

Associations of Depression, Sleep, and Acculturation on Glycemic Control
in Korean Americans with Type 2 Diabetes Mellitus

By

Mihyun Jeong

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Graduate Supervisory Committee:

Elizabeth Reifsnider, Chair
Michael Belyea
Megan Petrov
Lesly Kelly

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ABSTRACT

Type 2 diabetes mellitus (T2DM) is a chronic disease affecting more than ten percent of the U.S. adults. Approximately 50 percent of people with diabetes fail to achieve glycemic targets of A1C levels below seven percent. Poor glycemic control disproportionately affects minority populations such as Korean Americans (KAs). Successful diabetes self-management requires a comprehensive approach that takes into account depression, sleep, and acculturation to achieve good glycemic control. Therefore, the purposes of this study were to: 1) describe the levels of glycemic control, depressive symptoms, sleep quality and duration, and acculturation; 2) examine an association of depressive symptoms with glycemic control; 3) identify mediational roles of sleep quality and sleep duration of less than 6 hours between depressive symptoms and glycemic control; and 4) explore a moderation role of acculturation between depressive symptoms and glycemic control in KAs with T2DM. This is a cross-sectional, descriptive correlational study. A total of 119 first generation KAs with T2DM were recruited from Korean communities in Arizona. A1C levels, the Center for Epidemiological Studies Depression Scale, the Pittsburgh Sleep Quality Index, the Suinn-Lew Asian Self-Identity Acculturation scale, the International Physical Activity Questionnaire, and the Berlin Questionnaire were measured. Descriptive statistics, multiple regression analyses, path analyses, and the Sobel tests were conducted for data analyses of this study. Poor glycemic control ($A1C \geq 7\%$), high depressive symptoms ($CES-D \geq 16$), poor sleep quality ($PSQI > 5$), and short sleep duration (< 6 hours) were prevalent among KAs with T2DM. The mean score of acculturation (2.18) indicated low acculturation to Western culture. Depressive symptoms were revealed as a significant independent predictor of

glycemic control. Physical activity was negatively associated with glycemic control, while cultural identity was positively related to glycemic control. Sleep quality and sleep duration of less than 6 hours did not mediate the relationship between depressive symptoms and glycemic control. Acculturation did not moderate the association between depressive symptoms and glycemic control. Diabetes self-management interventions of a comprehensive approach that considers depressive symptoms, sleep problems, and cultural differences in minority populations with T2DM are needed.

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CHAPTER I

INTRODUCTION

Background of the Study

Diabetes mellitus is a major public health problem with serious complications. In the United States, diabetes affects more than 12 percent of the general adult population and contributes to over 23,000 deaths every year, making it the seventh leading cause of mortality (American Diabetes Association [ADA], 2014). The financial burden of diabetes has a significant adverse effect on the US economy. In 2012, the total estimated diabetes costs were 245 billion US dollars, including direct medical costs for diabetes treatment and indirect costs such as disability, work loss, and premature mortality. People with diabetes incur 2.3 times higher medical costs than those without diabetes (ADA, 2014).

The prevalence of diabetes in the United States is estimated to be more than nine percent of the U.S. population and over twelve percent of American adults. Nine percent of Asian Americans have been diagnosed with diabetes. Of those, 90 percent have type 2 diabetes mellitus (T2DM; ADA, 2014). More than six percent of Korean Americans, who comprise approximately 0.4 percent of the total U.S. population, have been diagnosed with T2DM among Asian Americans adults (ADA, 2014; Choi, Chow, Chung, & Wong, 2011; Choi, Liu, Palaniappan, Wang, & Wong, 2013).

T2DM, characterized by high blood glucose levels, is a complex and chronic disease. It requires persistent diabetes self-management and lifestyle modifications to achieve and maintain good glycemic control that is defined as glycosylated hemoglobin (A1C) levels of less than seven percent (American Diabetes Association [ADA], 2016; Gæde et al., 2003; Hu et al., 2001). Fundamental management of

T2DM includes regular self-monitoring of blood glucose, consistent and suitable physical activity, nutrition management, and adherence to diabetic medications to improve diabetes outcomes including glycemic control. These diabetes self-care behaviors require continuous effort and ability to adapt to changing circumstances to maintain good glycemic control (ADA, 2016; Nathan et al., 2009).

Glycemic control is the most important goal for treatment and management of T2DM to improve quality of life of people with diabetes and reduce the financial burden of diabetes through the prevention of complications (ADA, 2016; Delamater, 2006). The American Diabetes Association (ADA, 2016) has recommended A1C values of less than seven percent as a gold standard of glycemic control even though the glycemic targets are determined based on age, duration of diabetes, comorbid conditions, and hypoglycemia unawareness. Poor glycemic control defined by A1C levels of seven percent or higher contributes to poor health outcomes and significant health burden. A one percent decrease in A1C value was shown to lead to a ten percent reduction in risk for coronary artery disease (Klein, 1995; Turner, et al., 1998). In contrast, poor glycemic control was demonstrated to lead to microvascular complications (e.g., nephropathy, neuropathy, and retinopathy) and increased risk of macrovascular complications (e.g., cardiovascular disease) (Diabetes Control and Complications Trial Research Group [DCCT], 1993; Liebl et al., 2002; UK Prospective Diabetes Study [UKPDS] Group, 1998; Williams, Van Gaal, & Lucioni, 2002). These complications caused by poor glycemic control account for approximately 50 percent of the total diabetes costs and eventually have a negative influence on quality of life. Moreover, medical costs of people with diabetes experiencing complications were over two times higher than those without

complications (American Diabetes Association [ADA], 2013; Liebl, Khunti, Orozco-Beltran, & Yale, 2015).

Despite the importance of good glycemic control, achieving and maintaining good glycemic control are major challenges for people with T2DM. Approximately 50 percent of people with diabetes fail to achieve glycemic targets of A1C levels below seven percent (Ali et al., 2013; Harris, Eastman, Cowie, Flegal, & Eberhardt, 1999; Saydah, Fradkin, & Cowie, 2004; Xu et al., 2013). Approximately 20 percent of people with diabetes have A1C values of greater than 9.5 percent (Saaddine et al., 2002). KAs with T2DM are no exception. More than 50% of KAs with T2DM have difficulty achieving optimal glycemic control (Choi & Rankin, 2009). A variety of physiological, behavioral, psychological, cultural, social, and environmental factors influence daily diabetes management and ability to achieve glycemic control. Successful diabetes self-management requires a comprehensive approach that takes into account all of these factors to achieve good glycemic control. Comprehensive diabetes management includes assessment and management of psychological factors such as depression, sleep characteristics, and acculturation that can influence glycemic control in vulnerable immigrant populations with T2DM, along with lifestyle modification (ADA, 2016).

Depression is a common mental health disorder that is two times more prevalent in people with diabetes compared to the general population, affecting approximately 15 percent of adults with T2DM (Anderson, Freedland, Clouse, & Lustman, 2001; Roy & Lloyd, 2012). Depression is linked with poor health outcomes that contribute to poor glycemic control. For example, depression is associated with poor lifestyle behaviors such as physical inactivity and an unhealthy diet that can

contribute to poor glycemic control (Payne, Steck, George, & Steffens, 2012; Strine et al., 2008; Weyerer, 1992). Obesity that leads to impaired glucose tolerance is a common physical condition of major depression (Luppino et al., 2010). Depression also is associated with physiological abnormalities such as changes in hypothalamic-pituitary-adrenal (HPA) axis activation and inflammation, which can induce insulin resistance (Champaneri, Wand, Malhotra, Casagrande, & Golden, 2010; Dantzer, O'Connor, Freund, Johnson, & Kelley, 2008; Golden, 2007). Symptoms of depression include sleep disturbance such as insomnia, early-morning wakefulness, or excessive sleeping (Courtet & Olié, 2012). These factors related to depression are also significantly associated with T2DM and glycemic control. Thus, depression comorbid with T2DM may increase the risk for complications and mortality from diabetes via adverse effects on glycemic control (Ali, et al., 2006; Lustman, Freedland, Griffith, & Clouse, 2000; Park, Katon, & Wolf, 2013).

Sleep is a modifiable lifestyle behavior and a necessary biologic function for a healthy mind and body. Sleep patterns and duration are often assessed in people with T2DM because they impact glycemic control, and the prevalence of poor sleep quality in adults with T2DM is 45 to 70 percent (Reutarkul et al., 2013; Knutson et al., 2006), compared to 10 to 30 percent in the general population (Ohayon & Paiva, 2005; Okubo et al., 2014). A recent meta-analysis found that poor sleep quality, short sleep duration, and long sleep duration were associated with higher levels of A1C in people with T2DM (Lee, Ng, & Chin, 2016). Poor sleep quality and short sleep duration are associated with a decrease in the production of leptin, a hormone linked to satiation, and an increase in the stimulation of ghrelin, a hormone related to hunger and increased appetite for carbohydrate-rich and sweetened foods (Nedeltcheva et al.,

2009; Spiegel, Tasali, Penev, & Van Cauter, 2004; Taheri, Lin, Austin, Young, & Mignot, 2004). Abnormal sleep patterns and duration are also associated with oxidative stress and increased sympathetic nervous system activity, which can inhibit insulin secretion and increase insulin resistance (Spiegel, Leproult, & Van Cauter, 1999). These effects of insufficient and disrupted sleep may lead to poor glycemic control. In addition to the influence of sleep on glycemic control, poor sleep quality and insufficient sleep are common experiences for patients with depression (Ohayon et al., 2002; Perlis et al., 1997). Given the strong relationship of sleep disturbance with depression and glycemic control, poor sleep quality and insufficient sleep duration may affect the association between depression and glycemic control in people with T2DM.

Acculturation is defined as a cultural phenomena of subsequent adoption, adaption, and synthesis in which immigrants with their original cultures have continuous contact with host culture patterns via immigration (Redfield, Linton, & Herskovits, 1936). Acculturation is regarded as an important sociocultural factor that may contribute to depression and T2DM. Immigrants such as KAs often experience major cultural shifts during the acculturation process. This acculturation can be perceived as stressful and increase the risk for depression (Gupta, Leong, & Valentine, 2013). Also, acculturation can indirectly contribute to the development of T2DM and glycemic control because immigrants experience Western social and cultural impacts on their lifestyle, and cultural values and beliefs of individuals affect their behaviors in daily life (Franzen & Smith, 2009; Hazuda, Haffner, Stern, & Eifler, 1988; Huang et al., 1996). For example, immigrants such as KAs may adopt some Western lifestyle behaviors such as increased intakes of fat and desserts and

reduce physical activity after they immigrate to the United States, which in turn is associated with an increased risk of T2DM and glycemic control (Choi, Wilbur, Miller, Szalacha, & McAuley, 2008; Evenson, Sarmiento, & Ayala, 2004; Kim & Chan, 2004; Venkatesh, Weatherspoon, Kaplowitz, & Song, 2013).

Statement of the Problem

Korean Americans with T2DM are more likely to have risk factors related to poor glycemic control. Koreans are known to be more genetically susceptible to insulin resistance and diabetes than non-Hispanic White (Chan et al., 2009). KAs have higher visceral fat accumulation than Whites at the same range of body mass index, which affects insulin resistance (Park, Allison, Heymsfield, & Gallagher, 2001). Chronic stress and psychological problems through immigration acculturation have the potential to contribute to insulin resistance and visceral adiposity that lead to poor glycemic control (Tull, Thurland, LaPorte, & Chambers, 2003). Therefore, KAs with T2DM may fail to achieve good glycemic control more frequently.

People with T2DM often experience difficulty achieving optimal glycemic control. More than 50 percent of people with T2DM present with A1C levels of 7 percent or greater (Ali et al., 2013; Saydah, Fradkin, & Cowie, 2004; Xu et al., 2013). Poor glycemic control contributes to development of microvascular complications and an increased risk of macrovascular complications, which in turn results in high healthcare costs, high rates of morbidity and mortality, and low quality of life (ADA, 2016). Furthermore, poor glycemic control disproportionately affects minority populations such as KAs (Choi & Rankin, 2009; Harris et al., 1999).

People with T2DM have an increased risk for comorbid depression, especially vulnerable populations such as KAs (Anderson et al., 2001; Choi & Reed,

2013). The comorbidity of T2DM and depression is associated with poorer diabetes outcomes in terms of disease severity, complications, treatment resistance, and mortality (Katon, 2003; Lustman et al., 2000). Depression is associated with disability, obesity, physical inactivity, noncompliance with medical treatment, and increased prevalence of other mental health problems including anxiety. These factors adversely affect diabetes self- management and thus may lead to poor glycemic control (Blair-West, Cantor, Mellsop, & Eyeson-Annan, 1999; Mulrow, Williams, & Trivedi, 1999; Murray & Lopez, 1997).

Sleep characteristics, such as sleep quality and sleep duration, may in part explain the association between depression and glycemic control (Seligowski et al., 2012) as they are symptoms of depression (APA, 2013). Increased inflammation levels (Pickup, 2004), alterations in HPA activity and increased activity of the autonomic nervous system (Hatzinger et al., 2008), obesity, and unhealthy behaviors such as physical inactivity and dietary intake (Turner et al., 1999) are associated with both depression and insufficient sleep or poor sleep quality. These factors have an indirect or direct effect on poor glycemic control (ADA, 2016; Bellastella et al., 2015; King, Mainous, Buchanan, & Pearson, 2003). Therefore, sleep duration and quality may mediate the association between depression and glycemic control in KAs with T2DM.

The link between depression and glycemic control in KAs with T2DM can be modified by acculturation. Less acculturation with American culture has been shown to increase risk for depression (On, Koeske, and Sales, 2002). Also, acculturation affects glycemic control or development of T2DM through unhealthy behaviors such as physical inactivity and unhealthy diet intake (Venkatesh, Weatherspoon, Kaplowitz,

& Song, 2013). Lifestyle, belief, and values are changed during the acculturative process. However, low acculturation in which one has difficulties adapting to the new culture can influence food choice, food preparation, participation of physical activity, social isolation, and high psychological stress, which in turn contribute to health and health conditions (Choi et al., 2008; Evenson, et al., 2004; Kim & Chan, 2004).

Depression and sleep characteristics including short sleep duration and poor sleep quality have been suggested as risk factors for the development of T2DM but what is not clear is whether depression contributes to glycemic control in KAs with T2DM and how sleep and acculturation affect the association between depression and glycemic control in this population. Therefore, investigating these associations may provide clinically useful information to elucidate the nature of these associations. Understanding the associations is important for early detection and tailoring in screening and managing depression and sleep problems for people with T2DM, especially vulnerable minority populations such as KAs with T2DM.

Significance of the Study

To current knowledge, this is the first study to investigate the relationships among depression, sleep characteristics, acculturation, and glycemic control in KAs with T2DM. The significance of this study is to expand knowledge regarding roles of sleep characteristics and acculturation on the association between depression and glycemic control. Identifying the nature of the relationships of depression, sleep quality and duration, and acculturation with glycemic control in KAs with T2DM may spur the development of individually and culturally tailored diabetes self-management interventions that consider depression, sleep, and acculturation among a vulnerable, minority group.

The contributory roles of sleep quality, sleep duration, and acculturation on the association between depression and glycemic control in people with T2DM are unknown. Previous studies on depression and sleep in diabetes have primarily focused on their association with diabetes self-management behaviors (Chasens, Korytkowski, Sereika, & Burke, 2012; Lin et al., 2004) or diabetes-related quality of life (Luyster, & Dunbar-Jacob, 2011; Schram, Baan, & Pouwer, 2009) rather than glycemic control. Most of the studies investigating the link between depression and glycemic control in T2DM did not consider the roles of sleep quality or duration and acculturation (Lustman et al., 2000; Richardson, Egede, Mueller, Echols, & Gebregziabher, 2008). A majority of studies investigating roles of sleep on glycemic control in T2DM used depression as a potential confounder to assess independent effect of sleep (Knutson et al., 2006; Lou et al., 2015; Nefs et al., 2015; Ohkuma et al., 2012; Reutarkul et al., 2013; Wang et al., 2015; Zheng et al., 2015). Furthermore, inconsistent findings in the studies investigating the relationships of depression and sleep with glycemic control have been reported (Lustman et al., 2000; Nefs et al., 2015; Ohkuma et al., 2012; Reutarkul et al., 2013; Richardson et al., 2008). In particular, few studies have examined depression and glycemic control in KAs with T2DM (Choi & Rankin, 2009; Choi & Reed, 2013), and no studies have been conducted, to date, on sleep and acculturation in KAs with T2DM.

Conceptual Framework

The Social Ecological Model (SEM) was used to identify the associations among a psychological factor, sleep factors, a sociocultural factor, and a physiological outcome in KAs with T2DM. The SEM (McLeroy, Bibeau, Steckler, & Glanz, 1988) is a broad, overarching system and set of theoretical principles to understand

interrelations among diverse personal and environmental factors in human health promotion (See Figure 1). Concepts of the ecological theory are established in terms of interconnection and interaction among environmental conditions and human behaviors.

SEM has five levels of influence on health and health behavior: individual, interpersonal, organizational, community, and public policy. Individual factors include personal, physiological, psychological, cultural and behavioral characteristics, such as age, income, education, knowledge, attitudes, self-concept, skills, and health history. Interpersonal relationships with family members, friends, and neighbors are important sources that have an influence on health related to individuals' behaviors (McLeroy et al., 1988). Organizational factors, such as use of incentives, management and supervisor support of changes in rules and regulations, changes in benefits for insurance coverage and child care, and changes in the structure of work, are used to support behavioral modifications (McLeroy et al., 1988). In addition, a community level is described as relationships among organizations, institutions, and informal networks. Community factors as the fourth level refer to mediating structures or face-to-face primary groups such as personal friendship networks and neighborhoods. The community level also embraces the relationships among organizations and groups such as local voluntary agencies, local governmental health providers, and local schools. Lastly, public policy incorporates local, state, and national laws and policies to protect health of communities. The use of regulatory policies has dramatic public health impact at the population level (McLeroy et al., 1988).

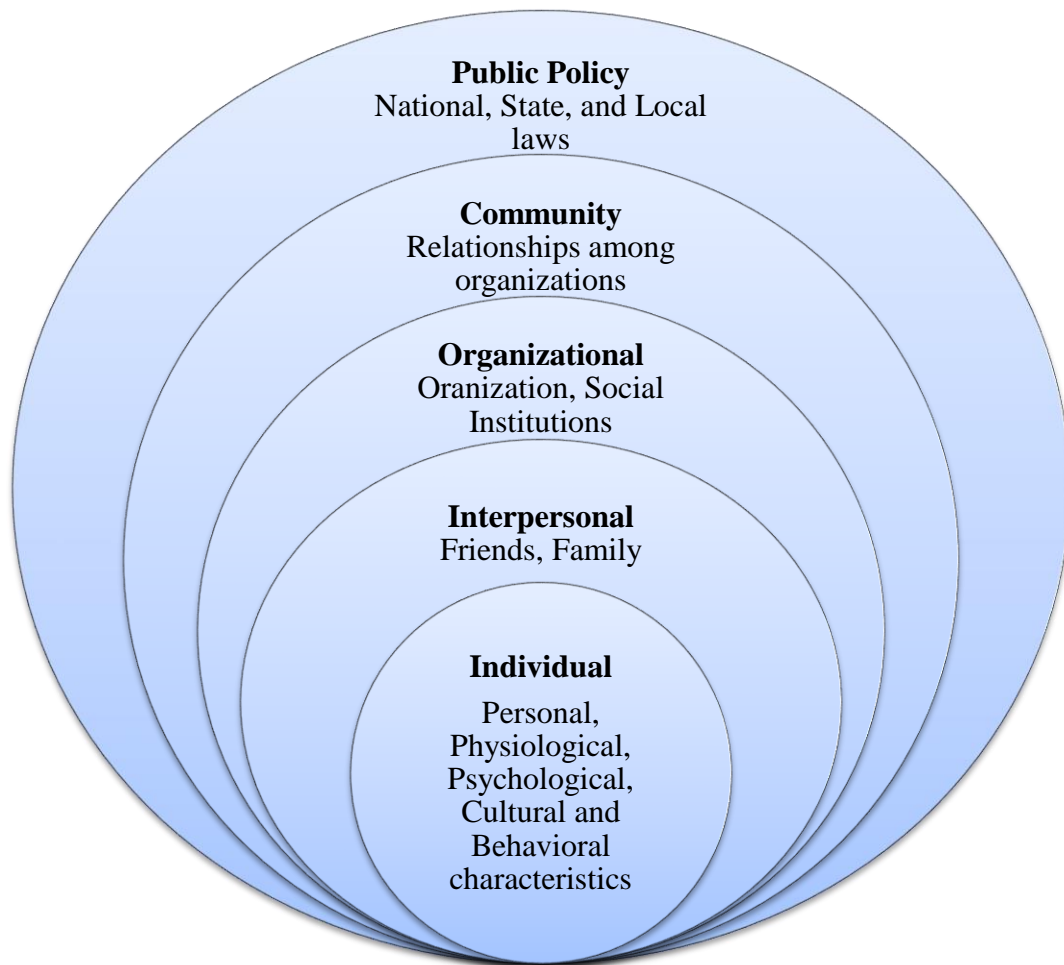


Figure 1. Social Ecological Model

Application of the SEM to Diabetes Management in T2DM

Diabetes self-management, with its a variety of dimensions and influences, emerges as an ecologically developed set of processes and behaviors (Stokols, 1996). Understanding diabetes self-management gives rise to an evaluation of the complementary nature of processes rooted at the individual level and processes based in the interpersonal level, organizations, communities, and policies.

In the individual level of diabetes self-management, psychological, social,

cultural, behavioral, and physiological factors have investigated as personal models of type 2 diabetes (Fihser et al., 2005). These factors that affect diabetes self-management have been addressed in diabetes self-management education and support programs. Especially, depression and acculturation are considered for individual-tailored diabetes self-management in minority populations with T2DM (ADA, 2016). Moreover, one of the most important socioecological factors that directly affect diabetes self-management is lifestyle behaviors. The most prominent lifestyle behaviors include physical activity, dietary intake and quality, smoking, and alcohol use. A study on a lifestyle intervention suggested ongoing healthy lifestyle behaviors for successful diabetes self-management (Mozaffarian et al., 2009).

Interpersonal factors that affect diabetes self-management are stress and support from friends and family (McLeroy et al., 1988). Especially, diet-specific family support for people with T2DM is more important than any other factor for glycemic control (Choi, 2009) since diet plays a key role for diabetes self-management and inadequate diet has a directly negative effect on high blood glucose levels (Glasgow & Toobert, 1988). Also, responses of family members and friends on T2DM and diabetes management have been associated with diabetes self-management behaviors of people with T2DM (Fisher et al., 2000). Therefore, more perceived family support can lead to better glycemic control (Choi, 2009). In addition, families with higher incomes and higher caregiver knowledge have been found to be associated with better glycemic control (Stallwood, 2006).

Organizations have positive and negative effects on health and health behaviors of people with T2DM. Organizations provide important economic and social resources. Organizational factors for diabetes self-management are associated

with the health care delivery system, relationships with providers, and support of healthcare organizations. For example, the American Diabetes Association (ADA) and American Association of Diabetes Educators (AADE) not only provide information and diverse programs including diabetes camps and support but also conduct a wide range of research for people with diabetes and the public. Nutrition recommendations and interventions for diabetes are suggested by ADA (2006). Nurse case management for effective health outcomes is one organizational factor (Cook et al., 1999).

Factors related to diabetes self-management at a community level are neighborhoods, work sites, and schools (McLeroy et al., 1988). School consists of organized health programming sessions transmitted to children through social structures such as fitness center, health class, school cafeteria and activities after school, which lead to health behaviors (Shaw-Perry et al., 2007). Training teachers and education professionals on diabetes are crucial for full-time monitoring of diabetic children in school (Aycan et al., 2012).

At a public policy level, broad policy factors influence health, diabetes, and diabetes complications. For example, two million adults with 65 years or older who suffer from diabetes had no health insurance coverage, which has considerable public health and economic impact. The United States Affordable Care Act, a policy for obtaining health insurance, was established to improve access to healthcare to address health problems including diabetes. Health insurance status directly affects diabetes management and prevention (Casagrande & Cowie, 2012).

Conceptual Framework and Variables of the Study

This study is grounded in the individual level of Social Ecological Model, focusing on psychological, sleep, and sociocultural perspectives of individuals with

T2DM. This conceptual framework describes how this context might impact glycemic control as an outcome of diabetes self-management. Therefore, the framework is composed of five domains: a psychological factor, sleep factors, a sociocultural factor, a physiological outcome, and control factors (See Figure 2).

For this study, a psychological factor is operationalized by depressive symptoms which are linked to sleep factors, a physiological outcome, and a sociocultural factor. Sleep factors which are affected by depressive symptoms include sleep quality and sleep duration of less than 6 hours. A sociocultural factor is defined by acculturation which is considered a significant contributor to depressive symptoms and glycemic control. A physiological outcome as a diabetes outcome includes glycemic control. Control factors include gender, body mass index (BMI), duration of diabetes, physical activity, and risk of obstructive sleep apnea.

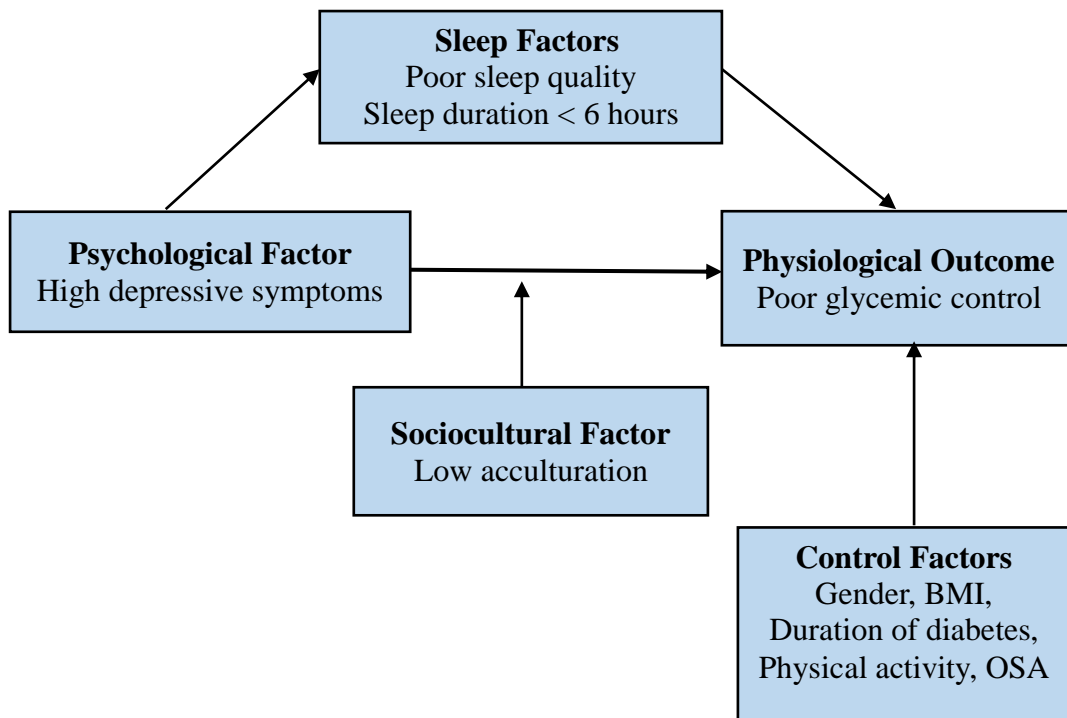


Figure 2. Conceptual Framework on Roles of Depression, Sleep, and Acculturation on Glycemic Control in Korean Americans with Type 2 Diabetes

Purpose of the Study

The purposes of the current study were to investigate descriptive characteristics on glycemic control, depressive symptoms, sleep quality and duration, and acculturation and to explore the relationships of depressive symptoms, sleep quality and duration, and acculturation with glycemic control in Korean Americans diagnosed with T2DM.

Study Aims and Hypotheses

Aim 1. Describe the levels of glycemic control, depressive symptoms, sleep quality and duration, and degree of acculturation in KAs with T2DM.

H1. KAs with T2DM would have a high prevalence of poor glycemic control, high depressive symptoms, poor sleep quality, short sleep duration, low levels of acculturation.

Aim 2. Investigate the relationship between depressive symptoms and glycemic control in KAs with T2DM.

H2. Depressive symptoms would be independently associated with poor glycemic control in KAs with T2DM.

Aim 3. Investigate the mediating roles of sleep quality and duration in the relationship between depressive symptoms and glycemic control in KAs with T2DM.

H3. Poor sleep quality and short sleep duration of less than 6 hours would mediate the association between depressive symptoms and glycemic control.

Aim 4. Investigate the moderating role of acculturation in the relationship between depressive symptoms and glycemic control in KAs with T2DM.

H4. Acculturation would moderate the association between depressive symptoms and glycemic control.

CHAPTER II

LITERATURE REVIEW

This chapter reviews literature on type 2 diabetes mellitus (T2DM), glycemic control, depression, sleep, acculturation, and Korean Americans (KAs). In addition, this chapter discusses relationships among depression, sleep quality and duration, acculturation, and glycemic control in people with T2DM. These associations in KAs with T2DM are also discussed.

Korean Americans (KAs)

Korean Americans (KAs) are one of the fastest growing ethnic minorities in the United States as the number of KAs has increased 27-fold since 1970 (Terrazas & Batog, 2009). KAs account for 0.4 percent of the U.S. population and about 10 percent of the total Asian American population. Approximately 80 percent of KA adults aged 18 or older were born outside of the U.S. (U.S. Census Bureau, 2010). The age-adjusted, diagnosed prevalence of T2DM for Asian Americans is nine percent, which is higher than that of non-Hispanic Whites (7.6%) (American Diabetes Association [ADA], 2014) and presents an approximately double increase for the past decade (McNeely & Boyko, 2004). After controlling for age, six to eight percent of KAs have T2DM, the third highest prevalence of T2DM among Asian American subgroups (ADA, 2014; Choi, Chow, Chung, & Wong, 2011; Choi, Liu, Palaniappan, Wang, & Wong, 2013). Despite the increasing KA population in the U.S. and the gradually rising prevalence of T2DM in KAs, research on glycemic control for KAs with T2DM is very limited.

In Arizona, approximately 13 percent of the population has diabetes. The

number of adults with T2DM has more than doubled during the past decade in Arizona (Arizona Department of Health Services, 2011). The growth rate of KA population in Arizona has increased more than 70 percent during the past decade. More than 20,000 KAs live in Arizona (Arizona Department of Health Services, 2011). According to a randomized phone survey among 266 KA adults that was conducted by the Asian Pacific Community in Action of Arizona (2009), approximately seven percent of KAs living in Maricopa county of Arizona had T2DM. Twenty-five percent of the KA respondents had no health insurance, and most of them were born in South Korea (96%) and spoke Korean language for the interview (97%). Also, nearly half of KAs were engaged in self-employed small businesses.

Characteristics such as a prominently high proportion of first generation immigrants, high preference for Korean language, and a high proportion of self-employed small businesses in KAs can contribute to a low level of acculturation (Redmond & Bunyi, 1993; Yeh & Inose, 2003). KAs who have greater cultural difference between their original culture and the American culture reported to have higher levels of adjustment difficulties during acculturative process, compared to European immigrants to the U.S who have lower cultural difference between cultures, especially in terms of language, hierarchical nature of relationships, and dietary habits (Redmond & Bunyi, 1993; Yeh & Inose, 2003). The increased cultural differences and adjustment difficulties between cultures have been shown to be associated with poorer mental health outcomes (Bernstein, Park, Shin, Cho, & Park, 2011; Gupta, Leong, & Valentine, 2013) and unhealthy behaviors, such as smoking (Hofstetter et al., 2004), diet (Satie-Abouta, Patterson, Neuhouser, & Elder, 2002), and lack of physical activity (Gomez, Kelsey, Glaser, Lee, & Sidney, 2004). Higher prevalence of depression in

KA adults with T2DM than non-immigrant American adults and other Asian subgroups (Choi & Reed, 2013; Mojtabai & Jorm, 2015) may be linked to the greater cultural differences (Gupta et al., 2013). Therefore, the high proportion of poor glycemic control in KAs with T2DM may be more attributable in part to depression and cultural differences, such as lack of English proficiency and diet (Venkatesh, Weatherspoon, Kaplowitz, & Song, 2013; Xu, Pan, & Liu, 2011).

Racial/ethnic immigrants can experience differential impacts and processes of acculturation on health and health-related behaviors. For example, total acculturation and social assimilation were shown to be positively associated with prevalence of coronary heart disease (CHD) in Japanese Americans (Reed et al., 1982), while acculturation was revealed to have a negative relation with obesity and diabetes in Hispanic Americans (Hazuda, Haffner, Stern, & Eifler, 1988) Thus, each specific ethnic group should be examined independently to better understand their unique health status and behaviors.

A few studies have found racial differences in sleep characteristics. Racial/ethnic minorities are often more likely to experience shorter sleep duration and worse sleep quality than non-Hispanic Whites (Carnethon et al., 2015; Grandner et al., 2013). In a large study investigating nationally representative data from the 2007-2008 National Health and Nutrition Examination Survey (NHANES) (Whinnery, Jackson, Rattanaumpawan, & Grandner, 2014), Asian American minorities are four times more likely to report short sleep duration of less than 5 hours than non-Hispanic Whites. Based on the reviewed literature, it is well known that depression is significantly associated with poor glycemic control (Anderson et al., 2001), whereas there are no studies on the relation between depression and glycemic control in KAs

with T2DM. Also, no study on sleep quality and duration has been found in KAs with T2DM, while strong correlations between depression, sleep problems, and poor glycemic control have been reported in T2DM (Cappuccio, D'Elia, Strazzullo, & Miller, 2010; Ohayon et al., 2002; Perlis et al., 1997; Shan et al., 2015).

Taken together, studies on roles of sleep characteristics and acculturation on the relation between depression and glycemic control are needed for understudied KAs with T2DM.

Type 2 Diabetes Mellitus (T2DM)

T2DM is a metabolic disease that is characterized by impaired metabolism of glucose resulting in chronic hyperglycemia which is caused by a defect in insulin secretion or insulin action. Insulin is a hormone that is secreted in the beta cells of pancreas and is necessary to regulate the amount of glucose in the blood and maintain normal brain and nervous system function (ADA, 2016). Insulin resistance and defects of regulation system of insulin secretion lead to development and progression of T2DM. Beta cells of the pancreas detect insulin resistance in the peripheral tissues and then increase insulin secretion, creating elevated fasting insulin levels. As continuous insulin resistance gradually rises insulin levels, the pancreas decreases or loses the ability to meet a demand of the increased insulin level. Eventually, insulin levels begin to decrease, and this progression develops into T2DM (Bogardus, Lillioja, Howard, Reaven, & Mott, 1984; Martin, Warram, & Krolewski, 1992).

T2DM is diagnosed by the following four criteria: 1) a fasting plasma glucose value of 126 mg/dl or higher; 2) a two-hour plasma glucose value of 200 mg/dl or higher during a 75g oral glucose tolerance test; 3) obvious symptoms of hyperglycemia, such as frequent urination (polyuria), feeling very thirsty (polydipsia),

feeling very hungry (polyphagia), weight loss, or blurry vision and a random plasma glucose value of 200 mg/dl or higher; 4) a A1C value of 6.5% or more (ADA, 2016).

T2DM is a heterogeneous disease that is caused by a combination of genetic and environmental factors even though the specific etiology of insulin resistance is unknown. Traditional risk factors of T2DM include an age of more than 45 years old (Kahn, 1994), family history of diabetes (Morris & Rimm, 1991), racial and ethnic populations including African American, American Indian, Hispanic/Latino, and Asian American, obesity, hyperlipidemia, gestational diabetes mellitus (GDM), sedentary lifestyle, and unhealthy diet habits (ADA, 2016). It is well known that obesity is a major risk for T2DM, even though there are strong genetic risk factors for T2DM (Ford, Williamson, & Liu, 1997; Resnick, Valsania, Halter, & Lin, 2000). T2DM is typically diagnosed in the elderly, but the increased prevalence of T2DM in children and young adults has been shown because of a higher prevalence of obesity and lack of physical activity in these populations (ADA, 2016; Bloomgarden, 2004). Risk factors such as obesity and physical inactivity are important and modifiable risk factors for prevention of T2DM and glycemic control (ADA, 2016).

People with T2DM are treated with a combination of lifestyle modification such as diet and exercise, and pharmacological therapy such as insulin and/or oral hypoglycemic agents to manage their blood glucose levels. Among adults with diabetes in the United States, use of only oral medication accounts for 58 percent of those treated, and use of only insulin is 12 percent. Fourteen percent take both insulin and oral medication and 16 percent use lifestyle modifications alone to manage T2DM (ADA, 2016; CDC, 2011). Dietary modifications are one of the most important elements in managing T2DM. In general, a balanced diet for people with

T2DM include a decrease in saturated fat, avoiding sugar sweetened beverages, limitation of alcohol intake, and limitation of sodium consumption to less than 2,300 mg per day. Given that roughly 85 percent of people with T2DM are overweight or obese, a combination of the nutrition therapy, physical activity, and weight management is more effective for reducing insulin resistance and improving glycemic control among people with T2DM than conducting the nutrition therapy alone (ADA, 2016). Physical activity is another important element of diabetes management because of its known effectiveness in improving glycemic control and preventing diabetes complications. Evidence for the benefits of physical activity in people with T2DM is profound (Colberg et al., 2010). For example, regular and high levels of exercise are associated with improvement in A1C levels (Boulé, Kenny, Haddad, Wells, & Sigal, 2003). Physical activity is also connected to weight loss, a decrease in cardiovascular risk factors (hypertension and hyperlipidemia), and prevention of diabetes complications (ADA, 2004; ADA, 2016; Colberg, & Riddell, 2013). The U.S Department of Health and Human Services (2016) recommends 150 minutes per week in moderate to vigorous exercise or 75 minutes per week in vigorous aerobic exercise for adults over age 18 years. An intervention study investigating the effect of physical activity in people with T2DM identified that moderate-to-vigorous exercise 3 or 4 times per week for 30 to 60 minutes per day resulted in a 10 to 20 percent reduction in A1C levels (Boulé, Kenny, Haddad, Wells, & Sigal, 2003).

Diabetes complications have serious health implications. People with T2DM are at risk of microvascular complications (i.e., nephropathy, neuropathy, and retinopathy) and macrovascular complications (i.e., cardiovascular disease and stroke). Cardiovascular disease (CVD) is a leading contributor to morbidity and mortality, and

it is two to four times more prevalent in people with diabetes than those without diabetes. Risk factors of CVD include dyslipidemia, hypertension, and smoking. Poor glycemic control is a direct risk factor of microvascular complications. Diabetic nephropathy characterized by microalbuminuria or proteinuria contributes to the development of kidney failure. Roughly half of newly diagnosed cases of kidney failure are related to a previous diagnosis of diabetes. Diabetic neuropathy is a serious complication due to distressing symptoms, ulcers, and gangrene. Damage to the nervous system leads to lower extremity amputations that account for more than 60 percent of non-traumatic amputations. Diabetic retinopathy is the leading cause of blindness in adults. About 30 percent of people with diabetes aged 40 years or older had diabetic retinopathy. Development and progression of these diabetes complications result from indirect and direct effects of poor glycemic control (CDC, 2011).

Glycemic Control

Glycemic control is a well-established treatment goal in diabetes management. The ADA recommends an A1C target less than seven percent even though glycemic targets consider age, individual preference, risk for hypoglycemia, and diabetes complications (ADA, 2016). Numerous studies have reported reductions in microvascular complications with improved glycemic control in T2DM. The United Kingdom Prospective Diabetes Study (UKPDS) demonstrated the significant association of intensive glycemic control with decreased rates of microvascular and neuropathic complications. The study revealed that a 0.9 percent decrease in A1C levels was associated with a 25 percent reduction in microvascular complications and a ten percent decrease in diabetes-related mortality (UKPDS group, 1988a; UKPDS

group, 1988b). A1C ten-year follow-up of the UKPDS cohorts confirmed and extended previous evidence that persistent hyperglycemia was major causes of microvascular complications of T2DM and that optimal glyceamic control (A1C < 7%) is beneficial to delay diabetes complications. This study also reported 25 percent reduction in microvascular complications in the intensive treatment group (Holman, Paul, Bethel, Matthews, & Neil, 2008). The prospective observational UKPDS suggested that low A1C is associated with reduction in the risk of microvascular complications in T2DM (Adler et al., 2000). The Kumamoto study indicated that intensive glyceamic control (A1C < 6.5%) delayed the onset and the progression of diabetic complications including retinopathy, nephropathy and neuropathy (Ohkubo et al., 1995). Stratton and colleagues (2000) reported that people with severely poor glyceamic control defined as A1C levels of 10 percent or higher had a three-fold increased risk of complications than those with intensive glyceamic control (A1C < 6%). Based on the evidence on the effect of glyceamic control in T2DM, A1C values of seven percent or lower for glyceamic control is a validated and beneficial recommendation to delay development and progression of diabetes complications.

Glyceamic control is evaluated for treatment and management of T2DM.

There are two methods to assess the effectiveness of glyceamic control: self-monitoring of blood glucose (SMBG); and self-monitoring of glycosylated hemoglobin (A1C). The most common measure for glyceamic control is an A1C test, which estimates the percent of glucose in the bloodstream attached to hemoglobin molecules in the previous two to three months since A1C has the lifespan of red blood cells. Thus, the more excess glucose in the bloodstream, the higher the percentage of hemoglobin molecules attached, and the higher the A1C level. In general, an A1C test

is conducted every three months and recommended at least twice a year (ADA, 2016).

Poor glycemic control is frequently observed in people with T2DM. A national study for estimates of glycemic control among American adults with diagnosed diabetes from 1999 to 2002 demonstrated that approximately 60 percent of adults in the United States had A1C levels of greater than seven percent, while more than 30 percent of the population had over eight percent A1C. In addition to these results, approximately 50 percent of adults aged 20 to 40 years had A1C levels of more than 8 percent, and minority populations were less likely to achieve good glycemic control than the non-Hispanic White population (Saydah et al., 2007). A systematic review examining racial differences on glycemic control reported that Asian Americans revealed higher A1C levels than non-Hispanic Whites. Roughly half of the reviewed 17 studies showed that Asian Americans have poor glycemic control of A1C levels of seven percent or higher (Campbell, Walker, Smalls, & Egede, 2012). In particular, Choi and Rankin (2009) reported that over half of participants had A1C levels of more than seven percent in their study on diabetes management in KAs with T2DM.

Depression

According to criteria of the Diagnostic and Statistical Manual, fifth edition (DSM-5), depression, as a major depression disorder, is characterized by at least 5 symptoms, including one of two core symptoms (anhedonia and depressed mood) for at least 2 weeks. Other symptoms include weight loss or gain, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue, feelings of worthlessness or inappropriate guilt, diminished ability to think or concentrate, or recurrent thoughts of death. These symptoms of depression may influence development of T2DM and

glycemic control through poor self-care behaviors. Methods for assessment of depression include clinical interviews to make a diagnosis and depression screening questionnaires to measure the number and severity of depressive symptoms present. (American Psychiatric Association [APA], 2013).

Depression is a serious mental health disorder, affecting approximately 16 percent of American adults (Kessler et al., 2005). Female gender, personal history of a prior depressive episode, and a family history of depression are associated with the development of depression. In general, women have approximately two times higher depressive symptoms than men (APA, 2013; Horwath, Cohen, & Weissman, 2002). Depression has an influence on disability, medical and psychiatric comorbidity, economic burden, and excess mortality.

Many studies have examined the prevalence of depression in KAs. More than 80 percent of KAs are first generation immigrants that are deeply affected by traditional Korean values (Song & Moon, 1998). These values influence psychological problems while the KAs adapt and adjust to their new culture (Shin & Features Submission, 1994). Low utilization of mental health services, reluctance to express depressive symptoms, and low acculturation such as lack of English proficiency in KAs can lead to a high prevalence of depression (Shin, 2002). A cross-sectional study using the Geriatric Depression Scale–Short Form (GDS-SF) demonstrated that high levels of depressive symptoms (GDS-SF scores greater than 5) were revealed in approximately 38 percent of elderly KAs (Kang, Basham, & Kim, 2013). A recent study with 1,118 elderly KAs reported that about 11 percent of them had clinical depression (PHQ-9K score ≥ 10) and roughly 20 percent had mild depression ($5 < \text{PHQ-9K score} > 10$) (Kim et al., 2015). A community-based study

with 230 KA adults reported that approximately 24 percent of them had mild or severe levels of depressive symptoms (PHQ-9K score ≥ 5). The first two studies (Kang et al.; Kim et al.) conducted for KA elderly indicate that the prevalence rates of depression were relatively higher than non-elderly KA adults. A meta-analysis study examining depression among Asian Americans demonstrated that prevalence of depression measured by the Center for Epidemiological Studies-Depression (CES-D) was approximately 33 percent for KAs. This was significantly higher than that for Chinese Americans and similar to that for Filipino Americans (Kim, Park, Storr, Tran, & Juon, 2015).

In addition, KAs tend to have a higher prevalence of risk factors for depression. Living alone, multiple chronic conditions, low educational attainment, cognitive impairment, no health insurance, limited access to mental health service, poor self-rated health, stressful life events, lack of English language proficiency, and satisfaction of visiting one's birth place were associated with depressive symptoms in KAs (Kang, Basham, & Kim, 2013; Kim et al., 2015). These factors also exacerbate conditions of uncontrolled chronic diseases such as T2DM (Kim, Juon, Hill, Post, & Kim, 2001).

Overall, depression has an adverse influence on quality of life and health outcomes. KA adults have roughly 2-fold higher depression rate than American adults and other Asian American populations. Depression contributes to chronic diseases, disability, mortality, and economic burden.

The Relationship between Depression and Glycemic Control in T2DM

People with T2DM have an increased risk of depression (ADA, 2016;

Anderson et al., 2001). There is abundant evidence showing that prevalence rates of depression are significantly increased in people with T2DM. Two meta-analysis studies have identified that 10 to 15 percent of adults with T2DM had a major depression disorder and that approximately 30 percent had high depressive symptoms (Anderson et al., 2001; Gavard, Lustman, & Clouse, 1993). Each of the studies included in the two meta-analyses assessed the prevalence of depression using a wide range of definitions for depression across multiple settings. The studies also had diverse study designs, methods, and methodological issues. However, it is evident that prevalence of depression in adults with T2DM is two to three times higher compared to the general population (Ali et al., 2006; Anderson et al., 2001; Golden et al., 2008; Knol et al., 2007; Roy & Lloyd, 2012). Evidence suggests that the prevalence of comorbid depression and T2DM is approximately two times higher than the prevalence of either depression or T2DM alone (Anderson et al., 2001).

A growing number of studies have investigated depression among KAs with T2DM. A cross-sectional study using the Center for Epidemiological Studies Depression scale (CES-D) reported that approximately 56 percent of KAs with T2DM had high depressive symptoms defined by the CES-D of 16 or more (Choi & Reed, 2013). A community-based study using the Geriatric Depression Scale–Short Form (GDS-SF) in 672 KA older adults aged 60 years or over reported that 33 percent of participants with diabetes had high depressive symptoms defined by the GDS-SF scores of less than 5, compared with 20 percent of those without diabetes. This study did not specify the type of diabetes (Jang, Park, Cho, Roh, & Chiriboga, 2012). All of these studies used validated screening questionnaires rather than clinical interview.

The comorbidity of T2DM and depression exacerbates health outcomes and

the progression for the two diseases in terms of severity, complications, treatment resistance, and mortality (Katon, 2003; Lustman et al., 2000). Therefore, the relation between depression and T2DM is bidirectional and results in more severely multifaceted sequelae. To date, the American Diabetes Association (2016) recommends routinely screening for psychological conditions such as depression for glycemic control, as psychological problems are likely to appear after diagnosis of diabetes.

However, it is unclear how depression influences poor glycemic control in T2DM. Several mechanisms regarding the association between depression and glycemic control in T2DM have been suggested, including depression-induced abnormalities in neuroendocrine and neurotransmitter function, decreased compliance with diabetes treatment and management, and behavioral and physical factors. Evidence of the mechanisms has shown that depression is associated with changes in hypothalamic-pituitary-adrenocortical (HPA) axis and sympathetic nervous system (SNS) that lead to increased cortisol levels and stress hormones, which in turn increases glucose production and decreases insulin sensitivity. Also, depression and insulin resistance tend to lead to increased proinflammatory responses (Champaneri, Wand, Malhotra, Casagrande, & Golden, 2010). Therefore, depression may have an adverse effect on glycemic control through these processes. It is also possible that antidepressants or antipsychotic medications lead to incidence of T2DM and poor glycemic control (Barnard, Peveler, & Holt, 2013).

Randomized controlled trials on depression have found that antidepressants are significantly associated with weight gain, hyperglycemia, and hypoglycemia (Barnard et al., 2013). A meta-analysis including 47 studies reported that depression

was significantly associated with non-adherence to diabetes self-management such as missed medical appointments, medication use, glucose monitoring, and foot care, which may lead to poor glycemic control (Gonzalez, Delahanty, Safren, Meigs, & Grant, 2008). Moreover, depression has shown to lead to physiological changes such as obesity and increased insulin resistance that contribute to poor glycemic control. Behavioral factors such as physical inactivity and high calorie diet are associated with depression, which are also risk factors of T2DM and glycemic control. Diminished activities, poor sleep and appetite dysregulation, and fatigue are common symptoms of depression (APA, 2013; Weyerer, 1992). These depression symptoms may influence glycemic control through poor self-care behaviors.

Achieving glycemic control is a major challenge to minimize the risk of diabetes complications for people with comorbid T2DM and depression. Numerous studies have reported that depression contributes to poor glycemic control in T2DM. For example, a meta-analysis including 24 studies published from 1975 to 1999 reported that depression was significantly associated with hyperglycemia. Interestingly, the effect size was in the small-to-moderate range (0.17) and larger when clinical interviews and diagnostic criteria (0.28) were used to assess depression rather than self-reported questionnaires (0.15). This meta-analysis demonstrated that there were differences in the effect size of studies due to study design, methodology, severity of depression, and type of diabetes (Lustman et al., 2000). Two longitudinal studies reported that depression was connected with poorer glycemic control over time in people with T2DM (Fisher et al., 2008; Golden et al., 2008). A cross-sectional study reported that high fasting insulin levels, 2-hour glucose concentrations, and insulin resistance were associated with high Hospital Anxiety and Depression–

depressive symptoms (HAD-D) scores, finding elevated glucose levels in people with T2DM and depression (Holt et al., 2009). Another cross-sectional study with 273 participants with depressive and anxiety symptoms in T2DM, using the Hospital Anxiety Depression Scale (HADS), showed an association of depressive symptoms with increased risk of poor glycemic control. In this study, however, anxiety was not associated with glycemic control (Gois, Dias, Raposo, do Carmo, & Barbosa, 2012).

Recent studies have examined the association between individual symptoms of depression and glycemic control. For instance, a secondary analysis study on depressive symptoms in 343 participants with T2DM reported that depressed mood, sleeping difficulties, appetite problems, and suicidal ideation were significantly associated with higher A1C levels at baseline after controlling for sex, age, education, ethnic minority, insulin treatment, body mass index, and smoking (Bot et al., 2013). A cross-sectional study investigated how depressive symptoms such as depressed mood, anhedonia, and anxiety were differently associated with poor glycemic control in 5,772 people with T2DM. The findings were that anhedonia was associated with poor glycemic control, but depressed mood and anxiety were not related to glycemic control (Nefs et al., 2012).

A large population-based study enrolling 4,193 participants with T2DM showed that 47 percent of people with major depression have eight percent or higher A1C levels. In this study, age was a significant moderator of the relationship between major depression and A1C levels. For example, younger people (< 65 years old) with major depression were more likely to have higher A1C levels than older people (≥ 65 years) with major depression ($p < .0001$) (Katon et al., 2004). One study reported that an increase in A1C attributable to depression ranged from 1.8 to 3.3 percent (Lustman

et al., 1997).

On the other hand, other longitudinal studies found no association between depression and glycemic control in people with T2DM (Co et al., 2015; Engum et al., 2007; Lin et al., 2009). Additionally, several recent studies did not find any relationship between depression and poor glycemic control (Aikens, 2012; Fisher et al., 2010; Georgiades et al., 2007). A population-based study conducted in primary care settings suggested that A1C levels were increased according to the severity of depressive symptoms even though its association was not significant (Ciechanowski, Katon, & Russo, 2000).

In KAs with T2DM, very limited research on depression has been conducted. There are only two cross-sectional studies on depression in KAs with T2DM. Unfortunately, the studies did not assess glycemic control such as A1C levels or fasting glucose levels, rather focused on quality of life as a diabetes outcome. A cross-sectional study reported that high depressive symptoms were significantly associated with low quality of life (Choi & Reed, 2013). Similarly, the other cross-sectional study showed significant association of higher depressive symptoms with lower diabetes-related quality of life (DQOL). Interestingly, this study presented that the relationship between DQOL and depressive symptoms were stronger for KA men than KA women (Choi, Reed, & Sarkisian, 2013).

Overall, there are inconsistent results among studies investigating the association between depression and glycemic control in T2DM. Differences in racial or ethnic populations, measures for depression assessment, and control factors that can affect glycemic control may contribute to the inconsistency. Given the inconsistent findings of studies on the association between depression and glycemic

control in T2DM and no research evaluating its association in KAs with T2DM, this study provides valuable information in developing diabetes self-management interventions in this population.

Sleep

Sleep is described a state of consciousness characterized by physiological and brain wave activity changes and a period of reduced behavioral activity associated with a typical posture, decreased responsiveness to the environment, relatively easy to reverse. Sleep amount and timing is controlled by a combination of two processes: sleep homeostasis and circadian rhythms. The concept of sleep homeostasis simply states that the greater amount of time awake, the greater the propensity to sleep. Continuously insufficient sleep has a negative influence on daytime function, cognitive performance, mood function, and metabolic function. Circadian rhythms regulate 24-hour fluctuations in hormone levels and sleep timing via the hypothalamic suprachiasmatic nucleus (SCN) and environmental factors such as light and lifestyle. Sleep is associated with important hormones that influence growth, regulate energy, and control metabolic and endocrine functions. For example, cortisol release follows a circadian rhythm, and peak release of growth hormone and prolactin are during the sleep period. (Borbély, 1982; National Sleep Foundation, 2013).

The National Sleep Foundation reported that more than 40 million Americans had sleep problems, and average sleep duration of Americans was about 7 hours per day. The National Sleep Foundation recommends sleep duration of 7 to 9 hours per day of sleep duration for healthy adults (National Sleep Foundation, 2005; National Sleep Foundation, 2013). In KAs, nearly 40 to 80 percent of Korean American older adults have sleep disturbance (Jang, Shin, Cho, Kim, & Chiriboga, 2011; Sok, 2008).

Sleep duration is described as how many hours of sleep people obtain on a typical night. Sleep quality is defined as satisfaction of the sleep experience, integrating aspects of sleep initiation, sleep maintenance, sleep quantity, and refreshment upon awakening. Sleep quality includes sleep efficiency, sleep disturbance, sleep latency, and chronotype. Sleep efficiency is defined as sleep in the episode potentially filled by sleep. Sleep latency is described as the duration of time from lights out or bedtime to onset of sleep (National Sleep Foundation, 2013). Sleep disturbance is defined as "difficulty initiating sleep, difficulty maintaining sleep, waking up too early, or sleep that is chronically non-restorative or poor in quality" (Berger, 2009, p. 166). Chronotype is defined as midpoint of sleep on free days (National Sleep Foundation, 2013).

Sleep is assessed by objective methods including polysomnography (PSG), actigraphy, subjective methods including self-reported questionnaires, sleep diaries, and clinical interviews. PSG is the gold standard measure for determining multiple sleep parameters and it is used to diagnose sleep disorders, whereas actigraphy is used for sleep-wake timings and is a cost-effective alternative to PSG. Self-reported questionnaires of sleep are useful and cost-effective for assessment in large populations. The Pittsburgh Sleep Quality Index (PSQI) as a validated measure of sleep quality is the most commonly used questionnaire among self-reported questionnaires in sleep research (Arora & Taheri, 2015).

The Relationship between Sleep and T2DM

Sleep plays an important role in human health. However, people with busy lifestyles in modern society are not aware of the importance of sleep and tend to override the physiological control mechanisms, resulting in alterations of sleep

duration and quality. Sleep duration and sleep quality have been recognized as important contributors to the development of T2DM. A large body of evidence has supported the independent associations of short sleep duration and poor sleep quality with development of T2DM (Cappuccio, D'Elia, Strazzullo, & Miller, 2010; Shan et al., 2015).

Potential mechanisms to explain the association between sleep and T2DM have been reported in experimental studies. Sleep duration and quality have been shown to have association with glucose use in the brain. Sleep-restricted participants had low use of glucose in their brain during waking hours, (Spiegel, Leproult, & Van Cauter, 1999), which in turn may increase the risk for T2DM or hyperglycemia. In addition, short sleep duration and poor sleep quality cause an increase in sympathetic nervous system activity, alteration in the hypothalamic-orexin-adrenal (HPA) axis that leads to increased cortisol and suppressed growth hormone secretion (Spiegel et al., 1999), an increase in inflammatory response (Mullington, Simpson, Meier-Ewert, & Haack, 2010), and abnormal adipocyte function (Beihl, Liese, & Haffner, 2009). These biological alterations from changed sleep duration or quality lead to decreased beta cell function and increased insulin resistance, which contribute to T2DM and high blood glucose levels (Loss, 1997; Spiegel, Leproult, & Van Cauter, 1999; Wieser, Moschen, & Tilg, 2013). Some prospective studies (Spiegel, Tasali, Penev, & Van Cauter, 2004; Taheri, Lin, Austin, Young, & Mignot, 2004) have shown that poor sleep quality and short sleep duration lead to changes in the appetite-regulating hormones including decreased leptin (which is one of the satiety hormones) and increased ghrelin which increases hunger. Impaired regulation of these hormones can cause increases in appetite and in turn generate an adverse influence on the normal

glucose homeostasis in the body. Therefore, increased hunger and food intake without commensurate increase in energy expenditure may increase risk for obesity, a risk factor of T2DM and poor glycemic control (López-García et al., 2008; Spiegel, Tasali, Penev, & Van Cauter, 2004; Taheri, Lin, Austin, Young, & Mignot, 2004).

Given the possible mechanisms on the association of sleep with the development of T2DM, sleep duration and quality may be associated with glycemic control in T2DM. Recently, a growing number of studies have examined its relations among patients with T2DM.

The Relationship between Sleep Quality and Glycemic Control in T2DM

The perception of poor sleep quality can result from a variety of sleep disorders and symptoms including insomnia disorder, insomnia symptoms such as difficulty falling asleep, frequent awakenings during the sleep, and early morning awakenings, and insufficient sleep given individual sleep need (APA, 2013). In T2DM, the impact of poor sleep quality on glycemic control was studied by Trento and colleagues (2008). The experimental study compared the wrist actigraph-assessed sleep patterns of 47 people with T2DM, who were using oral hypoglycemic agents and did not have any T2DM complications that might disturb sleep, to a control group of 23 healthy individuals. In this study, the two groups were similar in age, gender distribution, BMI, and occupational level at baseline. The study demonstrated that people with T2DM moved more in bed, had lower sleep maintenance and sleep efficiency, and had more fragmented sleep than of the control group. In particular, the fragmentation index and moving time were significantly higher in people with T2DM after controlling for age, gender, and education level.

Studies reported that approximately 50 percent of people with T2DM have

poor sleep quality according to the Pittsburgh Sleep Quality Index (scored > 5) (Cho, Lee, Ryu, Choi, & Kim, 2014; Lou et al., 2015; Luyster & Dunbar-Jacob, 2011).

Recently, ten studies have shown an association between self-reported sleep quality and glycemic control in people with T2DM. For example, a cross-sectional study used a modified PSQI score that removed the sleep duration domain to assess the independent association with sleep quality. In this study, sleep quality was significantly and positively associated with glycemic control after controlling for age, gender, BMI, diabetes complications, and insulin use. Diabetes complications and use of insulin moderated the relation between sleep quality and glycemic control (Knutson, Ryden, Mander, & Van Cauter, 2006). One cross-sectional study of 551 Chinese with T2DM reported that poor sleep quality defined by PSQI scores of more than 8 was significantly associated with poor glycemic control after controlling for age, gender, BMI, and duration of diabetes. In this study, the group with poor sleep quality (PSQI > 8) had the highest levels of insulin resistance compared with other two groups with PSQI scores of less than 5 and between 5 and 8 (Tang et al., 2014).

One small cross-sectional study examined the association of sleep quality on glycemic control among 46 participants with T2DM in Taiwan. The group with poor sleep quality defined as PSQI scores of 8 or more revealed about seven times higher risk of poor glycemic control compared with those with good sleep quality after adjustment for age, gender, and BMI. Also, sleep efficiency was significantly and positively associated with A1C (Tsai et al., 2012). One study of 564 participants with T2DM in Turkey reported that people with high A1C levels of more than 6.5% had a 1.5 times greater risk of poor sleep quality (PSQI \geq 5), compared with those with normal A1C levels of 6.5 percent or less (Keskin et al., 2015). A cross-sectional study of 724

Japanese with T2DM reported that poor sleep quality defined as PSQI scores of 9 or more was significantly associated with A1C levels after controlling for age and gender (Osonoi et al., 2015). Despite diverse criteria of PSQI, these studies have reported that the association between sleep quality and glycemic control was significant in T2DM.

However, not all studies agree on the relationship between sleep and glycemic control. A national, cross-sectional observational study with an online survey assessed subjective sleep-related impairment in adults with T1DM and T2DM, using the PSQI measure and the self-reported A1C test. The study of 230 participants with T2DM indicated that poor sleep quality (PSQI > 5) was not associated with A1C levels regardless of adjustment (Nefs et al., 2015). Reutrakul and colleague (2013) investigated whether chronotype was independently associated with glycemic control among patients with T2DM in primary care clinics. The PSQI was self-administrated and the A1C values were extracted from hospital medical records. The study reported that the correlation between PSQI scores and A1C levels was not significant (Reutrakul et al., 2013). Rather, chronotype was significantly associated with A1C after controlling for age, sex, race, BMI, diabetes complication, insulin use, depression. A cross-sectional study of 114 Caucasians with T2DM used the PSQI and performed the A1C test in a local clinic. No association between sleep quality and glycemic control was found in this study as well (Wan Mahmood et al., 2013). In a study of 140 Chinese on insulin therapy for T2DM, the association between poor sleep quality as PSQI scores of more than five and A1C levels was not significant (Song et al., 2013). One study reported that there were no differences in both fasting glucose levels and A1C levels between adults with good sleep quality by PSQI scores of 5 or less and poor sleep quality by PSQI scores of more than five. Sleep quality

was not associated with A1C levels (Aribas et al., 2015). A cross-sectional study evaluating the impact of sleep quality on quality of life in 944 Chinese with T2DM reported that the difference between good sleep quality defined as PSQI scores of less than 7 and poor sleep quality defined as PSQI scores of 8 or more among people with good glycemic control defined by A1C levels of less than 6.5 percent was not significant (Lou et al., 2015).

Overall, these studies used the PSQI for the assessment of sleep quality with different cut points to define poor sleep quality. Only one of the studies used a modified PSQI score. A1C level was the primary means of assessing for glycemic control. The findings from four studies support the hypothesis that poor sleep quality is independently associated with poor glycemic control (Knutson et al., 2006; Osonoi et al., 2015; Tang et al., 2014; Tsai et al., 2012), while six studies did not find significant associations between sleep quality and glycemic control in T2DM (Aribas et al., 2015; Lou et al., 2015; Nefs et al., 2015; Reutrakul et al., 2013; Song et al., 2013; Wan Mahmood et al., 2013). These inconsistent findings on sleep quality and glycemic control in T2DM can be reflected by different conceptual and methodological methods including a variety of confounders and different definitions of poor sleep quality. More studies are needed to understand the nature of the association between sleep quality and glycemic control in people with T2DM.

The Relationship between Sleep Duration and Glycemic Control in T2DM

Sleep duration may contribute to glycemic control in T2DM. Ten studies examining the association between sleep duration and glycemic control in people with T2DM were found. Two experimental studies conducted objective measurements for sleep duration rather than self-reported questionnaires. One small experimental study

with 40 participants with T2DM used wrist actigraphy for assessment of sleep duration, measured fasting glucose and insulin for glycemic control, and assessed the homeostatic model assessment (HOMA) for insulin resistance. In this study, sleep duration was not associated with fasting glucose, insulin, and HOMA regardless of adjustment for confounding factors (Knutson, Van Cauter, Zee, Liu, & Lauderdale, 2011).

Research on the relationship of sleep duration with glycemic control in T2DM has demonstrated inconsistent findings. Eight studies used self-reported questionnaires to investigate the effect of sleep duration on glycemic control in T2DM. A large cross-sectional study with 4,870 Japanese adults reported that A1C levels showed a U-shaped association with self-reported sleep duration. Short sleep duration of 5.5 hours per night and long sleep duration of 8.5 hours per night were significantly associated with higher A1C levels, compared with a sleep duration of 6.5 to 7.4 hours per night after controlling for age, sex, duration of diabetes, total energy intake, current smoking, drinking, exercise, use of insulin, and depressive symptoms (Ohkuma et al., 2013). A large national study with 2,134 Korean adults also exhibited a U-shaped association between sleep duration and glycemic control (fasting blood glucose and A1C) in T2DM. People with sleep duration of 9 hours or more per night were 1.5 times more likely to have A1C levels of 7% or over, compared with those with sleep duration of seven hours per night after adjustment for study year, age, sex, education, marital status, residential area, income, current alcohol use, current smoking physical activity, hypertension, body mass index, and waist circumference.

However, the association was no longer significant after additionally controlling for duration of diabetes (Kim et al, 2013). A study with 551 Chinese adults

reported that short (< 6 hours) and long sleep duration (> 8 hours) were significantly associated with poor glycemic control ($A1C \geq 7\%$), compared with moderate sleep duration (6 to 8 hours) (Tang et al., 2013). A study with adults aged 40 years or over who had T2DM used three different measurements including A1C, fasting plasma glucose, and post prandial glucose levels for assessment of glycemic control. Long night sleep duration of nine hours was significantly associated with higher A1C, fasting plasma glucose, post prandial glucose levels compared with night sleep duration of 6-9 hours after adjustment for confounding factors, while short sleep duration of less than six hours was not associated with glycemic control (Zheng et al., 2014).

In contrast, The Nurses' Health cohort study examined sleep duration and A1C levels in 935 women with T2DM reported that there was no difference in A1C levels by sleep duration (Williams, Hu, Patel, & Mantzoros, 2007). A cross-sectional study of 194 adults with T2DM attending a primary care clinic also reported that A1C levels were not correlated with self-reported sleep duration (Reutrakul et al., 2013). A study with 134 Caucasians with T2DM reported that sleep duration was not associated with A1C levels and fasting glucose levels (Wan Mahmood et al., 2013).

Overall, in cross-sectional studies using self-reported sleep duration, the association between sleep duration and poor glycemic control in T2DM is mixed. Two studies found both short and long sleep duration to be significantly associated with poor glycemic control (Ohkuma et al., 2013; Tang et al., 2013) and only long sleep duration in two other studies (Kim et al, 2013; Zheng et al., 2014). There was no association between glycemic control and sleep duration in four other studies (Reutrakul et al., 2013; Wan Mahmood et al., 2013; Wang et al., 2015; Williams et al.,

2007). The majority of these studies involved different subject populations, used different categorizations of sleep duration and differently-worded questions, and originated from different geographical locations and cultures. Therefore, the use of different study methods may have led to inconsistent findings in these studies even though most of the studies used large epidemiological datasets and adjusted for many potential confounders.

The Relationship among Depression, Sleep, and Glycemic Control in T2DM

Sleep quality and duration can be directly influenced by depression as sleep problems such as insomnia or hypersomnia are symptoms of clinical depression as well as forming part of the diagnostic criteria for depression (APA, 2013). People with depression often complain of difficulty getting to sleep, frequent awakenings during the night, early morning awakenings, and nonrestorative sleep (Ohayon et al., 2002; Perlis et al., 1997). Poor sleep quality was estimated to be present among 50 to 90 percent of people with clinical depression (Casper et al., 1985; Riemann, Berger, & Voderholzer, 2001). Epidemiological studies have shown that people with depression had significantly higher rates of sleep disturbance than the general population (Li, Lam, Chan, Yu, & Wing, 2012; Peterson & Benca, 2008).

The association between sleep duration and depression has been investigated by numerous studies. Short and long sleep duration is associated with depression or depressive symptoms. Two epidemiological studies reported that people with high depressive symptoms were more likely to report short sleep duration of less than 6 hours or long sleep duration of more than 8 hours (Kaneita et al., 2006; Krueger & Friedman, 2009).

Biological and behavioral factors associated with both depression and sleep

are also associated with poor glycemic control in T2DM such as inflammation, HPA axis activity, and obesity. Increases in inflammatory markers, often seen in individuals with short sleep duration, poor sleep quality, and depression, are associated with the development of T2DM and poor glycemic control because of insulin resistance and sustained low inflammatory responses (Pickup, 2004). One study on the association between glycemic control and inflammatory markers in T2DM reported that C-reactive protein (CRP) levels were positively correlated to A1C and negatively related to adiponectin that is identified as insulin resistance (Schulze, Rimm, Shai, Rifai, & Hu, 2004). A national study indicated that A1C was significantly associated with elevated CRP for A1C levels higher than 9 percent (OR 2.15, 95% CI 1.07–4.32) and for A1C levels higher than 11 percent (OR 4.40, 95% CI 1.87–10.38) after controlling for age, race, sex, smoking, duration of diabetes, use of insulin, and BMI. In this study, higher A1C also predicted elevated CRP (King, Mainous, Buchanan, & Pearson, 2003). Alterations in HPA activity and increased activity of the autonomic nervous system are also found in chronic insufficient sleep and depression (Hatzinger et al., 2008), which contribute to hyperglycemia or development of T2DM. An experimental study examined cortisol hormones to assess changes of HPA activity and glycemic control in T2DM. Serum cortisol levels were significantly correlated with fasting glucose levels (Bellastella et al., 2015). Obesity, a risk factor for poor glycemic control, is also associated with short or long sleep duration and depression. It is well known that glycemic control is influenced by BMI (Bae, Lage, Mo, Nelson, & Hoogwerf, 2015). As mentioned earlier, unhealthy behaviors such as physical inactivity and dietary intake are important factors for glycemic control and induced by insufficient sleep or poor sleep quality and depression (ADA, 2016; Turner et al.,

1999). Therefore, some biobehavioral factors influenced by sleep and depression may affect common mechanisms implicated in glycemic control in T2DM.

Based on the common mechanisms among depression, sleep, and glycemic control and the high prevalence of insufficient sleep, poor sleep quality, and depression in T2DM, research focusing on depression, sleep, and glycemic control in T2DM must be conducted. In the reviewed studies on sleep quality and duration and glycemic control in T2DM, eight studies assessed depressive symptoms with self-reported measures of depression (Knutson et al., 2006; Lou et al., 2015; Nefs et al., 2015; Ohkuma et al., 2012; Reutarkul et al., 2013; Reutrakul et al., 2015; Wang et al., 2015; Zheng et al., 2015). Of the eight studies, seven studies examined the association between sleep and depression and used depression as a confounding factor when analyzing independent roles of sleep duration or quality on glycemic control (Knutson et al., 2006; Lou et al., 2015; Nefs et al., 2015; Ohkuma et al., 2012; Reutarkul et al., 2013; Wang et al., 2015; Zheng et al., 2015). Only one study investigated separately the association of depression and sleep quality with diabetes specificity quality of life (DSQL) rather than glycemic control (Lou et al., 2015). Studies focusing on depression and glycemic control in T2DM did not assess sleep. A recent study using the Patient Health Questionnaire-9 items (PHQ-9) for depression assessment reported that people with higher severity of sleep problems on the PHQ-9 had significantly higher A1C levels compared to those with lower severity or absence of this symptom. Moreover, the study suggested the symptom of sleep problem as unique variance on glycemic control after controlling for potential clinical and demographic covariates even though this study had a small sample size (Czech, Orsillo, Pirraglia, English, & Connell, 2015). Evidence suggests that sleep may mediate depression and T2DM. For

example, Seligowski and colleague (2012) examined depression, sleep quality, and quality of life in veterans with T2DM. The Beck Depression Inventory for depression, PSQI for sleep quality, and diabetes quality of life (DQOL) scale for quality of life were assessed by self-report in this study. Sleep quality had a partial indirect effect on the association between depressive symptoms and DQOL. Gangwisch and colleagues (2010) reported insomnia and sleep duration as a mediator on the relationship between depression and hypertension. Sleep quality and duration may partially be explained the association between depression and glycemic control in people with T2DM.

Acculturation

Acculturation is defined as a transformation through the adjustment process between an original culture and a new culture and characterized by cultural change, adaptation, and adjustment through intercultural contact (Phinney, 2003).

Acculturation is a multifactorial process of sociocultural context and cultural learning, which leads to cultural changes in behaviors, language, values, attitudes, and beliefs through continuous intercultural contact with the original culture and the new culture (Soto-Greene, Salas-Lopez, Sanchez, & Like, 2004; Unzueta et al., 2004). Full acculturation leads to assimilation. For example, fully acculturated immigrants completely accept the host culture including values, behaviors, beliefs, and language and live with these new culture patterns in their daily lives without great difficulties. In contrast, separation as a consequence of acculturation is a process of maintaining the original cultural values, beliefs, and behaviors rather than the host culture practices (McDermott-Levy, 2009). Acculturation has been evaluated on the basis of language, cultural orientation of daily life, ethnic self-identification, and the length of residency (Aikens, 2012). Age, income, education, social support, length of residency,

self-efficacy, English proficiency, and generational status influence the level of acculturation (Abe-Kim, Okazaki, & Goto, 2001; Neff, & Hoppe, 1992).

Immigrants encounter cultural changes such as language barriers, discrimination, limitation of traditional and familiar food, financial strain, and different physical environment during the acculturation process, which affect psychosocial, behavioral, and physiological aspects of their health (Kandula, Kersey, & Lurie, 2004; Salant, & Lauderdale, 2003). Studies have examined the effect of acculturation on health. The findings have provided evidence that acculturation is associated with health risk factors such as smoking, obesity, lack of physical activity, unhealthy diet, and stress (Gomez, Kelsey, Glaser, Lee, & Sidney, 2004; Lee, Sobal, & Frongillo, 2000; Lara, Gamboa, Kahramanian, Morales, & Hayes Bautista, 2005). Moreover, while some studies showed that high acculturation as assimilation to the American culture was linked to low morbidity (Cheung, 1995; Takebayashi, 2004), other studies reported that high acculturation was correlated to increased risk of chronic diseases (Fujimoto et al., 2000) and psychiatric disorders (Guglani, Coleman, & Sonuga-Barke, 2000).

The Relationship among Depression, Acculturation, and Glycemic Control

Acculturation is considered an important predictor of depression. Immigrants experience cultural change during the acculturation process and are exposed to increased acculturative stressors, making them at greater risk for depression (Alegría et al., 2008). Some studies have investigated the association of acculturation with depression. A meta-analysis of 39 studies investigating the association of acculturation with depression among Asian Americans demonstrated that high levels of acculturation as assimilation to the America culture were significantly associated with

reduced depressive symptoms. However, when acculturation was used as orientation to the Asian culture (low acculturation to the mainstream culture), the association between acculturation and depression was negative, but not significant (Gupta, Leong, & Valentine, 2013). On the other hand, in a cross-section study investigating major depression among 1,747 Chinese Americans, acculturation was not associated with depression, but high acculturation exacerbated impact of negative life events on depression (Hwang & Myers, 2007). Studies evaluating the association between acculturation and depression among KAs exhibited mixed findings. For example, a study with 591 KAs reported that acculturation did not have a direct impact on depression (Ayers et al., 2009). However, Jang and Chiriboga (2009) investigated the association between acculturation and psychological problems in 472 KA elders. The study demonstrated that lower levels of acculturation with American culture were significantly associated with higher levels of depressive symptom. Oh and colleagues (2002) reported that specific domains of acculturation were directly related to depression. That is, lower acculturation in terms of Korean identity, traditions, and values was associated with higher risk for depression.

Acculturation may contribute to the development of chronic disease such as T2DM through unhealthy behaviors such as physical inactivity and unhealthy diet. Studies on the association between acculturation and diabetes have shown diverse findings. For example, less acculturation was associated with increased risk of diabetes among Mexican Americans and Arab Americans (Hazuda, Haffner, Stern, & Eifler, 1988; Jaber, Brown, Hammad, Zhu, & Herman, 2003), whereas high acculturation was linked to increased risk of diabetes in Japanese Americans (Huang et al., 1996). Moreover, diabetes self-care behaviors were not related to acculturation

in elderly Mexican American and Chinese Americans with T2DM. (Fisher et al., 2004; Wen, Shepherd, & Parchman, 2003). One study evaluated the impact of acculturation on glycemic control in Asian Indian adults with T2DM living in the USA, using the Suinn-Lew Asian Self-Identity Acculturation (SL-ASIA) questionnaire. In this study with a small sample size ($n=30$), higher acculturation levels were associated with lower A1C levels. Income, BMI, and diabetes duration operated as moderators of the impact of acculturation on A1C (Venkatesh, Weatherspoon, Kaplowitz, & Song, 2013). However, a cross-sectional study of 66 Mexican Americans with T2DM reported that there was no association between acculturation levels and A1C levels (Ross, Franks, Hall, Young, & Cardarelli, 2011). The findings of studies on acculturation are somewhat complex and inconsistent. Reasons for these variations in the study results can be differences in measurement of acculturation and depression, and in populations sampled.

No study has investigated the association between acculturation and glycemic control in KAs with diabetes. However, a few studies have demonstrated the effectiveness of a culturally tailored diabetes self-management intervention for KAs with T2DM in achieving glycemic control, improving diabetes self-management behaviors, and improving quality of life (Choi & Rush 2012; Kim et al., 2009; Song et al., 2010). The culturally tailored intervention focused on physiological and psychobehavioral outcomes, employing the native language and integrating cultural nutrition and cultural beliefs. After a six-week intervention, the intervention group revealed significantly increased diabetes-specific nutrition knowledge (Song et al., 2010). One study with a two-week intervention demonstrated significantly reduced A1C and decreased waist circumference at post intervention and at 3 month follow-up

(Choi & Rush 2012). A randomized controlled trial with two parallel arms (intervention and control groups) demonstrated a significant decrease in mean A1C levels, reduction in fasting glucose levels, and improvement of psychosocial outcomes in the intervention group. The A1C levels were reduced by 1.19 percent at 18 weeks follow-up and 1.31 percent at 30 weeks follow-up (Kim et al., 2009). These intervention studies addressed the importance of culture in diabetes self-management education for better diabetes outcomes and quality of life in minority populations, such as KAs. Therefore, acculturation may have a positive or negative influence on diabetes self-care management, which in turn contributes to diabetes outcome such as glycemic control.

Although no studies have examined the association among depression, acculturation, and T2DM, it is believed that acculturation may contribute to diabetes management in T2DM and mental health problems such as depression, based on evidence on the effect of acculturation on depression and diabetes management. Given the evidence that depression may precede poor glycemic control, it is reasonable to hypothesize that acculturation would moderate the association between depression and glycemic control in KAs with T2DM.

Summary

A large body of evidence on the association between depression and T2DM supports that depression in people with T2DM is related to poor glycemic control due to poor adherence to diabetes management. Also, sleep duration and quality have been shown to be associated with glycemic control in T2DM. Depression is associated with sleep such that people with depression have sleep problems, such as insomnia and insufficient sleep, through common mechanisms. Evidence provides that acculturation

is linked to depression and poor glycemic control in T2DM. Given that most of KAs are first generation immigrants, acculturation should be considered in investigating the relation between depression and glycemic control in T2DM. Despite the high prevalence of depression in KAs with T2DM, little is known about depression and glycemic control in this population. No study has examined the association between acculturation and glycemic control in this population.

CHAPTER III

METHODS

This chapter focuses on the methods of the current study and it is divided into six sections: the research design, the setting and sample, the protection of human subjects, the measures, the research procedures, and the data analysis.

Research Design

A cross-sectional, descriptive correlational study with a community-based approach was conducted to examine the relationships among depressive symptoms, sleep quality and duration, acculturation, and glycemic control in Korean Americans (KAs) with type 2 diabetes mellitus (T2DM).

Setting and Sample

Korean Americans ages 18 years or older with T2DM were recruited from the metropolitan area of Arizona. A sample of 119 subjects completed the process of this study. In this study, KAs were defined as people who were born in Korea and have lived in the United States for at least 1 year. The subjects had to be able to read, speak, and write in either Korean or English as all questionnaires and the consent form were administered in Korean or English. Only adults diagnosed with T2DM were recruited because characteristics, treatment, and management of T2DM, depression, and sleep problems differ in adults and children, (American Diabetes Association [ADA], 2014). In addition to these inclusion criteria, only KA adults who were willing to participate in this study and signed the written consent form were included. Adults with type 1 diabetes, pregnant women, and children under 18 years of age were excluded from this study.

To estimate the required sample size for the correlational and regression

analyses and goodness of fit tests, G*Power 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007) was used. A moderate correlation between the independent variables of sleep quality and duration, risk of depression, acculturation and the outcome variable of A1C of an effect size of $r = .30$ and power of .80 was considered meaningful. The minimum sample size for a moderate correlation between variables was 84 subjects. The sample of 119 provided approximately 92 percent power at alpha level $p = 0.05$. For the regression analyses to assume a moderate effect size of $R^2 = 0.15$, alpha of 0.05, and power of 0.80, the sample size of 119 subjects provided about 85 percent power to detect a moderate effect of eight predictors and approximately 79 percent power to detect a moderate effect of eleven predictors. For the goodness of fit tests with a moderate effect size of 0.3, alpha of .05, and power of .80, the required sample sizes were 143 subjects with degrees of freedom of 5. Therefore, this study used a little bit larger effect size than a moderate effect to prevent the risk of a type 2 error. As a result, the sample of 119 subjects showed slightly more than 85 percent power with an effect size of 0.35, alpha of .05, power of .80, and degrees of freedom of 5.

Protection of Human Subjects

Subjects were recruited after Institutional Review Board (IRB) approval at Arizona State University. The researcher explained the study purpose, procedures, duration of participation, risks, benefits, and subjects' right to confidentiality and withdrawal from the study without reprisal. Subjects were ensured voluntary participation and can withdraw from the study at any time. Written informed consent in English and Korean (subject's preferred language) was obtained from all participants after all study details have been fully explained. The researcher answered all questions about the study and ensured understanding of the protocol before the

participants sign the consent forms. The signed consent forms were kept in a locked drawer of a locked faculty office. Only research staff dedicated to this study had access to the signed consent forms. All subject data were labeled with identification numbers assigned to each participant. Physical data were secured in a locked file cabinet in a faculty office and all electronic data were stored on password protected computers. Only study personnel with data entry and access responsibilities were privy to these passwords. All computers associated with the project were regularly scanned for viral activity and all data were backed-up daily. A master list of the subject name's and contact information associated with each non-identifiable participant ID was stored in a faculty office in a locked cabinet and only accessible to the IRB-approved study team. The master list was destroyed once all data from the final sample were entered, cleaned, and verified for its accuracy.

Measures

This study used six instruments: a demographic questionnaire, the Suinn-Lew Asian Self-Identity Acculturation scale (SL-ASIA), the Center for Epidemiological Studies Depression Scale (CES-D), the Pittsburgh Sleep Quality Index (PSQI), the International Physical Activity Questionnaire (IPAQ), and Berlin Questionnaire (BQ). In addition, physiological measurement was conducted by the researcher. Table 1 summarizes the measurements and variables of this study.

Psychological Factor

Depression. The Center for Epidemiological Studies Depression Scale (CES-D-) was measured to assess psychological functioning and depressive symptoms including mood, somatic symptoms, and interpersonal relationships during the last week (Radloff, 1977). The CES-D consists of 20 items using a four-point Likert scale.

Table 1

Variables and Measures

Concepts	Variables	Scale	Items
Psychological Factor	Depressive symptoms	Center for Epidemiological Studies Depression (CES-D)	20
Sleep Factors	Sleep quality	Pittsburgh Sleep Quality Index (PSQI)	19
	Sleep duration		
Sociocultural Factor	Acculturation	Suinn-Lew Asian Self-Identity Acculturation (SL-ASIA)	21
Physiological Outcome	Glycemic control	A1C	
Control Factors	Body mass index (BMI)	Weight (kg) / Squared height (m ²)	
	Physical activity	International Physical Activity Questionnaire (IPAQ)	27
	Gender	Male or Female	
	Duration of diabetes	In years	
	Obstructive sleep apnea (OSA)	Berlin Questionnaire (BQ)	11

The scale ranges from 0, as rarely or none of the time (less than 1 day), to 3, as most or all of the time (5 to 7 days). The total score ranges from 0 to 60 with higher scores indicating greater depressive symptoms. The cutoff point for high depressive symptoms is 16 or over. The Cronbach's alpha of the CES-D-K was 0.89 (Noh, Kaspar, & Chen, 1998). In this study, internal consistency was Cronbach's alpha .81.

Sleep Factors

Sleep quality and duration. The Pittsburgh Sleep Quality Index (PSQI) evaluated sleep quality and sleep duration during the previous month. The self-report

questionnaire consists of 19 items which are categorized into seven elements including sleep duration, sleep quality, sleep disturbances, sleep latency, daytime dysfunction, habitual sleep efficiency, and use of sleep medications. Each question is scored from 0 to 3, and the total score of the PSQI ranges from 0 to 21. A global PSQI score greater than 5 had a sensitivity of 98.7% and specificity of 84.4% in distinguishing subjects with poor sleep quality from people with good sleep quality (Backhaus, Niemann, Hohagen, Riemann, & Junghanns, 2001). Buysse et al. (1989) suggested that the global PSQI score over 5 indicates clinically meaningful sleep disturbance as poor sleep quality. Sleep duration of less than 6 hours has been proven as short sleep duration for predicting poor glycemic control in people with T2DM and is most widely used as criteria of short sleep duration (Lee, Ng, & Chin, 2016). Therefore, this study used a global PSQI score greater than 5 as poor sleep quality and sleep duration of less than 6 hours as short sleep duration. The Korean version of the PSQI has good internal consistency (Cronbach's α .84) and test-retest reliability ($r = .65$) (Sohn, Kim, Lee, & Cho, 2012). In this study, the internal consistency of the PSQI was Cronbach's α .69.

Sociocultural Factor

Acculturation. The Suinn-Lew Asian Self-Identity Acculturation scale (SL-ASIA) assessed acculturation (Suinn, Rickard-Figueroa, Lew, & Vigil, 1987; Suinn, Ahuna, & Khoo, 1992). The SL-ASIA was developed from the Acculturation Rating Scale for Mexican Americans (ARSMA) (Cuellar, Harris, & Jasso, 1980). The SL_ASIA is widely used for Asian Americans including Koreans, Chinese, and Japanese. The self-reported questionnaire consists of 21 items that focus on language (four items), identity (four items), friendship (four items), behaviors (five items),

generational/geographic background (three items), and attitudes (one item). The final score for the 21-item questionnaire is calculated by dividing the total score by 21 and the total score ranges from one (i.e., low acculturation and high Asian identity) to five (i.e, high acculturation and high Western identity). The SL-ASIA has an internal consistency of .75 to .91 with established concurrent and construct validity (Suinn et al., 1992; Suinn, Khoo, & Ahuna, 1995). In the present study, this scale showed good internal consistency of Cronbach's alpha .77.

Physiological Outcome

Glycemic control. Glycosylated hemoglobin (A1C) was measured using a finger stick glucose test of whole blood by the A1C Now (Metrika, Inc., Sunnyvale, CA) to assess glycemic control. It provides a measure of an individual's average glucose control over the past three months. A1C has been widely used as the standard biomarker for the adequacy of glycemic management. The testing equipment has reported good correlation coefficient ($r = 0.72$ and 0.96) with the standardized high pressure liquid chromatography method (Klonoff et al., 2006; St John, Davis, Goodall, Townsend, & Price, 2006). Poor glycemic control was defined as A1C values of 7 % or more as recommended by guidelines from the American Diabetes Association to reduce microvascular complications of diabetes (ADA, 2014).

In this study, a registered nurse researcher conducted the A1C test, using the A1C Now testing machine. No fasting was required before the A1C test. Capillary whole blood was obtained by finger-pricking techniques with lancet device. The A1C Now testing machine and test strips were kept at an appropriate temperature range according to the recommendation from the supplier. A small cooler with ice packs was used to keep room temperature. Lids of bottles containing test strips were tightly

closed in order to avoid exposure from moisture. Whenever testing A1C, the researcher checked the conditions of the machine and test strips and used test strips that had not expired or been damaged. Safe disposal boxes were used to contain the used lancets, blood strips, and alcohol swabs. The filled bottles were sealed with heavy duty tape, labeled as used sharps, and were disposed at a hazardous waste at a community health center of ASU Health Services. Universal precautions were used by the researcher obtaining the specimen. This consisted of wearing gloves and using alcohol hand cleanser before and after testing.

Control Factors

Body Mass Index (BMI). Height was measured with a portable studio wall mounted meter, and weight was measured with a portable electronic scale. Height and weight were measured twice and averaged. Body mass index (BMI) was calculated by measuring participant's height and weight. The unit of measure for BMI is kilograms per meter squared (kg/m^2).

Physical activity. The International Physical Activity Questionnaire (IPAQ) assessed the habitual level of physical activity during the past week (Booth et al., 2003; Hagströmer, Oja, & Sjöström, 2006). The IPAQ was developed in 12 countries in the late 1990s and established as a valid and reliable instrument for assessing physical activity and inactivity among adults aged 18 to 65 years. The self-administrated IPAQ consists of 27 items. The IPQA assesses how much time was spent in the past seven days engaging in job-related physical activity (seven items), physical activity related to transportation (six items), housework, house maintenance, caring for family (six items) recreation, sport, and leisure time physical activity (six items), and time spent sitting (two items). The total physical activity was calculated

by multiplying the duration (minutes), frequency (days) and the intensity and then summing three domains including walking of 3.0, moderate activities of 4.0, and vigorous activities of 8.0. The total physical activity was expressed as minutes per week. The three categories of physical activity (PA) include low physical activity (PA < 600 min/week), moderate physical activity (600 < PA < 3,000 min/week), and high physical activity (PA > 3,000 min/week). The sitting time was expressed by combining sitting times on weekdays and weekend days in minutes per week (International Physical Activity Questionnaire, 2005). In this study, the total physical activity and sitting time were expressed as hours per week.

Obstructive Sleep Apnea (OSA). The Berlin Questionnaire (BQ) was measured to identify high risk of obstructive sleep apnea (OSA). The BQ includes three categories to assess snoring (five items), wake-time sleepiness and tiredness (four items), and hypertension and obesity (two items). Two or more categories with positive scores are stratified as high risk of OSA. Participants at high risk of OSA were controlled when analyzing the data of this study. This questionnaire is a widely used, simple, and validated instrument in identifying the risk of OSA. The BQ has demonstrated the Cronbach's α correlations of .86 to .96 with sensitivity of 86 percent, specificity of 77 to 95 percent (Netzer, Stoohs, Netzer, Clark, & Strohl, 1999; Sharma et al., 2006). The Korean version of the BQ was shown an adequate to good internal consistency (Cronbach's α correlations of .64 to .78) and test-retest reliability ($r = .85$) (Kang et al, 2013). Cronbach's alpha for this study was .67.

Demographic Factors

Sociodemographic characteristics (i.e., age, gender, length in the U.S., education, employment, occupation, annual household income, marital status, and

number of people in house), health-related characteristics (i.e., drinking, smoking, health insurance, menopausal status for women, and flu vaccination), diabetes-related characteristics (i.e., duration of diabetes, diabetes medication and other medications, presence of hypoglycemia, family history of diabetes, gestational diabetes history of women, diabetes education, frequency of clinic visit, and type and number of comorbid conditions) were assessed using a self-reported questionnaire. Also, waist circumference was measured in centimeters by using a non-stretching measurement tape in a horizontal plane around bare abdomen at tip of hip bone. Blood pressure (BP) was measured in the dominant arm twice with two minutes rest between measures in a sitting position using an aneroid sphygmomanometer with the proper sized cuff. The participants were asked not to speak and move and kept the arm at the level of the heart during the blood pressure measurement (Umana, Ahmed, Fraley, & Alpert, 2006).

Procedures

After receiving IRB approval at Arizona State University, the researcher visited thirty six Korean communities which are located in eleven cities of Arizona including Chandler, Mesa, Glendale, Gilbert Scottsdale, Sun City, Sierra Vista, Peoria, Phoenix, Tempe, and Tucson in order to obtain their permission to collect data from the study participants in their community sites. The Korean community sites include twenty five Korean churches, two temples, two Korean Catholic churches, five community education centers for elderly, and two Korean grocery stores. With their agreements, the flyer for recruitment of this study was posted in thirty Korean community sites. The posted flyers included benefits of participating in this study and the phone number of the researcher so that people could call to find out more about

the study. Fifteen Korean churches announced researcher's visit date and brief information about this study in their weekly church bulletins before the researcher visit Korean churches and contact the potential participants. Over the phone and through face to face meetings, the researcher provided brief information about the study and reviewed the eligibility criteria with the potential subject. If the potential subject met all criteria of the study and agreed to participate in the study, the researcher provided the purpose and procedures in detail. The subject and researcher arranged a convenient date and time for obtaining informed consent and collecting data. The study employed snowball sampling by asking the participants to introduce other Koreans to the researcher.

A convenient sample of 121 Korean American adults with T2DM was recruited from Korean communities from July through November 2016. Two individuals refused participation in the study because of uncompleted questionnaires and not enough time to answer the survey. A total of 119 participants completed the questionnaires and physiological measurements. All of the participants used Korean version of questionnaires. The places for data collection were Korean churches, participants' homes, and participants' workplaces according to participants' preference. Equipment and supplies used in collecting data were all portable. The study purpose, procedures, and potential benefits and risks in more detail with the informed consent form were explained to subjects. After signing written informed consent, participants completed a package of all self-reported questionnaires including demographic information, PSQI, CES-D, SL-ASIA, IPAQ, and BQ in Korean or in English in a quiet room. The completed questionnaires were reviewed and any noted incomplete items were queried and completed if the participant agreed to respond.

This process for data collection took an average of 40 minutes. Upon completing the questionnaires, the researcher measured the participants' height, weight, waist circumference, blood pressure, and A1C level through a finger stick blood. This portion of data collection took approximately 20 minutes on average.

Data Analysis

Prior to data analysis, double data entry and comparison were conducted for accuracy of data entry. Missing values and outliers were checked to enhance the quality of the data. Descriptive statistics were conducted to describe levels of glycemic control, severity of depression, poor sleep quality, sleep duration of less than 6 hours, levels of acculturation, and demographic characteristics (Aim 1). Normal distribution of the continuous variables was assessed by checking mean, mode, median, standard deviations, skewness, kurtosis, and outliers. Categorical variables were computed using frequencies and percentages. Cronbach's alpha was computed to test the internal consistency of each of the questionnaires.

Bivariate correlations were conducted to examine the associations between all study variables. Based on the results of Pearson correlations and literature review, gender, BMI, duration of diabetes, and physical activity were used as covariates in multiple regression and a path analysis. Risk of OSA was also included to control for participants at high risk of OSA. A hierarchical multiple regression analysis was performed to examine the association of depression with glycemic control after adjustment for gender, duration of diabetes, BMI, risk of OSA, physical activity, and sleep quality and duration (Aim 2).

Path analyses were conducted to examine mediation of sleep quality and duration separately on the association between depression and glycemic control after

controlling for gender, duration of diabetes, BMI, risk of OSA, and physical activity (Aim 3). To assess the goodness of fit of the model, chi-square statistic, comparative fit index (CFI), goodness-of-fit index (GFI), and root mean square error of approximation (RMSEA) were used (Elavsky & Gold, 2009). The appropriate model fit was considered to be CFI of more than .95, GFI of more than .90, and RMSEA of less than .06 (Elavsky & Gold, 2009; Peters, 2009). Sobel tests were used to assess the statistical significance of the indirect effects of the model.

Effect modification of acculturation on the association between depressive symptoms and glycemic control was performed using multiple regression in unadjusted model and adjusted model after controlling for gender, BMI, duration of diabetes, risk of OSA, and physical activity. Also, multiple regression analyses were conducted to identify moderating roles of the subscales of acculturation on the relationship between depressive symptoms and glycemic control in the unadjusted model and after adjusting for gender, BMI, duration of diabetes, risk of OSA, and physical activity in the adjusted model (Aim 4).

In multiple regression, multicollinearity of independent variables was assessed by variance inflation factors (VIF) and tolerance. A VIF higher than 10 or a tolerance lower than .01 was considered as multicollinearity. Significance was evaluated as a two-tailed test at a significance level of .05. All statistical analyses was performed using the Statistical Package for the Social Sciences 24.0 for Windows (SPSS, Inc., an IBM Company, Chicago, Illinois) and Analysis of Moment Structures 24.0 (AMOS; IBM).

CHAPTER IV

RESULTS

This chapter presents the findings of this study, which includes not only the characteristics of the sample but also the associations of depressive symptoms, sleep, and acculturation on glycemic control. Also, this chapter answers the research aims and hypotheses.

General Characteristics of Participants

A total of 121 Korean Americans (KAs) with type 2 diabetes mellitus (T2DM) who met the inclusion criteria were recruited from Korean American communities in Arizona. Two individuals withdrew from the study because one participant did not complete the questionnaires and return the survey, and the other participant indicated that they did not have enough time to answer the survey. The total sample included 119 participants who completed the self-reported questionnaires and physiological measurements of the study and were included for the data analyses of this study.

Sociodemographic Characteristics

The sociodemographic information of the participants is presented in Table 2. The mean age of the participants was 67 years (*SD* 9.68) with a range from 43 to 85 years. Slightly less than two thirds (63%) of the participants were 65 years or more. Approximately 70% were women and less than half (47.9%) had a college or higher level of education. The mean length of residency in the U.S. was 33.72 years (*SD* 10.45) and 64.7% had lived in the United States for more than 30 years. Slightly over one third (33.6%) of the sample were employed full time or part time, while about two thirds (66.4%) were retired or unemployed. Of those employed, the largest

Table 2

Sociodemographic Characteristics of Participants (N=119)

Variable	Frequency (Percent)	Mean (SD)
Gender		
Male	37 (31.1)	
Female	82 (68.9)	
Age (years)		67.00 (9.68)
Less than 65	44 (37.0)	
65 or more	75 (63.0)	
Length in the U.S. (years)		33.72 (10.45)
Less than 10	3 (2.5)	
11-20	14 (11.8)	
21-30	25 (21.0)	
31-40	45 (37.8)	
41-50	27 (22.7)	
More than 51	5 (4.2)	
Education		
Less than high school	30 (25.2)	
High school	32 (26.9)	
College or more	57 (47.9)	
Employment		
Employed	40 (33.6)	
Unemployed	79 (66.4)	
Occupation		
Business owner	11 (27.5)	
Minister	8 (20.0)	
Professional	5 (12.5)	
Laborer	13 (32.5)	
Manager/official	3 (7.5)	
Annual household income		
Less than \$10,000	10 (8.4)	
\$10,000 - \$24,999	25 (21.0)	
\$25,000 - \$49,999	26 (21.8)	
\$50,000 - \$74,999	22 (18.5)	
\$75,000 - \$99,999	10 (8.4)	
More than \$100,000	26 (21.8)	
Marital status		
Married	84 (70.6)	
Separated/divorced/widowed	32 (26.9)	
Single	3 (2.5)	
Number of people in house		
1 (alone)	25 (21.0)	
2 (with spouse)	70 (58.8)	
3 or more (with family or others)	24 (20.2)	

occupational domain was laborer (32.5%), followed by business owner (27.5%) and minister (20%). Approximately half (48.7%) of the participants reported an annual household income of \$50,000 or higher. Over two thirds (70.6%) of the participants were married and 26.9% were separated, divorced, or widowed. More than half (58.8%) of the participants lived with their spouse, whereas 21.0% lived alone.

Health-related Characteristics

The health status of the study participants is shown in Table 3. The mean body mass index (BMI) was 25.28 kg/m² (*SD* 3.39). Based on the BMI classifications for Asian Americans that the American Diabetes Association (ADA) suggests (ADA, 2016), obese participants (BMI ≥ 25 kg/m²) accounted for approximately half (47.9%), and 24.4% were overweight (23 ≤ BMI < 25 kg/m²). The mean waist circumference was 94.41 cm for men and 89.71 cm for women. The mean for systolic and diastolic blood pressure of the participants was 129.65 mmHg and 82.69 mmHg, respectively. Overall, less than one third (29.4%) had ever smoked tobacco and only four participants (3.4%) were currently smoking. Thirteen participants (10.9%) were currently drinking alcohol, but most (89.1%) were not drinking any alcohol. The majority (97.5%) of the participants had health insurance, while only three participants (2.5%) had no health insurance coverage. Nearly 70% of the participants received a flu vaccination last year, and 87.8% of the women were postmenopausal. High risk for obstructive sleep apnea (OSA) as shown by the Berlin Questionnaire (BQ) was observed in 42.9% of the sample. The mean time spent in physical activity assessed by the International Physical Activity Questionnaire (IPAQ) was 26.45 hours per week (*SD* 25.93), and the mean time spent sitting was 31.14 hours per week (*SD* 14.14). The mean duration of physical activity includes physical activities related to

Table 3

Health-related Characteristics of Participants (N=119)

Variable	Frequency (Percent)	Mean (SD)
Body Mass Index (BMI: kg/m ²)		25.28 (3.39)
<23 kg/m ² (normal)	33 (27.7)	
23 to <25 kg/m ² (overweight)	29 (24.4)	
≥25 kg/m ² (obese)	57 (47.9)	
Waist circumference (cm)		
Male		94.41 (6.26)
Female		89.71 (9.60)
Systolic blood pressure (mmHg)		129.65 (15.21)
Diastolic blood pressure (mmHg)		82.69 (7.72)
Drinking		
Yes	13 (10.9)	
No	106 (89.1)	
Smoking		
Yes	4 (3.4)	
Quit	35 (29.4)	
Never	80 (67.2)	
Health insurance		
No insurance	3 (2.5)	
Private	31 (26.1)	
Medicare	37 (31.1)	
Medicaid	32 (26.9)	
Tricare	11 (9.2)	
Medicare and tricare	5 (4.2)	
Menopause in women		
Yes	72 (87.8)	
No	10 (12.2)	
Flu vaccination		
Yes	83 (69.7)	
No	36 (30.3)	
Obstructive sleep apnea (OSA: BQ)		
Low risk	68 (57.1)	
High risk	51 (42.9)	
Physical activity (IPAQ: hour/week)		
Sitting time		31.14 (14.14)
Total physical activity		26.45 (25.93)
Low physical activity	40 (33.6)	
Moderate physical activity	55 (46.2)	
High physical activity	24 (20.2)	

Note. BQ = Berlin Questionnaire; IPAQ = International Physical Activity Questionnaire.

jobs, transportation, housework, and sports. Approximately a third (33.6%) of the participants participated in no exercise or low physical activity, while 66.4% reported moderate or high levels of physical activity.

Diabetes-related Characteristics

The diabetes-related characteristics of the participants are presented in Table 4. The duration of diabetes ranged from 1 to 42 years with a mean of 9.84 years (*SD* 9.65). Almost three quarters (74.8%) of the participants took oral hypoglycemic agents (OHA), and 16.8% relied solely on a lifestyle therapy such as diet and exercise for glycemic control. Nearly 6% of the participants received insulin treatment, and only three participants (2.5%) used both OHA and insulin. Most (83.2%) reported no hypoglycemia defined as a blood glucose level of less than 70 mg/dl regardless of symptoms of hypoglycemia. Fourteen participants (11.8%) experienced hypoglycemia one time, and six participants (5%) had hypoglycemia two times or more in the last month. Only 34.5% of the participants reported that they had ever received diabetes education. More than half (52.1%) of the sample had a family history of diabetes. Of the women participants, 11% had a history of gestational diabetes mellitus (GDM). The majority (90.8%) of the participants had seen their doctor regularly for diabetes treatment. The participants reported a clinic visit every three or four months (37.8%) and every six months (33.6%) for diabetes management. More than a third (37%) of the sample had two comorbid chronic conditions, and a quarter (25.2%) had three or more comorbid conditions. Seventeen participants (14.3%) had no comorbid conditions. Of the comorbid conditions, heart disease and stroke were reported in 10.9% and 4.2% of the participants respectively. Less than two thirds of the sample reported hypertension (59.7%) and hypercholesterolemia (62.2%), respectively.

Table 4

Diabetes-related Characteristics of Participants (N = 119)

Variable	Frequency (Percent)	Mean (SD)
Duration of diabetes (years)		9.84 (9.65)
Type of diabetes management		
Oral hypoglycemic agents (OHA)	89 (74.8)	
Insulin	7 (5.9)	
OHA and insulin	3 (2.5)	
No medication with lifestyle	20 (16.8)	
Hypoglycemia in the last month		
No	99 (83.2)	
1	14 (11.8)	
2 or more	6 (5.0)	
Diabetes education	41 (34.5)	
Family history of diabetes	62 (52.1)	
History of gestational diabetes in women	9 (11.0)	
Sees physician regularly	108 (90.8)	
Diabetes-related clinic visit		
Every 1 or 2 months	6 (5.0)	
Every 3 or 4 months	45 (37.8)	
Every 6 month	40 (33.6)	
Every 1 year	18 (15.1)	
No visit	10 (8.4)	
Number of comorbid condition		
0	17 (14.3)	
1	28 (23.5)	
2	44 (37.0)	
3 or more	30 (25.2)	
Type of comorbid condition		
Heart disease	13 (10.9)	
Stroke	5 (4.2)	
Hypertension	71 (59.7)	
Hypercholesterolemia	74 (62.2)	
Cancer	4 (3.4)	
Osteoporosis	13 (10.9)	
Arthritis	20 (16.8)	
Thyroid disease	7 (5.9)	
Other medication		
Anti-hypertensive agent	59 (49.6)	
Anti-hyperlipidemic agent	50 (42.0)	
Postmenopausal hormones	5 (6.1)	
Sleep medications	17 (14.3)	
Antidepressant	3 (2.5)	

Approximately half (49.6%) of the participants were taking oral antihypertensive medications, and less than half (42.0%) were taking oral medication for hyperlipidemia. Five women reported that they take postmenopausal hormones. Sleep medications or aids and antidepressants were reported in 14.3% and 2.5% of the sample.

Descriptive Statistics for the Main Study Variables

Descriptive statistics including the mean, standard deviation, range, frequency, and percent for glycemic control, risk of depression, sleep duration and quality, and acculturation are exhibited in Table 5 (Aim 1).

The mean glycosylated hemoglobin (A1C) level of the sample was 7.0 % (*SD* 1.09) with a range from 5.4 to 10.4%. Slightly over 40% showed poor glycemic control ($A1C \geq 7.0\%$), while approximately 60% maintained good glycemic control ($A1C < 7\%$). Of those with the poor glycemic control, eight participants (6.7%) revealed poorer glycemic control ($A1C \geq 9.0\%$). The total scores of depression as measured by the Center for Epidemiological Studies Depression (CES-D) ranged from zero to 37 with a mean of 12.55 (*SD* 8.17). Approximately one third (31.1%) of the sample reported high depressive symptoms ($CES-D \geq 16$), while about 70% reported low depressive symptoms ($CES-D < 16$). The mean sleep duration was 5.85 hours (*SD* 1.41) per night with a range from 3 to 9 hours. Short sleep duration of less than 5 hours was reported in 19.3% of the participants, and long sleep duration of 8 hours or more was observed in 11.8% of the sample. Approximately 30% of the participants reported sleeping between 6 and 6.9 hours per night. The total scores of sleep quality ranged from 1 to 17 with a mean of 7.55 (*SD* 3.67). Almost two thirds (66.4%) of the sample had poor sleep quality (Pittsburgh Sleep Quality Index [PSQI] >

Table 5

Descriptive Statistics for Glycemic control, Depressive Symptoms, Sleep, and Acculturation (N = 119)

Variable	Frequency (Percent)	Mean \pm SD	Actual Range
Glycemic control (%)		7.00 \pm 1.09	5.4-10.4
Good glycemic control (A1C < 7%)	70 (58.8)		
Poor glycemic control (A1C \geq 7%)	49 (41.2)		
Depressive symptoms		12.55 \pm 8.17	0-37
Low (CES-D < 16)	82 (68.9)		
High (CES-D \geq 16)	37 (31.1)		
Sleep characteristics			
Sleep duration (hours)		5.85 \pm 1.41	3-9
< 5	23 (19.3)		
5 to 5.9	27 (22.7)		
6 to 6.9	34 (28.6)		
7 to 7.9	21 (17.6)		
\geq 8	14 (11.8)		
Global sleep quality score		7.55 \pm 3.67	1-17
Good sleep quality (PSQI \leq 5)	40 (33.6)		
Poor sleep quality (PSQI > 5)	79 (66.4)		
Component scores			
Subjective duration		1.32 \pm 1.10	0-3
Sleep disturbance		1.08 \pm 0.46	0-2
Sleep latency		1.27 \pm 1.10	0-3
Daytime dysfunction		1.22 \pm 0.77	0-3
Sleep efficiency		0.97 \pm 1.07	0-3
Overall sleep quality		1.30 \pm 0.74	0-3
Need medication to sleep		0.39 \pm 0.91	0-3
Acculturation: SL-ASIA		2.18 \pm 0.35	1.3-3.0
Language		2.19 \pm 0.62	1.0-4.0
Friendships		1.47 \pm 0.51	1.0-2.8
Behaviors		2.57 \pm 0.58	1.2-4.0
Affinity		3.14 \pm 0.66	1.5-4.5
Self-identity		1.43 \pm 0.39	1.0-2.3

Note. A1C = Glycosylated Hemoglobin; CES-D = Center for Epidemiological Studies Depression Scale; PSQI = Pittsburgh Sleep Quality Index; SL-ASIA = Suinn-Lew Asian Self- Identity Acculturation scale.

5), while only one third (33.6%) reported good sleep quality ($PSQI \leq 5$). With respect to the PSQI component scores, the mean score for sleep disturbance and sleep latency was 1.08 (SD 0.46) and 1.27 (SD 1.10), respectively. The mean score of daytime dysfunction was 1.22 (SD 0.77) and the mean score of sleep efficiency was 0.97 (SD 1.07). The mean of acculturation on the Suinn-Lew Asian Self-Identity Acculturation (SL-ASIA) was 2.18 (SD 0.35), and the total scores of acculturation were below the bicultural level ranging from 1.3 to 3.0. In the subscales of acculturation, the mean scores of friendships and ethnic self-identity indicated low levels of acculturation, which demonstrates high Korean identification (1.47 and 1.43, respectively). The mean score for affinity was 3.14 which reflects a bicultural status.

Correlations between the Major Study Variables

Prior to the multiple regression analyses, the bivariate correlations between main variables including age, gender, BMI, duration of diabetes, risk of OSA, physical activity, acculturation, sleep duration, sleep quality, depressive symptoms, and glycemic control were examined. As shown in Table 6, glycemic control was significantly related to physical activity ($r = -.20, p = .03$), diabetes duration ($r = .20, p = .03$), and gender ($r_{pb} = .21, p = .02$), indicating that poorer glycemic control was correlated with less physical activity and longer duration of diabetes. There were no statistically significant associations of glycemic control with age ($r = .01, p = .94$), sleep quality ($r = -.03, p = .72$), sleep duration ($r = -.03, p = .72$), and acculturation ($r = .11, p = .25$). BMI ($r = .16, p = .08$), risk of OSA ($r = .12, p = .19$), and depressive symptoms ($r = .12, p = .18$) had a small correlation with glycemic control even though the relationships were not significant. Depressive symptoms were significantly positively related to sleep quality ($r = .37, p \leq .001$), indicating that the more

Table 6

Correlations between Study Variables ($N = 119$)

Variable	Age	Gender	BMI	Diabetes duration	OSA risk	Physical activity	Acculturation	Sleep duration	Sleep quality	Depressive symptoms	Glycemic control
Age	1										
Gender	-.06	1									
BMI	-.06	-.03	1								
Diabetes duration	.36***	-.25**	-.14	1							
OSA risk	-.04	-.12	.27**	-.06	1						
Physical activity	-.03	-.07	-.02	-.14	-.04	1					
Acculturation	-.15	-.04	-.06	.05	-.03	-.02	1				
Sleep duration	.03	-.13	-.05	-.01	-.03	-.01	-.12	1			
Sleep quality	.10	.22*	.01	.11	.03	-.16	.07	-.69***	1		
Depressive symptoms	.04	.19*	-.02	.10	.15	-.19*	.06	-.02	.37***	1	
Glycemic control	.01	-.21*	.16	.20*	.12	-.20*	.11	-.03	-.03	.12	1

Note. BMI = Body Mass Index; OSA = Obstructive Sleep Apnea.

Gender is coded 1 = female and 0 = male; OSA risk is coded 1 = high risk and 0 = low risk
 * $p < .05$; ** $p \leq .01$; *** $p \leq .001$

depressive symptoms reported, the poorer sleep quality reported. Also, higher depressive symptoms were related to less physical activity ($r = -.19, p = .04$) and gender ($r_{pb} = .19, p = .04$). There was a strong correlation between sleep quality and sleep duration ($r = -.69, p \leq .001$), showing that participants with shorter sleep duration had poorer sleep quality. Poor sleep quality was significantly related to gender ($r_{pb} = .22, p = .02$), but not to physical activity ($r = -.16, p = .09$).

Acculturation was not correlated with the study main variables. Risk of OSA was significantly related to BMI ($r = .27, p \leq .001$). Diabetes duration had statistically significant correlations with age ($r = .36, p \leq .001$) and gender ($r_{pb} = -.25, p = .007$).

Based on the findings of the Pearson correlations, five variables including gender, BMI, duration of diabetes, risk of OSA, and physical activity were used as covariates for multiple regression and path analyses.

Association between Depressive Symptoms and Glycemic Control

A hierarchical linear multiple regression analysis was performed to test an independent association of depressive symptoms with glycemic control after adjusting for gender, BMI, duration of diabetes, risk of OSA, physical activity, sleep quality, and sleep duration (Aim 2). The results of the regression analysis are listed in Table 7. Step 1 included gender, BMI, duration of diabetes, risk of OSA, and physical activity as covariates, and sleep quality and sleep duration were added in step 2. Depressive symptoms were entered in step 3. The first step including only covariates significantly explained 14% of variance in glycemic control ($R^2 = .14, F(5, 113) = 3.71, p = .004$), indicating that physical activity was significantly negatively associated with glycemic control ($\beta = -.19, p = .03$). The results for step 2 showed that sleep quality and duration did not contribute significantly to the prediction of additional variance in

Table 7

Hierarchical Multiple Regression Analysis for Association of Depressive Symptoms with Glycemic Control (N = 119)

Variable	Step 1			Step 2			Step 3		
	B	SE	β	B	SE	β	B	SE	β
Gender	-0.41	0.21	-0.18	-0.36	0.22	-0.16	-0.43	0.22*	-0.18
BMI	0.05	0.03	0.15	0.05	0.03	0.15	0.05	0.03	0.15
Diabetes duration	0.02	0.01	0.16	0.02	0.01	0.17	0.02	0.01	0.16
OSA risk	0.17	0.20	0.08	0.18	0.20	0.08	0.10	0.20	0.05
Physical activity	-0.01	0.004*	-0.19	-0.01	0.004*	-0.22	-0.01	0.004*	-0.20
Sleep quality				-0.05	0.04	-0.17	-0.09	0.04*	-0.29
Sleep duration				-0.13	0.10	-0.16	-0.19	0.10	-0.25
Depressive symptoms							0.03	0.01*	0.20
Constant	6.43	0.88		7.52	1.18		7.92	1.18	
R^2	0.14**			0.16**			0.19**		
ΔR^2				0.02			0.03*		

Note. BMI = Body Mass Index; OSA = Obstructive Sleep Apnea.

Gender is coded 1 = female and 0 = male; OSA risk is coded 1 = high risk and 0 = low risk.

* $p < .05$; ** $p \leq .01$; *** $p \leq .001$

glycemic control after controlling for covariates ($\Delta R^2 = .02$, $\Delta F(2, 111) = 1.03$, $p = .36$), exhibiting that sleep quality and sleep duration were not related to glycemic control. In step 3, depressive symptoms predicted a small but significant amount of variance in glycemic control after controlling for covariates and sleep quality and duration ($\Delta R^2 = .03$, $\Delta F(1, 110) = 3.98$, $p = .05$). Depressive symptoms were revealed as a significant independent predictor of glycemic control ($\beta = .20$, $p = .05$), indicating that those who had higher depressive symptoms had poorer glycemic control. Sleep quality was significantly negatively associated with glycemic control ($\beta = -.29$, $p = .04$), while sleep duration was not related to glycemic control after adjustment for covariates and depressive symptoms. Physical activity still remained as a significant predictor of glycemic control in step 3 ($\beta = -.20$, $p = .03$). Gender was shown as a significant predictor of glycemic control ($\beta = -.18$, $p = .05$), indicating that men had poorer glycemic control than women, on average.

Mediation of Sleep Quality and Duration

Figure 3 represents path model on mediation of sleep quality and duration of less than 6 hours between depressive symptoms and glycemic control after adjusting for gender, BMI, duration of diabetes, risk of OSA, and physical activity (Aim 3). This path model showed a poor overall fit for the data (chi-square = 95.056, $df = 11$, $p < .001$, root mean square error of approximation [RMSEA] = .254, comparative fit index [CFI] = .399, goodness-of-fit index [GFI] = .880). Depressive symptoms ($\beta = .20$, $p = .04$) and sleep duration of less than 6 hours ($\beta = .21$, $p = .03$) had significant direct effects on glycemic control, while sleep quality ($\beta = -.25$, $p = .07$) did not have a significant direct effect on glycemic control. Depressive symptoms had a significant direct effect on sleep quality ($\beta = .37$, $p = .02$) and did not have a significant direct

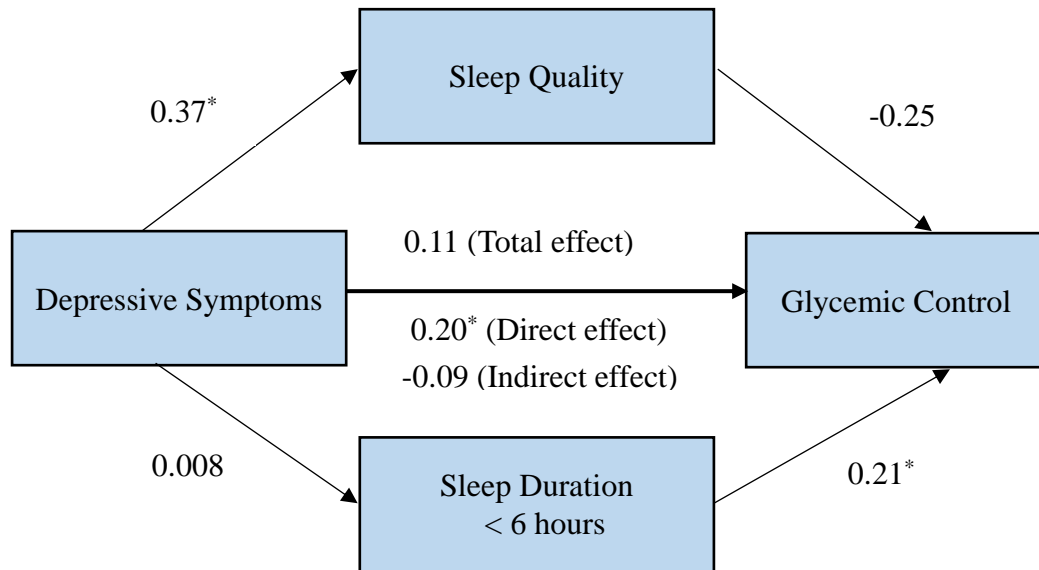


Figure 3. Standardized coefficients for the association between depressive symptoms and glycemic control as mediated by sleep quality and duration of less than 6 hours after adjustment for gender, BMI, duration of diabetes, risk of OSA, and physical activity.

* $p < .05$; ** $p \leq .01$; *** $p \leq .001$

effect on sleep duration of less than 6 hours ($\beta = .008, p = .99$). The standardized indirect effect of depressive symptoms on glycemic control by sleep quality and sleep duration of less than 6 hours was -0.09 ($p = .057$), indicating that the sleep quality and sleep duration of less than 6 hours had insignificant mediation effects between depressive symptoms and glycemic control.

As the goodness of fit of the initial hypothetical model into which both sleep quality and sleep duration of less than 6 hours were imputed did not reach the recommended levels, the paths of the model were modified in consideration of the modification indices. As a result, further path analyses to test each of mediating roles of sleep quality and sleep duration of less than 6 hours were conducted.

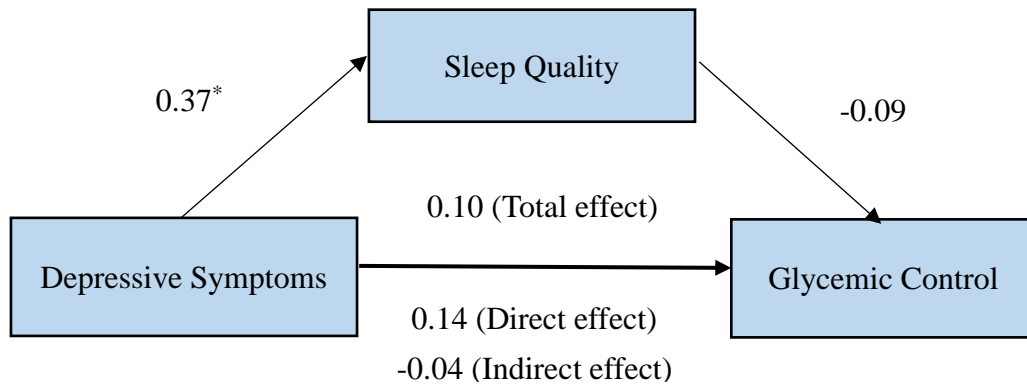


Figure 4. Standardized coefficients for the association between depressive symptoms and glycemic control as mediated by sleep quality after adjustment for gender, BMI, duration of diabetes, risk of OSA, and physical activity.

* $p < .05$

Figure 4 exhibits path model for mediation of sleep quality between depressive symptoms and glycemic control after adjusting for gender, BMI, duration of diabetes, risk of OSA, and physical activity. The path model represented goodness of fit for the data ($\chi^2 = 5.945$, $df = 5$, $p = .312$, root mean square error of approximation [RMSEA] = .04, comparative fit index [CFI] = .983, goodness-of-fit index [GFI] = .988). Depressive symptoms ($\beta = .14$, $p = .11$) and sleep quality ($\beta = -.09$, $p = .42$) did not have significant direct effects on glycemic control, while depressive symptoms ($\beta = .37$, $p = .02$) had a significant direct effect on sleep quality. Sleep quality had an insignificant mediation effect between depressive symptoms and glycemic control ($\beta = -.04$, $p = .30$).

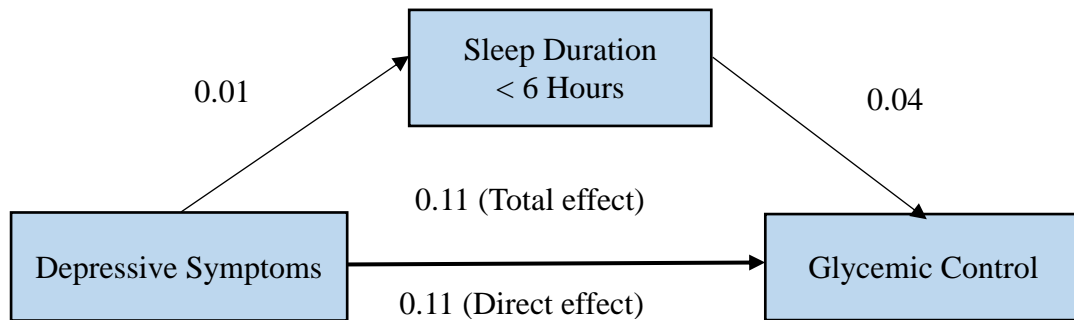


Figure 5. Standardized coefficients for the association between depressive symptoms and glycemic control as mediated by sleep duration of less than 6 hours after adjustment for gender, BMI, duration of diabetes, risk of OSA, and physical activity.

Figure 5 shows a path analysis for mediation of sleep duration of less than 6 hours between depressive symptoms and glycemic control after adjusting for gender, BMI, duration of diabetes, risk of OSA, and physical activity. This mediational model fits the data ($\chi^2 = 6.068$, $df = 5$, $p = .30$, root mean square error of approximation [RMSEA] = .043, comparative fit index [CFI] = .972, goodness-of-fit index [GFI] = .988). The value of the chi-square was non-significant and the RMSEA, CFI, and GFI values indicated good model-data fit. Depressive symptoms ($\beta = .11$, $p = .11$) and sleep duration of less than 6 hours ($\beta = .04$, $p = .42$) were revealed insignificant direct effects on glycemic control. High depressive symptoms ($\beta = .01$, $p = .99$) did not have significant direct effect on sleep duration of less than 6 hours. High depressive symptoms had no indirect effect on glycemic control by sleep duration of less than 6 hours.

Moderation of Acculturation

To test moderation of acculturation on relationship between depressive symptoms and glycemic control (Aim 4), multiple regression analyses were performed in unadjusted and adjusted models (Table 8). In the unadjusted model 1, the interaction between depressive symptoms and acculturation were not associated with glycemic control ($\beta = -.02, p = .85$). In the adjusted model 2, the interaction between depressive symptoms and acculturation did not have a significant association with glycemic control after controlling for gender, BMI, duration of diabetes, physical activity, and risk of OSA ($\beta = -.004, p = .99$) even though the model 2 was significant ($R^2 = .16, F(8, 110) = 2.62, p = .01$).

As the moderating role of the total scale of acculturation was not significant in the unadjusted and adjusted models, further multiple regression analyses were performed to assess moderation effects of five subscales (language, friendships, behaviors, affinity, and identity) of acculturation on glycemic control by depressive symptoms (Table 9). In the unadjusted model 1, identity was associated with glycemic control ($\beta = .38, p < .001$), indicating that participants who have higher identity revealed poorer glycemic control. Higher levels of identity reflect higher Western acculturation. Language ($\beta = -.06, p = .66$), friendships ($\beta = .02, p = .88$), behavior ($\beta = -.05, p = .71$), and affinity ($\beta = .07, p = .47$) were not related to glycemic control. The interactions of depressive symptoms and language, friendships, behaviors, affinity, and identity on glycemic control were not significant. In the adjusted model 2, identity still remained significant after controlling for gender, BMI, duration of diabetes, risk of OSA, and physical activity ($\beta = .31, p = .002$). There were no moderating roles of language, friendships, behaviors, affinity, and identity between

Table 8.

Moderation Analysis of Acculturation on Association between Depressive Symptoms and Glycemic Control (N = 119).

Variable	Unadjusted Model 1			Adjusted Model 2		
	B	SE	β	B	SE	β
Depressive symptoms	0.02	0.01	0.12	0.02	0.01	0.10
Acculturation	0.31	0.29	0.10	0.29	0.27	0.09
Depressive symptoms x acculturation	-0.01	0.04	-0.02	-0.00	0.04	-0.004
Constant	7.00	0.10		6.45	0.88**	
R^2	0.03			0.16		

Note. Model 2 was adjusted for gender, BMI, duration of diabetes, physical activity, and risk of OSA. BMI = Body Mass Index; OSA = Obstructive Sleep Apnea.

* $p < .05$; ** $p \leq .01$; *** $p \leq .001$

depressive symptoms and glycemic control after adjustment for covariates.

Table 9.

Moderation Analysis of Subscales of Acculturation on Association between Depressive Symptoms and Glycemic Control (N = 119).

Variable	Unadjusted Model 1			Adjusted Model 2		
	B	SE	β	B	SE	β
Depressive symptoms	0.02	0.01	0.11	0.02	0.02	0.10
Language	-0.10	0.22	-0.06	0.01	0.22	0.01
Friendships	0.03	0.21	0.02	-0.06	0.22	-0.03
Behaviors	-0.09	0.23	-0.05	-0.09	0.23	-0.05
Affinity	0.12	0.16	0.07	0.09	0.16	0.05
Identity	1.06	0.27***	0.38	0.88	0.28**	0.31
Depressive symptoms x Language	0.01	0.03	0.03	0.002	0.03	0.01
Depressive symptoms x Friendships	0.03	0.03	0.13	0.04	0.03	0.15
Depressive symptoms x Behaviors	-0.04	0.03	-0.15	-0.04	0.03	-0.14
Depressive symptoms x Affinity	0.02	0.03	0.11	0.02	0.03	0.11
Depressive symptoms x Identity	0.03	0.03	0.08	0.03	0.03	0.07
Constant	6.99	0.10		7.02	0.89	
R^2	0.18*			0.27**		

Note. Model 2 was adjusted for gender, BMI, duration of diabetes, physical activity, and risk of OSA. BMI = Body Mass Index; OSA = Obstructive Sleep Apnea.

* $p < .05$; ** $p \leq .01$; *** $p \leq .001$

Summary

The first hypothesis that KAs with T2DM would have a high prevalence of poor glycemic control, high depressive symptoms, short sleep duration, poor sleep quality, and low levels of acculturation was supported. More than a third of the participants showed poor glycemic control, high depressive symptoms, and short sleep duration of less than 6 hours. Most notable, approximately two thirds of the participants exhibited poor sleep quality. The second hypothesis that high depressive symptoms would be independently associated with poor glycemic control was supported. Higher depressive symptoms were associated with poorer glycemic control. The third hypothesis that sleep quality and sleep duration of less than 6 hours would mediate the association between depressive symptoms and glycemic control was rejected. The modified models revealed that the mediating role of sleep quality between depressive symptoms and glycemic control was not significant and there was no indirect effect of depressive symptoms on glycemic control by sleep duration of less than 6 hours. The fourth hypothesis that acculturation would moderate the association between depressive symptoms and glycemic control was rejected. The moderating roles of total score and subscales of acculturation between depressive symptoms and glycemic control were not significant.

CHAPTER V

DISCUSSION

The purpose of this study was threefold. The first purpose was to describe the levels of glycemic control, depressive symptoms, sleep quality and duration, and acculturation. The second purpose was to examine an independent association of depressive symptoms with glycemic control. Lastly, the third purpose was to identify mediational roles of sleep quality and duration and a moderation role of acculturation between the depressive symptoms and glycemic control in Korean Americans (KAs) with type 2 diabetes mellitus (T2DM).

Descriptive Characteristics

Glycemic Control

In this study, approximately 42 percent of KAs with T2DM showed poor glycemic control defined by A1C levels of 7 percent or more, which is lower than those reported in previous studies of people with T2DM (Koro, Bowlin, Bourgeois, & Fedder, 2004; Le et al., 2013; Noor et al., 2016; Shorr et al., 2000). The prevalence of poor glycemic control in the current study is lower than that of non-Hispanic whites (47%), non-Hispanic blacks (47%), and Mexican Americans (56%) (Casagrande, Fradkin, Saydah, Rust, & Cowie, 2013). In comparing glycemic control with Choi and Rankin's (2009) finding that more than half (58.7%) of KAs with T2DM had poor glycemic control, in this study fewer KAs with T2DM revealed poor glycemic control.

The lower prevalence of poor glycemic control in the current study than previous studies may be related to age and study year. Most prior studies on diabetic populations using the National Health and Nutrition Examination Surveys (NHANES)

data have reported that younger adults were more likely to have poor glycemic control (Casagrande et al., 2013; Saydah et al., 2007). A previous study using data from the NHANES, collected between 1988 and 2010, reported that the prevalence rate of diabetic people with poor glycemic control significantly decreased over time with increasing age. The reduced rate of poor glycemic control was notably seen in diabetic adults aged 65 to 74 years (Casagrande et al., 2013). The current study's participants had a mean age of 67 years and most were 65 years or older. Therefore, it might be possible to show relatively low prevalence of poor glycemic control in older KAs with T2DM.

Depression

Of all Korean American adults with T2DM in this study, 31.1 percent were found to suffer from clinically significant depressive symptoms as defined by the Center for Epidemiological Studies-Depression (CES-D) scores of 16 or more. The prevalence rate is similar to the proportions found in previous studies of multiethnic people with T2DM (17.2% - 31.6%) using the CES-D (Fisher, Chesla, Mullan, Skaff, & Kanter, 2001; Fisher et al., 2007). It is remarkably higher than the 14.8 percent reported in a recent study of 2,182 US adults with T2DM (Wang, Lopez, Bolge, Zhu, & Stang, 2016) and 9.2 percent reported for the general US adult population (Shim, Baltrus, Ye, & Rust, 2011). However, the prevalence of high depressive symptoms is similar to the 30 percent reported in a previous study for Korean women with T2DM (Park & Kim, 2012) and higher than the 10.8 percent reported in a previous study for KA elderly (Kim et al., 2015).

Higher prevalence of depression has been observed in people with T2DM compared to general populations (Ali et al., 2006; Anderson et al., 2001) and

immigrant populations compared to dominant cultural groups (Fazel, Wheeler, & Danesh, 2005). Korean immigrants have been reported to have higher rates of depression than Caucasian and other Asian immigrant populations (Shin, Han, & Kim, 2007). Considering that participants of this sample were first generation Korean Americans and most of them were women aged 65 years or older may partly explain the high prevalence of clinically significant depressive symptoms in this study compared to that of the US population and other ethnic groups.

Sleep Quality

In this study, approximately two thirds (66.4%) of participants reported poor sleep quality based on global Pittsburgh Sleep Quality Index (PSQI) scores of more than five. Although the prevalence of poor sleep quality varied in previous studies due to different definitions and measures, the finding of this study was higher than findings of previous studies using the same PSQI global criteria of 361 Dutch adults with T2DM (42%) (Nefs et al., 2015) and 194 US adults with T2DM (59.7%) (Reutrakul et al., 2013).

Poor sleep quality has been reported to be particularly prevalent among women after menopause (Kravitz et al., 2003). A meta-analysis of 29 studies indicated that women are more likely to suffer from poor sleep quality than men (Zhang & Wing, 2006). In the current study, as a majority (87.8%) of women participants were postmenopausal, it is possible that the prevalence of poor sleep quality in KAs with T2DM was somewhat higher than other populations with T2DM partly because of menopausal status.

Sleep Duration

This study found that 42% of the sample reported short sleep duration of less

than 6 hours in Korean American adults with T2DM. In previous studies on subjective sleep duration among people with T2DM, Nefs et al. (2015) reported that 12 percent of 361 Dutch adults with T2DM had short sleep duration of less than 6 hours. Similar findings identified that 13 percent of 8,543 participants reported short sleep duration of less than 6 hours in a study of Chinese adults with T2DM aged 40 years or older (Zheng et al., 2015).

Previous studies have indicated that ethnic minority groups such as African Americans, Hispanics, and Asian Americans were more likely to report shorter sleep duration than White Americans (Jean-Louis et al., 2015; Kripke et al., 2001). Thus, the remarkably high prevalence rate of short sleep duration of less than 6 hours in the current study of KAs with T2DM may be partly due to demographic characteristics among the participants such as older age, female gender, and immigration status as an ethnic minority population.

Acculturation

The mean scores of acculturation assessed by the Suinn-Lew Asian Self-Identity Acculturation scale (SL-ASIA) in the current study of KAs with T2DM was 2.18, which reflects high Korean identification and a low level of acculturation. This study finding was slightly higher than those reported in previous studies using the SL-ASIA (2.02 – 1.79) of 428 KA women aged 40 years or older (Lee et al., 2014) and 50 Chinese Americans with cancer (Edrington et al., 2009).

Previous studies have identified that acculturation has a significant and positive association with length of residence (Madianos, Gonidakis, Ploubidis, Papadopoulou, & Rogakou, 2008; Zea, Asner-Self, Birman, & Buki, 2003). In this study, the mean length of residence in the United States of Korean Americans was

about 34 years, while that of Chinese Americans in the study by Edrington et al. (2009) was 18 years. Therefore, Korean Americans in the current study may have slightly higher levels of acculturation than Chinese Americans even though the values of acculturation of the studies were in the range that reflects strong Asian identification.

Depression as an Independent Predictor of Poor Glycemic Control

In the current study, there was no significant correlation between depressive symptoms and glycemic control. However, after adjusting for gender, body mass index (BMI), duration of diabetes, risk of obstructive sleep apnea (OSA), physical activity, sleep quality, and sleep duration, the regression model showed high depressive symptoms were a significant and independent predictor of poor glycemic control. That is, higher depressive symptoms were associated with higher levels of A1C in KAs with T2DM. The effect size of depressive symptoms on glycemic control was small but significant.

This finding is consistent with previous cross-sectional studies demonstrating a relationship between depressive symptoms and glycemic control among people with T2DM despite the adjustment of a variety of relevant covariates (Crispín-Trebejo, Robles-Cuadros, & Bernabé-Ortiz, 2015; Zhang et al., 2015). A study of 2,538 Chinese adults with T2DM reported that depression was an independent factor of poor glycemic control after adjusting for age, gender, duration of diabetes, education, current smoking, BMI, use of insulin, sensory neuropathy, and coronary heart disease. (Crispín-Trebejo et al., 2015). A study that recruited 277 people with T2DM in Peru adjusted for age, gender, education, duration of diabetes, current working, place of

birth, hospital status, hospital admissions last years, presence of hypertension, presence of retinopathy, presence of diabetic foot, total cholesterol, and 24 hours proteins in urine. Depression was shown to be independently associated with poor glycemic control (Zhang et al., 2015). Lutman and colleagues (2000) conducted a meta-analysis of 24 studies and confirmed that depression was significantly associated with hyperglycemia in both type 1 diabetes and type 2 diabetes, which is also in line with the study finding.

The current study adjusted for gender, BMI, duration of diabetes, risk of OSA, sleep quality, and sleep duration as covariates because these variables were significantly related to glycemic control or sleep quality and duration. After controlling for these covariates, the regression model revealed a statistically significant and positive relationship between depressive symptoms and glycemic control.

Sleep Quality and Duration as Mediators

In this study, the initial hypothesized model described that the relationship between depressive symptoms and glycemic control would be mediated by sleep quality and sleep duration of less than 6 hours. However, the path model did not meet the recommend levels for the goodness of fit. Therefore, separate path analyses on sleep quality and sleep duration of less than 6 hours respectively were conducted to explore mediation roles between depressive symptoms and glycemic control.

In the alternative models, the mediating test of sleep quality between depressive symptoms and glycemic control was not supported after adjustment for gender, BMI, duration of diabetes, risk of OSA, and physical activity, even though the relationship between depressive symptoms and sleep quality was significant. Sleep

duration of less than 6 hours did not mediate the association between depressive symptoms and glycemic control in KAs with T2DM after controlling for gender, BMI, duration of diabetes, risk of OSA, and physical activity.

Although no studies so far have reported that sleep quality and duration mediate the relationship between depressive symptoms and glycemic control in T2DM, there are previous studies investigating a mediating role of sleep. For example, Seligowski et al. (2013) found that sleep quality was a partially mediating factor between depressive symptoms and diabetes quality of life in people with T2DM. Different symptoms of depression might have different influences on glycemic control. Mediators related to depression and glycemic control in T2DM might be other factors such as diet, physical activity, and medication adherence. Therefore, this hypothesis needs further research to investigate mediatory roles of sleep quality and duration on objective diabetes outcomes.

Acculturation as a Moderator

This study showed that there was no moderation of acculturation between depressive symptoms and glycemic control in KAs with T2DM in both unadjusted and adjusted models. Based on the multidimensional process of acculturation (Unzueta et al., 2004) and each subgroup of acculturation having different impacts on health and health problems (Oh et al., 2002), the moderating tests of subgroups including language, friendships, behaviors, affinity, and identity of acculturation between depressive symptoms and glycemic control were conducted. Subgroups of acculturation did not have moderating roles on the association of depressive symptoms with glycemic control in unadjusted and adjusted models.

No previous studies have investigated the moderating role of acculturation on

the relationship between depressive symptoms and glycemic control. However, previous studies have reported that many immigrants, in particular Asian Americans, suffered from psychological and social health problems related to acculturation (Berry, Kim, Minde, & Mok, 1987; Lee, Brancati, & Yeh, 2011) and that acculturation contributed to depression (Jang & Chiriboga, 2009) and glycemic control (Venkatesh et al., 2013). Based on these findings of previous studies, it was reasonable to hypothesize that acculturation would moderate the association between depressive symptoms and glycemic control in KAs with T2DM. Although the finding of the current study was inconsistent with the hypothesis for moderation of acculturation, there may be several possible reasons for inconsistent results with the hypothesized moderation of acculturation. Different measurements to assess acculturation and small sample sizes used in some studies may contribute to mixed findings in the relationship of acculturation with depression (Ayers et al., 2009; Jang & Chiriboga, 2009) and glycemic control (Ross et al., 2011; Venkatesh et al., 2013). Also, the limited range on the measurement (SL-ASIA) of acculturation can affect the test of moderation between depressive symptoms and glycemic control as most of the participants fell at the lower end of the scale of acculturation.

This is the first study to examine moderation of acculturation on the relationship of depressive symptoms with glycemic control in KAs with T2DM. More studies are needed to confirm or disconfirm a moderating role of acculturation in this relationship.

Limitations

There are several limitations that should be considered in this study. First, it is impossible to draw causal inferences of relationships of depression, sleep quality and

duration, and acculturation with glycemic control because of the cross-sectional design of this study. Longitudinal studies are necessary to confirm directionality of relationships between identified factors and glycemic control. Secondly, the data were collected from Korean community settings in a geographical region of Arizona. Therefore, it might not be appropriate to generalize the results of this study from this sample to Korean Americans who live in other states. Thirdly, demographic information and all questionnaires including depression, sleep quality and duration, and acculturation were self-reported. Therefore, there may be response bias on these data in the analyses of this study. There may exist common method variance that could yield potentially misleading results. Fourthly, there are many other factors that influence glycemic control in T2DM. For example, diabetes self-care behaviors such as diet and medication adherence are very important contributors of glycemic control in T2DM (Ley, Hamdy, Mohan, & Hu, 2014; Mayberry & Osborn, 2012). This may have resulted in the limited amount of variance explained by the selected variables in this study. However, this study did not consider those variables. Future studies should consider these factors. Lastly, path analyses used in this study included several limitations. There are assumptions for path analyses, such as the hypothesized model reflecting the actual causal associations and the causal flows in a one-way path (Petraitis, Dunham, & Niewiarowski, 1996). Due to the current study's design, violation of these assumptions was possible, which undermines the validity of the findings.

Implications for Clinical Practice

The findings of this study suggest the following clinical implications for

optimizing diabetes management and improving quality of life in people with T2DM.

There is a need to boost early screening efforts to detect psychological and sleep problems as the study findings showed increased proportions of high depressive symptoms and poor sleep quality. In addition, half of the participants were showed to have high risk for obstructive sleep apnea. Given that obstructive sleep apnea could directly contribute to depressive symptoms, poor sleep quality, and poor glycemic control, risk for obstructive sleep apnea should also be considered for diabetes management. Without assessment and management of depressive symptoms and sleep characteristics, people with T2DM are not able to not only achieve their glycemic targets but also maintain proper diabetes self-management. Especially, depressive symptoms that are significantly associated with poor sleep quality were revealed to be an independent risk factor of glycemic control in this study. Therefore, consultations and support to reduce high depressive symptoms and treatment for psychological concerns are critical for achievement of good glycemic control and improvement of quality of life in people with T2DM. In addition, the assessment and management of psychological problems should be conducted with early screening of sleep problems in comprehensive diabetes management programs.

In this study, although most of KAs have lived in the U.S. for over 30 years, they still had low identification of American culture, in particular ethnic identity. Also, they had health insurance, but most did not receive diabetes self-management education. Thus, culturally tailored and accessible diabetes self-management intervention programs should be systematically and constantly provided to achieve and maintain good glycemic control in these vulnerable populations. Especially, nurses and health professionals in community settings must provide vulnerable

immigrants with proper knowledge and skills regarding diabetes self-management, considering their cultural differences and individual differences. With culturally tailored diabetes self-management, physical activity-centered diabetes self-management programs should be addressed in elderly people with T2DM as the study showed physical activity as a significant contributor to achieve good glycemic control. Physical activity is well-known to help minimize high depressive symptoms (Rosenbaum, Tiedemann, Sherrington, Curtis, & Ward, 2014), poor sleep quality, and short sleep duration (Reid et al., 2010). Therefore, a comprehensive diabetes self-management intervention that can address and manage the contributors of glycemic control including depression, sleep disturbance, acculturation, and physical activity should be provided for vulnerable immigrant populations with T2DM such as KAs.

Conclusion

This study explored the associations among depressive symptoms as a psychological factor, sleep quality and duration as sleep factors, acculturation as a sociocultural factor, and glycemic control as a physiological outcome in 119 Korean Americans diagnosed type 2 diabetes who live in Arizona.

This study provided important information that KA adults with T2DM had high prevalence of high depressive symptoms, poor sleep quality, short sleep duration of less than 6 hours, and low levels of acculturation. These study findings update and extend knowledge of previous studies on KAs with T2DM

Depressive symptoms were significantly and positively associated with poor glycemic control when gender, BMI, duration of diabetes, risk of obstructive sleep apnea, and physical activity were controlled. On the other hand, there were no mediations of sleep quality and sleep duration of less than 6 hours and moderation of

acculturation between depressive symptoms and glycemic control in KAs with T2DM.

Overall, identified associations among depressive symptoms, sleep quality and duration, acculturation, and glycemic control should inform future research in the area of psychological, sleep, behavioral, and cultural components of glycemic control and methodology used to further investigate significant determinants of glycemic control.

Directions for Future Research

More studies are needed to identify the influences of depressive symptoms, sleep quality and duration, and acculturation on glycemic control over time in T2DM. Longitudinal research should be conducted to verify casual relationships among these variables. Larger sample sizes and diverse ethnic samples are needed to replicate the findings of the current study, potentially providing a greater variety of individual characteristics, statistically solid analyses, and confidence in the generalizability of the findings in other ethnic populations with T2DM.

The lack of mediating roles of sleep quality and duration between depressive symptoms and glycemic control indicates that there may be other mediators such as diet, physical activity, and medication adherence between depressive symptoms and glycemic control. Future studies may consider including these potential mediators. Also, this study used self-reported questionnaires to assess depressive symptoms and sleep quality and duration. Further research needs to use clinical diagnosis to assess depression and objective measurements such as polysomnographic or actigraphic recordings to assess sleep quality and duration because these measurements are more objective than self-reported questionnaires and might provide different results of the

study.

This study assessed only depressive symptoms as a psychological factor affecting glycemic control. Many studies have reported that psychological problems such as anxiety and diabetes distress influence poor glycemic control in T2DM (Asuzu, Walker, Williams, & Egede, 2017; Whitworth et al., 2016) and suggested management of an overall psychological perspective for glycemic control. Future research must consider anxiety and diabetes distress as psychological factors affecting glycemic control.

This study focused on only glycemic control as a diabetes outcome. Sleep quality and sleep duration of less than 6 hours did not mediate in the relationship between depressive symptoms and glycemic control. However, based on previous studies on relationships among depression, sleep quality and duration, and T2DM, future research could include diabetes self-care behaviors and quality of life as diabetes outcomes for comprehensive diabetes management because depression and sleep quality and duration may contribute to diabetes self-care behaviors or quality of life.

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APPENDIX A
IRB APPROVAL

APPROVAL: EXPEDITED REVIEW

Elizabeth Reifsnider
 CONHI - Administration
 602/496-1394
 Elizabeth.Reifsnider@asu.edu

Dear Elizabeth Reifsnider:

On 6/6/2016 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Depression, Sleep, Acculturation, and Glycemic Control in Korean Americans with Type 2 Diabetes.
Investigator:	Elizabeth Reifsnider
IRB ID:	STUDY00004438
Category of review:	(2)(a) Blood samples from healthy, non-pregnant adults, (4) Noninvasive procedures, (7)(a) Behavioral research
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	<ul style="list-style-type: none"> • Response to Modification 1.pdf, Category: Other (to reflect anything not captured above); • Instruments_Korean.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Consent form_Korean.pdf, Category: Consent Form; • Consent form_English.pdf, Category: Consent Form; • EHS112_IBC, Category: Other (to reflect anything not captured above); • Translation_Korean_DQOL_DDS.pdf, Category: Translations; • Revised Recruitment Flyer_Korean.pdf, Category: Recruitment Materials; • Revised Recruitment Flyer_English.pdf, Category: Recruitment Materials; • Response to Modification 3.pdf, Category: Other (to

	<p>reflect anything not captured above);</p> <ul style="list-style-type: none"> • Backtranslation_DQOL_DDS.pdf, Category: Translations; • Physiological Measurement_English.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Response to Modification 2.pdf, Category: Other (to reflect anything not captured above); • Physiological measurement_Korean.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Revised HRP-503b_Bioscience_Mihyun Jeong.pdf, Category: IRB Protocol; • Response to Modification 4.pdf, Category: Other (to reflect anything not captured above); • Revised backtranslation form_Mihyun Jeong.pdf, Category: Translations; • recruitment script_English.pdf, Category: Recruitment Materials; • Recruitment script_Korean.pdf, Category: Recruitment Materials; • Instruments_English.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);
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The IRB approved the protocol from 6/6/2016 to 6/5/2017 inclusive. Three weeks before 6/5/2017 you are to submit a completed Continuing Review application and required attachments to request continuing approval or closure.

If continuing review approval is not granted before the expiration date of 6/5/2017 approval of this protocol expires on that date. When consent is appropriate, you must use final, watermarked versions available under the “Documents” tab in ERA-IRB.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Mihyun Jeong
Michael Belyea
Lesly Kelly
Mihyun Jeong

Elizabeth Reifsnider
Megan Petrov

APPENDIX B
FLYER (ENGLISH/KOREAN)



For Korean Americans with Type 2 Diabetes

Recruitment of Research Participant

Title of research

Depression, Sleep, Acculturation, and Glycemic Control in Korean Americans with Type 2 Diabetes

Purposes of research

The purposes of this study are to examine diabetes-related conditions in Korean Americans with type 2 diabetes mellitus, to investigate the relation between depression and glycemic control, and to identify how sleep behaviors (sleep quality and duration) and acculturation influence the association between depression and glycemic control in this population in Arizona.

Eligibility criteria

1. Adults aged 18 or older
2. With type 2 diabetes mellitus
3. Koreans who were born in Korean and have lived in the United States for at least 1 year

What to do

- ❖ Answer a set of questionnaires about depression, sleep, acculturation, and diabetes-related information
- ❖ Be measured A1C, height, weight, waist circumference, and blood pressure

Benefits

- ❖ A1C, body mass index (BMI), and Blood pressure will be measured.
- ❖ A depression screening test will be provided.
- ❖ Information about Diabetes and diabetes management will be provided.
- ❖ The tests of this study will be conducted at no cost.

How to contact

If you want to take part in this study or you have any questions concerning the research study, please call Mihyun Jeong, the research investigator, at (480)-306-1526 or contact by email (mihyun.jeong@asu.edu).



제2형 당뇨병을 가진 한국분들을 위한

연구 참가자 모집합니다

연구제목: 제2형 당뇨병을 가지고 있는 한국 이민자들에 대한 우울증, 수면, 문화적 적응, 그리고 혈당조절에 관한 연구.

연구목적

제2형 당뇨병을 가진 한국 이민자들의 당뇨 관련 건강상태를 조사하고 혈당조절과 우울과의 연관성을 알아보며 수면과 문화적 적응이 혈당조절과 우울과의 관계에 어떻게 영향을 미치는지를 알아보기 위한 연구입니다.

자격요건

1. 18세 이상의 성인으로써
2. 제2형 당뇨병을 가지고 있고
3. 한국에서 태어났으며 미국에서 1년 이상 살고 계신 한국분

연구내용

- ❖ 우울, 수면, 문화적 적응, 그리고 당뇨 관련 정보에 대한 설문조사
- ❖ 당화혈색소, 키 몸무게, 허리둘레, 혈압을 측정

혜택

- ❖ 3개월 동안의 평균혈당을 나타내는 당화혈색소검사, 비만도, 혈압을 측정해 드립니다.
- ❖ 우울증 검사를 하실 수 있습니다.
- ❖ 당뇨병과 당뇨관리에 대한 정보를 제공해 드립니다.
- ❖ 제공되는 검사들은 무료로 진행됩니다.

문의 및 신청

본 연구에 참여를 원하거나 질문이 있으시면 애리조나 주립대학, 간호대학, 연구조사자 정미현 (전화번호: [480-306-1526](tel:480-306-1526) or mihyun.jeong@asu.edu)에게 연락주시면 자세히 설명해 드리겠습니다.

APPENDIX C
MEASURES (ENGLISH/KOREAN)

Demographic Information (English)

ID# _____

Date _____

1. Date of birth: _____/_____ (month/year)

2. Gender: _____ Male / _____ Female

3. How many years have you been in the United States? _____ Years

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

_____ No education

_____ Elementary School

_____ Middle School

_____ High School

_____ College (less than 4years)

_____ University (4years)

_____ Graduate School

5. Marital status:

_____ married, living with spouse

_____ married, separated

_____ single, living alone

_____ single, living with someone

_____ single, recently widowed (2 years)

6. What is your job/occupation? _____

7. Including yourself, how many people live in your home? _____

8. What is the total annual income of your household?

_____ Less than \$4,999

_____ \$5,000 through \$9,999

_____ \$10,000 through \$24,999

_____ \$25,000 through \$49,999

_____ \$50,000 through \$74,999

_____ \$75,000 through \$99,999

_____ \$100,000 and greater

9. How many alcoholic drinks do you consume on average per week?

_____ I don't drink alcohol

_____ 1- 2 per week

- _____ 3 – 5 per week _____ 6 or more per week
10. What kind of health insurance do you have?
 Yes ___ () / No ___
11. How much do you spend for health insurance?
 Yourself: \$ _____ / month
 You and your family \$ _____ / month
12. How long have you had type 2 diabetes? _____ years
13. How often do you see a physician for your diabetes?
 _____ Every 1-2 months _____ Every 3-4 months
 _____ Every 6 or more months _____ Other
 _____ No
14. How often do you see a physician for other health care concerns?
 _____ Every 1-2 months _____ Every 3-4 months
 _____ Every 6 or more months _____ Other
 _____ No
15. Have you ever received diabetes self-management education? Yes ___ / No ___
16. Do you attend any diabetes support groups? Yes ___ / No ___
17. What type of diabetic medication do you take?
 _____ No _____ pill(s) _____ insulin _____ both pills and insulin
18. Do you take sleeping pill(s)? Yes ___ / No ___
19. Do you take antidepressants? Yes ___ / No ___
20. Do you take any other medications? (If yes, please list)

21. Do you have any of diabetes complications? (Check all that apply)
 _____ diabetic retinopathy _____ diabetic nephropathy
 _____ diabetic neuropathy _____ amputation

22. In the last month, how often have you had a blood sugar less than 70?

never once two or more (times/week)

23. Do you have any of these health problems? (Check all that apply)

Heart disease

Cancer

Stroke

High blood pressure

High cholesterol

Osteoporosis

Arthritis

Others (please list): _____

24. How many days did you have breakfast on average per week?

Never

1-2 days

3-4 days

5-6 days

Everyday

25. Have any of the members of your immediate family been diagnosed with diabetes
(please check all that apply)?

No

Father

Mother

Sibling

Children

If you are a woman, answer this question

26. Do you have menopause? Yes ___ / No__

27. Do you take hormone? Yes ___ / No__

Pittsburgh Sleep Quality Index (English)

ID# _____

Date _____

INSTRUCTIONS:

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

1. During the past month, what time have you usually gone to bed at night?

BED TIME _____

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

NUMBER OF MINUTES _____

3. During the past month, what time have you usually gotten up in the morning?

GETTING UP TIME _____

4. During the past month, how many hours of actual sleep did you get at night?
(This may be different than the number of hours you spent in bed.)

HOURS OF SLEEP PER NIGHT _____

For each of the remaining questions, check the one best response.

Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you . . .

- a) Cannot get to sleep within 30 minutes

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

- b) Wake up in the middle of the night or early morning

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

- c) Have to get up to use the bathroom

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

d) Cannot breathe comfortably

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

e) Cough or snore loudly

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

f) Feel too cold

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

g) Feel too hot

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

h) Had bad dreams

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

i) Have pain

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

j) Other reason(s), please describe_____

How often during the past month have you had trouble sleeping because of this?

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

6. During the past month, how would you rate your sleep quality overall?

Very good _____	Fairly good _____
Fairly bad _____	Very bad _____

7. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

No problem at all _____
Only a very slight problem _____
Somewhat of a problem _____
A very big problem _____

10. Do you have a bed partner or room mate?

No bed partner or room mate _____
Partner/room mate in other room _____
Partner in same room, but not same bed _____
Partner in same bed _____

If you have a room mate or bed partner, ask him/her how often in the past month you have had . . .

a) Loud snoring

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

b) Long pauses between breaths while asleep

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

c) Legs twitching or jerking while you sleep

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

d) Episodes of disorientation or confusion during sleep

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

e) Other restlessness while you sleep; please describe_____

Not during past month_____	the Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-------------------------------	-----------------------------------	------------------------------	------------------------------------

Berline Questionnaire (English)

ID# _____

Date _____

Please choose the correct response to each question.

CATEGORY 1

1. Do you snore?

- a. Yes
- b. No
- c. Don't know

If you snore:

2. Your snoring is:

- Slightly louder than breathing
- As loud as talking
- Louder than talking
- Very loud – can be heard in adjacent rooms

3. How often do you snore?

- Nearly every day
- 3-4 times a week
- 1-2 times a week
- 1-2 times a month
- Never or nearly never

4. Has your snoring ever bothered other people?

- Yes
- No
- Don't Know

5. Has anyone noticed that you quit breathing during your sleep?

- Nearly every day
- 3-4 times a week
- 1-2 times a week
- 1-2 times a month
- Never or nearly never

CATEGORY 2

6. How often do you feel tired or fatigued after your sleep?

- Nearly every day
- 3-4 times a week
- 1-2 times a week
- 1-2 times a month
- Never or nearly never

7. During your waking time, do you feel tired, fatigued or not up to par?

- Nearly every day
- 3-4 times a week
- 1-2 times a week
- 1-2 times a month
- Never or nearly never

8. Have you ever nodded off or fallen asleep while driving a vehicle?

- Yes
- No

If yes:

9. How often does this occur?

- Nearly every day
- 3-4 times a week
- 1-2 times a week
- 1-2 times a month
- Never or nearly never

CATEGORY 3

10. Do you have high blood pressure?

- Yes
- No
- Don't know

Suinn-Lew Asian Self-Identity Acculturation (English)

ID# _____

Date _____

INSTRUCTIONS: The questions which follow are for the purpose of collecting information about your historical background as well as more recent behaviors which may be related to your cultural identity. Choose the one answer which best describes you.

1. What language can you speak?

1. Asian only (for example, Chinese, Japanese, Korean, Vietnamese, etc.)
2. Mostly Asian, some English
3. Asian and English about equally well (bilingual)
4. Mostly English, some Asian
5. Only English

2. What language do you prefer?

1. Asian only (for example, Chinese, Japanese, Korean, Vietnamese, etc.)
2. Mostly Asian, some English
3. Asian and English about equally well (bilingual)
4. Mostly English, some Asian
5. Only English

3. How do you identify yourself?

1. Oriental
2. Asian
3. Asian-American
4. Chinese-American, Japanese-American, Korean-American, etc.
5. American

4. Which identification does (did) your mother use?

1. Oriental
2. Asian
3. Asian-American
4. Chinese-American, Japanese-American, Korean-American, etc.
5. American

5. Which identification does (did) your father use?

1. Oriental
 2. Asian
 3. Asian-American
 4. Chinese-American, Japanese-American, Korean-American, etc.
 5. American
6. What was the ethnic origin of the friends and peers you had, as a child up to age 6?
1. Almost exclusively Asians, Asian-Americans, Orientals
 2. Mostly Asians, Asian-Americans, Orientals
 3. About equally Asian groups and Anglo groups
 4. Mostly Anglos, Blacks, Hispanics, or other non-Asian ethnic groups
 5. Almost exclusively Anglos, Blacks, Hispanics, or other non-Asian ethnic groups
7. What was the ethnic origin of the friends and peers you had, as a child from 6 to 18?
1. Almost exclusively Asians, Asian-Americans, Orientals
 2. Mostly Asians, Asian-Americans, Orientals
 3. About equally Asian groups and Anglo groups
 4. Mostly Anglos, Blacks, Hispanics, or other non-Asian ethnic groups
 5. Almost exclusively Anglos, Blacks, Hispanics, or other non-Asian ethnic groups
8. Whom do you now associate with in the community?
1. Almost exclusively Asians, Asian-Americans, Orientals
 2. Mostly Asians, Asian-Americans, Orientals
 3. About equally Asian groups and Anglo groups
 4. Mostly Anglos, Blacks, Hispanics, or other non-Asian ethnic groups
 5. Almost exclusively Anglos, Blacks, Hispanics, or other non-Asian ethnic groups
9. If you could pick, whom would you prefer to associate with in the community?
1. Almost exclusively Asians, Asian-Americans, Orientals
 2. Mostly Asians, Asian-Americans, Orientals
 3. About equally Asian groups and Anglo groups
 4. Mostly Anglos, Blacks, Hispanics, or other non-Asian ethnic groups
 5. Almost exclusively Anglos, Blacks, Hispanics, or other non-Asian ethnic groups
10. What is your music preference?
1. Only Asian music (for example, Chinese, Japanese, Korean, Vietnamese, etc.)
 2. Mostly Asian

3. Equally Asian and English
4. Mostly English
5. English only

11. What is your movie preference?

1. Asian-language movies only
2. Asian-language movies mostly
3. Equally Asian/English English-language movies
4. Mostly English-language movies only
5. English-language movies only

12. What generation are you? (circle the generation that best applies to you:)

1. 1st Generation = I was born in Asia or country other than U.S.
2. 2nd Generation = I was born in U.S., either parent was born in Asia or country other than U.S.
3. 3rd Generation = I was born in U.S., both parents were born in U.S., and all grandparents born in Asia or country other than U.S.
4. 4th Generation = I was born in U.S., both parents were born in U.S., and at least one grandparent born in Asia or country other than U.S. and one grandparent born in U.S.
5. 5th Generation = I was born in U.S., both parents were born in U.S., and all grandparents also born in U.S.
6. Don't know what generation best fits since I lack some information.

13. Where were you raised?

1. In Asia only
2. Mostly in Asia, some in U.S.
3. Equally in Asia and U.S.
4. Mostly in U.S., some in Asia
5. In U.S. only

14. What contact have you had with Asia?

1. Raised one year or more in Asia
2. Lived for less than one year in Asia
3. Occasional visits to Asia
4. Occasional communications (letters, phone calls, etc.) with people in Asia
5. No exposure or communications with people in Asia

15. What is your food preference at home?

1. Exclusively Asian food
2. Mostly Asian food, some American
3. About equally Asian and American
4. Mostly American food
5. Exclusively American food

16. What is your food preference in restaurants?

1. Exclusively Asian food
2. Mostly Asian food, some American
3. About equally Asian and American
4. Mostly American food
5. Exclusively American food

17. Do you

1. Read only an Asian language?
2. Read an Asian language better than English?
3. Read both Asian and English equally well?
4. Read English better than an Asian language?
5. Read only English?

18. Do you

1. Write only an Asian language?
2. Write an Asian language better than English?
3. Write both Asian and English equally well?
4. Write English better than an Asian language?
5. Write only English?

19. If you consider yourself a member of the Asian group (Oriental, Asian, Asian-American, Chinese-American, etc., whatever term you prefer), how much pride do you have in this group?

1. Extremely proud
2. Moderately proud
3. Little pride
4. No pride but do not feel negative toward group
5. No pride but do feel negative toward group

20. How would you rate yourself?

1. Very Asian
2. Mostly Asian
3. Bicultural
4. Mostly Westernized
5. Very Westernized

21. Do you participate in Asian occasions, holidays, traditions, etc.?

1. Nearly all
2. Most of them
3. Some of them
4. A few of them
5. None at all

22. Rate yourself on how much you believe in Asian values
(e.g., about marriage, families, education, work):

- | | | | | |
|------------------|---|---|---|------------------------------------|
| 1 | 2 | 3 | 4 | 5 |
| (do not believe) | | | | (strongly believe in Asian values) |

23. Rate your self on how much you believe in American (Western) values:

- | | | | | |
|------------------|---|---|---|------------------------------------|
| 1 | 2 | 3 | 4 | 5 |
| (do not believe) | | | | (strongly believe in Asian values) |

24. Rate yourself on how well you fit when with other Asians of the same ethnicity:

- | | | | | |
|--------------|---|---|---|-----------------|
| 1 | 2 | 3 | 4 | 5 |
| (do not fit) | | | | (fit very well) |

25. Rate yourself on how well you fit when with other Americans who are non-Asian (Westerners):

- | | | | | |
|--------------|---|---|---|-----------------|
| 1 | 2 | 3 | 4 | 5 |
| (do not fit) | | | | (fit very well) |

26. There are many different ways in which people think of themselves. Which ONE of the following most closely describes how you view yourself?

1. I consider myself basically an Asian person (e.g., Chinese, Japanese, Korean, Vietnamese, etc.). Even though I live and work in America, I still view myself basically as an Asian person.

2. I consider myself basically as an American. Even though I have an Asian background and characteristics, I still view myself basically as an American.
3. I consider myself as an Asian-American, although deep down I always know I am an Asian.
4. I consider myself as an Asian-American, although deep down, I view myself as an American first.
6. I consider myself as an Asian-American. I have both Asian and American characteristics, and I view myself as a blend of both.

International Physical Activity Questionnaire (English)

ID# _____
Date _____

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you 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 think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous and moderate 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. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

PART 1: JOB-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3.

1. Do you currently have a job or do any unpaid work outside your home?

Yes

No



Skip to PART 2: TRANSPORTATION

The next questions are about all the physical activity you did in the last 7 days as part of your paid or unpaid work. This does not include traveling to and from work.

2. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, heavy construction, or climbing up stairs as part of your work? Think about only those physical activities that you did for at least 10 minutes at a time.

_____ days per week

No vigorous job-related physical activity



Skip to question 4

3. How much time did you usually spend on one of those days doing vigorous physical activities as part of your work?

_____ hours per day

_____ minutes per day

4. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads as part of your work? Please do not include walking.

_____ days per week

No moderate job-related physical activity → *Skip to question 6*

5. How much time did you usually spend on one of those days doing moderate physical activities as part of your work?

_____ hours per day
_____ minutes per day

6. During the last 7 days, on how many days did you walk for at least 10 minutes at a time as part of your work? Please do not count any walking you did to travel to or from work.

_____ days per week

No job-related walking → *Skip to PART 2: TRANSPORTATION*

7. How much time did you usually spend on one of those days walking as part of your work?

_____ hours per day
_____ minutes per day

PART 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you traveled from place to place, including to places like work, stores, movies, and so on.

8. During the last 7 days, on how many days did you travel in a motor vehicle like a train, bus, car, or tram?

_____ days per week

No traveling in a motor vehicle → *Skip to question 10*

9. How much time did you usually spend on one of those days traveling in a train, bus, car, tram, or other kind of motor vehicle?

_____ hours per day
_____ minutes per day

Now think only about the bicycling and walking you might have done to travel to and from work, to do errands, or to go from place to place.

10. During the last 7 days, on how many days did you bicycle for at least 10 minutes at a time to go from place to place?

_____ days per week

No bicycling from place to place → *Skip to question 12*

11. How much time did you usually spend on one of those days to bicycle from place to place?

_____ hours per day
_____ minutes per day

12. During the last 7 days, on how many days did you walk for at least 10 minutes at a time to go from place to place?

_____ days per week

No walking from place to place → *Skip to PART 3:
HOUSEWORK, HOUSE
MAINTENANCE, AND
CARING FOR FAMILY*

13. How much time did you usually spend on one of those days walking from place to place?

_____ hours per day
_____ minutes per day

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the last 7 days in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

14. Think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, chopping wood, shoveling snow, or digging in the garden or yard?

_____ days per week

No vigorous activity in garden or yard → *Skip to question 16*

15. How much time did you usually spend on one of those days doing vigorous physical activities in the garden or yard?

_____ hours per day
_____ minutes per day

16. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do moderate activities like carrying light loads, sweeping, washing windows, and raking in the garden or yard?

_____ days per week

No moderate activity in garden or yard → *Skip to question 18*

17. How much time did you usually spend on one of those days doing moderate physical activities in the garden or yard?

_____ hours per day
_____ minutes per day

18. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do moderate activities like carrying light loads, washing windows, scrubbing floors and sweeping inside your home?

_____ days per week

No moderate activity inside home → *Skip to PART 4:
RECREATION, SPORT
AND LEISURE-TIME
PHYSICAL ACTIVITY*

19. How much time did you usually spend on one of those days doing moderate physical activities inside your home?

_____ hours per day
_____ minutes per day

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the last 7 days solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

20. Not counting any walking you have already mentioned, during the last 7 days, on how many days did you walk for at least 10 minutes at a time in your leisure time?

_____ days per week

No walking in leisure time → *Skip to question 22*

21. How much time did you usually spend on one of those days walking in your leisure time?

_____ hours per day
_____ minutes per day

22. Think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do vigorous physical activities like aerobics, running, fast bicycling, or fast swimming in your leisure time?

_____ days per week

No vigorous activity in leisure time → *Skip to question 24*

23. How much time did you usually spend on one of those days doing vigorous physical activities in your leisure time?

_____ hours per day
_____ minutes per day

24. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do moderate physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis in your leisure time?

_____ days per week

No moderate activity in leisure time → *Skip to PART 5: TIME SPENT SITTING*

25. How much time did you usually spend on one of those days doing moderate physical activities in your leisure time?

_____ hours per day
_____ minutes per day

PART 5: TIME SPENT SITTING

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

26. During the last 7 days, how much time did you usually spend sitting on a weekday?

_____ hours per day
_____ minutes per day

27. During the last 7 days, how much time did you usually spend sitting on a weekend day?

_____ hours per day
_____ minutes per day

Center for Epidemiologic Studies Depression (English)

ID# _____

Date _____

Below is a list of some of the ways you may have felt or behaved. Please indicate how often you've felt this way during the **past week**. Respond to all items.

	Place a check mark in the appropriate column. During the past week-----...	Rarely or none of the time (less than 1 day)	Some or a little of the time (1 – 2 days)	Occasionally or a moderate amount of the time (3 – 4 days)	Most or all of the time (5 – 7 days)
1.	I was bothered by things that usually don't bother me.				
2.	I did not feel like eating; my appetite was poor.				
3.	I felt that I could not shake off the blues, even with the help from family or friends.				
4.	I felt that I was just as good as other people.				
5.	I had trouble keeping my mind on what I was doing.				
6.	I felt depressed.				
7.	I felt that everything I did was an effort.				
8.	I felt hopeful about the future.				
9.	I thought my life had been a failure.				
10.	I felt fearful.				
11.	My sleep was restless.				
12.	I was happy.				
13.	I talked less than usual.				
14.	I felt lonely.				
15.	People were unfriendly.				
16.	I enjoyed life.				
17.	I had crying spells.				
18.	I felt sad.				
19.	I felt that people dislike me.				
20.	I could not get "going".				

Demographic Information (Korean)

ID# _____

Date _____

1. 생년월일: _____/_____/____ (달/년)

2. 성별: _____ 남자 _____ 여자

3. 몇 년간 미국에 사셨습니까? _____ 년

4. 학력이 어떻게 되십니까?

_____ 교육을 받은 적이 없다

_____ 초등학교

_____ 중학교

_____ 고등학교

_____ 전문대학

_____ 4년제 대학

_____ 대학원

5. 결혼상태는 어떻게 되십니까?

_____ 결혼을 했고 배우자와 함께 살고 있다

_____ 결혼 했었지만 지금은 따로 살거나, 별거 중이거나, 이혼을 한 상태이다

_____ 미혼이고 혼자 살고 있다

_____ 미혼이고 친척이나 룸메이트와 함께 살고 있다

_____ 결혼했었지만 사별한지 2년 이하이다

6. 직장은 무엇입니까? _____

7. 본인을 포함해서 몇 명과 함께 살고 있습니까? _____ 명

8. 가계의 총 일년 수입이 어떻게 되십니까? (가족들의 수입총합)

\$4,999 이하 \$5,000 ~ \$9,999
 \$10,000 ~ \$24,999 \$25,000 ~ \$49,999
 \$50,000 ~ \$74,999 \$75,000 ~ \$99,999
 \$100,000 이상

9. 평균 일주일에 술을 얼마나 드십니까?

전혀 마시지 않는다 1-2 일
 3-5일 6일 이상

10. 어떤 건강보험을 가지고 있습니까?

예 (종류: _____) / 아니오

직장의료보험 개인의료보험
 Medicare Medicaid Tricare

10-2. 주치의 한국인 미국인 기타 (적어주십시오)

11. 건강보험료는 얼마를 내고 있습니까?

본인: \$ _____/month

본인과 가족포함: \$ _____/month

12. 당뇨병은 얼마나 되셨습니까? _____ 년

13. 당뇨병 치료를 위해 얼마나 자주 의사를 만나십니까?

1~2 달마다 3~4달마다
 6개월 혹은 그 이상마다 기타
 전혀 만나지 않는다

14. 다른 건강관리를 위해 얼마나 자주 의사를 만나십니까?

_____ 1~2 달마다 _____ 3~4달마다

_____ 6개월 혹은 그 이상마다 _____ 기타

_____ 전혀 만나지 않는다

15. 당뇨교육을 받으신 적이 있습니까? 예_____ / 아니오_____

16. 당뇨지원그룹에 참석합니까? 예_____ / 아니오_____

17. 어떤 당뇨약을 드십니까?

_____ 먹지 않는다 _____ 경구혈당강하제만

_____ 인슐린 _____ 경구혈당강하제와 인슐린 병합요법

18. 수면제를 드십니까? 예_____ / 아니오_____

19. 항우울제를 드십니까? 예_____ / 아니오_____

20. 다른 약들을 드시고 있다면 적어주십시오.

21. 당뇨 합병증이 있습니까? (모두 체크하십시오)

_____ 당뇨성 망막증 _____ 당뇨성 신장증

_____ 당뇨성 신경병증 _____ 절단 (다리 혹은 발가락)

22. 지난달에 얼마나 자주 혈당이 70 이하로 떨어졌습니까?

_____ 전혀 _____ 한번

_____ 2번 이상 (_____ 번/주)

23. 다음의 질환들을 가지고 있으십니까? 모두 체크하십시오.

_____ 심장질환 _____ 암
_____ 뇌졸중 _____ 고혈압
_____ 고콜레스테롤 _____ 골다공증
_____ 관절염

기타(적어주십시오):

24. 평균 일주일에 아침식사를 며칠 드십니까?

_____ 전혀 먹지 않는다 _____ 1~2일
_____ 3~4일 _____ 5-6일
_____ 매일

25. 직계가족 중에 당뇨병이 있으신 분을 모두 체크하십시오.

_____ 없다
_____ 아버지 _____ 어머니
_____ 형제/자매 _____ 자식

여성분들만 대답하십시오.

26. 폐경하셨습니까? _____ 예 _____ 아니오

27. 호르몬제를 복용하십니까? _____ 예 _____ 아니오

Pittsburgh Sleep Quality Index (Korean)

ID# _____

Date _____

지시문:

다음은 지난 한 달간(30일) 당신의 일상적인 수면 습관에 관한 질문들입니다. 응답을 할 때는 지난 한달 간 낮이나 밤의 대부분 시간에 당신이 어떠했는지를 정확하게 말씀해주셔야 합니다. 모든 질문에 빠짐없이 응답해주시기 바랍니다.

1. 지난 한 달간, 당신은 보통 몇 시에 잠자리에 들었습니까?

잠자리에 든 시간 _____

2. 지난 한 달간, 당신은 매일 밤에 잠이 드는데 보통 몇 분이 걸렸습니까?

_____ 분

3. 지난 한 달간, 당신은 보통 아침 몇 시에 일어 났습니까?

일어난 시간 _____

4. 지난 한 달간, 당신은 밤에 실질적으로 몇 시간이나 잠을 잤습니까?

(이것은 당신이 잠자리에 누워 있던 시간과 다를 수 있습니다.)

하루 밤에 잠자는 시간 _____

다음 각 문항에서 가장 적합한 응답을 하나만 고르십시오. 모든 질문에 빠짐없이 응답해주시기 바랍니다.

5. 지난 한 달간, 당신은 얼마나 자주 다음과 같은 이유로 잠을 자는데 어려움이 있었습니까?

가) 30분 이내에 잠을 들 수 없었다.

지난 달에는 일주일에 _____ 일주일에 _____ 일주일에 _____
없었다 _____ 한번 이하 _____ 한 두 번 _____ 세 번 이상 _____

나) 한밤중이나 아침 일찍 잠이 깼다.

지난 달에는 일주일에 _____ 일주일에 _____ 일주일에 _____
없었다 _____ 한번 이하 _____ 한 두 번 _____ 세 번 이상 _____

다) 화장실에 가기 위해서 일어나야 했다.

지난 달에는 일주일에 일주일에 일주일에
없었다_____ 한번 이하_____ 한 두 번_____ 세 번 이상_____

라) 편안하게 숨을 쉴 수가 없었다.

지난 달에는 일주일에 일주일에 일주일에
없었다_____ 한번 이하_____ 한 두 번_____ 세 번 이상_____

마) 심하게 기침을 하거나 코를 골았다.

지난 달에는 일주일에 일주일에 일주일에
없었다_____ 한번 이하_____ 한 두 번_____ 세 번 이상_____

바) 너무 춥다고 느꼈다.

지난 달에는 일주일에 일주일에 일주일에
없었다_____ 한번 이하_____ 한 두 번_____ 세 번 이상_____

사) 너무 덥다고 느꼈다.

지난 달에는 일주일에 일주일에 일주일에
없었다_____ 한번 이하_____ 한 두 번_____ 세 번 이상_____

자) 나쁜 꿈을 꾸었다.

지난 달에는 일주일에 일주일에 일주일에
없었다_____ 한번 이하_____ 한 두 번_____ 세 번 이상_____

차) 통증이 있었다.

지난 달에는 일주일에 일주일에 일주일에
없었다_____ 한번 이하_____ 한 두 번_____ 세 번 이상_____

카) 기타 다른 이유(들)이 있으면 직접 기입해 주십시오

지난 한 달간, 당신은 얼마나 자주 위에 기입한 이유들 때문에 잠을 자지 못했습니까?

지난 달에는 일주일에 일주일에 일주일에
없었다_____ 한번 이하_____ 한 두 번_____ 세 번 이상_____

6. 지난 한 달간, 당신의 수면상태를 전반적으로 어떻게 평가하겠습니까?

매우 좋다 _____

좋은 편이다 _____

나쁜 편이다 _____

매우 나쁘다 _____

7. 지난 한 달간, 잠을 자기 위해서 얼마나 자주 약을 복용하였습니까?

(처방 된 것이거나, 처방전이 필요하지 않은 것 모두 포함)

지난 달에는 일주일에 _____ 일주일에 _____ 일주일에 _____

없었다 _____ 한번 이하 _____ 한 두 번 _____ 세 번 이상 _____

8. 지난 한 달간, 당신은 운전, 식사, 혹은 사회활동을 하는 동안에 얼마나 자주 졸음을 느꼈습니까?

지난 달에는 일주일에 _____ 일주일에 _____ 일주일에 _____

없었다 _____ 한번 이하 _____ 한 두 번 _____ 세 번 이상 _____

9. 지난 한 달간, 당신은 매사 처리에 끝까지 의욕을 유지하는데 얼마나 많은 문제가 있었습니까?

전혀 문제가 되지 않았다 _____

아주 약간 문제가 되었다 _____

어느 정도 문제가 되었다 _____

매우 크게 문제되었다 _____

10. 당신은 다른 사람과 같은 잠자리에 자거나 집을 같이 쓰는 사람이 있습니까?

같은 잠자리에 자거나 집을 같이 쓰는 사람이 없다 _____

집에 다른 방을 쓰는 사람이 있다 _____

방을 같이 쓰지만 같은 잠자리에서 자지 않는다 _____

같은 잠자리에서 자는 사람이 있다 _____

만일 같은 방을 쓰거나 같은 잠자리에서 자는 사람이 있다면, 그 사람에게 지난 한 달간, 당신이 다음과 같은 행동을 얼마나 자주 했는지 물어보십시오.

a) 심하게 코골기

지난 달에는 일주일에 _____ 일주일에 _____ 일주일에 _____

없었다 _____ 한번 이하 _____ 한 두 번 _____ 세 번 이상 _____

b) 잠잘 때 숨을 한동안 멈추고 다시 숨쉬기

지난 달에는 일주일에 일주일에 일주일에
없었다_____ 한번 이하_____ 한 두 번_____ 세 번 이상_____

c) 잠잘 때 다리를 갑자기 떨거나 흔들기

지난 달에는 일주일에 일주일에 일주일에
없었다_____ 한번 이하_____ 한 두 번_____ 세 번 이상_____

d) 잠자다가 잠시 시간, 장소, 상황을 인식하지 못하거나 혼란스러워함

지난 달에는 일주일에 일주일에 일주일에
없었다_____ 한번 이하_____ 한 두 번_____ 세 번 이상_____

e) 잠자는 동안 다른 뒤척거리는 행동들이 있었으면 직접 기입해 주십시오

지난 달에는 일주일에 일주일에 일주일에
없었다_____ 한번 이하_____ 한 두 번_____ 세 번 이상_____

Berline Questionnaire (Korean)

ID# _____

Date _____

1. 최근 5년간 체중에 변화가 있습니까?

- 늘었다
- 줄었다
- 그대로이다

2. 귀하는 잠을 잘때 코를 곱니까?

- 예
- 아니오
- 모르겠다

만약 귀하가 코를 곤다면:

3. 코 고는 소리가 얼마나 큼니까?

- 숨소리 보다 약간 크다
- 대화하는 소리 크기이다
- 대화하는 소리보다 크다
- 옆방에서 들릴 정도로 매우 크다

4. 얼마나 자주 코를 곱니까?

- 거의 매일
- 일주일에 서너번
- 일주일에 한두번
- 한달에 한두번
- 없거나 거의 없다

5. 코를 고는 것이 주위 사람을 성가시게 한 적이 있습니까?

- 예
- 아니오

6. 잠자는 동안, 주변 사람들로 부터 얼마나 자주 숨이 멎춘다고 들었습니까?

- 거의 매일
- 일주일에 서너번
- 일주일에 한두번
- 한달에 한두번
- 없거나 거의 없다

7. 잠을 자고 일어난 후, 얼마나 자주 피곤함을 느끼십니까?

- 거의 매일
- 일주일에 서너번
- 일주일에 한두번
- 한달에 한두번
- 없거나 거의 없다

8. 깨어있는 동안 얼마나 자주 피곤함을 느끼십니까?

- 거의 매일
- 일주일에 서너번
- 일주일에 한두번
- 한달에 한두번
- 없거나 거의 없다

9. 차를 운전할때 좋음 운전을 한 적이 있습니까?

- 예
- 아니오

있다면 얼마나 자주 있습니까?

- 거의 매일
- 일주일에 서너번
- 일주일에 한두번
- 한달에 한두번
- 없거나 거의 없다

10. 고혈압이 있습니까?

- 예
- 아니오
- 모르겠다

Suinn-Lew Asian Self-Identity Acculturation (Korean)

ID# _____

Date _____

아래의 질문들은 당신의 문화적 정체성과 관련될지도 모르는 당신의 역사적 배경과 최근의 행동들에 대한 정보에 관한 것들입니다. 가장 적합하다고 생각되는 하나를 골라 주십시오. 귀하를 가장 잘 설명하는 하나를 고르시기 바랍니다.

1. 귀하께서는 어떤 언어를 사용하십니까?
 1. 한국어만 사용
 2. 주로 한국어를 사용하고, 약간의 영어 사용
 3. 한국어와 영어 모두 능통
 4. 주로 영어를 사용하고 약간의 한국어 사용
 5. 영어만 사용

2. 귀하께서는 어떤 언어를 더 선호하십니까?
 1. 한국어만 사용
 2. 주로 한국어를 사용하고, 약간의 영어 사용
 3. 한국어와 영어 모두 능통
 4. 주로 영어를 사용하고 약간의 한국어 사용
 5. 영어만 사용

3. 귀하의 정체성에 대해서 어떻게 설명하시겠습니까?
 1. 동양인 (Oriental)
 2. 아시아인 (Asian)
 3. 아시아계 미국인 (Asian American)
 4. 한국계 미국인 (Korean American)
 5. 미국인 (American)

4. 귀하 어머니의 정체성에 대해서 어떻게 설명하시겠습니까?

1. 동양인 (Oriental)
 2. 아시아인 (Asian)
 3. 아시아계 미국인 (Asian American)
 4. 한국계 미국인 (Korean American)
 5. 미국인 (American)
5. 귀하 아버지의 정체성에 대해서 어떻게 설명하시겠습니까?
1. 동양인 (Oriental)
 2. 아시아인 (Asian)
 3. 아시아계 미국인 (Asian American)
 4. 한국계 미국인 (Korean American)
 5. 미국인 (American)
6. 귀하는 6살까지 어떤 친구들과 어울리셨습니까?
1. 거의 대부분 아시아인, 아시아계 미국인, 동양인만
 2. 대부분 아시아인, 아시아계 미국인, 동양인
 3. 대강 비슷하게 아시아인들과 백인들
 4. 대부분이 백인들, 흑인들, 멕시코사람들 또는 다른 비 아시아계 사람들
 5. 대부분 백인들, 흑인들, 멕시코사람들 또는 다른 비 아시아계 사람들만
7. 귀하는 6살에서 18살까지 어떤 친구들과 어울리셨습니까?
1. 거의 대부분 아시아인, 아시아계 미국인, 동양인만
 2. 대부분 아시아인, 아시아계 미국인, 동양인
 3. 대강 비슷하게 아시아인들과 백인들
 4. 대부분이 백인들, 흑인들, 멕시코사람들 또는 다른 비 아시아계 사람들
 5. 대부분 백인들, 흑인들, 멕시코사람들 또는 다른 비 아시아계 사람들만
8. 귀하는 현재 거주지역에서 어떤 분들과 교류하십니까?
1. 거의 대부분 아시아인, 아시아계 미국인, 동양인만
 2. 대부분 아시아인, 아시아계 미국인, 동양인
 3. 대강 비슷하게 아시아인들과 백인들

4. 대부분이 백인들, 흑인들, 멕시코사람들 또는 다른 비 아시아계 사람들
 5. 대부분 백인들, 흑인들, 멕시코사람들 또는 다른 비 아시아계 사람들만
9. 귀하는, 만약 선택하신다면, 거주지역의 어떤 분들과 교류하기를 원하십니까?
1. 거의 대부분 아시아인, 아시아계 미국인, 동양인만
 2. 대부분 아시아인, 아시아계 미국인, 동양인
 3. 대강 비슷하게 아시아인들과 백인들
 4. 대부분이 백인들, 흑인들, 멕시코사람들 또는 다른 비 아시아계 사람들
 5. 대부분 백인들, 흑인들, 멕시코사람들 또는 다른 비 아시아계 사람들만
10. 어떤 음악을 선호하십니까?
1. 오직 한국음악만
 2. 거의 한국음악
 3. 한국음악과 미국음악 비슷한 수준으로
 4. 거의 미국음악
 5. 오직 미국음악만
11. 어떤 영화를 선호하십니까?
1. 오직 한국어로 된 영화만
 2. 거의 대부분 한국어로 된 영화
 3. 한국어와 영어로 된 영화 두 가지 비슷하게
 4. 거의 대부분 영어로 된 영화
 5. 오직 영어로 된 영화만
12. 귀하는 어떤 세대입니까? (가장 적합한 것을 하나만 고르세요.)
1. 1세대: 본인이 한국 혹은 미국이 아닌 다른 나라에서 출생
 2. 2세대: 본인은 미국에서 출생, 부모님 두 분 중 한 분이 한국 혹은 미국이 아닌 다른 나라에서 출생
 3. 3세대: 본인은 미국에서 출생, 부모님 두 분 모두 미국에서 출생, 조부님 모두한국 혹은 미국이 아닌 다른 나라에서 출생

4. 4세대: 본인은 미국에서 출생, 부모님 두 분 모두 미국에서 출생, 조부님 두 분 중 한 분은 미국에서 다른 한 분은 한국 혹은 미국이 아닌 다른 나라에서 출생

5. 5세대: 본인, 부모님, 그리고 조부님 모두 미국에서 출생

13. 귀하는 어디에서 성장하셨습니다까?

1. 한국에서만
2. 대부분은 한국에서, 그리고 미국에서 조금
3. 한국과 미국에서 반반씩
4. 대부분은 미국에서, 그리고 한국에서는 조금
5. 미국에서만

14. 한국과의 관계를 어떻게 설명하시겠습니까?

1. 1년 혹은 그 이상 한국에서 자랐다
2. 한국에서 1년 미만 살았다
3. 가끔 방문한다
4. 가끔 편지나 전화로 한국에 있는 사람들과 교류한다
5. 한국에 있는 사람들과는 교류가 전혀 없다

15. 귀하가 집에서 선호하는 음식은?

1. 오직 한국 음식만
2. 대부분 한국 음식, 가끔 미국 음식
3. 한국 음식과 미국 음식 비슷하게
4. 거의 미국 음식
5. 오직 미국 음식만

16. 귀하가 식당에서 선호하는 음식은?

1. 오직 한국 음식만
2. 대부분 한국 음식, 가끔 미국 음식
3. 한국 음식과 미국 음식 비슷하게
4. 거의 미국 음식

5. 오직 미국 음식만

17. 귀하는

1. 한국어만 읽을 수 있다
2. 영어보다는 한국어를 더 잘 읽는다
3. 영어와 한국어를 똑같이 잘 읽는다
4. 한국어보다 영어를 더 잘 읽는다
5. 영어만 읽을 수 있다

18. 귀하는

1. 한국어만 쓸 수 있다
2. 영어보다는 한국어를 더 잘 쓸 수 있다
3. 영어와 한국어를 똑같이 잘 쓸 수 있다
4. 한국어보다 영어를 더 잘 쓸 수 있다
5. 영어만 쓸 수 있다

19. 귀하는 미국에 거주하는 한국인으로서 어느 정도의 자부심을 갖습니까?

1. 매우 자랑스럽다
2. 그럭저럭 자랑스럽다
3. 거의 자랑스럽지 않다
4. 자랑스럽지 않지만 한국인에 대해 부정적인 느낌은 없다
5. 자랑스럽지 않고 한국인에 대한 부정적인 느낌이 있다.

20. 본인을 어떻게 평가하겠습니까?

1. 매우 한국적이다
2. 거의 한국적이다
3. 한국적이면서도 동시에 미국화 되어있다
4. 거의 미국화 되어있다
5. 매우 미국화 되어있다

21. 귀하는 한국 공휴일이나 경축일을 지키십니까?

1. 거의 모두
2. 대부분
3. 어느 정도
4. 약간
5. 거의 지키지 않음

22. 귀하는 자신이 한국 가치관을 어느 정도 따른 다고 생각하십니까?

(예, 결혼, 가족, 교육, 일 등에 대해서):

- | | | | | |
|------------|---|---|-------------|---|
| 1 | 2 | 3 | 4 | 5 |
| (거의 받지 않음) | | | (매우 강하게 받음) | |

23. 귀하는 미국가치관을 어느 정도 따릅니까? :

- | | | | | |
|------------|---|---|-------------|---|
| 1 | 2 | 3 | 4 | 5 |
| (거의 받지 않음) | | | (매우 강하게 받음) | |

24. 귀하는 한국사람들과 어울릴 때 얼마나 잘 어울리십니까?

- | | | | | |
|------------|---|---|-------------|---|
| 1 | 2 | 3 | 4 | 5 |
| (거의 받지 않음) | | | (매우 강하게 받음) | |

25. 귀하는 미국인들과 어울릴 때 얼마나 잘 어울리십니까?

- | | | | | |
|------------|---|---|-------------|---|
| 1 | 2 | 3 | 4 | 5 |
| (거의 받지 않음) | | | (매우 강하게 받음) | |

26. 사람들은 보통 여러 가지 방법으로 자기 자신을 평가합니다. 다음 중 귀하를 가장 잘 설명하는 하나는?

1. 나는 나 자신을 기본적으로 한국인이라고 생각한다. 비록 내가 미국에 살고 일하고 있지만 결국 난 한국인이라고 여긴다.
2. 나는 나 자신을 기본적으로 미국인이라고 생각한다. 비록 내가 한국적인 배경과 특징을 갖고 있지만, 나는 결국 미국인이라고 여긴다.
3. 나는 나 자신을 한국계 미국인이라고 생각한다. 그럼에도 불구하고 나는 내가 한국인이라는 것을 알고 있다.
4. 나는 나 자신을 한국계 미국인이라고 생각한다. 그럼에도 불구하고 나

는 내가 기본적으로는 미국인이라고 생각한다.

5. 나는 나 자신을 한국계 미국인이라고 생각한다. 나는 한국과 미국 양쪽의 특성을 모두 갖고 있어서 내 자신으로부터 양쪽 모두의 특성을 잘 발견할 수 있다.

International Physical Activity Questionnaire (Korean)

ID# _____

Date _____

이 설문은 사람들이 평소에 하는 신체활동에 대해 알아보고자 만들어졌습니다. 설문지는 지난 7일간의 귀하의 신체활동시간에 대해 질문할 것입니다. 당신 스스로 활동적이지 않다고 생각되더라도 각 질문에 응답해 주시기 바랍니다. 직장에서의 활동 뿐 아니라 집안 일, 마당 일, 이동하는 것, 그리고 여가활동이나 운동 또는 스포츠에 사용하는 시간에 대해 생각해 보십시오.

당신이 지난 7일간 하신 모든 격렬한 활동과 중간 정도 활동을 생각해 보십시오. 격렬한 신체활동이란 힘들게 움직이는 활동으로서 평소보다 숨이 훨씬 더 차게 만드는 활동입니다. 중간 정도 신체활동이란 중간 정도 힘들게 움직이는 활동으로서 평소보다 숨이 조금 더 차게 만드는 활동입니다.

제 1장 : 직업과 관련된 신체활동

첫 장은 귀하의 직업과 관련된 질문입니다. 여기에는 급여를 받는 직업뿐 아니라 농사일, 자원봉사 활동, 학업 그리고 기타 급여를 받지 않더라도 집 밖에서 하는 일이 포함됩니다. 집안 일, 정원 가꾸기, 집 유지보수와 가족 돌보기와 같이 가정에서 하는 급여를 받지 않는 활동은 제외됩니다. 이런 내용은 제 3장에서 질문 할 것입니다.

1. 귀하는 현재 직업을 가지고 있거나 혹은 급여를 받지 않더라도 집 밖에서 하는 일이 있습니까?

- 예
- 아니오 => 제 2 장 : 교통수단으로 가세요

다음 질문은 급여 여부와 상관없이 직업에 관련하여 지난 7일간 귀하의 모든 신체 활동에 관한 것입니다. 단 출퇴근 이동은 포함하지 않습니다.

2. 지난 7일간 직장 일로 무거운 것을 나르거나, 힘든 작업을 하거나, 힘든 건축일, 또는 계단 오르기 같은 격렬한 신체활동을 며칠 동안 하셨습니까? 한번에 적어도 10분 이상 지속한 활동만을 생각하여 응답해주시기 바랍니다.

일주일에 _____ 일

- 직업 관련 격렬한 신체활동 없었음 => 4번으로 가세요

3. 직장 일로 격렬한 신체활동을 한 날, 보통 하루 중 몇 시간을 소비하였습니까?

하루에 _____ 시간 _____ 분

4. 한번에 적어도 10분 이상 지속한 신체활동에 대해서만 생각해 주십시오. 지난 7일 동안 귀하의 직장 일로 가벼운 것을 나르기와 같은 중간 정도의 신체 활동을 한 날은 며칠입니까? 걷기는 포함시키지 마십시오.

일주일에 _____ 일

직업 관련 중간 정도 신체활동 없었음 => 6번으로 가세요

5. 직장 일로 중간 정도 신체활동을 한 날, 보통 하루 중 몇 시간을 소비하였습니까?

하루에 _____ 시간 _____ 분

6. 지난 7일 동안, 직장 일로 한번에 적어도 10분 이상 걸었던 날은 며칠입니까? 출퇴근할 때 걸었던 것은 포함하지 마십시오.

일주일에 _____ 일

직업 관련 걸은 적 없음=> 2장 : 교통수단으로 가세요

7. 직장 일로 걸었던 날, 보통 하루 중 몇 시간을 소비하였습니까?

하루에 _____ 시간 _____ 분

제 2 장 : 교통수단과 관련된 신체활동

다음 질문들은 한 장소에서 다른 장소로 이동하는 방법에 대한 내용입니다. 직장, 상점, 극장 등 모든 장소간 이동을 포함시키기 바랍니다.

8. 지난 7일 동안, 버스, 자동차, 전철, 기차 같은 교통수단을 이용한 날은 며칠입니까?

일주일에 _____ 일

교통수단을 이용하지 않았음 => 10번으로 가세요

9. 버스, 자동차, 전철, 기차 등과 같은 교통수단을 이용한 날, 보통 하루 중 몇 시간을 소비하였습니까?

하루에 _____ 시간 _____ 분

출퇴근을 위해, 심부름을 위해 또는 한 장소에서 다른 장소로 이동하기 위해 자전거를 타거나 걸었던 것에 대해서만 생각해 보십시오.

10. 지난 7일 동안 장소를 이동할 때 자전거를 한번에 적어도 10분 이상 탄 날이 며칠입니까?

일주일에 _____ 일

장소를 이동할 때 자전거를 탄 적 없음 => 12번으로 가세요

11. 장소를 이동할 때 자전거를 탔던 날, 보통 하루 중 몇 시간을 소비하였습니까?

하루에 _____ 시간 _____ 분

12. 지난 7일 동안 장소를 이동할 때 한번에 적어도 10분 이상 걸은 날은 며칠입니까?

일주일에 _____ 일

장소를 이동할 때 걷지 않음 => 제 3장으로 가세요

13. 장소를 이동할 때 걸었던 날, 보통 하루 중 몇 시간을 소비하였습니까?

하루에 _____ 시간 _____ 분

제 3장 : 집안일, 집 유지보수, 가족 돌보기

이번에는 귀하가 지난 7일 동안 집안일, 정원 가꾸기, 마당 작업, 집 유지보수, 가족 돌보기

등 집안이나 집 주위에서 했던 신체활동에 관한 질문입니다.

14. 한번에 적어도 10 분 이상 지속한 신체활동만 생각해 주십시오. 지난 7일 동안, 정원이나 마당에서 무거운 짐 옮기기, 나무 쪼개기, 눈 치우기, 땅 파기와 같은 격렬한 신체활동을 한 날은 며칠입니까?

일주일에 _____ 일

□ 정원이나 마당에서 격렬한 신체활동을 한 적이 없음 => 16번으로 가세요

15. 정원이나 마당에서 격렬한 신체활동을 한 날, 보통 하루 중 몇 시간을 소비하였습니까?

하루에 _____ 시간 _____ 분

16. 한번에 적어도 10분 이상 지속한 신체활동에 대해서만 생각해 주십시오. 지난 7일 동안 정원이나 마당에서 가벼운 짐 옮기기, 쓸기, 창문 닦기와 같은 중간 정도 신체활동을 한 날은 며칠입니까?

일주일에 _____ 일

□ 정원이나 마당에서 중간 정도 활동을 한 적 없음=> 18번으로 가세요

17. 정원이나 마당에서 중간정도의 신체활동을 한 날, 보통 하루 중 몇 시간을 소비하였습니까?

하루에 _____ 시간 _____ 분

18. 한번에 적어도 10분 이상 지속했던 신체활동에 대해서만 생각해 주십시오. 지난 7일 동안 집안에서 가벼운 물건을 나르거나 유리창을 닦거나 마루를 닦거나 집안을 닦는 것과 같은 중간정도의 신체활동을 한 날은 며칠입니까?

일주일에 _____ 일

□ 집에서 중간정도 신체활동 한 적 없음=>제 4장으로 가세요

19. 집안에서 중간정도 신체활동을 한 날, 보통 하루 중 몇 시간을 소비하였습니까?

하루에 _____ 시간 _____ 분

제 4장 : 레크리에이션, 스포츠, 여가시간 신체활동

이 부분은 지난 7일간 운동 또는 여가로만 활동한 모든 신체활동에 대한 것입니다. 이미 응답한 활동은 포함시키지 마십시오.

20. 이미 응답한 걸기는 계산하지 말고 지난 7일간 여가시간에 한번에 적어도 10분간 걸은 날은 일주일에 며칠입니까?

일주일에 _____ 일

□ 여가시간에 걸은 적 없음 => 22번으로 가세요

21. 여가시간에 걸었던 날, 보통 하루 중 몇 시간을 소비하였습니까?

하루에 _____ 시간 _____ 분

22. 한번에 적어도 10분 이상 지속한 신체활동에 관해서만 생각해 주십시오. 지난 7일간 여가 시간에 에어로빅, 달리기, 빠른 자전거타기, 인라인스케이트, 축구경기 또는 빠른 수영과 같은 격렬한 신체활동을 한 날은 일주일 중 며칠입니까?

일주일에 _____ 일

□ 여가시간에 격렬한 활동을 한 적 없음 => 24번으로 가세요

23. 여가시간에 격렬한 신체활동을 한 날, 보통 하루 중 몇 시간을 소비하였습니까?

하루에 _____ 시간 _____ 분

24. 한번에 적어도 10분 이상 지속했던 신체활동에 관해서만 생각해 주십시오.

지난 7일간 여가시간에 빨리 걷기, 보통 속도로 자전거타기, 보통 속도로

수영하기, 복식 테니스와 같은 중간정도의 신체활동을 한 날이 며칠입니까?

일주일에 _____ 일

□ 여가시간에 중간정도 활동을 한 적 없음=> 제 5 장으로 가세요

25. 여가시간에 중간정도 신체활동을 한 날, 보통 하루 중 몇 시간 소비하였습니까?

하루에 _____ 시간 _____ 분

제 5 장 : 앉아서 보낸 시간

마지막 질문들은 귀하가 직장에서, 집에서, 학업 중에 그리고 여가시간에 앉아서 보내는 시간에 관한 것입니다. 여기에는 책상에 앉아 있거나 친구와 만나거나 독서를 하거나 텔레비전을 보기 위해 앉아 있거나 누워 있는 시간이 포함됩니다. 앞에서 이미 응답한 교통수단을 이용할 때 앉아 있었던 시간은 포함되지 않습니다.

26. 지난 7일 동안, 주중 하루에 앉아서 보낸 시간은 보통 얼마나 됩니까?

하루에 _____ 시간 _____ 분

27. 지난 7일 동안, 주말 하루에 앉아서 보낸 시간은 보통 얼마나 됩니까?

하루에 _____ 시간 _____ 분

Center for Epidemiological Studies Depression Scale (Korean)

ID# _____

Date _____

아래에 있는 항목들은 **지난 일주일** 동안의 당신의 상태에 대한 질문입니다. 그와 같은 일들이 **지난 일주일** 동안 얼마나 자주 일어났었는지 답변해 주십시오.

	지난 일주일 동안	극히 드물 다 1일 이하	가끔 1~ 2일	종종 3~ 4일	대부분 5일 이상
1	평소에는 아무렇지도 않던 일들이 귀찮게 느껴졌다.				
2	먹고 싶지 않았다: 입맛이 없었다.				
3	가족이 도와준다 하더라도, 나의 울적한 기분을 떨쳐 버릴 수 없었다.				
4	다른 사람들만큼의 능력은 있다고 생각했다.				
5	무슨일을 하든 정신 집중하기가 힘들었다.				
6	우울했다.				
7	내가 한 모든 일들이 힘들게 느껴졌다.				
8	미래에 대해 희망적으로 느껴졌다.				
9	내 인생은 실패작이라는 생각이 들었다.				
10	두려움을 느꼈다.				
11	잠을 설쳤다 (잠을 잘 이루지 못했다).				
12	행복했다.				
13	평소에 비해 말수가 적었다: 말수가 줄었다.				
14	세상에 홀로 있는 듯한 외로움을 느꼈다.				
15	사람들이 나에게 차갑게 대하는 것 같았다.				
16	생활이 즐거웠다.				
17	갑자기 울음이 나왔다.				
18	슬픔을 느꼈다.				
19	사람들이 나를 싫어하는 것 같았다.				
20	도무지 무엇을 시작할 엄두가 나지 않았다: 기운이 나지 않았다.				