provided a link that was sent to students who did not receive the survey. However, the link was only to version A of the survey and because of this, more participants completed this version. Some students did not contact the co-investigator about not receiving the survey and some did not make contact until after the on-line survey was closed. It is possible that some students did not complete the survey because they were experiencing high stress due to finals and the results may be an underestimate of the impact of perceived stress in the models.

The use of structural equation modeling procedures permitted the inspection of a variety of models and potential relationships. However, variables that could have been different for men and women or influenced the report of illness behavior, such as current and past medical conditions, were not controlled for in the analysis as this would have involved adding more latent variables to the model. For example, the fact that women are more likely than men to experience illness (Broom, 2005; McDonough & Walters, 2001; Verbrugge, 1985) may have influenced differences in the number of reported behaviors in this study. The sample size allowed for adequate statistical power for the structural equations (MacCallum et al., 1996). However, the sample size may not have been adequate for the effects through multiple factors, as more complex models require larger samples (Kline, 2005). This lack of power may have increased the possibility of

accepting the hypotheses of interest in these complex models when the observation was due to chance (Pedhazur, 1997). However, it is possible that similar relationships would be found with a larger sample due to the intercorrelations found between variables prior to conducting structural equation modeling procedures (see Table 2). Although it is important to study nonexperimental relationships between gender, psychosocial factors, and health, it can be difficult to obtain large sample sizes to detect true relationships.

The limitations of this study are consistent with the limitations that arise in other studies that use self-report measures. Among the most common is that individuals differ with regard to the meaning attributed to their experiences, such as those related to health center visits (Mathis & Lecci, 1999) and to the labeling and perception of their symptoms (Herbert & Cohen, 1994). The accuracy of self-report data, particularly of health behaviors, is at times questionable (Degnan et al., 1992). The seriousness of these limitations is a function of the measurement instrument and the conditions in which it is used (Streiner & Norman, 2003). The illness behavior items used in this study may not have been an accurate measurement of such behavior due to the phrasing of the items. For example, two items referred to "visits to the doctor" or "ill but did not visit the doctor" and students may not have reported visits to health care providers that were not with physicians. Item phrasing may have resulted in confusion and consequent non-response to these items. This may have resulted in an underestimate of reported illness behavior. However, the potential confusion over the items may have impacted the validity of the measurement of illness behavior. In an attempt to address measurement issues, this study utilized measures with sufficient reliability and validity and a confirmatory factor analysis was conducted prior to the path analysis.

The results of this study are only appropriate to generalize to college and university students who are similar to the study's sample and due to the unique aspects of college life. The sample was mostly first and second year students and the results may not apply to older and more experienced students because it is possible that social support, coping skills, and stress levels may change as they become more familiar with the college experience or stressors and/or life circumstances may be different when nearing the end of college. In addition, the sample was mostly female and this may have overestimated the effect of gender on the direct and indirect relationships. It may have also limited the understanding of associations among constructs for males. To explore the potential complex relationships, a large sample was needed and therefore all participants were included in the analyses. In an attempt to balance the model, the measurement portion of the model included common items for each gender in order to have relatively equal representation in the construct. The results indicated that the significant effects on illness behavior were found only for women and, in hindsight, the models could have been tested with only the female participants. Future research should consider separate models by year in school and gender. The model used in this study, however, could shed light on similar relationships that occur among other college populations. The measured health outcomes could be relatable to different groups and could be considered in future research as an efficient measure of illness behavior.

This study contributes to the literature that has examined relationships among gender, psychosocial factors, and illness behavior. First, the study's findings provide further support for the variables that have previously and consistently been found to have an influence on illness behavior. Second, the study's findings suggest that the influence of

gender through these variables might broaden the explanation for gender distinctions in illness behavior. Third, the study provides evidence that the psychosocial variables are not independent in their influence on illness behavior and interact in various ways. Last, the current study, through its research design, provides evidence that the use of multiple health-related factors may provide a more complete picture of the how gender and psychosocial factors influence illness behavior in a very complex manner. Understanding the factors that contribute to the over-use or under-use of health services on college campuses and the factors that could possibly improve college student health provide opportunities to impact how individuals perform in school and eventually meet their educational goals. Interventions on college campuses aimed at reducing the probability or severity of illness and subsequent illness behavior can occur at several different levels of need. For example, primary prevention interventions that encourage students to engage in healthy behaviors (i.e., proper nutrition and exercise, refraining from substance use) should continue to be important aspects of college health education. Secondary prevention interventions can identify and encourage students who are vulnerable to high stress, and the potential health risks, to prevent and manage stress with psychosocial resources (i.e., social support networks and coping skills) so that it does not affect their health or academic performance (American College Health Association, 2005). Tertiary prevention strategies can encourage students with specific health problems to use such psychosocial resources to reduce the extent of the health problem's impact on their health and ability to perform academically.

Future research investigating the impact of gender and psychosocial factors on illness behavior should be as detailed and specific as possible in order to discern the mechanisms

through which these factors operate. The measurement of illness behavior and psychosocial factors related to health continues to provide information about how individuals' health is expressed and how it is affected by their experiences and behavior. Methodologically, future studies should consider testing separate models by gender to better understand how the direction of the numerous variables found to be important might impact illness behavior differently for men and women. These next investigative steps would further our understanding of illness behavior and allow for the development of more effective evidence-based interventions. For instance, based on this study, useful interventions could focus on the enhancement of self-efficacy for using support coping skills as well as for creating support networks and negotiating needed support.

The results of this study are of practical importance because colleges and universities are concerned with improving student health as well as identifying and addressing factors that impede learning, including stress and illness (American College Health Association, 2005). Improvements in health for college students may be attained by applying social norms theory (Lodzinski, Motomura, & Schneider, 2005). This theory suggests that individuals tend to guide their behavior in accordance with what they perceive to be situation-relevant norms. Interventions that target high-risk drinking among college students, for example, focus on reducing the misperceptions of the amount of drinking on campus (Perkins, 2003). This approach has also been applied on college campuses to reduce tobacco use and prevent sexual assault (Lodzinski et al., 2005). In relating this idea to the current study on psychosocial factors and illness behavior, there may be treatment seeking and illness behavior norms among college students and these may be different for men and women. Potential misconceptions about reasons for seeking

treatment and consequences of seeking treatment (or not) could be explored and corrected through media campaigns or university health center websites.

The National College Health Assessment (American College Health Association, 2005) distributed at 33 campuses in 2003 (including the campus for the current study) found that 32% of students rated stress as the number one factor affecting individual academic performance. One potentially effective intervention technique to reduce or prevent stress-related changes in immunity that may impact illness behavior involves psychological support and training in relaxation, stress management, problem-solving, and coping skills (Deckro et al., 2002; Marsland, Bachen, Cohen, & Manuck, 2001). A six session group intervention strategy focused on this type of training has been effective in improving immunity (increased NK cell activity) for individuals with malignant melanoma (Fawzy et al., 1993) and decreasing reported psychological distress and perceived stress for college students (Deckro et al., 2002). A skill building program could be applied in a college setting for students in high stress academic programs (i.e., graduate school, veterinary medicine) or high stress circumstances (i.e., non-traditional and first generation students, employed students, international students). In addition, based on the results of the current study, such training should focus on the creation and utilization of social support networks as coping skills, the potential positive impact of these skills on health and stress, and the possibility that these interventions should be gender specific. Future research should implement such intervention strategies and assess the impact on the health and accompanying behavior of college students as well as academic performance and retention.

References

American College Health Association. (2005). The American college health association national college health assessment (ACHA-NCHA), spring 2003 reference group report. *Journal of American College Health, 53(5)*, 199-210.

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

Barnett, R., Biener, L, & Baruch, G. (1987). *Gender and stress*. New York: The Free Press.

Baron, R., & Kenny, D. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51(6),* 1173-1182.

Baum, A., & Grunberg, N. (1991). Gender, stress, and health. *Health Psychology, 10(2)*, 80-85.

Benham, G. (2006). The highly sensitive person: Stress and physical symptom reports. *Personality and Individual Differences, 40*, 1433-1440.

Berkman, L, & Syme, L. (1994). Social networks, host resistance, and mortality: A nine year follow-up study of Alameda County residents. In A. Steptoe & J. Wardle (Eds.), *Psychosocial processes and health: A reader* (pp. 43-67). Cambridge, UK: Cambridge University Press.

Bird, C., & Rieker, P. (1999). Gender matters: An integrated model for understanding men's and women's health. *Social Science & Medicine, 48*, 745-755.

Blalock, J., & Joiner, T. (2000). Interaction of cognitive avoidance coping and stress in predicting depression/anxiety. *Cognitive Therapy and Research, 24(1)*, 47-65.

Bowling, A. (2005). Just one question: If one question works, why ask several? *Journal of Epidemiology and Community Health, 59(5)*, 342-345.

Broom, D. (2005). Gender and health. In J. Germov (Ed.), *Second opinion: An introduction to health sociology* (3rd ed.) (pp. 95-110). New York: Oxford University Press.

Brown, R., & Schutte, N. (2006). Direct and indirect relationships between emotional intelligence and subjective fatigue in university students. *Journal of Psychosomatic Research, 60*, 585-593.

Burns, V., Carroll, D., Drayson, M., Whitham, M., & Ring, C. (2003). Life events, perceived stress and antibody response to influenza vaccination in young, healthy adults. *Journal of Psychosomatic Research, 55*, 569-572.

Bury, M. (2005). *Health and illness: Short introductions*. Massachusetts: Polity Press.

Byrne, B. (2005). *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. New Jersey: Lawrence Erlbaum Associates.

Carver, C. (1997). You want to measure coping but your protocol's too long: Consider the brief COPE. *International Journal of Behavioral Medicine, 4,* 92-100.

Carver, C., Scheier, M., & Weintraub, J. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology, 56(2)*, 276-283.

Challis, G., & Stam, H. (1992). A longitudinal study of the development of anticipatory nausea and vomiting in cancer chemotherapy patients: The role of absorption and

autonomic perception. *Health Psychology, 11*, 181-189.

Cockerham, W. (2007). *Medical sociology* (10th ed.). New Jersey: Pearson Prentice Hall.

Cohen, J., & Cohen, P. (1983). Applied multiple regression/correlation for the behavioral sciences (2nd ed.). New Jersey: Erlbaum.

Cohen, J., Cohen, P., West, S., & Aiken, L. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). New Jersey: Lawrence Erlbaum Associates, Inc.

Cohen, S. (1995). Psychological stress and susceptibility to upper respiratory infections. *American Journal of Respiratory and Critical Care Medicine, 152*, 553-558.

Cohen, S., Doyle, W., Skoner, D., Fireman, P., Gwaltney, J., Jr., & Newsom, J. (1995). State and trait negative affect as predictors of objective and subjective symptoms of respiratory viral infections. *Journal of Personality and Social Psychology, 68(1)*, 159-169.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social behavior, 24(4)*, 385-396.

Cohen, S., Tyrrell, D., & Smith, A. (1993). Negative life events, perceived stress, negative affect, and susceptibility to the common cold. *Journal of Personality and Social Psychology, 64*, 131-140.

Cohen, S., & Wills, T. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin, 93*, 310-357.

Connor-Smith, J., & Compas, B. (2004). Coping as a moderator of relations between reactivity to interpersonal stress, health status, and internalizing problems. *Cognitive Therapy and Research, 28(3)*, 347-368.

Costa, P., & McCrae, R. (1985). Hypochondriasis, neuroticism, and aging. When are somatic complaints unfounded? *American Psychologist, 40(1)*, 19-28.

Crawford, M., & Unger, R. (2000). *Women and gender: A feminist psychology* (3rd ed.). NewYork: McGraw Hill.

Cropley, M., & Steptoe, A. (2005). Social support, life events and physical symptoms: A prospective study of chronic and recent life stress in men and women. *Psychology, Health & Medicine, 10(4)*, 317-325.

Cummings, N. (1991). The somatizing patient. In C. Austad & W. Berman (Eds.), *Psychotherapy in managed health care: The optimal use of time and resources* (pp. 234-247). Washington, D. C.: American Psychological Association.

Deckro, G., Ballinger, K., Hoyt, M., Wilcher, M., Dusek, J., Myers, P., et al. (2002). The evaluation of a mind/body intervention to reduce psychological distress and perceived stress in college students. *Journal of American College Health, 50(6),* 281-287.

Degnan, D., Harris, R., Ranney, J., Quade, D., Earp, J., & Gonzales, J. (1992). Measuring the use of mammography: Two measures compared. *American Journal of Public Health, 82,* 1386-1388.

DeLongis, A., & Holtzman, S. (2005). Coping in context: The role of stress, social support, and personality in coping. *Journal of Personality, 73(6)*, 1-24.

Denton, M., Prus, S., & Walters, V. (2003). Gender differences in health: A Canadian study of the psychosocial, structural and behavioural determinants of health. *Social Science & Medicine, 58*, 2585-2600.

Denton, M., & Walters, V. (1999). Gender differences in structural and behavioural determinants of health: An analysis of the social production of health. *Social Science*

& Medicine, 48, 1221-1235.

Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. (2002). *Worker health chartbook, 2000: Nonfatal injury*. http://www.cdc.gov/niosh/pdfs/2002-119.pdf.

Devonport, T., & Lane, A. (2006). Cognitive appraisal of dissertation stress among undergraduate students. *The Psychological Record, 56*, 259-266.

Dixon, W., & Reid, J. (2000). Positive life events as a moderator of stress-related depressive symptoms. *Journal of Counseling and Development, 78,* 343-347.

Diong, S., Bishop, G., Enkelmann, H., Tong, E., Why, Y., Ang, J., & Khader, M. (2005). Anger, stress, coping, social support and health: Modelling the relationships. *Psychology and Health, 20(4)*, 467-495.

Edwards, K., Hershberger, P., Russell, R., & Markert, R. (2001). Stress, negative social exchange, and health symptoms in university students. *Journal of American College Health, 50(2)*, 75-79.

Fawzy, R., Fawzy, N., Hyun, C., Elashoff, R., Guthrie, D., Fahey, J., & Morton, D. (1993). Malignant melanoma: Effects of an early structured psychiatric intervention, coping, and affective state on recurrence and survival 6 years later. *Archives of General Psychiatry, 50*, 681-689.

Fisher, S. (1996). Life stress, personal control, and the risk of disease. In C. Cooper (Ed.), *Handbook of stress, medicine, and health* (pp. 121-136). Boca Raton, FL: CRC Press.

Fleming, R., Baum, A., Gisriel, M., & Gatchel, R. (1982). Mediating influences of social support on stress at Three Mile Island. *Journal of Human Stress, 8*, 14-22.

Frankenhaeuser, M. (1991). The psychophysiology of workload, stress, and health: Comparison between the sexes. *Annals of Behavioral Medicine, 13*, 197-204.

Glanz, K., Lewis, F., & Rimer, B. (1997). *Health behavior and health education: Theory, research, and practice*. San Francisco: Jossey-Bass Publishers.

Goldstein, M., Siegel, J., & Boyer, R. (1984). Predicting changes in perceived health status. *American Journal of Public Health, 74(6)*, 611-614.

Gore, S. (1985). Social support and styles of coping with stress. In, S. Cohen & S. Syme (Eds.), *Social support and health* (pp. 263-278). New York: Academic Press, Inc.

Greenglass, E., & Noguchi, K. (1996). Longevity, gender and health: A psychocultural perspective. Paper presented at the meeting of the International Society of Health Psychology, Montreal, CA.

Hall, N., Chipperfield, J., Perry, R., Ruthig, J., & Goetz, T. (2006). Primary and secondary control in academic development: Gender-specific implications for stress and health in college students. *Anxiety, Stress, and Coping, 19(2)*, 189-210.

Herbert, T., & Cohen, S. (1993). Stress and immunity in humans: A meta-analytic review. *Psychosomatic Medicine, 55*, 364-379.

Herbert T., & Cohen, S. (1994). Stress and illness. *Encyclopedia of Human Behavior, 4*, 325-332.

Holmes, T., & Rahe, R. (1967). The social readjustment rating scale. *Journal of Psychosomatic Research, 11*, 213-218.

Holtzman, S., Newth, S., & DeLongis, A. (2004). The role of social support in coping with daily pain among patients with Rheumatoid Arthritis. *Journal of Health Psychology, 9*, 677-695.

Hudd, S., Dumlao, J., Erdmann-Sager, D., Murray, D., Phan, E., Soukas, N., & Yokozuka, N. (2000). Stress at college: Effects on health habits, health status and self-esteem. *College Student Journal, 34(2)*, 217-227.

Ingledew, D., Hardy, L., & Cooper, C. (1997). Do resources bolster coping and does coping buffer stress? An organizational study with longitudinal aspect and control for negative affectivity. *Journal of Occupational Health Psychology, 2(2)*, 118-133.

Kasl, S., & Cobb, S. (1966a). Health behavior, illness behavior, and sick-role behavior: I. Health and illness behavior. *Archives of Environmental Health, 12*, 246-266.

Kasl, S., & Cobb, S. (1966b). Health behavior, illness behavior, and sick-role behavior: II. Sick role behavior. *Archives of Environmental Health, 12*, 531-541.

Kiecolt-Glaser, J., Garner, W., Speicher, C., Penn, G., Holliday, J., & Glaser, R. (1984). Psychosocial modifiers of immunocompetence in medical students. *Psychosomatic Medicine, 46(1)*, 7-14.

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

Lodzinski, A., Motomura, M., & Schneider, F. (2005). Intervention and evaluation. In, F. Schneider, J. Gruman, & L. Coutts (Eds.), *Applied social psychology: Understanding and addressing social and practical problems* (pp. 55-73). California: Sage Publications, Inc.

MacCallum, R., Browne, M., & Sugawara, H. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 1(2)*, 130-149.

Magni, G., Silvestro, A., Tamiello, M., Zanesco, L., & Carl, B. (1988). An integrated approach to the assessment of family adjustment to acute lymphocytic leukemia in children. *Acta Psychiatrica Scandinavica, 78*, 639-642.

Mahon, N., Yarcheski, A., & Yarcheski, T. (1993). Health consequences of loneliness in adolescents. *Research in Nursing & Health, 16*, 23-31.

Maier, S., Watkins, L., & Fleshner, M. (1994). Psychoneuroimmunology: The interface between behavior, brain, and immunity. *American Psychologist, 49*, 1004-1017.

Manne, S., & Zautra, A. (1989). Spouse criticism and support: Their association with coping and psychological adjustment among women with rheumatoid arthritis. *Journal of Personality and Social Psychology, 56*, 608-617.

Marsland, A., Bachen, E., Cohen, S., & Manuck, S. (2001). Stress, immunity, and susceptibility to infectious disease. In A. Baum, T. Revenson, & J. Singer (Eds.), *Handbook of health psychology* (pp. 683-695). New Jersey: Lawrence Earlbaum Associates.

Matheny, K., Ashby, J., & Cupp, P. (2005). Gender differences in stress, coping, and Illness among college students. *Journal of Individual Psychology, 61(4)*, 365-379.

Mathis, M., & Lecci, L. (1999). Hardiness and college adjustment: Identifying students in need of services. *Journal of College Student Development, 40(3)*, 305-309.

Matud, M. (2004). Gender differences in stress and coping styles. *Personality and Individual Differences, 37*, 1401-1415.

McDonough, P., & Walters, V. (2001). Gender and health: Reassessing patterns and explanations. *Social Science & Medicine, 52*, 547-559.

Mechanic, D. (1972). Social and psychological factors affecting the presentation of Bodily complaints. *New England Journal of Medicine, 286*, 1132-1139.

Mechanic, D. (1978). Illness behavior. In D. Mechanic (Ed.), *Medical sociology* (pp. 249-289). The Free Press: New York.

Mechanic, D. (1995). Sociological dimensions of illness behavior. *Social Science Medicine, 41(9)*, 1207-1216.

Miilunpalo, S., Vuori, I., Oja, P., Pasanen, M., & Urponen, H. (1997). Self-rated health status as a health measure: The predictive value of self-reported health status on the use of physician services and on mortality in the working-age population. *Journal of Clinical Epidemiology, 50(5)*, 517-528.

Miller, S., & Kirsch, N. (1987). Sex differences in cognitive coping with stress. In R. Barnett, L. Biener, & G. Baruch (Eds.), *Gender and stress* (pp. 278-307). New York: The Free Press.

Miranda, J., Perez-Stable, E., Munoz, R., Hargreaves, W., & Henke, C. (1991). Somatization, psychiatric disorder, and stress in utilization of ambulatory medical services. *Health Psychology, 10(1)*, 46-51.

Moos, R., & Schaefer, J. (1993). Coping resources and processes: Current concepts and measures. In L. Goldberger, & S. Breznitz (Eds.), *Handbook of stress (2nd ed.)*, (pp. 127-141). New York: The Free Press.

National Center for Health Statistics. (2005). *Health, United States, 2004*. Washington, D. C.: U. S. Government Printing Office.

Norlander, T., Von Schedvin, H., & Archer, T. (2005). Thriving as a function of affective personality: Relation to personality factors, coping strategies, and stress. *Anxiety,*

Stress, & Coping, 18(2), 105-116.

Olfson, M., Gilbert, T., Weissman, M., Blacklow, R., & Broadhead, W. (1995). Recognition of emotional distress in physically healthy primary care patients who perceive poor physical health. *General Hospital Psychiatry, 17*, 173-180.

Pearlin, L., & Schooler, C. (1978). The structure of coping. *Journal of Health and Social Behavior, 19*, 2-21.

Pedhazur, E. (1997). *Multiple regression in behavioral research: Explanation and prediction* (3rd ed.). Florida: Harcourt Brace College Publishers.

Pennebaker, J. (1982). *The psychology of physical symptoms*. New York: Springer-Verlag.

Pennebaker, J. (2000). Psychological factors influencing the reporting of physical symptoms. In A. Stone, J. Turkkan, C. Bachrach, J. Jobe, H. Kurtzman, & V. Cain (Eds.), *The science of self-report: Implications for research and practice* (pp. 299-315). New Jersey: Lawrence Erlbaum Associates.

Perkins, H. (2003). The emergence and evolution of the social norms approach to Substance abuse prevention. In H. Perkins (Ed.), *The social norms approach to preventing school and college age substance abuse: A handbook for educators, counselors, and clinicians* (pp. 21-34). San Francisco: Jossey-Bass.

Pilisuk, M., Boylan, R., & Acredolo, C. (1987). Social support, life stress, and subsequent medical care utilization. *Health Psychology, 6(4)*, 273-288.

Pritchard, M., & Wilson, G. (2003). Using emotional and social factors to predict student success. *Journal of College Student Development, 44(1)*, 18-28.

Quill, T. (1985). Somatization disorder. One of medicine's blind spots. *Journal of the American Medical Association, 254*, 3075-3079.

Risor, M. (2006). Illness behavior and functional somatic symptoms: Rethinking the concept of illness behavior from an anthropological perspective. *Social Theory & Health, 4*, 180-201.

Rosario, M., Shinn, M., Morch, H., and Huckabee, C. (1988). Gender differences in coping and social supports: Testing socialization and role constraint theories. *Journal of Community Psychology, 16*, 55-69.

Ross, C., & Bird, C. (1994). Sex stratification and health lifestyle: Consequences for men's and women's perceived health. *Journal of Health and Social Behavior, 35(2)*, 161-178.

Sarason, I., Sarason, B., Shearin, E., & Pierce, G. (1987). A brief measure of social support: Practical and theoretical implications. *Journal of Social and Personal Relationships, 4,* 497-510.

Sax, L. (1997). Health trends among college freshmen. *Journal of American College Health, 45,* 252-262.

Scheier, M., & Bridges, M. (1995). Person variables and health: Personality predispositions and acute psychological states as shared determinants for disease. *Psychosomatic Medicine, 57*, 255-268.

Silverman, M., Eichler, A., & Williams, G. (1987). Self-reported stress: Findings from the 1985 National Health Interview Survey. *Public Health Reports, 102*, 47-53.

Sobel, M. (1986). Some new results on indirect effects and their standard errors in Covariancestructure models. In N. Tuma (Ed.), *Sociological methodology* (pp. 159-

186). San Francisco: Jossey-Bass.

Sobel, M. (1987). Direct and indirect effects in linear structural equation models. *Sociological Methods & Research, 16(1)*, 155-176.

Soderstrom, M., Dolbier, C., Leiferman, J., & Steinhardt, M. (2000). The relationship of hardiness, coping strategies, and perceived stress to symptoms of illness. *Journal of Behavioral Medicine, 23(3)*, 311-328.

Steptoe, A., & Wardle, J. (2001). Health behaviour, risk awareness and emotional well being in students from Eastern Europe and Western Europe. *Social Science & Medicine, 53*, 1621-1630.

Stokes, J., & Wilson, D. (1984). The inventory of socially supported behaviors: Dimensionality, prediction, and gender differences. American Journal of Community Psychology, 12, 53-69.

Stone, A., & Neale, J. (1984). New measure of daily coping: Development and preliminary results. *Journal of Personality and Social Psychology, 12*, 53-69.

Straub, R. (2003). *Health psychology*. New York: Worth Publishers.

Straub, R., Grunberg, N., Street, S., & Singer, J. (1990). Dominance: Another facet of type A. *Journal of Applied Social Psychology, 20*, 1051-1062.

Streiner, D., & Norman, G. (2003). *Health measurement scales: A practical guide to Their development and use* (3rd ed.). New York: Oxford University Press.

Thomas, J. (2006). *An examination of moderators of stress and illness behavior among College students*. Unpublished master's thesis, Colorado State University, Fort Collins.

Treharne, G., Lyons, A., & Tupling, R. (2001). The effects of optimism, pessimism, social support, and mood on the lagged relationship between daily stress and symptoms. *Current Research in Social Psychology, 7(5)*, 60-81.

U. S. Department of Labor, Bureau of Labor Statistics. (2007). *Women in the labor force: A databook*. http://www.bls.gov/cps/wlf-databook-2007.pdf.

Varni, J., Setoguchi, Y., Rappaport, L., & Talbot, D. (1992). Psychosocial adjustment and perceived social support in children with congenital/acquired limb deficiencies. *Journal of Behavioral Medicine, 15*, 31-44.

Verbrugge, L. (1985). Gender and health: An update on hypotheses and evidence. *Journal of Health and Social Behavior, 26(3)*, 156-182.

Wade, T., Pevalin, D., & Vingilis, E. (2000). Revisiting student self-rated physical health. *Journal of Adolescence, 23*, 785-791.

Watson, D., & Pennebaker, J. (1989). Health complaints, stress, and distress: Exploring the central role of negative affectivity. *Psychological review, 96*, 234-254.

Williams, P., Wiebe, D., & Smith, T. (1992). Coping processes as mediators of the relationship between hardiness and health. *Journal of Behavioral Medicine, 15*, 237-255.

Winkleby, M., Jatulis, D., Frank, E., & Fortmann, S. (1992). Socioeconomic status and health: How education, income, and occupation contribute to risk factors for cardiovascular disease. *American Journal of Public Health, 82(6)*, 816-820.

Wolfson, M. (2002). Illness behavior and stress: A longitudinal study in a college sample. *Dissertation Abstracts International*. (UMI No. 3038449)

Young, J. (2004). Illness behaviour: A selective review and synthesis. *Sociology of Health & Illness, 26(1)*, 1-31.

Appendix A

Consent to Participate in a Research Study
Colorado State University

TITLE OF STUDY: An Examination of Moderators of Stress and Illness in College Students

PRINCIPAL INVESTIGATOR: Evelinn Borrayo, Ph. D.
Contact information: borrayo@lamar.colostate.edu; 491-7324

CO-PRINCIPAL INVESTIGATOR: Jenifer Thomas, M. S.
Contact information: jjthomas@lamar.colostate.edu; 491-5825

WHY AM I BEING INVITED TO TAKE PART IN THIS RESEARCH? It is important to study the relationship between stress and health among college students because the potential consequences of stress include increased physical symptoms, missed class and work, and increases in negative coping behaviors such as alcohol, tobacco, and drug use.

WHO IS DOING THE STUDY? This study is being conducted through the Department of Psychology and is a project conducted by Jenifer Thomas, M. S., a graduate student in the department. This project is under the supervision of Evelinn Borrayo, Ph. D., research supervisor and advisor. Several undergraduate psychology students will help in administering questionnaires and in entering information into a computerized statistical program.

WHAT IS THE PURPOSE OF THIS STUDY? The purpose of this study is to determine how individual psychological characteristics (such as coping style, emotions, and health value), health status, and health behaviors may change the relationship between stress and health.

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST? The consent process of the study will take place at Colorado State University through the Psychology Department in Clark building room C-72 on November 30, December 1 and 2. The questionnaires will be completed on-line at your convenience during the last week of the fall semester (Dec. 4-8).

WHAT WILL I BE ASKED TO DO? Assessments will take place the last week of the fall semester where participants will complete eight self-report questionnaires on-line. Each questionnaire should take about 10 – 15 minutes to complete for a total of 60 – 90 minutes. Also at this time, information from medical records from the university health center will be accessed by a university health center employee to determine the number and nature of medical visits during the semester for each subject.

ARE THERE REASONS WHY I SHOULD NOT TAKE PART IN THIS STUDY? This study is not appropriate for individuals who do not receive their primary health care at Hartshorn Health Services.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS? There are potential risks associated with participation in this study related to physical and psychological discomfort. The

potential risks associated with completing the questionnaires for the study are minimal. However, the risk associated with disclosing intimate issues may result in psychological discomfort or emotional distress. The possible risk associated with access to information from student medical records is break in confidentiality and this may also result in worry or psychological discomfort. Although it is not possible to identify all potential risks in research procedures, the researcher(s) have taken reasonable safeguards to minimize any known and potential, but unknown, risks.

WILL I BENEFIT FROM TAKING PART IN THIS STUDY? In this study, there is no direct benefit from participating in the study. However, all participants will receive information about stress management and the university stress management program. Individuals who are interested in the study results or their individual results can contact the co-investigator (Jenifer Thomas at jjthomas@lamar.colostate.edu or 970-491-5825) after the completion of the fall semester.

DO I HAVE TO TAKE PART IN THE STUDY? Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without penalty or loss of benefits to which you are otherwise entitled.

WHAT WILL IT COST ME TO PARTICIPATE? There is no cost for participation in the study.

WHO WILL SEE THE INFORMATION THAT I GIVE? We will keep private all research records that identify you, to the extent allowed by law.

Your information will be combined with information from other people taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. You will not be identified in these written materials. We may publish the results of this study; however, we will keep you name and other identifying information private. Your name will appear on this consent form and the participant identification sheet, but for any other documents obtained a code will be used (the code will contain the last two digits of your social security number/the last two digits of your phone number/your birth date). The research team will collect social security numbers for the purpose of medical records access; however you can withhold this information and still participate in the study.

We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. For example, your name will be kept separate from your research records and these two things will be stored in different places under lock and key.

CAN MY TAKING PART IN THE STUDY END EARLY? No.

WILL I RECEIVE ANY COMPENSATION FOR TAKING PART IN THIS STUDY? As an incentive for participation, you will receive a packet that includes a pass for one free mind/body session (this includes yoga and pilates) or cycling pass at the Student Recreation Center and a $5 coupon for any massage at the Student Recreation Center. In addition, the incentive packet will include pamphlets for the Hartshorn Health Services, the Student Recreation Center, the University Counseling Center, and the University Counseling Center Stress Management Program. After completion of the survey on-line, you will be eligible for a drawing of a free massage at the Student Recreation Center, a free spring semester mind/body pass, and various gift certificates.

WHAT HAPPENS IF I AM INJURED BECAUSE OF THE RESEARCH? The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal

responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

WHAT IF I HAVE QUESTIONS? Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions about the study, you can contact the co-investigator, Jenifer Thomas at jjthomas@lamar.colostate.edu or 970-491-5825. If you have any questions about your rights as a volunteer in this research, contact Janell Meldrem, Human Research Administrator, at 970-491-1655. We will give you a copy of this consent form to take with you.

WHAT ELSE DO I NEED TO KNOW?

In order to determine incidents of illness during the study, the research team would like to access information from the medical records of participants from Hartshorn Health Services. Records will be viewed by authorized health center personnel. The research team will not physically obtain your records and only the necessary information for the study (number of visits to the health center during the study semester and the primary reason for the visit) will be recorded. Please initial the appropriate statement.

____ I agree to participate in this study and give my permission for the investigator to receive information from Hartshorn Health Services to determine the number and nature of my visits to the health center.

____ I agree to participate in this study but do not give permission for the investigator to receive information regarding the number and nature of my visits to the health center

____ I do not receive health care at Hartshorn Health Center.

The survey will be available on-line and you may complete it when it is most convenient for you.

By signing below, I certify that I will be the one to complete the surveys.

_____

Your signature acknowledges that you have read the information stated and willingly sign this consent form. Your signature also acknowledges that you have received, on the date signed, a copy of this document containing ___ pages.

_____ _____

Signature of person agreeing to take part in the study Date

_____

Printed name of person agreeing to take part in the study

_____ _____

Name of person providing information to participant Date

_____

Signature of Research Staff

Obtain your parent's permission ONLY if you are under 18 years of age.

PARENTAL SIGNATURE FOR MINOR

As parent or guardian I authorize _____ (print name) to become a participant for the described research. The nature and general purpose of the project have been satisfactorily explained to me by _____ and I am satisfied that proper precautions will be observed.

_____

Minor's date of birth

_____

Parent/Guardian name (printed)

_____ _____

Parent/Guardian signature Date

Appendix B

Participant Identification Sheet

Date_____

Name_____

Local
address_____

Phone_____

Email_____

Social security number_____

Date of birth_____

Participant ID_____
(last two digits of social security number/last two digits of phone number/birth date)

Participant Information Sheet

Participant ID_____ Date_____
Age_____ Gender_____

Relationship status
____Single
____Married
____Living with partner
____Divorced
____Widowed
____Separated
____Other

Ethnic origin
____Anglo/White
____Asian American/Pacific Islander
____Black/African American
____Hispanic/Latino(a)/Mexican American
____Native American/American Indian
____International student: Please specify ethnicity_____
____Other: Please specify_____

Living situation (check all that apply)
____On campus
____Off campus
____Non-related roommate (s) Please specify number:____
____With family Please specify number and relationship:_____
____Live alone

University status ___Freshman ___Sophomore ___Junior ___Senior
Number of credits this semester_____
Major_____ CSU cumulative GPA (approximate)_____
Where do you receive health care? ____University Health Center ____Off campus
Do you currently work? ___ Yes ___ No ____On campus ____Off campus
Hours per week____

Are you affiliated with any groups on or off campus (religious, cultural, academic, etc.)?
___ Yes ___ No If yes, please list._____

Do you utilize any of the services provided by the advocacy offices on campus? Please check all that apply.
____Asian/Pacific American Student Services
____Black Student Services
____Division of Student Affairs
____El Centro Student Services
____Gay, Lesbian, Bisexual, Transgender (GLBT) Student Services
____Native American Student Services
____Off Campus Student Services
____Resources for Adult Learners
____Resources for Disabled Students
____Women's Programs & Studies
____I do not use any of these services.

Do you utilize any other services on campus not previously mentioned? ___ Yes ___ No

If yes, please list_____

For this semester, were you eligible for financial assistance through the university?
___ Yes ___ No
Did you receive financial assistance through the university for this semester? ___ Yes ___ No

Appendix C

Health Outcomes Survey

Participant ID_____

1. Please indicate how often you visited the doctor…

   Last two weeks: _____ times
   Last month: _____ times
   2 – 6 months: _____ times
   7 months – 1 year: _____ times

2. Please indicate how often you have been ill but did not visit the doctor…

   Last two weeks: _____ times
   Last month: _____ times
   2 – 6 months: _____ times
   7 months – 1 year: _____ times

3. Please indicate how often you missed classes due to illness…

   Last two weeks: _____ times
   Last month: _____ times
   2 – 6 months: _____ times
   7 months – 1 year: _____ times

4. Please indicate how often you missed work due to illness…

   Last two weeks: _____ times
   Last month: _____ times
   2 – 6 months: _____ times
   7 months – 1 year: _____ times

Appendix D

Social Support Questionnaire (Short Form) SSQSR

The following question asks about people in your environment who provide you with help or support. Think in your mind the names of people you know, excluding yourself, whom you can count on for help or support in the manner described. Then, provide the number of people you thought of. How many people can you really count on to…

	Number
Be dependable when you need help	
Help you feel more relaxed when you are under pressure or tense	
Accept you totally, including both your worst and your best points	
Care about you, regardless of what is happening to you	
Help you feel better when you are feeling generally down-in-the-dumps	
Console you when you are very upset	

How satisfied are you with people in your environment who provide you with help or support in the following areas:

People you can count on to be dependable when you need help.

	Check box
Very satisfied	
Fairly satisfied	
A little satisfied	
A little dissatisfied	
Fairly dissatisfied	
Very dissatisfied	

People you can count on to help you feel more relaxed when you are under pressure or tense.

	Check box
Very satisfied	
Fairly satisfied	
A little satisfied	
A little dissatisfied	
Fairly dissatisfied	
Very dissatisfied	

People that accept you totally, including both your worst and your best points.

	Check box
Very satisfied	
Fairly satisfied	
A little satisfied	
A little dissatisfied	
Fairly dissatisfied	
Very dissatisfied	

People you can count on to care about you, regardless of what is happening to you.

	Check box
Very satisfied	
Fairly satisfied	
A little satisfied	
A little dissatisfied	
Fairly dissatisfied	
Very dissatisfied	

People you can count on to help you feel better when you are feeling generally down-in-the-dumps.

	Check box
Very satisfied	
Fairly satisfied	
A little satisfied	
A little dissatisfied	
Fairly dissatisfied	
Very dissatisfied	

People you can count on to console you when you are very upset.

	Check box
Very satisfied	
Fairly satisfied	
A little satisfied	
A little dissatisfied	
Fairly dissatisfied	
Very dissatisfied	

From http://web.psych.washington.edu/research/sarason/: "Permission is granted to researchers to use these instruments. We would appreciate information about the findings of studies in which they are used."

Appendix E

Confidential Health History Questionnaire

1. How would you rate your overall health: At the present time

Excellent
Very good
Good
Fair
Poor
Very poor

2. How would you rate your overall health: Three months ago

Excellent
Very good
Good
Fair
Poor
Very poor

3. Do you have any current medical conditions? (including colds and/or chronic conditions)

Yes (please list and explain)
No

4. Do you have any current medical conditions which require regular medical attention?

Yes (please list and explain)
No

5. Have you had any major illnesses in the past?

Yes (please list and explain)
No

6. Please list any medications you are currently taking. (including aspirin or other over-the-counter medications)

Medication(s)
Reason
Times taken per day
Start date
End date
I am not currently taking any medications.

7. In the past, have you used any of the following tobacco products?
Cigarette
Cigar
Pipe
Chew Tobacco
Snuff
Never used

8. Have you ever tried to quit the use of a tobacco product?
Yes (please specify when and indicate if you were successful or not)
No

9. Do you currently use any tobacco products?
Yes
No

10. Please indicate how often in a day you use the following tobacco products: Cigarette
I do not use this tobacco product
Less than once a day
Once a day
Two times a day
Three times a day
Four times a day
Five times a day
Six or more times a day

11. Please indicate how often in a day you use the following tobacco products: Cigar
I do not use this tobacco product
Less than once a day
Once a day
Two times a day
Three times a day
Four times a day
Five times a day
Six or more times a day

12. Please indicate how often in a day you use the following tobacco products: Pipe
I do not use this tobacco product
Less than once a day
Once a day
Two times a day
Three times a day
Four times a day
Five times a day
Six or more times a day

13. Please indicate how often in a day you use the following tobacco products: Chew Tobacco
I do not use this tobacco product
Less than once a day
Once a day
Two times a day
Three times a day
Four times a day
Five times a day
Six or more times a day

14. Please indicate how often in a day you use the following tobacco products: Snuff
I do not use this tobacco product
Less than once a day
Once a day
Two times a day
Three times a day
Four times a day
Five times a day
Six or more times a day

15. Please indicate your total years of tobacco use. Please include your past and current use.

16. In the past, have you used any of the following alcohol products?
Beer
Wine
Liquor
Never used

17. Have you ever tried to quit the use of an alcohol product?
Yes (please specify when and indicate if you were successful or not)
No

18. Do you currently use any alcohol products?
Yes
No

19. Please indicate how often in a day you use the following alcohol products: Beer
I do not use this alcohol product.
Less than once a day
Once a day
Two times a day
Three times a day
Four times a day
Five times a day
Six or more times a day

20. Please indicate how often in a day you use the following alcohol products: Wine
I do not use this alcohol product.
Less than once a day
Once a day
Two times a day
Three times a day
Four times a day
Five times a day
Six or more times a day

21. Please indicate how often in a day you use the following alcohol products: Liquor
I do not use this alcohol product.
Less than once a day
Once a day
Two times a day
Three times a day
Four times a day
Five times a day
Six or more times a day

22. Please indicate your total years of alcohol use. Please include your past and current use.

23. In general, would you consider yourself a healthy eater?
Yes
No

24. Have your eating habits changed in the past two weeks?
Yes (please explain)
No

25. Are you taking any nutritional supplements? (please provide details)
Supplement(s)
Reason
Times taken per day
Taken for how long?
I am not currently taking any nutritional supplements.

26. Have you tried to lose weight since coming to CSU?
Yes (how recently?)
No

27. Have you lost weight?
Yes (how many pounds?)
No

28. Have you been exercising regularly for the past three months?
Yes
No

29. What type of exercise do you regularly participate in? Please indicate the number of days per week that you participate in each activity.
Walking
Running
Cycling
Swimming
Aerobics
Weight training
Martial arts
Other exercise

30. Compared to three months ago, how much regular physical activity do you currently get?
Much less
Somewhat less
About the same
Somewhat more
Much more

31. Have you been treated for stress before?
Yes (please explain why)
No

32. What methods or resources do you currently use to deal with stress?

33. Do you believe that stress is currently a problem for you? (please explain your answer)
Yes
No

34. Have you considered seeking help for the stress you may experience? (please explain your answer)
Yes
No

35. How many hours do you sleep per night (on average)?

36. In general, do you have difficulty falling asleep?
Yes (please explain)
No

37. In general, do you wake up during the night?
Yes (please explain)
No

From personal communication dated April 26, 2004: "Jen, Nice to meet you. Here is the medical history questionnaire. Tracy L. Nelson, MPH, PhD, Assistant Professor, Department of Health and Exercise Science, Colorado State University, B 215E Moby Complex, Fort Collins, C0 80523, T: 970-491-6320 F: 970-491-0445"

Appendix F

Brief COPE Inventory

This question asks you to indicate what you generally do and feel, when you experience stressful events. Think about what you usually do when you are under a lot of stress and then respond to each of the following items by selecting an answer for each. Please try to respond to each item separately in your mind from each other item. Choose your answers thoughtfully, and make your answers as true FOR YOU as you can. Please answer every item. There are no "right" or "wrong" answers, so choose the most accurate answer for YOU—not what you think "most people" would say or do. Indicate what YOU usually do when YOU experience a stressful event.

	I usually don't do this at all	**I usually do this a little bit**	**I usually do this a medium amount**	**I usually do this a lot**
1. I turn to work or other activities to take my mind off things.	1	2	3	4
2. I concentrate on my efforts on doing something about the situation I'm in.	1	2	3	4
3. I say to myself "this isn't real."	1	2	3	4
4. I use alcohol or other drugs to make myself feel better.	1	2	3	4
5. I get emotional support from others.	1	2	3	4
6. I give up trying to deal with it.	1	2	3	4
7. I take action to try to make the situation better.	1	2	3	4
8. I refuse to believe that it has happened.	1	2	3	4
9. I say things to let my unpleasant feelings escape.	1	2	3	4
10. I get help and advice from other people.	1	2	3	4
11. I use alcohol or other drugs to help me get through it.	1	2	3	4
12. I try to see it in a different light, to make it seem more positive.	1	2	3	4
13. I criticize myself.	1	2	3	4
14. I try to come up with a strategy about what to do.	1	2	3	4
15. I get comfort and understanding from someone.	1	2	3	4
16. I give up the attempt to cope.	1	2	3	4
17. I look for something good in what is happening.	1	2	3	4
18. I make jokes about it.	1	2	3	4
19. I do something to think about it less, such as going to movies, watch TV, read, daydream, sleep, or shop.	1	2	3	4
20. I accept the reality of the fact that it has happened.	1	2	3	4
21. I express my negative feelings.	1	2	3	4
22. I try to find comfort in my religion or	1	2	3	4

spiritual beliefs.				
23. I try to get advice or help from other people about what to do.	**1**	**2**	**3**	**4**
24. I learn to live with it.	**1**	**2**	**3**	**4**
25. I think hard about what steps to take.	**1**	**2**	**3**	**4**
26. I blame myself for things that happened.	**1**	**2**	**3**	**4**
27. I pray or meditate.	**1**	**2**	**3**	**4**
28. I make fun of the situation.	**1**	**2**	**3**	**4**

From http://www.psy.miami.edu/faculty/ccarver/CCscales.html: "All of these scales are being made available here for use in research and teaching applications. All are available without charge and without any need for permission."

Appendix G

Perceived Stress Scale

Participant ID_____

The questions in this scale ask you about your feelings and thoughts during the last two weeks and the last month. In each case, you will be asked to indicate by selecting how often you felt or thought a certain way.

	Never	Almost never	Sometimes	Fairly Often	Very Often
1. In the **last two weeks**, how often have you been upset because of something that happened unexpectedly?	**0**	**1**	**2**	**3**	**4**
In the **last month**?	**0**	**1**	**2**	**3**	**4**
2. In the **last two weeks**, how often have you felt that you were unable to control the important things in your life?	**0**	**1**	**2**	**3**	**4**
In the **last month**?	**0**	**1**	**2**	**3**	**4**
3. In the **last two weeks**, how often have you felt nervous and "stressed"?	**0**	**1**	**2**	**3**	**4**
In the **last month**?	**0**	**1**	**2**	**3**	**4**
4. In the **last two weeks**, how often have you felt confident about your ability to handle your personal problems?	**0**	**1**	**2**	**3**	**4**
In the **last month**?	**0**	**1**	**2**	**3**	**4**
5. In the **last two weeks**, how often have you felt that things were going your way?	**0**	**1**	**2**	**3**	**4**
In the **last month**?	**0**	**1**	**2**	**3**	**4**
6. In the **last two weeks**, how often have you found that you could not cope with all the things that you had to do?	**0**	**1**	**2**	**3**	**4**
In the **last month**?	**0**	**1**	**2**	**3**	**4**
7. In the **last two weeks**, how often have you been able to control irritations in your life?	**0**	**1**	**2**	**3**	**4**
In the **last month**?	**0**	**1**	**2**	**3**	**4**

8. In the **last two weeks**, how often have you felt that you were on top of things**?**	**0**	**1**	**2**	**3**	**4**
In the **last month**?	**0**	**1**	**2**	**3**	**4**
9. In the **last two weeks**, how often have you been angered because of things that were outside of your control?	**0**	**1**	**2**	**3**	**4**
In the **last month**?	**0**	**1**	**2**	**3**	**4**
10. In the **last two weeks**, how often have you felt difficulties were piling up so high that you could not overcome them?	**0**	**1**	**2**	**3**	**4**
In the **last month**?	**0**	**1**	**2**	**3**	**4**

From http://www.psy.cmu.edu/~scohen/: "Permission for use of scales is not necessary when use is for academic research or educational purposes."

Table 1

Means and standard deviations by gender

	Males			Females			
Variables	n	Mean	SD	n	Mean	SD	t
Illness behavior	73	.86	.90	176	1.35	1.21	-3.08**
Social support satisfaction	91	20.71	3.53	205	21.76	3.12	-2.55*
Perceived health status	91	2.16	1.01	205	2.60	1.14	-3.17**
Coping skills	91	9.04	3.36	205	11.64	3.35	-6.14**
Emotional support	91	4.47	1.89	205	5.94	1.70	-6.60**
Instrumental support	91	4.57	1.79	205	5.70	1.88	-4.85**
Perceived stress	91	5.80	3.20	205	7.19	3.05	-3.53**

Note. Illness behavior was a total of four dichotomized items (0 = no reported illness behaviors, 1 = one or more reported illness behaviors). Social support satisfaction was a total of four items on a 6 point Likert scale (1 = very dissatisfied to 6 = very satisfied). Perceived health status was a one item categorical variable (1 = excellent, 2 = very good, 3 = good, 4 = fair, 5 = poor, 6 = very poor). Coping skills (use of instrumental and emotional support) was a total of four items on a 4 point Likert scale (1 = I usually don't do this to 4 = I usually do this a lot). Perceived stress was total of four items on a 5 point Likert scale (0 = never to 4 = very often).

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

Table 2

Intercorrelations and covariances among variables for the entire sample ($N = 296$)

Variables	1	2	3	4	5	6	7	8
1. Illness behavior	1.	*06*	*-.001*	*.06*	*.02*	-	-	*.03*
2. Gender	.19**	1	*.23*	*.47*	*.68*	-	-	*.35*
3. Social support satisfaction	-.01	.15*	1	*-.14*	*.10*	-	-	*-.11*
4. Perceived health status	.31**	.18**	-.17**	1	*.11*	-	-	*.28*
5. Coping skills	.17**	.34**	.17**	.11	1	-	-	*.06*
6. Emotional support	.14*	.36**	.18**	.11	.93**	1	-	-
7. Instrumental support	.17**	.27**	.14*	.10	.94**	.75**	1	-
8. Perceived stress	.24**	.20**	-.23**	.32**	.09	.08	.09	1

Note. Covariances appear in italics. Illness behavior was a total of four dichotomized items (0 = no reported illness behaviors, 1 = one or more reported illness behaviors). Gender was a one item categorical variable (0 = male, 1 = female). Social support satisfaction was a total of four items on a 6 point Likert scale (1 = very dissatisfied to 6 = very satisfied). Perceived health status was a one item categorical variable (1 = excellent, 2 = very good, 3 = good, 4 = fair, 5 = poor, 6 = very poor). Coping skills (use of instrumental and emotional support) was a total of four items on a 4 point Likert scale (1 = I usually don't do this to 4 = I usually do this a lot). Perceived stress was total of four items on a 5 point Likert scale (0 = never to 4 = very often).
* $p < .05$, ** $p < .01$

Table 3

Intercorrelations among variables for males (top right, $N = 91$) and females (bottom left, $N = 205$)

Variables	1	2	3	4	5	6	7
1. Illness behavior	-	.21	.18	.08	.03	.13	.08
2. Social support satisfaction	-.14	-	-.11	.05	.08	.01	-.32**
3. Perceived health status	.31**	-.24**	-	-.02	-.04	.02	.19
4. Coping skills	.11	.17*	.08	-	.92**	.91**	.09
5. Emotional support	.09	.18*	.10	.93**	-	.67**	.04
6. Instrumental support	.12	.15*	.06	.94**	.76**	-	.13
7. Perceived stress	.26**	-.23**	.33**	-.004	-.006	-.002	-

Note. Illness behavior was a total of four dichotomized items (0 = no reported illness behaviors, 1 = one or more reported illness behaviors). Gender was a one item categorical variable (0 = male, 1 = female). Social support satisfaction was a total of four items on a 6 point Likert scale (1 = very dissatisfied to 6 = very satisfied). Perceived health status was a one item categorical variable (1 = excellent, 2 = very good, 3 = good, 4 = fair, 5 = poor, 6 = very poor). Coping skills (use of instrumental and emotional support) was a total of four items on a 4 point Likert scale (1 = I usually don't do this to 4 = I usually do this a lot). Perceived stress was total of four items on a 5 point Likert scale (0 = never to 4 = very often).

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

Table 4

Fit indices for the mediation, compound indirect effects, alternative compound indirect effects, combined compound indirect effects, and nested models

Model	*df*	X^2	RMSEA	CFI	PNFI	X^2_{diff}
Mediation model						
1. Original model	122	229.93*	.05	.94	.63	
2. Trimmed model	127	237.54*	.05	.94	.65	
Difference between models 1 & 2						7.61
Compound indirect effects model						
3. Original model	122	229.93*	.06	.94	.63	
4. Trimmed model	127	238.25*	.05	.93	.65	
Difference between models 3 & 4						8.32
Alternative compound indirect effects model						
5. Original model	122	229.93*	.06	.94	.63	
6. Trimmed model	127	235.76*	.05	.94	.65	
Difference between models 5 & 6						5.83
Combined compound indirect effects model						
7. Original model	126	233.08*	.05	.94	.65	
8. Trimmed model	127	236.00*	.05	.94	.65	
Difference between models 7 & 8						2.92

* $p < .01$

Table 5

Standardized regression coefficients and *z*-values for factor loadings in the trimmed mediation model

	Factor Loading	*z*
Social Support Satisfaction		
People you can count on to care about you, regardless of what is happening to you.	.69	--
People you can count on to console you when you are very upset.	.83	12.45
People you can count on to help you feel better when you are feeling generally down-in-the dumps.	.87	12.78
People you can count on to help you feel more relaxed when you are under pressure or tense.	.74	11.31
Coping		
I try to get advice or help from other people about what to do.	.79	--
I get help and advice from other people.	.84	14.86
I get comfort and understanding from someone.	.79	13.95
I get emotional support from others.	.77	13.59
Perceived Stress		
How often have you felt nervous and "stressed"?	.59	--
How often have you felt that you were on top of things?	.64	7.68
How often have you felt difficulties were piling up so high that you could not overcome them?	.73	8.07
How often have you felt confident about your ability to handle your personal problems?	.52	6.73
Illness Behaviors		
Indicate how often you missed work due to illness.	.48	--
Indicate how often you missed classes due to illness.	.90	5.72
Indicate how often you have been ill but did not visit the doctor.	.35	4.54
Indicate how often you visited the doctor.	.42	5.19

Note. $N = 297$. All z values greater than 1.96 are significant at $p < .05$ or smaller.

Table 6

Standardized regression coefficients and *z*-values for the trimmed mediation model

Structural paths	Effect	*z*
From Gender		
Social support satisfaction	.16	2.54
Perceived health status	.18	3.18
Coping	.35	5.78
Perceived stress	.23	3.34
On Illness Behaviors		
Perceived health status	.31	3.68
Perceived stress	.20	2.35

Note. $N = 297$. All z values greater than 1.96 are significant at $p < .05$ or smaller.

Table 7

Decomposition of standardized effects for the trimmed mediation model

	Endogenous variable				
Causal variable	Social support satisfaction (SSQSR)	Perceived health status (PHS)	Coping	Perceived stress (PSS)	Illness behavior
Gender					
Direct effect	.16*	.18**	.35**	.23**	--
Indirect via PHS	--	--	--	--	.06*
Indirect via PSS	--	--	--	--	.05*
Total effect	.16	.18	.35	.23	.11
Perceived health status					
Direct effect	--	--	--	--	.31**
Total effect	--	--	--	--	.31
Perceived stress					
Direct effect	--	--	--	--	.20*
Total effect	--	--	--	--	.20

Note. $N = 297$. The statistical significance of indirect effects was estimated with the Sobel test (Sobel, 1986). ** $p < .01$, * $p < .05$

Table 8

Standardized regression coefficients and *z*-values for factor loadings in the trimmed compound indirect effects model

	Factor Loading	*z*
Social Support Satisfaction		
People you can count on to care about you, regardless of what is happening to you.	.69	--
People you can count on to console you when you are very upset.	.83	12.44
People you can count on to help you feel better when you are feeling generally down-in-the dumps.	.87	12.77
People you can count on to help you feel more relaxed when you are under pressure or tense.	.74	11.30
Coping		
I try to get advice or help from other people about what to do.	.79	--
I get help and advice from other people.	.84	14.86
I get comfort and understanding from someone.	.79	13.94
I get emotional support from others.	.77	13.58
Perceived Stress		
How often have you felt nervous and "stressed"?	.59	--
How often have you felt that you were on top of things?	.65	7.65
How often have you felt difficulties were piling up so high that you could not overcome them?	.73	7.96
How often have you felt confident about your ability to handle your personal problems?	.53	6.78
Illness Behaviors		
Indicate how often you missed work due to illness.	.48	--
Indicate how often you missed classes due to illness.	.90	5.72
Indicate how often you have been ill but did not visit the doctor.	.35	4.54
Indicate how often you visited the doctor.	.42	5.19

Note. $N = 297$. All z values greater than 1.96 are significant at $p < .05$ or smaller.

Table 9

Standardized regression coefficients and *z*-values for the trimmed compound indirect effects model

Structural paths	Effect	*z*
From Gender		
Social support satisfaction	.16	2.53
Perceived health status	.18	3.18
Coping	.35	5.78
Perceived stress	.22	3.17
On Perceived Stress		
Social support satisfaction	-.23	-3.14
Perceived health status	.29	4.07
On Illness Behaviors		
Perceived health status	.31	3.69
Perceived stress	.20	2.31

Note. $N = 297$. All z values greater than 1.96 are significant at $p < .05$ or smaller.

Table 10

Decomposition of standardized effects for the trimmed compound indirect effects model

	Endogenous variable				
Causal variable	Social support satisfaction (SSQSR)	Perceived health status (PHS)	Coping	Perceived stress (PSS)	Illness behavior
Gender					
Direct effect	.16*	.18**	.35**	.22**	--
Indirect via SSQSR	--	--	--	-.04*	--
Indirect via SSQSR + PSS	--	--	--	--	-.01*
Indirect via PHS	--	--	--	.05*	--
Indirect via PHS + PSS	--	--	--	--	.01*
Indirect via PSS	--	--	--	--	.04
Total effect	.16	.18	.35	.23	.04
Social support satisfaction					
Direct effect	--	--	--	-.23**	--
Indirect via PSS	--	--	--	--	-.05
Total effect	--	--	--	-.23	-.05
Perceived health status					
Direct effect	--	--	--	.29**	.31**
Indirect via PSS	--	--	--	--	.06*
Total effect	--	--	--	.29	.37
Perceived stress					
Direct effect	--	--	--	--	.20*
Total effect	--	--	--	--	.20

Note. $N = 297$. The statistical significance of the indirect effects was estimated with the Sobel test (Sobel, 1986). ** $p < .01$, * $p < .05$

Table 11

Standardized regression coefficients and *z*-values for factor loadings in the trimmed alternative compound indirect effects model

	Factor Loading	*z*
Social Support Satisfaction		
People you can count on to care about you, regardless of what is happening to you.	.69	--
People you can count on to console you when you are very upset.	.83	12.49
People you can count on to help you feel better when you are feeling generally down-in-the dumps.	.87	12.83
People you can count on to help you feel more relaxed when you are under pressure or tense.	.74	11.35
Coping		
I try to get advice or help from other people about what to do.	.79	--
I get help and advice from other people.	.84	14.86
I get comfort and understanding from someone.	.79	13.91
I get emotional support from others.	.77	13.60
Perceived Stress		
How often have you felt nervous and "stressed"?	.59	--
How often have you felt that you were on top of things?	.64	7.67
How often have you felt difficulties were piling up so high that you could not overcome them?	.73	8.05
How often have you felt confident about your ability to handle your personal problems?	.53	6.74
Illness Behaviors		
Indicate how often you missed work due to illness.	.48	--
Indicate how often you missed classes due to illness.	.90	5.73
Indicate how often you have been ill but did not visit the doctor.	.35	4.52
Indicate how often you visited the doctor.	.42	5.17

Note. $N = 297$. All z values greater than 1.96 are significant at $p < .05$ or smaller.

Table 12

Standardized regression coefficients and *z*-values for the trimmed alternative compound indirect effects model

Structural paths	Effect	*z*
From Gender		
Social support satisfaction	.24	3.93
Coping	.35	5.80
Perceived stress	.24	3.51
From Perceived Stress		
Social support satisfaction	-.32	-4.00
Perceived health status	.38	5.21
On Illness Behaviors		
Perceived health status	.30	3.61
Coping	.15	2.08
Perceived stress	.19	2.20

Note. $N = 297$. All z values greater than 1.96 are significant at $p < .05$ or smaller.

Table 13

Decomposition of standardized effects for the trimmed alternative compound indirect effects model

	Endogenous variable				
Causal variable	Social support satisfaction (SSQSR)	Perceived health status (PHS)	Coping	Perceived stress (PSS)	Illness behavior
Gender					
Direct effect	.25**	--	.24**	.35**	--
Indirect via Coping	--	--	--	--	.04*
Indirect via PSS + PHS	--	--	--	--	.04**
Indirect via PSS	--	.13**	--	--	.07
Total effect	.25	--	.24	.35	.15
Perceived health status					
Direct effect	--	--	--	--	.30**
Total effect	--	--	--	--	.30
Coping					
Direct effect	--	--	--	--	.15*
Total effect	--	--	--	--	.15
Perceived stress					
Direct effect	-.32**	.38**	--	--	.19*
Indirect via PHS	--	--	--	--	.11**
Total effect	-.32	.38	--	--	.30

Note. $N = 297$. The statistical significance of the indirect effects was estimated with the Sobel test (Sobel, 1986). $^{**}p < .01$, $^{*}p < .05$

Table 14

Standardized regression coefficients and *z*-values for factor loadings in the trimmed combined compound indirect effects model

	Factor Loading	*z*
Social Support Satisfaction		
People you can count on to care about you, regardless of what is happening to you.	.69	--
People you can count on to console you when you are very upset.	.83	12.45
People you can count on to help you feel better when you are feeling generally down-in-the dumps.	.87	12.78
People you can count on to help you feel more relaxed when you are under pressure or tense.	.74	11.31
Coping		
I try to get advice or help from other people about what to do.	.79	--
I get help and advice from other people.	.84	14.86
I get comfort and understanding from someone.	.79	13.95
I get emotional support from others.	.77	13.59
Perceived Stress		
How often have you felt nervous and "stressed"?	.59	--
How often have you felt that you were on top of things?	.64	7.68
How often have you felt difficulties were piling up so high that you could not overcome them?	.73	8.07
How often have you felt confident about your ability to handle your personal problems?	.52	6.73
Illness Behaviors		
Indicate how often you missed work due to illness.	.48	--
Indicate how often you missed classes due to illness.	.90	5.72
Indicate how often you have been ill but did not visit the doctor.	.35	4.54
Indicate how often you visited the doctor.	.42	5.19

Note. $N = 297$. All z values greater than 1.96 are significant at $p < .05$ or smaller.

Table 15

Standardized regression coefficients and *z*-values for the trimmed combined compound indirect effects model

Structural paths	Effect	*z*
From Gender		
Perceived health status	.13	2.21
Coping	.36	5.84
Perceived stress	.27	3.88
From Perceived Stress		
Perceived health status	.30	3.95
On Illness Behaviors		
Perceived health status	.30	3.66
Coping	.15	2.16
Perceived stress	.18	2.18

Note. $N = 297$. All *z* values greater than 1.96 are significant at $p < .05$ or smaller.

Table 16

Decomposition of standardized effects for the trimmed combined compound indirect effects model

	Endogenous variable				
Causal variable	Social support satisfaction (SSQSR)	Perceived health status (PHS)	Coping	Perceived stress (PSS)	Illness behavior
Gender					
Direct effect	--	.13*	.36**	.27**	--
Indirect via Coping	.08**	--	--	--	.05*
Indirect via PHS	--	--	--	--	.04
Indirect via PSS	--	.08**	--	--	.05*
Indirect via Coping + SSQSR	--	--	--	-.02**	--
Indirect via PSS + PHS	--	--	--	--	.02**
Indirect via Coping + SSQSR + PSS	--	-.07**	--	--	-.004*
Indirect via Coping + SSQSR + PSS + PHS	--	--	--	--	-.002**
Total effect	.08	.21	.36	.25	.15
Social support satisfaction					
Direct effect	--	--	--	-.30**	--
Indirect via PSS	--	-.09**	--	--	-.06
Indirect via PSS + PHS	--	--	--	--	-.03**
Total effect	--	-.09	--	-.30	-.09
Perceived health status					
Direct effect	--	--	--	--	.30**
Total effect	--	--	--	--	.30
Coping					
Direct effect	.21**	--	--	--	.15*
Indirect via SSQSR	--	--	--	-.06*	--
Indirect via SSQSR + PSS	--	-.02**	--	--	-.01*
Indirect via SSQSR + PSS + PHS	--	--	--	--	-.006**
Total effect	.21	-.02	--	-.06	.15
Perceived stress					
Direct effect	--	.30**	--	--	.19*
Indirect via PHS	--	--	--	--	.09**
Total effect	--	.30	--	--	.28

Note. $N = 297$. The statistical significance of the indirect effects was estimated with the Sobel test (Sobel, 1986). $^{**}p < .01$, $^{*}p < .05$

Figure Captions

Figure 1. Confirmatory factor analysis model.

Figure 2. Mediation model of gender on illness behavior through perceived stress, coping skills, perceived health status, and social support satisfaction.

Figure 3. Compound indirect effects model of gender differences in social support satisfaction, perceived health status, and coping skills on illness behavior as mediated by perceived stress.

Figure 4. Alternative compound indirect effects model of gender differences in perceived stress as mediated by social support satisfaction, perceived health status, and coping skills on illness behavior.

Figure 5. Final trimmed confirmatory factor analysis model.

Figure 6. Final trimmed mediation model.

Figure 7. Final trimmed compound indirect effects.

Figure 8. Final trimmed alternative compound indirect effects model.

Figure 9. Combined indirect effects model of the effect of gender differences in social support satisfaction and perceived health status on illness behavior as mediated by perceived stress. Also, the effect of gender on illness behavior as mediated by perceived health status, coping, and perceived stress.

Figure 10. Final trimmed combined compound indirect effects model.

Figure 1

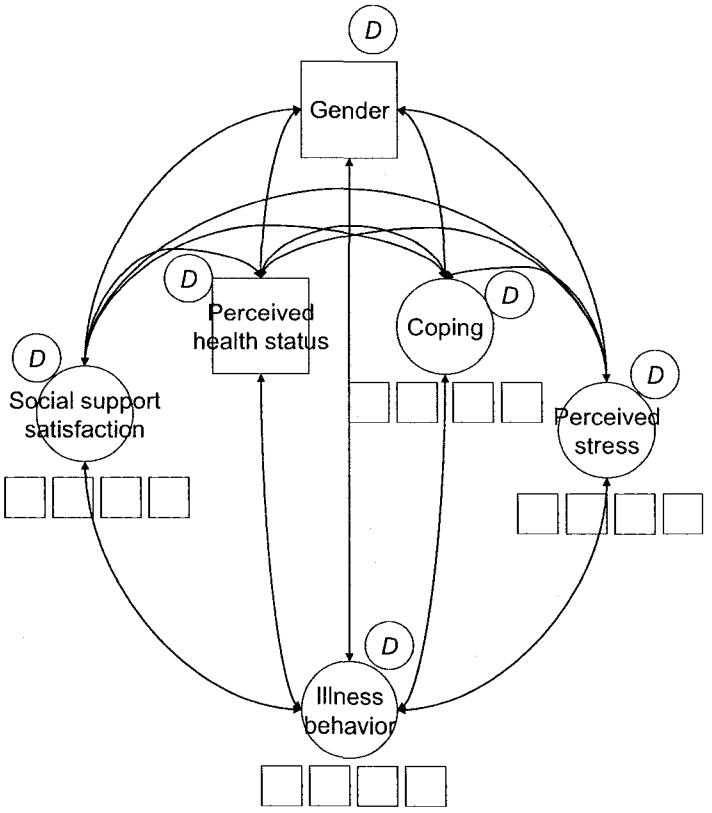

D
Gender
D
Perceived health status
D
Coping
D
Social support satisfaction
D
Perceived stress
D
Illness behavior

Figure 2

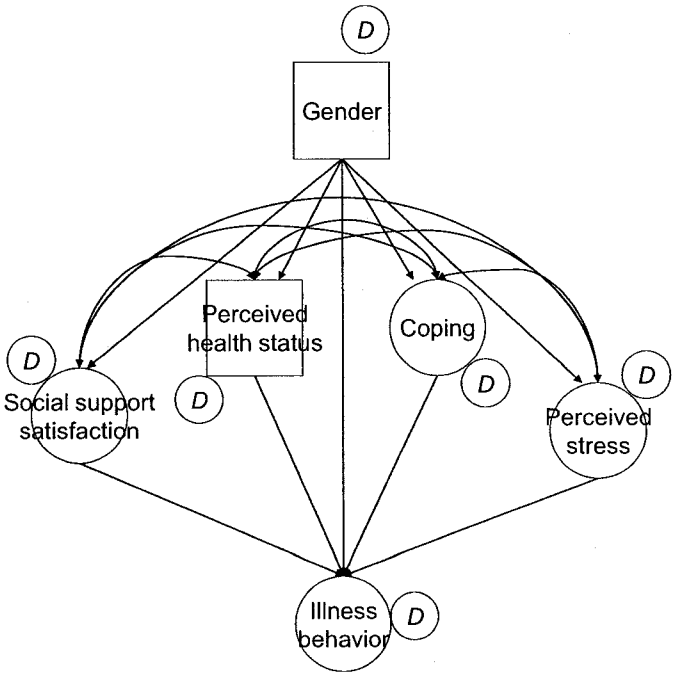

D
Gender
Perceived health status
Coping
D
D
Social support satisfaction
D
D
Perceived stress
Illness behavior
D

Figure 3

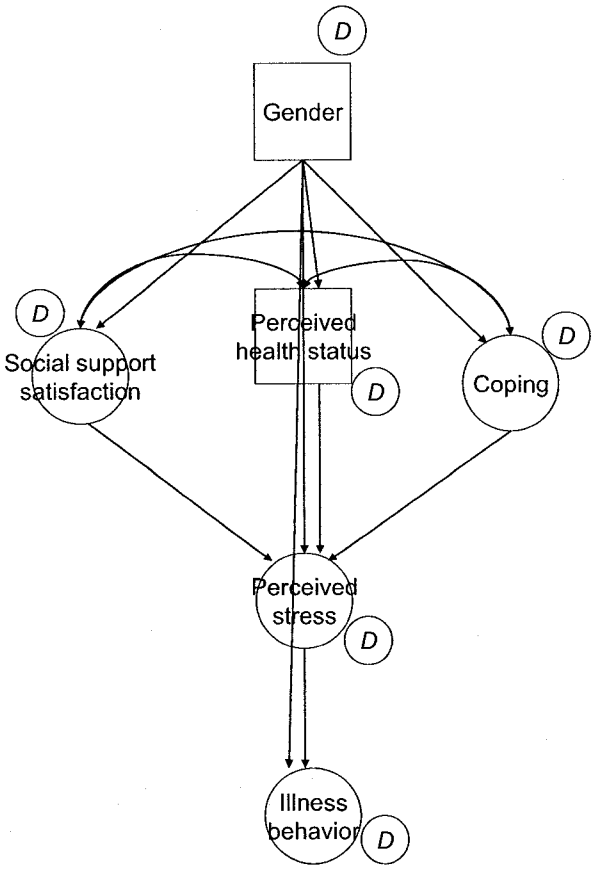

D
Gender
D
Social support satisfaction
Perceived health status
D
D
Coping
Perceived stress
D
Illness behavior
D

Figure 4

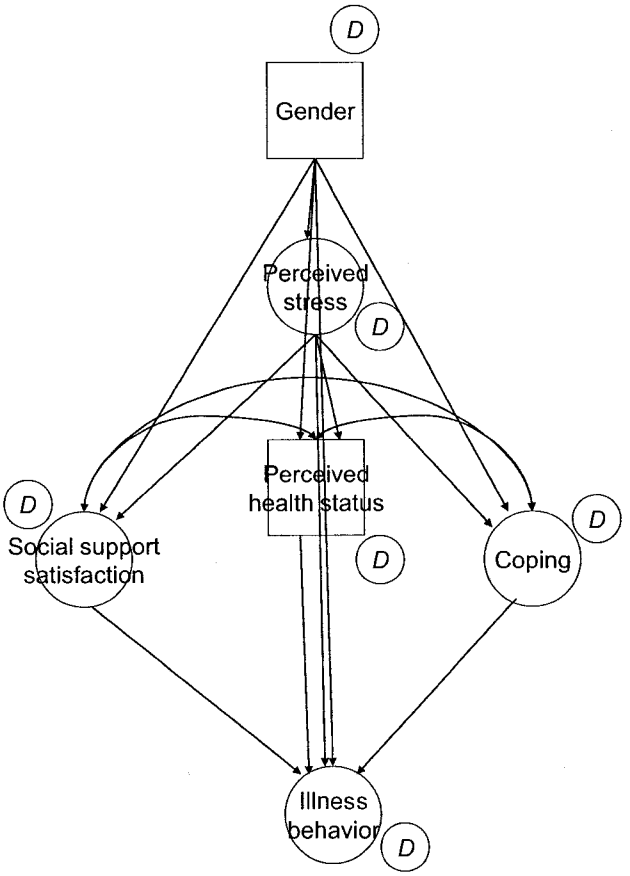

D
Gender
Perceived stress
D
Perceived health status
D
D
Social support satisfaction
D
Coping
Illness behavior
D

Figure 5

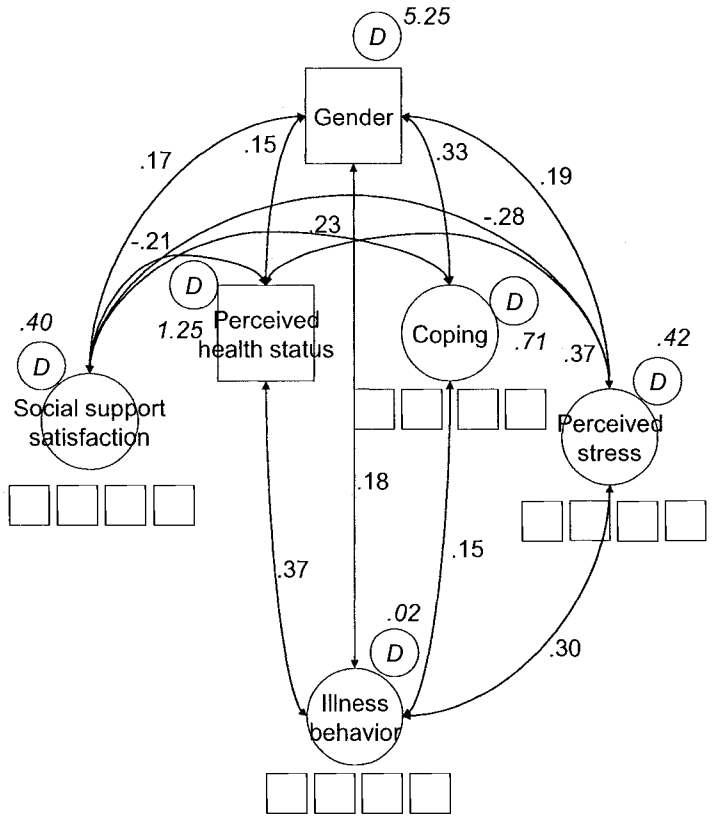

5.25
D
Gender
.17
.15
.33
.19
-.21
.23
-.28
D
1.25
Perceived health status
Coping
D
.71
.37
.40
D
Social support satisfaction
.42
D
Perceived stress
.18
.37
.15
.02
D
.30
Illness behavior

Figure 6

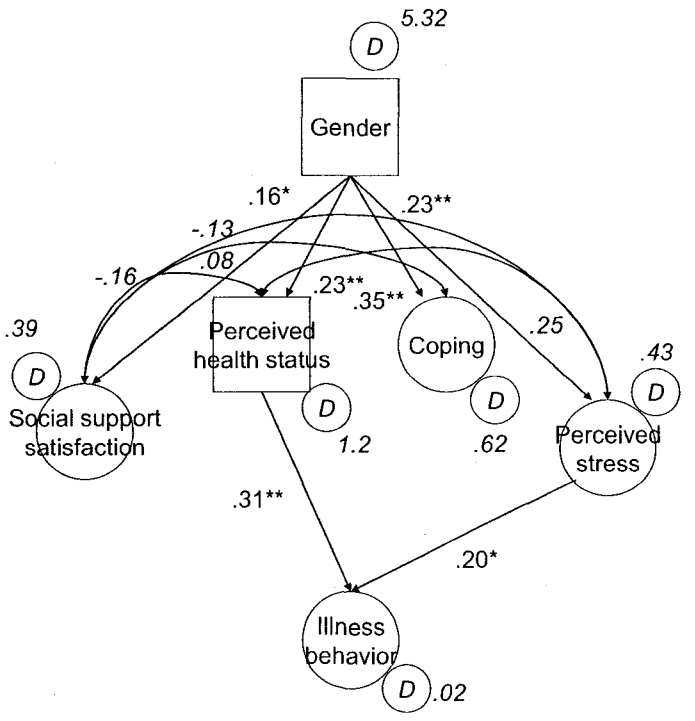

5.32
D
Gender
.16*
.23**
-.13
.08
-.16
.23**
.35**
.25
.39
D
Social support satisfaction
Perceived health status
D
1.2
Coping
D
.62
.43
D
Perceived stress
.31**
.20*
Illness behavior
D
.02

Figure 7

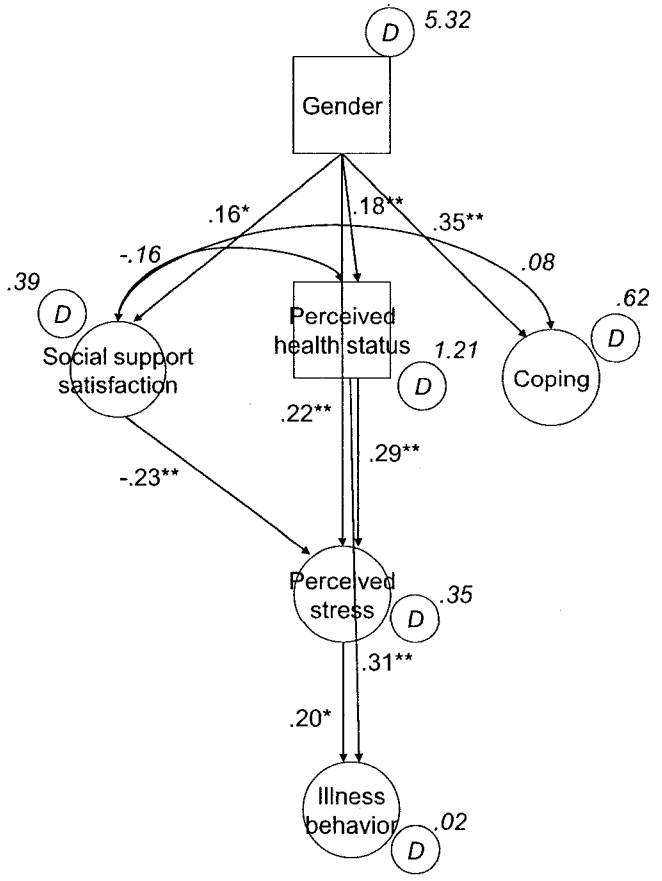

D
5.32
Gender
.16*
.18**
.35**
-.16
.08
.39
D
Social support satisfaction
Perceived health status
1.21
D
Coping
.62
D
.22**
.29**
-.23**
Perceived stress
.35
D
.31**
.20*
Illness behavior
.02
D

Figure 8

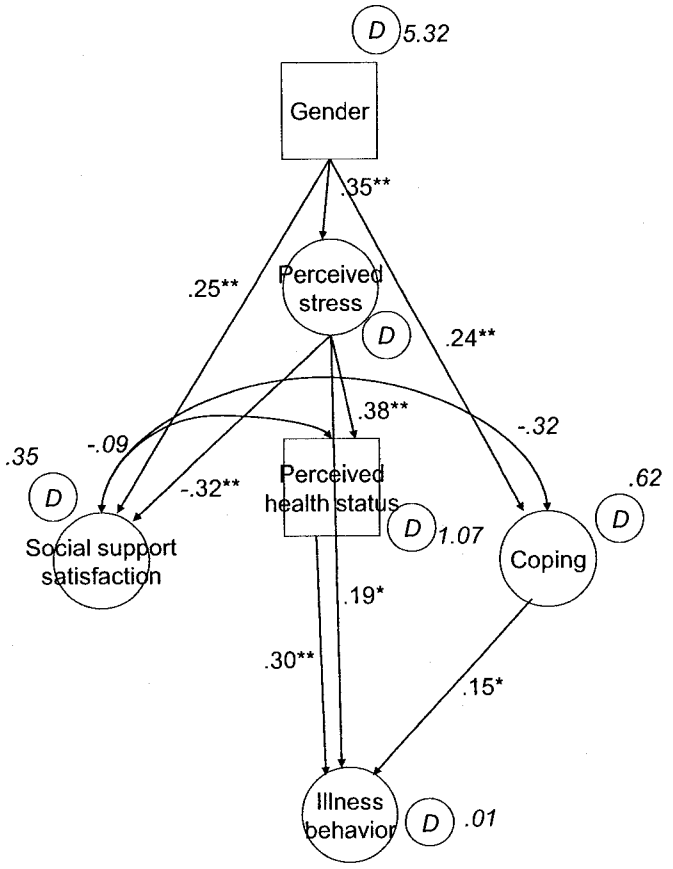

D
5.32
Gender
.35**
.25**
Perceived stress
D
.24**
.38**
-.09
-.32
.35
D
-.32**
Perceived health status
D
1.07
.62
D
Social support satisfaction
Coping
.19*
.30**
.15*
Illness behavior
D
.01

Figure 9

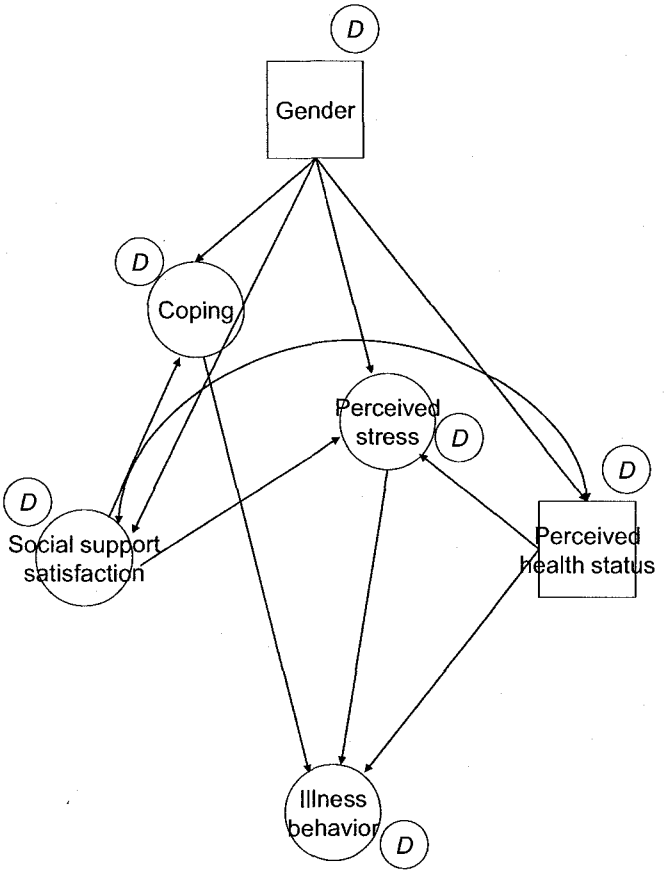
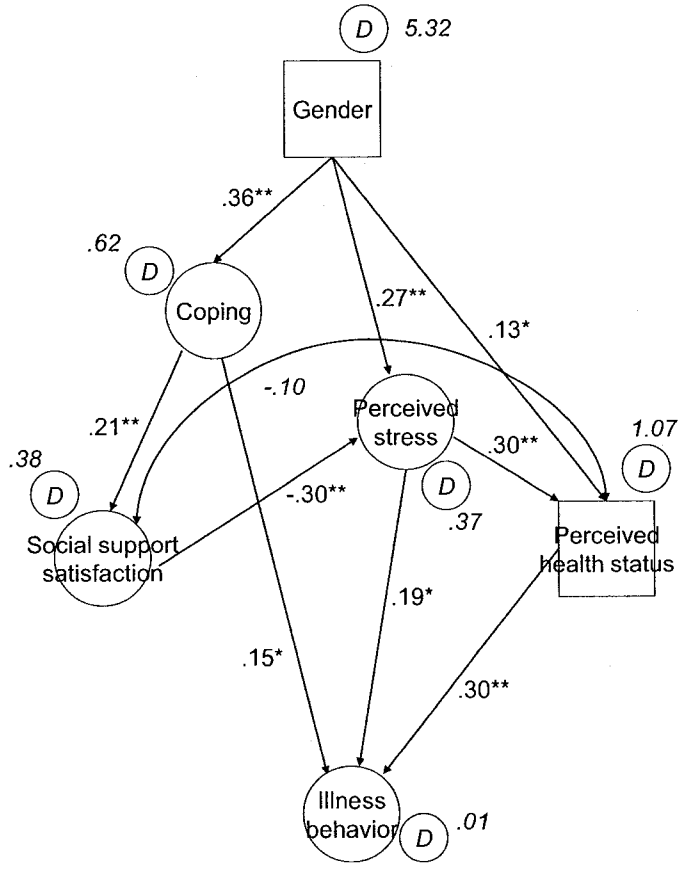

D
Gender
D
Coping
Perceived stress
D
D
D
Social support satisfaction
Perceived health status
Illness behavior
D

Figure 10


D
5.32
Gender
.36**
.62
D
Coping
.27**
.13*
-.10
.21**
Perceived stress
.30**
1.07
D
.38
D
-.30**
D
.37
Social support satisfaction
Perceived health status
.19*
.15*
.30**
Illness behavior
D
.01