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Coronary Heart Disease Risk and Risk Perception in
Korean Immigrants with Type 2 Diabetes

by

Sarah Eunkyung Choi

DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Nursing

in the

GRADUATE DIVISION

of the

UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

## DEDICATION

I dedicate this work to the loving memory of my beloved brother, Won Keun Choi, and to my dear grandmother, Soon Rye Park.  It is their love and prayer from heaven that has sustained me throughout this journey.

campus. He generously made room in his schedule for my long-distance trips to UCSF, which allowed me to complete my data analyses in a timely manner. Heartfelt thanks also go to Dr. Robert Slaughter and Dr. Grace Yoo for their indispensable contributions to the groundwork for my doctoral research. Last but not least, I want to thank Dr. Kathy Lee for her encouragement to turn a class project into a manuscript, which ultimately resulted in a submission for publication.

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Coronary Heart Disease (CHD) Risk and Risk Perception in

Korean Immigrants with Type 2 Diabetes

by

Sarah E. Choi, RN, MSN, FNP

**ABSTRACT**

**Background:** Perceived risk is a predictor for adopting risk-reducing behaviors. Despite

the rising incidence of type 2 diabetes in Korean immigrants and their increased risk of

coronary heart disease (CHD) associated with diabetes, little is known about the level of

CHD risk perception and risk factor control in this group.

**Purpose**: 1) Describe the level of coronary heart disease (CHD) risk perception and risk

factors; 2) examine factors associated with CHD risk perception; 3) describe glucose

control status; and 4) examine determinants of glucose control in Korean immigrants with

type 2 diabetes.

**Methods:** A cross-sectional descriptive study design was used. Data were collected from

a community sample of 143 Korean adults with type 2 diabetes, aged 30 to 80 years old.

Participants completed questionnaires and submitted to a finger stick blood test for

glycosylated hemoglobin (HbA1c), cholesterol panel, and anthropometric measures.

Multiple regression analyses were conducted to evaluate factors influencing CHD risk

perception and glucose control in Korean immigrants with type 2 diabetes.

**Findings:** Perception of CHD risk among participants was low. Most (76.9%) perceived

their risk to be the same or lower than their peers in the general population. According to

American Diabetes Association (ADA) guidelines, CHD risk- factor control was

suboptimal. More than half had uncontrolled blood pressure and higher low density

lipoprotein cholesterol (55% and 53.6% respectively) than the target goal. CHD

knowledge had a significant positive effect and self-reported general health had a

significant negative effect on the perception of CHD risk. The mean HbA1c level was

7.6 % (SD = 1.5; range = 5.6 to 12.5). Less than half of the participants (41.3%) met the

ADA's goal of less than 7%. Roughly 22% of variance in HbA1c levels was explained

by a linear combination of family diet support, acculturation, body mass index (BMI),

waist-to-hip ratio (WHR), the duration of diabetes, the number of diabetic medications,

age, gender, and education ($R^2$ = 0.223, F[9,133] = 4.24; $p$ < .0001). In the final model,

family diet support, age, WHR, the duration of diabetes, and the number of diabetic

medications determined glucose control.


Word Count: 345

*Sally H. Rankin, PhD*

Chairperson, Doctoral Dissertation Committee

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# CHAPTER ONE

## Introduction

The incidence of diabetes among Asian Americans and Pacific Islanders (AAPI) is rising at an alarming rate with type 2 diabetes accounting for 90-95% of cases among this population (Joslin Diabetes Center, 2004). Koreans are the fifth largest group among all AAPIs and constitute 12% of that population (U.S. Census Bureau, 2000). Although there is no national data for the prevalence of type 2 diabetes in AAPI or Korean immigrants, data from Korean immigrants in Hawaii estimates that the frequency is at least twice that of the white population (Centers for Diseases Control and Prevention [CDC], 2002).

Coronary heart disease (CHD) is a major complication of diabetes and the leading cause of premature death among people with type 2 diabetes (National Institute of Diabetes and Digestive and Kidney Disease [NIDDK], 2005). Adults with type 2 diabetes mellitus are two to four times more likely to have heart disease than people without diabetes (Nesto, 2001; Norhammar et al., 2004). Although data indicates that CHD mortality in the U.S. is declining, the rate of decline is uneven between individuals with and without diabetes. Specifically, between 1971 and 1993, age-adjusted CHD mortality in non-diabetic individuals decreased by 51% whereas patients with diabetes experienced only a 15% decline in CHD mortality (Gu, Cowie, & Harris, 1999).

As the prevalence of type 2 diabetes increases in Korean immigrants, CHD in this group will also rise. A number of recent studies of individuals with diabetes indicate that in addition to maintaining optimal glucose levels, aggressive CHD risk factor control is critical for reducing the risk of CHD (American Diabetes Association [ADA], 2006; Raven, 2002). Furthermore, psychosocial attributes play a significant role in CHD risk reduction because a large part of CHD risk factor control and glucose management

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requires individuals to develop healthy practices through lifestyle modification (Chiuve, McCullough, Sacks, & Rimm, 2006; Diabetes Prevention Program Research Group, 2002).

The literature indicates that perceptions of personal risk for a disease may be an important factor in developing preventive health behaviors (King et al., 2002). Perceived risk of CHD has been positively related to the desire to make risk-reducing behavior changes (Silagy, Muir, Coulter, Thorogood, & Roe, 1993; Winkleby, Flora, & Kraemer, 1994). Despite evidence supporting risk perception as the first step toward desired health behavior (Green, Grant, Hill, Brizzolara, & Belmont, 2003), research is limited in this area and the few available studies have found remarkably low CHD risk perception among patients with diabetes (Carroll, Naylor, Marsden, & Dornan, 2003; Merz, Buse, Tuncer, & Twillman, 2002).

While the significant beneficial effects of glucose control on prevention of complications in type 2 diabetes have been demonstrated (United Kingdom Prospective Diabetes Study Group, 1998; Stratton et al., 2000), information on glucose management status in Korean immigrants with type 2 diabetes is scarce. Furthermore, even less is known about psycho-socio-cultural factors that influence optimal management of diabetes in Korean immigrants with type 2 diabetes. However, studies of other ethnic immigrant groups with type 2 diabetes suggest that family support, acculturation, and certain demographic and health variables may play a significant role in the maintenance of adequate glucose levels (Fisher et al., 2004; Ilias, Hatzimichelakis, Souvatzoglou, Anagnostopoulou, & Tselebis, 2001; Wen, Shepherd, & Parchman, 2004).

This dissertation study has three main aims. The primary aim is to describe CHD risk perception in Korean immigrants with type 2 diabetes and to examine factors associated with their level of CHD risk perception. The second is to describe CHD risk factor control status according to parameters established by national guidelines. The third is to investigate the status of glucose control measured by hemoglobin HbA1c level and to determine factors influencing the level of glucose in this group.

Leventhal's theory of self-regulation provides the study's conceptual framework. In the past, this model has been applied to aid in understandings individuals' perceptions regarding threats to illness, factors that influence the perceptions of these threats, and how these perceptions of threats influence health promotion and illness prevention behaviors. According to this model, illness or potential health threats initiate the interactive, parallel processes of cognition and emotion. According to this framework, cognition is the objective interpretation of a threat and emotion is the subjective reaction to a threat (Bishop, 1991; Leventhal, Meyer, & Nerenz, 1980). By using one's own knowledge and experience, illness-related information is processed by the cognition pathway as a way to understand the disease and its effect on oneself. In response to the health threat and as a way of coping with it, the emotion pathway incorporates socio-cultural values and beliefs.

Each of these parallel processes has the following three components: representation, coping, and appraisal (Leventhal et al., 1980). In the representation stage, cognitive and emotional perceptions of illness are formed by thinking about causes of the illness, how a person labels the symptoms, how a person perceives the consequences of the threat of illness, and how the illness is perceived as either a short-term or long-term

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problem. Perceptions formed in this representation stage guide the next stage, coping, and are characterized by attempts to minimize risk and to control fear and other emotions related to the illness. Finally, in the appraisal stage, the effectiveness of both types of coping responses is evaluated. This provides feedback for the adjustment of coping strategies.

In this study of Korean immigrants with type 2 diabetes, illness/threat representation is reflected in CHD risk perceptions. Since CHD does not produce symptoms until the disease process is fairly advanced, patients' risk perceptions are more likely to be formed by their own knowledge about heart disease and beliefs and self-perceptions regarding general health status. Individuals' knowledge and beliefs transform abstract disease threats into personally relevant threats by engaging cognitive pathways to promote action. In addition, information from other people, such as family or friends, emphasizing the patient's risk for heart disease and need for glucose control engage emotion-perceptual pathways and may be utilized in relation to the threat representation. Perceptions formed in the representation stage lead to appropriate actions to reduce CHD risk and influence the coping response. In this study, the coping response is reflected in the level of glucose and CHD risk factor control. The socio-cultural environment, experienced through acculturation and family support, influences both the representation and coping stages of the model. Given the descriptive and cross-sectional nature of the study, only illness/threat representation and the behavioral aspects of the coping component of the model were applied.

The dissertation includes three separate papers. Two papers report the research processes and findings, and a third paper reports results from a meta-analysis of the

effects of acculturation on smoking in Asian Americans. Since these three papers were prepared as submissions for publication, each follows the format specified by the journal to which it was to be submitted.

The complete dissertation is organized into five chapters. Chapter one serves as the introduction, chapters 2-4 are comprised of the three papers mentioned above, and chapter 5 is the summary. A manuscript of chapter 2, entitled: "Perception of coronary heart disease risk in Korean immigrants with type 2 diabetes", will be submitted to *The Diabetes Educator*. This paper presents study findings from a sample of 143 Korean immigrants with type 2 diabetes residing in a West Coast Korean community. The purpose of this chapter is two-fold: (1) to describe CHD risk perception and CHD risk factor control status in a sample of Korean immigrants with type 2 diabetes, and (2) to examine the influence of demographic characteristics, health variables (i.e. medication and smoking status), CHD knowledge, and self-reported general health on CHD risk perception.

The second paper (Chapter 3), entitled: "Glucose control in Korean immigrants with type 2 diabetes", will be submitted to *Nursing Research.* This paper presents findings from the study that specifically relate to diabetes management. The purpose of this investigation was to describe the level of diabetes control and to examine potential determinants of glucose control (i.e. family support, acculturation, body mass index, waist to hip ratio, years with diabetes, number of diabetes medications, age, gender, education) in Korean immigrants with type 2 diabetes.

The third paper (Chapter 4), entitled: "Effects of acculturation on smoking behavior in Asian Americans: A Meta-Analysis", will be submitted to the *Journal of*

*Cardiovascular Nursing*. This paper presents findings from a meta-analysis of nine studies examining the relationship between acculturation and smoking in Asian ethnic groups. The purpose of the meta-analysis was to summarize the direction and magnitude of the effect of acculturation on smoking behavior. Although this chapter does not involve the dissertation study, it closely relates to this work on the basis that smoking is a CHD risk factor and the fact that the prevalence of smoking among Korean immigrants is the highest of all ethnic groups in the U.S. (Tang, Shimizu, & Chen, 2005).

Finally, the last chapter (Chapter 5) summarizes findings from the previous articles and addresses the current state of knowledge regarding CHD risk and perception in Korean immigrants with type 2 diabetes. The chapter concludes with recommendations for future research.

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# CHAPTER TWO

**Perception of Coronary Heart Disease Risk in**

**Korean Immigrants with Type 2 Diabetes**

Abstract

**Purpose**: The purpose of this study was to examine coronary heart disease (CHD) risk perception, risk factor status, and factors associated with CHD risk perception in Korean immigrants with type 2 diabetes mellitus.

**Methods:** A community sample of 143 Korean adults with type 2 diabetes, aged 30 to 80 years old, completed questionnaires and biological measures. A multiple regression analysis was conducted to evaluate the relationships between CHD knowledge, general health, smoking, medications for CHD risk factors, demographic variables (independent variables) and the perception of CHD risk (dependent variable).

**Results:** Participants had low perception of CHD risk, with most (76.9%) indicating their risk to be the same or lower than people of the same age and sex in the the general population. Overall, CHD risk- factor control was suboptimal according to American Diabetes Association guidelines. Only 41.3% of participants met the HbA1c goal of less than 7%. More than half (55%) had uncontrolled blood pressure, and a similar proportion (53.6%) had higher low density lipoprotein cholesterol than the target goal. CHD knowledge and self-reported general health influenced the perception of CHD risk. More CHD knowledge and poor general health were associated with higher perception of CHD risk.

**Conclusions:** To increase the perception of CHD risk in Korean immigrants with type 2 diabetes, diabetes educators and clinicians should educate such patients about CHD risk factors and discuss their risk status at every visit. Those who report their health to be good deserve particular attention.

Coronary heart disease (CHD) is a major complication and the leading cause of death for people with diabetes.[1, 2] People with diabetes are 2 to 4 times more likely to have heart disease than people without diabetes.[3-5] Studies have found low perception of CHD risk among patients with diabetes, despite their increased risk.[6, 7] According to a recent survey by the American Diabetes Association (ADA) and the American College of Cardiology, the perception of personal risk of heart disease among a large group of diabetic patients was remarkably low, with more than half (52%) indicating that they did not feel at risk of a heart condition.[8]

Perceptions of personal risk for a disease may be important in preventive health behaviors. As the health belief model suggests, an individual is likely to take a recommended health action if he or she perceives himself or herself to be at risk of getting a serious disease.[9, 10] The perceived risk of coronary heart disease has been positively related to the desire to make risk-reducing behavior changes and actual behavior changes.[11, 12]

Despite evidence supporting risk perception as the first step toward desired health behavior, existing information suggests that adults often incorrectly perceive their risk of developing a disease and adopt an optimistic bias.[13-15] Underestimating disease risk has important implications for CHD risk reduction because people who do not perceive themselves as vulnerable to CHD are less likely to adopt recommended behaviors to prevent it.[16, 17] The literature suggests that several factors, such as perceptions of general

health,[16, 18] knowledge of CHD risk,[13, 19, 20] and demographic variables, such as age, education, and gender [18, 21] may be related to the risk perception for CHD.

Koreans are the fifth largest group among Asian Americans and Pacific Islanders, constituting 12% of that population.[22] Although data on the prevalence of type 2 diabetes mellitus in Korean immigrants in the United States are not available, the prevalence in Korean immigrants in Hawaii is estimated to be at least twice that of the White population.[23] An epidemiological study conducted near Baltimore reported that the incidence of diabetes in elderly Korean American men was higher than in any other ethnic group, including black and Hispanic populations.[24] In Korea, diabetes, most often type 2 diabetes, affects about 7.2% of adults over 30 years of age.[25]

Despite the rising incidence of type 2 diabetes in Korean immigrants, little is known about the level of CHD risk perception and CHD risk factors in Korean immigrants with type 2 diabetes. This information, however, is critical because CHD risk perception that is not appropriate to actual risk (eg, low risk perception in diabetic patients with uncontrolled hypertension and high cholesterol) may prevent a patient from adopting and engaging in CHD risk-reduction behavior. Information on factors that influence risk perception will also help diabetes educators and clinicians design effective interventions.

The purpose of this study was to describe CHD risk perception and risk-factors and to investigate the factors that are associated with personal perception of CHD risk in a sample of Korean immigrants with type 2 diabetes. The specific aims were (1) to examine CHD risk perception, (2) to describe the level of CHD risk-factor control according to ADA guidelines,[26] and (3) to evaluate the selected correlates for association

with CHD risk perception in this group. For clinicians working with Korean immigrants with type 2 diabetes, the results will be useful in planning population-specific, CHD-risk-reduction strategies.

**Methods**

Design and Sample

This cross-sectional, correlation study investigated a convenience sample of 143 Korean immigrant men and women between 30 and 80 years of age with type 2 diabetes. Individuals in a West Coast Koreatown  were recruited with flyers and posters from community sites, which included 2 health clinic waiting areas, pharmacies, and a shopping mall. Interested persons met the researcher in the reception area of the clinic or pharmacy or called to arrange an appointment. To be eligible for inclusion, individuals had to be Korean-born immigrant men or women between 30 and 80 years old, with a diagnosis of type 2 diabetes for at least a year, and able to speak, read, and write in Korean or English. The study was approved by a university institutional review board, and all participants were provided with written informed consent.

**Data Collection Procedures**

After participants submitted their written informed consent, the researcher distributed questionnaires at the study site. Participants chose the language version (English or Korean) they preferred and were encouraged to ask for assistance, if needed. The researcher or the registered nurse at one of the study sites administered a glycosylated hemoglobin (HbA1c) test according to standardized procedures. After data collection was completed, the participants received the results of their blood pressure tests, their blood tests, and their anthropometric measures.

Upon completing the questionnaire, each participant was assessed for clinical measures: blood pressure, cholesterol (lipid panel), and HbA1c. Blood pressure was measured with an electronic blood pressure monitor (A&D Medical Model UA-767) using standardized procedures. This device was validated against a mercury sphygmomanometer and has been reported to be as reliable as the conventional stethoscope sphygmomanometer.[27, 28] Two readings 2 minutes apart were taken after a participant had been seated for at least 5 minutes and were then averaged by the researcher. Using a finger-stick sample of whole blood, a lipid panel was analyzed with the CardioChek PA™, a cholesterol measuring device that meets the accuracy guidelines of the National Cholesterol Education Program.[29] HbA1c was measured using the same finger-stick blood sample by the Metrika A1c Now InView, which is certified by the National Glycohemoglobin Standardization Program. Both the CardioChek PA™ and A1c Now InView ™ are tests granted waived status under the Clinical Laboratory Improvement Amendments of 1988, laboratory regulations established by the US Food and Drug Administration. HbA1c levels were also obtained from those patients recruited from a health center who offered their personal HbA1c records for use in the study. Because the clinic also used the A1c Now InView and these values were written in by the clinic staff, the results provided by participants were used if they had been obtained within the preceding 3 months.

While waiting for the blood test results, participants were assessed for anthropometric measures: height and weight to assess body mass index (BMI) and waist and hip circumference to assess the waist-to-hip ratio. With participants in bare feet, height was measured in centimeters to the top of the head using a nonstretching

measuring tape secured to the wall. Weight was measured in kilograms using a professional body-weight scale; participants wore only light clothing, empty of all belongings, and no shoes. BMI was calculated using the formula: ($BMI = kg/m^2$). Waist circumference was measured in centimeters by placing a nonstretching measuring tape in a horizontal plane around a participant's bare abdomen at the top of the iliac crest. The reading was taken after an expiration, making sure that the tape was secure but not too tight. Hip measurement was taken at the point of maximum circumference over the buttocks, with the measuring tape held in a horizontal plane touching the skin (the surface of light clothing in this study) but not indenting soft tissue. The waist-to-hip ratio was calculated by dividing waist measurement by hip measurement.

**Measures of CHD Risk Perception: The Dependent Variable**

CHD risk perception, the dependent variable, was measured by an index of perceived risk used by Becker and Levine[13] in a study of a high-risk population (siblings of people with premature CHD). Perceived risk is defined as the perception of the possibility of experiencing a premature CHD event.[13] This index comprises 4 items, using a scale of 1 to 5, with 1 indicating *no concern at all* or *very low probability estimates* for having an event and 5 indicating *very high levels of concern* and *extremely high estimates* for having an event. The items address a person's (1) frequency of concern over having a CHD event, (2) his or her estimate of the likelihood of having such an event in the next 5 years, (3) the likelihood of having such an event in his or her lifetime, and (4) his or her estimated CHD risk compared with people of similar age and sex in the general population. The fourth item offered responses of *much less*, *less*, *about the same*, *more*, and *much more* risk than people in the general population. Items are summed. The

potential range of the perceived risk index is 4 to 20 points. A high score indicates a high level of perceived risk. The published internal consistency of this index using Cronbach's α was .80.[13] In this study sample, Cronbach's α was .78.

**Measures of Independent Variables:**

CHD Knowledge, Medication Status for CHD Risk, Current Smoking, and General Health

The participants' CHD knowledge was assessed by asking them to identify factors thought to be caused by or associated with CHD. Smoking, consumption of saturated fat or high serum cholesterol, high blood pressure, family history, age, sex, sedentary lifestyle, stress, obesity, and diabetes are worth 1 point on the scale if answered yes;, arthritis and asthma are worth 1 point if answered no. There is no penalty for incorrect answers and a total score could range from 0 to 12 points. A higher score indicates a higher level of CHD knowledge. This method was modified from the one used in the study of siblings of CHD patients.[13]

Medications related to CHD risk were measured by self-report of medication use for diabetes, hypertension, and cholesterol. If a participant were taking medications for these CHD risk conditions, his or her yes response confirmed the presence of added CHD risk and the patient's awareness of his or her diagnoses. Smoking status was measured by the question, "Do you now smoke cigarettes everyday, some days, or not at all?" Responses with everyday or some days were coded as "current smoker."

General health was measured by the question, "In general, would you say your health is: Excellent, Very good, Good, Fair, or Poor?" This variable was rated from 1 to 5, with 1 indicating *excellent* and 5 indicating *poor health*; scores were later reverse

coded for analyses. This single item measure came from the Medical Outcomes Study 36-Item Short Form Survey developed by Ware and Sherbourne [30] and has been shown to be a powerful predictor of later health outcomes.[31-33]

**Statistical Analyses**

Descriptive statistics provided information on the variables in this study. Bivariate analyses were conducted to examine the relationship between the independent variables and CHD risk perception. Independent variables were examined for collinearity. A multiple linear regression was done to examine the independent association between CHD risk perception (dependent variable) and the independent variables: CHD knowledge; self-reported general health; medication use for diabetes, hypertension, cholesterol, smoking, age, gender; and education. First, the $R^2$ of the complete model was examined for significance.  Then, the unique contribution of each independent variable was tested to explain the variance in CHD risk perception. The Statistical Package for Social Sciences, SPSS 12.0, was used to analyze the data.

**Results**

Demographic and Health Characteristics

Of the 150 potential individuals who met the inclusion criteria, 7 declined participation. A total of 143 patients participated in the study. The sample characteristics are shown in Table 1. The sample was 51.7% women, and the mean age was 62.4 years (SD = 12.8; range = 30 to 80). All participants preferred and completed the Korean version of the questionnaire. Over one half lived alone or with only 1 family member, were married, and had higher than a college education. The mean duration of residence in the United States was 21.7 years (SD = 9.2), and the mean duration of diabetes was 6.8

years (SD = 6.2). The mean HbA1c level was 7.6 % (SD = 1.45; range = 5.6 to 12.5).

Most participants (85.3%) were taking medication for diabetes, more than two thirds

(70.6%) were taking medication for hypertension, and less than two thirds (59.4%) were

taking medication for cholesterol. More than two thirds (68.5%) indicated that their

general health was poor or fair, and only 6.3% reported very good health. Not one

reported excellent health.

**CHD Risk Perception**

The mean score for CHD risk perception was 8.14 (SD = 2.56; median 8.0),

indicating that the participants had low CHD risk perception overall. The distribution of

the scores was positively skewed (skewness = .720, SE = .203), indicating that responses

were clustered around the low end. In response to a question about frequency of concern

about having a CHD event, more than half of the participants (57.3%) responded *never* or

*rarely*. Nearly two thirds (61.5%) indicated that the likelihood of their having a CHD

event in the next 5 years was *not likely,* and almost half (49.7%) responded similarly for

their lifetime CHD risk.  Most participants (76.9%) reported that their CHD risk was the

same as or lower than people in the general population of similar age and sex.

**CHD Risk Factors**

Less than half of the participants (41.3%) achieved the ADA's goal of HbA1c

levels less than 7%, and only 23.1% reached the American Association of Clinical

Endocrinologists' goal of less than 6.5%.  Overall, more than one third had either a

systolic BP (42.7%) or a diastolic BP (35.7%) higher than the recommended control level.

More than half (53.6%) had low density lipoprotein cholesterol levels above

recommended treatment goal, and less than half (47.3%) of those individuals were taking

cholesterol-lowering medication. Most participants (81.1%) exceeded the overweight

parameter of BMI (23 kg/m²) recommended by the World Health Organization for

Asians.[34] Similarly, most men (82.6%) and women (85.1%) exceeded the Asia-Pacific

criteria for waist circumference, 90 cm and 80 cm respectively.[35] Table 2 shows the

status of CHD risk factor control in Korean immigrants with type 2 diabetes according to

the ADA's recommended goals.

**CHD Knowledge**

The mean total CHD knowledge score was 8.82 (SD = 1.81; range = 3-12),

indicating that participants had a high level of knowledge on risk factors associated with

CHD. Most identified being overweight or obesity (88.8%), dietary fat or high

cholesterol (81.8%), hypertension (87.4%), and stress (89.5%) as factors associated with

or thought to cause CHD. Slightly lower proportions indicated smoking (76.9%), diabetes

(74.1%), a sedentary lifestyle (75.5%), and family history (72.7%) to be risk factors.

About two thirds (66.4%) thought age was a risk factor for CHD, although just a third

(30.1%) thought gender played a role as a risk factor.

**Bivariate and Multivariate Analyses for CHD Risk Perception**

The results of bivariate analyses are presented in Table 3. Significant positive

correlations were found for CHD knowledge and hypertension medication, although

significant negative correlations were discovered for education and general health status.

On multivariate analyses, the linear combination of the predictors in the model

was significantly related to the level of CHD risk perception. The $R^2$ was 0.219,

indicating that the model explained roughly 22% of the variance in CHD risk perception

($R^2 = 0.219$; F $[9,133] = 4.149$; $P < .0001$). Self-reported general health status and CHD

knowledge were significant predictors of CHD risk perception. A higher level of CHD knowledge was associated with a higher level of risk perception, although better self-reported general health status was associated with lower levels of CHD risk perception. Table 4 presents the results of the regression analyses.

**Discussion and Conclusions**

The purpose of this study was to investigate the level of CHD risk perception, risk factor control, and factors influencing CHD risk perception among Korean immigrants with type 2 diabetes. Participants had low perception of CHD risks and their control of CHD risk factors was suboptimal. The study suggests that CHD knowledge and general health are important in determining CHD risk perception in this group.

The low perception of CHD risks in this study is consistent with previous studies of CHD risk perception in high-risk populations.[6, 13, 17] However, when compared with a recent national study of individuals with type 2 diabetes,[7] the proportion of those who indicated their CHD risk to be the same or lower than like individuals in the general population was much higher in this study (77% vs 52%). Such a high rate in patients with diabetes is a concern because a low perception of CHD risks may negatively affect their decision to adopt and to maintain risk reduction behaviors. This finding indicates the need to increase risk perception to a level commensurate with the high risk present in diabetic Korean immigrants.

In this study, the control of diabetes and CHD risk factors were suboptimal, according to ADA goals. Although the control was better than the U. S. national data on adults with diabetes [36] (HbA1c [42% vs 37%], blood pressure [45% vs 36%], and total cholesterol [66 % vs 48%] respectively), the findings show the need to improve risk

factor management in Korean immigrants with type 2 diabetes. Similar research is needed in other Korean or Asian immigrants with diabetes to compare these findings. Studies are also needed to determine if the suboptimal control of CHD risk factors is related to the failure of educators or clinicians to educate patients about the relationship between type 2 diabetes and CHD or to patients simply misunderstanding these two as separate problems. As a recent study suggests [7], most diabetes educators and clinicians may consider the lowering of blood glucose to be their highest priority in reducing CHD events in patients with diabetes, leading patients to think that controlling other risk factors are not as important. No definitive data from clinical trials, however, show that intensified glycemic control significantly reduces the risk of CHD in patients with type 2 diabetes; control of blood pressure, control of lipids, and smoking cessation are thought to be more important in reducing premature deaths from CHD.[37]

The results of this study show that knowledge of CHD and general health significantly influence CHD risk perception. More knowledge was associated with increased risk perception, although high scores of CHD knowledge in this sample were not reflected in the level of risk perception. The finding indicates that education may be beneficial in increasing a person's risk perception and helping the patient connect their risk of CHD with their diabetes. Educational programs on CHD and risk factor control, specifically designed for diabetic patients, should be part of each patient's visit with diabetes educators and clinicians.

Self-reported general health was found to be negatively associated with CHD risk perception, as shown in previous studies,[18, 20, 38] suggesting that diabetic individuals who report their general health to be good may incorrectly perceive their CHD risk to be low.

Although it is not surprising that people who believe they are in good health feel less vulnerable to getting any illness, including CHD, diabetes educators and clinicians must emphasize to diabetic patients, particularly those who feel healthy, that they are still at risk for CHD. Future studies need to investigate effective ways to communicate CHD risk to people with diabetes so that these individuals understand their risk of CHD and adopt risk reduction behavior.

This study also found that more than two thirds of the participants rated their health as *fair* or *poor* (68.5%). This figure is similar to that in recent studies of the general population of Korean Americans over 65 years old (69%).[39, 40] Based on this comparison, it is unclear if having a chronic disease, such as diabetes influences the general heath status ratings in Korean immigrants. The literature indicates that Asian Americans are more likely than non-Hispanic Whites to report fair or poor health in response to the general health question, even though they are often described as having fewer chronic diseases than other US populations.[41] Future studies comparing the general health status of diabetic and nondiabetic individuals from different groups of Korean immigrants and other ethnic Asian groups may explain the small difference noted in the current study. And they may also suggest a different way of measuring general health in Asian immigrants, such as using culture-specific languages and expressions in questionnaires.

Previous literature also suggests that demographic variables, such as age, sex, and education, are related to an increased risk perception for certain conditions, such as heart attack. [38, 42] These variables, however, were not found to be significant determinants of CHD risk perception in this study. And, taking medications for diabetes, high blood

pressure, high cholesterol, or smoking did not influence a patient's perception of CHD risk. This finding concurs with that of Frijling et al,[38] who found that diabetes, a history of high blood pressure, and a history of high cholesterol did not relate to patient estimates of CHD risk. Although participants taking medications for these risk factor conditions may have felt that their CHD risk factors were also being addressed and thus did not consider themselves at further risk, research is needed to better understand these findings.

This study has several limitations. First, because it used a convenience sample from community sites in a West Coast Koreatown, the results may not be generalizable to Korean immigrants living in other geographic areas. Second, the sample comprised first generation immigrants only. Thus, generalizing the results to Koreans born in the United States may not be appropriate. Third, nonfasting cholesterol levels were obtained in 9 participants who could not return for a fasting measure, although this probably did not affect the data significantly. Finally, the measure of CHD knowledge was limited to the recognition of risk factors and may not have fully reflected the participants' understanding of CHD risk (eg, why these are risk factors). Future studies should be conducted using more representative samples and multidimensional measures of CHD knowledge. Measures specific to populations with diabetes that are culturally appropriate may need to be developed for this purpose.

In conclusion, this study provides useful information to improve the care of Korean immigrants with type 2 diabetes. No comparable clinical or risk factor data are available for this group of patients, despite the increasing incidence of type 2 diabetes within the Korean immigrant community. However, if patients have suboptimal control

of their diabetes and CHD risk factors, a low perception of CHD risks may inhibit appropriate actions to prevent CHD.

This study's findings have important implications for diabetes educators who provide care to Korean immigrants with type 2 diabetes. The importance of CHD knowledge suggests that diabetes educators and other health care providers should educate individuals with diabetes about their high CHD risk. The CHD knowledge acquired from such education may increase risk perception and lead to appropriate actions to reduce the risk of CHD. Those with low CHD knowledge and those reporting good general health deserve special attention because these individuals tend to have a low perception of CHD risk and an unrealistically optimistic view of their CHD risk.

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Table 1

Characteristics of the Study Sample (N = 143)

| Characteristic | Mean ± SD |
|---|---|
| Age | 62.4 ± 12.8 |
| Years in the US | 21.7 ± 9.2 |
| Years with diabetes | 6.8 ± 6.2 |
| HbA1c | 7.6 ± 1.5 |
| **Characteristic** | **N (%)** |
| Gender | |
| Female | 74 (51.7) |
| Male | 69 (48.3) |
| Marital Status | |
| Married | 88 (61.5) |
| Living with partner | 5 ( 3.5) |
| Divorced or separated | 16 (11.2) |
| Widowed | 26 (18.2) |
| Never married | 8 ( 5.6) |
| Household status | |
| Lives alone | 31 (21.7) |
| Lives with spouse or partner | 71 (49.7) |
| Lives with spouse or partner and children | 20 (14.0) |
| Lives with married children and grandchildren | 21 (14.7) |
| Educational level | |
| Elementary school or less (0-6 grades) | 20 (14.0) |
| High school (7-12 grades) | 42 (29.4) |
| College/university | 71 (49.7) |
| Graduate school or more | 10 ( 7.0) |
| Annual household income | |
| Less than $20,000 | 75 (52.4) |
| $20,000 - $39,999 | 16 (11.2) |
| $40,000 - $59,999 | 16 (11.2) |
| $60,000 - $79,999 | 16 (11.2) |
| $80,000 or more | 20 (14.0) |
| On diabetes medication | 122 (85.3) |
| On hypertension medication | 101 (70.6) |
| On cholesterol medication | 85 (59.4) |
| Self-reported general health | |
| Poor | 44 (30.8) |
| Fair | 54 (37.8) |
| Good | 36 (25.2) |
| Very good | 9 ( 6.3) |
| Excellent | 0 ( 0.0) |

HbA1c = glycosylated hemoglobin.

Table 2

Participants Failing Treatment Goals for Coronary Heart Disease Risk Factors*

| Variable | N = 143  (%) |
|---|---|
| SBP ≥ 130 mm Hg | 61 (42.7) |
| DBP ≥ 80 mm Hg | 51 (35.7) |
| Total Cholesterol ≥ 200 mg/dL | 48 (33.6) |
| TG ≥ 150 mg/dL | 68 (47.6) |
| LDL ≥ 100 mg/dL† | 74 (53.6) |
| HDL, mg/dL | M: 37 (53.6) |
| (≤ 40 men, ≤ 50 women) | W: 45 (60.8) |
| Waist circumference‡ | M: 57 (82.6) |
| (> 90 cm men, >80 cm women) | W: 63 (85.1) |
| Waist to hip ratio | M: 52 (75.4) |
| (> 0.9 men, > 0.85 women) | W: 47 (63.5) |
| BMI ≥ 23 kg/m²§ | 116 (81.1) |
| HbA1c ≥ 7% | 84 (58.7) |
| Smoking | 23 (16.1) |

Abbreviations: SBP, systolic blood pressure; DBP, diastolic blood pressure; TG, Triglyceride; LDL, low density lipoprotein; HDL, high density lipoprotein; BMI, body mass index; HbA1c, glycosylated hemoglobin; M, men; W, women.
*Adapted from: American Diabetes Association, Clinical Practice Recommendations. *Diabetes Care.* 2006; 29(suppl 1): S4-42.

†Sample size for this variable was 138 due to 5 missing values (3 men and 2 women). When TG is above 400, LDL cannot be calculated.
‡World Health Organization Asia-Pacific Criteria, 2000.
§World Health Organization recommendation for Asians, 2002.

Table 3

Correlations Among the Main Independent Variables

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CHD Risk perception | - | | | | | | | | | |
| Age | .05 | - | | | | | | | | |
| Gender | .16 | .17* | - | | | | | | | |
| Education | -.20* | -.30** | -.43** | - | | | | | | |
| General Health | -.36** | .04 | -.14 | .18* | - | | | | | |
| Current Smoking | .01 | -.29** | -.19* | .10 | .01 | - | | | | |
| CHD knowledge | .21* | -.22* | -.01 | .20* | -.04 | .13 | - | | | |
| Diabetes medication | .05 | .09 | .07 | -.09 | -.14 | -.09 | -.09 | - | | |
| Hypertension medication | .19* | .43** | .15 | -.14 | -.17* | -.26** | -.06 | .21* | - | |
| Cholesterol medication | .04 | .33** | .00 | -.11 | -.05 | -.07 | -.03 | .14 | .34** | - |

Abbreviation: CHD, coronary heart disease.
* $P < .05$ (two-tailed)  ** $P < .01$ (two-tailed)


Table 4

Multiple Regression Analyses of CHD Risk Perception

| Source | R² | beta | sr² | df | F | p |
|---|---|---|---|---|---|---|
| Overall | .219 | | | 9,133 | 4.15 | .000 |
| Age | | .022 | .000 | 1,133 | 0.06 | .815 |
| Gender | | .041 | .001 | 1,133 | 0.22 | .643 |
| Education | | -.154 | .017 | 1,133 | 2.88 | .092 |
| Current smoking | | .039 | .001 | 1,133 | 0.22 | .637 |
| General health status | | -.304 | .084 | 1,133 | 14.19 | .000** |
| CHD knowledge | | .231 | .048 | 1,133 | 8.26 | .005** |
| Diabetes medication | | -.017 | .000 | 1,133 | 0.05 | .829 |
| Hypertension medication | | .134 | .013 | 1,133 | 2.15 | .145 |
| Cholesterol medication | | -.033 | .001 | 1,133 | 0.15 | .699 |

* $P < .05$ (two-tailed) ** $P < .01$ (two-tailed).

# CHAPTER THREE

## Glucose Control in Korean Immigrants with Type 2 Diabetes

Abstract

**Background:** Despite the rising incidence of type 2 diabetes in Korean immigrants and the importance of glucose control in reducing complications, little is known about diabetes control and factors influencing glucose levels in these individuals. **Objectives:** This study's purpose was to examine factors influencing glucose control in Korean immigrants with type 2 diabetes. **Method:** A cross-sectional descriptive study design was used. Data were collected from 143 Korean immigrant men and women with type 2 diabetes between the ages of 30 and 80. Participants completed questionnaires, a finger stick blood test for glycosylated hemoglobin (HbA1c) and anthropometric measures.

**Results:** The mean HbA1c level was 7.6 % (SD = 1.5; range = 5.6 to 12.5). Less than half of the participants (41.3%) met the American Diabetes Association's goal of less than 7%. Multiple regression analyses indicated that roughly 22% of variance in HbA1c levels was explained by a linear combination of family diet support, acculturation, body mass index (BMI), waist-to-hip ratio (WHR), the duration of diabetes, the number of diabetic medications, age, gender, and education ($R^2 = 0.223$, $F[9,133] = 4.24$; $p < .0001$). After adjusting for demographic and health variables, family diet support, WHR, the duration of diabetes, the number of diabetic medications, and age significantly influenced glucose control. **Discussion:** Findings support the positive role of family involvement in diabetes management. Patients with long-standing diabetes, higher WHR, and more diabetic medications deserve special attention because they tend to have higher HbA1c levels. Studies are needed to investigate the negative association of age with HbA1c levels observed in this population.

**Key Words:** type 2 diabetes, family, disease management, immigrant, Korean Americans

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Diabetes mellitus is a metabolic disease characterized by hyperglycemia due to impaired insulin secretion, insulin metabolism, or both (Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, 1999). Impaired insulin use rather than lack of insulin production is often associated with type 2 diabetes, which accounts for more than 90% of diabetic cases in the United States and most industrialized countries (Mann, 2002). In 2005, the estimated prevalence of diabetes among adults in the United States was 9.6 %, and the incidence is on the rise (National Institute of Diabetes and Digestive and Kidney Diseases, 2005).

Following the national trend, the incidence of type 2 diabetes among Asian Americans and Pacific Islander (AAPI) groups is rapidly rising (Joslin Diabetes Center, 2004). Koreans are the fifth largest AAPI group and constitute 12% of that population (U.S. Census Bureau, 2000). Although national statistics on the prevalence of type 2 diabetes in Korean immigrants are not available, the prevalence of type 2 diabetes in Korean immigrants in Hawaii is estimated to be at least twice that of the White population (Joslin Diabetes Center, 2004). An epidemiological study conducted in the Baltimore area reported that the incidence of diabetes in elderly Korean American men was higher than in any other ethnic group, including Blacks and Hispanics (Kim, Juon, Hill, Post, & Kim, 2001). In Korea, diabetes affects about 7.2% of Korean adults over 30 years of age, and most cases are type 2 diabetes (Sung, Sung, Kim, & Kim, 2001).

Despite the rising incidence and significant impact of glucose control on diabetes-related complications in type 2 diabetes (United Kingdom Prospective Diabetes Study Group, 1998), information on Korean immigrants with type 2 diabetes is scarce. And, even less is known about bio-behavioral and psychosocial factors that influence the

optimal management of diabetes in this population. Recent studies of other ethnic groups, however, suggest that family support, acculturation, and certain demographic and health variables, such as anthropometric measurements, may play a significant role in maintaining adequate glucose control in individuals with type 2 diabetes.

Family members create a shared social reality that is linked to health (Kleinman, Eisenberg, & Good, 1978). Behaviors that influence health are strongly influenced by families. Lifestyle behaviors (e.g., diet, exercise, and smoking) and health care behaviors (e.g., adherence to a medical regimen) are usually developed, maintained, or changed within the family setting (Campbell, 2003). The family environment has particular relevance for patients with type 2 diabetes because behaviors, such as food preparation and exercise monitoring, are the mainstays of disease management, and these behaviors evolve through or take place within the family setting (Hauser, 1990). Family members' responses to the disease and to disease management can affect a patient's self-care behavior (Fisher & Weihs, 2000).

Research on familial influence on diabetes management in adults with type 2 diabetes is limited because most research has studied children and adolescents with type 1 diabetes (Fisher & Weihs, 2000). And, research on the family's role in type 2 diabetes management in Asian immigrants is extremely limited (Esperat, Inouye, Gonzalez, Owen, & Feng, 2004). Published studies of various ethnic populations that have examined the relationships between family support, self-care behavior, and metabolic control in adults have reported mixed results. Some studies have shown that strong family support appears to have a positive impact on glycemic control and self-care behaviors (Fisher et al., 2004; Ilias, Hatzimichelakis, Souvatzoglou, Anagnostopoulou, & Tselebis, 2001; Wen,

Shepherd, & Parchman, 2004), whereas other studies have found no relationship (Chyun et al., 2006; Gleeson-Kreig, Bernal, & Woolley, 2002). Although these studies provide evidence for the family's influence on diabetes self-care and management, not one has examined the direct effect of diabetes-specific family support on clinical outcome, as measured by glycemic control in ethnic minorities.

Family relationships are vital in the Korean culture. As with Chinese people, Koreans adhere to traditional Confucian principles of family organization that view harmony as the source of family well-being. Filial piety plays a significant role in care-giving practices, and adult children have an obligation to care for their ill parents. Koreans are taught to be self-sufficient and to seek help only from within the family if they cannot cope with a situation on their own (Uba, 1994). Although socioeconomic conditions may redefine the role of each family member and cause changes in the traditional family structure and dynamics (Kim & Theis, 2000), a family is hypothesized to be a strong influence in Korean immigrants because their culture values familial and group collectivism., To date, however, little is known about the direct role of family support in glycemic control in this family-oriented group.

When people immigrate to a new country, their risk of disease gradually shifts to resemble that of the native residents (Gomez, Kelsey, Glaser, Lee, & Sidney, 2004). This shift in disease risk may result from changes in health beliefs and behaviors that occur as immigrants assimilate the health practices of the new country (Unger et al., 2000). Acculturation, defined as the process by which foreign-born individuals adopt the values, beliefs, norms, attitudes, and behaviors of the mainstream culture (Suinn, 1998), has been examined as an explanatory variable in a variety of health conditions in studies of ethnic

minorities, including type 2 diabetes. Although findings indicate that significant changes in diabetes risk and behavior are associated with acculturation (Kandula, Kersey, & Lurie, 2004; Salant & Lauderdale, 2003; Singh & Miller, 2004), the direction of the relationship is inconsistent throughout the studies. For example, less acculturated Arab Americans and Mexican Americans are generally at greater risk of diabetes than those with greater acculturation (Hazuda, Haffner, Stern, & Eifler, 1988; Jaber, Brown, Hammad, Zhu, & Herman, 2003), though more acculturation is associated with increased risk of diabetes in Japanese Americans (Gomez et al., 2004; Huang, Rodriguez, Burchfiel, Chyou, & Curb, 1996). Acculturation is not associated with diabetes self-care and management in elderly Mexican American and Chinese American patients with type 2 diabetes (Fisher et al., 2004; Wen et al., 2004). Although no such study has been done in diabetic Korean immigrants, a few epidemiological studies indicate that acculturation is associated with obesity, lack of physical activity, diet, and smoking behaviors in Korean Americans (Lee, Sobal, & Frongillo Jr, 2000; Song et al., 2004).

Many biological parameters have been suggested to predispose an individual to type 2 diabetes, including obesity. Although earlier studies do not show a link between diabetes and obesity in Asians, their findings are attributed to a lack of consideration for ethnic variation in anthropometric criteria for obesity (Park et al., 2005; Yoshiike, Matsumura, & Zaman, 1998). When the definition of obesity was corrected for ethnicity and the criteria lowered for Asians, studies found a strong association between body mass index (BMI) and glucose level (Chang et al., 2004; Sung et al., 2001). Although a recent epidemiological study reports that both BMI and waist-to-hip ratio (WHR) measures were positively associated with diabetes risk in nondiabetic individuals (Schulze et al.,

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2006), it has not been ascertained if these measures continue to predict glucose control in people with type 2 diabetes.

The purpose of this study was to describe the level of diabetes control, examine potential correlates of glucose control (family support, acculturation, BMI, WHR, years with diabetes, the number of diabetic medications, age, gender, and education) and to test the association between selected correlates and the level of glucose control in Korean immigrants with type 2 diabetes.

<div align="center">Research Design and Methods</div>

This cross-sectional descriptive study enrolled a convenience sample of 143 immigrant Korean men and women with type 2 diabetes between 30 and 80 years of age. Subjects were recruited with flyers and posters from a variety of community sites in a West Coast Koreatown, including two health center clinic waiting areas, pharmacies, and shopping malls. The subjects were self-identified as Korean-born immigrants with a diagnosis of type 2 diabetes for at least a year and able to speak, read, and write in Korean or English. The study was approved by a university institutional review board, and all participants provided written informed consent.

<div align="center">*Procedures*</div>

After obtaining study consent, participants were asked to complete questionnaires (e.g., demographic and health history, the Short Acculturation Scale for Koreans, and the Diabetes Family Behavior Checklist – II) in either English or Korean according to their preference. Upon completing the questionnaire, a participant was given a finger stick blood test to assess his or her level of glycosylated hemoglobin (HbA1c) and was measured to calculate BMI and WHR. HbA1c levels were obtained by the researcher or a

staff nurse at one of the study sites using standardized procedures. When data collection was completed, participants were given the results of their HbA1c and anthropometric measures.

<div align="center">*Measures*</div>

*Glycosylated Hemoglobin: The Dependent Variable*

The HbA1c level was measured from a finger stick sample of whole blood by the A1c Now Inview (Metrika, Sunnyvale, CA), an instrument certified by the National Glycohemoglobin Standardization Program. HbA1c was also obtained from those patients who were recruited at a health center and who offered their recorded HbA1c levels for the study. Because the clinic uses the same instrument (A1cNow Inview) as this study and these values were recorded by the clinic staff, participant-provided results were used if they were less than 3 months old instead of doing new finger stick tests.

*Independent Variables*

Three sets of independent variables were established for this study: family support, acculturation, and demographic and health variables.

*Family support.* Family support was measured by the Diabetes Family Behavior Checklist-II (DFBC; Glasgow & Toobert, 1988). The scale was developed to assess supportive and nonsupportive family behaviors specific to diabetes on a five-point Likert-type scale in the following areas: medication compliance, glucose testing, exercise, and diet. Scores can be calculated in several ways: a supportive summary score, a nonsupportive summary score, and regimen-specific composite scores. Previous studies indicate that subscales are stronger predictors of their respective areas of regimen adherence than either the overall supportive or nonsupportive summary score (Glasgow

& Toobert, 1988). This study used two regimen-specific subscales (diet and exercise) to assess diabetes family support because these are the mainstay of diabetes management. Nonsupportive items in these subscales were reverse coded, summed for total subscale scores, and then averaged to obtain mean scores. Higher scores indicate a stronger perception of supportive interaction.   The internal consistency (Cronbach's alpha) of this sample was .59 for the diet subscale and .76 for the exercise subscale.

*Acculturation*. Acculturation was measured with a Korean translation of the Short Acculturation Scale for Hispanics (Marin, Otero-Sabogal, & Perez-Stable, 1987). This 12-item scale has a five-point Likert-type format and measures acculturation in three domains: language, media, and ethnic social relations. The possible total score ranges from 12 to 60. The mean score can be used as an interval scale, where scores close to 5 indicate *high levels of acculturation and* those close to 1 indicate *little acculturation*. The scale has been widely used in health care research with Hispanic populations and has a reported reliability of .92 in that population (Marin et al., 1987). To the best of the researchers' knowledge, it has not been used in a Korean sample. Internal consistency (Cronbach's alpha) for this study sample was .93.

*Demographics and health variables.* Information on age, gender, education, years with diabetes, and the number of diabetic medications was obtained from a patient's self-report on the questionnaire. To determine BMI and WHR, height, weight, waist and hip circumferences were measured. Height was measured in centimeters - without shoes - using a nonstretching measuring tape secured to the wall. Weight was measured in kilograms by a professional body-weight scale; participants wore light clothing and no shoes or belongings (e.g., keys and cell phones). BMI was calculated using the formula

BMI = kg/m$^2$. Waist circumference was measured in centimeters by placing a nonstretching measuring tape in a horizontal plane around the bare abdomen at the top of the iliac crest or just above the hip bone. The reading was taken at the end of an expiration, making sure that the tape was secure but not too tight. The hip measurement was taken at the point yielding maximum circumference over the buttocks. WHR was calculated by dividing the waist measurement by the hip measurement.

*Translation of Instruments*

For this study, the Short Acculturation Scale for Hispanics (English version) and the DFBC were translated into Korean by the lead author and then back-translated into English by a bilingual graduate student nurse using techniques suggested by Brislin (1986). Any discrepancies were resolved by the consensus of three bilingual Korean immigrants – two health care professionals and a volunteer translator at a medical center near the Korean community. The instrument was pilot tested with five diabetic patients in the same Korean community sites as the study population to determine if there were major problems with the instrument, such as the wording of the questions and instructions or the Korean translation. There were a few problems with the exact translation of some of words into Korean. For example, translating the words *nag, criticize*, and *congratulate* on the DFBC into Korean was difficult. Based on the feedback of the pilot-test participants, the three bilingual reviewers debated whether to translate these words broadly and decided to use "jan-so-ri" for both nag and criticize and "ching-chan" for congratulate. Although these words mean "small complaints" and "praise" when back-translated into English, it was agreed that the meanings of these words in Korean are closer to those in the scale's original version and better understood by participants.

*Statistical Analyses*

Descriptive statistics provided information on the variables in this study. Bivariate analyses were conducted to evaluate the relationship between the independent variables and HbA1c. Independent variables were examined for multicollinearity. To address this study's research question, a multiple linear regression was done in which the level of glucose control, measured by HbA1c, was the dependent variable and family support, acculturation, BMI, WHR, the number of years with diabetes, the number of diabetic medications, age, gender, and education were the independent variables. First, the overall $R^2$ of the complete model was examined for significance. If the overall model was significant, the unique contribution of each separate independent variable in explaining the variance in HbA1c was tested. Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 12.0 (SPSS Inc., Chicago, IL).

Results

Of the 150 interested subjects who met the inclusion criteria, 7 declined participation. Their reasons included "not having enough time for the entire study," "want to do blood test only," and "need to talk with family first." A total of 143 patients participated in the study, and all preferred the Korean version of the questionnaire. The demographics of the sample are shown in Table 1. The sample was 51.7% women and the mean age was 62.4 years (SD = 12.8; range = 30 to 80). Over one half were married and had higher than a college education. The mean duration of living in the United States was 21.7 years (SD = 9.2), and the mean duration of diabetes was 6.8 years (SD = 6.2).

*Glucose Control*

The mean HbA1c level was 7.6 % (SD = 1.5; range  5.6 to 12.5; see Table 2).

Less than half of the participants (41.3%) achieved the American Diabetes Association's

(ADA) goal of less than 7% and only 23.1% reached the American Association of

Clinical Endocrinologists' goal of less than 6.5%. Most were taking oral medication for

glucose control (85.3%) and about one third (33.6%) of the participants were taking more

than two drugs. Eleven of those on oral medication (9%) were also on insulin.

*Family Support, Acculturation, and Anthropometric Characteristics*

The family member in most frequent contact with a patient was his or her spouse

(62.2%), followed by children (27.3%), and siblings and others (10.5%). More than one

third (40.6%) indicated that the family member with whom they had the most contact had

little or no understanding of their diabetes management. The mean scores for diet-specific

family support, exercise-specific family support, acculturation, BMI, and WHR are

shown in Table 2. Diet family support scores indicate a higher perception of supportive

interaction than exercise-support scores, although both indicate a moderate level of

supportive interaction. The acculturation total mean score indicates a lower level of

acculturation. According to the World Health Organization's suggested BMI for Asians

(Steering Committee of the WHO, 2000) and the BMI classifications Sung et al. (2001)

used in their recent Korean epidemiologic study, 45.4% of the sample in the current study

was overweight (BMI 23 or above) and 35.7% was obese (BMI 27 or above).

*Correlations Between Independent and Dependent Variables*

The independent variables in the model included family support, acculturation,

BMI, WHR, the duration of diabetes, the number of diabetic medications, age, gender,

and education. Of these variables, bivariate correlations between family diet support, the

duration of diabetes, WHR, and the number of diabetic medications were significant. The correlations between the independent variables and the dependent variable are shown in Table 3.

*Multiple Regression Analyses*

Multivariate linear regression analyses were conducted to examine the association of independent variables with the dependent variable (HbA1c). The independent variables were DFBC-II diet support, acculturation, BMI, WHR, duration of diabetes, the number of diabetic medications age, gender, and education. The linear combination of these variables in the model was significantly related to the level of HbA1c ($R^2 = 0.223$, F [9,133] = 4.24; $p < .0001$). The $R^2$ of 0.223, indicates that the model explained 22.3% of the total variance in HbA1c. After adjusting for the other variables in the model, diet family support, duration of diabetes, WHR, age, and the number of diabetic medications were significant predictors of glucose control. Longer duration of diabetes, higher WHR, and a greater number of diabetic medications were associated with higher levels of HbA1c, though stronger perceptions of positive family support with diet and older age were associated with lower levels of HbA1c. The result of the regression analysis is presented in Table 4.

Discussion

The purpose of this study was to describe the level of diabetes control and to examine factors influencing glucose control in Korean immigrants with type 2 diabetes. According to ADA guidelines, glucose control was suboptimal. The study suggests that diet family support, WHR, duration of diabetes, the number of diabetic medications, and age were important determinants of glucose control in this group.

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Glucose control observed in this study is consistent with recent studies. The mean HbA1c level (7.6%, SD = 1.5, range = 5.6-12.5) was similar to Fisher et al.'s (2004) finding in Chinese American patients with type 2 diabetes (7.4%, SD = 1.3, range = 4.5 to 11.9). The samples in these two studies were comparable in age, duration of residency in the United States, years with diabetes, and proportion of the sample using insulin. In comparing glucose control with the findings of Chyun et al. (2006), however, in which the study sample was predominantly White, fewer participants in this study met the ADA goal of < 7% (41% vs. 55%).

Family support specific to diet was found to have a significant positive influence on glycemic control in Korean immigrants with type 2 diabetes. This finding contradicts two recent studies that investigated the relationship between family context and glycemic control. Fisher and colleagues (2004) found that couple emotion management was not significantly related to HbA1c in a sample of Chinese immigrants with type 2 diabetes. Another study found that higher levels of family coherence in Hispanic American patients predicted negative changes in glucose control (Chesla et al., 2003). The differences in results between these studies and the present study could be related to the different domains of family support that were measured.

Using a measure of family support specifically developed for diabetes, this study provides evidence for and demonstrates the importance of diet family support in the optimal management of type 2 diabetes in Korean immigrants. Health care providers working with this population should consider involving families in diabetes care, especially in diet management. Further research to investigate other areas in which family support can be effective in glycemic control may be beneficial.

With respect to anthropometric measures, the average BMI in this study (25.8 ± 3.2) was higher than 24.9 ± 0.5 in Japanese Americans with type 2 diabetes (McNeely et al., 2001) and 25.0 ± 2.8 in Chinese Americans with type 2 diabetes (Fisher et al., 2004). The average WHR in this study (0.89 ± 0.05) was lower than that for Hispanics (0.93 ± 0.06) and European Americans (0.95 ± 0.09; Fisher et al., 2000), but higher than Japanese Americans (0.87 ± 0.01; Nakashima et al., 2006). No studies on Korean immigrants with type 2 diabetes were available for comparison. This finding, however, suggests that Korean immigrants with type 2 diabetes are more likely to be obese than other Asian immigrants and thus more likely to have difficulty controlling their HbA1c.

WHR has been shown to be a better predictor for diabetes and atherosclerosis than BMI and is emerging as an effective anthropometric measure to assess the risk for these diseases (Schulze et al., 2006). In Asian populations, WHR is positively associated with blood pressure and percent body fat and shows better predictive power than BMI (Sakurai et al., 2006; Yang et al., 2006). But there have been no investigations to determine if anthropometric measures predict glycemic control in those individuals already diagnosed with type 2 diabetes. In this study, WHR performed better than BMI in predicting the level of glucose control in type 2 diabetic Korean immigrants. Future studies examining which anthropometric measure is the most sensitive indicator of glucose control in this population may help clinicians to identify diabetic individuals who may require more intensive management.

Age was another important predictor of HbA1c but was inversely associated with the HbA1c level. Based on the lead investigator's field experience and previous epidemiologic studies that have shown that Korean Americans have the highest uninsured

rate among Asian Americans and Pacific Islanders (Frisbie, Cho, & Hummer, 2002), it is possible that few younger people can afford medical care for their diabetes until age 65, when they become Medi-Care eligible. In fact, another study has found that middle-aged Korean Americans (mean 42.4) were least likely to visit physicians among Asian Americans (Frisbie, Cho, & Hummer, 2002). Thus, many young diabetic individuals may turn to pharmacies, health food stores, or the internet for self-treatment instead of seeking proper medical care, resulting in poor glucose control. Because this study was conducted in a West Coast Koreatown where a number of clinics and Korean-speaking providers are available, language or cultural barriers are less likely to be reasons for limited access to care.

Busy work and family schedules may explain why younger, asymptomatic, diabetic Korean immigrants are not seeking diabetic care as recommended. And, psychosocial factors – differing perceptions of illness from older people or denial - may affect how well younger people adhere to recommended care. The inverse relationship of age with HbA1c levels observed in this study deserves further investigation for potential variables that may influence the negative relationship. Meanwhile clinicians working with Korean immigrants with type 2 diabetes should work closely with younger patients to achieve optimal glucose control in this group.

In this study, acculturation was not linked to glucose control. Despite the average time of residency in the United States, the overall acculturation level in this sample was low, as reflected by the participants' mean scores on the acculturation scale and by their infrequent use of English (all participants completed the Korean-version of the questionnaire). This finding is consistent with Kim and Chan's study (2004) that reported

low level of acculturation in Korean Americans residing in East Coast Korean American communities with an average of 9.9 years (SD = 7.2) of residency in the United States. Low level of acculturation was also found in Chinese Americans with type 2 diabetes who have lived in the United States an average of 20.7 years (SD = 13.0; Fisher et al., 2004). Acculturation in both studies was measured by the Suinn-Lew Asian Self-Identity Acculturation Scale (Suinn, 1998). These findings, however, suggest that health care providers cannot expect the number of years lived in the United States to indicate a patient's acculturation level based on scale response.

Several limitations of this research should be noted. First, the study design is cross-sectional; thus, causality cannot be determined. Second, the study used a convenience sample from community settings in a West Coast Koreatown, thus, results may not be generalizable to Korean immigrants living in other areas of the country. Third, the acculturation scale used in this study was the first in this population. It is possible that the scale did not capture the domains of acculturation that are considered important in Koreans, and this may have influenced the study's outcome. Finally, due to difficulty recruiting younger subjects, the sample was over-represented by people older than 65. Thus, generalizing findings from this study to younger age groups may not be appropriate.

<div align="center">Conclusion</div>

This study provides information on glucose control and factors influencing HbA1c levels in Korean immigrants with type 2 diabetes. To the lead researcher's knowledge, no such data have been published on this group despite the increasing incidence of type 2 diabetes in the immigrant Korean community. Diabetic Korean

immigrants who are younger, taking more diabetic medications, have had diabetes longer, have higher WHR, and less family support with their diet management deserve special attention because their diabetes tends to be less well- controlled. And, this study's findings lend strong support to the development and evaluation of family involvement with diet management in Korean immigrants with type 2 diabetes as an effective way of improving glucose control.

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Table 1

*Characteristics of the Study Sample*

| Characteristic | Mean ± SD |
|---|---|
| Age | 62.4 ± 12.8 |
| Years in the United States | 21.7 ± 9.2 |
| Years with diabetes | 6.8 ± 6.2 |
| **Characteristic** | **N (%)** |
| Gender | |
|    Females | 74 ( 51.7) |
|    Males | 69 ( 48.3) |
|    Total | 143 (100.0) |
| Marital status | |
|    Married | 88 ( 61.5) |
|    Living with a partner | 5 ( 3.5) |
|    Divorced or separated | 16 ( 11.2) |
|    Widowed | 26 ( 18.2) |
|    Never married | 8 ( 5.6) |
|    Total | 143 (100.0) |
| Household status | |
|    Lives alone | 31 ( 21.7) |
|    Lives with spouse or partner | 71 ( 49.7) |
|    Lives with spouse or partner and children | 20 ( 14.0) |
|    Lives with married children and grandchildren | 21 ( 14.7) |
|    Total | 143 (100.0) |
| Educational level | |
|    Elementary school or less (grades 0 to 6) | 20 ( 14.0) |
|    High school (grades 7 to12) | 42 ( 29.4) |
|    College or university | 71 ( 49.7) |
|    Graduate school or more | 10 ( 7.0) |
|    Total | 143 (100.0) |
| Annual household income | |
|    Less than $ 20,000 | 75 ( 52.4) |
|    $ 20,000 - $ 39,999 | 16 ( 11.2) |
|    $ 40,000 - $ 59,999 | 16 ( 11.2) |
|    $ 60,000 - $ 79,999 | 16 ( 11.2) |
|    $ 80,000 or more | 20 ( 14.0) |
|    Total | 143 (100.0) |

Table 2

*Means, Standard Deviations, and Obtained Range of Scores for Main Study Variables*
*(N = 143)*

| Variables | Mean | SD | Min | Max |
|---|---|---|---|---|
| HbA1c | 7.59 | 1.45 | 5.6 | 12.5 |
| DFBC diet | 3.28 | 0.53 | 2.00 | 4.75 |
| DFBC exercise | 2.92 | 0.63 | 1.67 | 4.67 |
| Acculturation | 1.56 | 0.56 | 1.00 | 3.08 |
| BMI | 25.8 | 3.2 | 18.6 | 36.4 |
| WHR | 0.89 | 0.05 | 0.77 | 1.06 |
| Years with diabetes | 6.78 | 6.21 | 1 | 30 |
| Number of diabetic medications | 1.22 | 0.80 | 0 | 4 |

HbA1c = glycosylated hemoglobin, DFBC = Diabetes Family Behavior Checklist, BMI = body mass index, WHR = waist-to-hip ratio

Table 3

*Correlations Among the Main Study Variables*

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.HbA1c | - | | | | | | | | | | |
| 2.DFBC diet | -.17* | - | | | | | | | | | |
| 3. DFBC exercise | -.14 | .26** | - | | | | | | | | |
| 4. Acculturation | -.04 | .09 | .04 | - | | | | | | | |
| 5. BMI | -.09 | .14 | .09 | .12 | - | | | | | | |
| 6. WHR | .18* | .20* | .06 | .11 | .30** | - | | | | | |
| 7.Years with diabetes | .22** | -.06 | .05 | -.09 | .02 | .19* | - | | | | |
| 8.Number of diabetic medications | .27** | .00 | -.13 | -.10 | .05 | .09 | .25** | - | | | |
| 9. Age | -.16 | -.03 | -.07 | -.48** | -.06 | -.10 | .21* | .01 | - | | |
| 10. Gender | -.05 | -.20* | -.17* | -.15 | -.13 | -.60** | -.14 | .12 | .17* | - | |
| 11. Education | -.04 | .12 | .18* | .47** | .09 | .19* | .05 | -.09 | -.30** | -.43** | - |

HbA1c = glycosylated hemoglobin, DFBC = Diabetes Family Behavior Checklist, BMI = body mass index, WHR = waist-to-hip ratio, DFBC Diet and DFBC Exercise are subscales of the Diabetes Family Behavior Checklist. High scores on DFBC diet and DFBC exercise indicate supportive interaction with the family.
* $p < .05$ (two-tailed).  ** $p < .01$ (two-tailed).


Table 4

*Multiple Regression Analyses*

*Dependent Variable: HbA1c*

| Source | R² | beta | sr² | df | F | *p* |
|---|---|---|---|---|---|---|
| Overall | .223 | | | 9,133 | 4.24 | .000 |
| DFBC diet | | -.170 | .027 | 1,133 | 4.58 | .034* |
| Acculturation | | -.097 | .006 | 1,133 | 1.02 | .316 |
| BMI | | -.142 | .018 | 1,133 | 3.10 | .081 |
| WHR | | .226 | .029 | 1,133 | 4.93 | .028* |
| Years with diabetes | | .180 | .027 | 1,133 | 4.54 | .035* |
| Number of diabetic medications | | .194 | .033 | 1,133 | 5.62 | .019* |
| Age | | -.266 | .050 | 1,133 | 8.53 | .004** |
| Gender | | .043 | .001 | 1,133 | 0.16 | .687 |
| Education | | -.055 | .002 | 1,133 | 0.33 | .570 |

DFBC = Diabetes Family Behavior Checklist, BMI = body mass index, WHR = waist hip ratio, DM = diabetes mellitus

* $p < .05$ (two-tailed), ** $p < .01$ (two-tailed)

**CHAPTER FOUR**

**Effects of Acculturation on Smoking Behavior in Asian Americans:**

**A Meta-Analysis**

Abstract

**Background:** Cigarette smoking is the most preventable risk factor for many negative health consequences, such as cancer, heart disease, and lung disease. In the United States, the prevalence rate in Asian immigrants is high (26% to 70%), with Southeast Asian men having the highest rate. Acculturation has been associated with smoking behavior in this ethnic group. **Objective:** The purpose of this meta-analysis is to describe the extent to which acculturation affects smoking behavior in Asian immigrants and to compare the direction and magnitude of the effect between subgroups by gender and age. **Methods:** Databases within PubMed, CINAHL, The Cochrane Library, and PsycINFO were searched. Twenty-one studies published in English or Korean from 1994 through 2005 met criteria, and 9 of these studies contained sufficient data. Among the 9 studies, 3 presented gender-specific data; thus, these studies were entered separately for men and women, making a total of 12 entries for final analysis. The odds ratio was used as an effect size statistic. The values of odds ratios were calculated from data in the studies. **Results:** The average effect size for men was 0.53, indicating that acculturated men are 53% less likely to smoke than nonacculturated or "traditional" men. The average effect size for women was 5.26, suggesting that acculturated women are 5 times more likely to smoke than traditional women. In adolescents, the average effect size was 1.92, indicating that acculturated adolescents are almost 2 times more likely to smoke than traditional adolescents. **Conclusions:** Acculturation may have a protective effect on smoking behavior in Asian men and a harmful effect in Asian women and adolescents. The magnitude of effect is larger in women and adolescents than in men. Smoking cessation programs should target acculturated women, adolescents, and traditional men.

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Smoking is the leading preventable cause of death in the United States and is associated with many negative health outcomes, such as cancer, heart disease, and lung diseases.[1] Although a recent national survey conducted in English in the United States indicates that Asians have the lowest reported smoking prevalence among major racial-ethnic groups (17.8 % for men and 4.8% for women ),[2] regional studies using group-appropriate languages have suggested higher rates of tobacco use among Asian American populations. According to these studies, smoking rates among Asian American men ranged from 26% in South Asian men to more than 70% in Cambodian and Laotian men; among Asian American women the smoking rates ranged from 1 % to 7 %, with a substantially higher rate in a Cambodian sample.[3]

Acculturation is the process by which foreign-born individuals adopt the values, customs, norms, attitudes, and behaviors of the mainstream culture.[4, 5] Many studies of ethnic immigrant populations have posited that acculturation influences health outcomes. The findings suggest, however, that the direction of acculturation effects may vary among ethnic groups and specific health conditions. Several studies have examined the relationship between acculturation and health behaviors in Asian Americans. Acculturation was positively associated with exercise in Korean Americans, but negatively in Japanese Americans.[6-8] In contrast, acculturation was positively associated with dietary fat intake in all Asian groups studied.[7, 9-12]

Interest in the effects of acculturation on tobacco use among Asian Americans is increasing with reports of high prevalence and the recognition that smoking is a major health concern in this growing population.[13] Studies that examined the relationship

between acculturation and smoking behavior indicate that more acculturated Asian men were less likely and more acculturated women more likely to smoke.[8, 14-17] Studies also suggest that more acculturated Asian adolescents are more likely to smoke.[19, 20]

Using scale and nonscale measures, these studies used various methodological approaches to measure acculturation. Scales are based on theoretical models and are designed to yield one summary measurement of an underlying construct. Nonscale measures, such as language, place of birth, and age at immigration, used individually or in combination, assess separate dimensions of acculturation. As Salant and Lauderdale [18] observe in their review of the studies of acculturation and physical health, acculturation is predominantly conceptualized as a linear and unidirectional cultural change. This view is also reflected in measures used in the studies under review.

Using the Suinn-Lew Asian Self-Identity Acculturation Scale (SL-ASIA) and place of residence, Song et al [8] reported that acculturation was strongly positively associated with smoking in Korean American women. When compared to women in Korea, acculturated Korean American women had almost 3 times the rate of smoking. In the same study, however, smoking was significantly lower among Korean American male immigrants (31%) than among men in Seoul, South Korea (62%). Another study that used the SL-ASIA reported that younger Korean American men and women were more likely to be smokers.[14]

Findings were similar and consistent in studies that used nonscale measures. Tang et al[17] reported that increased English proficiency seems to reduce smoking prevalence rates among Asian men but had the opposite effect among Asian women. Unger et al [19] reported that English language use was associated with an increased risk of lifetime

smoking in Asian American adolescents in California. Chen et al [20] also reported high levels of acculturation among Asian American youth as measured by English/native language use and the age of immigration to the United States, both of which are associated with higher smoking prevalence rates. Using place of birth alone as an acculturation indicator, Maxwell and colleagues [21] reported that smoking rates were higher among foreign-born than U.S.-born men; the opposite effects were observed among Asian women.

Although these individual studies provide evidence for the influence of acculturation on smoking behavior in Asian American subgroups, and the evidence was consistent about the direction of the relationship within the groups of men, women, and adolescents, the overall strength of the relationships has not been examined. Clinicians working with Asian Americans need to know the effects of acculturation on smoking behavior to identify individuals at risk of starting or continuing to smoke and to develop culturally appropriate prevention or intervention plans. By using effect size statistics, meta-analysis, a systematic approach to identifying, appraising, and synthesizing the results of relevant studies, enables an investigator to compare the effect of the findings among studies and to summarize their research results into useful clinical information.[22, 23] Thus, the purpose of this meta-analysis is to summarize the extent to which acculturation is associated with smoking behavior in Asian American men, women, and adolescents and to compare the direction and magnitude of the effect among these groups.

**Methods**

*Literature Search and Study Selection*

Databases in PubMed, CINAHL, The Cochrane Library, and PsycINFO were searched

using the following key words: acculturation, smoking, tobacco, and Asian, Asian

American, and Asian immigrants in combination.  Studies, published in English or

Korean (the first author's native language), were included that measured acculturation

and smoking in the Asian American population. The initial search yielded 21 studies, of

which 11, including 1 foreign article in the Yonsei Medical Journal, met the inclusion

criteria. Qualitative studies, studies of Pacific Islander populations, review articles,

commentaries, case reports, research methodology papers, and multiple publications

using the same data set, were excluded.  On subsequent examination, 2 eligible studies [5, 7]

were excluded because effect size calculation with their data was not feasible. A total of 9

cross-sectional studies were included in this meta-analysis.  These studies are

summarized in the Table.

*Quality Assessment*

The first author assessed the quality of the studies with a study-quality scoring tool

modified from the work of Taylor-Piliae and Froelicher.[24]  Ten criteria were appraised on

a 4-point scale, (0 = absent, 1 = low, 2 = medium, 3 = high), to determine a study-quality

score. The criteria included study design, sample selection, description of the independent

variable (acculturation) and dependent variable (smoking), appropriate statistics, and

presentation of data. Possible scores ranged from 0 to 30. Any study with a quality score

below 67% (< 20) of the total possible score was eliminated from this analysis.

*Data Abstraction and Calculations of Effect Size*

Using the data abstraction form developed for this meta-analysis, information from the 9

studies was extracted to record study sample characteristics, the independent variable

(acculturation), the outcome variable (smoking rate/prevalence), results, and statistical

methods. The odds ratio was used as an effect size statistic in this meta-analysis. In the

design of research studies, effect size is important for power calculations and helps

clinicians and researchers understand the magnitude and direction of a relationship.[25, 26]

Cohen[25] has previously presented guidelines for assessing effect sizes. For the odds ratio,

an effect size of 1.50 is judged to be a small effect, 2.50 is a medium effect, and 4.30 is a

large effect.[25] Odds ratios of less than 1 indicate a protective effect.

Odds ratios represent estimated effect sizes for the individual studies, with the

odds ratio in this meta-analysis representing the ratio of the odds of smoking in the

acculturated group relative to the odds of smoking in the traditional group. The values of

the odds ratios and 95% confidence intervals (CI) were calculated from each study's data

using Excel Spreadsheet software[*]. When data on frequencies could not be obtained, the

effect measure was extracted along with its CI. The following formula was used:

|  | Acculturated | Traditional | Total |
|---|---|---|---|
| Smoking | a | b | a + b |
| Nonsmoking | c | d | c + d |
| Total | a + c | b + d | N |

$$\text{Odds ratio} = ad\,/\,bc$$

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[*] Moore, D: Meta-Analysis Workbook. Department of Epidemiology and Biostatistics, University of California, San Francisco; 1999.

The studies included in this meta-analysis had already dichotomized acculturation (acculturated vs traditional) for their analyses and presentations of results using operational definitions or cut points. Continuous acculturation measures, such as length of stay in the United States, were dichotomized using cut points established by the study's authors (eg, those living in the United States more than 10 years were categorized as acculturated). For a scale measure, Song et al [8] used cluster analysis to determine acculturated and traditional groups. Thus, this meta-analysis followed the definition or cut point set by each study to determine acculturated and traditional groups.

**Results**

*Descriptive Data from Studies in Meta-Analysis*

Quality scores ranged from 23 to 28 (mean = 25.3, SD = 1.8); thus no studies were excluded based on their quality. Each study's purpose was clearly defined in the meta-analysis. Sample sizes ranged from 311 to 5822 subjects, and data were obtained from a self-administered questionnaire[15, 16, 19, 27] or from a telephone interview. With the exception of the adolescent studies, smoking prevalence was based on current smokers who were defined as individuals who reported that they had smoked at least 100 cigarettes in their lifetime and were currently smoking.[2] In adolescent studies, lifetime smoking prevalence was used instead, which was defined as ever smoked a whole cigarette[20] or ever tried cigarette even a few puffs.[19] Three studies[8, 15, 28] measured acculturation with a scale, and 6 studies used a nonscale measure of acculturation. Among nonscale measures, language (eg, English proficiency, language used at home) was used in 5 studies and length of stay in the United States was used in 1 study.[16]

Although a process, acculturation was categorized and treated as a state (eg, acculturated vs traditional) in these studies.

*Effects of Acculturation on Smoking*

Results from this meta-analysis are summarized in the Table. Three studies [8, 15, 17] presented gender-specific data; thus, these studies were entered separately, making a total of 12 entries. Overall, there was no significant difference in the prevalence of cigarette smoking between acculturated and traditional Asian Americans, as shown in the Figure by the average effect size (effect size = 0.98; CI = 0.53, 1.81; random effects model). Effect sizes were similar within the groups of Asian men, women, and adolescents. There were, however, noticeable effect size differences between these groups. The average effect size for men indicated that acculturated men are 0.53 times less likely to smoke than traditional men. The average effect size for women suggested that acculturated women are more than 5 times more likely to smoke than traditional women. In adolescents, the average effect size indicated that acculturated adolescents are almost 2 times more likely to smoke than traditional adolescents.

The Figure illustrates effect sizes as odds ratios. Six studies were statistically significant with 95% CI that excluded 0. With the exception of Song,[8] all studies of men lined up on the left side of the reference line (drawn over 1 on the x axis), suggesting that acculturation in Asian American men is associated with less risk for smoking. Women and adolescents clustered on the right side of the reference line, indicating acculturation may have the opposite effect for women and adolescents. The risk of smoking is highest in women, followed by adolescents. Effect size lines moved toward the center and to the

right when men and women were studied together, indicating that the protective effect of acculturation in men was attenuated by the negative effect in women.

The studies of women and adolescents also show greater variability of effect size than male-only studies, as evidenced by wide CIs. Considering that the studies of women used the same research design and methods as their counterparts in the studies of Song,[8] Fu,[15] and Tang,[17] this wide range of variation may indicate that there are true gender differences in the direction and magnitude of acculturation's effect on smoking behavior among Asian Americans. The studies of adolescents used different definitions of smoking than the adult studies did. The difference, however, was in the amount of smoking, not in the concept/construct; thus, this had little effect on the analysis.

**Discussion**

The results of this meta-analysis indicate that acculturation has a beneficial effect in Asian American men and a harmful effect in Asian American women and adolescents. Effect sizes of acculturation on smoking in women were greater than those for men and adolescents, although not statistically significant in some studies. This finding suggests that gender differences and acculturation status should be considered in assessing smoking behavior in Asian Americans. Also, the extent of acculturation may be important in understanding the smoking behavior of Asian adolescents.

To the authors' knowledge, there are no other meta-analyses on acculturation and smoking in Asian Americans with which to compare this study's findings. The effects of acculturation on smoking in this meta-analysis, however, were consistent with those from individual studies on direction and magnitude. Nevertheless, because the number of studies included in this analysis for each subgroup (Asian men, women, and adolescents)

was small and because of this study's limitations, its results need to be interpreted with caution.

The limitations of this meta-analysis are apparent in two areas, the first of which concerns the primary studies included in the review. These primary studies were not homogeneous in design, methods, measurement, or statistical analysis. For example, some studies included multiple ethnic groups in the category Asian Americans, and others targeted one specific Asian group. This is a problem because the word acculturated may not mean the same level of acculturation throughout all Asian subgroups. According to Chen et al, [20] 75% of Chinese American adolescents spoke English only at home, whereas 27% of all Asian youths spoke English only at home. Such large cultural diversity within Asian American groups in the primary studies needs to be considered when interpreting the results.

The measurement of acculturation is another issue in the primary studies. Although a multidimensional process, acculturation was reduced to a single indicator in most of the studies, such as language fluency, place of birth, or length of residence in the United States. Among these nonscale measures, language is the strongest predictor of acculturation.[29] Language fluency, however, may not be the most appropriate indicator of acculturation for all Asian subpopulations. For example, many Filipinos and Indians speak English even in their native countries. For them, proficiency in English does not translate into a higher level of acculturation. Because of the limited nonscale measures used in the primary studies of this review, the results may not indicate a definite association between acculturation and smoking. Instead, they may indicate an association between English language use (an important component of the acculturation process) and

smoking. Additional acculturation dimensions may have allowed for a more complete examination of the relationship of acculturation and smoking.

The second limitation of this meta-analysis concerns how the review was conducted. The potential publication bias and bias in weighting the components of the quality of the studies need to be considered. The study would have been strengthened by extending the search to include unpublished studies, such as abstracts and dissertations, and broadening inclusion criteria to include other languages. Additionally, the ability to accurately interpret the summary estimates was limited due to the heterogeneity of the studies.

**Conclusions**

Despite the limitations, these findings have smoking prevention and cessation implications for clinicians serving Asian American populations. Acculturation may have a protective effect on smoking behavior in Asian men and harmful effects for Asian women and adolescents. The magnitude of effect is larger in women and adolescents than in men. Smoking cessation programs should target acculturated women and adolescents as well as traditional men. The results of this study also suggest that prevention strategies may need to consider the acculturation status of the intended individuals. Prevention programs may be more effective if they are appropriate to the acculturation status of the individual.

Future research examining the effects of acculturation on smoking among diverse Asian ethnic groups should consider using measures for different dimensions of acculturation (eg, ethnic identity, social network/relations). This is necessary to identify the critical domains of acculturation that influence smoking behavior and to expand

current knowledge about the effect of acculturation on smoking. It is equally important that acculturation should be measured as a process rather than a state to assess its relationship with smoking behavior along the acculturation continuum.

In addition, future studies should examine the differences in acculturation's effects on smoking among Asian American subpopulations by demographic characteristics and socioeconomic status to identify possible mediators to this relationship. As an initial step, this meta-analysis reveals the importance of studying men and women separately because the male results may attenuate those of the females. Findings from this type of research will help researchers and clinicians gain insight into the importance of acculturation in predicting smoking behavior in Asian Americans, identify groups at risk, and plan population-specific smoking interventions.

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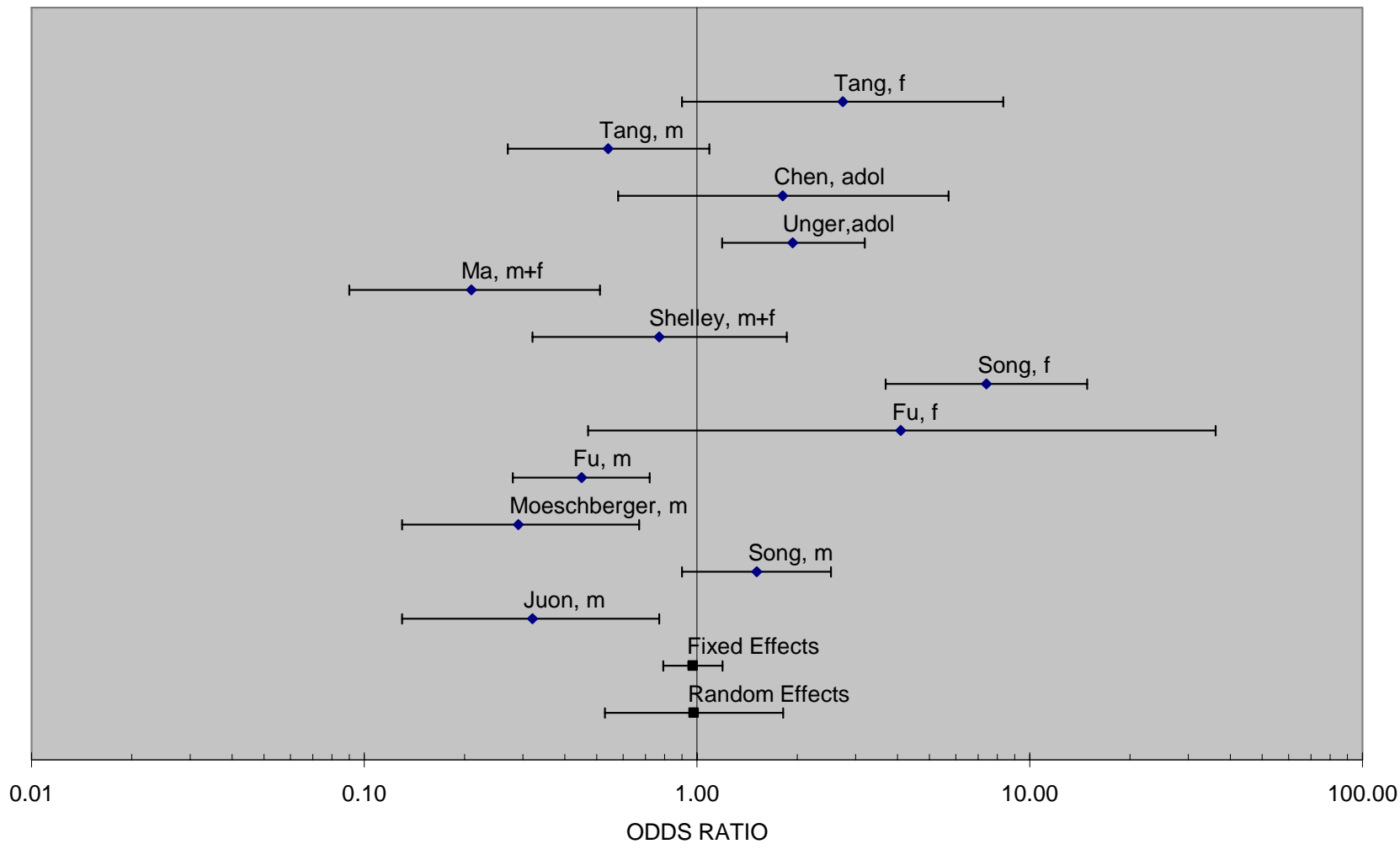
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| Author/Year | Ethnicity | Group | N | Acculturation Measures | Effect Size (OR) | 95 % LBCI | 95% UBCI |
|---|---|---|---|---|---|---|---|
| Song et al[8], 2004 | Korean | M | 1,332 | SL-ASIA, 13 items | 1.22 | 0.97 | 1.54 |
| Fu et al[15], 2003 | Chinese American | M | 228 | English proficiency calculated from 4 questions(score range 4-16) | 0.45 | 0.28 | 0.72 |
| Juon et al[16], 2003 | Korean | M | 333 | Proxy (length of stay in U.S.) | 0.32 | 0.13 | 0.77 |
| Tang et al[17], 2005 | Asian American (Korean, Filipino, South Asian, Japanese, Chinese, Vietnamese) | M | 2,597 | English proficiency from 2 questions; language spoken at home and how well speaking English | 0.54 | 0.27 | 1.09 |
| Moeschberger et al[28], 1997 | Southeast Asian | M | 716 | Language proficiency and language/social/food preference | 0.26 | 0.19 | 0.35 |
| Song et al[8], 2004 | Korean | F | 1,498 | SL-ASIA, 13 items | 6 | 3.33 | 10.82 |
| Fu et al[15], 2003 | Chinese American | F | 311 | Same as above | 4.1 | 0.47 | 36.25 |
| Tang et al[17], 2005 | Asian American | F | 3,225 | Same as above | 2.74 | 0.90 | 8.32 |
| Ma et al[27], 2004 | Asian American (Vietnamese, Cambodians, Koreans, Chinese) | M+F | 1,101 | Frequency of native language use/eating traditional food, length of stay in U.S., birthplace (a part of 77-item survey instrument developed by the author) | 0.64 | 0.50 | 0.81 |
| Shelley et al[29], 2004 | Chinese | M+F | 712 | Proxy (English use at home, read English newspaper daily) | 0.87 | 0.49 | 1.56 |
| Unger et al[12], 2000 | Asian American (Vietnamese, Cambodians, Chinese, Filipinos, Japanese, Koreans, other) | Adol | 2,836 | Proxy (language spoken at home) | 1.91 | 1.42 | 2.57 |
| Chen et al[20], 1999 | Asian American (Chinese, Filipinos, Japanese, Korean, other Asians) | Adol | 1,870 | Proxy (self reported native language, language spoken at home) | 1.82 | 0.59 | 5.59 |

LBCI denotes lower bound confidence interval; UBCI denotes upper bound confidence interval. Effect size is not significant if 0 is included in the confidence interval. Odds ratios of less than 1 indicate a protective effect. M = males, F = females, Adol = adolescents.

Acculturation and smoking (effect size with 95% confidence interval). All studies are listed by the first author and year; m = males, f = females, adol = adolescents.

# CHAPTER FIVE

## Conclusions and Recommendations for Future Research

Coronary heart disease (CHD) is the leading cause of premature death in people with type 2 diabetes (Centers for Diseases Control and Prevention, 2002; Norhammar et al., 2004). With the rising incidence of type 2 diabetes in Korean immigrants, CHD is becoming an emerging health concern in this group. Although a number of studies have demonstrated significant beneficial effects of optimal glucose control on microvascular disease, the risk of CHD was found to decrease only slightly in spite of strict adherence to glucose control measures (Stratton et al., 2000; United Kingdom Prospective Diabetes Study Group, 1998). Thus, in addition to glucose management, efforts to reduce CHD risk in individuals with type 2 diabetes must be geared toward aggressive control of multiple CHD risk factors (American Diabetes Association, 2006; Raven, 2002).

Studies suggest that healthy lifestyle practices through lifestyle behavior modification may be the most effective way of achieving the control of both CHD risk factors and glucose levels (Chiuve, McCullough, Sacks, & B., 2006; Diabetes Prevention Program Research Group, 2002). Studies also suggest that perceived risk may be an important motivator for adopting CHD risk-reducing behavior. Based on these previous studies, this dissertation study investigated the level of CHD risk perception, risk factor control, and factors influencing the risk perception in Korean immigrants with type 2 diabetes (Chapter 2). The study also examined the level of glucose control and its determinants in this group (Chapter 3).

The findings indicated that Korean immigrants with type 2 diabetes hold remarkably low risk perception for CHD. The majority (76.9%) reported their CHD risk at the same level or lower than the general population of the same age and gender. This percentage is significantly higher than the 52% of diabetic individuals who reported low

levels of CHD risk perception in a recent national survey (Merz, Buse, Tuncer, & Twillman, 2002). Dissertation results also revealed that Korean immigrants with type 2 diabetes are at risk for CHD. This is evidenced by the significant portions of the study participants failing to meet recommended goals for CHD risk factor controls set by the American Diabetes Association (ADA). One clinical implication of these findings is that optimistic bias in CHD risk perception may deter many diabetic Korean immigrants who are at risk for CHD from engaging in appropriate CHD risk-reducing behaviors. This, in turn, will increase CHD morbidity and mortality.

Determining what influences one's risk perception has been a challenge for researchers. In this study of diabetic Korean immigrants, nine potential variables were examined for association with CHD risk perception. They include age, gender, education, current smoking patterns, medications for CHD risk factors (diabetes, hypertension, and cholesterol), CHD knowledge of risk factors, and self-reported general heath status. Overall, findings indicated that approximately 22% of the total variance in CHD risk perception could be explained by the optimal combination of these nine variables ($R^2 = 0.219$; $F [9,133] = 4.15$; $P<.0001$). After controlling for other variables in the model, only CHD knowledge of risk factors had a positive effect, and self reported general health had a significant negative effect on CHD risk perception.

Research on knowledge and risk perception to date is not conclusive. Although the overall level of CHD risk perception in this sample was low, knowledge of CHD risk factors was positively associated with risk perception in this study. These findings may have important clinical and research implications. Clinically, the findings suggest that education related to CHD risk factors may have a positive impact on CHD risk perception

and help increase one's risk perception to levels that match one's risk status. For researchers, the findings confirm that knowledge is still an important variable to pursue in future investigations involving risk perception.

Consistent with previous studies, self-reported general health was a strong predictor in this study accounting for the largest portion (8.4%; $sr^2 = 0.0835$) of the total variance associated with CHD risk perception. However, the negative relationship indicated that those who rated their overall health as good were less likely to perceive themselves at high risk for CHD. This can be a concern in diabetic individuals because regardless of how they rate their general health, having diabetes puts them at high risk for CHD. Therefore, diabetic individuals reporting their health as good deserve particular clinical attention since they may underestimate their risk for CHD and may not feel the need to adopt CHD risk reducing behaviors. To avoid a negative impact from this optimistic bias, clinicians should review and discuss CHD risk factors routinely with the patient in connection with diabetes. This will also help patients make the link between diabetes and CHD risk, a move strongly recommended by the ADA and American College of Cardiology (ACC).

In this research, gaining knowledge about glucose control status in this group and exploring factors that may influence glucose control were equally important to the investigation of CHD risk and perception. The mean glycosylated hemoglobin (HbA1c) level was 7.6 % (SD=1.45; range=5.6-12.5) and only less than half of subjects (41.3%) achieved the ADA goal of less than 7.0%. Glucose control, defined as HbA1c less than 7%, was significantly influenced by diet related family support, waist to hip ratio (WHR), duration of diabetes, number of diabetes medications, and age. More family support with

diet regimen and older age were associated with lower hemoglobin HbA1c (indicating better glycemic control), while higher WHR, longer duration with diabetes, and more diabetes medications were associated with higher HbA1c levels. Acculturation was suggested as a potential predictor of type 2 diabetes management in previous studies with ethnic minorities, yet it did not have a significant effect on glucose control in this study. Whether this finding was related to measurement issues needs to be examined in future studies using acculturation tools assessing different dimensions of the construct.

Information on the family's role in the management of type 2 diabetes in adult populations is scarce, although proper diet is recognized as a key component in type 2 diabetes management and naturally involves the family in as much as meals are shared among family members. In this study, positive effects of family support on glucose control relating to diet are encouraging and offer a justification for more family involvement at the time of diet counseling with Korean immigrant diabetic patients. Interestingly, family support in exercise did not have a significant influence on glucose control. Future research on family support in adults with type 2 diabetes should consider exploring different domains of family support to identify those areas that offer the most beneficial effects on their glucose control. This will allow clinicians to target specific areas when involving families in the counseling of diabetic patients.

The strong negative effect of age on glucose control in this study was an unexpected finding.  This finding was especially surprising when the duration of diabetes and the number of diabetes medications, two factors that are likely to be associated with advancing age, showed significant positive relationships with glucose control. Based on existing epidemiological studies, one possible explanation for poor glucose control in

younger Korean immigrants could be their inability to afford costly medical care for diabetes through a lack of health insurance, whereas those subjects over the age of 65 had access to Medicare. However, further research is needed to understand this phenomenon and investigate psychosocial variables and other potential factors that may influence the relationship between age and glucose control. In addition, similar studies in other ethnic groups will help us understand whether this finding is only specific to Korean immigrants. Nevertheless, this study indicates that clinicians working with diabetic Korean immigrants should pay attention to younger Korean immigrants with type 2 diabetes because they are more likely to have poorly controlled glucose levels and are, therefore, at increased risk for CHD.

Although WHR was implicated as a risk factor for CHD and diabetes in non-diabetic individuals (Schulze et al., 2006), its influence on glucose control in diabetic populations has not been investigated. This study demonstrated significant positive effects of WHR on HbA1c levels in Korean immigrants with type 2 diabetes. Contrary to its role as a risk factor for type 2 diabetes in the general adult population in Korea (Chang et al., 2004; Sung, Sung, Kim, & Kim, 2001), body mass index (BMI) did not have significant effect on HbA1c levels in Korean immigrants with type 2 diabetes. This may indicate that once Korean immigrants have developed diabetes, WHR (measure of visceral adiposity) has a stronger influence on glucose level than BMI. In this respect, the finding that the majority in this sample had higher than normal WHR is an added concern because high WHR will make it difficult to control blood glucose. Clinical interventions for WHR reduction may be necessary to effectively manage glucose in diabetic Korean immigrants and these measures should be incorporated in overall weight loss programs.

Future research should investigate this finding using both diabetic and non-diabetic subjects from Korean immigrants in the United States and examine how the relationship between WHR and glucose level influences CHD risk in Korean immigrants with type 2 diabetes.

In addition to valuable health information about Korean immigrants with type 2 diabetes, this study provided several methodological points for consideration by future investigators. First, posters and flyers were not effective ways of recruiting study participants. In the event that future studies are adequately funded, advertisements in Korean newspapers or on the radio can be effective recruitment methods since many Korean immigrants get health information through these media. Second, the estimated time required for the study procedures was a major factor in potential subjects' willingness to participate in the study. Therefore, every effort was made to accommodate the subjects' wishes and to use their time efficiently without affecting the quality of the data. Efforts included data collection on weekends, home visits upon request, administering questionnaires while participants waited for their appointment with a healthcare provider, taking anthropometric measures while waiting for finger stick blood tests, and using participant-provided HbA1c results when they met the protocol criteria. These strategies were helpful to retain recruited subjects and obtain a complete data set for each participant. Third, future researchers studying Korean immigrants should budget generously for time to build and maintain relationships with the study population and key persons in the community who can provide advice on feasibility of data collection procedures and assistance with subject recruitment. These measures will support effective

recruitment of study participants in this population and increase the likelihood of valid research findings.

Leventhal's self-regulation model applied in this study was effective in examining the relationships of socio-cultural (family support and acculturation), demographic, and clinical variables to CHD risk perception (representation) and glucose control (coping) in Korean immigrants with type 2 diabetes because the model incorporates both personal and environmental components to explain cognitive and emotional processes involved in one's illness representation and coping. Additionally, the model's flexibility allowed the use of only the representation and coping stages. Thus, Leventhal's theoretical model of self-regulation may be a useful conceptual framework for studies that examine socio-cultural components in relation to health risk perception or behavior in Koreans and other ethnic minority immigrant populations.

Apart from the dissertation research, Chapter 4 presented a meta-analysis on acculturation and smoking. This meta-analysis quantitatively reviewed nine studies that evaluated the impact of acculturation on smoking behavior in Asian Americans and summarized the effects. The results indicated that acculturation may have a protective effect on smoking behavior in Asian men and a harmful effect in Asian women and adolescents. An important clinical implication from this meta-analysis is that smoking cessation programs should target acculturated women and adolescents as well as traditional men.

In conclusion, the dissertation provided significant insight about the status of CHD risk, risk perception, and glucose control in Korean immigrants with type 2 diabetes. It also identified determinants of CHD risk perception and glucose control in this group.

To our knowledge, this was the first study that specifically examined CHD risk in diabetic Korean immigrants and measured glucose control status using hemoglobin HbA1c, a more accurate and reliable marker for glucose control than a random blood glucose. These findings will serve as groundwork for future research of diabetic populations.

Still, our knowledge about the effects of influencing factors on CHD risk perception and glucose control in this group is very limited. Future studies need to examine the ways in which diabetic people estimate their CHD risk, explore other potential variables that may help identify those who are more likely to underestimate their CHD risk, and look at how differences in risk perception shapes decisions to adopt CHD risk reducing behaviors. Additionally, future research should investigate diabetes management areas in which family support may be most effective in glucose control, and the way age influences glucose control from a psychosocial perspective. Finally, possible reasons for the statistically insignificant effect of acculturation on glucose control observed in this study should be examined using different tools measuring various dimensions of acculturation. Furthermore, replication of similar studies in other Asian ethnic groups will be helpful in understanding potential ethnic differences. For clinicians, researchers, and policy makers who are engaged in efforts to reduce CHD risk in people with type 2 diabetes, understanding the ways in which different individuals estimate their CHD risk and identifying key determinants of glucose control are imperative.

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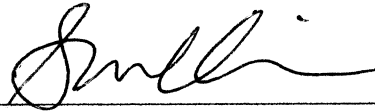
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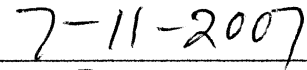352*, 837-853.

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