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Physical Activity and Depressive Symptoms among Korean Americans in Los Angeles

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Physical Activity and Depressive Symptoms among Korean Americans in Los Angeles

A dissertation submitted in partial satisfaction of the

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in Health Services

by

Alison Kay Herrmann Farrell

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ABSTRACT OF THE DISSERTATION

Physical Activity and Depressive Symptoms among Korean Americans in Los Angeles

by

Alison Kay Herrmann Farrell

Doctor of Philosophy in Health Services

University of California, Los Angeles, 2012

Professor Roshan Bastani, Chair

Korean Americans are among the most rapidly growing U.S. population groups, yet relatively little is known about factors associated with their mental health. Depressive symptoms have been documented among Korean Americans, but targeting depression in this group may be challenging due to cultural norms that inhibit discussion of emotions and structural barriers to the receipt of health care. Physical activity (PA) has been negatively associated with depression in other groups and may be a promising means of addressing depressive symptoms among Korean Americans, yet the relationship between PA and depression has not yet been examined in this group. Moreover, few studies have investigated factors associated with PA among Korean Americans. Prevalence of tradition gender roles among Korean Americans suggest that gender may be important to consider in studies of PA and depression in this group. To address gaps in the extant literature, two studies are conducted to examine PA and depressive

symptoms among Korean American women and men. The first study examines PA in detail and evaluates factors associated with obtaining minimally recommended levels of PA. The second study examines PA in relation to depressive symptoms, independently and in association with health insurance status and chronic disease diagnosis.

Participants (N=260) were recruited at Los Angeles Korean churches. Data were collected on-site using interviewer administered Korean language questionnaires. PA was assessed using the International PA Questionnaire, Short Form (IPAQ-SF). Depressive symptoms were assessed using the Eight Item Patient Health Questionnaire (PHQ-8). Data are evaluated among the total sample and by gender. PA is described in terms of overall levels, intensity, common types of and barriers to activity, and guidelines knowledge. Logistic regression analyses are used to examine odds of meeting minimal PA guidelines in relation to guidelines knowledge, the most commonly reported barrier to PA (lack of time), social and environmental support for PA, presence of children in the home, weight status, and chronic disease diagnosis (hypertension, heart disease, or diabetes), controlling for demographic covariates. PA is evaluated in keeping with the 2007 ACSM/AHA PA guidelines, with secondary analyses to consider the 2008 PA Guideline for Americans. Overall levels of depressive symptoms are examined and ordinary least squares (OLS) regression is used to evaluate symptoms consistent with moderate or lesser levels of depression in relation to PA, chronic disease diagnosis, and health insurance status, controlling for demographic covariates. Seemingly unrelated regression analyses are conducted to examine relationships evaluated in OLS analyses of depressive symptoms while jointly estimating total PA as a function of factors examined in relation to meeting minimal PA

guidelines.

Rates of PA and depressive symptoms observed in the sample were higher than those reported for the U.S. population. Average levels of depressive symptoms were greater among women than men in the sample. Overall, PA levels did not vary by gender and PA was not independently associated with depressive symptoms among women or men. Among men, health status was a determinant of the association between: (a) PA and depression and (b) health insurance status and depression. Specifically, among men diagnosed with a chronic disease, depressive symptoms were lower among those who met, versus do not meet, minimal PA guidelines and higher among those without, versus with, health insurance coverage. Among women, lack of health insurance coverage was independently associated with higher levels of depressive symptoms whereas heath status was the factor most strongly associated with PA. Odds of obtaining minimally recommended levels of PA were greater among women with, versus without, chronic disease diagnoses. Guidelines knowledge and reporting time as a barrier were the factors most strongly associated with PA among men; odds of obtaining minimally recommended levels of PA were greater among men with, versus without, PA guidelines knowledge and lower among men who did, versus did not, report time as a PA barrier. Similarities were observed between Koreans and other Americans in terms of PA guidelines knowledge as well as common types of PA and barriers to PA.

Failure to observe a relationship between PA and depression was surprising. Additional studies are needed to determine the reason for the findings, and to examine the relationship between

PA and depressive symptoms among Korean Americans. Findings suggest that interventions may be needed to address depressive symptoms in this group and that gender differences may be important to consider in these efforts. Health status may be important to consider when targeting depression among Korean American men in particular. Insurance status may also be important to consider in such efforts; additional research is needed to examine the reasons underlying the relationship between insurance status and depression, especially among women. Despite higher levels of PA observed in the sample in comparison to U.S. population-level estimates, the finding that at least one-fourth of participants failed to obtain minimally recommended levels of PA indicates that efforts to increase PA levels among Korean Americans are needed. Findings suggest that chronic disease diagnosis may serve as a teachable moment for increasing PA in this group, particularly among women. Similarities observed between the sample and the larger population in terms of types of PA reported, barriers to activity, and knowledge of PA guidelines demonstrate a low need for tailoring of PA focused materials for Koreans. Findings expand the limited literatures related to PA and depressive symptoms among Korean Americans and point to numerous directions for future research.

The dissertation of Alison Kay Herrmann Farrell is approved.

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2012

Dedication

This dissertation is dedicated to my mother, Barbara J. Herrmann, to whom I attribute my love of learning, spirit of determination, and commitment to promoting health equity. Her support and faith in me throughout the years have inspired me to tackle challenges head on and to pursue my goals, even in the face of adversity. No child could ask for more.

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This dissertation work would not have been possible without the guidance, patience, and support of my advisor, Dr. Roshan Bastani. The quality of this work was greatly enhanced by her direction and insights, as well as those of my committee members: Drs. Robert M. Kaplan, William J. McCarthy, Jack Needleman, and Annette L. Stanton. I would also like to acknowledge the unyielding support extended to me by my husband, Brendan Farrell, throughout all the years of my doctoral training.

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Herrmann AK, Glenn B, Jo AM, Cha J, Maxwell A, Bastani R. (2008, October). Development of a Church-Based Small Group Intervention to Increase Hepatitis B (HBV) Screening Among Korean Americans. 136th Annual Meeting of the American Public Health Association, San Diego, CA.

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Chapter 1: INTRODUCTION

Projections that racial and ethnic minorities will comprise greater than half (54%) of the U.S. population by 2050 (U.S. Census Bureau, 2008) have brought attention to the importance of understanding determinants and potential modifiers of health in these groups. The Asian population in the U.S. grew by 46% between 2000 and 2010, from 11.9 million to 17.3 million, representing an increase from 4.2% to 5.6% of the total U.S. population during this period (Hoeffel, Ratstogi, Kim & Shahid, 2012). This growth is over four times the 9.7% increase, from 281.4 million to 308.7 million, observed in the general U.S. population during that time frame (Hoeffel, et al., 2012). Moreover, between 2000 to 2010 the percentage increase in the U.S. Asian population was similar to that observed among the U.S. Latino population, accounted for the greatest proportion of growth in the total U.S. population over this time period; Specifically, between 2000 and 2010 the U.S. Latino population grew by 43% from 35.3 million to 50.5 million, representing an increase from 13% to 16% of the total U.S. population (Enis, Rios-Vargas, & Albert, 2011). Despite this rapid growth, Asian Americans receive little attention in the health research literature. The lack of attention may be due to the common perception of Asians as healthier than members of other groups and therefore in less need of public health intervention

In certain respects Asians are healthier than other Americans, but chronic disease rates and health behaviors of immigrant groups are known to fall more closely in line with the larger population with increasing length of stay in the U.S. (Deapen, Liu, Perkins, Bernstein, & Ross, 2002; Goel, McCarthy, Phillips, & Wee, 2004; Lauderdale & Rathouz, 2000; LaVeist, 2002) and health advantages presently observed among Asian Americans are unlikely to be maintained

over time. Additionally, significant between-group heterogeneity has been recognized in Asian American's physical (e.g., Gomez, Kelsey, Glaser, Lee, & Sidney, 2004; Venkat Naryan, et al., 2010) and mental health (e.g., Min & Woon, 2006; Takeuichi, et al., 2007). Therefore, considering all Asians as a single group is likely to mask important subgroup variations in health and health behaviors. Research is needed to identify modifiable factors associated with health among Asian American population groups in order to inform efforts to maintain and improve their health and to minimize health disparities.

Depression is one of the most burdensome chronic diseases worldwide (Lopez, Mathers, Ezzati, Jamison, & Murray, 2006; WHO, 2002) and the most commonly experienced mental disorder in the U.S. population (Kessler, et al., 2003; U.S. Census Bureau, 2005). A high prevalence of depression has been observed across racial and ethnic groups (Huang, et al., 2006; Takeuichi, et al., 2007; USDHHS, 1999; 2001a). In comparison to common physical health conditions though, research focused on depression among diverse population groups has been limited to date. Studies examining depression among Asian Americans have been especially limited, despite reports that depression may be equally common among Asians as in the general U.S. population (Huang, et al., 2007; USDHHS, 2001a).

Koreans are currently the fourth largest Asian American group (after Chinese, Filipino, and Asian Indian) and the size of this group is rapidly increasing; according to recent U.S. Census data, the Korean American population grew by 39 percent between 2000 and 2010, reaching 1.7 million nationally (Hoeffel, et al., 2012). The potential impact of health issues experienced by Korean Americans increases as the population continues to grow. Studies are

needed now to identify modifiable factors associated with preventable common chronic health conditions and related health behaviors in this group.

In comparison to other U.S. population groups, higher levels of depressive symptoms have been documented in studies conducted among Korean Americans (e.g., Donnelly, 2001; 2007; Hughes, 2002; Hyun, 2001; Jang & Chiriboga, 2010; Kim, 2002a; Kuo, 1984; Kuo and Tsai, 1986; Oh, Koeske, & Sales, 2002; Shin, 1993; 1994). A growing body of research is focused on depression in this group (e.g., Ayers, et al., 2009; Donnelly, 2007; 2001; Jang, Kim & Chirboga, 2005; Jang, et al., 2010; Jang & Chirboga, 2011; Jiang, 2004; Kim, Han, Shin, Kim & Lee, 2005; Park and Bernstein, 2008). Relatively little research has aimed to identify modifiable factors associated with depressive symptoms among Korean Americans however. This is troubling given evidence from research in other groups to suggest that even relatively low levels of depressive symptoms may be associated with impaired functioning (Cuijpers, de Graff, & van Dorsselaer, 2004; Lewinson, Solomon, Seeley, & Zeiss, 2000; Preisig, Merikangas, & Angst, 2001; Hjarsbech, et al., 2011; Rai, et al., 2011) or more advanced stages of depression over time (Broadhead, Blazer, George, & Tse, 1990; Cuijpers, et al., 2004; Cuijpers & Smit, 2004; Fogel, Eaton, & Forde, 2006; Lewinson, et al., 2000; Maier, Gansicke, & Weinffenbach, 1997; Shankman, et al., 2009). In order to effectively mitigate the burden of depression among Korean Americans, research is needed to identify modifiable factors associated with the depressive symptoms experienced in this group.

Addressing depression among Korean Americans may be challenging however, due to pervasive cultural factors that inhibit discussion of emotion (Bernstein, 2007; Donnelly, 2001; Kim & Rew, 1994; Park & Beernstein, 2008) and prevalent structural barriers to the receipt of

health care (Barnes, Adams, Powell-Griner, 2008; Brown, Ojeda, Wyn, & Levan, 2000; Dao, 2010; KFF & APHF, 2008) observed in this population group. In light of these issues, efforts to target modest levels of depressive symptoms that do not require discussion of emotion and can be targeted outside of the traditional healthcare setting may be a promising means of promoting well-being and preventing more advanced stages of depression among Korean Americans. Physical activity (PA) is a potentially important target for such efforts given the well established negative association between PA and depression based on research in other groups (Camacho, Roberts, Lazarus, Kaplan, & Cohen, 1991; Conn, 2010; DeMoor, Been Stubbe, Boomsma & Geus, 2006; Ensel & Lin, 2004; Farmer, et al., 1988; Fox, 1999; Goodwin, 2003; Paluska & Schenk, 2000; Rethorst, Wipfli, & Landers, 2009; Stephens, 1988; Strine, et al., 2006; Strohle, 2009; Taylor, Pietrobon, Pan, Huff, & Higgins, 2004; Weyer, 1992;), including Koreans in Korea (Park & Han, 2003). Both the World Health Organization (WHO, 2002) and the National Institute for Mental Health (NIMH, 2010) recognize PA as useful for reducing symptoms of depression. The relationship between PA and depression has not yet been examined among Korean Americans however. The present research was conducted to address this gap in the literature.

Research Aims and Hypotheses

The objective of this research is to examine the relationship between PA and depressive symptoms among Korean Americans. To accomplish this objective, two studies will be conducted. The first study will focus directly on PA among Korean Americans and the second study will investigate PA in relation to depressive symptoms among Korean Americans. Specific aims and hypotheses of the investigations are described in detail below. Expected relationships between study factors are depicted in Figure 1 (Aim 1) and Figure 2 (Aim 2).

Aim 1: Assess PA and associated factors among Korean Americans.

- Describe PA reported by Korean Americans, including activity intensity, common forms of activity, and overall PA level in terms of compliance with national guidelines.
- Assess knowledge of PA guidelines and barriers to PA among Korean Americans and investigate these factors in relation to meeting minimal PA guidelines.
- Examine family, social, and environmental factors in relation to meeting minimal PA guidelines among Korean Americans.
- Examine weight status and chronic disease diagnosis in relation to meeting minimal PA guidelines among Korean Americans.
- Assess gender differences in factors associated with meeting minimal PA guidelines among Korean Americans.

<u>Hypotheses</u>

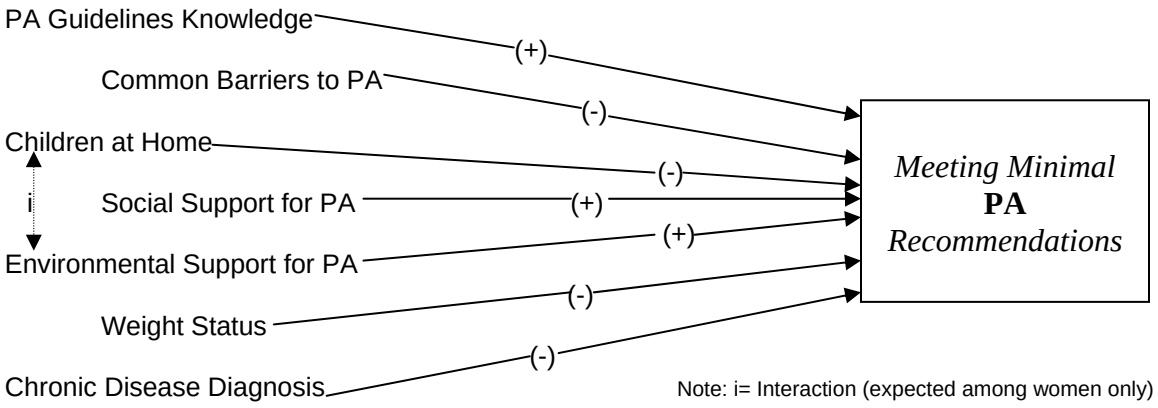
A. Greater knowledge of PA guidelines, fewer barriers to PA, absence of children at home, greater environmental support for PA, greater social support for PA, healthy weight status, and lack of chronic disease diagnoses will be independently associated with greater

likelihood of meeting minimal PA guidelines, controlling for gender, age, education, marital status, and percent of life lived in the U.S.

B. Children at home, social support for PA, and weight status will be more strongly associated with PA among women, as compared with men.

C. Among women, an interaction between environmental support for PA and children at home is expected such that environmental support for PA will have a stronger influence on PA among those with children at home, controlling for other study factors.

Figure 1. Expected Relationships between Study Variables and Physical Activity (PA)



Aim 2: Examine PA in relation to depressive symptoms among Korean Americans.

- Document levels of depressive symptoms reported by Korean Americans.
- Examine the association between PA and depressive symptoms among Korean Americans.
- Investigate the relationship between chronic disease diagnosis and depressive symptoms among Korean Americans.

- Investigate the relationship between health insurance coverage and depressive symptoms among Korean Americans.
- Evaluate interactions between PA, chronic disease diagnosis, and health insurance coverage in relation to depressive symptoms among Korean Americans.
- Assess gender differences in depressive symptoms and associated factors among Korean Americans.

Hypotheses

D. Failure to meet minimal PA guidelines, chronic disease diagnosis, and lack of health insurance coverage will be independently associated with greater depressive symptoms, controlling for gender, age, education, marital status, weight status, and percent of life lived in the U.S.

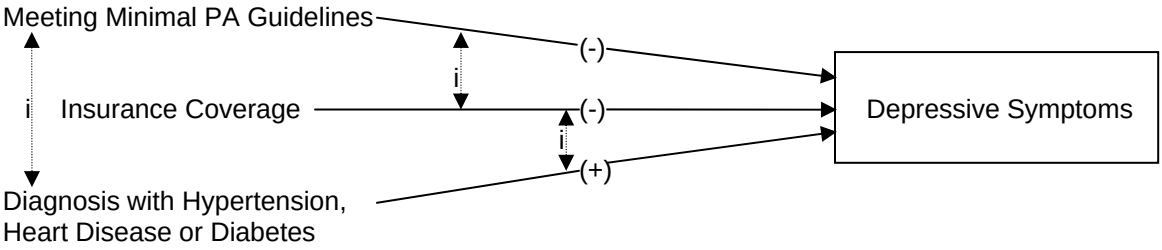
E. An interaction will be observed between PA and chronic disease diagnosis such that the relationship between chronic disease diagnosis and depressive symptoms will be stronger among those who fail to meet minimal PA guidelines, as compared to those who meet minimal PA guidelines, controlling for gender, age, education, marital status, weight status, and percent of life lived in the U.S.

F. An interaction will be observed between PA and insurance status such that the relationship between lack of health insurance coverage and depressive symptoms will be stronger among those who fail to meet minimal PA guidelines, as compared to those who meet minimal PA guidelines, controlling for gender, age, education, marital status, weight status, and percent of life lived in the U.S.

G. An interaction will be observed between chronic disease diagnosis and insurance status such that the relationship between lack of health insurance coverage and depressive symptoms will be stronger among those with a chronic disease diagnosis, as compared to those without such diagnoses, controlling for gender, age, education, marital status, weight status, and percent of life lived in the U.S.

H. A three-way interaction will be observed between PA, chronic disease diagnosis, and health insurance status such that the interaction between chronic disease diagnosis and insurance status will be stronger among those who fail to meet minimal PA guidelines as compared with those who meet minimal PA guidelines, controlling for gender, age, education, marital status, weight status, and percent of life lived in the U.S.

Figure 2. Expected Relationships between Study Variables and Depressive Symptoms



Note: i = Interaction

Review of the Literature

An overview of the published literature relevant to the investigations conducted is provided in the following section. First, characteristics of the Korean American population are presented. Next, a brief summary of depression and depressive symptoms is provided, followed by an overview of prior findings regarding depression among Korean Americans. PA research is then summarized generally, and with regard to studies focused on PA among Korean Americans. Finally, a review of prior findings regarding the relationship between PA and depression is provided.

Korean Americans

Koreans are among the most recently immigrated and most rapidly growing U.S. population groups (Hoeffel, et al., 2012; Oh, et al., 2002; U.S. Census Bureau, 2005; 2008; 2012). The Korean American Coalition (2012), a designated U.S. Census Information Center, reported that the total U.S. Korean population increased by nearly 35% between the years of 1990 to 2000 and additional growth of 39% was documented between 2000 and 2010 (Hoeffel, et al., 2012). According to data from the 2010 U.S. Census, Koreans are the 4th largest Asian population group in the U.S., with a size of 1.7 million,and the 5th largest Asian population group in California, with a size of over 512,000 (Hoeffel, et al., 2012).

The U.S. Korean population is mainly concentrated in large urban areas, with the highest numbers of Korean Americans residing in the greater Los Angeles metropolitan area (Korean American Coalition, 2012; Min & Song, 1998; Terrazas, 2009; U.S. Census Bureau, 2012). As of the 2000 U.S. Census, fully 96% of U.S. Koreans were living in metropolitan areas, with one-third residing in California and nearly one-fourth residing in the Southern California region that

includes Los Angeles, Orange, Riverside, and Ventura Counties (Yu, Choe, & Han, 2002). According to data from the U.S. Census Bureau's 2010 American Communities Survey, over two-thirds of Koreans in California (67.8) and one-fifth of Koreans in the U.S. (20.2%) reside in the greater Los Angeles metropolitan area (U.S. Census Bureau, 2012).

Koreans are similar to other U.S. immigrant groups in that over half report limited English proficiency (57% according to the U.S. Census Bureau's 2007 American Community Survey; Terrazas, 2009). Korean Americans are more highly educated however, than other U.S. immigrant groups or the general U.S. population; 52% of U.S. Koreans over the age of 25 years have at least a four-year college degree, as compared with 30% in the general population (U.S. Census Bureau, 2012).

A number of researchers (e.g., Bernstein, 2007; Pak, 2006; Park & Bernstein, 2008) have explained that traditional Korean culture, heavily influenced by Confucianism, is largely preserved among Koreans in the U.S. In keeping with established Korean cultural values, family integrity is highly prioritized and traditional gender roles are largely maintained. For example, it is common for Korean American women to be exclusively responsible for housework and childrearing regardless of their employment status outside the home (Kim & Rew, 1994; Sin, Jordan, & Park, 2011; Um & Dancey, 1999). As described by Pak (2006), frequently used Korean phrases illustrate women's appropriated roles; the phrase "hyonmon yangcho", translated to English as "wise mother and good wife", is a commonly used motto to describe the responsibilities of Korean women; "samjongjodo", translated to English as the "Rule of Three", stipulates that Korean women are to be obedient to the men in their families. Specifically, they

are to be obedient to their fathers prior to marriage, to their husbands after marriage, and to their sons after their husband's death (Pak, 2006).

Churches have been referenced as one of the primary means through which traditional Korean culture has been preserved in the U.S. (Pak, 2006; Park & Bernstein, 2008) and it has been estimated that 60-80% of Korean Americans are affiliated with Korean churches (Hurh & Kim, 1990b; Juon, Choi, & Kim, 2000; Min, 1990). In addition to providing spiritual services, Korean churches serve as social centers of the community. Cultural, social, service and educational activities are regularly coordinated by Korean churches and churches have been observed to be important resources for health and social service information in the Korean American community (Pak, 2006; Park & Bernstein, 2008).

Health and social service information may be especially important for Korean Americans given that they are less likely than members of other U.S. population groups to have health insurance coverage or a usual source of health care (Barnes, et al., 2008; Brown, et al., 2000; Dao, 2010; KFF & APIAHF, 2008), and more likely than members of other groups to delay or not receive medical care due to cost (Barnes, et al., 2008) or to report fair or poor overall health (CDC, 1998; Kandula, Lauderdale & Baker, 2007). It has been observed that insurance status is less closely associated to markers of socio-economic status among Koreans than in other groups (Dao, 2010; Shin, Song, Kim, & Probst, 2005). This discrepancy is often attributed to the large number of Korean Americans who are self employed; it has been estimated that as many as one-third of Korean Americans fall into this category (Yu, et al., 2002).

With regard to physical health, epidemiological research has documented higher rates of hypertension among Koreans in comparison to other Americans and to Koreans in Korea

(Kim, Kim, Juon, & Hill, 2000). Higher rates of heart disease and diabetes have also been identified among Korean Americans as compared to Koreans in Korea (Frisbie, Cho, & Hummer, 2001; Lee, Sobal, & Frongillo, 2000; Song, et al., 2004). With regard to mental health, depression has been observed to more common among Koreans as compared to other U.S. groups (Donnelly, 2001; 2007; Hughes, 2002; Hyun, 2001; Jang & Chiriboga, 2010; Kim, 2002a; Kuo, 1984; Kuo and Tsai, 1986; Oh, et al., 2002; Shin, 1993; 1994). Findings of two prior studies suggest that engagement in church activities may confer benefits in terms of lessened depressive symptoms among Korean Americans (Hurh & Kim, 1990a; Lee, Moon, & Knight, 2004).

Depression and Depressive Symptoms

Depression has been recognized as a leading cause of global disability and the third leading contributor to the burden of disease in high income countries such as the U.S. (Lopez, Mathers, Ezzati, Jamison, & Murray, 2006). In the U.S. population, lifetime and one year prevalence rates of major depressive disorder, the most extreme presentation of depressive symptoms, have been estimated at 16% and 7%, respectively (Kessler, et al., 2003). Greater numbers of Americans however, experience depressive symptoms to lesser degrees (Lewinsohn, Shankman, Gau, & Klein, 2004). Depressive symptoms are observed more commonly among women than men across population groups globally and within the U.S. (Kessler, 2003; Lopez, et al., 2006).

According to the American Psychiatric Association (2000) and the National Institutes of Mental Health (2010), symptoms of depression are varied and may manifest as negative feelings (e.g., sadness, hopelessness, worthlessness, or guilt), somatic disruptions (e.g.,

restlessness, fatigue, sleep or appetite disruptions), or thoughts of suicide. These organizations recognize variations in depression severity based upon the number and frequency of symptoms experienced. Researchers in the field have suggested that it may be useful to consider depressive symptoms in terms of a continuum (e.g., Angst, Sellaro, & Merikangas, 2000; Geiselman & Bauer, 2000; Goldberg, 2000). A growing literature indicates that even relatively low levels of depressive symptoms may be associated with impaired psychosocial (Cuijpers, et al., 2004; Lewinson, et al., 2000; Preisig, et al., 2001) and occupational functioning (Hjarsbech, et al., 2011; Rai, et al., 2011) as well as more advanced stages of clinical depression over time (Broadhead, et al., 1990; Cuijpers, et al., 2004; Cuijpers & Smit, 2004; ; Fergusson, Horwood, Ridder, & Beautrais, 2005; Fogel, et al., 2006; Lewinson, et al., 2000; Maier, et al., 1997; Shankman, et al., 2009). Whereas individuals experiencing advanced forms of depression may require drug treatment in addition to psychotherapy, the National Institutes of Mental Health (2010) acknowledge that those with fewer or less persistent symptoms may improve with psychotherapy alone, or even without treatment.

Depressive Symptoms among Korean Americans

Comparably higher levels of depressive symptoms than those reported for the general U.S. population have been observed among Korean Americans in a number of published studies (Donnelly, 2007; Hyun, 2001; Jang & Chiriboga, 2010; Oh, et al., 2002; Shin, 1993; 1994). Additionally, researchers have observed greater depressive symptoms among Korean Americans as compared with other Asian immigrant population groups (Donnelly, 2001; Hughes, 2002; Kim, 2002; Kuo, 1984; Kuo and Tsai, 1986); this has also been observed among Korean women specifically, in comparison to other Asian American women (Jiang, 2004). As in the

general U.S. population, recent studies have observed greater depressive symptoms among Korean American women, as compared with men (e.g., Donnelly, 2007; Jang, Kim, & Chiriboga, 2011). Prior studies (Choi, 1997; Hurh & Kim, 1990a) however, found similar levels of depressive symptoms among Korean American women and men.

In addition to experiencing greater depressive symptoms than other U.S. population groups, studies suggest that Koreans are less likely than members of other groups to seek mental health care (Donnelley, 2007) and a tendency has been documented for those who do seek care to do so in primary care settings (Donnelly, 1992; 2007; Sur, 1994; Weissman, et al, 1996). Additionally, when Korean Americans seek mental health services, it tends to be only after a prolonged time and at advanced stages of distress (Shin, 2002). Among Korean Americans, mental health care is more likely to be sought by a family member on behalf of the affected individual than on one's own behalf (Bernstein, 2007).

Observed tendencies of Korean Americans not seek mental health care may be associated with prevalent health system barriers in this group previously described (i.e., low rate of insurance and usual source of care). Traditional Korean cultural practices may also influence care seeking in relation to the experience of depressive symptoms. For example, Bernstein (2007) explained that it is generally not considered appropriate for Koreans to openly discuss emotional problems as maturity in Korean culture is measured in accordance with ability to control one's feelings. Additionally, a number of researchers have explained that stigma is associated with mental health problems in Korean culture, with such problems viewed to reflect negatively on the family of the affected individual (Bernstein, 2007; Donnelly, 2001; Kim & Rew, 1994). Park and Beernstein (2008) noted that a negative spiritual influence is

traditionally viewed to be the source of mental health problems among Koreans and being affected by negative spirits in this manner is highly stigmatized. Among Koreans, physical and mental health are traditionally viewed as interaction between body, mind, and nature. The phrase "woo-ul-jeung", translated to English as a state of being out of balance, was used by Korean immigrants in one prior study as a translation for depression (Shin, 2002).

Perhaps due to the cultural factors described above, a tendency has been observed for Koreans to express depressive symptoms as somatic complaints (Donnelly, 2007; Kim, et al., 2005; Pang, 1998; 2000; Weissman, et al., 1996), as in other Asian groups (e.g., Kleinman, 1982; Leong & Lau, 2001; Lin & Cheung, 1999). Results of recent focus groups suggest that Korean American immigrants may not recognize physical symptoms as indicators of depression (Sin, et al., 2011). The experience of chronic somatic symptoms as a result of the suppression of negative emotions is a recognized phenomenon among Koreans though, known as "hwa-byung" which translates to "fire disease" or "anger disease" (Kim & Lee, 2003; Kim & Rew, 1994; Lin, et al., 1992; Min, 2008; Pang, 1998; 2000).

An increasing number of studies focus on depression among Korean Americans (e.g., Ayers, et al., 2009; Donnelly, 2007; 2001; Jang & Chirboga, 2011; Jang, Kim & Chirboga, 2005; Jang, Park, Kim & Kang, 2010; Jiang, 2004; Kim, et al., 2005; Park and Bernstein, 2008), yet relatively little research has focused on health behaviors or relationships between health behaviors and mental health in this group. Rather, a majority of studies have examined the relationship between acculturative stress (e.g., Choi, 1997; Hurh & Kim, 1990; Jang & Chiroboga, 2010; Kim & Rew, 1994; Oh, et al., 2002; Shin, 1994; 1993) and depression. Other factors that have been observed in association with depression among Korean Americans include social

support (Ayers, et al., 2009; Berry, Kim, Mindey, & Mok, 1987; Chae, Lee, Lincoln, & Ihara, 2011; Choi, 1997; Kim, et al., 2005; Lee, Crittenden, & Yu, 1996; Lee, et al., 2004; Min, Moon, & Lubben, 2005; Mui, 2001; Shin, 1994; Shin, Han, & Kim, 2007), sense of control (Jang, Chiriboga, Kim, & Rew, 2010; Kim, 2002b), depression related knowledge (Jang, Gum & Chiriboga, 2010), and discrimination (Chae, et al., 2011; Gee, Spencer, Chen, Yip, & Takeuchi, 2007; Jang, et al., 2010; Noh, Kaspar, & Wickrama, 2007).

Physical Activity (PA)

PA has been associated with decreased risk and levels of multiple common chronic diseases including: depression (Camacho, et al., 1991; DeMoor, et al., 2006; Ensel & Lin, 2004; Fox, 1999; Goodwin, 2003; Paffenbarger, Lee, & Leung, 1994; Paluska & Schenk, 2000; Strine, et al., 2008; Strohle, 2009; Weyer, 1992), hypertension (Chase, Sui, Lee, & Blair, 2009; Haapanen, Miilunpalo, Vuori, Oja, & Pasanen, 1997; Hu, et al., 2004; Moreau, et al., 2001; Paffenbarger, Wing, Hyde, & Jung, 1983; Pereira, et al., 1999), heart disease, (Lee, Rexrode, Cook, Manson, & Buring, 2001; Lee, Sesso, & Paffenbarger, 2000; Manson, et al, 2002; 1999; Murphy, Nevill, Neville, Biddle, & Hardman, 2002; Tanasescu, et al., 2002; Williams, 2001) and diabetes (Sigal, Kenny, Wasserman, Castenada-Sceppa, & White, 2006; Tuomilehto, et al., 2001; Hu, et al., 1999; Ivy, Zderic, & Fogt, 1999; Haapanen, et al., 1997).

In order to obtain health benefits, current recommendations suggest that Americans engage in at least 30 minutes of moderate intensity PA on at least 5 days per week, or at least 20 minutes of vigorous intensity PA on at least three days per week, or some equivalent combination of moderate and vigorous intensity PA over the course of the week (Haskell, et al, 2007; Nelson, et al, 2007). The more recent 2008 PA Guidelines for Americans are slightly more

flexible than prior guidelines in that they specify only a total number of weekly PA minutes, which are suggested to obtained though multiple bouts spreads over the course of the week, rather than a particular number of days of PA or minutes of PA per day; Like the prior guidelines, these guidelines stipulate that PA should be accrued in at least 10 minute intervals (USDHHS, 2008; 2008a). Despite the known benefits of PA, surveillance data indicate that from one-half to one-third the U.S. population, depending upon the PA guidelines applied, fails to obtain recommended levels of PA (CDC, 2007; 2008). Levels of PA have consistently been demonstrated to be greater among men, as compared with women (e.g., Bauman, et al., 2009; CDC, 2005; King, et al., 2000; Salmon, Owen, Bauman, Schmitz, & Booth, 2000).

In light of low levels of PA observed across the population, researchers have attempted to indentify modifiable factors that predict PA. The positive relationship between social support and PA has been well documented (e.g., for Booth, Owen, Bauman, Clavisi, & Leslie, 2000; Castro, Sallis, Hickman, Lee, & Chen, 1999; Eyler, et al., 1999; Leslie, et al., 1999; Sternfield, Ainsworth, & Quesenberry, 1999; Wilcox, Castro, King, Housemann, & Brownson, 2000). In recent years, increased attention has focused on understanding the influence of environmental resources on PA; accessibility of recreation facilities (Booth, et al., 2001; Brownson, Baker, Housemann, Brennan, & Bacak, 2001; Giles-Corti & Donovan, 2002; Kirtland, et al, 2004), access to sidewalks (Addy, et al., 2004) and environmental safety (Booth, et al, 2001; Nies, 1998; Yancey, et al, 2004) have been associated with greater levels of PA. Geographic Information System (GIS) research has demonstrated the importance of perceptions in terms of neighborhood PA resources; more active individuals have most accurately identified accessibility of PA resources in their communities, while inactive

individuals have most accurately identified issues related to lack of safety in their neighborhoods (Kirtland, et al., 2003).

PA among Korean Americans

Research findings published to date suggest that PA levels are suboptimal among Korean Americans (CDC, 1997; Han, et al., 2007; Yang, et al., 2007). Among Korean American women in particular, a widespread view of PA as unpleasant mandatory work (Im & Choe, 2004) and a prevalent social acceptance of inactivity (Yang, et al., 2007) have been documented.

Data available regarding PA among Korean Americans are limited by a tendency to focus exclusively on women (e.g., Choi, Wilber, & Kim, 2011; Choi, Wilber, Miller, Szalacha, & McAuley, 2008; Im & Choe, 2001; 2004; Yang, et al., 2007) and leisure-time PA (i.e., purposeful activities such as jogging, hiking, aerobics, or cardiovascular conditioning rather than on activities incidental to paid work, housework, or transport; e.g., Hofstetter, et al., 2008; Yang, et al., 2007). Much remains unknown regarding PA among Korean Americans. A wide range of estimates have been generated with regard to the proportion of Koreans that meet minimal PA guidelines. Additionally, little research has focused on the types of activities considered to be PA, common barriers to PA, and knowledge of PA guidelines in this group.

Estimates based solely on leisure-time PA indicate that approximately one-fourth to one-third of Korean Americans meet minimal PA guidelines (CDC, 1997; Han, et al., 2007; Yang, et al., 2007), with higher levels of activity documented among men than women (Kandula & Lauderdale, 2005; Lee, et al., 2000; Hofstetter, et al., 2008), as in the larger U.S. population and in other population subgroups (National Center for Health Statistics, 2007). When both leisure and non-leisure time PA were assessed however, over 75% of Midwestern Korean American

women were found to meet minimal PA guidelines (Choi, et al., 2008; 2011). The aforementioned PA levels were estimated in accordance with the 2007 American College of Sports Medicine/American Heart Association (ACSM/AHA) PA Guidelines (Haskell, et al, 2007; Nelson, et al., 2007), or similar earlier versions of these guidelines. Estimates based on the more flexible 2008 PA Guidelines for Americans (USDHHS, 2008; 2008a) are presently lacking for Korean Americans.

A small number of studies have suggested that social and environmental factors, such as social support (Choi, et al., 2011; Im & Choe, 2004; Yang, et al., 2007) and perceived access to neighborhood PA (Choi, et al., 2008), may facilitate PA among Korean American women. Perceived neighborhood access to PA has also been positively associated with PA levels among Asian American women generally (Bungum, Lounsbery, Moonie & Gast, 2009; Sternfeld, et al., 1999). Conversely, having young children has been reported as a barrier to PA among Korean American women (Choi, et al., 2008; 2011). Other factors, such as perceptions of neighborhood safety (Booth, et al, 2001; Kirtland, et al., 2003; Nies, et al., 1998; Yancey, et al., 2004), knowledge of PA guidelines (Moore, Fulton, Kruger, & McDivitt, 2010), weight status (Brock, et al., 2009; CDC, 2008; Tucker, et al, 2011; Yancey, et al., 2004), smoking (see Kaczynski, Manske, Mannell, & Grewal, 2008 for review), and chronic disease diagnosis (Denmark-Wahnefried, Aziz, Rowland, & Pinto, 2011; Neuhoser, Miller, Kristal, Barnett, & Cheskin, 2002; Neutel & Campbell, 2008), that have been associated with PA in other U.S. population groups have yet to be examined among Korean Americans.

PA and Depressive Symptoms

The relationship between greater levels of PA with lower levels of depressive symptoms is well established (Camacho, et al., 1991; DeMoor, et al., 2006; Ensel & Lin, 2004; Fox, 1999; Goodwin, 2003; Paluska & Schenk, 2000; Strohle, 2009; Weyer, 1992). In the U.S., depressive disorders are more common among those who are physically inactive, as compared with those who are more active (Strine, et al., 2008). This relationship has also been observed among Koreans among in Korea (Park & Han, 2003).

The American Psychiatric Association (2000) has recognized that PA may be of value as a supplemental treatment for depression. Both the National Institutes of Mental Health (2010) and the World Health Organization (2002) recognize PA as effective in reliving minimal levels of depression and as an effective compliment to other treatments for more advanced forms of depression.

In U.S. population-level samples, even small amounts of PA are associated with advantages in terms of lower levels of depression, as compared with no activity (Strine, et al., 2008; Taylor, et al., 2004). Additionally, researchers have observed a dose-response relationship such that the greatest increase in PA-related benefits in terms of reducing depressive symptoms are observed at the lowest initial levels of PA (Dunn, Trivedi, & O'Neal, 2001; Stephens, 1988; Weyerer, 1992). The inverse association between PA and depressive symptoms has been observed in both women and men (DeMoor, et al., 2006; Farmer, et al., 1988; Galper, Trivedi, Barlow, Dunn, & Kampert, 2006).

Contribution to the Field

Depressive symptoms and suboptimal levels of PA have been documented in prior research among Korean Americans, a rapidly growing population group. The negative relationship between PA and depressive symptoms is well established, yet this potentially modifiable health behavior has not been examined in relation to depressive symptoms among Korean Americans and relatively little is known about factors associated with PA in this group. This research addresses gaps in the literature by examining PA and depressive symptoms among Korean Americans through two studies.

Given the limited available data regarding PA and associated factors in this group, the initial investigation is focused on PA; levels and types of PA are documented, PA guidelines knowledge and barriers to PA are assessed, and factors associated with meeting minimal PA guidelines are examined. Next, depressive symptoms are examined; overall levels of depressive symptoms are evaluated and the relationship between PA, other potentially important factors, and depressive symptoms is assessed. In light of gender differences observed in both depressive symptoms and PA among Koreans (Donnelly, 2007; Hofstetter, et al., 2008; Jang, et al., 2011; Kandula & Lauderdale, 2005; Lee, et al, 2000b) and in other groups (Bauman, et al., 2009; CDC, 2005; Kessler, 2003; King, et al., 2000; Lopez, et al., 2006; Salmon, et al, 2000), and the pervasiveness of traditional gender roles among Korean Americans (Bernstein, 2007; Kim, 1998; Kim & Rew, 1994; Pak, 2006; Um & Dancey, 1099; Sin, et al., 2011) which may influence each of these factors, the role of gender is closely examined in each of these investigations.

The first study, focused on PA and associated factors, expands the current literature by examining leisure-time PA as well as PA accrued through activities incidental to daily life (e.g.,

housework, commuting, paid work, childcare) among Korean women and men. Additionally, this research contributes to the presently limited literature regarding factors associated with PA among Korean Americans and is among the first studies to examine PA in keeping with two recent sets of PA guidelines, the 2007 AHA/ACMS PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007) and the 2008 PA Guidelines for Americans (USDHHS, 2008; 2008a). Consideration of both guidelines allows for evaluation of differences in relationships observed in accordance with varied guidelines as well as greater comparability with other research. This study, conducted as a precursor to the investigation of PA and depressive symptoms, is also of independent value given the established relationship between PA with numerous chronic health conditions (e.g., Chase, et al., 2009; Haapanen, et al., 1997; Hu, et al., 2004; Ivy, et al., 1999; Lee, et al., 2000a; 2001; Manson, et al., 1999; 2002; Moreau, et al., 2001; Murphy, et al., 2002; Paffenbarger, et al., 1983; Pereira, et al., 1999; Sigal, et al., 2006; Tanasescu, et al., 2002; Tuomilehto, et al., 2001; Williams, 2001). Findings may be of particular importance given the rapid growth of the Korean American population and the documented relationship between increasing rates of chronic disease with increasing length of stay in the U.S. (Deapen, et al., 2002; Goel, et al., 2004; Lauderdale & Rathouz, 2000; LaVeist, 2002).

The second study conducted is among the first to examine the relationship between PA and depression among Korean Americans. Findings may be important for efforts to address levels of depression previously observed in this group (e.g., Hyun, 2001; Oh, et al., 2002; Donnelly, 2001; 2007; Shin, 1993; 1994; Jang & Chiriboga, 2010; Hyun, 2001; Kuo, 1984; Kuo and Tsai, 1986; Kim, 2002; Hughes, 2002) given PA may be targeted in the absence of discussing of emotions and outside of the traditional healthcare setting. These factors are potentially

important due to cultural factors observed to inhibit discussion of emotion (Beernstein, 2007; Donnelly, 2001; Kim & Rew, 1994; Park & Beernstein, 2008) and prevalent structural barriers to the receipt of health care (Barnes, et al., 2008; Dao, 2010; Brown, et al., 2000; KFF & APIAHF, 2008) reported as prevalent among Korean Americans. In addition to directly evaluating the relationship between PA and depressive symptoms, interactions between PA, chronic disease diagnosis, and insurance status will be examined in relation to depressive symptoms. Findings in this area are important given low rates of health insurance coverage among Korean Americans (Barnes, et al., 2008; Dao, 2010; Brown, et al., 2000; KFF & APIAHF, 2008) and the potentially important role of insurance in relation to receipt of health care.

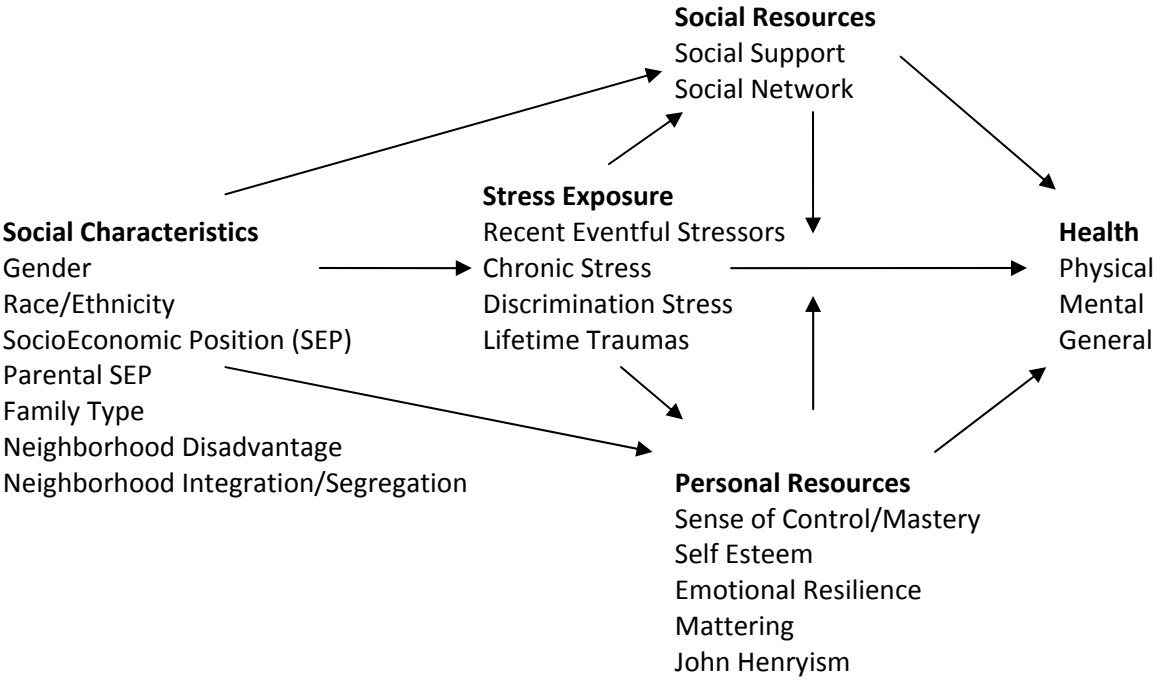
Findings will contribute to the limited literatures related to both PA and depressive symptoms among Korean Americans. The evaluation of gender differences in these relationships may be especially important given the prevalence of traditional gender roles among the U.S. Korean population described by other researchers (e.g., Bernstein, 2007; Pak, 2006; Park & Bernstein, 2008). Results may suggest important directions for future investigations and interventions focused on PA and depressive symptoms among Korean Americans, independently and in relation to one another. Consideration of similarities and differences observed in comparison to other groups with regard to PA and depression may be especially important for informing utilization of existing interventions to address these factors, with tailoring incorporated only as needed. In contrast to commonly adopted approaches which emphasize differences between population groups, consideration of similarities and differences may allow for more judicious use of resources, thereby enhancing the reach and impact of interventions aimed to increase PA and decrease depression at the population level.

Chapter 2: THEORETICAL FRAMEWORK AND ANALYTIC MODEL

The theoretical framework used to guide this research is Turner's (2010) adaptation of Pearlin's (1981) Stress Process Model. Pearlin (1999) has described the model, developed to frame investigations of relationships between social stress and stressors, personal and social resources, and health outcomes, as a general orienting framework to guide thinking regarding potentially stressful circumstances. Since its introduction, The Stress Process Model has been used extensively to identify potentially modifiable factors associated with mental health. Turner (2010) recognized the potential for The Stress Process Model to explain health disparities; his adaptation of the model is presented in Figure 3.

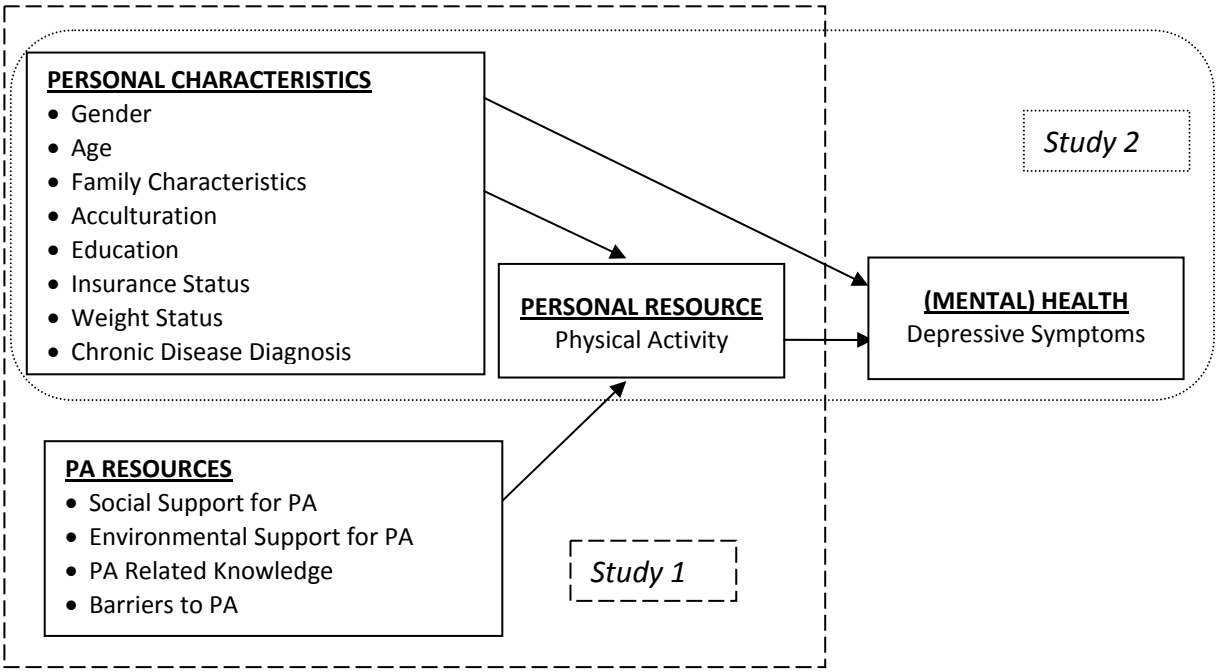
<u>Figure 3.</u> Theoretical Framework

Turner's (2010) adaptation of the Stress Process Model



This theoretical framework was chosen for its incorporation of a range of factors conceptually important to an investigation of the relationship between social factors, personal and social resources, and health. However, the complex relationships encompassed within and between constructs included in the framework exceed the scope of the present research. For this reason, the theoretical framework, research focus, and available data were used to construct an analytic model directly related to the current research endeavor (Figure 4). Specific components of the analytic model included in the two investigations conducted are noted in the figure.

Figure 4. Analytic Model



The analytic model is focused on the health outcome of depressive symptoms, and encompasses relationships between personal characteristics, PA resources, the personal resource of PA, and depressive symptoms. The personal resource of PA is the central focus of

the model. The model recognizes personal characteristics as determinants of PA, and in turn recognizes the personal resource of PA as a determinant of health outcomes, specifically depressive symptoms. The model recognizes personal characteristics to relate to health both directly and indirectly, through their relationship with personal resources.

Social and environmental resources specific to PA are also encompassed by the model, and are recognized as determinants of PA along with PA specific knowledge and barriers. A more broad focus on social support and neighborhood factors is beyond the scope of the present research and therefore not included in the analytic model.

The model depicts relationships using directional errors. However, the investigations conducted are cross-sectional in nature and therefore make it more difficult for conclusions to be drawn regarding the directionality of relationships; a recognized limitation of this research is the potential for reverse causality (i.e., PA may influence weight status rather than weight status influencing PA, or both relationships may exist simultaneously).

Chapter 3: METHODS

Data Source

Data were collected on-site at two Korean Christian churches in Los Angeles, before and after regularly scheduled Sunday church services. Members of these and neighboring churches were invited to participate in health research activities being conducted at the church including: an interview about health behaviors, basic health screening tests (blood pressure, blood glucose, cholesterol), and physical measures of height and weight. One week prior to the date of data collection, church bulletins advertised the upcoming research activity. Details of the research activity were also included in announcements made at the conclusion of church services one week prior to, and on the date of, data collection. Additionally, the research activity was announced during the meal served at the church on the date of data collection.

The first church, located in South Los Angeles, reported a total membership of approximately 400. The second church, located in the Koreatown neighborhood of Los Angeles, reported a total membership of approximately 100. At both locations, over twenty trained study staff were present at the church site from 8:30 in the morning through 4:30 in the afternoon, in order to allow for study participation prior to or following scheduled church services; the first church held three services and the second held two services. Prior to conducting data collection activities, staff members participated in a full day training session that included the following components: research ethics, human subjects' regulations, obtaining verbal informed consent, interviewer skills training, and survey administration. Interviewers practiced administration of the study survey with one another and also with a member of the research team. Staff who collected anthropormphic measurements completed

a separate two-hour training session where they practiced data collection procedures with one another and other research team members.

Eligibility Criteria

Church members were considered eligible to participate in the full research study if they were of Korean descent, over the age of 18, and were able to walk freely without the use of any assistance devices (e.g., cane, walker). Eligible participants were invited to participate in any, or all, study activities of interest to them. Ineligible participants were thanked for their interest in study activities and invited to participate in the health screening component of the study only, if they were interested.

Data Collection

Questionnaires were administered face-to-face by trained Korean American interviewers, fluent in Korean and English, and took approximately 30 minutes to complete.

Measures of height and weight were collected by trained Korean American study staff, a practicing nurse and a registered dietician educated in Korea, both fluent in Korean and English. A portable stadiometer (Seca 213 model) and digital floor scale (Detecto DR550C model) were used in these assessments. Prior to the height assessment, participants were asked to remove their shoes and those with vertical hairstyles, or "up-dos", were asked to remove ties holding hair in place until the height measurement was completed. The stadiometer arm was rested gently on the crown of the participant's head. Participants were requested to dip their chins slightly to ensure that the crown was exposed. Prior to the assessment of weight, participants were asked to remove their shoes, empty their pockets, and to remove as much clothing and jewelry as possible (i.e., remove outer coats and sweaters, watches, etc.) Height was assessed

to the nearest 1/8 of an inch and weight was assessed to 1/10 of a pound. Both height and weight were assessed three times, and in the event of variation the average of the three measures was taken. All measures of height were taken by one staff member and all measures of weight were taken by the other staff member.

The study protocol and all study measures were approved by the University of California, Los Angeles Institutional Review Board. All study participants provided verbal informed consent prior to engaging in study activities. A reimbursement of $30 was provided for study participation.

Sample

A total of 260 church members completed the interviewer administered questionnaires, 99% (257/260) in Korean language. Sample characteristics, for the total sample and separately by gender, are presented in Table 1.

The majority of participants were Korean-born (96%), over half were female (58%), and the average age was 51 years (range: 18-75). Nearly one-third (30%) of participants reported speaking no or poor English. Average length of stay and proportion of life lived in the U.S. among the sample were 18 years (range: <1 – 44) and 37% (range: <1 – 100%), respectively. A majority of participants were married or living as married (83%) and over half had at least one child living in their home (58%). Participants were well educated; over half had a four-year college degree or greater (57%). Approximately one-third of participants reported an annual income of over $50,000 (34%). Among those who were employed outside of the home, approximately two-thirds reported being self-employed or employed by a family member (66%).

Less than half of the sample reported having any form of health insurance coverage (44%) or a usual source of health care (48%).

Table 1. Sample Characteristics

		Total Sample (N = 260)	**Females** (N = 151)	**Males** (N = 109)
CATEGORICAL MEASURES		**%** (n)	**%** (n)	**%** (n)
Foreign Born		**96.2** (250)	**98.7** (149)	**92.7** (101)
Annual Income	<$20K	**16.1** (30)	**11.9** (18)	**11.0** (12)
	$20-$30K	**14.6** (38)	**10.6** (16)	**11.0** (12)
	$30-$50K	**18.1** (47)	**17.2** (26)	**19.3** (21)
	$50-$80K	**18.8** (49)	**20.5** (31)	**16.5** (18)
	> $80K	**14.7** (38)	**9.9** (15)	**21.1** (23)
Education	< HS	**9.2** (24)	**10.6** (16)	**7.3** (8)
	HS Degree	**25.8** (67)	**27.8** (42)	**22.9** (25)
	Some College	**8.5** (22)	**8.6** (13)	**8.3** (9)
	Undergrad Degree	**42.7** (111)	**45.0** (68)	**39.4** (43)
	Post Graduate Degree	**14.6** (31)	**5.3** (8)	**21.1** (23)
Any Children at Home		**57.7** (148)	**60.3** (91)	**52.3** (57)
Live as **Married**		**83.1** (216)	**88.1** (133)	**76.1** (83)
Any Health Insurance		**43.5** (113)	**39.7** (60)	**48.6** (53)
Usual Source of Health Care		**48.1** (125)	**47.7** (72)	**48.6** (53)
English	None – Poor	**30.4** (79)	**35.1** (53)	**22.9** (25)
	So-So	**52.7** (137)	**52.3** (79)	**53.2** (58)
	Well – Fluent	**9.6** (25)	**7.9** (12)	**11.9** (13)
Employment	Outside of the Home	**62.3** (157)	**56.6** (82)	**70.1** (75)
	Self/Family Member Employed^	**65.6** (103)	**50.0** (41)	**82.7** (62)
CONTINUOUS MEASURES		**Mean** (range)	**Mean** (range)	**Mean** (range)
Age in Years		**50.9** (18-75)	**50.0** (18-75)	**52.2** (18-74)
Years in US^^		**17.8** (<1-44)	**17.5** (<1-44)	**18.1** (<1-41)
% Life in US^^		**36.5** (<1-100)	**35.4** (<1-100%)	**38.0** (<1-100%)
Age at Immigration^^		**34.2** (6-69)	**32.9** (6-67)	**36.2** (9-69)

Note: ^ Data shown for participants employed outside of the home only; ^^ Data shown for Foreign-born participants only

A comparison of sample demographics with those of Koreans in the U.S., California, and the Los Angeles metropolitan area (Los Angeles, Long Beach, and Santa Ana) based on data from the U.S. Census Bureau's 2010 American Communities Survey (U.S. Census Bureau, 2012) is presented in Table 2. This comparison demonstrates that the study sample included a greater proportion foreign-born individuals, was older, more likely to be married or self-employed, and less likely to have health insurance coverage, as compared with the Korean population in the U.S., California, and Los Angeles. Levels of education, length of stay in the U.S. among those who were foreign-born, and the proportion of married individuals with children under the age of 18 in the sample however, were similar to Koreans in the U.S., California, and Los Angeles.

Table 2. Demographic Characteristics of Koreans in the Sample in Comparison to Koreans in the U.S., California, and the Greater Los Angeles Metropolitan Area*, based on data from the U.S. Census Bureau's 2010 American Communities Survey

Demographic Characteristic:	**Study Sample**	**U.S.**	**California**	**L.A.***
Median Age (years)	53	33	37	38
% Female	58.1	54.7	53.2	53.5
% Foreign Born	96.2	63.7	67.7	66.6
Lived in US ≤ 10 years	30.2	32.7	31.2	31.6
Lived in US 10-20 years	27.8	22.5	21.9	23.5
% Married	83.1	54.5	55.1	52.7
% Married with children < 18 years	31.1	26.2	25.5	24.4
% ≥ 25 yrs with ≥ 4 yr college degree	55.1	52.2	55.6	54.7
% Self-Employed	25.0	10.4	13.3	13.9
% with Any Health Insurance	43.5	75.9	72.8	68.1

* Los Angeles, Long Beach, Santa Ana

Measures

Questionnaire Development

The questionnaire was developed to assess socio-demographics, health behaviors, health conditions, psychosocial and environmental factors, health care access and utilization, as well as knowledge of current health recommendations, barriers to healthy eating and PA, and willingness and preferences regarding participation in future health related research. Korean language translations were undertaken using standardized procedures for the translation of health questionnaires (Hendricson, et al, 1989). Specifically, translation and back-translation of all questionnaire items was completed by multiple bilingual translators, with comparison of versions for equivalent item meaning used to generate a final integrated Korean version of the questionnaire. When existing Korean language versions of questionnaire items were available, as in the case of the PA measure, comparisons were made with previously translated items and variations were reviewed using a modified committee method (Garyfallos et al., 1991; Miller & Chandler, 2002). Slight modifications from publicly available translations were maintained in the final Korean language questionnaire in order to communicate the essential meaning of items to study participants. It is a recognized limitation of this research that all self-report measures are subject to measurement error and social desirability bias. All questionnaire items included in study analyses are presented in Appendix A. As noted previously, study analyses used objectively measured, rather than self-reports of, height and weight. Additional details regarding the sources of study variables and treatment of the variables in each of the investigations are provided in Appendix B.

Outcome Measures

Below, the outcome variables considered in the two investigations conducted (PA and Depressive Symptoms) are described in detail. Other study variables are described later, along with the methods of each study.

Physical Activity (PA)

Measure: PA was measured using the International Physical Activity Questionnaire short form (IPAQ-SF; Craig, et al., 2003), a widely used measure of self-reported PA. Respondents report on the frequency and duration of walking, moderate- and vigorous-intensity activities engaged in for periods of at least 10 consecutive minutes over the past 7 days. Respondents are instructed to include activities engaged in during paid work, housework, transportation, recreation, and exercise.

Scoring algorithms for the IPAQ-SF are presented by Craig and colleagues (2003) and are available online at www.ipaq.ki.se/scoring.pdf. In order to obtain summary measures of PA, weekly minutes of each type of activity are calculated. Minutes of exercise are then weighted by a metabolic equivalent (MET; multiples of resting energy expenditure; walking=3.3 METs, moderate PA=4.0 METs, Vigorous PA=8.0 METs). Based on these calculations, PA is expressed in terms of MET-min/week. The scoring mechanism allows for the consideration of PA in terms of overall activity or specifically with regard to any of the three intensities (i.e., walking, moderate, vigorous; alone or in combination). Resulting scores provide a continuous measure of PA.

Additionally, cut-points for three activity-level categories (i.e., low, moderate, high activity levels) are provided with the scoring algorithms; the Met-Min/week calculations used to

generate these levels correspond with recommendations that Americans obtain at least 30 minutes of moderate intensity PA on at least 5 days per week, or at least 20 minutes of vigorous intensity PA on at least three days per week, or some equivalent combination of moderate and vigorous intensity PA over the course of the week (Haskell, et al, 2007; Nelson, et al, 2007). Reports of PA over the past 7 days are used to assign categorical scores as follows:

- Moderate scores are assigned to individuals who report PA consistent *with any* of the following criteria: (a) 5 or more days of moderate activity or walking for a total of 30 or more minutes per day, (b) 3 or more days of vigorous activity for a total of 20 or more minutes per day, or (c) 5 days of any combination of walking, moderate, or vigorous intensity activity equivalent to at least 600 MET-Min/week
- High scores are assigned to individuals who report PA consistent *with any* of the following criteria: (a) 3 or more days of vigorous activity equivalent to at least 1500 MET-Min/week or (b) 7 days of any combination of walking, moderate, or vigorous intensity activity equivalent to at least 3000 MET-min/week
- Low scores are assigned to individuals who do not meet the criteria for moderate or high scores

Using this protocol, an individual who reported 25 minutes of walking on 3 days of the week (25 min * 3 days * 3.3 METS = 247.5 MET min) and 45 minutes of moderate activity on 2 other days of the week (45 min * 2 days * 4 METS = 360 MET min) would be assigned a moderate score (total activity = 607.5 MET-min accrued over 5 days). An individual who reported 5 days of walking for 30 minutes each day would also be assigned a moderate score.

In contrast, a high score would be assigned to an individual who reported 65 minutes of vigorous activity on 3 days of the week (65 min * 3 days * 8 METS = 1560 MET min) or to an individual who reported 7 days of activity equivalent to 3 days of walking for 90 minutes (90 min * 3 days * 3.3 METS = 891 METS), 2 days of moderate activity for 90 minutes (90 min * 2 days * 4 METS = 720 METS), and 2 days of vigorous activity for 90 minutes (90 min * 2 days * 8 METS = 1440 METS), as this activity is consistent with over 3000 MET-min (3051 total MET-min). An individual who reported 5 days of walking for 25 minutes or an individual who reported 2 days of vigorous activity for 120 minutes would receive a low score.

Development and international validation of the IPAQ-SF are described by Craig and colleagues (2003); Across 12 countries the instrument demonstrated acceptable reliability (75% of correlation coefficients were found to be above .65), strong concurrent validity with the IPAQ long form (pooled rho = .67, 95% CI: .64-.70), and moderate agreement with accelerometer measured activity (rho=.30, 95% CI: .23-.36), leading to the conclusion that the IPAQ-SF is useful tool for use in cross-cultural investigations of PA. Brown and colleagues (2004) evaluated the IPAQ-SF in comparison to three other commonly used self-report measures of PA, including Behavioral Risk Factor Surveillance Items, and concluded that the IPAQ had the best test-retest reliability and the strongest intra-class correlations for total weighted minutes of PA.

Korean Version: Validation of the Korean version of the IPAQ-SF is described by Oh and colleagues (2007), who demonstrated adequate reliability (spearman rho =.43-.65; Kappa = .37-.62) and validity (spearman rho = .27 in comparison to accelerometer) in a Korean sample.

The Korean translation of questionnaire items included in the present study varied only slightly from the measure used by Oh, et al (2007). For example, questions about sitting behavior referenced workdays and non-workdays rather than in relation to weekdays and weekends. Choi and colleagues (2008; 2011) used the long form of the IPAQ to evaluate PA among middle-aged Korean American women living in the Chicago area. To date, no published studies have used the Korean version of the IPAQ-SF in a Korean American sample.

Depressive Symptoms

Depressive symptoms were measured using the depression module of the Patient Health Questionnaire (PHQ; Koenke & Spitzer, 2002; Kroenke, Spitzer, & Williams, 2001; Kroenke, et al., 2009). The measure was developed to screen for depressive symptoms, diagnose depressive episodes, and monitor depression severity in a primary care setting, and originally included 9 items (PHQ-9; Kroenke, et al., 2001). The questionnaire is based on Diagnostic and Statistical Manual IV (DSM-IV; APA, 2000) diagnostic criteria for major depressive episode, and includes common somatic presentations of depressive symptoms (e.g., trouble falling or staying asleep, or sleeping too much; feeling tired or having little energy; poor appetite or overeating) as well as negative feelings (e.g. feeling down, depressed or hopeless; feeling bad about yourself, or that you are a failure or have let your family down). Consistent with DSM-IV diagnostic criteria, the ninth item of the PHQ-9 assesses suicidal or self-injurious ideation. Kroenke and colleagues (2009) provide evidence from several studies to demonstrate that this item, assessing suicidal or self-injurious ideation, is decidedly the least frequently endorsed item of the PHQ-9, and that its deletion has only a minor effect on scale scoring. Hence, the ninth PHQ-9 scale item was omitted to create the PHQ-8, a measure deemed appropriate for use in instances when adequate suicide

intervention may not be provided (Kroenke, et al., 2009). The U.S. Centers for Disease Control and Prevention (CDC; 2010a) used the PHQ-8 in the nationally administered Behavioral Risk Factor Surveillance Survey (BRFSS) in 2006 and 2008. The PHQ-8 was used to assess depressive symptoms in the current investigation.

The PHQ-8 is comparable to the PHQ-9 in terms of diagnosing depressive disorders. With both PHQ scales, scores of 5, 10, 15, and 20 represent mild, moderate, moderately severe, and severe depression; these validated cutoffs, can be used to diagnose depression severity (Kroenke, et al., 2001; 2009; Kroenke & Spitzer, 2002). Kroenke and Spitzer (2002) provide detailed comparisons of PHQ-8 and PHQ-9 scale characteristics. When using a diagnostic algorithm based on DSM-IV criteria, there is evidence that PHQ-9 and PHQ-8 scores of 10 or greater represent clinically significant depression (Kroenke, et al, 2001; 2009). Kroenke and colleagues (2009) investigated the sensitivity and specificity of PHQ-8 scores obtained from a U.S. population based-sample in terms of a cut-off score of 10. The sensitivity and specificity of a PHQ-8 score of 10 or greater for major depressive disorder were 100% and 95% respectively. Sensitivity and specificity of a PHQ-8 score of 10 or greater for any depressive disorder were 70% and 98% respectively.

Kroenke and colleagues (2009) also calculated likelihood ratios for any depressive disorder using suggested cut-points (i.e., 5, 10, 15, 20) and found that, compared with individuals without any depressive disorder, among individuals with any depressive disorder, a PHQ-8 score of: 5-9 is twice as likely, 10-14 is 15 times as likely, 15-19 is 103 times as likely, and 20-24 is 233 times as likely, while a score of 0-4 is 100 times less likely.

Designed for self-administration, the PHQ-8 and PHQ-9 ask respondents to report on the frequency that they have experienced symptoms over the past two weeks using four levels: not at all, on several days, on more than half of the days, nearly every day. Items are scored from 0 (not at all) to 3 (nearly every day). The PHQ-9 has been used widely to screen for depression and depressive symptoms, both self and interviewer administered, in clinical and population based settings (Kroenke, et al., 2009). The PHQ-9 has been validated as both a diagnostic and severity measure in studies of patients in primary care and obstetrics and gynecology clinics with strong evidence provided for the validity of the scale as a measure of depression severity: criterion, construct, and external validity of the measure were established, excellent internal consistency was demonstrated (alphas of .89 and .86), and strong test-retest reliability was obtained (Kroenke, et al, 2001).

Korean Version: Donnelly (2007) concluded that the PHQ-9 provides a useful tool to screen for depression among Korean Americans in a community setting, reporting excellent internal reliability (alpha = .92) for the translated scale. Due to the inclusion of somatic symptoms, Donnelly (2007) concluded that the PHQ-9 scale may provide a more accurate means of assessing depression among Korean Americans, as compared with other commonly used measures that may not effectively capture depressive symptoms expressed as somatic issues. While not emphasized by Donnelly (2007), an additional strength of the PHQ-9 (or PHQ-8) for use among Korean populations is the lack of positive affect items; other researchers have cautioned that commonly used depression measures which include positive affect components may over-estimate depressive symptoms among Koreans, due to a tendency to

refrain from expressing positive emotions observed in this group (Jang, et al., 2005; Noh, Avison, & Kaspar, 1992; Noh, Kaspar, & Chen, 1998).

Several prior studies have used the PHQ among Koreans in Korea (e.g., Cho, et al., 2007; Kim, et al., 2005; Woo, Park, Chung, & Hong, 2010) but its use among Korean Americans has been limited to date. Since Donnelly's (2007) study validating the Korean language version of the measure, three studies have used the instrument with elderly Korean Americans specifically (Donnelly & Kim, 2008; Jang, et al., 2011; Sin, Choe, Kim, Chae, & Jeon, 2010).

Data Preparation

After data collection and data entry were completed, data were descriptively examined. Items representing scales were scored and psychometric statistics were evaluated to ensure acceptable levels of internal consistency (e.g., PA, depression, environmental support for PA). Other measures representing composites of multiple variables were also calculated (e.g., BMI calculated as a function of height and weight). Distributions of variables were examined and decisions were made with regard to categorization of variables for inclusion in analyses; a majority of variables were treated as dichotomous measures given the limited size of the study sample and data were coded accordingly. Continuous variables were examined for skewedness and potential transformations of variables that may better approximate normal distributions were considered. Treatment of all study variables (e.g., dichotomous, continuous, etc.) is depicted in Appendix B.

Due to the limited sample size, it was decided that multivatiate analyses would be conducted using complete cases generated via multiple imputation of missing values of predictor variables, carried out through the chained equations approach with STATA's user-

written ICE command (Royston, 2005). Advantages of this approach include that variables are not assumed to have a multivariate normal distribution. Especially important for the present dataset, since the ICE process involves a series of univariate models rather than one large model, it has been recognized to be useful in situations in which a relatively large number of variables are to be included in the model or a relatively small number of sample cases are available (UCLA: ATS, SCG, 2011).

As a first step in the data imputation process, missing values in the original dataset were examined. It was determined that income would not be included in the imputation model as nearly one-quarter of participants (23%) were missing data for this variable and it was expected that other study variables may not be good sources of information regarding income. For example, among Koreans income tends not to be highly correlated with education (Yu, et al., 2002) or insurance coverage (Dao, 2010; Shin, et al., 2005) as it is in other groups. One prior study found that many Korean women may not even know their household incomes (Kim, 2002a).

Based on the recommendations of Graham and colleagues (2007) for multiple imputation in studies with limited sample size, 15 imputed data-sets were generated. In developing the imputation model, individual questionnaire items were used as opposed to summary measures created from multiple items, except in the case of BMI which was imputed as one continuous measure rather than as two separate measures of height and weight. Each individual item was considered to ensure that appropriate model was used to estimate the item. This process involved the specification of variables to be considered as ordered (e.g., education,

self-rated health, etc.) and variables to be considered as non-ordered categories (e.g., marital status).

All variables included in studies 1 and 2 were included in the imputation model. Specifically, these variables included: IPAQ-SF items, PHQ-8 items, gender, age, number of children in the home, marital status, percent of life lived in the US, education, smoking status, public insurance, private insurance, social support for PA items, environmental support for PA items, chronic condition items, as well as measured weight status (BMI). Auxiliary variables included those considered for inclusion in studies 1 or 2, as well as other variables thought to be conceptually important to the variables being estimated but not included in either study due to limitations of sample size or inter-relation of variables (i.e., multicollinearity threat). These variables include: number of years lived in the U.S., self-rated weight, self-reported BMI, usual source of health care, self-rated PA, self-rated health, weekly working hours, English language proficiency, nightly sleep hours, items assessing stress, items assessing acculturation, country of birth, fruit and vegetable consumption, and additional mental health items. Appendix A includes all questionnaire items included in the imputation model.

Nearly three-quarters of the sample (73%) were missing no data for variables included in the imputation model, while remaining participants were missing from 1 (14%) to 7 variables (< 1%). The total number of missing observations for variables included in the imputation model per sample participant is presented among the total sample and by gender in Table 3. The number of missing observations for each variable included in the imputation model is presented among the total sample and by gender in Table 4.

Table 3. Total Number of Missing Observations among Variables Included in Imputation Model by Proportion (and number) of Sample Participants			
# of Missing Observations	**Total Sample** (N=260)	**Women** (N=151)	**Men** (N=109)
0	72.7 (189)	72.2 (109)	73.3 (80)
1	14.2 (37)	15.9 (24)	11.9 (13)
2	5.4 (14)	5.3 (8)	5.5 (6)
3	3.1 (8)	2.7 (4)	3.7 (4)
4	3.1 (8)	2.7 (4)	3.7 (4)
5	.4 (1)	0 (0)	.9 (1)
6	.8 (2)	.7 (1)	.9 (1)
7	.4 (1)	.7 (1)	0 (0)

With regard to the data included in analyses conducted for study one and study two, the proportion of missing values per predictor ranged from 0 (gender; age) to 3% (children in the home) in study 1 and from 0 (gender; age; insurance coverage) to 8% (meet minimal PA recommendations) in study 2. Among the sample included in study one (N=240), complete data were available for 89% of participants (n=213) and values for one (10%, n=23) or two (1%, n=3) predictor variables were not available from a total of 26 participants. Of the sample included in study two (N=250), complete data were available for 86% of participants (n=216) and values for one (12%, n=31) or two (1%, n=3) predictor variables were not available for the remaining 14% (n=34) of participants.

A series of "dry-runs" were conducted to ensure that the appropriate model was being used. Initially, perfect prediction was observed for some of the variables. Use of the "boot" option (bootstrap) was considered to attend to this issue as it relaxes the assumption of multivariate normality on the distribution of regression coefficients. First though, the number of categories in variables in question were condensed (e.g., the English language ability variable was collapsed to three categories rather than five = none/poor, so so, well/fluent). Additionally,

as the model was not able to converge for marital status, this item was changed to a two-level variable (married vs. not). These tactics were successful in producing a model that converged and the "boot" option was therefore not used.

Table 4: Number of Women (N=151) and Men (N=109) Missing Each Variable

STUDY VARIABLES	Women	Men	***AUXILIARY VARIABLES***	Women	Men
PA (IPAQ – SF)			**# Years in the U.S.**	4	1
# Days Vigorous Activity	4	3	**Self-Rated Weight**	-	1
Min/Day of Vigorous Activity	4	5	**Self-Reported BMI**	1	-
# Days of Moderate Activity	2	6	**Usual Source of Health Care**	5	4
Min/Day of Moderate Activity	5	7	**Self-Rated PA**	0	1
# Days Walking	2	-	**Self-Rated Health**	1	-
Min/Day of Walking	3	-	**Weekly Working Hours**	10	2
Depressive Symptoms (PHQ-8)			**English Language Proficiency**	1	1
Little Interest/Pleasure in Doing Things	2	2	**Country of Birth**	-	-
Feeling down, depressed, hopeless	1	1	**Nightly Sleep Hours**	1	1
Sleep troubles	-	-	**Stress Items**		
Feeling tired/little energy	-	-	Unable to Control Important Things	1	-
Poor Appetite or Overeating	-	-	Ability to Handle Personal Problems	-	-
Bad Feelings (failure/let others down)	1	-	Felt Things "Going Your Way"	-	-
Trouble concentrating	-	1	Difficulties Can Not be Overcome	1	-
Moving/speaking slowly or Restlessness	-	1	1 Items Stress Measure (Rate: 1-10)	-	1
Social Support - PA			**Acculturation Items**		
Friends (offer to) exercise with you	1	-	Language Speak with Friends	-	2
Family (offers to) exercise with you	2	-	Language Newspapers/Magazines	-	1
Environmental Support – PA			Mindset/Lifestyle	-	2
- ***Access***			**Fruit/Vegetable Consumption**		
Public places (parks/sports fields/etc.)	1	-	Times ate fruit yesterday	3	1
Sidewalks	-	1	Times ate vegetables yesterday	2	2
- ***Safety***			**Mental Health**		
Public places (parks/sports fields/etc.)	1	1	Happy Person	1	1
Sidewalks	1	1	Felt Calm and Peaceful	-	1
PA Guideline Knowledge	-	-	Very Nervous Person	-	-
Time Barrier to PA	-	-	Felt Downhearted and Blue	-	-
Chronic Disease Diagnosis			Down in Dumps, Can't Cheer Up	-	1
Hypertension	1	-			
Heart Disease	-	1			
Diabetes	1	2			
Health Insurance Coverage					
Private Insurance	2	1			
Public Insurance	-	-			
Age	-	-			
Number of Children in the Home	3	4			
Marital Status	3	1			
% of Life Lived in the U.S.	4	1			
Education	4	1			
Smoking Status	2	-			
Measured BMI	0	2			

PA = Physical Activity; IPAQ-SF= International PA Questionnaire, Short Form; PHQ-8 = Eight Item Patient Health Questionnaire; BMI = Body Mass Index

Once imputed data were produced, all variables were compared to ensure that means and standard deviations, and ranges (including variable minimums and maximums) were generally similar to the original dataset. Upon confirmation of these characteristics, new variables were created for data summary measures (e.g., IPAQ-SF, PHQ-8, etc.). In keeping with von Hippel's (2007) suggestion, dependent variables for each of the studies were included in the imputation model as their omission would have artificially reduced the strength of their relationships with the independent variables, but cases with imputed values for the dependent variable were excluded from the respective investigations.

Data Analyses

Descriptive analyses are used to summarize characteristics of the study sample and to examine variation within study measures. Additionally, descriptive data are used to compare outcome measures (PA and depressive symptoms) with reports from U.S. population-level samples. Spearman correlations are calculated to examine relationships between study variables. Chi-square and t-tests are used to examine study variables in relation to the outcomes of PA and depressive symptoms, and to evaluate gender differences in study variables. Multivariate logistic regression analyses are use to estimate PA, in terms of whether or not minimal guidelines were met, as a function of: PA guideline knowledge, time barrier to PA, social support for PA, environmental support for PA, weight status, children in the home, chronic disease diagnosis, gender, age, education, marital status, and percent of life lived in the U.S. Ordinary least squares (OLS) regression is used to estimate depressive symptoms as a function of PA, chronic disease diagnosis, insurance status, gender, weight status, age, education, marital status, and percent of life lived in the U.S. Finally, seemingly unrelated

regression methods are used to jointly estimate these relationships; for these analyses the PA outcome was evaluated as a continuous measure. More detailed descriptions of study analyses are presented in relation to the individual studies in the following chapters.

Chapter 4: STUDY 1 - PHYSICAL ACTIVITY AND ASSOCIATED FACTORS AMONG KOREAN AMERICAN WOMEN AND MEN

Generally considered in aggregate with all other Asian Americans in the scientific literature, Koreans tend to be thought of as healthy and not a priority for health research. Unique characteristics of Koreans in terms of their relationship to the U.S. healthcare system as well as their mental and physical health however, illustrate a need for health-related research in this group. Investigation of modifiable health behaviors in particular, may enhance efforts to promote the health of Korean Americans. Physical activity (PA) is a health behavior with well established benefits that is currently not well understood in this group.

The few data available regarding PA among Koreans are limited by a tendency to focus exclusively on women (e.g., Choi, et al., 2008; 2011; Im & Choe, 2001; 2004; Yang, et al., 2007) and leisure-time PA (i.e., purposeful activities such as jogging, hiking, aerobics, or cardiovascular conditioning rather than activities incidental to paid work, housework, or transport; e.g., Choi, et al., 2008; Hofstetter, 2008; Yang, et al., 2007). Much remains unknown regarding PA among Korean Americans. A wide range of estimates have been generated with regard to the proportion of Koreans that meet minimal PA guidelines. Additionally, the types of activities considered to be PA, knowledge of PA guidelines, and common barriers to activity remain to be examined in this group.

Research findings published to date suggest that few Koreans engage in adequate amounts of PA to obtain health benefits; estimates based solely on leisure-time PA indicate that approximately one-fourth to one-third of Korean Americans meet minimal PA guidelines (CDC, 1997; Han, et al., 2007; Yang, et al., 2007;), with higher levels of activity documented among

men than women (Hofstetter, et al., 2008; Kandula & Lauderdale, 2005; Lee, et al, 2000b), as in the larger U.S. population and in other population subgroups (National Center for Health Statistics, 2007). When both leisure and non-leisure time PA were assessed however, over 75% of Midwestern Korean American women were found to meet minimal PA guidelines (Choi, et al., 2008; 2011).

The aforementioned rates of meeting minimal PA guidelines were estimated in accordance with the 2007 American College of Sports Medicine and American Heart Association (ACSM/AHA) PA Guidelines (Haskell, et al, 2007; Nelson, et al., 2007), or similar earlier versions of these guidelines. Estimates based on the more flexible 2008 PA Guidelines for Americans (USDHHS, 2008; 2008a) are presently lacking for Korean Americans. In order to clarify the rates of meeting minimal PA guidelines in this group, studies assessing both leisure and non-leisure time PA among Korean American women and men are needed. In light of differences in PA estimates obtained based on varied guidelines, it is important that researchers specify the guidelines used to establish rates of PA and make comparisons with studies that use similar criteria for determining PA levels.

Beyond simply establishing rates of PA among Korean Americans, research is needed to identify factors associated with PA in this group. A small number of studies have suggested that social and environmental factors, such as social support (Choi, et al., 2011; Im & Choe, 2004; Yang, et al., 2007) and perceived access to neighborhood PA (Choi, et al., 2008), may facilitate PA among Korean American women. Perceived neighborhood access to PA has also been positively associated with PA levels among Asian American women generally (Bungum, et al., 2009; Sternfeld, et al., 1999). Conversely, having young children has been reported as a barrier

to PA among Korean American women (Choi, et al., 2008; 2011). Other factors, such as perceptions of neighborhood safety (Booth, et al, 2001; Kirtland, et al., 2004; Nies, et al., 1998; Yancey, et al., 2004), knowledge of PA guidelines (Moore, et al., 2010), weight status (e.g., Brock, et al., 2009; CDC, 2008; Tucker, et al, 2011; Yancey, et al., 2004), smoking (see Kaczynski, Manske, Mannell, & Grewal, 2008 for review), and chronic disease diagnosis (Denmark-Wahnefriedet al., 2011; Neuhoser, et. al., 2002; Neutel & Campbell, 2008), that have been associated with PA in other U.S. population groups have yet to be examined among Korean Americans.

The present study aims to address significant gaps in the literature by providing a detailed description of PA and assessing rates of meeting minimal PA guidelines among Korean Americans. In addition, factors previously associated with PA among Koreans and in other population groups are examined in relation to meeting minimal PA guidelines in the study sample. This study is among the first to specifically consider PA among Korean American men as well as women and to examine variations between PA levels estimated in accordance with the 2007 ACSM/AHA PA Guidelines versus estimates based on the 2008 PA Guidelines for Americans in this group.

Hypotheses tested include the following:

A. Greater knowledge of PA guidelines, fewer barriers to PA, absence of children at home, greater environmental support for PA, greater social support for PA, healthy weight status, and lack of chronic disease diagnoses will be independently associated with greater likelihood of meeting minimal PA guidelines, controlling for gender, age, education, marital status, and percent of life lived in the U.S.

B. Children at home, social support for PA, and weight status will be more strongly associated with PA among women, as compared with men.

C. Among women, an interaction between environmental support for PA and children at home is expected such that environmental support for PA will have a stronger influence on PA for those with children at home, controlling for other study factors.

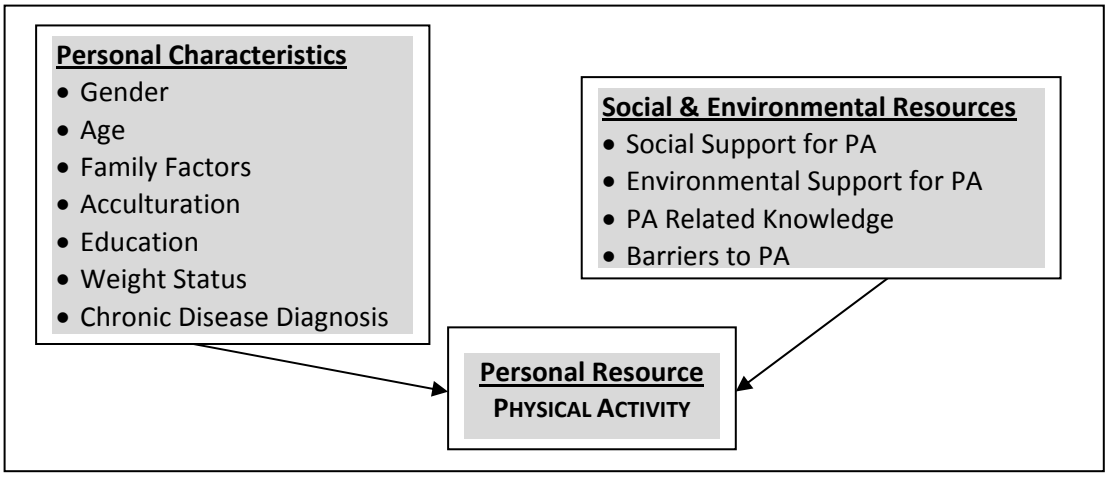
METHODS

Participant Recruitment, Eligibility Criteria, Data Collection Procedures, and the Study Survey were described previously. Methods specific to Study 1 are described below.

Analytic Model

The analytic model used to guide analyses conducted in this study is focused on the personal resource of PA, as influenced by personal characteristics and PA-specific resources. Figure 5 provides a graphic presentation of the model, including factors encompassed by the constructs of personal characteristics and PA resources.

Figure 5. Analytic Model



Measures

The present analyses focus on PA survey items: PA, modes of PA, PA guidelines knowledge, barriers to PA, as well as social and environmental support for PA. Analyses also include weight status, chronic disease diagnosis, and other demographic characteristics. Below, study measures are described in turn. All study measures are also included in Appendix A.

Physical Activity (PA) was measured using the International Physical Activity Questionnaire, short form (IPAQ-SF; Craig, et al., 2003). A detailed description of this measure was provided in Chapter 3.

The primary measure of PA used in this study was obtained by applying standard scoring criteria (available at http://www.ipaq.ki.se) to IPAQ-SF data; weekly minutes of each type of activity (vigorous PA, moderate PA, walking) were calculated and then weighted by a metabolic equivalent to create a continuous summary measure of PA. Scoring algorithms were then used to create a categorical measure of PA (low, moderate, high), which corresponds closely with 2007 ACSM/AHA PA Guidelines (i.e., not meet, meet, exceed) to obtain a minimum level of PA, through 10 minute or longer bouts of moderate or vigorous activity, that is equivalent to 30 minutes of moderate activity on 5 or more days per week (Haskell, et al, 2007; Nelson, et al, 2007). Examples of PA patterns consistent with the 3 categorical scores were provided in Chapter 3. For this study, the moderate and high categories were combined and evaluated in comparison with failure to meet minimal guidelines (i.e., low category) to maximize statistical power.

A secondary measure of meeting minimal PA guidelines was also calculated based on the IPAQ-SF data, to reflect correspondence with the 2008 PA Guidelines for Americans. The

two-to-one, vigorous-to moderate, weighting procedure (i.e., 1 minute of vigorous PA valued as 2 minutes; 1 minute of moderate PA valued as 1 minute) recommended in the first appendix of the guidelines (available at http://health.gov/PAGUIDELINES/guidelines/appendix1.aspx) was used to score PA data for these analyses, with total weekly PA of 150 minutes or more considered to meet minimal guidelines. Although the IPAQ-SF assesses walking separately from moderate activity, one minute of walking was considered equivalent to one minute of moderate activity for this measure of PA.

Examples of categorization of PA using this protocol follow. Individuals who reported: 60 minutes of walking, 30 minutes of moderate PA, and 30 minutes of vigorous PA (60 min + 30 min + 30min*weight of 2 = 150 min) or (90min*weight of 2 = 180 min) over the course of a week, or in one day, are considered to have met minimal PA guidelines. On the other hand, individuals who reported 20 minutes of walking on 7 days (20 min * 7days = 140 min), or 140 minutes of walking on one day, or 30 minutes of vigorous PA on 2 days (30min*2days *weight of 2 = 120), or 60 minutes of vigorous PA on 1 day are categorized as not having met minimal PA guidelines. Table 5 provides a comparison of the two sets of guidelines evaluated.

Modes of PA referenced by participants when responding to IPAQ-SF questions were assessed using two open-response items that immediately followed questions regarding vigorous and moderate PA. Participants were asked "*What types of activities did you think about as you answered this question? In other words, what types of vigorous (item 1) / moderate (item 2) physical activities did you do, or not do, during the past 7 days?*"

PA Guidelines Knowledge was assessed with three open-response questions; *"What is the recommended number of days per week that adults should be physically active?" "What is*

the total amount of time that adults are recommended to be physically active each week?" and *"At the minimum, how many consecutive minutes of physical activity are recommended to produce health benefits?"* These items are similar to those included in the National Cancer Institute's Health Information National Trends (HINTS) Survey (available at www.hints.cancer.gov).

Table 5: MINIMAL ACTIVITY RECOMMENDED TO OBTAIN HEALTH BENEFITS: IPAQ (2007 ACSM/AHA PA Guidelines) vs. 2008 PA Guidelines for Americans

STANDARD:	**IPAQ MEDIUM CATEGORY** (2007 ACSM/AHA PA GUIDELINES)		**2008 PA GUIDELINES FOR AMERICANS**	
PA INTENSITY:	Moderate	Vigorous	Moderate	Vigorous
GENERAL GUIDELINE:	**≥ 5 days/week of moderate PA or walking for 30 minutes per day**	**≥ 3 days/week, ≥ 20 minutes per day**	**150 minutes/week***	**75 minutes/week***
OPTIONS:	*An equivalent combination of walking, moderate, and vigorous activity on ≥ 5 days to produce ≥ 600 MET minutes/week*		*An equivalent combination of moderate and vigorous activity*	
SPECIFICALLY RECOMMENDS:	**Days of Activity per Week Minutes of Activity per Day**		**Minutes of Activity per Week**	

Note: Activity must be in bouts ≥ 10 minutes; PA= physical activity; ACSM=American College of Sports Medicine; AHA = American Heart Association; * Preference stipulated that PA be spread over the course of the week

Barriers to PA were assessed using one open response item that asked *"What is the biggest problem that you face when it comes to getting regular physical activity?"*

Social Support for PA was assessed using two items with 5 response levels ranging from never to very often: *"How often do your friends (item 1) / family members (item 2) exercise, or offer to exercise, with you?"* Items are similar to those included in the Social Support for Exercise Scale (Sallis, Grossman, Pinski, Patterson, & Nader, 1987) and the Family and Friend Support for Exercise Habits Scale (Sallis, Hovell, & Hofstetter, 1992), which has been adapted

and used with Korean American women (Choi, et al., 2008; 2011) and women of other racial/ethnic minorities (Eyler, et al., 1999). Items were scored from 0 to 4 and scores were summed to produce a continuous indicator of social support for PA.

Environmental Support for PA was measured based on respondents' perceptions regarding safety of, and access to, neighborhood PA resources (2 items per construct). Safety items included "*Public places to exercise in my neighborhood, such as parks &/or sports fields or facilities, are safe*." and "*I feel safe walking/jogging/running in my neighborhood?"* Access questions included "*Public places to exercise in my neighborhood, such as parks &/or sports fields or facilities, are accessible to me"* and *"Sidewalks are available in my neighborhood"*. Response options included 5 levels ranging from strongly disagree to strongly agree. Items are representative of those included in the Environmental Supports for Physical Activity Questionnaire (SIP 4-99 Research Group, 2002), previously used in a study of PA with Korean American women (Choi, et al., 2008). Each item was scored from 0 to 4 and scores were summed to create a continuous indicator of environmental support for PA.

Weight Status was based on calculations of Body Mass Index (BMI = kg/m^2), according to measures of participants' height and weight, obtained using a portable stadiometer (Seca 213 model) and digital scale (Deteco model DR550C); detailed information regarding the protocol used to assess height and weight was presented in Chapter 3. World Health Organization (WHO, 2004) suggested BMI cut-offs for Asian populations were used to determine participants' weight status (23, vs. 25, is the overweight cutoff), which was considered as a dichotomous variable (overweight/obese vs. not). Standard BMI cutoffs (overweight $\geq$ 25) were also assessed as a secondary measure of BMI.

Chronic Disease Diagnosis indicates diagnosis with hypertension, heart disease or diabetes, determined based on participants' responses to three questions which asked *"Has a doctor ever told you that you had hypertension* (item 1) */ heart disease* (item 2) */ diabetes* (item 3)*?"* Chronic disease diagnosis was considered as a dichotomous measure (any vs. none).

Other measures included in this report were: *children in the home* (any vs. none), *smoking* (current smoker vs. not), *education* (≥ 4 year college degree vs. less), *marital status* (married/living as married vs. not), *age* (continuous), *percent of life lived in the US* (continuous), and *gender* (female vs. male).

Statistical Analyses

Descriptive, bivariate, and multivariate analyses were performed for the total sample as well as within the two gender strata. The outcome of meeting minimal PA guidelines was examined in relation to: PA guidelines knowledge, PA barriers, social support for PA, environmental support for PA, weight status, children in the home, smoking and chronic disease diagnosis, as well as and demographic characteristics of: age, gender, education, marital status, and percent of life lived in the U.S. Analyses were conducted using chi-square and t-tests as well as multivariate logistic regression (logit). It was intended that all variables examined in bivariate analyses also be included in multivariate analyses. As described in Chapter 3, given the limited sample size, multivariate analyses were conducted using complete cases generated via multiple imputation of missing values of predictor variables, carried out through the chained equations approach with STATA's user-written ICE command (Royston, 2007). All study analyses were conducted using the STATA software package version 10.0 (StataCorp, 2007).

RESULTS

Sample Characteristics

Table 6 presents characteristics of the study sample, which includes 240 Korean American study participants who provided complete PA data. Data are presented for each of the study variables examined, among the total sample and stratified by gender.

Table 6. Sample Characteristics

	TOTAL SAMPLE (n=240)	**WOMEN** (n=141)	**MEN** (n=99)
% Sample:			
Female	58.8	--	--
Meet Minimal 2007 AHA/ACSM PA Guidelines	66.6	66.6	66.6
Meet Minimal 2008 PA Guidelines for Americans	74.2	72.3	76.8
Report ≥ 5 days PA recommended/week	54.0	52.1	56.6
Report Time as Barrier to PA	41.3	45.4	35.4
Overweight/Obese*	69.8	73.0	66.3
≥ 1 Child in the Home	59.2	63.0	53.7
Current Smoker	14.6	8.6	23.2
≥ 1 Chronic Disease Diagnosis**	39.2	33.8	46.9
≥ 4 year college degree	55.3	59.4	62.4
Married	76.6	77.1	75.8
Mean (SD) of:			
Social Support - PA	5.46 *(1.84)*	5.35 *(1.83)*	5.35 *(1.83)*
Environmental Support - PA	14.72 *(2.04)*	14.49 *(2.15)*	15.05 *(1.84)*
Safety	6.98 *(1.50)*	6.78 *(1.60)*	7.28 *(1.60)*
Access	7.74 *(1.02)*	7.71 *(1.08)*	7.71 *(1.08)*
Age	51.31 *(13.13)*	50.69 *(12.25)*	52.20 *(14.32)*
% of Life Lived in U.S.	36.98 *(22.46)*	35.43 *(19.19)*	39.14 *(26.32)*

PA = Physical Activity; *Overweight/Obese = BMI ≥ 23 (WHO, 2004); **Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes

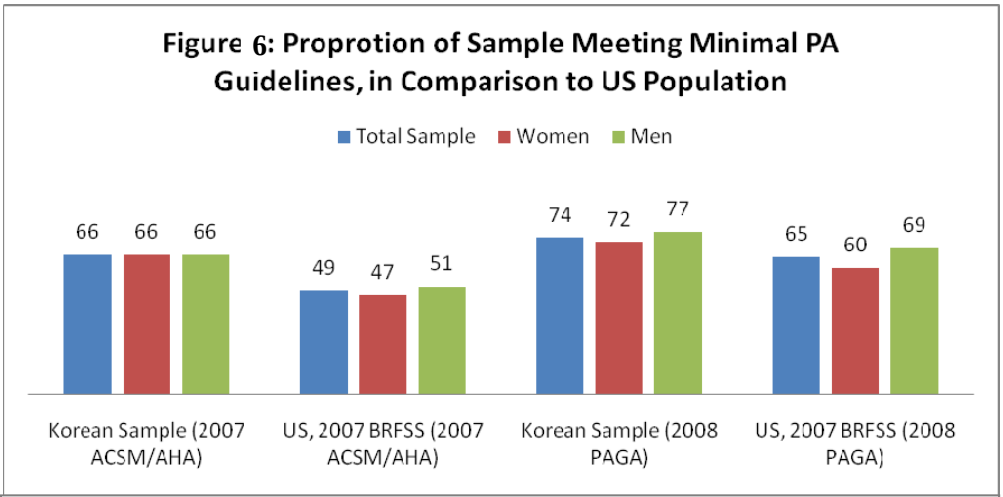
A majority of the sample was Korean-born (94%, data not included in table). Over half the sample was female (59%) and 76% were married. The sample was well educated (55% had ≥ a 4-year college degree). The mean age of participants was 51 (range: 18-75 yrs) and average time in the U.S. was 18 years (range: <1–44, data not included in table). A majority of participants (70%) were overweight or obese and over a third (39%) reported a chronic disease diagnosis. Fifty-six percent of the sample was uninsured (data not included in table) and 48% had no usual source of care (48%; data not included table). Nearly all sample participants were fluent in Korean language (99%, data not included table).

Physical Activity (PA)

Meeting Minimal Guidelines

Figure 6 illustrates the proportion of the sample that met minimal PA guidelines based on the IPAQ-SF categories, which closely correspond to the 2007 ACSM/AHA PA Guidelines (Haskell, et al., 2007; Nelson, et al., 2007), and based on the 2008 PA Guidelines for Americans (USDHHS, 2008; 2008a). Meeting minimal PA guidelines among the sample is also presented in comparison to a recent U.S. population-level sample [2007 Behavioral Risk Factor Surveillance Survey (BRFSS); CDC, 2008].

Based on the IPAQ categories, two-thirds (66.6%; equal by gender) of the sample met minimal PA guidelines (i.e., low IPAQ category). Based on the 2008 PA Guidelines for Americans, nearly three-quarters (74.2%; 72.3% women, 76.8% men) of the sample met minimal guidelines. Meeting minimal PA guidelines did not vary significantly gender, based on either guideline.



PA= Physical Activity; BRFSS = Centers for Disease Control & Prevention (CDC) Behavioral Risk Factor Surveillance Survey; 2007 ACSM/AHA= 2007 PA Guidelines, issued by The American College of Sports Medicine and the American Heart Association (Haskell, et al., 2007; Nelson, et al., 2007); 2008 PAGA= 2008 PA Guidelines for Americans, issued by the U.S. Dept of Health & Human Services (USDHHS, 2008; 2008a)

PA Intensity (Vigorous PA, Moderate PA and Walking)

Only 32% of the sample reported any vigorous PA. Moderate PA was reported by nearly three-quarters of the sample (73%) and more than one-quarter of the sample (29%) reported moderate PA on 5 or more days of the week. Walking was reported by 87% if the sample and nearly half of the sample (49%) reported walking on five or more days of the week.

Vigorous PA was more common among men than women; 46% of men reported any vigorous PA, in comparison to 22% of women ($p<.001$). Among those who reported vigorous PA, men reported an average of three times the weekly minutes of women (M: 301 vs. 103 minutes, $p=.016$). Moderate PA and walking did not vary by gender.

Modes of PA

Modes of vigorous and moderate PA reported by study participants are displayed in Table 7. A total of 34 different modes of vigorous PA (26 among women, 24 among men) and 28 modes of moderate PA (22 among women, 23 among men) were reported.

Table 7: Activities Reported as Vigorous and Moderate by Sample Participants, Listed by number of women (n=141) and men (n=99) reporting each activity

VIGOROUS ACTIVITIES	Women	Men	**MODERATE ACTIVITIES**	Women	Men
Running	71	36	Walking	41	17
Aerobics	20	1	Jogging	28	24
Weight Training	5	16	Housework	21	12
Swimming	14	5	Biking	12	11
Biking	7	11	Stretching	14	5
Soccer	2	15	Golfing	2	15
Tennis	11	6	Hiking/Climbing	10	5
Basketball	3	9	Swimming	10	2
Gym Cardio	9	3	Running	2	5
Jogging	6	3	Gym Cardio	5	1
Walking	6	3	Yard Work	2	3
Hiking/Climbing	5	2	Weight Training	1	3
Table Tennis	2	5	Table Tennis	1	3
Dancing	2	2	Dancing	2	2
Football	4	--	Yoga	4	--
Volleyball	--	4	Tennis	--	3
Badminton	1	2	Aerobics	1	1
Boxing	1	2	Basketball	--	2
Digging	--	3	Badminton	--	2
Golfing	--	2	Workplace PA	--	2
Martial Arts	--	2	Gymnastics	1	1
Workplace PA	--	2	Heavy Lifting	2	--
Calisthenics	--	1	Stair Climbing	1	1
Farming	1	--	Jump rope	2	--
Yard Work	1	--	Shopping	--	2
Gymnastics	1	--	Martial Arts	--	1
Housework	1	--	Calisthenics	1	--
Hula Hoop	1	--	Hula Hoop	1	--
Heavy Lifting	1	--			
Squash	1	--			
Stair Climbing	1	--			
Swordsmanship	--	1			
Wrestling	--	1			
Yoga	1	--			

The most commonly reported mode of vigorous PA was running (45%; 50% of women, 36% of men). Other types of vigorous PA reported by 5-10% of the sample, listed in order of frequency, include: aerobics, weight training, swimming, biking, soccer, tennis, basketball and use of "cardio machines".

The most commonly reported modes of moderate PA were walking (24%; 29% of women, 17% of men) and jogging (22%; 20% of women, 24% of men), followed by housework/cleaning among women (15%) and golfing among men (15%). Other forms of moderate PA reported by 5-13% of the sample, listed in order of frequency, include: biking, stretching, hiking and swimming.

PA Guidelines Knowledge

Participants' knowledge of minimal PA guidelines regarding days of PA per week, minutes of PA per week, and minutes of PA per bout of activity was limited. Approximately half (54%) of the sample reported that PA is recommended on 5 or more days of the week, while the remaining participants reported fewer days (M = 4.68, SD=1.49, range=2-7). Eighty-six percent of the sample reported that more than 150 minutes of PA are recommended per week whereas 13% of participants indicated that less than 150 minutes of PA are recommended weekly. On average, participants reported that 480 minutes (SD=327) are recommended weekly, with 420 representing the median minutes of weekly PA reported among participants. With regard to time per bout of PA, nearly all participants (97%) overestimated the minimal duration of 10 minutes. On average, participants reported that 39 minutes (SD=21) are recommended per bout of PA, with 30 minutes representing the median recommended minutes per bout of activity reported by participants. Reporting that five or more days of PA

are recommended per week (*PA guidelines knowledge;* yes vs. no) was investigated in relation to meeting minimal PA guidelines in bivariate (Table 9) and multivariate analyses (Table 10).

Barriers to PA

Barriers to PA reported by participants are presented in Table 8. Among women and men, time was reported most commonly (41% of sample), followed by laziness (15% of sample).

Table 8. Barriers to Physical Activity Reported by Study Participants
Listed in order of total number of participants reporting the barrier

Barrier	Women (n=141)	Men (n=99)
Lack of Time	64	35
Laziness	28	6
Poor Body Condition / "Too Hard", "Painful"	12	10
Cost / "Too Expensive"	6	7
Lack of Interest / "Boring"	9	3
Lack of Energy / "Too Tired"	3	4
Lack of facility or Equipment	6	--
Lack Willpower	3	--
Lack Activity Partner	1	2
Lack of Childcare	2	--
Difficult to maintain	1	1
Transportation	1	--
Unsafe	1	--
Gym too far away	1	--

Less frequently cited PA barriers include, in order of frequency: poor body condition, dislike of PA/think PA is boring, cost, being too tired/lack of energy, lack of facilities or equipment, lack of PA partner, lack of childcare, and lack of transportation. Whether

participants reported time as a PA barrier (*time barrier;* yes vs. no) was investigated in relation to meeting minimal PA guidelines in bivariate (Table 9) and multivariate analyses (Table 10).

Bivariate Analyses

Factors Associated with Meeting Minimal PA Guidelines

Table 9 displays the results of bivariate analyses of study factors in relation to the outcome of meeting minimal PA guidelines. Results are presented for the total sample and stratified by gender.

The factors most strongly associated with meeting minimal PA guidelines in bivariate analyses were PA guidelines knowledge and chronic disease diagnosis. A greater proportion of participants who reported that 5 or more days of PA are recommended per week (i.e., PA guidelines knowledge) than those who reported that fewer than 5 days of PA are recommended per week met minimal PA guidelines (76 vs. 56%, p=.001); this finding was consistent in gender stratified analyses, although the relationship was stronger among men (79 vs. 51%, p=.004) than women (74 vs. 58%, p=.048). In addition, a greater proportion of participants who had, versus had not, been diagnosed with hypertension, heart disease, or diabetes (i.e., chronic disease diagnosis) met minimal PA guidelines (79 vs. 59%, p=.001); whereas this was the strongest relationship observed among women in gender-stratified analyses (85 vs. 57%, p=.001), rates of meeting minimal PA guidelines did not vary significantly in relation to whether or not men in the sample had been diagnosed with a chronic disease (72 vs. 64%, p=.38).

Weight status was related to meeting minimal PA guidelines in bivariate analyses among women, but not men, and reporting time as a barrier to PA was related to meeting minimal PA

guidelines in bivariate analyses among men, but not women. A greater proportion of women in the sample who were, versus were not, overweight/obese met minimal PA guidelines (73 vs. 56%, p=.036); a similar, although non-significant, trend was observed in the total sample (70 vs. 58%, p=.08) but not among men (66 vs. 65%, p=.9). A greater proportion of men in the sample who did not, versus did, report time as a barrier to PA met minimal PA guidelines (73 vs. 54%, p=.053); a similar, although non-significant, trend was observed in the total sample (70 vs. 62%, p=.16) but not among women (68 vs. 66%, p=.81).

When weight status was examined in accordance with standard BMI cut-offs (i.e., overweight/obese $\geq$ 25) a smaller proportion of participants were categorized as overweight or obese as compared with the Asian-specific (WHO, 2004) measure (45 vs. 71%; 37 vs. 63% of women; 56 vs. 83% of men; data not included in table). Relationships observed between this measure of weight status and meeting minimal PA guidelines remained similar to those reported for weight status determined in accordance with the Asian-specific BMI cut-offs and PA in both magnitude and significance, with the exception that the relationship among women no longer reaching statistical significance. Trends were observed such that meeting minimal PA guidelines was more common among those who were, versus were not, overweight or obese, in the total sample (72 vs. 62%, p=.119; data not included in table) and among women (75 vs. 62%, p=.109; data not included in table), but not among men (69 vs. 64%, p=.57; data not included in table).

Table 9. Sample Characteristics in Relation to Meeting Minimal PA Guidelines: Results of Bivariate analyses

	TOTAL SAMPLE (n=240)			**WOMEN** (n=141)			**MEN** (n=99)		
CATEGORICAL VARIABLES									
	N (%)	**% MEET**	***P****	**N** (%)	**% MEET**	***P****	**N** (%)	**% MEET**	***P****
Gender									
Female	**141** (58.8)	66.7		---			---		
Male	**99** (41.3)	66.7	*1.0*						
PA Guideline Knowledge									
≥5 Days per Week	**129** (54.0)	76.0		**73** (52.1)	74.0		**56** (56.6)	78.6	
< 5 Days per Week	**110** (46.0)	55.5	***.001***	**67** (47.9)	58.2	***.048***	**43** (43.4)	51.2	***.004***
Time Barrier to PA									
Yes	**99** (41.3)	61.6		**64** (45.4)	65.6		**35** (35.4)	54.3	
No	**141** (58.8)	70.2	*.16*	**77** (54.6)	67.5	*.81*	**64** (64.7)	73.4	***.053***
Weight Status**									
Ovwt/Obese	**169** (71.0)	69.8		**89** (63.1)	73.0		**80** (82.5)	66.3	
Not Ovwt/Obese	**69** (29.0)	58.0	*.08*	**52** (36.9)	55.8	***.036***	**17** (17.5)	64.7	*.90*
Children in the Home									
≥ 1	**138** (59.2)	65.9		**87** (63.0)	69.0		**51** (53.7)	60.8	
None	**95** (40.8)	66.3	*.95*	**51** (37.0)	60.8	*.33*	**44** (46.3)	72.7	*.22*
Smoking									
Current Smoker	**35** (14.6)	74.3		**12** (8.6)	75.0		**23** (23.2)	73.9	
Nonsmoker	**204** (85.4)	65.7	*.32*	**128** (91.4)	66.4	*.54*	**76** (76.8)	64.5	*.40*
Chronic Disease Diagnosis***									
≥ 1	**93** (39.2)	78.5		**47** (33.8)	85.1		**46** (46.9)	71.7	
None	**144** (60.8)	59.0	***.002***	**92** (66.2)	56.5	***.001***	**52** (53.1)	63.5	*.38*
Education									
≥ College Degree	**130** (55.3)	61.5		**69** (50.4)	59.4		**61** (62.4)	63.9	
< 4 College Degree	**105** (44.7)	74.3	***.038***	**68** (49.6)	75.0	***.052***	**37** (37.8)	73.0	*.36*
Marital Status									
(Living as) Married	**183** (76.6)	64.5		**108** (77.1)	67.6		**75** (75.8)	60.0	
Not married	**56** (23.4)	73.2	*.23*	**32** (22.9)	62.5	*.59*	**24** (24.2)	87.5	***.013***
CONTINUOUS VARIABLES									
	Not Meet *M (SD)*	***Meet*** *M (SD)*	***P****	***Not Meet*** *M (SD)*	***Meet*** *M (SD)*	***P****	***Not Meet*** *M (SD)*	***Meet*** *M (SD)*	***P****
Social Support PA	5.43 (1.93)	5.47 (1.80)	*.85*	5.21 (2.06)	5.43 (1.71)	*.51*	5.73 (1.70)	5.53 (1.94)	*.62*
Envir Support – PA	14.54 (2.03)	14.81 (2.04)	*.35*	14.36 (2.13)	14.55 (2.17)	*.61*	14.81 (1.87)	15.17 (1.82)	*.37*
Age	51.89 (12.35)	51.03 (13.53)	*.63*	49.70 (12.51)	51.18 (12.15)	*.50*	55.0 (2.02)	50.80 (15.39)	*.17*
% of Life Lived in US	33.38 (17.64)	38.76 (24.36)	*.08*	36.31 (19.30)	35.00 (19.69)	*.71*	29.39 (16.12)	44.09 (29.09)	***.008***

PA = Physical Activity; *Differences between groups calculated using Chi-square and t-tests; **Overweight/Obese = BMI ≥ 23 (WHO, 2004); ***Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes

Demographic factors associated with meeting minimal PA guidelines in bivariate analyses also varied by gender. Among the total sample (p=.038) and women (p=.052), participants with less than a four-year college degree were more likely than those with greater levels of education to meet minimal PA guidelines. Among men, those who were not married, versus were (p=.013), and those who had lived on average a greater, versus lesser, proportion of their lives in the U.S. (p=.008) were more likely to meet minimal PA guidelines.

Social support for PA, environmental support for PA, children in the home, smoking status and age were not associated with meeting minimal PA guidelines in bivariate analyses. Environmental support for PA was further examined by considering access and safety separately; no relationships were found between these measures and PA.

The most commonly reported chronic disease diagnosis, hypertension (51% of sample, versus diabetes=14% and heart disease =12%), was also examined in relation to meeting minimal PA guidelines (data not included in table). Relationships observed were similar to those reported for chronic disease diagnosis in terms of significance and relationship magnitude such that those who received a hypertension diagnosis were more likely than those who had not to meet minimal PA guidelines (80 vs. 60%, p=.002). This finding was consistent among women (88 vs. 58%, p<.001), but hypertension diagnosis was not significantly associated with meeting minimal PA guidelines among men (72 vs. 64%, p=.45).

A final set of bivariate analyses was conducted to examine study variables in relation to meeting the 2008 PA Guidelines for Americans (See Appendix C for results). As in the primary analyses, participants who reported that 5 or more days of PA are recommended per week were more likely to meet minimal guidelines than those who reported that fewer than 5 days of

PA are recommended per week (82 vs. 65%, p=.002); this finding was consistent in gender stratified analyses, although stronger among men (86 vs. 65%, p=.016) than women (80 vs. 65%, p=.044). Chronic disease diagnosis was the factor most strongly associated with meeting minimal PA guidelines among women; a greater proportion of women with, versus without, a chronic disease diagnosis met minimal PA guidelines (87 vs. 64%, p = .004). As in the primary analyses, a similar trend was observed in the total sample (81 vs. 70%, p=.07), but not among men (74 vs. 81%, p = .42). In all, no significant variations were observed in factors associated with meeting minimal PA guidelines in these analyses, as compared with the primary analyses.

Gender Differences in Factors Examined in Relation to PA

Among the sample, men were significantly more likely than women to be: overweight/obese (83 vs. 63%, p=.001), diagnosed with a chronic disease (47 vs. 34%, p=.042) or a current smoker (23 vs. 9%, p=.002). Additionally, mean levels of environmental support for PA were higher among men than women (M: 15.1 vs. 14.5, p = .018); examination of access and safety separately revealed that perceived access to PA resources did not vary by gender (p=.61), but perceptions of environmental safety were greater among men as compared with women (7.27 vs. 6.78, p=.01).

The gender difference in weight status such that a greater proportion of men than women were classified as overweight/obese was also observed when considering BMI in terms of standard, rather than Asian specific, cutoffs (56 vs. 37%, p=.004). The proportion of men versus women diagnosed with hypertension alone was not significantly different (40 vs. 30%, p=.11). No significant gender differences were observed among the sample with regard to PA

guidelines knowledge, time barrier to PA, social support for PA, children in the home, age, education, marital status, or percent of life in the U.S.

Correlations between Study Variables

In order to evaluate potential multicollinearity between study variables to be included in multivariate analyses, spearman correlations among study variables were evaluated. All correlations observed were less than r=.53, suggesting that multicollinearity would not pose a problem for the analyses. In the total sample, the strongest relationships observed were between age and chronic disease diagnosis (r=.42, p<.001) and all remaining relationships between variables were less strong (r < .4). Among women the relationship between age and chronic disease diagnosis was somewhat stronger (r=.45, p<.001) and all remaining variables were less strongly correlated with one another (r < .30). Among men, the relationship between age and chronic disease diagnosis was somewhat weaker (r=.38, p<.001), marital status was associated with the presence of children in the home (r=.52, p<.001), and all remaining relationships between study variables were weaker (r<.37).

Multivariate Analyses: Factors Associated with Meeting Minimal PA Guidelines

Logistic regression models were used to examine the outcome of meeting minimal PA guidelines in relation to: PA guidelines knowledge, PA barriers, social support for PA, environmental support for PA, weight status, children in the home, and chronic disease diagnosis, as well as demographic characteristics of: gender, age, education, marital status, and percent of life lived in the U.S. Although included in bivariate analyses, smoking was not considered in multivariate analyses due to the limited number of smokers in the sample and the desire to conserve degrees of freedom in hypothesis-testing.

Results of these analyses, among the total sample and stratified by gender, are presented in Table 10.

Controlling for covariates, PA guidelines knowledge and chronic disease diagnosis remained the factors most strongly associated with meeting minimal PA guidelines. Reporting that five or more days of PA are recommended per week (PA guideline knowledge) was associated with over twice the odds of meeting minimal PA guidelines as was reporting that fewer than five days of PA are recommended per week (OR: 2.63, p=.002) and diagnosis with a chronic disease (i.e., hypertension, heart disease, or diabetes) was associated with three times the odds of meeting minimal PA guidelines in comparison to lack of such a diagnosis (OR=3.09, p=.002). Controlling for other covariates, the demographic factors of college education (OR: .47, p=.019) and higher age (OR=.96, p=.010) were associated with lower likelihood of meeting minimal PA guidelines.

In gender stratified multivariate analyses, chronic disease diagnosis was the factor most strongly associated with meeting minimal PA guidelines among women and PA guideline knowledge was the factor most strongly associated with meeting minimal PA guidelines among men. Among women, a diagnosis of hypertension, heart disease or diabetes (i.e., chronic disease diagnosis), versus a lack thereof, was associated with over five times the odds of meeting minimal PA guidelines controlling for other factors (OR: 5.69, p=.001).

Among men, reporting that five or more days of PA are recommended per week (i.e., PA guideline knowledge), versus fewer days, was associated with over four times the odds of meeting minimal PA guidelines after controlling for other factors (OR: 4.19, p=.007). Reporting

time as a barrier to PA, versus not, was associated with a decreased likelihood of meeting minimal PA guidelines in multivariate analyses among men (OR: .30, p=.030).

Table 10. Factors Associated with Meeting Minimal PA Guidelines: Results of Logistic Regression Analyses

VARIABLE:	Odds Ratio (95% CI; p-value)		
	TOTAL SAMPLE (N=240)	**WOMEN** (N = 141)	**MEN** (N=99)
Female	1.28 (.67-2.43; .458)	--	--
PA Guidelines Knowledge (≥ 5 days/week)	**2.63** *(1.44-4.81; .002)*	1.82 (.82-4.04; .143)	**4.19** *(1.48-11.83; .007)*
Time Barrier to PA	.58 (.32-1.08; .084)	.91 (.40-2.04; .815)	**.30** *(.10-.89; .030)*
Overweight/Obese*	1.68 (.85-3.32; .134)	1.95 (.85-4.49; .117)	1.82 (.44-7.54; .408)
≥ 1 Child in the Home	1.12 (.59-2.14; .728)	1.62 (.68-3.84; .272)	.97 (.31-3.04; .956)
≥ 1 Chronic Disease Diagnosis**	**3.09** *(1.50 – 6.35; .002)*	**5.69** *(1.95-16.62; .001)*	2.02 (.63-6.44; .234)
≥ 4 Year College Degree	**.47** *(.25-.89; .019)*	.46 (.20-1.04; .061)	.75 (.24-2.36; .619)
Married/Living as Married	.92 (.42-2.05; .845)	1.22 (.45-3.33; .694)	.48 (.08-2.71; .405)
Social Support PA^	1.01 (.85 -1.19; .910)	1.01 (.80-1.27; .941)	1.02 (.78-1.35; .865)
Environmental Support PA^	1.08 (.93-1.25; .337)	1.01 (.83-1.22;.953)	1.15 (.87-1.53; .322)
Age^	**.96** *(.94-.99; .010)*	**.97** *(.93-1.00; .053)*	.96 (.91-1.02; .163)
% of Life Lived in US^	1.01 (.99-1.02; .238)	.99 (.97-1.01; .479)	1.03 (1.00-1.05; .065)

PA = Physical Activity; *Overweight/Obese = BMI ≥ 23 (WHO, 2004); ** Chronic Disease = Diagnosis of Hypertension, Heart Disease, or Diabetes; ^ = continuous measure

Multivariate analyses were repeated substituting weight status determined in accordance with standard cut-offs versus the WHO (2004) Asian specific cutoffs (model results presented in Appendix D); results were similar to the original model, including significance of all covariates and magnitude of all relationships. Of note however, the pattern observed in primary analyses such that being overweight/obese versus of lower weight status (OR: 1.95, p=.117) was associated with greater odds of meeting minimal PA guidelines among women in the sample, was diminished when standard weight status cut-offs were applied (OR: 1.62, p=.271).

Multivariate analyses were also repeated substituting diagnosis with hypertension alone for the summary measure of chronic disease diagnosis (model results presented in Appendix E). Results were similar to the original model, including significance of all covariates and magnitude of all relationships.

A final series of multivariate analyses was conducted to examine the outcome of meeting the minimal 2008 PA Guidelines for Americans (model results presented in Appendix F). Results of these analyses were largely similar to those depicted in Table 10, with a few exceptions observed among the total sample and among men. Specifically, among the total sample, weight status was significantly associated with meeting minimal PA guidelines such that being overweight or obese, versus not, was associated with twice the likelihood of meeting minimal PA guidelines (OR: 2.02, p=.048); similar patterns were observed among women (OR=2.01, p=.115) and men (OR=3.40, p=.102). In the total sample, the odds ratio for chronic disease diagnosis (OR: 1.84, p=.113) was smaller than in the original model and not statistically significant, but all other relationships were similar to those observed in the original model.

Among men, a time barrier to PA was not significantly associated with meeting minimal PA guidelines, after controlling for other factors (OR: 3.77, p=.022), but all other relationships remained consistent with those observed in primary analyses. No differences were observed among women in comparison to the primary analyses. When standard weight status cut-offs were substituted for the Asian-specific cut-offs in models that estimated PA in keeping with the 2009 PA Guidelines for Americans (see Appendix G for model results), weight status was not significantly associated with meeting minimal PA guidelines among the total sample (OR: 1.31, p=.415), or in gender stratified analyses among women (OR: 1.15, p=.757) or men (OR: 2.02, p=.256).

Additional models were estimated among the total sample to examine interactions between gender and factors that varied in gender stratified analyses (PA guideline knowledge; time barrier to PA; chronic disease diagnosis; age). No significant interactions were observed between gender and these study variables in relation to meeting minimal PA guidelines (see Appendix H for results).

Support for Hypothesized Relationships

In the following section, results specific to the study hypotheses are reviewed. Support for hypotheses varied by gender therefore, results are reviewed in relation to gender. Hypothesis A predicted that greater knowledge of PA guidelines, fewer barriers to PA, absence of children at home, greater environmental support for PA, greater social support for PA, healthy weight status, and lack of chronic disease diagnoses would be independently associated with greater likelihood of meeting minimal PA guidelines, controlling for gender, age, marital status, percent of life lived in the U.S., and education. Hypothesis B predicted that children at

home, social support for PA, and weight status would be more strongly associated with PA among women, as compared with men. Finally, hypothesis C predicted an interaction between environmental support for PA and children at home among women such that environmental support for PA would have a stronger influence on PA among women with children at home, controlling for other study factors. The data provided support for some of the relationships predicted in hypothesis A, but did not support hypotheses B or C.

The expected relationships between PA guideline knowledge and a time barrier to PA were observed among men in the sample, but not among women. With regard to the relationship between knowledge of PA guidelines and meeting minimal PA recommendations, the data demonstrated a similar pattern among women and men, but provided no evidence of a relationship between reporting time as a barrier with meeting minimal PA guidelines among women. With regard to chronic disease diagnosis, the opposite relationship from what was expected was observed among women such that diagnosis with a chronic disease was associated with greater odds of meeting minimal PA guidelines (OR=5.69, p=.001); chronic disease diagnosis was not associated with meeting minimal PA guidelines among men.

Contrary to expectations, no significant relationships were observed between children in the home, environmental support for PA, social support for PA, or weight status with meeting minimal PA guidelines among women or men. Results did suggest that there may be a stronger relationship between weight status and meeting minimal PA guidelines among women than men, however this relationship was in the opposite direction from what was predicted such that greater weight status appeared to be associated with greater likelihood of meeting minimal PA guidelines among women (OR: 1.95, p=.117). This relationship was diminished

when Asian specific BMI cut-offs (WHO, 2004) were replaced with standard BMI cut-offs (OR: 1.62, p=.271) however; weight status was not associated with meeting minimal PA guidelines among men regardless of the BMI cut-offs evaluated.

Results did not provide support for the expected interaction between environmental support for PA and children in the home with PA among women in the sample, nor was this interaction significant in the total sample or among men (data not included in table). Findings indicated that environmental support for PA is not associated with meeting minimal PA guidelines among sample participants, regardless of whether children are present in their home. It should be noted that initial models used to examine this interaction were suggestive of quasi-complete separation of the data (data not included in table). This issue arises in cases of logistic regression when outcome data are overly separated in relation to a variable or multiple variables, and is observed most frequently in analyses used to investigate relationships among relatively small samples (UCLA: ATS, SCG, 2012). In this instance, data are overly separated among the sample when evaluating whether or not minimal PA recommendations are met in relation to presence or absence of a child in the home as well as environmental support for PA. In an additional effort to examine this study hypothesis, data were stratified by whether or not children were present in the home (data not included in table). Environmental support for PA was not significantly associated with whether or not minimal PA guidelines were met among women with or without children in the home; consistent findings were obtained among men and in the total sample.

DISCUSSION

Findings add to the presently limited literature regarding PA among Korean Americans, illustrate the importance of including Korean women and men in PA-related research, and highlight methodological issues related to the assessment and reporting of PA levels in this and other groups. Higher rates of meeting minimal PA guidelines observed in the sample in comparison to the larger U.S. population suggest that church-going Koreans may be important to consider as a model for other groups with lower levels of PA. This may be particularly true for church-going Korean women, whose levels of activity were equal to men in the sample and among whom greater weight status and chronic disease diagnosis were associated with a greater likelihood of meeting minimal PA guidelines. These findings are in contrast with other groups in which men are more active than women and where greater weight status and chronic disease diagnosis have been associated with lower levels of activity. Despite these key differences, results demonstrate that Koreans are quite similar to other Americans with regard to many aspects of PA; similarities were observed with regard to types and intensity of PA reported, knowledge of PA guidelines, and barriers to PA, indicating that many existing PA related materials may be appropriate for use among Koreans.

In the following section, similarities and differences observed among sample participants in comparison to the larger U.S. population are considered, along with potential explanations for and implications of these findings. Factors most strongly associated with meeting minimal PA guidelines among sample participants, and gender differences in these factors, are discussed. Important methodological considerations regarding the assessment of

PA illustrated by study findings are also discussed and multiple suggestions for future research are proposed.

Results indicate that **meeting minimal PA guidelines may be more common among Koreans than in the overall U.S. population** and illustrate the importance of clearly identifying the specific PA guidelines referenced, in order that appropriate comparisons may be made across groups. According to the 2007 ACSM/AHA PA Guidelines, two-thirds of Koreans in the sample obtained minimal levels of activity needed to gain health benefits, in contrast to one-half of a 2007 U.S. population-level sample (CDC, 2008; USDHHS, 2001b). According to the slightly more flexible 2008 PA Guidelines for Americans, approximately three-quarters of Koreans in the sample met minimal guidelines, as compared with two-thirds of the 2007 population-level sample (CDC, 2008; 2010b). Equal levels of activity among women and men in the sample were especially surprising given that lower levels of PA have consistently been found among women in comparison with men, both across the U.S. population and within racial/ethnic subgroups (Bauman, et al., 2009; National Center for Health Statistics, 2007; Troiano, et al., 2008), including Korean Americans (Kandula & Lauderdale, 2005; Lee, et al., 2000b).

Rates of PA in the sample were *lower* however, than rates observed among a sample of Korean women in the Chicago metropolitan area (Choi, et al., 2008; 2011); based on the 2007 ACSM/AHA PA Guidelines, 75% of Korean women in that sample obtained minimally recommended levels of PA. This difference may illustrate regional variation in PA among Korean Americans. Such variations have been observed in the larger U.S. population (CDC, 2008). Although markers of acculturation were not significantly associated with PA *within*

either sample, *between* group differences may be related to acculturation to U.S. lifestyle, which has been positively associated with regular PA among Koreans (Song, et al., 2004). Comparable measures of acculturation were not available across the two samples, however all women were fluent in Korean language and over 70% of each sample had lived in the U.S. for 10 or more years. Still, acculturation to U.S. lifestyle may be greater among Korean women in Chicago than Korean women in Los Angeles, which is home to the largest concentration of Koreans outside of Korea (U.S. Census Bureau, 2005). Additional studies are needed to confirm potential regional variations in PA levels among Korean Americans and to determine whether these variations are associated with acculturation to U.S. lifestyle or other factors.

Higher levels of PA observed among Koreans in comparison to the larger U.S. population suggest that **Koreans, particularly women, could serve as an important model for other groups with lower levels of PA**. Self-reports are known to yield over-estimations of PA levels (Troiano, et al., 2008; Woodcock, Franco, Orsini, & Roberts, 2011) however, and both racial/ethnic (Ham & Ainsworth, 2010; Tucker, et al., 2011) and gender (MacKay, Oliver & Schofield, 2011) differences in inflation of self-reported PA have been identified, making cross-group comparisons challenging. The degree to which Asian Americans, including Koreans, over-report PA in relation to other racial/ethnic groups is presently unknown. At a population-level, a tendency for men to over-report PA to a greater degree than women (MacKay, et al., 2011) has been observed, but it is not known whether this pattern is consistent among Koreans.

In other groups, gender variations in over-reporting of PA have been attributed largely to lower levels of vigorous PA among women than men, since vigorous PA most frequently corresponds to leisure-time activity, which tends to be more memorable than activities

incidental to paid work, housework, or transport (MacKay, et al., 2011). Unlike many studies that focus only on leisure-time activities however, PA in the sample was assessed using a measure (IPAQ-SF) that aims to capture both leisure and non-leisure time activities. Consistent with findings among the larger U.S. population (Troiano, et al., 2008) and among Korean Americans (Hofstetter, et al., 2008), vigorous PA was less common among women than men in the sample. Many women in the sample (15%) did report housework as moderate PA. The proportion of women who actually engaged in housework is likely much higher than this though, since Korean Americans tend to maintain traditional gender roles (Pak, 2006). When specifically assessed, Choi and colleagues (2011) found that housework corresponded to weekly PA that met minimal guidelines among a third of Korean women in their sample. If women were less likely to over-report PA than men, like in other groups, the equal rates of PA observed by gender in the study sample may actually represent higher rates of meeting minimal PA guidelines among Korean women than men.

On the other hand, additional details related to participants' reports of the types of activities that they referenced when reporting their own PA indicate that women in the sample may have over-reported their PA to a greater degree than men. Specifically, inappropriate categorization of activities with regard to their intensity and over-reporting of walking may have resulted in over-estimation of total PA among the sample, and these issues were observed more commonly among women than men. For the most part, participants appropriately categorized activities as either moderate or vigorous in intensity. A small portion of participants however, a majority of them women (15% vs. 8% of men), identified stretching as moderate PA and walking as vigorous PA; these designations are likely inappropriate and would

result an over-estimation of total PA level. A larger concern with regard to over-reporting of PA is that many participants, a majority of them women (33% vs. 20% of men), reported referencing walking when responding to questions regarding moderate or vigorous PA even though walking was assessed as a separate form of activity. Reporting time spent walking in response to multiple survey items would have resulted in an over-estimation of total PA and may have masked lower levels of PA among women in comparison to men, since this occurred more frequently among women than men in the sample. These issues suggest that equal rates of PA observed among women and men in the sample may actually reflect a greater likelihood for Korean men to meet minimal PA recommendations than Korean women, which would be consistent with findings in other groups and the larger population.

The aforementioned concerns underscore the importance of focusing on participants' process for responding to self-report questions. Had participants not been asked to report on the types of activities that they referenced when responding to study questions, these concerns would have gone un-acknowledged. In future studies, researchers should take steps to ensure that participants clearly understand the specific types of activities that are to be reported in relation to questions posed. In order to determine the degree to which Koreans over-report PA, how this compares with other racial/ethnic groups, and to examine gender differences in over-reporting of PA among Koreans, studies that pair objective measures of PA (i.e., accelerometry) with self-reports are needed in this group.

While rates of activity observed among sample participants were higher than in the larger population, the fact that **one-quarter to one-third of Koreans failed to obtain the minimal levels of activity needed to obtain health benefits**, depending on the guidelines used,

should not go unrecognized. Efforts to increase PA levels among those who failed to meet minimal recommendations are needed. Given the limitation of over-reporting inherent to self-reported measures of PA (Troiano, et al., 2008; Woodcock, et al., 2011; Tucker, et al., 2011) and the recognized dose-response relationship between PA and health benefits (Woodcock, et al., 2011; Pate, et al., 1995), efforts to increase PA more broadly among Koreans may be most appropriate. **Similarities observed between Koreans and other Americans, with regard to types of PA, guideline knowledge, and barriers to PA suggest that extensive tailoring of resources used to promote PA at the population level may not be necessary for this group.**

The types of activities that sample participants most commonly reported as PA (e.g., running, walking, jogging, aerobics, housework, and wide range of sporting activities) did not demonstrate cultural specificity or uniqueness among Koreans as compared with other Americans (Brownson, Eyler, King, Brown, Shyu, & Sallis, 2000; Ham, Kruger & Tudor-Locke, 2009). It was somewhat surprising that fewer than 10% of participants reported hiking as an example of PA, since prior reports from Korean American women (Im & Choe, 2001; 2004), and much conventional thinking, note hiking as an especially popular activity in this population. It is possible that the sample represented fewer hikers than are commonly found in the Korean community. However, since participants were asked to report on the types of activities that they referenced when thinking of PA, rather than the activities that they specifically engaged in, it is unlikely that especially popular activities in the Korean community would be uncommonly reported. The types of activities that were commonly reported indicate that educational materials highlighting activities such as running or jogging, various sports, house and yard work, or walking, that are common in the general U.S. population (Brownson, et al., 2000; Ham, et al.,

2009), would be appropriate for use among Koreans and **tailored materials highlighting exceptional or culturally-specific activities are likely not needed for this group**.

Further similarity between Koreans and the larger U.S. population was observed with regard to low levels of PA guidelines knowledge (Bennett, Wolin, Puelo, Masse, & Atienza 2009; Moore, et al., 2010). The proportion of Koreans in the sample who reported that 5 or more days of PA are recommended per week was approximately equal to that obtained from a 2005 U.S. population-based sample (54 vs. 57%; Bennett, et al., 2009). In the present sample, these reports were associated with a greater likelihood of meeting minimal PA guidelines. That this finding was consistent regardless of whether meeting minimal PA recommendations was estimated based on the 2007 ACSM/AHA PA Guidelines, which specifically recommended 5 or more days of activity per week, or the 2008 PA Guidelines for Americans, which do not specifically recommend a number of weekly activity days, is noteworthy. This may indicate that sample respondents were unaware of recent changes in PA guidelines or may simply demonstrate that thinking more days of PA are recommended throughout the week is associated with a greater likelihood of meeting minimal PA guidelines.

In as much as reports correctly reflected PA guideline knowledge among sample participants, a reasonably strong understanding of the 2007 ACSM/AHA PA Guidelines was demonstrated by those participants who reported that 5 or more days of PA are recommended per week. Study participants responded to an open- ended question, as compared with participants in the aforementioned population-level sample who chose between several options to select the correct guideline. This difference is question format (i.e., open response vs. multiple-choice) likely explains why study participants were much less likely than those in

the U.S. population-level sample (Bennett, et al., 2009) to correctly report the total number of PA minutes recommended per week (14 vs. 86%).

In contrast to the U.S. sample where women were more likely than men to correctly identify PA guidelines, no gender differences were detected in the current Korean sample with regard knowledge of PA guidelines. Gender differences were observed however, in the relationship between PA guideline knowledge and PA. Whereas reporting that 5 or more days per week of PA are recommended was the factor most strongly associated with an increased likelihood of meeting minimal PA guidelines among men, this relationship was less pronounced among women and failed to persist when controlling for other factors. Additional research is needed to determine whether the knowledge, in accordance with the 2008 PA Guidelines for Americans, that no particular number of days of PA are recommended is associated with PA levels among Koreans or the larger U.S. population. Moreover, studies are needed to determine whether increases in various aspects of PA guideline knowledge are associated with increases in PA, and whether these relationships vary by gender.

Low levels of PA guidelines knowledge may be associated with barriers to PA, which were also similar among sample participants and the larger U.S. population (CDC, 2011; Sallis & Hovell, 1990; Sallis, et al., 1992); time was the most frequently reported barrier to PA among Koreans in the sample, followed closely by barriers indicative of a lack of motivation such as laziness and lack of interest. Reporting time as a PA barrier was associated with a decreased likelihood of meeting minimal PA guidelines among men in the sample, based on the 2007 ACSM/AHA PA Guidelines, but not on 2008 PA Guidelines for Americans. This is not especially surprising since the later guidelines are relaxed with regard to when specifically during the

week PA is to be obtained. Given that nearly all participants were unaware that health benefits are associated with brief bouts of PA lasting only 10 minutes (on average the amount was overestimated by nearly four times) and a large majority over-estimated the minimal weekly activity recommendation of 150 minutes of moderate activity (by over three times on average), materials that highlight these aspects of the PA guidelines would be appropriate for use among Koreans and may mitigate the perception of time as a barrier to PA. Additional research is needed to determine whether addressing low levels of knowledge related to the aforementioned components of PA guidelines reduces perceptions of time as a barrier to PA and whether such reductions are associated with increased PA levels, among Koreans or in the larger population, and to examine gender differences in these relationships. **Gender differences observed in the relationship between time barrier and meeting minimal PA guidelines suggest that increasing knowledge of the duration of PA recommended per bout of activity and per week may be effective at increasing rates of PA among Korean men.**

Whereas PA guideline knowledge and a time barrier to PA were associated with PA among men in the sample, diagnosis with a chronic disease was associated with PA among women. That women diagnosed with hypertension, heart disease, or diabetes were more likely to meet minimal PA guidelines than women who had not received one of these diagnoses indicates that **diagnosis with a chronic disease that may be controlled by PA may serve as a teachable moment for increasing PA among Korean women**. That a larger proportion of men than women in the sample were diagnosed with chronic disease, yet these diagnoses were more strongly associated with meeting minimal PA guidelines among women than men, suggests a need for greater encouragement of Korean men to increase PA levels following

diagnosis with a chronic disease that may be controlled through PA. The relationship between chronic disease and PA among Korean women is contrary to that observed in other groups and the larger U.S. population (Denmark-Wahnefried, et al., 2011; Neuhoser, et. al., 2002; Neutel & Campbell, 2008). The gender differences observed, however, are in keeping with prior research that found greater PA levels and knowledge regarding the benefits of PA for hypertension control among hypertensive Korean women as compared with hypertensive Korean men (Han, et al., 2007).

In addition to chronic disease diagnosis, results indicate that elevated weight status may be associated with increased PA among KA women; this finding is also in contrast to associations observed in the larger U.S. population (CDC, 2008). Recommendations from medical professionals may play a role in this relationship; among a U.S. population-based sample, physicians were more likely to recommended lifestyle modification to hypertensive patients who were obese than to those who were not (Xu & Ragain, 2005). On the other hand, results may reflect an issue associated with inappropriate categorization of participants as overweight/obese based on recommended cutoffs for Asians (WHO, 2004) that are lower for those of members of other groups. This may explain why the relationship between weight status and PA was diminished when standard weight status cutoffs were applied. This explanation is in keeping with results of a recent study by Zeng and colleagues (2011) which suggests that the standard weight status cutoffs are most appropriate for determining health risk among Asians. An alternative explanation for the observed relationship between weight status and PA is that women in the sample represent a group sensitive to health threats, given that they were recruited at an event that offered free health screenings. A prior study found

that health behavior changes following a health threat were more common among women of elevated weight status than men (Lemon, Zapka & Clemow, 2004). Further research is needed to confirm the relationships between chronic disease diagnosis and weight status with PA among Koreans, and to determine the underlying reasons for these relationships. It would be useful to consider whether or not a medical professional recommended PA, generally or as a means of controlling chronic disease, in relation to PA among Korean women and men in future research; these factors were not assessed in the present sample. Prospective studies are needed to establish causality between chronic disease diagnosis and increased PA levels among Korean Americans, to determine the roles of weight status and medical professionals' recommendations in this relationship, and to examine gender differences in these areas.

Interestingly, a recent study found that health and weight related goals were associated with relatively less PA over time than goals related to quality of life (Segar, Eccles & Richardson, 2011). Although these relationships were observed after controlling for weight status, health status was not accounted for in the study. Health goals may be more salient for Koreans, and therefore associated with higher levels of PA, in comparison to members of other groups who are more likely to have health insurance and a usual source of care. Still, this would not explain gender differences observed in the relationships between chronic disease and weight status with PA. Of note, prior research conducted in a large (N=1,302) randomly selected Australian sample also found that PA was associated with objectively measured weight status among women but not among men, although in that study greater PA was associated with lower weight status (Ball, Owen, Salmon, Bauman, & Gore, 2001). Prospective research is needed to

examine the relationship between weight status and chronic disease diagnosis with PA related goals, including potential racial/ethnic and gender differences in these relationships.

Demographic factors found to influence the likelihood of meeting minimal PA guidelines among study participants were age and educational attainment. Lower levels of activity in relation to older age are commonly observed in PA research and therefore this relationship was not unexpected among the study sample. Prior findings regarding the relationship between education and PA have been mixed however. The inverse relationship between these factors in the sample may be resultant of the inclusion of non-leisure time activities in the assessment of PA. Those with less education are likely to engage in greater amounts of PA in their daily lives (e.g., physically engaging occupation rather than sedentary office work, walking or bicycling rather than driving to get from place to place, doing household chores rather than hiring someone else to do them), in comparison to those with more education. The reason for lack of a relationship between education and PA among men in the sample is not clear however and merits further study.

A number of factors that had previously been associated with PA among Korean American women, including children in the home, social support for PA, and environmental support for PA, were not found to relate to PA among women or men in the sample. Prior studies that have observed relationships between children in the home with PA have specifically focused on young children (generally less than 5 years old). Due to the small number of parents of very young children in the study, such a measure was not possible and therefore presence of any children in the home was assessed instead. It may be that the presence of younger, versus older, children in the home has a greater negative influence on PA.

Where social and environmental supports for PA are concerned however, study measures were consistent with those used in prior research. That very few participants referenced social or environmental factors as barriers to PA provides additional support for the findings that these may not be especially important determinants of PA in this group. Additional research is needed to further examine these relationships, particularly since they were associated with greater levels of PA among Korean American women in prior research (Choi, et al., 2008; 2011) and are central to the analytic model for this study. It should be noted that the theoretical model used to guide this research suggests that more general forms of social and environmental support are important influences on personal resources (PA in this study). It may be useful to include such measures in future research focused on PA among Korean Americans, in order to more clearly understand the determinants of this important health behavior.

Taken together, results of this study represent a significant contribution to the presently limited literature regarding PA among Korean Americans. Findings demonstrate key similarities and differences between PA among Koreans in comparison to the larger U.S. population and illustrate important gender differences in PA among Koreans. This study is among the first to specifically examine PA among Korean American men, and gender stratified analyses provided an opportunity to evaluate differences in the relationship between factors examined in relation to PA. Had these analyses not been considered, valuable information regarding varied importance of chronic disease diagnosis and PA guideline knowledge with regard to increasing likelihood of meeting minimal PA guidelines among women and men would have gone unrecognized. As prior studies in this population have not included men, and it is widely

recognized that Koreans tend to espouse traditional and specific gender roles, it was important to evaluate PA in this manner despite the relatively small sample size, a recognized limitation of this study. In addition to the mixed gender sample, other noteworthy strengths of the study include utilization of a well-validated and widely recognized measure of PA, use of objectively measured height and weight to assess weight status, and comparative assessment of PA in keeping with the two most commonly used variations of PA guidelines.

The measure of PA used (IPAQ) has been identified as the best candidate for a standard measure of PA (Woodcock, et al., 2001), yet it is not without limitations of which the reader should remain aware. Other researchers have cautioned that PA guidelines were established based largely on leisure-time activity (Bauman, et al., 2009) and it has been suggested that IPAQ levels may over-estimate guideline correspondence, and advised that the moderate IPAQ be viewed as an absolute minimum amount of PA to achieve health benefits (Bergman, Grjibovski, Hagstromer, Bauman, & Sjostrom, 2008). Conversely, the IPAQ may overestimate correspondence with guidelines in keeping with the 2008 Physical Activity Guidelines for Americans (USDHHS, 2008; 2008a), since they include no specific recommendation regarding days of activity per week. The secondary set of analyses in which the PA outcome was determined in relation to the 2008 PA Guidelines for Americans was included in order to explore variations in PA levels determined in accordance with differing guidelines.

Of the three proposed methods for scoring PA in relation to the 2008 PA Guidelines for Americans, the method employed has been found to provide the central estimate (Tucker, et al., 2011) and was therefore considered the most appropriate for use in this study. Still, estimates may be limited by the consideration of walking as equivalent to moderate PA. Given that the

IPAQ has been identified as the most appropriate self-report measure for use across studies, specific scoring algorithms in keeping with the 2008 PA Guidelines for Americans are needed.

With regard to PA measures, it is also important to note that PA levels among the U.S. population, used for comparisons with the study sample, were obtained from the Behavioral Risk Factor Surveillance Survey, which specifically excludes PA engaged in during paid work and does not assess walking separately from moderate PA. These differences may have contributed to the higher levels of PA observed among Koreans in the sample versus the U.S. population. Data from an international study of PA using the IPAQ-SF indicated that 84% of Americans met minimal PA guidelines (Bauman, et al., 2009). Based on these results, levels of PA in the sample are lower than those of the U.S. population.

Other limitations of this study include that all data, except for participants' height and weight, were obtained from self reports and are therefore subject to bias. Additionally, study participants represent a convenience sample of Los Angeles Korean church members who were recruited to participate in a health study that included both free health screening tests. As such, they may have been especially motivated with regard to health or have had a high need for health services and may not be representative of the larger Korean American population. Finally, the cross-sectional nature of the data precludes the identification of causal relationships between study variables. Prospective research is needed to further examine PA in this group.

In sum, this study contributes significantly to the presently limited literature focused on PA among Korean Americans, a rapidly growing population group with unique health characteristics that may make health behaviors such as PA particularly important. Higher levels of PA in contrast with the larger U.S. population suggest that Koreans may serve as an

important model for other groups with lower levels of PA. In terms of efforts to increase PA among less active Koreans, similarities observed with the larger U.S. population suggest that extensive cultural tailoring of existing materials is likely unnecessary for this group. Gender differences in factors associated with PA however, may be particularly important to consider when addressing PA among Koreans. Findings point toward numerous important directions for future research.

Chapter 5: STUDY 2 - PHYSICAL ACTIVITY AND DEPRESSIVE SYMPTOMS AMONG KOREAN AMERICAN WOMEN AND MEN

Relatively little research has aimed to identify modifiable factors associated with depressive symptoms among Korean Americans. This is troubling given tremendous growth observed in the Korean American population in recent years (Hoeffel, et al., 2012; Oh, et al., 2002; U.S. Census Bureau, 2005; 2008; 2012) and evidence from research in other groups to suggest that even relatively low levels of depressive symptoms may be associated with impaired functioning (Cuijpers, et al., 2004; Hjarsbech, et al., 2011; Lewinson, et al., 2000; Preisig, et al., 2001; Rai, et al., 2011) or more advanced stages of clinical depression over time if left untreated (Broadhead, et al., 1988; Cuijpers, et al., 2004; Cuijpers & Smit, 2004; Fogel, et al., 2006; Lewinson, et al., 2000; Maier, et al., 1997; Shankman, et al., 2009). In order to determine how best to mitigate the burden of depression among Korean Americans, studies are needed to identify modifiable factors associated with the depressive symptoms experienced in this group.

Due to cultural factors pervasive in the Korean community that inhibit discussion of emotion (Beernstein, 2007; Donnelly, 2001; Kim & Rew, 1994; Park & Beernstein, 2008) and prevalent structural barriers to the receipt of health care (Barnes, et al., 2008; Brown, et al., 2000; Dao, 2010; KFF & APIAHF, 2008) reported among Korean Americans, addressing depression medically in this group may be challenging. Physical activity (PA) in a potentially important target for efforts to address the experience of depressive symptoms among Korean Americans, given the well established negative association between PA and depression based on research in other groups (Camacho, et al., 1991; Conn, 2010; DeMoor, et al., 2006; Ensel & Lin, 2004; Farmer, et al., 1988; Fox, 1999; Goodwin, 2003; Paluska & Schenk, 2000; Rehorst, et al. 2009; Stephens, 1988; Strine, et al., 2006; Strohle, 2009; Taylor, et al., 2004; Weyer, 1992),

including Koreans in Korea (Park & Han, 2003). Both the World Health Organization (WHO, 2002) and the National Institute for Mental Health (NIMH, 2010) recognize PA as useful for reducing symptoms of depression. The relationship between PA and depression has not yet been examined among Korean Americans however. The present research was conducted to address this gap in the literature.

Few prior studies have sought to evaluate whether meeting minimal PA guidelines is associated with depressive symptoms and none have evaluated the relationship between PA, at minimally recommended or other levels, and depressive symptoms among Asian Americans generally, or Korean Americans specifically. It is important to understand depression in relation to these levels of PA as they are the levels commonly promoted in PA-focused public health efforts.

In this study, PA in keeping with the 2007 ACSM/AHA guidelines (Haskell, et al., 2007; Nelson, et al., 2007) is examined in primary analyses. Secondary analyses examine PA in terms of the 2008 PA Guideline for Americans (USDHHS, 2008; 2008a). PA was examined in relation to depressive symptoms independently and in association with chronic disease diagnosis and insurance status.

Prior analyses, described in Chapter 4, revealed a positive relationship between diagnosis with a hypertension, heart disease, or diabetes with greater levels of PA among Korean American women. This finding is in contrast to the relationship observed between chronic disease diagnoses with PA in other groups (Denmark-Wahnefried, et al., 2011; Neuhoser, et. al., 2002; Neutel & Campbell, 2008). Additionally, such diagnoses have been associated with higher levels of depressive symptoms in other groups (e.g., Anderson, Freeland,

Clouse, & Lustman, 2001; Rugulies, 2002; Stine, et al., 2008; Wulsin & Singal, 2003) and have been associated with worse self-rated mental health among older Korean Americans (Jang, et al., 2011). For these reasons, it was deemed important to examine the influence of chronic disease diagnosis, and the joint influence of PA and chronic disease diagnosis, on depressive symptoms among Korean Americans in this investigation.

Health insurance status was also examined, both independently and in association with PA, in relation to depressive symptoms in this study. As noted previously, low rates of health insurance coverage have been documented among Koreans in comparison to other U.S. groups (Barnes, et al., 2008; Brown, et al., 2000; Dao, 2010; KFF & APIAHF, 2008) and lack of insurance coverage has been found to be less closely associated with socio-economic status or acculturation among Koreans than in other U.S. groups (Dao, 2010; Shin, et al., 2005). Prior studies have observed greater levels of depression among uninsured versus insured members of other groups after controlling for demographic factors and markers of socio-economic status (Lesser, et al., 2005; Mauksch, et al., 2001). Lack of health insurance coverage has also been associated with underuse of mental health services in other groups (e.g., Wells, Sherbourne, Sturm, Young, & Burnam, 2002; Wang, et al., 2005) and findings from one of the largest surveys of Korean Americans indicated that insurance coverage was the factor most strongly associated with health care use (Shin, et al., 2005). Furthermore, insurance status may influence the cost of chronic-disease related care and therefore may contribute to a relationship between chronic disease diagnosis and depressive symptoms. For these reasons, it was deemed important to examine health insurance status in relation to PA and depressive symptoms here.

This study was conducted in order to expand the presently limited literature regarding depression among Korean Americans by assessing symptom levels and examining PA, in keeping with minimally recommended levels, in relation to depressive symptoms. Hypotheses predicted the following relationships, controlling for covariates of gender, age, education, marital status, weight status, and percent of life lived in the U.S.:

D. Failure to meet minimal PA guidelines, chronic disease diagnosis, and lack of health insurance coverage will be independently associated with greater depressive symptoms.
E. An interaction will be observed between PA and chronic disease diagnosis such that the relationship between chronic disease diagnosis and depressive symptoms will be stronger among those who fail to meet minimal PA guidelines, as compared to those who meet minimal PA guidelines.
F. An interaction will be observed between PA and insurance status such that the relationship between lack of health insurance and depressive symptoms will be stronger among those who fail to meet minimal PA guidelines, as compared to those who meet minimal PA guidelines.
G. An interaction will be observed between chronic disease diagnosis and insurance status such that the relationship between lack of health insurance coverage and depressive symptoms will be stronger among those with a chronic disease diagnosis, as compared to those without such diagnoses.
H. A three-way interaction will be observed between PA, chronic disease diagnosis, and insurance status such that the interaction between chronic disease diagnosis and insurance

status will be stronger among those who fail to meet minimal PA guidelines as compared with those who meet minimal PA guidelines.

METHODS

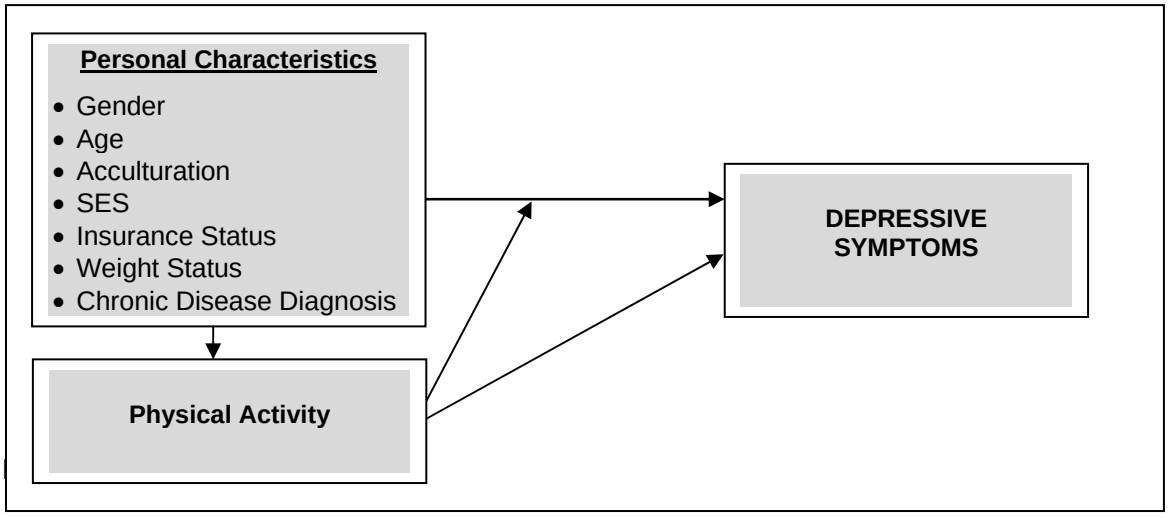
Participant Recruitment, Eligibility Criteria, Data Collection Procedures, and the Study Survey were described in Chapter 3. Methods specific to Study 2 are described below.

Analytic Model

The analytic model used to guide analyses conducted in this study is focused on the outcome of depressive symptoms, as influenced by the personal resource of PA and personal characteristics. Figure 7 provides a graphic presentation of the analytic model.

Analyses presented in this chapter focus on participants' reports of depressive symptoms, PA, chronic disease diagnoses, and health insurance coverage as well as their gender. Analyses also include weight status and other demographic characteristics. Questionnaire items are described below and are presented in Appendix B.

Figure 7. Analytic Model



Measures

The present analyses focus on items that assess depressive symptoms, PA, health status, and insurance status. Analyses also include weight status and other demographic characteristics. Below, study measures are described in turn. All study measures are also included in Appendix A.

Depressive Symptoms were measured using the depression module of the Patient Health Questionnaire (PHQ; Koenke, et al., 2001; 2009); specifically, the eight-item version of this measure (PHQ-8). Respondents report on the frequency that they have experienced symptoms over the past two weeks using four levels: not at all, on several days, on more than half of the days, nearly every day. Items are scored from 0 (not at all) to 3 (nearly every day). Scores of 5, 10, 15, and 20 represent mild, moderate, moderately severe, and severe depression; these validated cutoffs, can be used to diagnose depression severity (Kroenke, et al, 2001; 2009; Kroenke & Spitzer, 2002). Chronbach's alpha for the 8 scale items in the study sample was .75 (males: .72; females: .77). A detailed description of this measure, including use of the Korean version, was provided in chapter 3.

This study evaluated depressive symptoms as a continuous measure. Initial consideration of the data included all participants who provided complete PHQ-8 data (N=255). With the exception of descriptive analyses comparing the sample to the larger U.S. population, the sample was further restricted to exclude participants with PHQ-8 scores representing moderately-severe or greater levels of depression (i.e., PHQ-8 scores $\geq$ 15). This decision was made in light of the recognized need for psychotherapeutic and/or drug treatment for participants with moderately severe or severe depression (MacArthur & MacArthur, 2009), as the study examines PA in

relation to depressive symptoms because PA is a potentially modifiable factor that may be addressed outside of traditional health care settings, and in an effort to obtain a more normal distribution of the depressive symptoms outcome in the study sample. Secondary analyses focus more closely on a further restricted sample that excludes participants with low levels of depressive symptoms indicating that treatment may not be needed (i.e., PHQ-8 scores <5).

Physical Activity (PA) was measured using the International Physical Activity Questionnaire, short form (IPAQ-SF; Craig, et al., 2003). As in the prior study, PA is considered in terms of whether or not participants obtained minimally recommended levels of PA in keeping with the 2007 AHA/ACSM guidelines (Haskell, et al, 2007; Nelson, et al., 2007). Secondary analyses examine PA in keeping with the 2008 PA Guidelines for Americans (USDHHS 2008, 2008a). A detailed description of the IPAQ-SF was provided in prior chapters (3 and 4). A summary of differences in the two PA guidelines evaluated, and details regarding scoring of IPAQ-SF data based on both guidelines, was provided in Chapter 4.

Chronic Disease Diagnosis indicates diagnosis with hypertension, heart disease or diabetes, determined based on participants' responses to three questions which asked *"Has a doctor ever told you that you had hypertension* (item 1) */ heart disease* (item 2) */ diabetes* (item 3)*?"* Chronic disease diagnosis was considered as a dichotomous measure (any vs. none). As in the prior study (Chapter 4), secondary analyses were conducted to examine whether or not hypertension alone had ever been diagnosed (yes vs. no).

Insurance Coverage was assessed using two questions. Specifically, participants were asked *"Do you have any private health insurance?"* and "*At this time, do you have Medicaid/Medical?"* The second question was preceded by a brief explanation;

"*Medicaid/MediCal is a health insurance program that pays for medical care for certain low-income children and their families, pregnant women, and disabled or elderly people."* Responses to these questions were used to create a single dichotomous measure reflecting lack of any (public or private) insurance coverage among participants (no coverage vs. any coverage).

Other measures included in this report were: *weight status* (overweight/obese vs. not), based on measures of participants height and weight and scored based on World Health Organization suggested BMI cut-offs for Asian populations (BMI $\geq$ 23 = overweight; WHO, 2004), *education* ($\geq$ 4 year college degree vs. less), *marital status* (married/living as married vs. not), *age* (continuous), *percent of life lived in the US* (continuous), and *gender* (female vs. male). As in the prior study (Chapter 4), a secondary measure of weight status, consistent with standard BMI cut-offs for general populations (overweight $\geq$ 25) was also examined in relation to depressive symptoms.

Statistical Analyses

Descriptive, bivariate, and multivariate analyses were performed for the total sample and within the two gender strata. The outcome of meeting depressive symptoms was examined in relation to: PA, chronic disease diagnosis, insurance coverage, and demographic characteristics of: weight status, marital status, age, education, percent of life lived in the US, and gender. Spearman correlations, chi-square, and t-tests were used to examine all study variables in relation to depressive symptoms and to assess potential gender differences in each of the variables. The data were also stratified by PA (met minimal guidelines vs. not) and chronic disease diagnosis (diagnosed with hypertension, heart disease or diabetes, vs. not) in order to allow for preliminary investigations of predicted two-way interactions in relation to

depressive symptoms (i.e., PA x insurance status, PA x chronic disease diagnosis, chronic disease diagnosis x insurance status) thorough bivariate comparisons.

Ordinary Least Squares Regression Analyses

Next, multivariate analyses were conducted using ordinary least squares (OLS) regression methods. First, potential transformations of the depressive symptoms outcome were considered to determine whether any would enhance the fit of the data to a normal distribution. OLS models were then used to examine PA, chronic disease diagnosis, and insurance status in relation to depressive symptoms, first alone (i.e., 3 factor models), and then controlling for gender, weight status, education, marital status, age, and percent of life lived in the U.S. Hypothesized interactions were examined, in turn, in subsequent series of analyses. When multiple interactions were significant at the $p \leq .1$ level, final models were estimated to include each of those interactions. All variables examined in bivariate analyses were included in multivariate models.

Seemingly Unrelated Regression Analyses

Due to the fact that this study is the second of two investigations aimed to evaluate PA and depressive symptoms, an additional effort was made to account for the shared error variance in the estimation of each of these factors in this research (e.g., PA as estimated in study 1 and depressive symptoms as estimated in study 2). Shared error variance in the estimation of depressive symptoms and PA was expected for multiple reasons, including: association between the outcomes, shared factors assessed in relation to the outcomes, and that both outcomes and all other study factors were obtained from the same sample. For these reasons, a final series of multivariate analyses was conducted using seemingly unrelated

regression (SUREG) methods to estimate depressive symptoms as a function of PA, chronic disease diagnosis, insurance status, and demographic factors, while controlling for shared variance in errors associated with total PA (estimated as a function of guideline knowledge, time barrier, environmental support for PA, social support for PA, children in the home, chronic disease diagnosis, weight status, education, marital status, age, percent life lived in the U.S., and gender, as in the prior study; see Chapter 4).

As presented by Zellner (1962), SUREG models are comprised of a set of linear equations across which errors are correlated. SUREG methods promise gains in efficiency over OLS estimations of the individual equations by considering the equations as a system using an application of generalized least squares estimation, commonly referenced as feasible generalized least squares (FGLS; Timm, 2002). It bears noting that alternatives to FGLS estimation have been introduced for use with SUREG models, but FGLS is recommended for applications of SUREG in small samples (Beasley, 2008) and was therefore used in this study.

This research places greater emphasis on the general nature of relationships between independent factors and depressive symptoms, therefore the precision of estimates obtained is not of critical importance to study conclusions. Still, gains in efficiency and reductions in bias of estimates obtained from the use of SUREG methods were sought in an effort to bolster confidence in findings obtained using OLS methods and to provide greater clarity with regard to non-statistically significant trends observed in OLS analyses.

In order to conduct the SUREG analyses, which combine multiple OLS equations, it was necessary to consider the PA outcome as a continuous measure. In contrast to most studies which employ SUREG methods to increase efficiency of estimates obtained in all study

equations, here the estimation of total PA in SUREG analyses was specifically carried out in an effort to reduce bias in the estimates obtained from OLS analyses of depressive symptoms. For the purposes of the present series of investigations, factors associated with a continuous PA outcome are of less interest than those associated with whether or not minimal PA guidelines were met, as was evaluated in the prior study (see Chapter 4).

Due to the known positive skew of the continuous PA data, the initial step in SUREG analyses was the consideration of potential transformations that may provide a better fit to a normal distribution. The first series of SUREG analyses was conducted to jointly estimate depressive symptoms as a function of study variables (i.e., meeting minimal PA guidelines, chronic disease diagnosis, insurance status, weight status, education, marital status, age, percent of life lived in the US, and gender) and total PA as a function of independent factors evaluated in relation to meeting minimal PA guidelines in the prior study (i.e., guideline knowledge, time barrier, environmental support for PA, social support for PA, children in the home, chronic disease diagnosis, weight status, education, marital status, age, percent life lived in the U.S., and gender; Chapter 4). Subsequent series of SUREG models were estimated to examine interactions observed to be significant at the $p \leq .1$ level in OLS analyses of the outcome measures.

Given the limited sample size, multivariate analyses were conducted using complete cases generated via multiple imputation of missing values of predictor variables, carried out through the chained equations approach with STATA's user-written ICE command (Royston, 2007). Additional details regarding data imputation were provided previously in Chapter 3. All analyses were conducted using the STATA software package version 10.0 (StataCorp, 2007).

Due to the fact that the SUREG command may not be combined with multivariate analyses in multiple ICE-imputed data-sets, SUREG analyses were conducted using one of the complete datasets generated.

RESULTS

Sample Characteristics

The analytic sample included 250 Korean American study participants who provided complete depressive symptoms data and reported symptoms consistent with moderate or lesser depression. Characteristics of the sample in relation to each of the variables examined in study analyses are presented in Table 11.

A majority of the sample was Korean-born (94%, data not included in table). The sample was well educated (58% had $\geq$ a 4-year college degree), over half were female (59%), and 78% were married. The mean age of participants was 51 (range: 18-75 yrs) and average time in the U.S. was 18 years (range: <1–44, data not included in table). A majority of participants (71%) were overweight or obese and over a third (37%) reported a diagnosis of hypertension, heart disease, or diabetes (chronic disease diagnosis). Fifty-six percent of the sample had no public or private health insurance (insurance coverage) and half (50%) reported no usual source of care (data not included in table). Nearly all sample participants were fluent in Korean language (99%, data not included in table).

Table 11. Sample Characteristics

	Total Sample (N = 250)	**Women** (N = 145)	**Men** (N = 105)
Categorical Variable: *% of sample (N)*			
Female	58.5 (145)	--	--
Met Minimal PA Rec^	67.0 (154)	65.9 (89)	68.4 (95)
Chronic Disease Diagnosis^^	37.3 (92)	32.9 (47)	43.3 (45)
No Insurance Coverage	56.0 (140)	58.6 (85)	52.4 (55)
Overweight or Obese^^^	70.6 (175)	61.4 (89)	83.5 (86)
≥ College	57.7 (140)	54.3 (76)	62.3 (64)
Married	78.1 (192)	78.1 (111)	77.9 (81)
PA Guideline Knowledge*	53.8 (129)	51.8 (73)	56.6 (56)
Time Barrier to PA*	41.3 (99)	45.4 (64)	35.4 (35)
≥ 1 Child in the Home*	59.8 (146)	63.4 (90)	54.9 (56)
Continuous Variable: *Mean (SD)*			
Depressive Symptoms	4.85 (3.23)	5.28 (3.29)	4.26 (3.06)
Age	50.9 (13.21)	50.38 (12.53)	51.62 (14.11)
% of Life Lived in U.S.	36.76 (22.61)	35.89 (19.56)	37.94 (26.25)
Environmental Support PA*	14.72 (2.04)	14.49 (2.15)	15.05 (1.83)
Social Support PA*	5.46 (1.84)	5.36 (1.83)	5.60 (1.86)
Square Root of Total PA*	44.85 (28.09)	42.57 (25.84)	48.10 (30.85)

Note: PA = physical activity; ^Met 2007 ACSM/AHA Minimal PA Guideline (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004); * Presented for participants with complete PA data only (n=240, 141 women; 99 men)

Depressive Symptoms

A comparison of the proportion of individuals with PHQ-8 scores representing varied levels of depression severity (no, mild, moderate, moderately-severe to severe) between all study participants who provided complete PHQ-8 data (N=255) and a 2006 U.S. population-level sample (Kroenke, et al., 2009) is presented in Table 12. Compared with the U.S. sample, a greater proportion of study participants were categorized as having mild to moderate depression (47 vs. 21%) and fewer were categorized with no depression (51 vs. 76%).

As mentioned previously, for the purposes of all remaining study analyses, participants with levels of depressive symptoms indicative of moderately severe to severe depression (i.e., PHQ-8 score ≥ 15) were excluded from the study sample. This affected five participants, four categorized with moderately severe depression (3 women and one man) and one woman categorized with severe depression. The resulting analytic sample, described briefly under "Sample Characteristics" and in Table 11, included 250 participants who reported symptoms consistent with moderate or lesser depression. Mean levels of depressive symptoms among participants in the remaining analytic sample were 4.85 (SD=3.23, range 0-14). Nearly half of the sample (48%) had PHQ-8 scores of 5 or greater, consistent with mild-moderate depression; among these participants, average PHQ-8 scores were 7.56 (SD=2.43, range 5-14).

TABLE 12. PROPORTION OF STUDY SAMPLE EXPERIENCING VARIOUS LEVELS OF DEPRESSIVE SYMPTOMS, IN COMPARISON TO U.S. POPULATION

	STUDY SAMPLE (N=255)			**U.S. POPULATION** *(2006 BRFSS; Kroenke, 2009)*
Depressive Symptoms: PHQ-8	Total (N=255)	Women (N=149)	Men (N=106)	Total Sample (N=198,678)
0-4: No Depression	51.4%	45.6%	59.4%	75.8%
5-9: Mild Depression	38%	40.9%	33.9%	15.9%
10-14: Moderate Depression	8.6%	10.7%	5.7%	5%
≥ 15: Moderately Severe –Severe Depression*	2%	2.7%	1%	3.5%

BRFSS = Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance Survey; * Sample participants scoring in this level of depressive symptoms were excluded from the study sample and were not included in analyses

Bivariate Analyses

Factors Associated with Depressive Symptoms

Table 13 presents the results of bivariate analyses examining all study variables in relation to depressive symptoms. The factors most strongly associated with depressive symptoms in bivariate analyses included gender, insurance status, and weight status. Average levels of depressive symptoms were greater among women than men in the study sample (M: 5.28 vs. 4.26, p =.014). With regard to depression severity, women were more likely than men to have PHQ-8 scores consistent with mild–moderate depression (53 vs. 40%, p=.04; data not included in table), as opposed to lower levels of depressive symptoms. Among participants with mild-moderate depression (N=119), women did not report significantly higher levels of depressive symptoms than men (M: 7.74 vs. 7.24, p=.28; data not included in table).

Greater mean levels of depressive symptoms were observed among participants without, versus with, health insurance coverage (M: 5.3 vs. 4.27, p =.012). As depicted in Table 13, similar patterns were observed in gender stratified analyses. Insurance status was the only factor significantly associated with depressive symptoms in bivariate analyses among women (p =.048) and no significant relationships were observed in bivariate analyses among men.

Among all study participants, average levels of depressive symptoms were greater among those who were not, versus were, overweight/obese (M: 5.75 vs. 4.47, p=.004). When weight status was evaluated in terms of standard BMI cutoffs (overweight $\geq$ 25) however, this difference was not observed (M: 4.99 vs. 4.69, p=.44; data not included in table).

Table 13. BIVARIATE ANALYSES OF STUDY VARIABLES AND DEPRESSIVE SYMPTOMS OUTCOME

	Total Sample (N = 250)	**Women** (N = 145)	**Men** (N = 105)
Categorical Variable *Proportion of sample (N); [Mean Depressive Symptoms: Category vs. Referent, p]*			
Female	58.5% (145) ***[5.28 vs. 4.26, .014]***	--	--
Met Minimal PA Recommendation^	67.0% (154) *[4.86 vs. 4.93, .87]*	65.9% (89) *[5.28 vs. 5.11, .77]*	68.4% (95) *[4.29 vs. 4.67, .59]*
Chronic Disease Diagnosis^^	37.3% (92) ***[4.44 vs. 5.10, .12]***	32.9% (47) *[4.91 vs. 5.53, .29]*	43.3% (45) *[3.96 vs. 4.41, .46]*
No Insurance Coverage	56.0% (140) ***[5.3 vs. 4.27, .012]***	58.6% (85) ***[5.73 vs. 4.63, .048]***	52.4% (55) *[4.64 vs. 3.84, .18]*
Overweight or Obese^^^*	70.6% (175) ***[4.47 vs. 5.75, .004]***	61.4% (89) ***[4.91 vs. 5.86, .09]***	83.5% (86) ***[4.02 vs. 5.41, .09]***
≥ College	57.7% (140) *[4.91 vs. 4.75, .70]*	54.3% (76) *[5.46 vs. 5.05, .46]*	62.3% (64) *[4.27 vs.4.28, .99]*
Married	78.1% (192) ***[4.64 vs. 5.44, .10]***	78.1% (111) *[5.12 vs. 5.55, .52]*	77.9% (81) ***[3.98 vs. 5.30, .07]***
Continuous Variable *Mean (SD, range); Pairwise correlation with depressive symptoms [r, p]*			
Age	50.9 (13.21, 18-75) *[.07, .28]*	50.38 (12.53, 18-75) *[.05, .54]*	51.62 (14.11, 18-74) ***[.45, .07]***
% of Life Lived in U.S.	36.76 (22.61, 0-100) *[.03, .67]*	35.89 (19.56, 0-100) *[.06, .52]*	37.94 (26.25, 0-100) *[.10, .24]*

Note: Mean depressive symptoms in the total sample = 4.85 (SD=3.23, range=0-14); [p] = Differences between groups calculated using Spearman correlations and t-tests; PA = physical activity; ^Met 2007 ACSM/AHA Minimal PA Guideline (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004); * Significant gender difference observed in study variable

No significant differences in depressive symptoms were observed among participants in relation to PA, chronic disease diagnosis, education, marital status, age, or proportion of life lived in the U.S. However, data suggest that average levels of depressive symptoms may vary in relation to chronic disease diagnosis (p=.12) and marital status (p=.10), with greater symptoms observed among participants who reported no, versus any, chronic disease diagnoses and who were not, versus were, married. Among men only, data indicate that average levels of depressive symptoms may be positively associated with age (p=.07)

Greater differences in average levels of depressive symptoms were observed among sample participants when secondary measures of PA and chronic disease were considered. Whereas no differences were observed in average levels of depressive symptoms in relation to whether or not the 2007 AHA/ACSM PA guidelines were met, when PA was considered in terms of the 2008 PA Guidelines for Americans (data not included in table), average depressive symptoms were objectively lower among those who met, versus did not meet, minimal PA guidelines (M: 4.7 vs., 5.4, p=.13); this difference was less pronounced among women (M: 5.1 vs. 5.6, p=.47) than men (M: 4.18 vs. 5.25, p=.18). When chronic disease diagnosis was considered in terms of hypertension only (data not included in table), greater differences in average levels of depressive symptoms were observed than when hypertension was considered along with heart disease and diabetes. Specifically, higher average levels of depressive symptoms were observed among those without, versus with, hypertension diagnoses (M: 5.12 vs. 4.21, p=.04); this difference was more pronounced among women (M: 5.58 vs. 4.51, p=.08) than men (M: 4.4 vs. 3.87, p=.39).

Secondary Measure of Depressive Symptoms: Mild-Moderate Depression

Bivariate analyses previously described were repeated in a restricted sample that included only those participants who were categorized as having mild-moderate, versus lower levels, of depressive symptoms (N=119; 117 women and 42 men). Insurance status was the only factor by which average levels of depressive symptoms varied in this group. As in the complete sample, symptoms were greater among those without, versus with, any health insurance coverage (M: 7.96 vs. 6.98, p=.04). Also consistent with findings from the complete

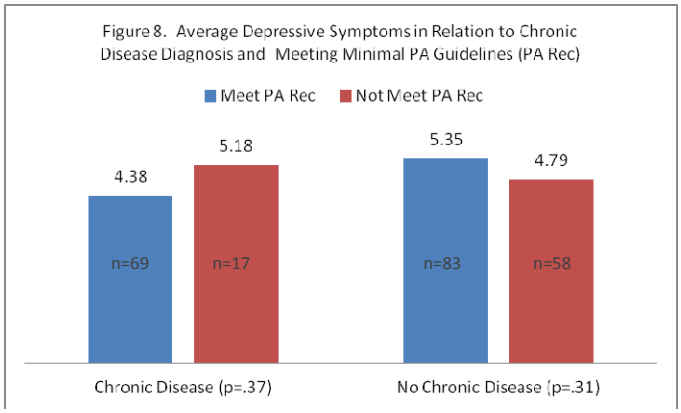
sample, this difference was observed in stratified analyses among women (M: 8.3 vs. 6.9, p=.01) but not among men (M: 7.32 vs. 7.12, p=.79).

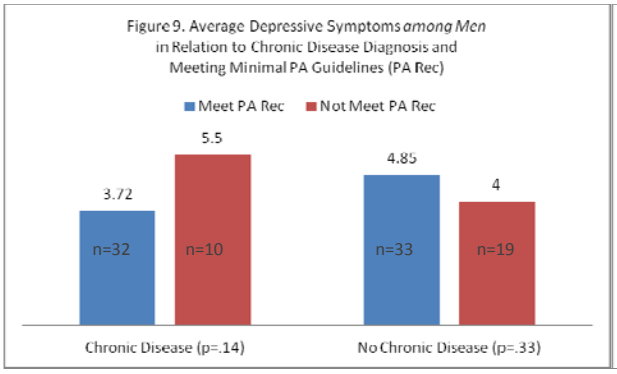
Preliminary Investigation of Study Variable Interactions in Relation to Depressive Symptoms

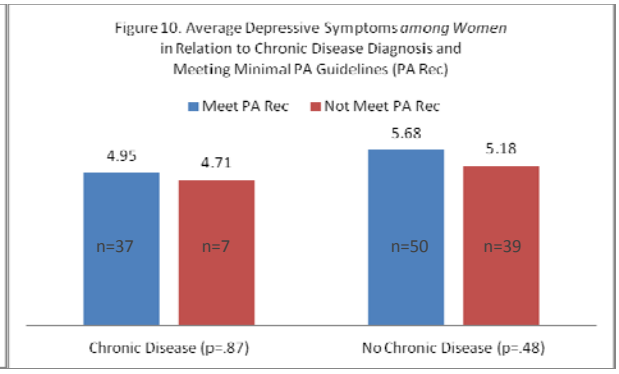
Data were also stratified by PA and by chronic disease diagnosis in order to examine hypothesized 2-way interactions between PA and chronic disease diagnosis, PA and insurance status, and insurance status and chronic disease diagnosis with depressive symptoms. Figures 8-16 present the results of these preliminary analyses.

Chronic Disease Diagnosis and Physical Activity

No statistically significant differences were observed with regard to levels of depressive symptoms in relation to whether or not minimal physically activity guidelines were met, regardless of whether or not participants were diagnosed with a chronic disease (See Figure 8). Among men diagnosed with a chronic disease however, a pattern was observed such that average levels of depressive symptoms were greater among those who failed to meet, versus met, minimal PA recommendations (M: 5.50 vs. 3.72, p=.14); this difference was not observed among men without a chronic disease diagnosis (See Figure 9) or among women more generally (See Figure 10).

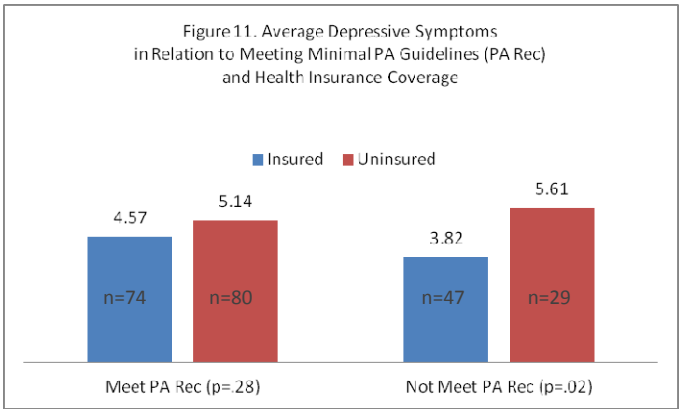


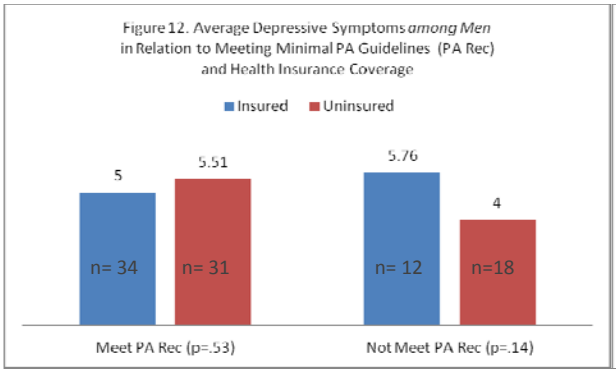


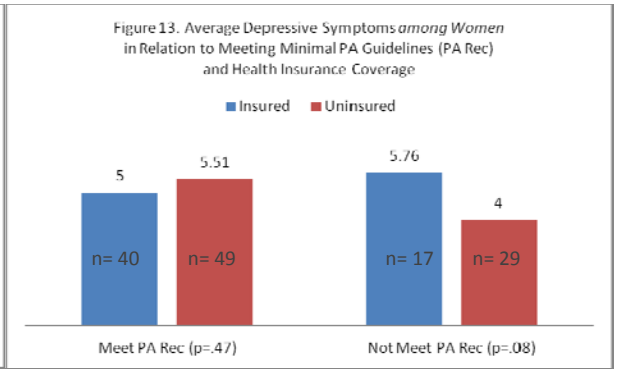


Physical Activity and Health Insurance Coverage

Significantly greater mean levels of depressive symptoms observed among uninsured versus insured participants were restricted to those who did not meet minimal PA recommendations (M: 5.61 vs. 3.83, p=.018; See Figure 11). Consistent findings were obtained among men (see Figure 12), but an opposite pattern was observed among women such that depressive symptoms appeared to be higher among insured, versus uninsured, women who failed to obtain minimally recommended levels of PA (see Figure 13).

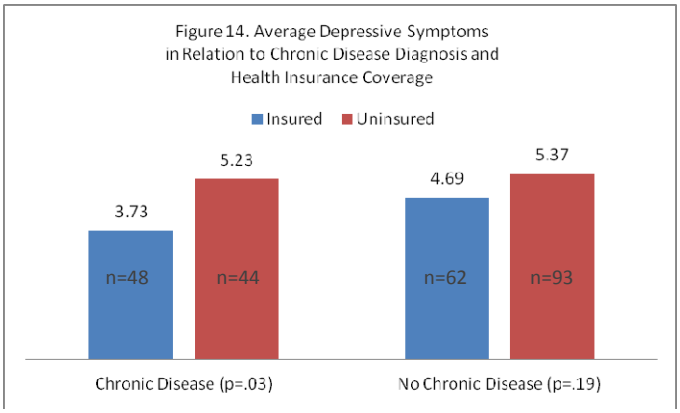


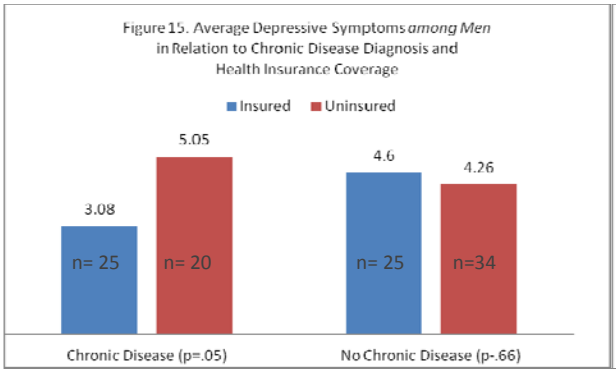


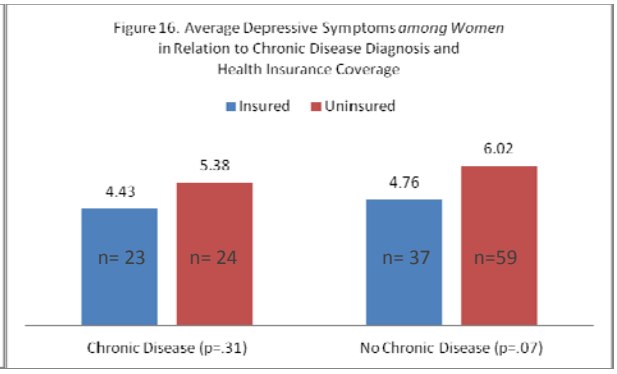


Chronic Disease Diagnosis and Health Insurance Coverage

As illustrated in Figure 14, greater average levels of depressive symptoms observed among uninsured versus insured study participants were more pronounced among those with a chronic disease diagnosis (M: 5.23 vs. 3.73,p=.03), as compared to those without such diagnoses (M: 5.38 vs. 4.69, p =.19). Consistent findings were obtained men (see Figure 15), but a different pattern was observed among women such that greater levels of depressive symptoms among uninsured versus insured women were restricted to those not diagnosed with a chronic disease (see Figure 16).







Gender Differences in Study Variables

An additional series of biviariate analyses was conducted to examine potential gender differences in study variables. Weight status varied significantly by gender such that women were less likely to be overweight/obese than men (51 vs. 77%, p<.001). This difference was also observed when considering BMI in terms of standard cutoffs (overweight $\geq$ 25); 39% of women versus 56% of men classified as overweight/obese (p=.006). No significant gender differences were observed among the sample with regard to age, proportion of life lived in the U.S., education, marital status, whether or not minimal PA guidelines were met, insurance coverage, or chronic disease diagnosis.

Correlations between Study Variables

Prior to conducting multivariate analyses, spearman correlations between study variables were investigated. All relationships observed were at the level of r=.41 or less, and it was therefore not expected that multicollinearity would pose a problem for the multivariate analyses. In the total sample, the strongest relationships observed were between age and chronic disease diagnosis (r=.41, p<.001), and other variables were less strong related to one

another (all r < .3). Among women, age was also associated with being overweight/obese (r=.31, p<.001) and among men, percent of life lived in the U.S. was associated with PA (r=.23, p<.05).

Multivariate Analyses: Factors Associated with Depressive Symptoms

Multivariate analyses were conducted using the raw depressive symptoms outcome data, as no transformations provided a better fit to a normal distribution. OLS regression models were used to examine PA, chronic disease diagnosis, and insurance status in relation to depressive symptoms, first alone (i.e., 3 factor models; data presented in Appendices I-L), and then controlling for gender, weight status, education, marital status, age, and percent of life lived in the U.S. (see Table 14).

Table 14 also presents OLS models that include interactions observed to be significant at the $p \leq .1$ level in the total sample or gender stratified analyses. All hypothesized interactions examined, in turn, in the series of analyses conducted are presented in Appendices I-K. Results of OLS models that included secondary measures of PA (in accordance with 2008 PA Guidelines for Americans), chronic disease diagnosis (hypertension diagnosis), and weight status ($BMI \geq 25$ = overweight) are presented in Appendices L, M, and N respectively. Results of OLS analyses in a restricted sample that included only those participants who were categorized as having mild-moderate, versus lower levels, of depressive symptoms (N=119; 117 women and 42 men) are presented in Appendices O-Q.

Table 14. PA, Insurance Coverage & Chronic Disease Diagnosis in Relation to Depressive Symptoms: Results of Multivariate Ordinary Least Squares Regression Analyses controlling for gender, weight status, marital status, education, age, % of life lived in the U.S.

Variable	B (SE) among **Total Sample** (N=250)				*B (SE)* among **Women** (N=145)				*B (SE)* among **Men** (N=105)			
Meet Min PA Rec (PA) ^	.15 (.44)	.61 (.53)	.17 (.44)	.59 (.53)	.67 (.61)	.65 (.71)	.67 (.61)	.65 (.71)	-.77 (.68)	.33 (.87)	-.79 (.66)	.15 (.86)
Chronic Disease (CD)^^	-.39 (.48)	.72 (.84)	-.93 (.68)	.19 (1.01)	-.56 (.69)	-.66 (1.26)	-.42 (.99)	-.50 (1.51)	-.18 (.67)	**1.81† (1.19)**	**-1.71† (.93)**	.15 (1.42)
No Insurance (No Ins)	**.81* (.42)**	**.78† (.42)**	.46 (.53)	.48 (.53)	**.93† (.60)**	**.94† (.57)**	1.02 (.71)	1.02 (.71)	.68 (.63)	.59 (.62)	-.49 (.79)	-.43 (.79)
Female	**.76† (.42)**	**.79† (.42)**	**.75† (.42)**	**.78† (.42)**	--	--	--		--	--	--	
Overwt/ Obese^^^	**-.84† (.47)**	**-.87† (.47)**	**-.85† (.47)**	**-.87† (.47)**	-.78 (.60)	-.78 (.61)	-.78 (.61)	-.78 (.61)	-.87 (.85)	-.83 (.84)	-.75 (.84)	-.73 (.83)
≥ College	.25 (.42)	.22 (.42)	.25 (.42)	.22 (.42)	.43 (.57)	.43 (.58)	.43 (.57)	.43 (.58)	.11 (.67)	.11 (.66)	.14 (.66)	.14 (.65)
Married	**-.82† (.52)**	**-.79† (.52)**	**-.88† (.52)**	**-.84† (.52)**	-.59 (.68)	-.58 (.68)	-.57 (.68)	-.57 (.69)	-1.37 (.94)	-1.04 (.94)	**-1.59† (.92)**	-1.28 (.93)
Age	-.01 (.02)	<.01 (.02)	<.01 (.02)	.01 (.02)	-.01 (.03)	-.01 (.03)	<.01 (.03)	.01 (.03)	.01 (.03)	<.01 (.03)	.02 (.03)	.01 (.03)
% Life in U.S.	-.01 (.01)	<-.01 (.01)	<-.01 (.01)	<-.01 (.01)	-.01 (.02)	-.01 (.02)	-.01 (.02)	.01 (.02)	<.01 (.01)	<.01 (.01)	.01 (.01)	.01 (.01)
PA X CD	--	**-1.5† (.95)**	--	-1.41 (.95)	--	.13 (1.42)	--	.10 (1.43)	--	**-2.77* (1.37)**	--	**-2.34† (1.36)**
No Ins X CD	--	--	.95 (.86)	.80 (.86)	--	--	-.24 (1.20)	-.23 (1.21)	--	--	**2.86* (1.23)**	**2.52* (1.23)**
R^2	.078	.088	.082	.079	.068	.069	.069	.069	.078	.110	.126	.122

*p≤.05; †p≤.1;^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004)

Table 15. PA, Insurance Coverage & Chronic Disease Diagnosis in Relation to Depressive Symptoms: Results of Multivariate Ordinary Least Squares (OLS) and Seemingly Unrelated Regression (SUR) Analyses in the Study Sample, controlling for weight status, marital status, education, age, and % of life lived in the U.S.

Variable	B (SE) among **OLS** (N=250)				*B (SE)* among **SUR** (N=230)			
Meet Min PA Rec (PA) ^	.15 (.44)	.61 (.53)	.17 (.44)	.59 (.53)	.53 (.47)	**.96† (.52)**	.53 (.46)	**.89† (.52)**
Chronic Disease (CD)^^	-.39 (.48)	.72 (.84)	-.93 (.68)	.19 (1.01)	-.42 (.49)	.66 (.85)	**-1.04† (.69)**	.04 (1.03)
No Insurance (No Ins)	**.81* (.42)**	**.78† (.42)**	.46 (.53)	.48 (.53)	**.77† (.43)**	**.72† (.43)**	**.3**4 (.54)	.36 (.54)
Female	**.76† (.42)**	**.79† (.42)**	**.75† (.42)**	**.78† (.42)**	.59 (.43)	.63 (.43)	.57 (.43)	.61 (.43)
Overwt/ Obese^^^	**-.84† (.47)**	**-.87† (.47)**	**-.85† (.47)**	**-.87† (.47)**	**-.92† (.48)**	**-.96* (.48)**	**-.94* (.48)**	**-.96* (.48)**
≥ College	.25 (.42)	.22 (.42)	.25 (.42)	.22 (.42)	.25 (.44)	.22 (.43)	.23 (.43)	.20 (.43)
Married	**-.82† (.52)**	**-.79† (.52)**	**-.88† (.52)**	**-.84† (.52)**	-.71 (.53)	-.70 (.52)	**-.79† (.53)**	-.76 (.53)
Age	-.01 (.02)	<.01 (.02)	<.01 (.02)	.01 (.02)	<.01 (.02)	<.01 (.02)	<.01 (.02)	<.01 (.02)
% Life in U.S.	-.01 (.01)	<-.01 (.01)	<-.01 (.01)	<-.01 (.01)	<-.01 (.01)	<-.01 (.01)	<-.01 (.01)	<-.01 (.01)
PA X CD	--	**-1.5† (.95)**	--	-1.41 (.95)	--	**-1.47† (.94)**	--	-1.31 (.94)
No Ins X CD	--	--	.95 (.86)	.80 (.86)	--	--	**1.11 (.87)**	.95 (.88)
R^2	.078	.088	.082	.079	.062	.062	.062	.069

*p≤.05; †p≤.1;^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004)

Table 16. PA, Insurance Coverage & Chronic Disease Diagnosis in Relation to Depressive Symptoms: Results of Multivariate Ordinary Least Squares (OLS) and Seemingly Unrelated Regression (SUR) Analyses *among Women,* controlling for weight status, marital status, education, age, and % of life lived in the U.S.

Variable	B (SE) among **OLS** (N=145)				*B (SE)* among **SUR** (N=135)			
Meet Min PA Rec (PA) ^	.67 (.61)	.65 (.71)	.67 (.61)	.65 (.71)	.80 (.62)	.85 (.68)	.85 (.62)	.85 (.68)
Chronic Disease (CD)^^	-.56 (.69)	-.66 (1.26)	-.42 (.99)	-.50 (1.51)	-.48 (.69)	-.50 (1.27)	-.52 (1.00)	-.53 (1.51)
No Insurance (No Ins)	**.93† (.60)**	**94† (.57)**	1.02 (.71)	1.02 (.71)	.69 (.57)	.69 (.57)	.67 (.70)	.67 (.70)
Overwt/ Obese^^^	-.78 (.60)	-.78 (.61)	-.78 (.61)	-.78 (.61)	**-.94† (.60)**	**-.95† (.61)**	**-.95† (.60)**	**-.95† (.61)**
≥ College	.43 (.57)	.43 (.58)	.43 (.57)	.43 (.58)	.39 (.58)	.39 (.59)	.39 (.59)	.39 (.59)
Married	-.59 (.68)	-.58 (.68)	-.57 (.68)	-.57 (.69)	-.61 (.69)	-.61 (.69)	-.62 (.70)	-.62 (.70)
Age	-.01 (.03)	-.01 (.03)	<.01 (.03)	.01 (.03)	<.01 (.03)	<.01 (.03)	<.01 (.03)	<.01 (.03)
% Life in U.S.	-.01 (.02)	-.01 (.02)	-.01 (.02)	.01 (.02)	-.01 (.02)	-.01 (.02)	-.01 (.02)	-.01 (.02)
PA X CD	--	.13 (1.42)	--	.10 (1.43)	--	<.01 (1.38)	--	.01 (1.39)
No Ins X CD	--	--	.95 (.86)	.80 (.86)	--	--	.05 (1.20)	.05 (1.20)
R^2	.068	.069	.069	.069	.055	.054	.054	.054

*p≤.05; †p≤.1;^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004)

Table 17. PA, Insurance Coverage & Chronic Disease Diagnosis in Relation to Depressive Symptoms: Results of Multivariate Ordinary Least Squares (OLS) and Seemingly Unrelated Regression (SUR) Analyses *among Men*, controlling for weight status, marital status, education, age, and % of life lived in the U.S.

Variable	B (SE) among **OLS** (N=105)				*B (SE)* among **SUR** (N=95)			
Meet Min PA Rec (PA) ^	-.77 (.68)	.33 (.87)	-.79 (.66)	.15 (.86)	-.23 (.71)	-.69 (.87)	-.42 (.70)	.31 (.86)
Chronic Disease (CD)^^	-.18 (.67)	**1.81† (1.19)**	**-1.71† (.93)**	.15 (1.42)	-.26 (.70)	1.50 (1.15)	**-1.78† (.94)**	-.21 (1.42)
No Insurance (No Ins)	.68 (.63)	.59 (.62)	-.49 (.79)	-.43 (.79)	.97 (.65)	.85 (.64)	-.28 (.82)	-.20 (.82)
Overwt/ Obese^^^	-.87 (.85)	-.83 (.84)	-.75 (.84)	-.73 (.83)	-.75 (.85)	-.73 (.83)	-.66 (.82)	-.66 (.82)
≥ College	.11 (.67)	.11 (.66)	.14 (.66)	.14 (.65)	.21 (.70)	.13 (.69)	.18 (.68)	.12 (.67)
Married	-1.37 (.94)	-1.04 (.94)	**-1.59† (.92)**	-1.28 (.93)	-1.17 (.96)	-.90 (.95)	**-1.41† (.94)**	-1.17 (.94)
Age	.01 (.03)	<.01 (.03)	.02 (.03)	.01 (.03)	.02 (.03)	<.01 (.01)	.03 (.03)	.02 (.03)
% Life in U.S.	<.01 (.01)	<.01 (.01)	.01 (.01)	.01 (.01)	.01 (.01)	<.01 (.01)	.02 (.01)	.01 (.01)
PA X CD	--	**-2.77* (1.37)**	--	**-2.34† (1.36)**	--	**-2.47† (1.31)**	--	**-1.92† (1.31)**
No Ins X CD	--	--	**2.86* (1.23)**	**2.52* (1.23)**	--	--	**2.96* (1.27)**	**2.56* (1.29)**
R^2	.078	.110	.126	.122	.066	.102	.119	.140

*p≤.05; †p≤.1;^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004)

Models examined in OLS analyses were also evaluated using SUREG analyses that jointly estimated total PA. The SUREG analyses included participants who provided complete depressive symptoms and PA data, reducing the sample to 230 participants. A square root transformation was used to normalize the positively skewed distribution of the continuous

measure of PA included in SUREG analyses. Tables 15-17 present the results of the equations estimating depressive symptoms obtained from SUREG analyses, alongside estimates obtained from OLS analyses. Specifically, these tables present OLS and SUREG models estimating main effects of study variables, controlling for other factors, as well as those that included interactions observed to be significant at the $p \leq .1$ level. Results of the equations estimating total PA obtained from SUREG analyses are presented in Appendix R and complete SUREG models (i.e., equations estimating depressive symptoms and equations estimating total PA) are presented in Appendices S and T.

Lack of health insurance coverage was the independent factor most strongly associated with greater levels of depressive symptoms in the sample and was the only factor that appeared to be associated with depressive symptoms among women. No independent relationships were observed between study variables and depressive symptoms among men. However, interactions were observed between chronic disease diagnosis with insurance status and with PA in relation depressive symptoms among men. No interactions were observed in multivariate analyses among women. Similar findings were obtained from models that included secondary measures of depressive symptoms, PA, chronic disease diagnosis, or weight status, and regardless of whether OLS or SUREG analyses were used, with the exception of the relationship observed between insurance status and depressive symptoms among women. A detailed description of findings obtained through multivariate analyses follows.

OLS analyses demonstrated that not having health insurance coverage was associated with significantly greater depressive symptoms as compared with having insurance coverage in the study sample, controlling for all study covariates (β=.81, SE=.42, p=.05). Patterns were also

observed such that (a) greater levels of depressive symptoms were associated with female, as compared with male, gender (β=.763, SE=.42, p=.071) and (b) lower levels of depressive symptoms were associated with overweight/obese versus lower weight status (β=-.839, SE=.47, p=.077) and being married as compared with not married (β=-.816, SE=.52, p=.118), controlling for all covariates. Additionally, a pattern consistent with an interaction between PA and chronic disease diagnosis in association with lower levels of depressive symptoms was observed, controlling for other factors (β=-1.44, SE=.96, p=.134). Other interactions investigated (PA x insurance status; insurance status x chronic disease; PA x insurance status x chronic disease) were not associated with depressive symptoms in the total sample, controlling for covariates (data not included in table; see Appendices I-K). Similar findings were obtained using models that included secondary measures of PA, chronic disease, and depressive symptoms (see Appendices L, M, O-Q) and from SUREG analyses (see Tables 15-17). When the secondary measure of BMI was considered (overweight $\geq$ 25), no relationships were observed between weight status and depressive symptoms in either OLS (β=.118, SE=.43, p=.782; data not included in table, see Appendix N) or SUREG analyses (β=.037, SE=.44, p=.933; data not included in table), controlling for covariates. Other relationships observed in OLS and SUREG models among the total sample were not influenced by the measure of BMI that was evaluated.

Among women, insurance coverage was the only factor associated with depressive symptoms in OLS analyses that also included PA and chronic disease diagnosis as independent variables (β=1.08, SE=.55, p=.05, data not included in table, see Appendix K); the significance of this relationship was diminished by the inclusion of demographic covariates in the model (β=.93, SE=.57, p=.103), however. Similar findings were obtained from models estimated using

secondary measures of depressive symptoms, chronic disease diagnosis, and weight status (data not included in table). When meeting minimal PA guidelines was estimated based upon the 2008 PA Guidelines for Americans, both the magnitude and the significance of the relationship between insurance status and depressive symptoms were reduced (β=.76, SE=.58, p=.19; data not included in tables, see Appendix L). Similarly, insurance status was not significantly related to depressive symptoms in SUREG analyses among women (β=.71, SE=.57, p=.213). As depicted in Table 16, weight status did emerge as significant in relation to depressive symptoms in SUREG analyses among women (β=-.965, SE=.48, p=.044). This relationship was not observed when standard BMI cut-offs (overweight $\geq$ 25) were evaluated, however (β=-.01, SE=.44, p=.979; data not included in table).

Among men, no independent relationships were observed between study variables with depressive symptoms. Significant interactions were observed among men between chronic disease diagnosis with lack of insurance coverage (β=2.86, SE=1.23, p=.023) and meeting minimal PA guidelines (β= -2.77, SE=1.37, p=.046) in relation to depressive symptoms, controlling for all other study factors. When both interactions were simultaneously entered into multivariate models controlling for study covariates, the interaction between chronic disease diagnosis and lack of insurance coverage remained statistically significant (β=2.59, SE=1.24, p=.04) whereas the significance of the interaction between chronic disease diagnosis with meeting minimal PA guidelines was reduced to be more in keeping with a trend (β=-2.35, SE=1.37, p=.09). Findings were similar regardless of whether primary or secondary measures of depressive symptoms, PA, chronic disease diagnosis, and weight status were considered or whether OLS or SUREG models were evaluated.

Additional OLS models were estimated among the total sample to examine interactions between gender and factors that varied in gender stratified analyses (insurance status; weight status; PA x chronic disease diagnosis; insurance status x chronic disease diagnosis); none of these interactions was significantly associated with depressive symptoms however (Appendix I includes the results of these analyses).

Support for Hypothesized Relationships

In the following section, results are briefly reviewed in relation to the study hypotheses. Hypothesis D predicted that failure to meet minimal PA guidelines, chronic disease diagnosis and lack of health insurance coverage would be independently associated with greater levels of depressive symptoms, controlling for other study factors. No evidence of the expected relationships between PA or chronic disease diagnosis and depressive symptoms was observed. As noted however, support was obtained for the expected relationship between insurance status and depressive symptoms in the total sample and among women in particular.

Hypotheses E-H predicted interactions between study variables such that main effects predicted between PA, chronic disease diagnosis, and insurance status in relation to depressive symptoms were expected to be stronger or weaker depending upon other study measures. As noted previously, no support was obtained for these study hypotheses among women in the sample. Although main effects were not observed, the data do provide support for hypothesis E in the total sample and among men. Relationships observed were in keeping with study predictions in that meeting minimal PA guidelines, versus failing to do so, was associated with lower depressive symptoms among participants with a chronic disease diagnosis, and this relationship was not observed for participants without a chronic disease diagnosis. Additionally,

the data provide support for the relationship predicted in hypothesis G among men in the sample such that lack of insurance was associated with greater levels of depressive symptoms among men with chronic disease diagnoses, but not among men without such diagnoses. The data did not provide support for hypotheses F or H, which predicted an interaction between PA and insurance status and a three-way interaction between PA, chronic disease diagnosis, and insurance status, receptively.

Results of SUREG Analyses estimating Total PA

As mentioned previously, relationships depicted in the model used to estimate total PA included in SUREG analyses are not a primary focus of the investigations conducted. Still, results are briefly discussed below in comparison to the findings of Study 1 presented in the prior chapter (see Appendices R and S for model results). The results are generally consistent with those obtained through logistic regression analyses of the dichotomous PA measure (i.e., met versus did not meet minimal PA guidelines) and described in the prior chapter. As in the logistic regression models presented, PA guidelines knowledge was the factor most significantly associated with total PA among men, such that the knowledge that five or more days of PA are recommended per week, versus a lack thereof, was associated with greater PA. Also, as observed in relation to the dichotomous PA outcome, chronic disease diagnosis was the factor most strongly associated with total PA among women, such that diagnosis with hypertension, heart disease or diabetes was associated with greater PA, versus no diagnosis. A time barrier was not associated with total PA among men however, which is in contrast to the finding obtained in relation to the dichotomous measure of PA. Perhaps most importantly,

evaluation of the continuous PA outcome provided another opportunity to examine the interaction between environmental support and children at home that was considered in Study 1. Contrary to hypothesis C investigated in that study, no interaction was observed between these factors among women in the sample. Among men however, and in the total sample, data indicate that environmental support for PA was associated with more total PA for those without children at home. This relationship is contrary to that predicted for women; environmental support was expected to have a greater influence on PA among women with children at home, versus those without children at home. The magnitude of this relationship is not especially large though and results must be interpreted with caution.

DISCUSSION

Findings add to the presently limited literature regarding depression among Korean Americans. Greater levels of depressive symptoms observed among the sample in comparison to the larger U.S. population are consistent with findings of prior research and underscore the need for promising interventions to address depression among Korean Americans. Additional research regarding modifiable factors associated with depressive symptoms in this group is needed to inform intervention development. Study findings point toward numerous directions for future research.

This study was among the first to investigate PA in relation to depressive symptoms among Korean Americans and one of the few to examine PA in terms of minimally recommended levels in relation to depressive symptoms in any group. In the following section, overall levels of depression observed in the sample are briefly discussed. Next, detailed

consideration is given to relationships observed between PA and other factors with depressive symptoms, including gender differences in these relationships as well as potential explanations for and implications of study findings. Important methodological considerations related to the assessment of PA in relation to depressive symptoms are also discussed and multiple suggestions for future research are proposed.

Higher levels of depressive symptoms observed among the sample in comparison with the larger U.S. population are in keeping with findings of prior researchers (e. g., Donnelly, 2007; Hyun, 2001; Jang & Chiriboga, 2010; Oh, et al., 2002; Shin, 1993; 1994). Despite the rates of depressive symptoms experienced by Korean Americans in the sample, it is important to recognize that very **few study participants reported symptoms consistent with moderately-severe or severe depression. Rather, the vast majority of the sample (98%) reported more moderate levels of depressive symptoms**. As noted previously, such levels of depression may be associated with impaired psychosocial functioning (Cuijpers, et al., 2004; Lewinson, et al., 2000; Preisig, et al., 2001), impaired occupational functioning (Hjarsbech, et al., 2011; Rai, et al., 2011), and more advanced stages of clinical depression over time (Broadhead, et al., 1988; Cuijpers, et al., 2004; Cuijpers & Smit, 2004; Fogel, et al., 2006; Lewinson, et al., 2000; Maier, et al., 1997; Shankman, et al., 2009), but likely do not require psychotherapy or pharmacological treatment (NIMH, 2010; McArthur & McArthur, 2009). This is encouraging from an intervention standpoint given recognized cultural barriers to the open expression of emotion and structural barriers to the receipt of health care among Korean Americans. PA was evaluated in relation to depressive symptoms in the present study because it is a modifiable factor that may be targeted outside of the healthcare setting, without discussing emotions, and

has been well established as a negative influence on the experience of depressive symptoms in other groups.

That **no independent relationships were observed between PA and depressive symptoms among women or men in the sample** was surprising given the substantial body of prior research in other groups that has documented lower levels of depressive symptoms in relation to higher levels of PA, and the mounting evidence to indicate that even modest amounts of PA may confer benefits in the form of reduced experiences of depression. There is no known reason that a consistent relationship should not exist among Koreans Americans, therefore possible explanations for this unexpected finding merit consideration. **It is possible that levels of PA evaluated were too low or too high to demonstrate an association with depression.** Alternately, PA engaged in outside of leisure time (i.e., incidental to paid work, housework, or transport) included in this study may not have the same relationship to depression as leisure-time PA. **It may be that the purpose and mindset surrounding PA are important determinants of the relationship between PA and depression.** Below, each of these potential explanations is considered in greater detail.

It is possible that the minimal levels of PA examined in this study were *too low* to demonstrate an influence on depression. Few previous researchers have directly examined the relationship between mental health and recommended PA levels. In one study among a U.S. population-level sample, Taylor and colleagues (2004) found less depression among those who obtained PA consistent with levels assessed here, as compared with those who reported lower levels of activity. PA was assessed using self-report in this study, and over-reporting is recognized limitation (Troiano, et al., 2008; Tucker, et al., 2011; Woodcock, et al., 2011). It may

be that over-reporting of PA among sample participants resulted in assessment of PA that was even lower than recommended levels. Still, the aforementioned study (Taylor, et al., 2004) and the vast majority of research in other populations that did find a relationship between PA and depression was also based on self-reports. As discussed in the prior chapter though, Korean Americans may over-report PA to a greater degree than members of other groups and additional research using objective measures of PA is needed to examine this possibility.

Regardless of the degree to which Korean Americans over-report of PA, an association between PA and depressive symptoms was expected given greater depressive symptoms observed among individuals who engaged in even very low levels of PA, as compared with those who engaged in no PA in prior studies conducted among U.S. population-level samples (Stephens, 1988; Taylor, et al., 2004). These findings, as well as the dose-response relationship observed between PA and depressive symptoms in other groups such that the greatest benefits of PA are observed in contrast to the lowest initial levels (Strine, et al., 2006; Weyerer, 1992) suggest that levels of PA assessed may have been *too high* to demonstrate an association with depression. It in order to inform public health efforts to promote PA, it is important to determine whether the critical levels of PA needed to influence depressive symptoms among Korean Americans and members of other groups differ from those prescribed in current PA recommendations; further research in this area is needed.

It may also be that the purpose of activity is an important determinant of whether PA influences depressive symptoms. For instance, non-leisure time activities (i.e., activities incidental to paid work, housework, or transport) may yield fewer benefits in terms of depressive symptoms than elective activities engaged in during leisure time. In contrast to the

majority of prior research examining PA in relation to depression, which has focused specifically on leisure-time activity, PA engaged in during both leisure and non-leisure time activities was assessed in this research. Where physical health is concerned, it is clear that where, or for what purpose, activities are engaged in are not especially important; PA provides physiological benefits. The relationship is likely less straightforward where mental health is concerned. The assessment of PA in the current study did not allow for determination of relative amounts of activity that were engaged in by study participants during work versus leisure time, so further exploration of this relationship was not possible.

In one prior study, Farmer and colleagues (1988) observed a cross-sectional association between lower levels of both leisure-time and occupational PA with increased depressive symptoms. Since that time however, few studies have examined whether PA engaged in for differing purposes may yield varied mental health benefits. Ohta and colleagues (2006) observed mental health benefits in association with PA engaged in for the purpose of commuting to work among Japanese study participants. Commuting and workplace activity are distinct endeavors however, and it is conceivable that PA engaged in for commuting may alleviate some of the stresses associated with work, whereas PA during work may not. More recently, Proper and colleagues (2012) found an association between greater time spent sitting during leisure time with worse mental health but observed no relationships between amount of occupational sitting with mental health. While neither the type nor purpose of PA were not directly assessed in this study, findings suggest that the possibility that activities engaged in during leisure time may have a greater influence on mental health than activities engaged in for work merits further examination.

Among Korean American women, a commonly held view of PA as unpleasant mandatory work has been reported (Im & Choe, 2004). This state of mind regarding PA may help to explain why greater levels of PA were not associated with lower levels of depression among women in the study sample. It may be that the mental health benefits of PA are dependent on the both the purpose of PA and the mindset adopted when approaching PA. Enhanced understanding of these relationships may be important to inform effective public health messaging for Koreans and other groups. Current PA guidelines emphasize health benefits of total PA, and do not differentiate based on the purpose of the activity. If it is found that purpose of PA is a determinant of mental health benefits, it may be important to specifically promote greater levels of leisure-time PA, even for those who obtain otherwise adequate amounts of PA though occupational or other non-leisure endeavors (e.g, housework). In one recent study, goals related to quality of life were associated with relatively more PA over time than goals related to weight or physical health status (Segar, et al., 2011). This finding suggests that greater emphasis on the mental health benefits of PA may be warranted in public health efforts to increase PA. If such approaches are adopted, it will be important to determine whether leisure and non-leisure time PA confer similar mental health benefits so that appropriate messaging may be developed. Hence, additional research in this area is needed.

Obtaining minimally recommended amounts of PA <u>was</u> associated with fewer depressive symptoms among men in the sample who reported diagnoses of hypertension, heart disease, or diabetes. The relationship between PA and depressive symptoms among these men may also be associated with their reasons for engaging in PA. For example, if men diagnosed with chronic disease engaged in PA in an effort to manage their disease, PA may

provide them with an enhanced sense of control over their health. Traditional gender roles commonly adopted among Koreans place men in positions of control (Pak, 2006), so feelings associated with loss of control among Korean men many be especially troubling. Among older Korean Americans, Jang and colleagues (2010) found that lower sense of control was strongly associated with greater levels of depression; in fact, sense of control accounted for 20% of the variance in depression in their study sample. Other researchers have observed associations between sense of control with general health and well being among Korean Americans (Jang, Kim, & Chiriboga, 2006; Noh & Avison, 1996).

Prior findings regarding control and depression were not restricted to Korean men however. If women diagnosed with chronic disease also engaged in PA in order to manage their conditions, an association between PA and chronic disease would also be expected in relation to depressive symptoms among women in the sample. The failure to observe such a relationship may be related to the fact that few women in the sample diagnosed with a chronic disease failed to obtain minimally recommended levels of PA (only 7%, vs. 30% of men diagnosed with chronic disease). Also, as reported in the prior chapter, chronic disease diagnosis was the factor most strongly associated with meeting minimal PA recommendations among women. **Additional studies with larger samples and prospective designs are needed to more closely examine the relationship between feelings of control, PA, and depressive symptoms among Korean American women and men.**

It is noteworthy that very similar findings were obtained from: (1) OLS models used to estimate depressive symptoms and (2) SUREG models that estimated depressive symptoms jointly with PA, among both women and men in the sample. Similar results indicate that the

potential bias due to joint causality of PA and depressive symptoms may not be significant among church-going Korean Americans.

Chronic disease diagnosis also played a significant role in whether or not men's levels of depressive symptoms varied in relation to their insurance status. Among men diagnosed with a chronic disease, greater levels of depressive symptoms were observed among those who did not have health insurance coverage, as compared to those with health insurance. This relationship was expected and stands to reason given chronic diseases merit ongoing medical care, which may become particularly burdensome in the absence of health insurance coverage. Again, it was surprising that this relationship was not observed among women in the sample. That the finding was specific to men may be related to the prevalence of traditional gender roles among Koreans which prescribe that men provide financial support for their families. Financial stressors associated with a chronic disease in the absence of health insurance coverage may be especially stressful for Korean men due to this expectation. Whereas the focus in the published literature with regard to traditional gender roles and influence on well-being has customarily been on women, it may be important for those interested in addressing health among Korean Americans to consider the potential influence of traditional gender roles on men as well. Qualitative studies may be particularly useful to understand how well men feel that they are able to handle the responsibilities ascribed to them in relation to traditional gender roles. Additionally, future quantitative investigations of depression in this group may benefit from inclusion of measures that assess levels of traditional roles among study participants.

It is noteworthy that the magnitude of the opposing relationships between lack of insurance coverage and obtaining minimal PA recommendations among men diagnosed with chronic disease were very similar; lack of insurance coverage was associated with approximately two greater depressive symptoms, whereas obtaining minimally recommended amounts of PA was associated with approximately two fewer depressive symptoms. That no three-way interaction was observed between PA, chronic disease diagnosis, and insurance status in relation to depressive symptoms among men may be due to limited power associated with the relatively small sample size of just over 100 men. **Additional research is warranted to examine the potentially complex relationship between PA, chronic disease, and insurance status among Korean Americans.** PA is a recommended means of controlling hypertension, heart disease, and diabetes for everyone with such diagnoses, but for those without insurance coverage it may be especially important in order to prevent comorbid depression. Furthermore, depression has been generally associated with poor compliance with prescribed treatments for the chronic conditions evaluated here (DiMateo, Lepper, & Croghan, 2000; Gehi, Haas, Pipkin, & Whooley, 2005; Kalsekar, et al., 2006; Kilbourne, et al., 2005; Kim, Han, Hill, Rose, & Roary, 2003; Lin, et al., 2004; Morrato, Hill, Wyatt, Ghushchyan, & Sullivan, 2007; Morris, Li, Kroenke, Bruner-England, & Young, 2006; Wang, et al., 2002; Ziegelstein, et al., 2000). Therefore if PA is associated with lower levels of depressive symptoms among those with chronic disease, its benefits may extend beyond the physiological benefits directly attributable to the activity. Such benefits are important for all individuals with chronic disease, but may be especially important for those with limited access to care due to lack of health insurance coverage. Prospective studies that consider changes in depression associated with changes in PA over time in relation

chronic disease diagnosis and insurance status are needed in order to understand whether it may be relatively especially important to encourage increases in PA among uninsured individuals diagnosed with chronic disease.

Whereas insurance status was observed to influence depressive symptoms among men diagnosed with chronic disease, findings suggested that health insurance status may influence women's depressive symptoms more generally. The reason underlying this relationship is unclear however, and merits additional study. Despite the low rates of insurance coverage among Korean Americans, few prior studies have accounted for insurance coverage when investigating depression in this group. It has been found that insurance status is less closely associated to markers of socio-economic status among Koreans than in other groups (Dao, 2010; Shin, et al., 2005), but we know little about factors that are most closely tied to insurance coverage in this group. Qualitative studies may be helpful to gain a better understanding of the meaning that Korean Americans apply to insurance status and the factors with which it is associated. Additionally, with health insurance reform currently pending in the U.S., the stage is set for a natural experiment that may provide enhanced understanding to the relationship between insurance coverage and depression among Koreans and other U.S. groups. Given the high proportion of Korean Americans who currently do not have health insurance, it will be especially interesting to examine changes in this group in relation to changes in eligibility for health insurance. Findings of the present investigation suggest that an unexpected positive consequence of health insurance reform may be reductions in the experience of depressive symptoms among Korean Americans.

At this time, several limitations of this research merit consideration. First, it is recognized that the relatively large number of covariates considered within this small sample and the multiple series of analyses conducted increase the risk of finding spurious associations due to over-fitting or multiple testing. These practices were adopted here due to the formative nature of the research, but nonetheless bear mentioning as a study limitation. Despite the limited sample size, gender stratified analyses were critical to the ability to observe important differences among sample participants and are viewed as a strength of this study. Had gender stratified analyses not been conducted, differences observed between women and men would have been limited to those associated with overall levels of depressive symptoms.

Sensitivity analyses involving multiple measures of PA and weight status are also viewed as strengths of this investigation, despite the additional analyses required in order to consider these factors. Changing PA guidelines present a challenge for researchers and practitioners, as they make it difficult to compare across studies. Use of both guidelines allows for comparisons of study findings with much of the current literature that is based on the 2007 AHA/ACSM guidelines as well with future studies that will likely begin to adopt the more recent 2008 PA Guidelines for Americans.

This study also assessed two variations of weight status in relation to BMI. Asian-specific BMI cutoffs categorized a large proportion of Koreans in the sample, particularly men, as overweight/obese and produced surprising findings in terms of relationships between weight status and depression among study participants. When standard BMI cutoffs were applied to the sample, these relationships were no longer observed. In keeping with the findings of Zheng and colleagues (2011), results of the present study suggest that the standard BMI cut-offs may

provide a more meaningful and useful distinction of weight status among Korean Americans than the more conservative cut-offs suggested specifically for Asians (WHO, 2004).

The cross-sectional nature of the data evaluated and the fact that all measures aside from height and weight were self-reported represent important limitations of this research; as a result of these issues, causal relationships between study variables are more difficult to establish and factors assessed are subject to reporting bias. Additionally, a number of factors with well-established relationships to depression were not evaluated in this study and should be included in efforts to gain a more comprehensive understanding of depression in this group. Factors that merit inclusion in future research include social support, discrimination, and knowledge. Social support is known to be an important determinant of depression and prior researchers have observed this relationship among Korean Americans as well (Berry, et al., 1987; Chae, et al., 2011; Choi, 1997; Kim, et al., 2005; Lee, et al., 2004; Mui, 2001; Shin, 1994). Discrimination has also been associated with depression in other groups and two recent studies among Asian Americans found that greater perceptions of discrimination were associated with greater odds of experiencing depression in the past year (Chae, et al., 2011; Gee, et al., 2007). Knowledge may also be important to consider in future investigations as it is amenable to intervention. In one study of older Korean Americans, low levels of knowledge about depression were associated with greater depressive symptoms (Jang, et al., 2010).

A final word of caution must be offered with regard to the generalizability of study findings. Participants represent a convenience sample of Los Angeles Korean church members who were recruited to participate in a health study that included free health screening tests. As such, they may have been especially motivated with regard to health or have had a high need

for health services and may not be representative of the larger Korean American population. This may explain why findings regarding severity of depression are in contrast to those of Donnelly (2007) even though depression was assessed using the same measure; among attendees at a community health fair in a large Eastern U.S. city, greater levels of moderately-severe to severe depression were observed in that sample in comparison to U.S. population-level estimates. It may be that the church-going Korean American population experiences less severe forms of depression than those who do not attend church; some evidence of this relationship has been observed in prior studies (Hurh & Kim, 1990; Lee, et al., 2004). Based on differing measures, other researchers have reported greater average levels of depressive symptoms among Koreans than in other U.S. groups (e.g., Hyun, 2001; Hughes, 2002; Jang & Chiriboga, 2010; Kuo, 1984; Kuo & Tsai, 1986; Oh, et al., 2002; Shin, 1993; 1994), but it is not clear whether differences were due mostly to extreme levels of depressive symptoms, as found by Donnelly (2007), or to more moderate levels as found here. Even if it is determined that study findings are specific to church-going Koreans in Los Angeles, it is important to continue exploring relationships observed given that a majority of Korean Americans do attend church (Juon, et al., 2000) and that the Los Angeles area is home to a large proportion of Koreans in the U.S. (Hoeffel, et al., 2012; U.S. Census Bureau, 2012).

In conclusion, levels of depressive symptoms observed in the present sample are consistent with those that may be managed with PA, but PA was not independently associated with depression in the study sample. Results of the present study suggest that it may be important to consider PA as a means of decreasing experiences of depressive symptoms among Korean Americans diagnosed with chronic disease, and perhaps especially for uninsured Korean

American men in this group. Given high rates of chronic disease, especially hypertension, and low rates of health insurance coverage observed among Korean Americans, targeting these individuals may yield significant benefits. Gender differences observed in factors associated with depressive symptoms warrant additional consideration. Studies with larger sample sizes that use prospective designs are needed to provide a more clear understanding of the relationships observed here.

Chapter 6: DISCUSSION

This dissertation work was conducted to examine depression and predictors of depressive symptoms among Korean Americans. The primary aim of the research was to evaluate the role of PA in explaining depressive symptoms in this rapidly growing population group. Using data collected from a convenience sample of Korean American church members in Los Angeles, two studies were conducted. The first study examined PA and associated factors. The second study examined how PA may be related to depressive symptoms, independently and in association with chronic disease diagnosis and health insurance status.

In the section that follows, key findings from the two investigations are reviewed and then discussed. Next, limitations and strengths of the research are considered. Finally, important implications of the dissertation findings and directions for future research are presented.

With regard to depressive symptoms and PA, results demonstrate similarities as well as differences between Korean Americans and members of other U.S. population groups. Findings also highlight potentially important gender differences among Korean Americans in relation to each of these factors. Additionally, findings point to important methodological considerations for future health research among Korean Americans and in other groups. Results suggest numerous directions for future research.

Summary of Key Findings

Levels of both depressive symptoms and PA were higher among Korean American sample participants than those reported in prior studies conducted with general U.S. population samples (Kroenke, 2009; CDC, 2008). As in other groups, greater depressive

symptoms were observed among women than men in the sample. Contrary to findings of research in other groups however, PA levels did not vary by gender and were not independently associated with depressive symptoms in the sample. Factors associated with depressive symptoms and with PA varied by gender.

It was unexpected that neither PA nor diagnosis with a chronic disease were independently associated with depressive symptoms among men or women in the sample. In keeping with expectations, greater levels of depressive symptoms were observed among uninsured, versus insured, women in the sample. This relationship was anticipated regardless of gender though, and was not observed among men.

More complex relationships were observed between study factors and depressive symptoms among men in the sample Both PA and health insurance status were observed to moderate the influence of a chronic disease diagnosis on depressive symptoms among men. Obtaining minimally recommended levels of PA, versus not, was associated with lower levels of depressive symptoms among men diagnosed with a chronic disease. Having health insurance coverage, versus not having coverage, was also associated with lower levels of depressive symptoms among men diagnosed with a chronic disease. These relationships were not observed among men who did not report chronic disease diagnoses or among women more generally. Although a three-way interaction between PA, chronic disease diagnosis and insurance status was also expected, this relationship was not observed among men or women in the sample.

With regard to PA, both men and women in the sample were found to be similar to other Americans in a number of ways, including types and intensity of PA reported, knowledge

of PA guidelines, and common barriers to PA. In general, participants displayed a limited knowledge of PA guidelines reflecting an overestimation of the amount of PA recommended in order to achieve health benefits. Knowledge of PA guidelines was positively associated with greater odds of obtaining minimally recommended levels of PA. Time was the most commonly reported barrier to PA among men and women in the sample, but this barrier was negatively associated with PA among men only. Among women, being diagnosed with a chronic disease was the factor most strongly associated with meeting minimal PA guidelines. These findings are in contrast to other U.S. groups in which negative relationships have been observed between PA and chronic disease diagnoses. Chronic disease diagnosis was not associated with PA among men in the sample.

Findings in Relation to the Analytic Model

A number of the study findings are in keeping with the relationships outlined by the analytic model used to guide this investigation. Personal characteristics were related to both PA and depressive symptoms, and the influence of PA on depressive symptoms was dependent upon the personal characteristic of chronic disease diagnosis. Additionally, the resources of PA-specific knowledge and barriers were associated with PA. That PA was not directly associated with depressive symptoms in the sample, and no evidence of a relationship between these factors was observed among women, is in contrast to the relationships predicted by the analytic model however. Other findings that diverged from the analytic model include the failure to observe relationships between social and environmental support for PA and PA.

Secondary Findings (Results of Sensitivity Analyses)

As noted previously, this study was among the first to evaluate PA in accordance with two recent versions of PA guidelines. In order to ensure comparability with rates of PA reported across studies, it is important that researchers specify the guidelines used to establish rates of PA. That relationships observed between PA and other study variables were generally consistent, regardless of which guideline was evaluated however, indicates that specification of the particular guideline may not be critical for research endeavors that aim to establish relationships between PA and other variables. Believing that five or more days of PA are recommended per week was associated with greater likelihood of meeting minimal PA guidelines regardless of the guideline assessed. Given that the 2008 PA Guidelines for Americans do not specify a particular number of days of activity per week, it will be important to determine whether knowledge of this less restrictive guideline, in contrast to the 2007 ACSM/AHA PA guidelines, influences PA among Koreans or in other groups.

Like PA, two separate measures of weight status were evaluated in this research (e.g., Asian-specific versus standard measures). Results suggest that the standard BMI cutoffs may provide more meaningful and useful distinctions among Korean Americans when considering PA and depression. This finding is important given current controversy associated with the appropriateness of Asian-specific BMI cutoffs; Zehng and colleagues (2011) suggested that standard cutoffs may actually be most appropriate for use in health research among Asians. As noted in prior chapters, Asian-specific BMI cutoffs categorized a large proportion of Koreans in the sample, particularly men, as overweight/obese and produced unexpected findings in terms of relationships between weight status and PA and depression among study participants.

When standard BMI cutoffs were applied to the sample, these relationships were no longer observed.

Discussion of Study Results

Failure to observe a relationship between PA and depression in the sample was unexpected. Additional studies are needed to determine the reason for this finding, and to examine the relationship between PA and depressive symptoms among Korean Americans.

That the vast majority of sample participants reported symptoms consistent with moderate or lesser levels of depression suggests that clinical interventions such as counseling or pharmacological treatments may not be necessary to influence depression among Korean Americans. This is important given structural barriers to receipt of health care [e.g., low rates of insurance coverage and usual source of care (Barnes, et al., 2008; Brown, et al., 2000; Dao, 2010; KFF & APIAHF, 2008)] and cultural barriers to open expression of emotion [e.g., maturity associated with ability to control emotions (Bernstein, 2007); stigma associated with mental disease (Bernstein, 2007; Donnelly, 2001; Kim & Rew, 1994; Park and Beernstein, 2008)] that are many Korean Americans have been reported to face.

As noted, the primary aim of this research was to examine PA as a predictor of depressive symptoms among Korean Americans. Although no independent relationship was observed between PA and depression in this research, findings did provide several clues to the factors associated with depressive symptoms in this group. Results suggest that health status may be important to consider when targeting depression among Korean American men in particular. Additional research is needed to examine the potentially complex relationship between PA, chronic disease diagnosis, health insurance status and depressive symptoms

among Korean American men and women. Results also suggest that health insurance status may be an important independent predictor of depressive symptoms, among Korean American women in particular, and therefore may be important to consider in efforts to target depressive symptoms in this group; additional research is needed to examine the reasons underlying the relationship between insurance status and depression.

Although PA was not associated with depressive symptoms in this research, PA is an important health behavior with many well established health benefits and is therefore important to understand regardless of its relationship to depression. For example, PA has been associated with decreased risk and levels of multiple common chronic diseases including: hypertension (Chase, et al. , 2009; Haapanen, et al., 1997; Hu, et al., 2004; Moreau, et al., 2001; Paffenbarger, et al., 1983; Pereira, et al., 1999), heart disease, (Lee, et al., 2001; Lee, et al., 2000; Manson, et al, 2002; 1999; Murphy, et al., 2002; Tanasescu, et al., 2002; Williams, 2001) and diabetes (Sigal, et al., 2006; Tuomilehto, et al., 2001; Hu, et al., 1999; Ivy, et al., 1999; Haapanen, et al., 1997).

Given the rapidly growing number of Korean immigrants to the U.S. in recent years (Hoeffel, et al., 2012; Oh, et al., 2002; U.S. Census Bureau, 2005; 2008; 2012) and the documented relationship between increasing rates of chronic disease with increasing length of stay in the U.S. (Deapen, et al., 2002; Goel, et al., 2004; Lauderdale & Rathouz, 2000; LaVeist, 2002), it is critical that effective ways to prevent and control chronic disease among Korean Americans are identified. Greater levels of hypertension, heart disease and diabetes have already been observed among Koreans in the U.S. as compared to those in Korea (Kim, et al., 2000; Frisbie, et al., 2001; Lee, et al., 2000; Song, et al., 2004) and hypertension is more

prevalent among Korean Americans that in the general U.S. population (Kim, et al., 2000). Although important for all population groups, prevention and control of chronic disease may be especially important for Korean Americans given the health system barriers faced by many members of this group [e.g., low rates of health insurance coverage and usual source of care, (Barnes, et al., 2008; Brown, et al., 2000; Dao, 2010; KFF & APIAHF, 2008)]. For these reasons, it is important to understand modifiable factors such as PA that may help to prevent and control chronic diseases among Korean Americans. The initial investigation conducted for this dissertation, which focused on PA and associated factors, generated numerous findings that may be important to consider in efforts to promote PA among Koreans and in other groups.

Notwithstanding the higher levels of PA observed in the sample in comparison to the general U.S. population, failure of one-quarter to one-third of sample participants to meet minimal PA guidelines indicates that there is a need for interventions to increase PA levels among Korean Americans. The limitation of self-reports of PA to be positively biased (Troiano, et al., 2008; Tucker, et al., 2011; Woodcock, et al., 2011) and the observed likelihood of over-reporting of PA by study participants in this research suggests that rates of PA in the sample may actually be lower than those reported. Furthermore, since health behaviors of immigrants have been observed to fall more closely in line with the general U.S. population with increasing length of stay in the U.S. (LaVeist, 2002), it may be expected that rates of PA among Korean Americans will decrease unless concerted efforts are made to ensure that this does not occur. For these reasons, it may be worthwhile to promote greater levels of PA among all Korean Americans. Effective interventions to this end are needed.

Similarities observed between the sample and the larger population in terms of types of PA reported, barriers to activity, and knowledge of PA guidelines demonstrate a low need for tailoring of PA focused materials for Koreans Americans. Rather, ongoing population-level approaches that aim to promote common forms of activity, address time barriers to PA, and increase knowledge regarding the amount of time recommended for PA may be effective in increasing PA among Korean Americans with few modifications aside from translation of existing materials to Korean language. For Korean American men in particular, results suggest that increasing knowledge of the duration of PA recommended per bout of activity and per week may be an effective means of increasing PA levels. Findings also suggest that chronic disease diagnosis may serve as a teachable moment for increasing PA among Korean Americans, particularly women.

PA was examined in relation to depressive symptoms in this research because it is an important health behavior that has been negatively associated with depression in other groups, may be targeted outside of the traditional healthcare setting, and does require discussion of emotion. Except for the subgroup of men diagnosed with chronic disease however, PA was not associated with depressive symptoms in the sample.

There is no apparent reason why Korean Americans would be different than members of other groups in terms of the relationship between PA and depression. Therefore, potential explanations for this contradictory finding merit consideration and were discussed in detail in the prior chapter; possibilities include the relatively high rates of PA observed in the sample as compared with other U.S. groups, the levels of PA evaluated, and failure to consider the reasons that participants engaged in PA. Levels of PA assessed or reasons for engaging in PA

may have influenced the ability to observe a relationship between PA and depressive symptoms. Each of these possibilities carries important implications for efforts to promote PA among Korean Americans and at the population level, so both are reviewed briefly below.

It may be that levels of PA required to influence depressive symptoms are different than those addressed by current PA recommendations. This study was among the first to evaluate PA in terms of whether or not minimal guidelines were met in relation to depression. This level of PA was selected for evaluation given its importance from a public health standpoint; recommendations state that these are the minimal levels of PA needed to obtain health benefits and efforts to promote PA at the population-level focus on these amounts of activity. In light of recent modifications in PA guidelines, the two most recent versions of PA guidelines were assessed. It is noteworthy that PA was not associated with depressive symptoms based upon either set of guidelines. A prior study that examined leisure-time PA in keeping with minimally recommended levels among a U.S. population-level sample found that being sedentary was associated with greater odds of experiencing 14 or more days of mental distress during the prior month, as compared with obtaining minimally recommended levels of activity. However, no differences in frequency of mental distress over the past month were observed when participants who obtained insufficient versus sufficient to meet minimally recommended levels (Taylor, et al., 2004). These findings suggest that levels of PA needed to influence depression may be lower than those identified by PA guidelines. Aside from that study however, few investigations have examined the relationship between PA in keeping with minimally recommended levels in relation to depression. It will be important to determine whether levels of PA needed to mitigate depressive symptoms are different than those

stipulated by current PA guidelines, so that efforts to promote PA may address PA levels accordingly.

In addition, the type of activities may be important to consider when evaluating PA in relation to depressive symptoms. In this research, activities engaged in outside of leisure time were included in the assessment of PA. This is in contrast to a majority of PA research, which is focused exclusively on leisure-time activities. As discussed in the prior chapter, activities incidental to housework, childcare, and other non-leisure activities may not convey the same mental health benefits as leisure-time activities. If so, then inclusion of these types of activities in the evaluation of PA may have obscured the relationship between PA and depression in this research. Greater understanding of whether the type of PA is critical to the relationship between PA and depression is needed so that efforts to promote PA may appropriately emphasize leisure versus non-leisure time activities. A clear understanding of the relationship between amount and type of PA needed to affect depressive symptoms is important for efforts to address depression among Korean Americans and in other groups.

That PA was associated with lower levels of depressive symptoms among men diagnosed with a chronic disease as compared with men without such diagnoses may lend support to the notion that the reason for engaging in PA plays a role in whether or not higher levels of activity are negatively associated with depression. As was also discussed in the prior chapter, if men diagnosed with chronic disease who engaged in greater amounts of PA did so in an effort to manage their disease, the activity may have provided them with an enhanced sense of control. The same line of reasoning may be applied to the greater levels of depressive symptoms observed among men diagnosed with a chronic disease who did not have health

insurance coverage, as compared with those who did have health insurance coverage, in that insurance may enhanced perceived ability to control chronic disease, as compared with a lack of insurance. These relationships were not observed among women diagnosed with a chronic disease. The reason that the relationship was observed among men only may be related to the responsibilities commonly ascribed to Korean men in relation to prevalent traditional gender roles [e.g., responsible for ensuring financial security of their families (Pak, 2006)]. Chronic disease diagnoses may be especially salient for men as they may be viewed as a threat to their ability to effectively provide for their families. Therefore managing chronic disease through PA would be especially important to enhancing Korean men's sense of control whereas lessened feelings of control may be associated with lack of health insurance coverage among Korean men diagnosed with chronic disease. Given high rates of chronic disease, especially hypertension, and low rates of health insurance coverage observed among Korean Americans, targeting depressive symptoms among uninsured individuals diagnosed with chronic diseases may yield significant benefits. This is important given that depression has been generally associated with poor compliance with treatments for the chronic conditions evaluated here (DiMateo, Lepper, & Croghan, 2000; Gehi, Haas, Pipkin, & Whooley, 2005; Kalsekar, et al., 2006; Kilbourne, et al., 2005; Kim, Han, Hill, Rose, & Roary, 2003; Lin, et al., 2004; Morrato, Hill, Wyatt, Ghushchyan, & Sullivan, 2007; Morris, Li, Kroenke, Bruner-England, & Young, 2006; Wang, et al., 2002; Ziegelstein, et al., 2000).

That nearly all women in the sample diagnosed with a chronic disease obtained minimally recommended levels of PA may best explain the failure to observe a relationship between PA and depressive symptoms in this group. As PA is recommended as a means of

improving and controlling the chronic diseases evaluated (hypertension, heart disease, and diabetes), higher rates of PA observed among women with these diagnoses suggest that Korean American women may be especially compliant with medical recommendations. Therefore, Korean American women may serve as useful models to consider in efforts to increase compliance with recommendations to increase PA among others who receive such diagnoses, including Korean American men.

In addition to chronic disease, results point to importance of health insurance in relation to depressive symptoms among Korean Americans, particularly women. The reason for this relationship is unclear however. Although it is known that many Korean Americans lack health insurance coverage, regardless of education or income levels, the significance that Korean Americans attribute to insurance coverage is not well understood. This information may provide clues to the reason underlying the relationship between insurance status and depressive symptoms in this group. Findings suggest that the implementation of pending health insurance reform may yield unexpected positive consequences in terms of reduced levels of depression among Korean Americans who are able to obtain health insurance coverage as a result of the changes. It will be important for researchers to capitalize on the natural experiment resulting from health insurance reform and evaluate changes in health insurance eligibility and status in relation to depression and other factors among Korean Americans, as well as other groups with low rates of health insurance coverage.

Strengths and Limitations

Key study findings are, of course, conditioned by limitations. The measures used to assess study outcomes represent both strengths and limitations. The measure of PA used

(IPAQ) has been identified as the best candidate for a standard measure of PA (Woodcock, et al., 2001). Results demonstrate however, that this measure may overestimate PA among Korean Americans. It is recognized that self-reports of PA in all groups tend to be positively biased, but study data indicate that misclassification of activities with regard to intensity (i.e., walking, moderate, vigorous) may add to the bias of PA estimates obtained via self-reports from Korean Americans, particularly women. This finding indicates that caution must be exercised when making comparisons between PA of Korean Americans with other groups, based on self-reported PA.

Additionally, as used here, the IPAQ may overestimate correspondence with guidelines in keeping with the 2008 PA Guidelines for Americans (USDHHS, 2008; 2008a). Of the three proposed methods for scoring PA in relation to the 2008 PA Guidelines for Americans, the method employed here has been found to provide the central estimate (Tucker, et al., 2011) and was therefore considered the most appropriate for use in this study. Still, estimates may be artificially inflated by the decision to consider walking to be equivalent to moderate PA. Specific IPAQ scoring algorithms in keeping with the 2008 PA Guidelines for Americans are needed.

The measure of depressive symptoms used is also associated with both strengths and weaknesses. The PHQ has been identified as a useful tool for screening for depression among Korean Americans in community settings (Donnelly, 2007; Donnelly & Kim, 2008). Donnelly (2007) suggested that the measure may more accurately estimate depression in this group in comparison to other commonly used measures that do not effectively capture depressive symptoms expressed as somatic issues. Still, it must be cautioned that a number of the somatic

symptoms assessed using the PHQ-8 are commonly experienced symptoms of a number of conditions and are not specific to depression. For this reason, low levels of depressive symptoms should be evaluated with caution. Secondary analyses conducted in a restricted study sample, excluding participants with particularly low levels of symptoms, produced findings consistent with those obtained in the total sample and therefore increase confidence in the findings presented.

The relatively small size of the study sample is an important limitation of this research, particularly given the number of study factors evaluated and the number of analyses conducted. This approach was adopted due to the exploratory and formative nature of this preliminary research. In a number of instances, it was deemed important to explore multiple versions of study measures, and doing so produced several important study findings. Additionally, given the prevalence of traditional gender roles in Korean culture, and gender differences observed by other researchers in relation to study outcomes, it was deemed important to conduct gender stratified analyses. Although this choice is associated with a cost in terms of diminished sample size, it proved to be important in that a majority of study findings varied by gender even though interactions between gender and other study factors were not observed in the total sample. For these reasons, the number of variables evaluated and the number of analyses conducted are believed to be justifiable. Still, results must be evaluated with caution due to multiplicity of hypotheses tested and the resulting likelihood of spurious associations.

Despite the large number of relationships evaluated, a number of potentially important study factors were not included in this research. Specifically, numerous factors with well-established relationships to depression were not evaluated in this study and should be included

in future efforts to gain a more comprehensive understanding of depression in this community. Factors that merit inclusion in future research include social support, discrimination, sense of control, and knowledge. Social support is known to be an important determinant of depression and prior researchers have observed this relationship among Korean Americans as well (Berry, et al., 1987; Choi, 1997; Kim, et al., 2005; Shin, 1994; Lee, et al., 2004; Mui, 2001; Chae, et al., 2011). Discrimination has also been associated with depression in other groups and two recent studies among Asian Americans found that greater perceptions of discrimination were associated with greater odds of experiencing depression in the past year (Chae, et al., 2011; Gee, et al., 2007). As discussed, sense of control was strongly associated with Korean American's depression in one study of older Korean Americans (Jang, et al., 2010) and may help to explain findings presented in this research. The same study found that low levels of knowledge about depression were associated with greater depressive symptoms (Jang, et al., 2010). Depression-related knowledge will be important to investigate in relation to depressive symptoms in future studies as it quite amenable to intervention.

Several factors associated with PA in other groups were also not evaluated in this research. The conceptual model used to guide this research suggests that social and environmental support, generally, are important influences on personal resources (PA in this study). It may be useful to include such measures in future research focused on PA among Korean Americans, in order to more clearly understand the determinants of this important health behavior. Analyses in the present study were restricted to evaluations of social and environmental support specific to PA and no relationships were observed between these factors with PA.

The manner in which the presence of young children in the home was assessed in this research also presents a limitation. Prior research has indicated that the presence of young children in the home may be an important determinant of PA among Korean American women (Choi, et al., 2008; 2011). Due to the small number of parents of very young children in the sample, such a measure was not practical and therefore presence of children of any age in the home was assessed instead. It may be that the presence of younger, versus older, children in the home has a greater negative influence on PA. Other factors potentially important to PA and depression among Korean Americans and in other groups not assessed in this research include working status and hours, smoking, and alcohol use patterns. Furthermore, it will be useful for future studies to examine levels of traditional cultural values and/or gender roles in order to evaluate their role in gender differences in PA and depressive symptoms among Korean Americans.

Final limitations of this research are that study participants represent a convenience sample of Los Angeles Korean church members who were recruited to participate in a health study that included free health screening tests, that self-reports were used to assess study measures, and that the data are cross-sectional. Given the characteristics of the study sample, findings may not be generalizable to Koreans in other parts of the U.S., to non-churchgoing populations, or to those who are not especially motivated with regard to their health. Less severe levels of depressive symptoms observed in comparison to those reported among a Korean American sample recruited at a community health fair (Donnelly, 2007) may be related to the fact that church participation is associated with greater well-being among Korean Americans (Hurh & Kim, 1990; Lee, et al., 2004). Still, findings are important given that a large

proportion of the U.S. Korean population resides in the Los Angeles area (Korean American Coalition, 2012; Min & Song, 1998; Terrazas, 2009; U.S. Census Bureau, 2012) and that most Korean Americans are church members (Hurh & Kim, 1990b; Juon, et al., 2000; Min, 1990). The self-report of all study measures aside from weight status and the cross sectional nature of the data however, present significant limitations in that measures are subject to bias, causal relationships may not be ascertained between study variables, and reverse causality between study variables may not be excluded as a potential explanation for the relationships observed.

Implications and Suggestions for Future Research

Findings add to the presently limited literatures related to PA and depression among Korean Americans, and among Asian Americans more generally. Understanding of modifiable factors associated with health and health behaviors in these groups is especially important in light of therapidly growing size of these populations. Study findings may also be particularly relevant for other groups of recent immigrants to the U.S.

That expected relationships were not observed between PA and depression in this research is an important finding that merits additional investigation. Prospective studies with larger sample sizes and objective measures of PA are needed in order to more closely examine this relationship. It will be helpful for investigations in this area to assess the types of PA engaged in by study participants. Results of such studies will be important for Korean Americans and other groups as they provide critical information regarding the appropriateness of current PA guidelines for addressing depressive symptoms.

Findings specific to PA suggest that interventions developed for use in other population groups may be effective at increasing PA among Korean Americans. Prospective research is

needed to examine this possibility. It will be helpful for such studies to evaluate whether knowledge of changing PA guidelines is associated with PA levels and to examine differences in reporting of PA, in relation to whether or not activities are engaged in during leisure time. Findings in these areas are needed for all U.S. population groups and may provide important insights regarding the most appropriate messages to be included in campaigns designed to promote PA.

Given study findings regarding health insurance status in relation to depressive symptoms, low levels of insurance coverage among Korean Americans, and the timing of this research in relation to pending health insurance reform, prospective studies that evaluate the influence of health insurance on depression among Korean Americans are recommended. Use of mixed methods approaches in these investigations may enhance understanding of the meaning that Korean Americans ascribe to health insurance coverage. Additionally, given the unique characteristics of Korean Americans without health insurance in comparison to other groups, it will be important to examine similarities and differences between Korean Americans and other

groups with low levels of health insurance coverage in relation to changing insurance eligibility.

Other factors that merit consideration in future studies are the relationships between chronic disease diagnosis, recommendations from medical professionals to engage in PA, insurance status, PA, and depressive symptoms. Study results suggest complex inter-relationships and potentially important gender differences between these factors among Korean Americans. Prospective studies with larger sample sizes are needed in order to examine these relationships. Enhanced understanding of these relationships may allow for more

effective interventions to address mental and physical health among Korean Americans and in other groups.

In sum, these findings add to the limited scientific literatures focused on PA and depressive symptoms among Korean Americans. Results point to numerous important directions for future research that may inform development of interventions to maintain and improve health outcomes among Korean Americans and in other groups.

DIRECTORY OF APPENDICES

Appendix A

Interview Questionnaire Items

DEMOGRAPHIC ITEMS

P2. Would you please provide your date of birth? _____ **(MM/DD/YYYY)**

☐ REFUSED

P3. What is your marital status? Are you

☐ Currently married
☐ Living with partner (*or* living as married)
☐ Widowed **(GO TO P4)**
☐ Separated **(GO TO P4)**
☐ Divorced **(GO TO P4)**
☐ Single, that is never been married **(GO TO P4)**
☐ DON'T KNOW **(GO TO P4)**
☐ REFUSED **(GO TO P4)**

P4. What is the highest level of education that you have completed?

☐ No formal education
☐ Elementary school
☐ Some High School or vocational school
☐ High School graduate
☐ Some College
☐ College graduate
☐ Post graduate/professional school
☐ OTHER, SPECIFY_____
☐ DON'T KNOW
☐ REFUSED

P5. Are you employed outside the home?

☐ Yes ☐ No **(Go to P9)** ☐ REFUSED **(Go to P9)**

If yes, ask P6-P8a:

P6. On average, how many hours do you work each week?

_____ Hours per week
☐ REFUSED

P9. Would you say you speak English...

☐ Fluently
☐ Well
☐ So so
☐ Poorly
☐ Not at all
☐ DON'T KNOW
☐ REFUSED

P10. In what country were you born?

☐ UNITED STATES **(Go to P12)**
☐ KOREA
☐ CHINA
☐ OTHER, SPECIFY _____
☐ DON'T KNOW
☐ REFUSED

P11. In what year did you come to live in the U.S.? _____ **(YYYY)**
☐ REFUSED

P13b. Do you have any children?

☐ Yes ☐ No (Go to P13k) ☐ REFUSED (Go to P13k)

P13c. How many children do you have?

_____ ☐ REFUSED (Go to P13k)

P13d. How many of your children live with you in your home?

_____ ☐ REFUSED (Go to P13k)

Please list the ages of your children?

P13e ._____
P13f. _____
P13g._____
P13h._____
P13i. _____
P13j. _____

P13k. Do any of your family members live in the LA area?

☐ Yes ☐ No ☐ REFUSED

P14. Which of the following best describes your total household income, that is, the income of all family members living with you? I don't need the exact amount ... just a range. Do you want me to read you the choices for monthly or yearly income?

Would you say approximately:

	YEARLY	MONTHLY
☐	>$120,000	>$10,000
☐	$80-120,000	$6,700-10,000
☐	$50-80,000	$4,200-6,700
☐	$30-50,000	$2,500-4,200
☐	$20-30,000	$1,700-2,500
☐	<$20,000	<$1,700
☐	DON'T KNOW	
☐	REFUSED	

HEALTH INSURANCE ITEMS

(READ THE FOLLOWING STATEMENT PRIOR TO ASKING QUESTION P16).
And now we have some questions about health insurance.

P16. Do you currently have any private health insurance?

- ☐ YES
- ☐ NO
- ☐ DON'T KNOW
- ☐ REFUSED

(READ THE FOLLOWING STATEMENT PRIOR TO ASKING QUESTION P17).
Medicaid/MediCal is a health insurance program that pays for medical care for certain low-income children and their families, pregnant women, and disabled or elderly people.

P17. At this time, do you have Medicaid/MediCal?

☐ YES ☐ NO ☐ DON'T KNOW ☐ REFUSED

GENERAL HEALTH ITEMS

P18. What is your height?

_____FT _____INCHES OR _____Centimeters ☐ REFUSED

P19. What is your weight?

_____POUNDS OR _____Kilograms ☐ REFUSED

P20. In general, would you say your health is? (Choose One)

- ☐ Excellent
- ☐ Very Good
- ☐ Good
- ☐ Fair
- ☐ Poor
- ☐ Refused

P21. Do you consider yourself to be overweight, underweight, or at a desired weight for your height?

- ☐ Overweight
- ☐ Underweight
- ☐ Desired weight / You are satisfied with your weight
- ☐ Refused

P22. Is there a place that you USUALLY go to when you are *sick* or need *advice* about your health?

☐ YES
☐ NO
☐ DON'T KNOW
☐ REFUSED

P24. How do you rate your activity level?

☐ Very active
☐ Somewhat active
☐ Not active
☐ DON'T KNOW/NOT SURE
☐ REFUSED

Now I would like to ask you some questions about your health.

Have you ever:	**YES**	**NO**	**Refused**
P25. Been diagnosed with Hypertension?			
P26. Been diagnosed with a heart disease?			
P29. Been diagnosed with diabetes?			

P30. Do you smoke cigarettes?

☐ Yes ☐ No **(Go to P33)** ☐ Refused **(Go to P33)**

SOCIAL and ENVIRONMENTAL SUPPORT FOR PHYSICAL ACTIVITY

(READ THE FOLLOWING STATEMENT BEFORE BEGINNING THE NEXT SERIES OF QUESTIONS).

For the following questions, please indicate how often you experience the event in question: Never, Rarely, Sometimes, Regularly, or Very Often.

P35. How often do your friends exercise (or offer to exercise) with you?

☐ Never
☐ Rarely
☐ Sometimes: Do and do not equally often
☐ Regularly
☐ Very Often
☐ Refused

P36. How often do your family members exercise (or offer to exercise) with you?

☐ Never
☐ Rarely
☐ Sometimes: Do and do not equally often
☐ Regularly
☐ Very Often
☐ Refused

(READ THE FOLLOWING STATEMENT BEFORE BEGINNING THE NEXT SERIES OF QUESTIONS).
Next, I am going to read a series of statements. Please indicate your level of agreement or disagreement with each statement. Specifically, please indicate whether you: strongly disagree, disagree, neither agree nor disagree, agree, or strongly agree.

P40. Public places to exercise in my neighborhood, such as parks &/or sports fields or facilities, are accessible to me.
- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree
- ☐ Refused

P41. Public places to exercise in my neighborhood, such as parks &/or sports fields or facilities, are safe.
- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree
- ☐ Refused

P42. Sidewalks are available in my neighborhood?
- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree
- ☐ Refused

P43. I feel safe walking/jogging/running in my neighborhood?
- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree
- ☐ Refused

ACCULTURATION LEVEL

P44. What language do you usually use with most of your friends?

- ☐ Only English
- ☐ Mostly English
- ☐ Korean and English
- ☐ Mostly Korean
- ☐ Only Korean
- ☐ DON'T KNOW
- ☐ REFUSED

P45. When you read newspapers or magazines, are they:

- ☐ Only in English
- ☐ Mostly in English
- ☐ About half in English and half in Korean
- ☐ Mostly in Korean
- ☐ Only in Korean
- ☐ DON'T KNOW
- ☐ REFUSED

P46. Do you think your mindset and lifestyle are more Korean or American?

- ☐ More Korean
- ☐ More American
- ☐ An equal blend of both
- ☐ DON'T KNOW
- ☐ REFUSED

PHYSICAL ACTIVITY ITEMS
(IPAQ-SF, MODES/TYPES OF ACTIVITY, PA GUIDELINE KNOWLEDGE)

(READ THE FOLLOWING STATEMENT BEFORE BEGINNING THE NEXT SERIES OF QUESTIONS).
We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions ask about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please report the following: activity during paid work, house and yard work, physical activity needed to get from place to place, recreation, exercise and sports.

Report all the **vigorous** activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Examples of vigorous physical activities include running (not jogging), fast bicycling, heavy lifting, digging, aerobics, and singles tennis. **Report only those physical activities that you did for at least 10 minutes at a time.**

P47. During the last 7 days, on how many days did you do **vigorous** physical activities like running, fast bicycling, heavy lifting, digging, aerobics, or singles tennis?

_____Days per week
☐ None **(GO TO P49)**
☐ DON'T KNOW **(GO TO P49)**
☐ REFUSED **(GO TO P49)**

P48. How much time did you usually spend doing vigorous physical activities on each of those days?

_____Hours _____Minutes per day
☐ DON'T KNOW
☐ REFUSED

P49. What types of activities did you think about as you answered this question? In other words, what types of vigorous physical activities did you do (or not do) during the past 7 days?

_____
_____
_____
☐ Refused

(READ THE FOLLOWING STATEMENT BEFORE BEGINNING THE NEXT SERIES OF QUESTIONS).
Report approximately all the **moderate** activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Examples of moderate activities include hiking, jogging at an easy pace, bicycling at an easy pace, housework, carrying light loads, and doubles tennis. **Report only about those physical activities that you did for at least 10 minutes at a time.**

P50. During the last 7 days, on how many days did you do moderate physical activities like hiking, jogging at an easy pace, bicycling at an easy pace, housework, carrying light loads, or doubles tennis? Do <u>not</u> include walking.

_____Days per week
☐ None **(GO TO P52)**
☐ DON'T KNOW **(GO TO P52)**
☐ REFUSED **(GO TO P52)**

P51. How much time did you usually spend doing moderate physical activities on each of those days?

_____Hours _____Minutes per day
☐ DON'T KNOW
☐ REFUSED

P52. What types of activities did you think about as you answered this question? In other words, what types of moderate physical activities did you do (or not do) during the past 7 days?

_____
_____
_____

☐ Refused

(READ THE FOLLOWING STATEMENT BEFORE BEGINNING THE NEXT SERIES OF QUESTIONS).
Report approximately the time you spent walking in the last 7 days. This includes at work and at home, walking in order to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

P53. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

_____Days per week
☐ None **(GO TO P55)**
☐ DON'T KNOW **(GO TO P55)**
☐ REFUSED **(GO TO P55)**

P54. How much time did you usually spend walking on each of those days?

_____Hours _____Minutes per day
☐ DON'T KNOW
☐ REFUSED

(READ THE FOLLOWING STATEMENT BEFORE MOVING ON TO THE NEXT TWO QUESTIONS).
These questions are about the time you spend sitting while at work, at home, while doing course work, and during free-time. This may include time spent sitting at a desk, visiting friends, reading, sitting, or lying down to watch television. Do not include any time spent sleeping at night.

P55. During the last 7 days, how much time in total did you usually spend sitting on a workday? Your best estimate is OK.
_____Hours _____Minutes per workday
☐ DON'T KNOW
☐ REFUSED

P56. During the last 7 days, how much time in total did you usually spend sitting on a non-workday? Your best estimate is OK.
_____Hours _____Minutes per non-workday
☐ DON'T KNOW
☐ REFUSED

(READ THE FOLLOWING STATEMENT BEFORE MOVING ON TO THE NEXT THREE QUESTIONS).

There are general recommendations for the number of days per week that US adults should be active, as well as for the number of minutes per day that US adults should be active.

P57. What is the recommended number of days per week that adults should be physically active?
_____ Days per week ☐ REFUSED

P58. What is the total amount of time that is adults are recommended to be active each week?
_____ Hours _____Minutes per week ☐ REFUSED

P59. At the minimum, how many consecutive minutes are recommended for aerobic activity to produce health benefits?
_____ Minutes ☐ REFUSED

NUTRITION ITEMS

P61. Yesterday, how many times did you eat fruit, such as apples or bananas?
_____Times
☐ None
☐ DON'T KNOW
☐ REFUSED

P62. Yesterday, how many times did you eat vegetables such as corn, cabbage, beans, seasoned vegetables, etc?
_____Times
☐ None
☐ DON'T KNOW
☐ REFUSED

STRESS

(READ THE FOLLOWING STATEMENT BEFORE MOVING ON TO THE NEXT SERIES OF QUESTIONS).

The questions in this section ask you about your feelings and thoughts during the last month. In each case, please indicate how often, during the last month, that you felt or thought a certain way: Never, Almost Never, Sometimes, Fairly Often, Very Often

P67. In the past month, how often did you feel that you were unable to control the important things in your life?
☐ Never
☐ Almost Never
☐ Sometimes
☐ Fairly Often
☐ Very Often
☐ Refused

P68. In the past month, how often did you feel confident about your ability to handle your personal problems?
☐ Never
☐ Almost Never
☐ Sometimes
☐ Fairly Often
☐ Very Often
☐ Refused

P69. In the past month, how often did you feel that things were going your way?

☐ Never
☐ Almost Never
☐ Sometimes
☐ Fairly Often
☐ Very Often
☐ Refused

P70. In the past month, how often did you feel that difficulties were piling up so high that you could not overcome them?

☐ Never
☐ Almost Never
☐ Sometimes
☐ Fairly Often
☐ Very Often
☐ Refused

(READ THE FOLLOWING STATEMENT BEFORE MOVING ON TO THE NEXT TWO QUESTIONS).
Now, please think about the overall amount of stress that you've felt in the past month.

P70a. On a scale from 1-10, with 1 being no stress at all and 10 being the highest possible amount of stress, how much stress did you feel in the past month?

|_____|_____|_____|_____|_____|_____|_____|_____|_____|_____|
1 2 3 4 5 6 7 8 9 10

☐ REFUSED

P70b. Compared with most other times in your life, would you say last month was:

☐ More Stressful ☐ Less Stressful ☐ Equally stressful ☐ REFUSED

SLEEPING PATTERNS & MOOD

P71. How many hours of sleep do you normally get per night during the work week?

_____ Hours per Night
☐ Refused

P71a. During the past month, how much of the time were you a happy person?

☐ None of the time
☐ A little of the time
☐ Some of the time
☐ A good bit of the time
☐ Most of the time
☐ All of the time
☐ Refused

P71b. How much of the time, during the past month, have you felt calm and peaceful?

- ☐ None of the time
- ☐ A little of the time
- ☐ Some of the time
- ☐ A good bit of the time
- ☐ Most of the time
- ☐ All of the time
- ☐ Refused

P71c. How much of the time, during the past month, have you been a very nervous person?

- ☐ None of the time
- ☐ A little of the time
- ☐ Some of the time
- ☐ A good bit of the time
- ☐ Most of the time
- ☐ All of the time
- ☐ Refused

P71d. How much of the time, during the past month, have you felt downhearted and blue?

- ☐ None of the time
- ☐ A little of the time
- ☐ Some of the time
- ☐ A good bit of the time
- ☐ Most of the time
- ☐ All of the time
- ☐ Refused

P71e. How much of the time, during the past month, did you feel so down in the dumps that nothing could cheer you up?

- ☐ None of the time
- ☐ A little of the time
- ☐ Some of the time
- ☐ A good bit of the time
- ☐ Most of the time
- ☐ All of the time
- ☐ Refused

(READ THE FOLLOWING STATEMENT BEFORE MOVING ON TO THE NEXT SERIES OF QUESTIONS).
The next series of questions will ask about your feeling over the past two weeks. Please indicate how often you have been bothered by any of the following problems.

Over the past two weeks, how often have you:

P71f. Little interest or pleasure in doing things?

- ☐ Not at all
- ☐ On several days
- ☐ On more than half of the days
- ☐ Nearly every day
- ☐ Refused

P71g. Feeling down, depressed, hopeless?

- ☐ Not at all
- ☐ On several days
- ☐ On more than half of the days
- ☐ Nearly every day
- ☐ Refused

P71h. Trouble falling or staying asleep, or sleeping too much?

- ☐ Not at all
- ☐ On several days
- ☐ On more than half of the days
- ☐ Nearly every day
- ☐ Refused

P71i. Feeling tired or having little energy?

- ☐ Not at all
- ☐ On several days
- ☐ On more than half of the days
- ☐ Nearly every day
- ☐ Refused

P71j. Poor appetite or overeating?

- ☐ Not at all
- ☐ On several days
- ☐ On more than half of the days
- ☐ Nearly every day
- ☐ Refused

P71k. Feeling bad about yourself - or that you are a failure or have let yourself or your family down?

- ☐ Not at all
- ☐ On several days
- ☐ On more than half of the days
- ☐ Nearly every day
- ☐ Refused

P71l. Trouble concentrating on things such as reading the newspaper or watching television?

- ☐ Not at all
- ☐ On several days
- ☐ On more than half of the days
- ☐ Nearly every day
- ☐ Refused

P71m. Moving or speaking so slowly that other people could have noticed? Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual?

- ☐ Not at all
- ☐ On several days
- ☐ On more than half of the days
- ☐ Nearly every day
- ☐ Refused

BARRIERS TO PHYSICAL ACTIVITY

P94. What is the biggest problem that you face when it comes to getting regular physical activity?

_____

_____

☐ REFUSED

Appendix B

STUDY VARIABLES: SOURCE, ANALYTIC TREATMENT, RELEVANT STUDY AIMS					
ANALYTIC MODEL	**VARIABLE**	**SOURCE**	**TREATMENT**	**AIM 1/ STUDY 1**	**AIM 1/ STUDY 2**
		Personal Characteristics			
Gender	Female or. Male	Interviewer Observation	Stratify &/or Dichotomous; Female = 1	IV	IV
Age	Date of Birth	--	Continuous	Control	
Family Characteristics:	Marital Status	--	Dichotomous; Married = 1	Control	
	Children at Home	--	Dichotomous; Yes = 1	IV	--
Acculturation:	% Life in US	Calculated based on self-reported dates of birth and arrival in the U.S.	Continuous	Control	
Education:	Years of Education	--	Dichotomous: ≥ College = 1	Control	
Weight Status:	BMI	Calculated based on height and weight assessed by study staff	Dichotomous: Overweight/Obese = 1	IV	Control
Chronic Disease Diagnosis	Ever diagnosed with hypertension, heart disease, or diabetes	--	Dichotomous: ≥ 1 diagnosis =1	Control	IV
Insurance Coverage	Any public or private health insurance	--	Dichotomous: Yes =1	--	IV
		Social & Environmental PA Resources			
Social Support for PA:	Family & Friend Support for PA	Social Support for Exercise Scale (Sallis, et al.1987) Friend and Family Support for Exercise Habits Scale (Sallis, Hovell, & Hofstetter, 1992; Korean version- Choi, et al., 2008; 2011)	Continuous	IV	--
Environmental Support for PA:	Safety and Accessibility of Neighborhood PA Resources	Environmental Supports for Physical Activity Questionnaire (SIP 4-99 Research Group; Korean version – Choi, et al., 2008)	Continuous	IV	--
PA Related Knowledge	≥ 5 days PA recommended per week	NCI HINTS survey (available at www.hints.cancer.gov)	Dichotomous: Yes=1	IV	--
Barriers to PA	Most commonly reported barrier = lack of time	Open response item	Dichotomous: Yes=1	IV	--
		Personal Resources			
Physical Activity	Meet Minimal PA Recommendations	IPAQ - SF General: Craig, et al., 2003 Korean: Oh, et al., 2007	Dictomous: 1= Met Minimal PA Recommendations	DV	IV
		Health			
Mental Health: Depression	Depressive Symptoms	PHQ-8 General: Kroenke, et al., 2009 Korean Lang: Donnelly, 2007	Continuous (Exploratory: 2 categories)	--	DV

Appendix C

SAMPLE CHARACTERISTICS IN RELATION TO MEETING MINIMAL PA GUIDELINES:
DESCRIPTIVE STATISTICS AND BIVARIATE ANALYSES – BASED ON 2008 PA GUIDELINES FOR AMERICANS

	TOTAL SAMPLE (n=240)			**WOMEN** (n=141)			**MEN** (n=99)		
	N (%)	**% MEET**	***P****	**N** (%)	**% MEET**	***P****	**N** (%)	**% MEET**	***P****
Gender									
Female	**141** (58.8)	72.3		---			---		
Male	**99** (41.3)	76.8	*.44*						
PA Guideline Knowledge									
≥5 Days per Week	**129** (54.0)	82.2		**73** (52.1)	79.5		**56** (56.6)	85.7	
< 5 Days per Week	**110** (46.0)	64.6	***.002***	**67** (47.9)	64.2	***.044***	**43** (43.4)	65.1	***.016***
Time Barrier to PA									
Yes	**99** (41.3)	73.7		**64** (45.4)	73.4		**35** (35.4)	74.3	
No	**141** (58.8)	74.5	*.90*	**77** (54.6)	71.4	*.79*	**64** (64.7)	78.1	*.67*
Weight Status**									
Overweight/Obese	**169** (71.0)	78.7		**89** (63.1)	78.7		**80** (82.5)	78.8	
Not Overweight/Obese	**69** (29.0)	62.3	***.009***	**52** (36.9)	61.5	***.028***	**17** (17.5)	64.7	*.22*
Children in the Home									
≥ 1	**138** (59.2)	76.1		**87** (63.0)	75.9		**51** (53.7)	76.5	
None	**95** (40.8)	70.5	*.34*	**51** (37.0)	64.7	*.16*	**44** (46.3)	77.3	*.93*
Smoking									
Current Smoker	**35** (14.6)	74.3		**12** (8.6)	75.0		**23** (23.2)	73.9	
Nonsmoker	**204** (85.4)	74.5	*.98*	**128** (91.4)	72.7	*.86*	**76** (76.8)	77.6	*.71*
Chronic Disease Diagnosis***									
≥ 1	**93** (39.2)	80.7		**47** (33.8)	87.2		**46** (46.9)	73.9	
None	**144** (60.8)	70.1	*.07*	**92** (66.2)	64.1	***.004***	**52** (53.1)	80.8	*.42*
Education									
≥ 4 yr. College Degree	**130** (55.3)	70.8		**69** (50.4)	68.1		**61** (62.4)	73.8	
< 4 yr. College Degree	**105** (44.7)	79.1	*.15*	**68** (49.6)	77.9	*.20*	**37** (37.8)	81.1	*.41*
Marital Status									
(Living as) Married	**183** (76.6)	74.9		**108** (77.1)	75.0		**75** (75.8)	74.7	
Not married	**56** (23.4)	71.4	*.61*	**32** (22.9)	62.5	*.17*	**24** (24.2)	83.3	*.38*
Social Support- PA^	***M:* 5.46** *SD:* (1.84)			***M:* 5.36** *SD:* (1.83)			***M:* 5.60** *SD:* (1.86)		
	239	5.54 (1.80)	*.19*	**140**	5.49 (1.72)	*.18*	**99**	5.63 (1.92)	*.73*
Environmental Support- PA^	***M:* 14.72** *SD:* (2.04)			***M:* 14.49** *SD:* (2.15)			***M:* 15.05** *SD:* (1.84)		
	237	14.85 (1.98)	*. 12*	**139**	14.58 (2.11)	*.43*	**99**	15.20 (1.74)	*.15*
Age^	***M:* 51.3** *SD:* (13.1)			***M:* 50.69** *SD:* 12.25			***M:* 52.20** *SD:* 14.32		
	240	51.22 (13.14)	*.86*	**141**	51.07 (11.96)	*.55*	**99**	51.43 (14.66)	*.33*
% of Life Lived in US^	***M:* 36.98** *SD:* (22.46)			***M:* 35.43** *SD:* (19.19)			***M:* 39.14** *SD:* (26.32)		
	235	38.27 (23.71)	*.13*	**137**	34.90 (19.65)	*.60*	**98**	42.77 (27.74)	***.013***

*Differences between groups calculated using Chi-square and t-tests; **Overweight/Obese = BMI ≥ 23(WHO, 2004); ***Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^ = continuous measure; PA = Physical Activity

Appendix D

FACTORS ASSOCIATED WITH MEETING MINIMAL PA GUIDELINES:
RESULTS OF LOGISTIC REGRESSION ANALYSES, *STANDARD WEIGHT STATUS CUTOFFS INCLUDED IN MODEL VS. WHO (2004) ASIAN SPECIFIC CUTOFFS AS IN PRIMARY ANALYSES*

VARIABLE:	Odds Ratio (95% CI; p-value)		
	TOTAL SAMPLE (N=240)	**WOMEN** (N = 141)	**MEN** (N=99)
Female	1.25 (.66-2.37; .493)	--	--
PA Guideline Knowledge (≥ 5 days/week)	**2.78** *(1.51-5.12; .001)*	1.91 (.86-4.22; .111)	**5.08** *(1.71-15.11; .003)*
Time Barrier to PA	**.60** *(.33-1.11; .11)*	.94 (.42-2.11; .887)	**.29** *(.10-.85; .023)*
Overweight/Obese*	1.59 (.85-2.98; .145)	1.62 (.69-3.81; .271)	2.44 (.76-7.85; .134)
≥ 1 Child in the Home	1.09 (.57-2.09; .805)	1.58 (.67-3.72; .297)	.83 (.25-2.73; .760)
≥ 1 Chronic Disease Diagnosis**	**2.97** *(1.43 – 6.13; .035)*	**5.48** *(1.89-15.91; .002)*	1.77 (.54-5.75; .345)
≥ 4 Year College Degree	**.45** *(.24-.86; .015)*	.46 (.20-1.04; .063)	.68 (.21-2.15; .510)
Married/Living as Married	.94 (.42-2.10; .884)	1.29 (.47-3.51; .619)	.44 (.07-2.66; .373)
Social Support PA^	1.02 (.87 -1.21; .777)	1.02 (.81-1.28; .890)	1.08 (.81-1.43; .604)
Environmental Support PA^	1.08 (.92-1.25; .354)	1.01 (.83-1.22;.948)	1.16 (.87-1.55; .306)
Age^	**.97** *(.94-.99; .015)*	**.97** *(.94-1.00; .085)*	.97 (.92-1.02; .247)
% of Life Lived in US^	1.01 (.99-1.03; .201)	.99 (.97-1.02; .603)	**1.02** *(1.00-1.05; .080)*

PA = Physical Activity; *Overweight/Obese = BMI ≥ 25 (Standard Cut-off); ** Chronic Disease = Diagnosis of Hypertension, Heart Disease, or Diabetes; ^ = continuous measure

Appendix E

FACTORS ASSOCIATED WITH MEETING MINIMAL PA GUIDELINES:
RESULTS OF LOGISTIC REGRESSION ANALYSES: *HYPERTENSION DIAGNOSIS INCLUDED IN MODEL VS. HYPERTENSION, HEART DISEASE OR DIABETES AS IN PRIMARY ANALYSES*

	Odds Ratio (95% CI; p-value)		
	TOTAL SAMPLE (N=240)	**WOMEN** (N = 141)	**MEN** (N=99)
Female	1.16 (.60-2.21; .663)	--	--
PA Guideline Knowledge (≥ 5 days/week)	**2.58** *(1.41-4.72; .002)*	1.92 (.86-4.28; .109)	**3.69** *(1.30-10.48; .014)*
Time Barrier to PA	.57 (.31-1.06; .076)	.93 (.42-2.08; .860)	**.29** *(.10-.86; .026)*
Overweight/Obese*	1.53 (.77-3.03; .223)	1.83 (.79-4.19; .156)	1.36 (.31-5.95; .683)
≥ 1 Child in the Home	1.08 (.56-2.07; .818)	1.48 (.63-3.48; .364)	1.02 (.32-3.26; .975)
Hypertension Diagnosis**	**3.09** (1.47 – 6.52; .003)	**6.84** *(2.07-22.66; .002)*	2.05 (.65-6.47; .220)
≥ 4 Year College Degree	**.46** *(.25-.88; .018)*	.48 (.21-1.09; .078)	.68 (.21-2.15; .508)
Married/Living as Married	.87 (.39-1.94; .729)	1.27 (.45-3.49; .649)	.33 (.05-2.17; .247)
Social Support– PA^	1.00 (.99 -1.03; .976)	1.00 (.79-1.25; .969)	.99 (.74-1.32; .954)
Environmental Support– PA^	1.06 (.91-1.23; .429)	.99 (.82-1.89;.880)	1.11 (.83-1.48; .483)
Age^	**.96** *(.94-.99; .016)*	**.96** *(.93-1.00; .052)*	.97 (.92-1.02; .192)
% of Life Lived in US^	1.01 (.99-1.03; .195)	.99 (.97-1.01; .492)	1.03 (1.00-1.06; .057)

*Overweight/Obese = BMI ≥ 23 (WHO, 2004); ** Chronic Disease = Diagnosis of Hypertension, Heart Disease, or Diabetes; ^ = continuous measure; PA = Physical Activity

Appendix F

FACTORS ASSOCIATED WITH MEETING MINIMAL PA GUIDELINES:
RESULTS OF LOGISTIC REGRESSION ANALYSES: *2008 PA GUIDELINES FOR AMERICANS USED TO CATEGORIZE PA OUTCOME VS. 2007 ACSM/AHA PA GUIDELINES AS IN PRIMARY ANALYSES*

VARIABLE:	Odds Ratio (95% CI; p-value)		
	TOTAL SAMPLE (N=240)	**WOMEN** (N = 141)	**MEN** (N=99)
Female	1.01 (.51-2.00; .974)	--	--
PA Guideline Knowledge (≥ 5 days/week)	**2.58** *(1.35-4.87; .004)*	1.84 (.79-4.27; .155)	**3.77** *(1.21-11.79; .022)*
Time Barrier to PA	.80 (.41-1.53; .494)	1.06 (.45-2.48; .897)	.56 (.17-1.84; .337)
Overweight/Obese*	**2.02** (*1.01-4.06; .048*)	2.01 (.84-4.79; .115)	3.40 (.78-14.76; .102)
≥ 1 Child in the Home	1.27 (.65-2.48; .489)	1.79 (.73-4.36; .200)	1.12 (.32-3.86; .863)
≥ 1 Chronic Disease Diagnosis**	1.84 (.87 – 3.91; .113)	**5.49** *(1.73-17.41; .004)*	.56 (.15-2.02; .373)
≥ 4 Year College Degree	.56 (.29-1.09; .087)	.60 (.25-1.40; .234)	.74 (.19-2.80; .654)
Married/Living as Married	1.41 (.63-3.15; .398)	1.66 (.59-4.63; .334)	1.09 (.18-6.64; .927)
Social Support– PA^	1.08 (.90 -1.29; .406)	1.08 (.85-1.37; .527)	1.13 (.83-1.53; .439)
Environmental Support– PA^	1.10 (.94-1.29; .219)	1.01 (.83-1.24;.886)	1.24 (.92-1.67; .163)
Age^	.97 (.94-1.00; .058)	.97 (.94-1.00; .068)	.99 (.93-1.05; .688)
% of Life Lived in US^	1.01 (1.00-1.03; .169)	.99 (.97-1.01; .384)	**1.04** (*1.01-1.07; .016*)

PA = Physical Activity *Overweight/Obese = BMI ≥ 23 (WHO, 2004); ** Chronic Disease = Diagnosis of Hypertension, Heart Disease, or Diabetes; ^ = continuous measure

Appendix G

FACTORS ASSOCIATED WITH MEETING MINIMAL PA GUIDELINES: RESULTS OF LOGISTIC REGRESSION ANALYSES, *2008 PA GUIDELINES FOR AMERICANS USED TO CATEGORIZE PA OUTCOME VS. 2007 ACSM/AHA PA GUIDELINES AND STANDARD WEIGHT STATUS CUTOFFS INCLUDED IN MODEL VS. WHO (2004) ASIAN SPECIFIC CUTOFFS*

VARIABLE	Odds Ratio (95% CI; p-value)		
	TOTAL SAMPLE (N=240)	**WOMEN** (N = 141)	**MEN** (N=99)
Female	.92 (.47-1.79; .807)	--	--
PA Guideline Knowledge (≥ 5 days/week)	**2.68** *(1.42-5.07; .002)*	1.94 (.85-4.44; .118)	**4.30** *(1.36-13.55; .013)*
Time Barrier to PA	.85 (.45-1.62; .630)	1.09 (.47-2.52; .848)	**.62** *(.19-1.96; .413)*
Overweight/Obese*	**1.31** (*.68-2.54; .415*)	1.15 (.47-2.82; .757)	2.02 (.60-2.76; .256)
≥ 1 Child in the Home	1.28 (.65-2.49; .473)	1.73 (.72-4.16; .261)	1.06 (.31-3.68; .923)
≥ 1 Chronic Disease Diagnosis**	1.86 (.88 – 3.97; .106)	**5.51** *(1.75-17.37; .004)*	.58 (.16-2.04; .393)
≥ 4 Year College Degree	.55 (.28-1.06; .075)	.62 (.26-1.44; .261)	.62 (.16-2.37; .487)
Married/Living as Married	1.42 (.64-3.15; .394)	1.68 (.61-4.65; .318)	1.20 (.20-7.03; .843)
Social Support PA^	1.10 (.93 -1.31; .275)	1.11 (.80-1.40; .399)	1.19 (.88-1.61; .268)
Environmental Support PA^	1.10 (.94-1.28; .246)	1.01 (.83-1.24;.884)	1.23 (.91-1.67; .175)
Age^	.98 (.95-1.00; .095)	.97 *(.94-1.01; .125)*	.99 (.93-1.05; .723)
% of Life Lived in US^	1.01 (1.00-1.03; .131)	.99 (.97-1.01; .471)	1.04 (1.01-1.07; .016)

PA = Physical Activity; *Overweight/Obese = BMI ≥ 25 (Standard Cut-off); ** Chronic Disease = Diagnosis of Hypertension, Heart Disease, or Diabetes; ^ = continuous measure

Appendix H

FACTORS ASSOCIATED WITH MEETING MINIMAL PA GUIDELINES:
RESULTS OF LOGISTIC REGRESSION ANALYSES AMONG TOTAL SAMPLE (N=240)
– INCLUDES EXAMINATION OF INTERACTION BETWEEN GENDER AND VARIABLES OBSERVED TO VARY BY GENDER IN STRATIFIED ANALYSES

VARIABLE:	**Odds Ratio** (95% CI; p)	**Odds Ratio** (95% CI; p)	**Odds Ratio** (95% CI; p)	**Odds Ratio** (95% CI; p)	**Odds Ratio** (95% CI; p)
Female	1.28 (.67-2.43; .458)	1.61 (.674-3.85; .278)	.87 (.385-1.97; .739)	.94 (.43-2.22; .973)	.34 (.02-5.15; .434)
PA Guideline Knowledge (≥ 5 days/week)	**2.63** *(1.44-4.81; .002)*	**2.64** *(1.44-4.85; .002)*	**2.62** *(1.43-4.81; .002)*	**2.64** *(1.44-4.85; .002)*	**2.66** *(1.45-4.87; .002)*
Time Barrier to PA	.58 (.32-1.08; .084)	.58 (.31-1.07; .081)	.32 (.12-.86; .024)	.58 (.31-1.07; .081)	.57 (.31-1.06; .078)
Overweight/Obese*	1.68 (.85-3.32; .134)	1.71 (.86-3.37; .123)	1.76 (.89-3.50; .106)	1.63 (.82-3.24; .160)	1.61 (.81-3.20; .175)
≥ 1 Child in the Home	1.12 (.59-2.14; .728)	1.13 (.59-2.16; .714)	1.12 (.58-2.15; .738)	1.13 (.59-2.18; .711)	1.12 (.58-2.14; .737)
**≥ 1 Chronic Disease ** **	**3.09** *(1.50 – 6.35; .002)*	**3.09** *(1.50 – 6.37; .002)*	**3.15** *(1.52 – 6.52; .002)*	**1.97** *(.75 – 5.20; .170)*	**3.18** *(1.53 – 6.61; .002)*
≥ 4 Year College Degree	**.47** *(.25-.89; .019)*	**.48** *(.26-.91; .024)*	**.48** *(.25-.89; .021)*	**.48** *(.26-.91; .025)*	**.47** *(.25-.88; .019)*
Married/Living as Married	.92 (.42-2.05; .845)	.93 (.42-2.06; .863)	.91 (.41-2.04; .822)	.99 (.44-2.22; .973)	.99 (.44-2.22; .983)
Social Support PA^	1.01 (.85 -1.19; .910)	1.01 (.86 - 1.20; .880)	1.00 (.85 - 1.19; .955)	1.01 (.85 -1.19; .951)	1.01 (.85 -1.19; .951)
Env. Support PA^	1.08 (.93-1.25; .337)	1.07 (.92-1.25; .368)	1.07 (.92-1.25; .351)	1.07 (.92-1.25; .392)	1.07 (.92-1.25; .374)
Age^	**.96** *(.94-.99; .010)*	**.96** *(.94-.99; .010)*	**.96** *(.94-.99; .008)*	**.96** *(.94-.99; .010)*	**.95** *(.91-.99; .015)*
% of Life Lived in US^	1.01 (.99-1.02; .238)	1.01 (.99-1.02; .248)	1.01 (.99-1.02; .316)	1.01 (.99-1.02; .251)	1.01 (.99-1.02; .265)
Gender x PA Guideline Knowledge	--	.61 (.18-2.05; .424)	--	--	--
Gender x Time Barrier to PA	--	--	**2.62** (.76-9.09; .128)	--	--
Gender x Chronic Disease**	--	--	--	**2.46** (.65-9.31; .185)	--
Gender x Age	--	--	--		1.03 (.98-1.08; .323)

PA = Physical Activity; *Overweight/Obese = BMI ≥ 23 (WHO, 2004); ** Chronic Disease = Diagnosis of Hypertension, Heart Disease, or Diabetes; ^ = continuous measure

Appendix I

PA, Insurance Coverage, & Chronic Disease Diagnosis in Relation to Depressive Symptoms: Multivariate OLS Regression Analyses in Total Sample (N=250) controlling for gender, weight status, marital status, education, age, and % of life lived in the U.S.

VARIABLE	Beta (SE)									
Meet Min PA Rec (PA) ^	.11 (.44)	.15 (.44)	.61 (.53)	.60 (.69)	.17 (.44)	.13 (.47)	.15 (.45)	.12 (.45)	.13 (.46)	.15 (.45)
No Insurance (No Ins)	**.98* (.41)**	**.81* (.42)**	**.78† (.42)**	**1.32† (.74)**	.46 (.53)	**.77† (.48)**	.64 (.63)	**.81* (.42)**	**.81* (.42)**	**.84† (.46)**
Chronic Disease (CD)^^	-.57 (.43)	-.39 (.48)	.72 (.84)	-.43 (.48)	-.93 (.68)	-.46 (.58)	-.40 (.48)	-.38 (.48)	-.45 (.58)	-.35 (.55)
Female		**.76† (.42)**	**.79† (.42)**	**.77† (.42)**	**.75† (.42)**	**.76† (.42)**	.60 (.62)	.09 (.91)	.72 (.49)	.79 (.46)
Overwt/ Obese^^^		**-.84† (.47)**	**-.87† (.47)**	**-.81† (.47)**	**-.85† (.47)**	**-.84† (.47)**	**-.83† (.47)**	**-.84† (.47)**	**-.84† (.47)**	**-.84† (.48)**
≥ College		.25 (.42)	.22 (.42)	.22 (.42)	.25 (.42)	.25 (.42)	.25 (.42)	.31 (.43)	.26 (.42)	.25 (.42)
Married		**-.82† (.52)**	**-.79† (.52)**	**-.80†* (.52)**	**-.88† (.52)**	**-.83† (.53)**	**-.82† (.52)**	**-1.37† (.84)**	**-.81† (.52)**	**-.81† (.52)**
Age		-.01 (.02)	<.01 (.02)	<.01 (.02)	<.01 (.02)	<.01 (.02)	<.01 (.02)	<.01 (.02)	<.01 (.02)	<.01 (.02)
% Life in U.S.		-.01 (.01)	<-.01 (.01)	<-.01 (.01)	<-.01 (.01)	<-.01 (.01)	<-.01 (.01)	<-.01 (.01)	<-.01 (.01)	<-.01 (.01)
PA X CD			**-1.5† (.95)**	--	--	--	--	--	--	--
PA X No Ins				-.75 (.89)	--	--	--	--	--	--
No Ins X CD					.95 (.86)	--	--	--	--	--
PA x No Ins x CD						.16 (.84)	--	--	--	--
Female x No Ins							.30 (.82)	--	--	--
Female x Married								.88 (1.05)	--	--
Female x PA x CD									.14 (.82)	--
Female x No Ins x CD										-.13 (.87)

*p≤.05; †p≤.10; ^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004)

Appendix J

PA, Insurance Coverage, & Chronic Disease Diagnosis in Relation to Depressive Symptoms:
Multivariate OLS Regression Analyses *among Women* (N=145) controlling for weight status, marital status, education, age, and % of life lived in the U.S.

VARIABLE	Beta (SE)						
Min PA Rec Met (PA) ^	.57 (.60)	.67 (.61)	.65 (.71)	1.05 (.97)	.67 (.61)	.62 (.63)	.65 (.71)
No Insurance (No Ins)	**1.10 (.55)***	**.93 (.60) †**	**.94 (.57) †**	1.35 (1.01)	1.02 (.71)	.83 (.65)	-.50 (1.51)
Chronic Disease (CD)^^	-.69 (.60)	-.56 (.69)	-.66 (1.26)	-.58 (.70)	-.42 (.99)	-.73 (.84)	1.02 (.71)
Overwt/ Obese^^^		-.78 (.60)	-.78 (.61)	-.76 (.61)	-.78 (.61)	-.78 (.61)	-.78 (.61)
≥ College		.43 (.57)	.43 (.58)	.43 (.57)	.43 (.57)	.43 (.57)	.43 (.58)
Married		-.59 (.68)	-.58 (.68)	-.57 (.70)	-.57 (.68)	-.62 (.68)	-.57 (.69)
Age		-.01 (.03)	-.01 (.03)	.01 (.03)	<.01 (.03)	.01 (.03)	.01 (.03)
% Life in U.S.		-.01 (.02)	-.01 (.02)	-.01 (.02)	-.01 (.02)	-.01 (.02)	.01 (.02)
PA X CD			.13 (1.42)	--	--	--	.10 (1.43)
PA X No Ins				-.60 (1.22)	--	--	--
No Ins X CD					-.24 (1.20)	--	-.23 (1.21)
PA x No Ins x CD						.40 (1.16)	--

*p≤.05; †p≤.10; ^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23(WHO, 2004)

Appendix K

PA, Insurance Coverage, & Chronic Disease Diagnosis in Relation to Depressive Symptoms: Multivariate OLS Regression Analyses *among Men* (N=145) controlling for weight status, marital status, education, age, and % of life lived in the U.S.

VARIABLE	Beta (SE)						
Min PA Rec Met (PA) ^	-.51 (.65)	-.77 (.68)	.33 (.87)	-.14 (1.01)	-.79 (.66)	-.87 (.74)	.15 (.86)
No Insurance (No Ins)	.71 (.61)	.68 (.63)	.59 (.62)	1.46 (1.13)	-.49 (.79)	.54 (.73)	-.43 (.79)
Chronic Disease (CD)^^	-.27 (.62)	-.18 (.67)	**1.81 (1.19) †**	-.22 (.67)	**-1.71 (.93) †**	-.34 (.82)	.15 (1.42)
Overwt/ Obese^^^		-.87 (.85)	-.83 (.84)	-.79 (.86)	-.75 (.84)	-.88 (.86)	-.73 (.83)
≥ College		.11 (.67)	.11 (.66)	<-.01 (.69)	.14 (.66)	.14 (.68)	.14 (.65)
Married		-1.37 (.94)	-1.04 (.94)	-1.32 (.95)	**-1.59 (.92) †**	**-1.45 (.97) †**	-1.28 (.93)
Age		.01 (.03)	<.01 (.03)	.01 (.03)	.02 (.03)	.01 (.03)	.01 (.03)
% Life in U.S.		<.01 (.01)	<.01 (.01)	<.01 (.01)	.01 (.01)	<.01 (.01)	.01 (.01)
PA X CD			**-2.77 (1.37)***	--	--	--	**-2.34 (1.36) †**
PA X No Ins				-1.14 (1.36)	--	--	--
No Ins X CD					**2.86 (1.23)***	--	**2.52 (1.23)***
PA x No Ins x CD						.46 (1.29)	--

*p≤.05; †p≤.10; ^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23(WHO, 2004)

Appendix L

PA, Insurance Coverage & Chronic Disease Diagnosis in Relation to Depressive Symptoms: Results of Multivariate Ordinary Least Squares Regression Analyses, controlling for gender, weight status, marital status, education, age, and % of life lived in the U.S. -- *PA estimated in keeping with 2008 PA Guidelines for Americans, vs. 2007 ACSM/AHA Guidelines as in Primary Analyses*

	B (SE) among **Total Sample** (N=250)			*B (SE)* among **Women** (N=145)		*B (SE)* among **Men** (N=105)		
Variable	***B (SE)*** With No Controls	***B (SE)*** With Controls	***B (SE)*** FINAL	***B (SE)*** With No Controls	***B (SE)*** With Controls /FINAL	***B (SE)*** With No Controls	***B (SE)*** With Controls	***B (SE)*** FINAL
Meet Min PA Rec (PA) ^	-.59 (.49)	-.38 (.50)	.21 (.60)	-.25 (.65)	-.10 (.67)	-.98 (.79)	-1.15 (.83)	.33 (1.17)
No Insurance (No Ins)	**.86* (.43)**	**.72† (.44)**	**.78† (.42)**	**.83† (.58)**	.66 (.60)	.81 (.65)	.89 (.68)	-.34 (.85)
Chronic Disease (CD)^^	-.41 (.45)	-.24 (.50)	1.30 (1.01)	-.47 (.62)	-.26 (.72)	-.28 (.66)	-.31 (.72)	.74 (1.77)
Female		.58 (.44)	**.67† (.44)**		--		--	--
Overwt/ Obese^^^		**-.83† (.49)**	**-.90† (.49)**		-.82 (.20)		-.58 (.89)	-.74 (.88)
≥ College		.14 (.44)	.16 (.44)		.27 (.60)		.18 (.73)	.34 (.71)
Married		-.72 (.54)	**-.69† (.54)**		-.56 (.73)		-1.17 (.99)	-1.13 (.97)
Age		<-.01 (.02)	<.01 (.02)		<.01 (.03)		.02 (.03)	.02 (.03)
% Life in U.S.		<-.01 (.01)	<-.01 (.01)		-.01 (.02)		<.01 (.02)	.01 (.02)
PA X CD			**-1.9† (1.09)**					**-2.98† (1.65)**
No Ins X CD								**2.62* (1.32)**

NOTE: Models examining all hypothesized interactions were examined in the total sample and in gender stratified analyses, the table presents results of models that demonstrated significant results (i.e., no significant interactions were observed in analyses among women, 2 significant interactions were observed in analyses among men and were estimated in one model presented in the table, 1 significant interaction observed among the total sample is presented in the table);*p≤.05; †p≤.10;^ Met Minimal 2008 PA Guidelines for Americans (USDHHS 2008, 2008a); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004)

Appendix M

PA, Insurance Coverage & Chronic Disease Diagnosis in Relation to Depressive Symptoms: Results of Multivariate Ordinary Least Squares Regression Analyses, controlling for gender, weight status, marital status, education, age, and % of life lived in the U.S. – *Hypertension included as an independent variable, vs. hypertension, heart disease, or diabetes as in primary analyses*

	B (SE) among **Total Sample** (N=250)		*B (SE)* among **Women** (N=145)		*B (SE)* among **Men** (N=105)	
Variable	***B (SE)*** With No Controls	***B (SE)*** With Controls FINAL	***B (SE)*** With No Controls	***B (SE)*** With Controls/ FINAL	***B (SE)*** With No Controls	***B (SE)*** With Controls FINAL
Meet Min PA Rec (PA) ^	.19 (.44)	.22 (.44)	.65 (.59)	.76 (.61)	-.40 (.65)	-.68 (.69)
No Insurance (No Ins)	**.92* (.41)**	**.77† (.42)**	**.99† (.56)**	**.84† (.57)**	.66 (.60)	.66 (.63)
Hypertention Diagnosis (HD)	**-.82† (.45)**	-.66 (.49)	-1.03† (.63)	-.98 (.73)	-.47 (.63)	-.36 (.67)
Female		**.82* (.42)**		--		--
Overwt/ Obese^^^		**-.74† (.47)**		-.73 (.60)		-.71 (.87)
≥ College		.26 (.42)		.37 (.57)		.16 (.67)
Married		**-.79† (.52)**		-.64 (.67)		-1.28 (.95)
Age		.01 (.02)		-.01 (.03)		.01 (.03)
% Life in U.S.		<-.01 (.01)		-.01 (.02)		.01 (.01)

NOTE: No significant interactions were observed in analyses that included hypertension as a covariate, results of models estimated to examine hypothesized study interactions are not presented in table; *p≤.05; †p≤.10;^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004)

Appendix N

PA, Insurance Coverage & Chronic Disease Diagnosis in Relation to Depressive Symptoms: Results of Multivariate Ordinary Least Squares Regression Analyses, controlling for gender, weight status, marital status, education, age, and % of life lived in the U.S. – *Standard Cutoffs used to determine weight status, vs. Asian specific cutoffs used in primary analyses*

	B (SE) among **Total Sample** (N=250)			*B (SE)* among **Women** (N=145)		*B (SE)* among **Men** (N=105)		
Variable	***B (SE)*** With No Controls	***B (SE)*** With Controls	***B (SE)*** FINAL	***B (SE)*** With No Controls	***B (SE)*** With Controls /FINAL	***B (SE)*** With No Controls	***B (SE)*** With Controls	***B (SE)*** FINAL
Meet Min PA Rec (PA) ^	.11 (.44)	.08 (.45)	.51 (.34)	.57 (.60)	.58 (.61)	-.51 (.65)	-.84 (.68)	.09 (.87)
No Insurance (No Ins)	**.98* (.41)**	**.88* (.42)**	**.84* (.05)**	**1.10† (.55)**	**1.02† (.57)**	.71 (.61)	.73 (.63)	-.41 (.79)
Chronic Disease (CD)^^	-.57 (.43)	-.51 (.49)	.56 (.52)	-.69 (.60)	-.74 (.70)	-.27 (.62)	-.24 (.68)	.05 (1.44)
Female		**.95* (.42)**	**.97* (.42)**		--		--	--
Overwt/ Obese^^^		**.12 (.43)**	.08 (.43)		.33 (.60)		-.02 (.65)	.04 (.63)
≥ College		.25 (.42)	.22 (.42)		.36 (.57)		.21 (.67)	.23 (.65)
Married		**-.91† (.52)**	**-.88† (.52)**		-.65 (.68)		**-1.60† (.96)**	-1.50 (.95)
Age		<.01 (.02)	<.01 (.02)		<-.01 (.03)		.02 (.03)	.02 (.03)
% Life in U.S.		<-.01 (.01)	<-.01 (.01)		-.01 (.02)		.01 (.01)	.01 (.01)
PA X CD			**-1.4† (.96)**					**-2.34 (1.37) †**
No Ins X CD								**2.59 (1.24)***

NOTE: Models examining all hypothesized interactions were examined in the total sample and in gender stratified analyses, the table presents results of models that demonstrated significant results (i.e., no significant interactions were observed in analyses among women, 2 significant interactions were observed in analyses among men and were estimated in one model presented in the table, 1 significant interaction observed among the total sample is presented in the table); *p≤.05; †p≤.10;^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 25

Appendix O

PA, Insurance Coverage, & Chronic Disease Diagnosis in Relation to Mild-Moderate Depressive Symptoms: Results of Multivariate OLS Regression Analyses in the sample (N=119), controlling for gender, weight status, marital status, education, age, and % of life lived in the U.S.

VARIABLE	Beta (SE)					
Meet Min PA Rec (PA) ^	-.21 (.49)	-.05 (.51)	.43 (.60)	.73 (.84)	-.06 (.52)	.14 (.55)
No Insurance (No Ins)	**.95 (.45)***	**1.12* (.48)**	**1.17* (.48)**	**2.01* (.90)**	**1.02† (.59)**	**1.39* (.55)**
Chronic Disease (CD)^^	-.02 (.47)	-.15 (.54)	1.11 (1.00)	-.09 (.54)	-.33 (.82)	.29 (.70)
Female		.49 (.49)	.61 (.49)	.52* (.49)	.50 (.49)	.52 (.49)
Overwt/ Obese^^^		-.25 (.50)	-.20 (.50)	-.17* (.51)	-.26 (.50)	-.17 (.51)
≥ College		.32 (.48)	.25 (.48)	.30 (.48)	.32 (.48)	.30 (.48)
Married		.56 (.56)	.62 (.56)	.60* (.57)	-.54 (.57)	.66 (.57)
Age		.02 (.02)	.02 (.02)	.02 (.02)	.02 (.02)	.02 (.02)
% Life in U.S.		.01 (.01)	.01 (.01)	.01 (.01)	.01 (.01)	.01 (.01)
PA X CD			**-1.69† (1.12)**	--	--	--
PA X No Ins				-1.22 (1.05)	--	--
No Ins X CD					.30 (1.00)	--
PA x No Ins x CD						-.96 (.99)

*p≤.05; †p≤.10; ^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004)

Appendix P

PA, Insurance Coverage, & Chronic Disease Diagnosis in Relation to Mild-Moderate Depressive Symptoms: Multivariate OLS Regression Analyses *among Women* (N=77), controlling for weight status, marital status, education, age, and % of life lived in the U.S.

VARIABLE	Beta (SE)					
Min PA Rec Met (PA) ^	.05 (.61)	.27 (.67)	.39 (.74)	1.11 (1.07)	.29 (.67)	.35 (.68)
No Insurance (No Ins)	**1.39 (.56)***	**1.51 (.60)***	**1.54 (.61)***	**2.50 (1.17)***	**1.64 (.74)***	**1.79 (.72)***
Chronic Disease (CD)^^	-.17 (.61)	-.41 (.74)	.19 (1.61)	-.30 (.75)	-.16 (1.08)	.09 (1.02)
Overwt/ Obese^^^		.01 (.62)	.02 (.62)	.08 (.62)	.03 (.62)	.08 (.63)
≥ College		.51 (.61)	.48 (.62)	.55 (.61)	.51 (.61)	.49 (.61)
Married		.36 (.73)	.39 (.73)	.37 (.73)	.37 (.73)	.43 (.73)
Age		.02 (.03)	.02 (.03)	.02 (.03)	.02 (.03)	.02 (.03)
% Life in U.S.		.01 (.02)	.01 (.02)	.01 (.02)	.01 (.02)	.01 (.02).
PA X CD			-.71 (1.72)	--	--	--
PA X No Ins				-1.33 (1.34)	--	--
No Ins X CD					-.42 (1.30)	--
PA x No Ins x CD						-.91 (1.30)

*p≤.05; †p≤.10;^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004)

Appendix Q

PA, Insurance Coverage, & Chronic Disease Diagnosis in Relation to Mild-Moderate Depressive Symptoms: Multivariate OLS Regression Analyses *among Men* (N=42), controlling for weight status, marital status, education, age, and % of life lived in the U.S.

VARIABLE	Beta (SE)					
Min PA Rec Met (PA) ^	-.67 (.82)	-.58 (.90)	.80 (1.19)	.52 (1.52)	-.66 (.91)	-.17 (1.10)
No Insurance (No Ins)	.08 (.78)	.37 (.93)	.26 (.91)	1.71 (1.74)	-.16 (1.12)	.63 (1.01)
Chronic Disease (CD)^^	.34 (.78)	.40 (.89)	**2.56 (1.52) †**	.46 (.90)	-.51 (1.38)	.90 (1.18)
Overwt/ Obese^^^		-1.17 (1.07)	-1.14 (1.04)	-1.02 (1.09)	-1.19 (1.07)	-1.10 (1.09)
≥ College		-.40 (.92)	-.47 (.90)	-.69 (.97)	-.47 (.93)	-.42 (.93)
Married		1.47 (1.19)	**1.88 (1.18) †**	1.74 (1.23)	1.33 (1.21)	1.72 (1.26)
Age		-.01 (.04)	-.03 (.04)	-.01 (.04)	<-.01 (.04)	-.01 (.04)
% Life in U.S.		.01 (.02)	<.01 (.02)	.02 (.02)	.01 (.02)	.01 (.02)
PA X CD			**-3.11 (1.79) †**	--	--	--
PA X No Ins				-1.77 (1.95)	--	--
No Ins X CD					1.49 (1.71)	--
PA x No Ins x CD						-1.22 (1.84)

*p≤.05; †p≤.10;^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004)

Appendix R

FACTORS ASSOCIATED WITH TOTAL PHYSICAL ACTIVITY (SQUARE ROOT OF PA) ESTIMATED CONTROLLING FOR SHARED ERROR VARIANCE IN ESTMATION OF DEPRESSIVE SYMPTOMS: RESULTS OF PA EQUATION GENERATED USING SEEMINGLY UNRELATED REGRESSION ANALYSES

INDEPENDENT VARIABLE:	**Total Sample** N=230 Beta (SE)				**Women** N=135 Betas (SE)			
Female	-3.89 (3.75)	-3.45 (3.73)	-3.44 (3.73)	-3.44 (3.73)	--	--	--	--
Knowledge	**10.49** (3.56)**	**10.91** (3.54)**	**10.89** (3.54)**	**10.89** (3.54)**	**7.02† (4.34)**	**7.57† (4.34)**	**7.57† (4.34)**	**7.57† (4.34)**
Time Barrier	-2.53 (3.64)	-2.46 (3.61)	-2.48 (3.61)	-2.46 (3.61)	3.69 (4.32)	3.68 (4.30)	3.68 (4.30)	3.68 (4.30)
Overwt/ Obese^^^	4.02 (4.09)	4.00 (4.05)	3.99 (4.05)	4.00 (4.05)	5.54 (4.62)	5.29 (4.61)	5.29 (4.61)	5.29 (4.61)
≥ 1 Child @ Home	-.08 (3.80)	**53.82* (25.90)**	**53.54* (25.91)**	**53.64* (25.91)**	6.63 (4.54)	39.08 (29.30)	39.08 (29.30)	39.07 (29.30)
CD^^	3.35 (4.04)	2.90 (4.01)	2.90 (4.01)	2.91 (4.01)	**9.22† (5.12)**	**9.14† (5.10)**	**9.14† (5.10)**	**9.15† (5.10)**
≥ College	-2.14 (3.62)	-2.17 (3.59)	-2.17 (3.59)	-2.17 (3.59)	-4.31 (4.45)	-4.33 (4.45)	-4.32 (4.43)	-4.32 (4.43)
Married	-.95 (4.66)	-.30 (4.63)	-.30 (4.63)	-.31 (4.63)	.83 (5.44)	.85 (5.44)	1.14 (5.43)	1.14 (5.43)
Social Sup PA	-.79 (.97)	-.77 (.97)	-.76 (.97)	-.77 (.97)	.15 (1.21)	.16 (1.21)	.18 (1.21)	.18 (1.21)
Env Sup PA	**1.83* (.90)**	**3.70** (1.27)**	**3.71** (1.27)**	**3.71** (1.27)**	.55 (1.04)	.53 (1.04)	1.71 (1.47)	1.71 (1.47)
Age	-.15 (.16)	-.15 (.16)	-.15 (.16)	-.14 (.16)	-.24 (.21)	-.26 (.21)	-.26 (.21)	-.26 (.21)
% Life in U.S.	**.18* (.09)**	**.16* (.09)**	**.16† (.09)**	**.16† (.09)**	-.15 (.12)	-.16 (.12)	**-.16 (.12)**	**-.16 (.12)**
Env Sup PA X ≥ 1 Child	--	**-3.69* (1.75)**	**-3.67* (1.75)**	**-3.67* (1.75)**	--	-2.27 (2.02)	-2.27 (2.02)	-2.27 (2.02)
R^2	.113	.125	.125	.125	.102	.110	.110	.109
	Men N=95 Betas (SE)							
Knowledge	**12.74* (5.78)**	**12.74* (5.78)**	**12.74* (5.78)**	**12.74* (5.78)**				
Time Barrier	-8.46 (5.96)	-8.46 (5.96)	-8.46 (5.96)	-8.46 (5.96)				
Overwt/ Obese^^^	8.22 (7.54)	8.22 (7.54)	8.22 (7.54)	8.22 (7.54)				
≥ 1 Child @ Home	-3.21 (6.39)	-3.21 (6.39)	-3.21 (6.39)	-3.21 (6.39)				
CD^^	-2.46 (6.01)	-2.46 (6.01)	-2.46 (6.01)	-2.46 (6.01)				
≥ College	8.43 (6.13)	8.43 (6.13)	8.43 (6.13)	8.43 (6.13)				
Married	-8.08 (9.22)	-8.08 (9.22)	-8.08 (9.22)	-8.08 (9.22)				
Social Sup PA	-1.34 (1.47)	-1.34 (1.47)	-1.34 (1.47)	-1.34 (1.47)				
Env Sup PA	**3.38* (1.59)**	**3.38* (1.59)**	**3.38* (1.59)**	**3.38* (1.59)**				
Age	.22 (.27)	.22 (.27)	.22 (.27)	.22 (.27)				
% Life in U.S.	**.39*** (.12)**	**.39*** (.12)**	**.39*** (.12)**	**.39*** (.12)**				
Env Sup PA X ≥ 1 Child	--	--	--	--				
R^2	.278	.300	.300	.300				

NOTE: Mean and (SE) of Square root of PA are 44.85(28.09) in the total sample, 42.57(25.84) among women, and 48.10(30.85) among men; ***p≤.001; **p≤.01; *p≤.05; †p≤.10;SX = Symptoms; PA=Physical Activity; ^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004); ; Sup = Support; Env = Environmental

Appendix S

FACTORS ASSOCIATED WITH DEPRESSIVE SYMPTOMS AND PHYSICAL ACTIVITY (SQUARE ROOT OF PA): RESULTS OF SEEMINGLY UNRELATED REGRESSION ANALYSES AMONG THE STUDY SAMPLE (N=230)

VARIABLE EST. DEPRESSIVE SX	Beta (SE)			
Meet Min PA	.53	**.96†**	.53	**.89†**
Rec (PA) ^	(.47)	**(.52)**	(.46)	**(.52)**
Chronic Dis	-.42	.66	**-1.04†**	.04
(CD)^^	(.49)	(.85)	**(.69)**	(1.03)
No Insurance	**.77†**	**.72†**	**.3**4	.36
(No Ins)	**(.43)**	**(.43)**	(.54)	(.54)
Female	.59	.63	.57	.61
	(.43)	(.43)	(.43)	(.43)
Overwt/	**-.92†**	**-.96***	**-.94***	**-.96***
Obese^^^	**(.48)**	**(.48)**	**(.48)**	**(.48)**
≥ College	.25	.22	.23	.20
	(.44)	(.43)	(.43)	(.43)
Married	-.71	-.70	**-.79†**	-.76
	(.53)	(.52)	**(.53)**	(.53)
Age	<.01	<.01	<.01	<.01
	(.02)	(.02)	(.02)	(.02)
% Life in U.S.	<-.01	<-.01	<-.01	<-.01
	(.01)	(.01)	(.01)	(.01)
PA X CD	--	**-1.47†**	--	-1.31
		(.94)		(.94)
No Ins X CD	--	--	**1.11**	.95
			(.87)	(.88)
R^2	.062	.062	.062	.069
VARIABLE EST. SQRT PA				
Female	-3.89	-3.45	-3.44	-3.44
	(3.75)	(3.73)	(3.73)	(3.73)
Knowledge	**10.49***	**10.91***	**10.89***	**10.89***
	(3.56)	**(3.54)**	**(3.54)**	**(3.54)**
Time Barrier	-2.53	-2.46	-2.48	-2.46
	(3.64)	(3.61)	(3.61)	(3.61)
Overwt/	4.02	4.00	3.99	4.00
Obese^^^	(4.09)	(4.05)	(4.05)	(4.05)
≥ 1 Child	-.08	**53.82***	**53.54***	**53.64***
@ Home	(3.80)	**(25.90**)	**(25.91**)	**(25.91**)
CD^^	3.35	2.90	2.90	2.91
	(4.04)	(4.01)	(4.01)	(4.01)
≥ College	-2.14	-2.17	-2.17	-2.17
	(3.62)	(3.59)	(3.59)	(3.59)
Married	-.95	-.30	-.30	-.31
	(4.66)	(4.63)	(4.63)	(4.63)
Social Sup PA	-.79	-.77	-.76	-.77
	(.97)	(.97)	(.97)	(.97)
Env Sup PA	**1.83***	**3.70****	**3.71****	**3.71****
	(.90)	**(1.27)**	**(1.27)**	**(1.27)**
Age	-.15	-.15	-.15	-.14
	(.16)	(.16)	(.16)	(.16)
% Life in U.S.	**.18***	**.16***	**.16†**	**.16†**
	(.09)	**(.09)**	**(.09)**	**(.09)**
Env Sup PA	--	**-3.69***	**-3.67***	**-3.67***
X ≥ 1 Child		**(1.75)**	**(1.75)**	**(1.75)**
R^2	.113	.125	.125	.125

***p≤.001; **p≤.01; *p≤.05; †p≤.10; SX = Symptoms; PA= Physical Activity; Sup = Support; Env = Environmental ^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^ hypertension, heart disease, or diabetes diangosis; ^^^ BMI ≥ 23 (WHO, 2004)

Appendix T

FACTORS ASSOCIATED WITH DEPRESSIVE SYMPTOMS AND TOTAL PHYSICAL ACTIVITY (SQUARE ROOT OF PA): RESULTS OF GENDER STRATIFIED SEEMINGLY UNRELATED REGRESSION ANALYSES

VARIABLE EST DEPRESSIVE SX	**Women** N=135 Betas (SE)				**Men** N=95 Betas (SE)			
Meet Min PA	.80	.85	.85	.85	-.23	-.69	-.42	.31
Rec (PA) ^	(.62)	(.68)	(.62)	(.68)	(.71)	(.87)	(.70)	(.86)
Chronic Dis	-.48	-.50	-.52	-.53	-.26	1.50	**-1.78†**	-.21
(CD)^^	(.69)	(1.27)	(1.00)	(1.51)	(.70)	(1.15)	**(.94)**	(1.42)
No Insurance	.69	.69	.67	.67	.97	.85	-.28	-.20
(No Ins)	(.57)	(.57)	(.70)	(.70)	(.65)	(.64)	(.82)	(.82)
Female	--	--	--	--	--	--	--	--
Overwt/	**-.94†**	**-.95†**	**-.95†**	**-.95†**	-.75	-.73	-.66	-.66
Obese^^^	**(.60)**	**(.61)**	**(.60)**	**(.61)**	(.85)	(.83)	(.82)	(.82)
≥ College	.39	.39	.39	.39	.21	.13	.18	.12
	(.58)	(.59)	(.59)	(.59)	(.70)	(.69)	(.68)	(.67)
Married	-.61	-.61	-.62	-.62	-1.17	-.90	**-1.41†**	-1.17
	(.69)	(.69)	(.70)	(.70)	(.96)	(.95)	**(.94)**	(.94)
Age	<.01	<.01	<.01	<.01	.02	<.01	.03	.02
	(.03)	(.03)	(.03)	(.03)	(.03)	(.01)	(.03)	(.03)
% Life in U.S.	-.01	-.01	-.01	-.01	.01	<.01	.02	.01
	(.02)	(.02)	(.02)	(.02)	(.01)	(.01)	(.01)	(.01)
PA X CD	**--**	<.01	**--**	.01	--	**-2.47†**	--	**-1.92†**
		(1.38)		(1.39)		**(1.31)**		**(1.31)**
No Ins X CD	--	--	.05	.05	--	--	**2.96***	**2.56***
			(1.20)	(1.20)			**(1.27)**	**(1.29)**
R^2	.055	.054	.054	.054	.066	.102	.119	.140
VARIABLE EST SQRT PA								
Female	--	--	--	--	--	--	--	--
Knowledge	**7.02†**	**7.57†**	**7.57†**	**7.57†**	**12.74**	**12.83***	**12.62***	**12.82***
	(4.34)	**(4.34)**	**(4.34)**	**(4.34)**	*****	**(5.70)**	**(5.70)**	**(5.70)**
					(5.78)			
Time Barrier	3.69	3.68	3.68	3.68	-8.46	-8.00	-7.96	-8.02
	(4.32)	(4.30)	(4.30)	(4.30)	(5.96)	(5.88)	(5.88)	(5.88)
Overwt/	5.54	5.29	5.29	5.29	8.22	9.34	9.34	9.37
Obese^^^	(4.62)	(4.61)	(4.61)	(4.61)	(7.54)	(7.45)	(7.45)	(7.45)
≥ 1 Child	6.63	39.08	39.08	39.07	-3.21	**79.52†**	**79.09†**	**78.90†**
@ Home	(4.54)	(29.30)	(29.30)	(29.30)	(6.39)	**(47.07)**	**(47.09)**	**(47.12)**
CD^^	**9.22†**	**9.14†**	**9.14†**	**9.15†**	-2.46	-3.96	-3.91	-3.92
	(5.12)	**(5.10)**	**(5.10)**	**(5.10)**	(6.01)	(5.97)	(5.97)	(5.97)
≥ College	-4.31	-4.33	-4.32	-4.32	8.43	8.15	8.11	8.15
	(4.45)	(4.45)	(4.43)	(4.43)	(6.13)	(6.04)	(6.04)	(6.04)
Married	.83	.85	1.14	1.14	-8.08	-8.91	-8.95	-8.97
	(5.44)	(5.44)	(5.43)	(5.43)	(9.22)	(9.09)	(9.09)	(9.09)
Social Sup PA	.15	.16	.18	.18	-1.34	-1.34	-1.35	-1.34
	(1.21)	(1.21)	(1.21)	(1.21)	(1.47)	(1.44)	(1.44)	(1.45)
Env Sup PA	.55	.53	1.71	1.71	**3.38***	**6.41****	**6.42****	**6.45****
	(1.04)	(1.04)	(1.47)	(1.47)	**(1.59)**	**(2.30)**	**(2.30)**	**(2.31)**
Age	-.24	-.26	-.26	-.26	.22	.29	**.29**	.29
	(.21)	(.21)	(.21)	(.21)	(.27)	(.27)	**(.27)**	(.27)
% Life in U.S.	-.15	-.16	**-.16**	**-.16**	**.39****	**.37****	**.37****	**.37****
	(.12)	(.12)	**(.12)**	**(.12)**	*****	**(.12)**	**(.12)**	**(.12)**
					(.12)			
Env Sup PA	--	-2.27	-2.27	-2.27	--	**-5.48†**	**-5.44†**	**-5.43†**
X ≥ 1 Child		(2.02)	(2.02)	(2.02)		**(3.09)**	**(3.10)**	**(3.10)**
R^2	.102	.110	.110	.109	.278	.300	.300	.300

***p≤.001; **p≤.01; *p≤.05; †p≤.10; Est = Estimating; SX = Symptoms; PA=Physical Activity; Sup = Support; Env = Environmental ^ Met Minimal 2007 ACSM/AHA PA Guidelines (Haskell, et al, 2007; Nelson, et al, 2007); ^^Chronic Disease Diagnosis = Diagnosis with hypertension, heart disease, or diabetes; ^^^Overweight/Obese = BMI ≥ 23 (WHO, 2004);

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