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The relationship between suicidality, major depressive disorder, and alcohol involvement among Chinese-, Korean-, and White-American college students

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The Relationship Between Suicidality, Major Depressive Disorder, and  
Alcohol Involvement Among Chinese-, Korean-, and White-American College Students

A dissertation submitted in partial satisfaction of the requirements for the degree of

Doctor of Philosophy

in

Clinical Psychology

by

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The dissertation of Nicole Cassandra Ebberhart Duranceaux is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

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Chair

University of California, San Diego

San Diego State University

2009

## DEDICATION

This dissertation represents the culmination of the work and commitment that are required to achieve a doctoral degree. It is with immense gratitude that I dedicate this paper to Irma Corral, Ph.D., who is still my friend but is now my sister. To Deacon Ernest Taylor, the head of my west-coast family. To my husband, who tolerated separation, long distance, and energy diverted. Finally, I dedicate this dissertation to my family, without whom I would have never made it anywhere. All my relatives.

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Duranceaux, N.C.E., Schuckit, M.A., Luczak, S.E., Eng, M.Y., Carr, L.G., & Wall, T.L. (2008). *Ethnic differences in level of response to alcohol between Chinese- and Korean-Americans* *Journal of Studies on Alcohol and Drugs*. 69 (2), 227-234.

Duranceaux, N. C. E., Schuckit, M. A., Robinson, S. K., & Wall, T. L. (2006). The impact of genetic variation in the alcohol dehydrogenase genes on the level of response to alcohol in non-Asians. *Alcoholism: Clinical and Experimental Research*, 30 (9), 1470-1478.

Ebberhart, N. C., Luczak, S. E., Avanecy, N., & Wall, T. L. (2003). Family history of alcohol dependence in Asian Americans. *Journal of Psychoactive Drugs*, 35 (3), 375-377.

## FIELDS OF STUDY

Major Field: Psychology (Specialization or Focused Studies)

Studies in Clinical Psychology  
University of California, San Diego/San Diego State University

ABSTRACT OF THE DISSERTATION

The Relationship Between Suicidality, Major Depressive Disorder, and  
Alcohol Involvement Among Chinese-, Korean-, and White-American College Students

by

Nicole Cassandra Ebberhart Duranceaux

Doctor of Philosophy in Clinical Psychology

University of California, San Diego, 2009  
San Diego State University, 2009

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Suicidality is a considerable problem and there has been a recent focus on its toll among college students. Suicidal ideation (SI) is considered a necessary, although not sufficient precursor to suicide and is also a significant problem. An estimated 40% to 50% of college students report they have considered suicide. While many factors influence SI, individuals with major depressive disorder (MDD) and heavy alcohol

involvement (AI) consistently appear to be at increased risk. SI, MDD, and AI vary between women and men and across ethnic groups. However, data regarding Asian Americans are scarce and in existing studies, multiple subgroups are often aggregated.

The current study explores the relationship between SI, MDD, and AI in college students from three ethnic backgrounds: Chinese ( $n = 190$ ), Korean ( $n = 214$ ), and White ( $n = 200$ ) Americans. It was hypothesized that SI, MDD, and AI would differ across sex and ethnicity. An exploratory model specifying MDD and AI as correlated predictors of SI was tested; it was further hypothesized that ethnicity would moderate the relationships between these variables. Over one-third of the sample reported lifetime SI. No sex differences were found, although when aggregated, Chinese and Koreans had a higher rate of SI than Whites. Ten percent of the sample met lifetime criteria for MDD, with women having a higher rate than men; no ethnic differences were found. Results regarding the AI variables (i.e., age of drinking initiation, maximum number of drinks ever consumed within 24 hours, and number of alcohol dependence symptoms) differed by sex and ethnicity. Generally, women exhibited lower levels of AI variables than men and Chinese exhibited lower levels of AI variables than Koreans and Whites. The hypothesis of moderation by ethnicity was supported. Results suggest that the relationships between SI, MDD, and AI are different for Chinese compared to Koreans and Whites. Current findings highlight heterogeneity among Asian-American subgroups and help explicate the relationship between suicidality and two robust risk factors.

## Introduction

Suicidality represents a significant problem worldwide and more lives are lost to suicide than to homicide or war each year (Hendin et al., 2008; World Health Organization, 2002). In the U.S., 30,000 lives are taken annually and an additional 600,000 attempts are made (Center for Mental Health Services, 2001; Hufford, 2001; Mokdad, Marks, Stroup, & Gerberding, 2004). Although suicide is the most severe, irreversible form of suicidality, suicidal ideation (SI) is also a significant problem. It has been associated with impaired functioning (Brenner, Hassan, & Barrios, 1999; Stephenson, Pena-Shaff, & Quirk, 2006) and may be considered a necessary, although not sufficient, precursor to completed suicide. While suicidal behavior affects society in general, there is an increasing awareness of the toll taken on the college community (U.S. Department of Health and Human Services, 2001), which represents approximately one-fourth of the total U.S. population of 18-24 year olds (Center for Mental Health Services, 2001). Alarming, the incidence of suicide among young adults in the general population increased by nearly 300% from 1952 to 1995, and suicide is the second leading cause of death among college students (Drum, 2008). A recent national survey of approximately 26,000 college students found that over 50% reported engaging in SI at least once over their lifetimes, with 15% reporting having "seriously considered" suicide (American College Health Association, 2001). Another national survey of over 16,000 participants found that 9.5% of college students had "seriously considered" suicide during the last school year (Furr, Westefeld, McConnell, & Jenkins, 2001), with a similar rate (9%) reported in a smaller study of

individuals (Brener et al., 1999). Other past-year estimates of SI among the college-attending population range from 10% to 25% (Kuo, Gallo, & Tien, 2001; Maris, Berman, Maltzberger, & Yufit, 1992; Moscicki, 1995, 1997), and there is evidence that college students between the ages of 18-24 years are more likely to endorse SI than those who are 25 years and older (Weissman et al., 1996; World Health Organization, 2001).

As SI has been linked to later suicide attempts and completions (Blazer, Kessler, McGonagle, & Schwarz, 1994; Kessler et al., 2003a), and as successful intervention will likely decrease this risk, it is useful to better understand factors associated with this phenomenon. Although there are many biological and psychosocial determinants of suicidal behavior, MDD, and heavy AI have consistently emerged as two of the most prominent risk factors.

### *Major Depressive Disorder*

MDD represents a major worldwide health concern (Grant, Moore, & Kaplan, 2003; Reich et al., 1998) and is one of the most prevalent mental disorders in the U.S. Lifetime estimates range from 6% to 17% (American College Health Association, 2007) among the U.S. general population. The current literature suggests that the peak onset of MDD is between 18 to 25 years of age (Bernal et al., 2007). Recently published data from a national survey of over 91,000 undergraduate and graduate students found that nearly 14.8% reported a lifetime diagnosis of MDD, with 34.2% of those individuals reporting having been diagnosed within the previous school year (Conner et al., 2006; Conner, Li, Meldrum, Duberstein, & Conwell, 2003; Driessen et al., 1998; Schaffer, Jelic, & Stanley, 2008).

MDD has been empirically identified as a risk factor for suicidality (Core Institute, 2000; Wechsler & Kuo, 2000). Multiple studies have found that depression in college students was predictive of SI (Stephenson et al., 2006), and one study found that those with a history of MDD had nearly three times the risk of SI than those without a history of this condition (Brener et al., 1999).

### *Alcohol Involvement*

A wide range of level of AI, from heavy episodic (i.e., binge) drinking to a formal diagnosis of alcohol dependence, has been linked to suicidal behavior (Dawson, Grant, Stinson, & Chou, 2004; Knight et al., 2002; Slutske, 2005), including SI (Hawkins et al., 1997; Hingson, Heeren, & Winter, 2006; Kosterman, Hawkins, Guo, Catalano, & Abbott, 2000). Over 80% of college students are current drinkers and over 44% are classified as “binge” drinkers, consuming five or more drinks on an occasion for men and four or more drinks on an occasion for women (DeWit, Adlaf, Offord, & Ogborne, 2000; Grant & Dawson, 1997; Hawkins, Catalano, & Miller, 1992). College students with chronic and frequent alcohol consumption had increased SI compared to infrequent or non drinkers (Prescott & Kendler, 2001), and students who reported having “seriously considered” suicide over the past year were more likely to engage in heavy episodic drinking than those who did not (Cottler, Campbell, Krishna, Cunningham-Williams, & Abdullah, 2005). The prevalence of alcohol dependence among college students is estimated to be between 6% and 11% (Kessler et al., 2003a; Li, Hewitt, & Grant, 2004), and age of drinking initiation (ADI) has been found to be a robust correlate of risk for alcohol dependence (Sher et al., 2005). A lower ADI has been associated with increased risk of later alcohol misuse and dependence than initiation at age 21 years (2004),



although the nature of this relationship remains unclear (Hasin, Goodwin, Stinson, & Grant, 2005; Kessler, 2003b; Kessler et al., 1994). Similar to MDD, the onset for alcohol dependence peaks during late adolescence and early adulthood (Hasin et al., 2005). Men and women who report SI are more likely to meet criteria for alcohol abuse or dependence than non-ideators (American Psychiatric Association, 2003).

#### *Major Depressive Disorder and Alcohol Involvement*

Taken as a whole, these data indicate that MDD and heavy AI are associated with elevated risk for suicidality, including ideation, attempts, and completion. Further, the peak onset of both disorders occurs in late adolescence and emerging adulthood (Kessler, 2003b), they often co-occur (Kessler et al., 1994), and risk for suicide-related behavior appears to increase in the presence of both conditions (5% versus 2%` ; Grant et al., 2004). Among individuals with MDD, those with a history of alcohol dependence have demonstrated increased SI compared to those without such a history (Wechsler & Kuo, 2000).

#### *Sex Differences*

Extant information suggests that SI, MDD, and level of AI, as well as their interrelationships, are influenced by many sociodemographic factors, including sex. It is well documented in many studies that men are more likely than women to commit suicide, although women attempt suicide at a greater rate than men (U.S. Census Bureau, 2008). Some studies have found that women show increased SI compared to men, while others have found comparable rates (U.S. Census Bureau, 2001). Wilsnack and colleagues (Sue, Sue, Sue, & Takeuchi, 1995; Takeuchi & Uehara, 1996; Wong & Halgin, 2006; Wong, Lai, Nagasawa, & Lin, 1998) raise the possibility that an

inadvertent sex bias may exist in the current literature because most research has focused exclusively on suicide completions; these investigators have encouraged future studies to explore and report sex-specific effects in SI and attempts in addition to completions.

There is considerable evidence that MDD is more common in women than men (American College Health Association, 2001; Brener et al., 1999; Schweitzer, Klayich, & McLean, 1995). A large national survey conducted in the U.S. (National Epidemiologic Survey on Alcohol and Related Conditions; NESARC) found that past-year and lifetime rates of MDD were approximately 7% and 17%, respectively, for females compared to 4% and 9% for males (Kennedy, Parhar, Samra, & Gorzalka, 2005). Other estimates of lifetime prevalence range from 10% to 25% for women and 5% to 12% for men (Lester, 1994; Shiang, Barron, Xiao, Blinn, & Tam, 1998; Zhang & Jin, 1996). Kessler and colleagues (Lester, 1994) found that women were 1.7 times more likely than men to have a lifetime diagnosis of MDD, which is consistent with 1994 findings that lifetime risk is approximately 20%-25% in women compared to 7%-12% in men (Center for Mental Health Services, 2001; Mokdad et al., 2004; Moscicki, 1995).

Sex differences in level of AI have also been well documented, with men demonstrating higher rates of alcohol use disorders (AUDs; abuse or dependence) and heavy episodic drinking than women. In a recent national investigation, men compared to women had both a higher past-year prevalence of alcohol abuse (7% versus 3%) and alcohol dependence (Hendin et al., 2008; Kim et al., 2006; Phillips, Li, & Zhang, 2002). Several studies report similar findings in college students, with men having a higher rate of AUDs than women (Beautrais, 2006; Murray & Lopez, 1996). Further, data from the Harvard School of Public Health Survey found that 26% of men compared to 21% of

women engaged in heavy episodic drinking during the previous two weeks (Hendin et al., 2008) when using a sex-specific measure (4 or more drinks on an occasion for women and 5 or more drinks on an occasion for men).

### *Ethnic Differences*

Most of the existing literature on rates of mental health disorders and their interrelationships has been generated from primarily White samples, and information on ethnic minorities in the U.S. remains relatively limited. Demographic composition is fundamental to consider when exploring the impact of psychopathology across ethnic groups, particularly within a culturally-diverse region like the U.S. The most recent population estimates indicate that out of a total population of 301.6 million individuals, 199.1 million (66.0%) self identified as White and 15.2 million (5.0%) self identified as Asian (Weissman et al., 1999). Moreover, Asian Americans represent one of the fastest-growing minority groups. It is projected that the Asian-American population will increase 213% between the years 2000 and 2050, and that Asian Americans will number over 20 million people by the year 2020 (Hendin et al., 2008; Nam, 2007; Phillips et al., 2002). Of individuals reporting only one race, Chinese comprised over one-fourth and Koreans comprised over one-tenth of the Asian-American population in the year 2000 (U.S. Census Bureau, 2001). Perceptions of Asian Americans as the "model minority," with little to no psychopathology, may lead to underestimation of mental health difficulties (U.S. Department of Health and Human Services, 2001) and empirical data are needed to evaluate this stereotype.

There is a small literature suggesting ethnic variation in suicidal behavior and related psychopathology in Whites and Asians, although current findings are equivocal.

Some studies have found that Asians have higher rates of SI and attempts than their White counterparts (Lee et al., 1990a, 1990b), while others have found no differences (American Psychiatric Association, 1987) or lower rates among Asians (Hasin et al., 2005; Zhang & Snowden, 1999).

Considerable international variation in suicide rates has been documented (Hasin et al., 2005) and there is some evidence that suicide rates for Asian Americans reflect those of their countries of origin (Hurh & Kim, 1984; Kuo & Tsai, 1986; Ying, 1988). Contrasting with an estimated suicide rate of 11 per 100,000 in the U.S. (Takeuchi et al., 1998), current estimates from the WHO report suicide rates of approximately 22 to 30 per 100,000 in China and 27 per 100,000 in South Korea (Cho et al., 2007). Additionally, China represents approximately 21% of the world population but has an estimated 30% to 40% of global suicides (Kuo, 1984). Interestingly, in China, the suicide rate for women is higher than that for men, which reflects the opposite pattern of a higher suicide rate for men compared to women in South Korea and the U.S. (Kosterman et al., 2000). There have been findings of higher rates of SI and attempts in South Korea than in China (Grant et al., 2004; Hasin, Stinson, Ogburn, & Grant, 2007), which contrast with a more recent finding of a lower suicide rate in South Korea than in China (Wechsler, Dowdall, Maenner, Gledhill-Hoyt, & Lee, 1998). These data, and the fact that most previous studies have emphasized completed suicide to the exclusion of ideation and attempts (9%; Helzer et al., 1990), indicate the need for further investigation.

The literature regarding ethnic differences in rates of MDD is complex. Epidemiological studies conducted in South Korea (12.6%; Luczak, Wall, Cook, Shea, & Carr, 2004) and Taiwan (7% versus 30%; Luczak, Wall, Shea, Byun, & Carr, 2001)

using translated versions of the Diagnostic Interview Schedule indicate the lifetime rate of DSM-III (Lester, 1994; Uehara, Takeuchi, & Smukler, 1994). MDD was approximately three times higher in South Koreans (3.4%) compared with Taiwanese (1.1%). While there are some data supporting commensurate rates between U.S. Asian Americans and White Americans (DSM-IV; American Psychiatric Association, 1994), there is also evidence that in the U.S., Asians have a lower prevalence of both 12-month and lifetime MDD compared to Whites (Hasin, Hatzenbuehler, Keyes, & Ogburn, 2006). Multiple studies have also found that, in several major U.S. urban areas, Chinese and Koreans have reported higher rates of depressive symptoms than Whites (SSAGA; Bucholz et al., 1994). Differences in MDD have also emerged among Asian-American subgroups. Lifetime and past-year rates of MDD have been estimated as 6.9% and 4.3%, respectively, for Chinese (Bucholz et al., 1994; Bucholz et al., 1995) and 4.3% and 1.7%, respectively, for Koreans (Liebetrau, 1983; Sheshkin, 1997). However, another study conducted in the Seattle, Washington area found that Chinese Americans had significantly lower levels of depressive symptoms than Korean Americans (1993).

Ethnic differences in rates of AUDs and heavy drinking have also been found. There is some evidence that Asian adolescents in the U.S. initiate drinking at an older age than White adolescents (CFI; Bentler, 1988), which may decrease risk for later misuse of alcohol by Asians compared to Whites. Additionally, both twelve-month and lifetime prevalence rates of AUDs were lower for Asians (4.5% and 11.6%, respectively) compared to Whites (8.9% and 34.1%, respectively) based on national survey data from over 43,000 individuals in the U.S (RMSEA; Browne & Cudeck, 1993). Among U.S. college samples, Asians (22% to 25%) reported lower rates of heavy episodic drinking

over the previous two weeks than Whites (47% to 48%) using a sex-specific measure (Bentler & Chou, 1988). This suggests that Asians as a whole exhibit lower rates of AUDs and a lower prevalence of hazardous drinking than Whites.

Variation in level of AI among Chinese and Koreans has been documented. One cross-national study found lower rates of alcohol dependence in Taiwanese (2%) compared to South Koreans (1988). Other studies have documented varying levels of AI in Asian-American subgroups with Chinese (4.7%) having a lower rate of alcohol dependence than Koreans (Satorra & Bentler, 1994) as well as a lower rate of heavy episodic drinking within the past two weeks (Brener et al., 1999; Meehan, Lamb, Saltzman, & O'Carroll, 1992).

In summary, the literature regarding SI, MDD, and AI among Asian Americans is scarce, and existing findings are indeterminate. Moreover, much of the extant research combines multiple Asian-American subgroups before making comparisons to other ethnic groups. There are growing empirical indications that data based on the aggregation of multiple Asian-American subgroups may be misleading (Aquinis, Pierce, & Quiqley, 1995; Gupta & Thornton, 2002; Nederhof, 1985). Long-standing perceptions of Asian Americans as the “model minority” are of uncertain accuracy and fail to consider heterogeneity among ethnic subgroups. Additional research is needed to better elucidate SI, MDD, and AI across ethnic groups.

### *Current Study*

This study involved the analysis of archival data from the laboratory of Tamara L. Wall, Ph.D., at the Veterans Affairs San Diego Healthcare System and the Veterans Medical Research Foundation. The participants were female and male Chinese, Korean,

and White college students. The overall goal of this study is to explore heterogeneity in SI, MDD, and AI by determining whether there are sex and ethnic differences. Ethnic heterogeneity is further explored through analyses of an a priori, exploratory model that specifies a hypothesized relationship between these variables for each ethnic subgroup. Results of this study will address potential heterogeneity in SI, MDD, and level of AI among a diverse sample of college students that includes two understudied Asian-American subgroups.

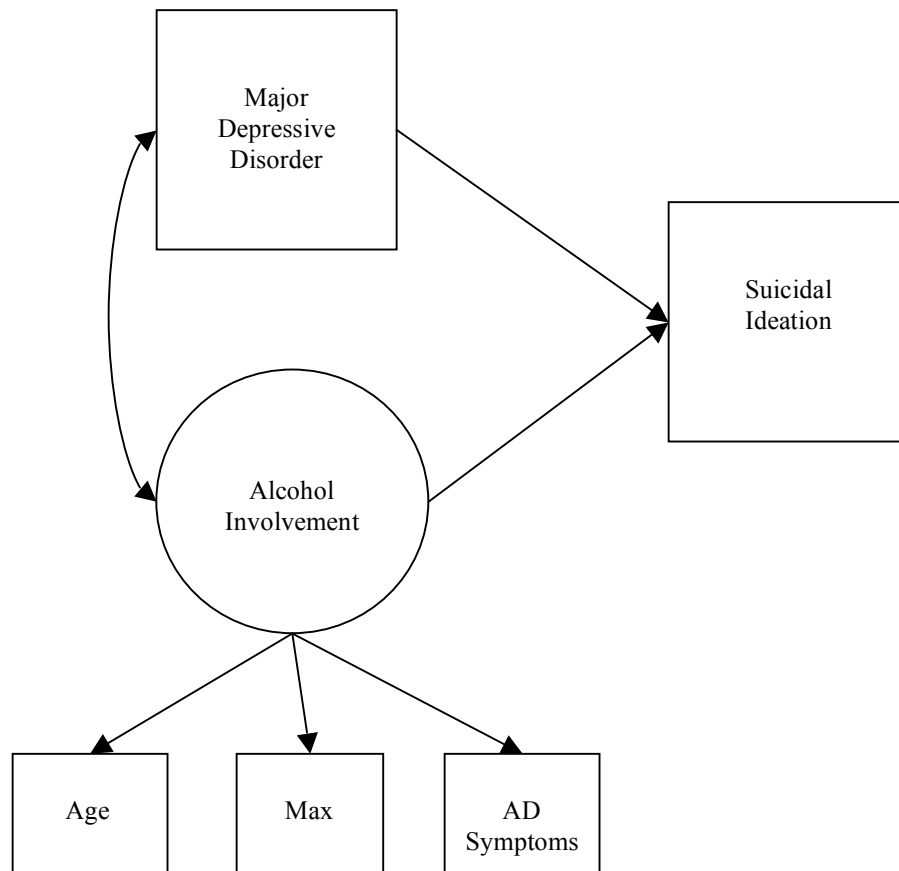
The first specific aim is to determine rates of SI for the entire sample, women and men separately, and across each ethnic subgroup. Based on the literature reviewed, it is hypothesized that women will report a greater rate of SI than men both within and across ethnic subgroups. It is further hypothesized that Chinese and Koreans will have higher rates of SI than Whites.

The second specific aim is to assess rates of MDD diagnosis based on criteria from the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (Moore, 1975) for the entire sample, women and men separately, and across each ethnic subgroup. Based on the literature reviewed, it is hypothesized that women will have a higher rate of MDD than men and that Chinese and Koreans will have higher rates of MDD than Whites.

The third aim is to assess AI for the entire sample, women and men separately, and across each ethnic subgroup. AI is measured using three variables: ADI, the maximum number of drinks ever consumed within a 24 hours (MAX), and the number of alcohol dependence (AD) symptoms endorsed based on DSM-IV criteria. While inclusion of alcohol abuse variables in assessment of AI was considered, it was ultimately

excluded from analyses due to evidence of lower reliability and psychometric validity than alcohol dependence (Hendin et al., 2008; Kim et al., 2006; Zhang, Conwell, Zhou, & Jiang, 2004). Based on the literature reviewed, it is hypothesized that women will have a lower level of AI than men. It is further hypothesized that Chinese will have a lower level of AI than Koreans and Whites, who are hypothesized to have a similar level of AI.

The fourth specific aim involves the exploration of an a priori, exploratory model of a hypothesized relationship between SI, MDD, and AI (Figure 1).

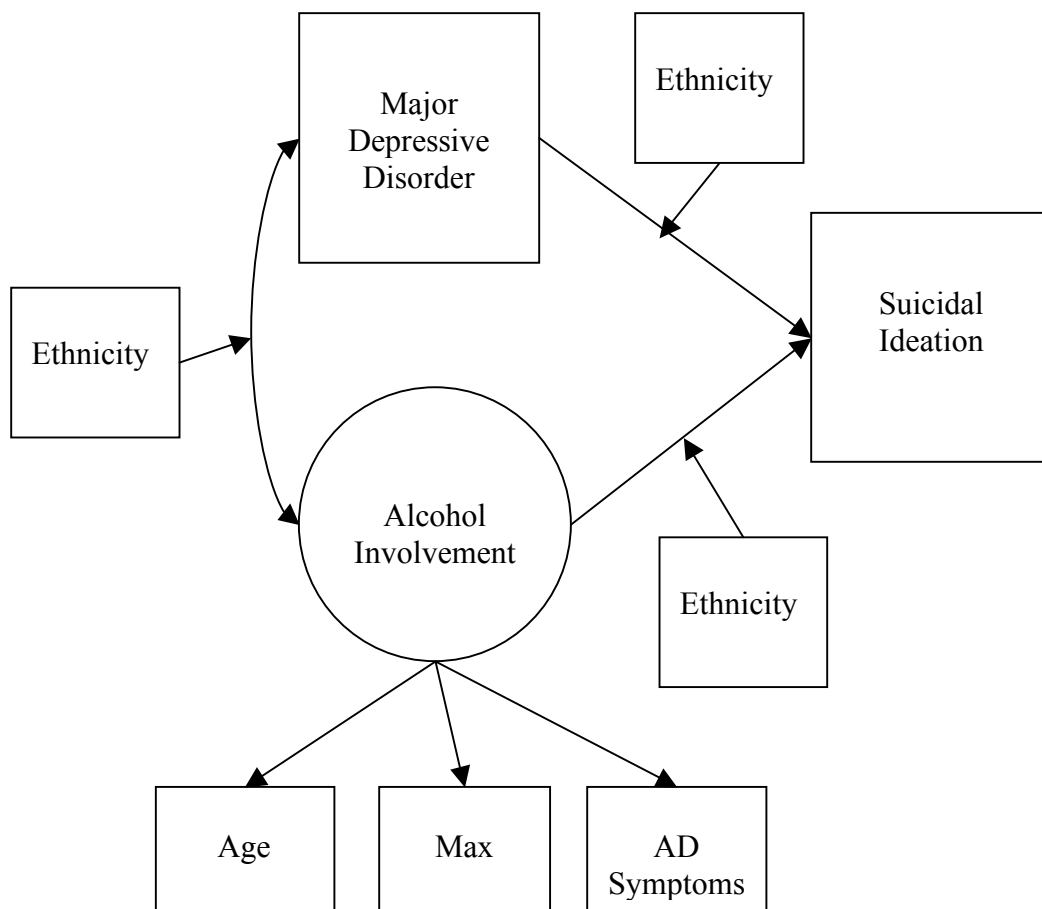


*Figure 1.* Full target model of the hypothesized relationship between suicidal ideation, major depressive disorder, and alcohol involvement.



This full target model designates MD and AI as correlated predictor variables and SI as the outcome variable. This model also specifies a direct path between MDD and SI and a direct effect between AI and SI. In this model, AI is the one latent factor and is composed of three items (ADI, MAX, and AD symptoms). The latent AI factor was first evaluated for the whole sample, among women and men separately, and across each ethnic subgroup to determine whether this factor is measuring the same alcohol construct in all groups. Second, the full target model was evaluated for the sample as a whole and for each sex and ethnic subgroup. Based on the literature reviewed, it is hypothesized that the target model will demonstrate adequate fit for women, men, Chinese, Koreans, and Whites.

The fifth specific aim involves the exploration of ethnicity (i.e., Chinese, Korean, and White) as a moderator of the effects delineated in the full target model (Figure 2). Moderation by ethnicity purports that the relationships between SI, MDD, and AI will change as a function of ethnicity. Based on the literature reviewed, it is hypothesized that ethnicity will moderate the relationships between SI, MDD, and AI.



*Figure 2.* Moderation by ethnicity of the proposed exploratory one-factor target model of a hypothesized relationship between suicidal ideation, major depressive disorder, and alcohol involvement.

## Method

This study involved retrospective analysis of data collected from 4/24/1996 until 3/25/2003 by staff in Dr. Tamara L. Wall's laboratory at the Veterans Affairs San Diego Healthcare System. The data for this study were generated as part of a larger study being conducted by Dr. Wall examining genetic and environmental risk factors for AI in Asian-American and White men and women. Participants ( $N = 604$ ) were recruited by advertisements for a paid research project and include Chinese- ( $n = 190$ ), Korean- ( $n = 214$ ), and White- ( $n = 200$ ) American college students. To decrease the likelihood of sample bias, the fliers did not state the investigation studied alcohol use. To be eligible, participants must have been 21-26 years of age and have reported being of entirely (all four biological grandparents) Chinese, Korean, or European White (non-Jewish) descent. Due to the examination of specific genotypes in the larger study from which the data were derived, any potential White subject reporting any known biological relative of African, Native American, Hispanic, or Jewish ethnicity was excluded from the study. Respondents were screened by telephone and scheduled for an in-person assessment. Written informed consent, approved by the University of California, San Diego Human Research Protection Program, was obtained. Each participant was individually assessed by a trained interviewer regarding demographic and individual characteristics. The following are the constructs and measures used to test the specific aims of this study:

*Suicidal Ideation, Major Depressive Disorder, Alcohol Dependence Criteria, Ethnicity.* SI was assessed as a dichotomous variable (i.e., one has/has not "thought of killing oneself"). Lifetime history of MDD was also assessed as a dichotomous variable (met DSM-IV diagnostic criteria, yes versus no). AD symptoms was assessed as a

continuous variable utilizing the nine DSM-IV criteria for alcohol dependence. AD symptoms was operationalized as the number of DSM-IV diagnostic criteria endorsed by the participant, ranging from zero (no symptoms endorsed) to nine (all nine symptoms endorsed); endorsement of three or more criteria is required for a formal diagnosis of AD based on DSM-IV criteria.

*ADI, MAX.* Each participant was asked to retrospectively report the age at which he or she first used alcohol (a drink, not a sip). Additionally, each participant was asked to retrospectively report the maximum number of drinks he or she has ever consumed within 24 hours. A drink was defined as 12 oz of beer, 4 oz of wine, or a single shot (1-1.5 oz) of 80 proof alcohol.

*Measures.* Demographic and personal psychiatric history, including SI, MDD, AD symptoms, and ethnicity, were assessed by administration of the Semi-Structured Assessment for the Genetics of Alcoholism (Cao, Wu, An, & Li, 2000; Phillips et al., 2002). The SSAGA is a lay, face-to-face interview based upon prior research in psychiatric epidemiology and previously validated research interviews. It was designed to assess demographics, medical history, physical, psychological, and social manifestations of alcohol abuse and dependence, as well as related psychiatric disorders. The SSAGA has shown good reliability and validity for the diagnosis of MDD and AD (Lee & Kleinman, 2000). A unique feature of the SSAGA is that its design allows for the assessment of psychiatric symptoms independent of substance abuse. Thus, care was taken to ensure that all diagnoses of MDD excluded substance-induced mood disorders. The SSAGA also gathers detailed information on ethnic background; ethnicity was determined by each participant's report of the ethnicity of their biological grandparents.

### *Data Analysis Plan*

Prior to examination of the hypotheses, distributional properties, means, and standard deviations, as well as a correlation matrix of all variables to be included in the model were examined to determine the fit between the data and the assumptions of the proposed statistical procedures (Table 1). The overall accuracy of the data was determined by running basic descriptive analyses in the software program SPSS (e.g., all values within range, all continuous variables have reasonable means and standard deviations, validity of the "splits" for dichotomous variables).

Specific aims one through three were tested by determining rates of SI and MDD, as well as means (SDs) for ADI, MAX, and AD symptoms. Data were evaluated for the sample as a whole and for each sex and ethnic subgroup. The chi-square statistic was utilized to compare rates for dichotomous variables. Multivariate analysis of variance (MANOVA) with planned comparisons and post-hoc analyses was used to compare means of continuous variables. To assess the practical significance of any statistically-significant group differences, effect sizes were calculated. Phi ( $\Phi$ ) and Cramer's phi ( $\Phi_C$ ) provide effect size values for the chi-square statistics (Zhang et al., 2004) used to evaluate SI and MDD. Cohen's  $d$  ( $d$ ) and partial eta squared ( $\eta^2_p$ ; Cohen, 1973, 1988) provide effect size values for ANOVA and MANOVA.

Specific aim four involved the examination of an a priori, exploratory target model of a hypothesized relationship between SI, MDD, and AI (Figure 1). SI is specified as the endogenous (outcome) variable with MDD and AI as correlated exogenous (predictor) variables. SI and MDD are manifest (i.e., measured) variables, and AI represents the one latent factor created from ADI, MAX, and ADG. Evaluation of the

model was accomplished utilizing the confirmatory factor analysis (CFA) and structural equation modeling (SEM) procedure in EQS version 6.1. First, CFA was used to assess fit of the AI latent variable for the whole sample and each sex and ethnic subgroup separately. Second, SEM was used to assess fit of the full target model of SI. SEM is conducted as a system of simultaneous regression equations of latent and manifest (i.e., measured) variables and was accomplished using the statistical analysis software EQS. Models were analyzed utilizing the maximum likelihood estimation.

As delineated by Tanaka (Hendin et al., 2008), there are many limitations to assessing model fit based on a single indicator (i.e., chi-square likelihood ratio test). As such, model fit was assessed using multiple measures, and cutoff values indicative of reasonable model fit, based on guidelines articulated in the current literature (Neeleman & Lewis, 1999; Vijayakumar, 2002). A model was deemed to have adequate fit if the Comparative Fit Index (Blazer et al., 1994; Kessler et al., 2003a) value exceeded .93 and the Root Mean Square Error of Approximation (American College Health Association, 2007) value was less than .08. A model was deemed to have good model fit if the CFI valued exceeded .95 and the RMSEA value was less than .05. The statistical significance of individual model parameters was evaluated using a standard alpha level of .05.

Specific aim five involved the examination of ethnicity (i.e., Chinese, Korean, and White) as a moderator in the full target model validated through analysis of specific aim four (Figure 2). Multigroup comparison, via SEM, was utilized to explore moderation and determine whether there are differences in the relationships between SI, MDD, and AI vary depending on ethnicity.

Multigroup comparison involved three phases of model testing: establishment of configural invariance, establishment of metric invariance, and establishment of variance/covariance invariance. First, configural invariance was examined by exploring the invariance of the proposed measurement model and establishment of a baseline model for each ethnic subgroup. This initial step was accomplished in analysis of specific aim four. The overall fit of the baseline models represents the unconstrained multiple group model against which the subsequent, more constrained models were compared. Second, metric invariance was examined by adding constraints (forcing the parameters to be equal across subgroups) and testing the invariance of the factor loadings. Third, more constraints were added and the invariance of the factor variances and covariances was explored. After each set of constraints was added, a comparison was performed between the less-restrictive and more-restrictive model via a chi-square difference test. If the difference between models is non-significant, the null hypothesis of equivalence across groups is maintained. If however, there is a significant difference between the models, the null hypothesis is rejected and moderation by ethnicity is supported.

#### *Power Analysis*

Current statistical theory recommends having a minimum of 5-10 observations per estimated parameter for adequate statistical power (Tseng & Streltzer, 1997; Ware & Kleinman, 1992). Additionally, it is generally recommended that the ration between observations to estimated parameters is approximately 15 to 20: 1 for data whose distributions are non-normal. The full target model in this study estimated nine parameters with a sample size of  $N = 604$ , providing approximately 67 observations per parameter. Within each ethnic group, this provides approximately 21 observations per

parameter for Chinese ( $n = 190$ ), 23 for Koreans ( $n = 214$ ), and 22 for Whites ( $n = 200$ ).

While there are no widely accepted methods for determining minimum sample size in SEM for a given power level, using power analysis based on multiple regression, tests would be able to detect an effect size of  $f = .03$  with  $N = 604$ ,  $\alpha = .05$ ,  $k = 7$  manifest variables, and power = .80. Thus, according to Cohen's interpretive guidelines (Kosterman et al., 2000), it is possible to detect small effects (ranging from  $f = .07$  to .08) utilizing the available data.



## Results

### *Demographic Variables*

Demographic information for the whole sample and according to ethnicity is presented in Table 1. Of the original 604 participants, 19 (3.1%) were lifetime abstainers, and these 8 Chinese (5 women), 6 Koreans (5 women), and 5 Whites (2 women) were excluded from all analyses. The remaining 585 participants (49.1% female) consisted of 182 Chinese, 208 Koreans, and 195 Whites with a mean age of approximately 22 years and a mean level of education of approximately 15 years. No significant differences were found across ethnicity for the percentage of the sample that was female [ $\chi^2(2, 583) = 0.58, p = .749$ ]. It is important to note some significant ethnic differences in demographic variables despite these items not being under investigation in the current study. There was a significant difference across ethnicity in the percentage of participants who were born in the U.S. across ethnicity [ $\chi^2(6, 579) = 1.57, p < .001$ ], as all (100.0%) White participants were U.S-born. However, there was not a significant difference in the percentage born in the U.S. between Chinese (51.6%) and Koreans [46.6%;  $\chi^2(3, 390) = 1.50, p = .683$ ]. There were significant ethnic differences in age [ $F(2, 583) = 9.10, p < .001$ ] and years of education [ $F(2, 583) = 3.26, p = .039$ ]. Planned contrasts indicated that Chinese ( $M = 21.9$  years) and Koreans ( $M = 21.7$  years), who did not significantly differ, were significantly younger than Whites ( $M = 22.2$  years). Planned contrasts also indicated that Chinese ( $M = 15.3$  years) reported significantly more education than Koreans ( $M = 15.1$  years), although Whites ( $M = 15.2$  years) did not significantly differ from either Asian group.

*Overview of Specific Aims 1-3*

The first three aims of this study were to determine sex and ethnic differences in rates of 1) SI, 2) MDD, and 3) AI using an ethnically-diverse sample of 21 to 26-year-old college students. As previously described, AI was measured using three indicators: ADI, MAX, and AD symptoms. The distributional properties of the AI variables were examined to evaluate whether they meet the statistical assumptions of normality, homoscedasticity of residuals, and linearity. To minimize skewness and kurtosis, values for MAX were square root transformed, with the transformed values used in all analyses. The untransformed values for ADI and AD symptoms better fit the statistical assumptions than the transformed values.

Zero-order bivariate correlations between sex, SI, MDD, and AI variables were calculated separately by ethnicity, and results are presented in Table 2 for Chinese, Table 3 for Koreans, and Table 4 for Whites. As the data included continuous, dichotomous, and ordinal variables, four correlation coefficients are presented: Pearson product moment coefficient (correlation between two continuous variables), the point-biserial coefficient (correlation between one continuous and one dichotomous variable), the phi coefficient (correlation between two dichotomous variables), and Spearman's rho (correlation involving ordinal variables).

To address specific aims 1 and 2, chi-square analyses, including measures of effect size ( $\Phi$  and  $\Phi_C$ ) were utilized to determine if SI and MDD differed across sex and ethnicity. To assess possible interaction effects, the data were also examined across sex and ethnicity in six subgroups: Chinese women and men, Korean women and men, and White women and men. Data from these six subgroups were evaluated in two ways:

across sex within ethnicity (i.e., Chinese women compared to Chinese men, Korean women compared to Korean men, White women compared to White men) and across ethnicity within sex (i.e., Chinese women compared to Korean women compared to White women, Chinese men compared to Korean men compared to White men).

For specific aim 3 both the main effect and interactive effects of sex and ethnicity were tested using 2 x 3 (Sex x Ethnicity) MANOVAs. This analysis included planned contrasts and post-hoc analyses utilizing Tukey's honestly significant difference (HSD) to preserve family-wise Type-I error. In order to evaluate the data in the six subgroups described above, post-hoc analyses were further explored through the use of independent-samples *t*-tests (to explore across sex within ethnicity) and analysis of variance (ANOVA; to explore across ethnicity within sex). An adjusted alpha level of .01 [.05 divided by 5 (the number of follow up comparisons)] was used to evaluate interactions in order to preserve an overall significance level of .05. Cohen's *d* (*d*) and partial eta squared ( $\eta^2_p$ ) provide estimates of effect size. Results of the analyses relating to specific aims 1 through 3 are summarized in Tables 5 and 6.

#### *Specific Aim 1: Suicidal Ideation*

As shown in Table 5, approximately 36% of the sample reported having ever thought of killing oneself. Chi-square analyses revealed that there were no significant differences in SI across sex [ $\chi^2(1, 584) = .60, \Phi = -.03, p = .439$ ]. While the overall chi-square suggested no ethnic differences [ $\chi^2(2, 583) = 4.99, \Phi_C = .09, p = .083$ ], further examination indicated that Asians (Chinese and Koreans combined) have a significantly higher rate of SI than Whites [ $\chi^2(1, 584) = 4.78, \Phi = -.09, p = .029$ ]. SI was analyzed across the six subgroups to assess for interaction effects (Table 6). Across sex within

ethnicity, there were no significant differences between Chinese women and men [ $\chi^2(1, 181) = .44, \Phi = -.05, p = .509$ ], Korean women and men [ $\chi^2(1, 207) = .05, \Phi = -.02, p = .826$ ], or White women and men [ $\chi^2(1, 194) = .13, \Phi = -.03, p = .716$ ]. The same pattern emerged for ethnicity within sex. No significant differences were found between Chinese, Korean, and White women [ $\chi^2(2, 285) = 2.69, \Phi_C = .10, p = .260$ ], or between Chinese, Korean, and White men [ $\chi^2(2, 296) = 2.31, \Phi_C = .09, p = .314$ ] for SI. Tables 5 and 6 also show lifetime rates of having ever tried to kill oneself. While approximately 4% of the entire sample reported having made a suicide attempt, differences across sex and ethnicity were not analyzed due to the low base rates of this phenomenon.

*Specific Aim 2: Major Depressive Disorder*

Approximately 10% of the sample met lifetime criteria for MDD (Table 5). Women were more likely to meet criteria for MDD than men [13.9% versus 6.4%;  $\chi^2(1, 584) = 9.22, \Phi = -.13, p = .002$ ]. While the overall chi-square indicated no significant differences in rates of MDD across ethnicity [ $\chi^2(2, 583) = 3.56, \Phi_C = .08, p = .169$ ], there was a trend for Chinese to have a lower rate of MDD compared to non-Chinese, i.e., Koreans and Whites combined [ $\chi^2(1, 584) = 3.55, \Phi = -.08, p = .059$ ]. As with SI, potential interaction effects were explored with analysis across six subgroups (Table 6). Across sex within ethnicity, there were trends toward significant differences between Chinese women and men [ $\chi^2(1, 181) = 2.94, \Phi = -.13, p = .087$ ], Korean women and men [ $\chi^2(1, 207) = 3.37, \Phi = -.13, p = .066$ ], and White women and men [ $\chi^2(1, 194) = 3.40, \Phi = -.13, p = .065$ ], although results were not statistically significant at the  $p = .05$  level. Results followed an identical pattern across ethnicity within sex. No significant

differences were found between Chinese, Korean, and White women [ $\chi^2(2, 285) = 2.10$ ,  $\Phi_C = .09$ ,  $p = .350$ ] or between Chinese, Korean, and White men [ $\chi^2(2, 296) = 1.92$ ,  $\Phi_C = .08$ ,  $p = .382$ ].

*Specific Aim 3: Alcohol Involvement Indicators*

MANOVA revealed significant main effects for sex and ethnicity for all three AI variables (Table 5). Additionally, a significant interaction effect between sex and ethnicity emerged for MAX. As such, main effects will only be described for ADI and AD symptoms, while the description of MAX will focus on the significant interaction effect. Results for ADI across six subgroups are summarized in Table 6.

*Age of Drinking Initiation.* MANOVA and planned contrasts revealed a significant main effect for sex for ADI, with women initiating drinking at a significantly older age than men [ $M = 16.9$  years versus  $M = 16.3$  years;  $F(1, 584) = 7.51$ ,  $\eta^2_p = .01$ ,  $p = .006$ ]. MANOVA also revealed a significant main effect for ethnicity [ $F(2, 583) = 7.51$ ,  $\eta^2_p = .03$ ,  $p = .001$ ]. Post-hoc analyses, utilizing HSD, indicated no significant difference between Chinese ( $M = 16.9$  years) and Koreans ( $M = 16.9$  years;  $d = .01$ ,  $p = .976$ ), although both Chinese and Koreans initiated drinking at a significantly older age than Whites [ $M = 16.0$  years;  $d = -.31$ ,  $p = .002$  and  $d = -.36$ ,  $p = .003$ , respectively]. The interaction effect between sex and ethnicity was not significant [ $F(2, 583) = 1.96$ ,  $\eta^2_p = .01$ ,  $p = .142$ ].

Independent-sample *t*-tests, with an adjusted alpha level of .01, were used to evaluate the data across sex within ethnicity for ADI. No significant difference emerged between Chinese women ( $M = 17.3$  years) and Chinese men [ $M = 16.5$  years;  $t(2, 180) = 1.60$ ,  $d = .24$ ,  $p = .112$ ] for ADI. A significant difference did emerge for Koreans. Korean

women ( $M = 17.4$  years) initiated drinking at a significantly older age than Korean men [ $M = 16.4$  years;  $t(2, 206) = 3.04, d = .39, p = .003$ ]. There was not a significant difference between White women ( $M = 16.0$  years) and White men in ADI [ $M = 16.0$  years;  $t(2, 193) = 0.05, d = .00, p = .960$ ].

ANOVA and planned contrasts were used to explore results across ethnicity within sex at the  $\alpha = .01$  level. Both Chinese women ( $M = 17.3$  years) and Korean women ( $M = 17.4$  years), who did not significantly differ with respect to ADI, initiated drinking at a significantly older age than White women [ $M = 16.0$  years;  $F(2, 285) = 8.53, \eta^2_p = .06, p < .001$ ]. There were no significant ethnic differences in ADI among men [ $F(2, 296) = 1.06, \eta^2_p = .01, p = .349$ ].

*Maximum Drinks Ever Consumed.* While MANOVA revealed a significant main effect for both sex [ $F(1, 584) = 71.15, \eta^2_p = .11, p < .001$ ], and ethnicity [ $F(2, 583) = 54.45, \eta^2_p = .16, p < .001$ ], these findings must be interpreted within the limits of the aforementioned interaction effect between sex and ethnicity for MAX [ $F(2, 583) = 5.90, \eta^2_p = .02, p = .003$ ]. Follow up analyses utilizing independent samples  $t$ -tests ( $\alpha = .01$ ) examined the six subgroups across sex within ethnicity. There were no differences between Chinese women ( $M = 6.0$  drinks) and Chinese men at the adjusted alpha level for MAX [ $M = 7.5$  drinks;  $t(2, 180) = -2.28, d = -.25, p = .024$ ]. However, results were significant for Koreans and Whites. Korean women ( $M = 8.0$  drinks) reported a significantly lower MAX than Korean men [ $M = 15.9$  drinks;  $t(2, 206) = -6.41, d = -.83, p = .002$ ]. Additionally, White women ( $M = 10.5$  drinks) reported a significantly lower MAX than White men [ $M = 17.1$  drinks;  $t(2, 193) = -5.85, d = -.84, p < .001$ ].

Across ethnicity within sex, ANOVA and planned contrasts ( $\alpha = .01$ ) revealed significant differences for women and men. Chinese women ( $M = 6.0$  drinks) reported a significantly lower MAX than Korean women ( $M = 8.0$  drinks), who reported a significantly lower MAX than White women [ $M = 10.5$  drinks;  $F(2, 285) = 19.17, \eta^2_p = .12, p < .001$ ]. Results were similar, although not identical for men. Chinese men [ $M = 7.5$  drinks;  $F(2, 296) = 37.28, \eta^2_p = .20, p < .001$ ] reported a significantly lower MAX than Korean men ( $M = 15.9$  drinks) and White men ( $M = 17.1$  drinks), although Korean men and White men did not significantly differ.

*Alcohol Dependence Symptoms.* MANOVA revealed a significant main effect for sex, with women ( $M = 0.6$  groups) endorsing a significantly lower number of AD symptoms than men [ $M = 1.2$  groups;  $F(1, 584) = 22.96, \eta^2_p = .04, p < .001$ ]. MANOVA also revealed significant main effect for ethnicity [ $F(2, 583) = 20.73, \eta^2_p = .07, p < .001$ ]. Post-hoc analyses, utilizing HSD, found that Chinese endorsed a significantly lower number of AD symptoms than Koreans ( $M = 0.4$  groups versus  $M = 1.1$  groups;  $d = -.53, p < .001$ ), who endorsed a significantly lower number of AD symptoms than Whites [ $M = 1.4$  groups;  $d = .17, p = .010$ ]. The interaction effect of sex and ethnicity was not significant for AD symptoms [ $F(2, 583) = 2.64, \eta^2_p = .01, p = .072$ ].

Significant differences in AD symptoms also emerged when conducting follow up analyses with independent sample  $t$ -tests ( $\alpha = .01$ ). Across sex within ethnicity, there were no differences between Chinese women ( $M = 0.2$  groups) and Chinese men [ $M = 0.5$  groups;  $t(2, 180) = -1.91, d = -.31, p = .058$ ] or Korean women ( $M = 0.7$  groups) and Korean men [ $M = 1.2$  groups;  $t(2, 206) = -2.51, d = -.32, p = .013$ ] for AD symptoms at  $\alpha = .01$ . However, White women ( $M = 0.9$  groups) reported a significantly lower

number of AD symptoms than White men [ $M = 2.1$  groups;  $t(2, 193) = -3.75, d = -.67, p < .001$ ].

For ethnicity within sex ( $\alpha = .01$ ), Chinese women [ $M = 0.2$  groups;  $F(2, 285) = 7.19, \eta^2_p = .05, p < .001$ ] reported a significantly lower number of AD symptoms than Korean ( $M = 0.7$  groups) and White women ( $M = .09$  groups), who did not significantly differ. Similar to women, Chinese men ( $M = 0.5$  groups) endorsed a significantly lower number of AD symptoms than Korean men ( $M = 1.2$  groups), who endorsed a significantly lower number of AD symptoms than White men [ $M = 2.1$  groups;  $F(2, 296) = 14.02, \eta^2_p = .09, p < .001$ ].

*Specific Aim 4: Model of the Relationship Between Suicidal Ideation, Major Depressive Disorder, and Alcohol Involvement.*

To evaluate the full a priori, exploratory one-factor model specifying a hypothesized relationship between SI, MDD, and AI, the latent AI factor was first evaluated for each sex (women, men) and ethnic (Chinese, Korean, White) subgroup. AI was indicated by three observed variables: ADI, MAX, and AD symptoms. This one-factor measurement model of AI was tested using the confirmatory factor analysis (CFA) procedure in EQS. Mardia's coefficient suggested that the data were highly non-normal. To account for this non-normality, alternative test statistics were employed in all analyses, including the Satorra-Bentler scaled chi-square (DeWit et al., 2000; Grant & Dawson, 1997; Hawkins et al., 1997; Robins & Pryzbeck, 1985) and the robust versions of the CFI, RMSEA, and standardized and unstandardized path coefficients. As this measurement model of AI is just-identified (i.e., zero degrees of freedom), the overall model fit information for this one-factor CFA is unobtainable. However, it is possible to



interpret the individual model parameters. Standardized and unstandardized path coefficients are reported for each sex and ethnic subgroup, with statistical significance set at alpha equals .05.

Standardized and unstandardized path coefficients for the entire sample and across sex and ethnicity are reported in Table 7. For ADI, the standardized path coefficients were generally modest to large and statistically significant at  $p = .05$  for the sample as a whole, women, men Koreans, and Whites. For Chinese, the standardized path coefficient for ADI was non-significant. Standardized path coefficients for MAX and AD symptoms were generally large and statistically significant for all groups. Results of the CFA suggest that the exploratory AI model is measuring the same alcohol variables for women and men. However, the non-significant standardized path coefficient for ADI among Chinese suggests that the model is measuring a dissimilar alcohol-involvement construct for Chinese compared to Koreans and Whites. Despite this finding, the current literature provides a basis for ADI as an important indicator of AI. Moreover, it is useful to maintain consistency in models when comparing across groups to further explore potential heterogeneity. For these reasons, ADI was retained for evaluation of the full, exploratory target model of a hypothesized relationship between SI, MDD, and AI.

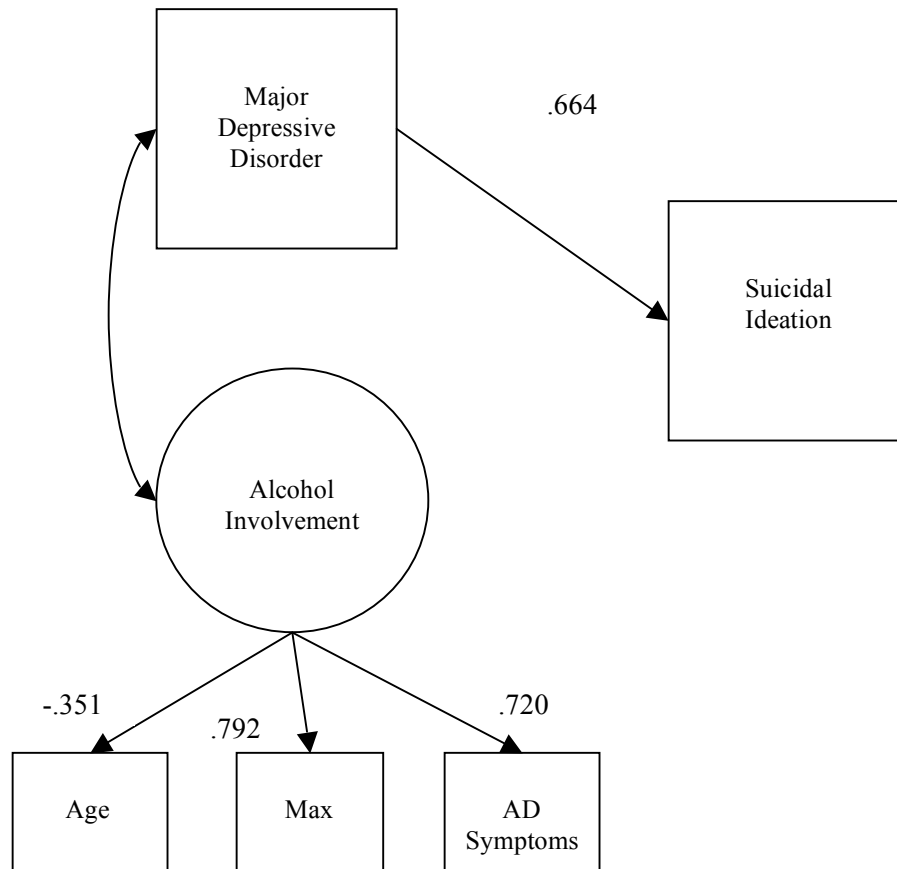
After validating the AI factor structure of the measurement model through CFA, the full target model of SI was examined (Figure 1). As described previously, the model specifies MDD and AI (the latent factor indicated by ADI, MAX, and AD symptoms) as correlated exogenous variables and SI as the endogenous variable. The model specifies a direct path between MDD and SI as well as a direct path between AI and SI. In the full target model, MDD was coded as a one-indicator factor in the measurement equations

and its metric was set at 1.00. This was done in order to estimate the interfactor correlation between MDD and AI and allow for model testing using EQS.

The full target model was initially tested for the entire sample. In model testing, SI and MDD were specified as categorical variables, generating polyserial and polychoric correlations. Results for the polyserial and polychoric correlations for all participants are reported in Table 8. As with the CFA in specific aim four, Mardia's coefficient suggested that the data were non-normal; robust fit indices and test statistics were utilized. The model fit well statistically [S-B  $\chi^2$  (5, N = 585) = 8.40,  $p = .135$ ] and descriptively [CFI = .989; RMSEA = .034, 90% CI (.000, .073)]. Results for all standardized and unstandardized path coefficients and interfactor correlations are presented in Table 9. All standardized path coefficients for the AI indicators were generally large and statistically significant at the  $p < .05$  level. The standardized path coefficient for MDD was set at 1.00 in order to evaluate the interfactor correlation between MDD and AI. The model generated two standardized path coefficients for SI, one for the AI factor (.010), which was not significant, and one for MDD (.656), which was statistically significant. Results indicated that the model explains approximately 43.2% of the variance in SI. The interfactor correlation between MDD and AI (.107) was not statistically significant at the  $p < .05$  level.

It is important to assess whether this target model demonstrates better model fit than a more parsimonious, lower-order model containing only a subset of the parameters from the higher-order, full target model. To evaluate this, the direct path between the AI factor to SI was eliminated, creating a more parsimonious model nested within the target model (Figure 3). This helped determine whether the variance in SI is better explained by

only MDD compared to MDD and AI. This lower-order model was then analyzed in a similar fashion as the target model.



*Figure 3.* Lower-order model of the hypothesized relationship between suicidal ideation, major depressive disorder, and alcohol involvement nested within the full target model. Standardized path coefficients are reported for the sample as a whole.

Mardia's Coefficient suggested that the data are non-normal and the robust versions of the fit indices and test statistics were interpreted. The nested, one-factor model also fit well statistically [ $S-B \chi^2(6, N = 585) = 8.37, p = .212$ ] and descriptively [CFI = .993; RMSEA = .026, 90% CI (.000, .064)]. All standardized path coefficients

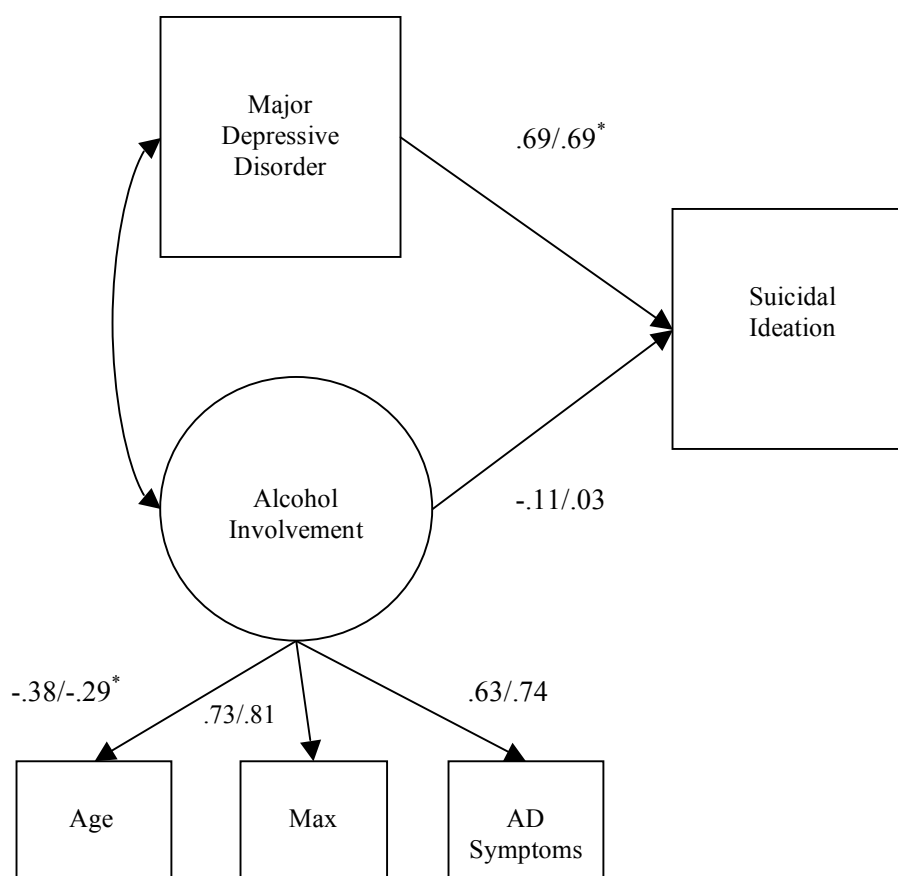
were generally large and statistically significant at  $p < .05$ . Values for standardized path coefficients for the AI indicators were  $-.351$  for ADI,  $.792$  for MAX, and  $.720$  for AD symptoms. As in the full target model, the standardized path coefficient for MDD was set at  $1.00$  to allow estimation of the interfactor correlation between MDD and AI. For the SI equation, the standardized path coefficient for MDD was  $.664$  and the model accounted for approximately  $44.1\%$  of the variance for SI.

This new, more parsimonious model estimates a subset of the parameters estimated in the full target model; as such, it may be considered nested within the full target model. The chi-square difference test was utilized to compare the models. As non-normality was indicated for both models, requiring the use of robust fit indices and test statistics, the Satorra-Bentler Scaled Difference was utilized (Grant & Dawson, 1997). Results of the adjusted chi-square difference test indicated no significant difference between the full target and nested models [ $\Delta\chi^2(1, N = 585) = .74, p = .388$ ]. This suggests that the nested model without the direct path between AI and SI better fits the data due to parsimony. However, the full target model was retained for further analyses to help expound upon this finding and to continue evaluation of the relationship between SI and AI variables previously found to be robustly related to SI. The full target model was then analyzed for women, men, Chinese, Koreans, and Whites.

*Women.* Results of the polyserial and polychoric correlations are presented in Table 10. Mardia's coefficient suggested non-normality and robust fit indices and test statistics were interpreted. The model did not fit well statistically [S-B  $\chi^2(5, N = 287) = 25.15, p < .001$ ] or descriptively [CFI =  $.901$ ; RMSEA =  $.119$ , 90% CI ( $.075, .166$ )]. All standardized and unstandardized path coefficients and interfactor correlations are

presented in Table 9. However, as the full target model did not fit well statistically or descriptively for women, individual parameters (e.g., path coefficients) should not be interpreted. The poor overall model fit suggests the full target model does not adequately represent the relationship between SI, MDD, and AI for women.

*Men.* Results of the polyserial and polychoric correlations are reported in Table 11. Mardia's Coefficient suggested non-normality and robust test statistics were interpreted. The model fit well statistically [S-B  $\chi^2(5, N = 298) = 4.31, p = .506$ ] and descriptively [CFI = 1.00; RMSEA = .000, 90% CI (.000, .075)]. All standardized and unstandardized path coefficients and interfactor correlations are presented in Table 9. For men, all standardized path coefficients for the AI indicators were statistically significant and moderate for ADI (-.292) and large for MAX (.809) and AD symptoms (.740). As noted previously, the standardized path coefficient for MDD was set at 1.00 to estimate the interfactor correlation between MDD and AI. For the SI equation, the standardized path coefficient for AI (.027) was not statistically significant; however, it was statistically significant for MDD (.685). The model accounted for 47.5% of the variance in SI. The interfactor correlation between MDD and AI (.150) was not statistically significant at the  $p < .05$  level.



*Figure 4.* Full target model of the hypothesized relationship between suicidal ideation, major depressive disorder, and alcohol involvement across sex. All values are standardized path coefficients. For each path, values are provided separately for women/men. Individual parameters are not interpretable for women due to poor overall model fit.  $^*p < .05$ .

*Chinese.* Results of the polyserial and polychoric correlations are presented in Table 12. Mardia's Coefficient indicated non-normality and robust fit indices and test statistics were interpreted. The model did not fit well statistically [S-B  $\chi^2(5, N = 182) = 11.71, p = .040$ ] or descriptively [CFI = .897; RMSEA = .086, 90% CI (.018, .151)]. Standardized and unstandardized path coefficients and interfactor correlations are presented in Table 9. However, as in the case of women, poor overall model fit precludes

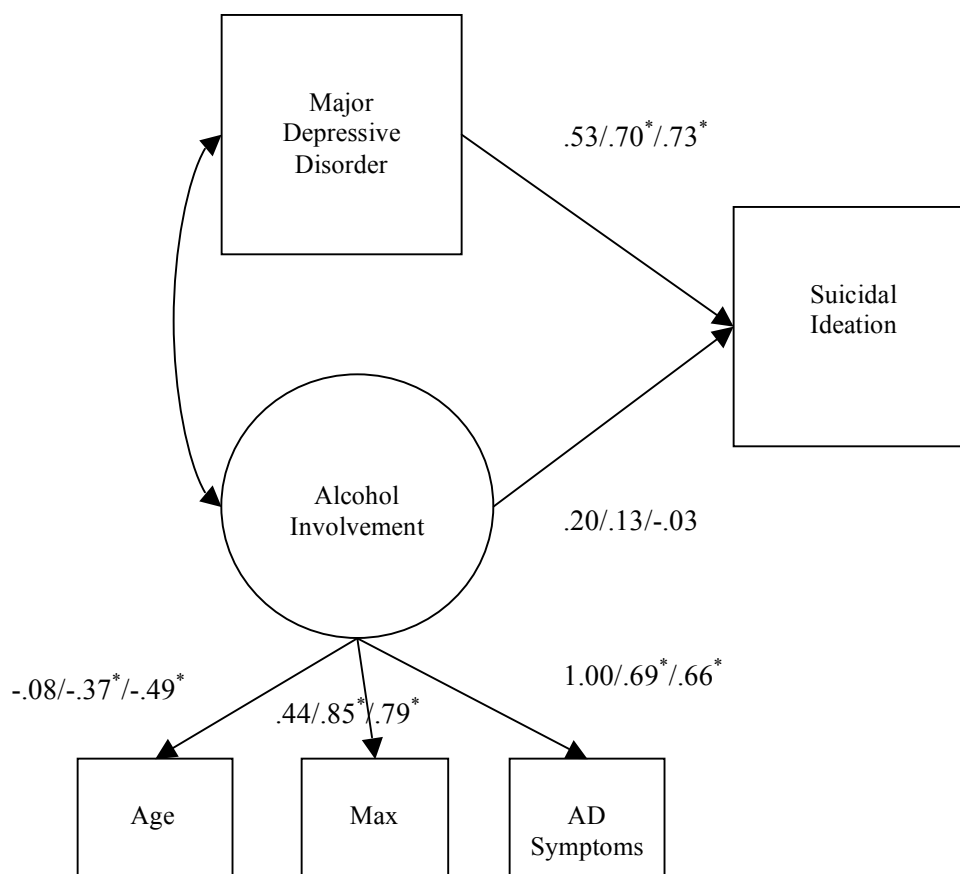
interpretation of the individual parameters and suggests that the full target model does not accurately represent the relationship between SI, MDD, and AI for Chinese.

*Koreans.* Results of the polyserial and polychoric correlations are reported in Table 13. Mardia's Coefficient suggested non-normality and robust fit indices and test statistics were interpreted. The model fit well statistically [S-B  $\chi^2$  (5, N = 208) = 3.37,  $p$  = .643] and descriptively [CFI = 1.00; RMSEA = .000, 90% CI (.000, .078)]. All standardized and unstandardized path coefficients and interfactor correlations are presented in Table 9. For the AI indicators, standardized path coefficients were generally large and statistically significant: -.372 for ADI, .851 for MAX, and .694 for AD symptoms. The standardized path coefficient for MDD was set at 1.00 to allow for estimation of the interfactor correlation. For the SI equation, the standardized path coefficient for AI (.134) was not statistically significant, although the standardized path coefficient for MDD (.703) was large and statistically significant. The model accounted for approximately 50.6% of the variance in SI. The interfactor correlation between MDD and AI (-.035) was not statistically significant.

*Whites.* Results of the polyserial and polychoric correlations are presented in Table 14. Mardia's Coefficient indicated non-normality and robust fit indices and test statistics were interpreted. The model fit well statistically [S-B  $\chi^2$  (5, N = 195) = 10.37,  $p$  = .065] and descriptively [CFI = .968; RMSEA = .074, 90% CI (.000, .138)]. Standardized and unstandardized path coefficients and interfactor correlations are presented in Table 9. The standardized path coefficients for all three AI indicators were large and statistically significant: -.490 for ADI, .791 for MAX, and .659 for AD symptoms. The standardized path coefficient for MDD could not be estimated as the

metric was set at 1.00 in model specification to allow for estimation of the interfactor correlation between MDD and AI. For the SI equation, the standardized path coefficient for the AI factor (-.032) was non-significant while the value for MDD (.732) was statistically significant. The model accounted for approximately 53.2% of the variation for SI. The interfactor correlation between MDD and AI (.093) was not statistically significant.





*Figure 5.* Full target model of the hypothesized relationship between suicidal ideation, major depressive disorder, and alcohol involvement across ethnicity. All values are standardized path coefficients. For each path, values are provided separately for Chinese/Koreans/Whites. Individual parameters are not interpreted for Chinese due to poor overall model fit. \*  $p < .05$ .

#### *Specific Aim 5: Ethnicity as a Moderator*

Ethnicity was explored as a moderator in three phases of model testing: establishment of configural invariance, establishment of metric invariance, and establishment of invariance of the factor variances and covariances. Multigroup comparisons were conducted between two ethnic subgroups at a time (i.e., Chinese compared to Koreans, Chinese compared to Whites, Koreans compared to Whites).

Evaluation of configural invariance involved analyses from specific aim four; the one-factor model of AI was first assessed through CFA and the full target model of SI was assessed with SEM to establish baseline models for each ethnic group. As reported, the full target model demonstrated poor overall fit for Chinese and good overall fit for Koreans and Whites. The poor fit for Chinese provides evidence against configural invariance for Chinese compared to Koreans and Whites. This finding supports the moderating role of ethnicity. As analyses failed to establish configural invariance for Chinese and either other ethnic group in the sample, multigroup comparison focuses on comparing Koreans and Whites.

The good overall model fit and the pattern of the standardized and unstandardized path coefficients for the full target model for Koreans and Whites supports configural invariance and establishes the baseline models for both ethnic groups. The overall fit of the two baseline models was determined by adding the sum of the chi-squares ( $\chi^2 = 13.73$ ) and the sum of degrees of freedom ( $df = 10$ ), adjusting for non-normality. This represents the overall fit of the two baseline models for Koreans and Whites and was used as the baseline model for comparison to metric invariance.

After the first two baseline models were tested to establish configural invariance, a stacked file target model for SI was tested for Koreans and Whites in an attempt to establish metric invariance. As described previously, the AI factor was indicated by three observed variables, and an interfactor correlation between MDD and AI was specified. In order to test metric invariance, the standardized path coefficients for each of the AI indicators (ie., ADI, MAX, and AD symptoms) were set to 1.00 in order to set the metric for the latent variable and facilitate estimation of variance. As the path coefficients must

be standardized one at a time, the full model was run three times to estimate variance for each factor. Mardia's Coefficient indicated non-normality, and robust fit indices and test statistics were interpreted. The constrained full target model for Koreans and Whites fit well statistically [S-B  $\chi^2$  (14, N = 403) = 16.37,  $p$  = .292] and descriptively [CFI = .993; RMSEA = .021, 90% CI (.000, .054)]. When this metric invariance model was compared to the baseline model using the Satorra-Bentler Scaled Difference, [ $\Delta\chi^2(4) = .776, p > .05$ ], the critical  $\chi^2$  value (9.49) for 4 *dfs* was not met. This suggests that the path coefficients are invariant across the two ethnic groups. Examination of the LaGrange Multiplier Statistics did not reveal any significant findings, again indicating that no constraints were to be released and that all path coefficients were identical for Koreans and Whites. These results support the establishment of metric invariance and allow for the final phase of multigroup comparison: establishment of variance/covariance invariance.

The full target metric invariance model was then tested to establish covariance invariance. The AI factor was indicated by three measured variables and one interfactor correlation between MDD and AI was specified. Mardia's coefficient indicated non-normality, and robust fit indices and test statistics were interpreted. The model fit well statistically [S-B  $\chi^2$  (15, N = 403) = 16.32,  $p$  = .361] and descriptively [CFI = .996; RMSEA = .015, 90% CI (.000, .050)]. When this covariance invariance model was compared to the metric invariance model, again using the Satorra-Bentler Scaled Difference [ $\Delta\chi^2(1, N = 403) < 0.001, p = .982$ ], the critical  $\chi^2$  value (3.84) for 1 *df* was not reached, and no significant difference between models was noted. This suggests there

are no differences in variance/covariance between Koreans and Whites, and that the variance/covariance invariance model provides the best fit of the three models tested (configural invariance, metric invariance, and covariance invariance) in multigroup comparisons due to parsimony.

## Discussion

Most of the existing literature on suicidality and its risk factors has been generated from primarily White samples. This study explored the relationship between SI, MDD, and AI in a diverse sample of college students. Rates of SI, MDD, and averages of AI indicators were determined for Chinese, Koreans, and Whites. The focus of this study was to assess potential heterogeneity among two traditionally understudied and aggregated Asian-American subgroups compared to members of the dominant American culture (i.e., Whites).

### *Specific Aim 1: Suicidal Ideation*

Over one-third (36.3%) of the entire sample reported lifetime history of SI. This is lower than the rate found in a large national survey of college students, where 50% of the sample reporting having engaged in suicidal ideation at least once over their lifetimes (Drum, 2008), although higher than other estimates ranging from 10% to 25% (Grant & Dawson, 1997; Hawkins et al., 1997). Overall, this rate is intermediate to rates found in other studies. The finding of no significant sex differences in SI was contrary to our hypothesis, based on evidence in the current literature suggesting higher rates of MDD for women compared to men, that women would have a higher rate of SI than men. Regarding ethnicity, results indicated that when Chinese and Koreans were aggregated, they had a higher rate of SI than Whites, although no differences were found between Asian subgroups. One potential reason for these findings may be the way SI was measured in this investigation; differences across studies may be due to variation in how SI was assessed or due to sample characteristics.

The current study assessed SI as part of a semi-structured clinical interview while most other studies used a self-report survey. Each participant in the current study was asked whether he or she had “ever thought of killing” himself or herself. This methodology made no distinction between fleeting ideation versus serious ideation, number of episodes of SI, the presence or absence of means, motive, plan, or intent, etc. It is possible that this method reduced sensitivity in identifying those with more problematic or risky SI, although this operationalization is congruent with the way suicidal ideation was assessed in large surveys. Additionally, there is some evidence that social desirability may bias responding (Prescott & Kendler, 2001), and that persons are less likely to endorse behavior that is perceived as socially undesirable (e.g., suicidal ideation) in face-to-face interviews compared to anonymous surveys (Brenner et al., 1999; Conner et al., 2003; Cottler et al., 2005; Driessen et al., 1998). The findings of no differences between women and men and a higher rate of SI among Asians compared to Whites contributes significantly to the literature regarding suicidality as most of the existing investigations on which the hypothesized differences were based have focused on suicide attempts and completions to the exclusion of SI.

The low base rates of suicide attempts precluded formal analysis. However, it is notable that, in this sample, no Chinese men and only approximately 2% of White men attempted suicide compared to 2-3 times the rates (5%-6%) for Chinese women, Korean women and men, and White women. Results may indicate the existence of protective factors for Chinese and White men or an unknown risk factor for Chinese women, Koreans, and White women.

There is a multitude of variables that potentially influence rates of suicidality, including economic conditions (Schuckit, 2009; Schuckit et al., 2007) and rurality versus urbanity (Core Institute, 2000; Donovan, Jessor, & Jessor, 1983; Glider, Wall, & Ehlers, 2004; Goodwin, Fergusson, & Horwood, 2004). Cultural and religious factors are also significant, including culturally-dictated roles for females and males. For example, higher rates of suicide for women compared to men in China have been attributed in part to traditional male dominance in the society as a whole, leaving women in less-stable social and economic circumstances compared to men (U.S. Department of Health and Human Services, 2001). There is also some evidence that socio-cultural stressors are more prominent risk factors of later suicidality in Asians compared to MDD or related affective disorders as is seen with primarily White samples in the U. S. (Reeves & Bennett, 2003; World Gazetteer, 2006).

Tolerance, acceptance, and/or endorsement of suicidality may also depend on cultural factors. For instance, suicide in more traditional Asian cultures may be viewed sympathetically if the motivation for ending one's life is for the betterment of the collective (e.g., family or community), in response to terminal illness, or as a means of redemption after disgrace (President's Advisory Commission on Asian Americans and Pacific Islanders, 2001). Religious views also influence suicidality, and may have a protective effect for both individuals and the larger society, depending on the degree to which religious beliefs are endorsed and promoted by the state (U.S. Department of Health and Human Services, 2001; Uehara et al., 1994). The current study did not assess any of these potentially important intervening variables. It would be useful to explore such variables in future research examining suicidality in culturally-diverse samples.

*Specific Aim 2: Major Depressive Disorder*

Ten percent of this sample met criteria for lifetime diagnosis of MDD. This result is consistent with national population estimates of 6%-17% (Wundt, 1916) and data from over 91,000 university students indicating 15% met lifetime diagnostic criteria for MDD (Hofstede, 1980). Additionally and consistent with the existing literature and our hypothesis, more women (13.9%) met the diagnosis than men (6.4%) for the sample as a whole. There were no differences in rates of MDD across ethnicity, and our hypothesis that Chinese and Koreans would have higher rates of MDD than Whites was not supported. Moreover, despite the finding of a higher rate of MDD among women for the sample as a whole, when comparing women and men within ethnicity (e.g., Chinese women compared to Chinese men), no significant differences emerged for any of the three ethnic subgroups. The data, however, suggest trends toward significant differences in MDD by ethnicity, with Chinese having a lower rate of MDD compared to Koreans and Whites when aggregated. Additionally, within each of the three ethnic subgroups, the data suggested trends for women to have a higher rate of MDD than men.

Findings of no significant differences in MDD by ethnicity are important, and are contrary to evidence that the conceptualization and expression of depression is culturally dictated (e.g., family, community, nation; Triandis, 1995). Current DSM-IV criteria, on which diagnoses in the current study were based, categorize depression as a disorder of mood and underscore the importance of psychological and emotional symptoms. Asians have been found to be more likely than Whites to report and emphasize somatic complaints when in distress while downplaying psychological symptoms (Bauman & Ennet, 1994; Grandy, 1996). Further, it has been proposed that rates of MDD may be



underestimated in Asians due to how symptoms are manifested and recognized (U.S. Census Bureau, 2004). Empirical support for this hypothesis exists in the current literature. There are indications that many individuals diagnosed with neurasthenia, a prevalent physical disorder in China characterized by physiological pain and weakness, may actually suffer from depression. A de-emphasis on, or a reticence to report, emotional symptoms is likely influenced by mind/body holism and the considerable stigma associated with psychological difficulties in Asian cultures. A lack of ethnic differences in MDD in the current study may be due to the sample characteristics (e.g., the current sample may be more acculturated than samples where differences in MDD have been found). It would be important to explore this possibility in future research.

*Specific Aim 3: Alcohol Involvement*

*Age of Drinking Initiation.* Findings that women initiate drinking at a significantly older age than men is consistent with our hypothesis of a lower level of AI for women compared to men and is consistent with previous findings (Grant et al., 2004; Knight et al., 2004; Wall, 2005; Wechsler & Kuo, 2000). When evaluating within the six subgroups, sex differences were only significant for Koreans. Korean women initiated drinking at a significantly older age than Korean men, although there were no differences between Chinese women and men or White women and men. This suggests that there may be cultural or biological factors leading to increased risk for AI for Korean men compared to Korean women.

The finding that there was not a significant difference in ADI between Chinese and Koreans does not support the hypothesis of a lower level of AI for Chinese compared to Koreans and Whites. However, there was a significant difference between Asians and

Whites, with both Chinese and Koreans initiating drinking at a significantly older age than Whites. This result is consistent with the current literature suggested an older ADI and consequently less risk for alcohol misuse among Asians compared to Whites .

In analysis of sex across ethnicity, results suggest that Chinese and Korean women initiate drinking at the same age, and that this age is younger than the age White women initiate drinking. There were also no significant differences found for men across ethnicity, suggesting that Chinese, Korean, and White men initiate drinking at approximately the same age. This may suggest that there are factors in all three cultures that lead to decreased risk for women compared to men regarding ADI.

*Maximum Drinks Ever Consumed.* Results regarding maximum number of drinks ever consumed highlight the importance of examining effects across six subgroups. Findings suggest that both Korean and White women have a lower number of MAX than Korean and White men, respectively. While the difference in MAX between women and men was not statistically significant for Chinese at the more stringent alpha level of .01, there was a trend toward this effect, and the overall pattern for all three ethnic groups is consistent with our hypothesis, with existing research (Wechsler & Kuo, 2000), and with findings related to ADI in the current study suggesting a lower AI in women compared to men. Additionally, findings of a lower MAX for Chinese women and men compared to Korean and White women and men support our hypotheses of a lower level of AI in Chinese and offers support for a protective effect associated with Chinese ethnicity.

*Alcohol Dependence Symptoms.* Women reported a significantly lower number of AD symptoms than men, offering support for our hypothesis of a lower level of AI for women compared to men. This is consistent with previous findings of lower rates of

AUDs for females compared to males (Grant et al., 2004). Additionally, Chinese reported the lowest number of AD symptoms, followed by Koreans, with Whites reporting the highest number of AD symptoms of this sample, supporting our original hypothesis.

When examining across six subgroups, there were significant sex differences for Koreans and Whites, with women reporting a lower number of AD symptoms than men. This was not the case for Chinese. The lack of a significant difference for Chinese men and women may be reflective of the overall pattern of a generally lower level of alcohol consumption and alcohol-related problems among Chinese compared to Koreans and Whites, and may indicate additional protective factors associated with Chinese ethnicity.

Overall, results regarding AI are consistent with current literature and support the hypothesis that women exhibit a lower level of AI than men and Chinese exhibit the lowest level of AI of the three ethnic groups in this sample. These results again highlight heterogeneity of risk for AI between Asian-American subgroups.

*Specific Aim 4: Model of Relationship Between Suicidal Ideation, Major Depressive Disorder, and Alcohol Involvement.*

The one-factor model of AI was evaluated for the entire sample, for women and men, and for Chinese, Koreans, and Whites. Results indicated that for women, men, Koreans, and Whites, ADI, MAX, and AD symptoms were significant, and that the AI factor was adequate for these groups. However, the ADI variable was not significant for Chinese, suggesting that the AI factor was not adequate for this ethnic group. This finding does not support the initial hypothesis that the target model would demonstrate adequate fit for all groups. It is notable that for Chinese, ADI was not a significant indicator of AI when considering the measurement model of SI. This contrasts with

several studies evaluating cross-sectional data suggesting that ADI is related to risk for alcohol dependence and a significant indicator of AI even after controlling for other risk factors (Dawson, 2000; Grant & Dawson, 1997), and utilizing ethnically-diverse samples. However, the relationship between ADI and risk for later alcohol misuse is unclear. As with findings for ADI, MAX, & AD symptoms, these findings again highlight the need to explore heterogeneity and examine factors contributing to unique risk and protection among ethnic subgroups.

While the initial analyses of the AI factor indicated discrepant adequacy for Chinese compared to other groups, the AI factor was retained and the full target model was tested. This was conducted to further explore the discrepancy between ethnic groups and evaluate the relationships between SI, MDD, and AI hypothesized in the model (Figure 1). The full target model was poor for both women and Chinese, indicating that this hypothesized relationship does not accurately depict the data for these groups. However, the model demonstrated good fit for the sample as a whole, men, Koreans, and Whites. While the model indicated good overall fit with large and statistically significant factor loadings for ADI, MAX, AD symptoms and MDD, a substantial proportion of the variance in SI (approximately 46% to 57%) was left unexplained. As noted earlier, this suggests that other variables not included in the current model should be evaluated to increase understanding of SI.

Results of the full model testing yielded two unexpected findings: non-significance of the AI factor and lack of correlation between MDD and AI in the full target model. These findings are consistent across sex and ethnicity and are further buttressed by the better overall model fit, due to parsimony, of the lower-order model

without the direct path from AI to SI (Figure 3). These findings contrast with multiple studies that have found relationships between MDD and AI, as well as between SI and MDD and SI and AI. It is possible that the measured variables selected as indicators of AI (i.e., ADI, MAX, and AD symptoms) were not adequate, and that other measured variables would have been significantly related and better explained the data. However, these findings are consistent with previous research that did not find a significant relationship between AUDs and major depression. Additionally, persons in their twenties are at the beginning of their drinking careers and typically exhibit lower rates of formal substance-related disorders than those seen in treatment or other high-risk samples despite having higher overall rates of drinking.

*Specific Aim 5: Ethnicity as a Moderator of the Relationship Between Suicidal Ideation, Major Depressive Disorder, and Alcohol Involvement.*

As described above, initial evaluation of the full target model for each ethnic subgroup found that the model was not the same for Chinese compared to Whites and Koreans. This finding suggests that the relationships between SI, MDD, and AI was different across ethnic subgroups and provided initial support for the hypothesis of ethnicity as a moderator of these relationships. The poor overall fit of the full target model for Chinese precluded the establishment of a Chinese baseline model for use in multigroup comparison; this suggests that the model is not measuring the same constructs for Chinese as for Koreans and Whites. Thus, formal comparison was completed for Koreans and Whites, for whom the full target model demonstrated good fit. Formal analyses comparing Koreans to Whites found that the model was measuring equivalent constructs across these two ethnic groups. Analyses of the full target model further

support the hypothesis of moderation by ethnicity. Results suggest that the relationship between SI, MDD, and AI are different for Chinese compared to Koreans and Whites, but are similar for Koreans compared to Whites. Although not a main focus of the current study, significant differences in demographic variables were found across ethnicity. All White participants were U.S. born, while about half of Chinese and Koreans were U.S. born. Additionally, the statistically-significant differences found across ethnicity for age and years of education are small and likely not meaningful.

When considering ethnic heterogeneity of psychopathology, it is important to consider cultural context. Broad terms like "Asian" and "White" encompass many cultures, and important differences may be obscured when data are averaged across ethnic subgroups. While this is true for White Americans, most subgroups within this category share a common language (i.e., English) and have roots in the U.S. that began in the early 17<sup>th</sup> century . In contrast, most Asian Americans are first or second generation immigrants who represent up to 43 ethnic groups and speak over 100 languages and dialects . Additionally, nearly four-fifths of Asian Americans speak a language other than English at home (Reeves & Bennet, 2004), with approximately 40% of Chinese and 41% of Koreans residing in households where no resident over age 14 and over speaks English "very well" . Consequently, Asian-American subgroup differences may be particularly pronounced, and aggregated data may offer an incomplete or misleading impression . These findings suggest that within the U.S., it is imperative to examine ethnic differences in psychopathology, as there is increasing evidence that different ethnic groups conceptualize both mental and physical illness in varied ways .

There is extensive evidence suggesting that culture, for which ethnicity is widely used as a proxy measure, represents a variable unique in its functioning with regards to experience. It has been purported within the scientific literature that culture is a cognitive variable through which all other experience is interpreted . When viewed in this manner, culture is inexorably linked to psychological phenomena and attempts to observe, describe, and explain behavior removed from its cultural context are spurious. This perspective continues to amass empirical support and there is increasing awareness of the role of culture in both research and clinical practice .

Two paradigms, individualism and collectivism, are culturally dictated and have been found to influence conceptualization of health and illness . Individualism is prominent in the U.S. majority culture which reflects Western, White values . Individualism emphasizes independence, individual competence and efficacy, and the needs and desires of the individual over those of the collective . This contrasts with collectivism that is prominent in Asian cultures . Collectivism emphasizes interdependence, collective competence and efficacy, and the needs and desires of the collective over those of the individual. Higher collectivism has been repeatedly found among Asian Americans compared to White Americans .

Dualism, the distinct separation between body and mind, is typically found in individualistic cultures, like the U.S. Holism or monism, connectedness or lack of separation between mind, body, and spirit, is more characteristic of collectivism and Asian cultures . Adherence to individualism versus collectivism and dualism versus holism likely has significant ramifications for ways in which mental illness is defined, as well as for effectiveness and acceptability of intervention and treatment strategies .

Cultural variation in the conceptualization and expression of psychopathology has been well documented, and there is increasing evidence of differences across ethnic groups within the U.S. in the conceptualization of both mental and physical illness .

While findings from the current study provide valuable information, some limitations must be noted. All data in this investigation were elicited from retrospective self reports, which may be subject to differential response bias across ethnic groups . Additionally, the cross-sectional nature of the design precludes examination of the temporal relationship among variables and highlights the need for future longitudinal designs to address causation. It is also likely that psychosocial and biological variables not included in the current study (e.g., level of acculturation, quantity and frequency of alcohol consumption, genotype) would augment the explanatory power of the hypothesized exploratory model. Finally, utilizing a college sample may limit the external validity of the findings, particularly as this sample was recruited from a highly competitive university. Asian Americans, however, achieve higher level of education than other ethnic groups within the U.S. , which may help increase the generalizability of the findings for young-adult Asian Americans.

In conclusion, the existing literature regarding among SI, MDD, and AI among Asian Americans is scarce. Further, extant research is frequently contradictory, as some studies have found increased rates of SI and MDD among Asians compared to Whites, while others have found the reverse or similar rates. The examination of SI, MDD, and AI in a sample of Chinese, Koreans, and Whites allows for comparison to the existing literature and expands the knowledge base regarding two traditionally understudied, and often aggregated, ethnic subgroups. Overall results may indicate potential protective factors



associated with Chinese ethnicity compared to Koreans and Whites. The findings from the present study will help explicate the relationship between these variables as well as provide needed information regarding the role of ethnicity, which may affect the influence of MDD and AI on suicidality. Findings may ultimately inform suicide prevention efforts targeted toward college-attending populations.

Table 1

*Demographic Variables for Chinese, Korean, and White College Students*

| Group   | Female <sup>a</sup><br>(%) | US Born <sup>a**</sup><br>(%) | Age <sup>**</sup><br>(Years) |           | Education <sup>**</sup><br>(Years) |           |
|---------|----------------------------|-------------------------------|------------------------------|-----------|------------------------------------|-----------|
|         |                            |                               | <i>M</i>                     | <i>SD</i> | <i>M</i>                           | <i>SD</i> |
| Whole   | 49.1                       | 67.4                          | 21.9                         | 1.23      | 15.2                               | 1.08      |
| Chinese | 51.1                       | 51.6                          | 21.9                         | 1.20      | 15.3                               | 0.91      |
| Korean  | 49.0                       | 46.6                          | 21.7                         | 1.08      | 15.1                               | 0.76      |
| Whites  | 47.2                       | 100.0                         | 22.2                         | 1.43      | 15.2                               | 1.45      |

\*  $p < .05$ . \*\*  $p < .01$

Table 2

*Bivariate Correlations Between Sex, Suicide Variables, Major Depressive Disorder, and Alcohol-Involvement Variables for Chinese*

| Variable                 | 1    | 2    | 3     | 4     | 5    | 6    | 7     |
|--------------------------|------|------|-------|-------|------|------|-------|
| 1. Sex                   | ---- | -.05 | -.16* | -.13  | -.12 | .17* | -.13  |
| 2. Ideation              |      | ---- | .20** | .23** | -.05 | .06  | .44** |
| 3. Attempt               |      |      | ----  | .50** | .13  | -.09 | .29** |
| 4. MDD                   |      |      |       | ----  | .08  | .15  | .47** |
| 5. Age Initiation        |      |      |       |       | ---- | .12  | -.03  |
| 6. Max Ever <sup>a</sup> |      |      |       |       |      | ---- | .10   |
| 7. AD Symptoms           |      |      |       |       |      |      | ----  |

<sup>a</sup>Square root transformation. \*  $p < .05$ . \*\*  $p < .01$

Table 3

*Bivariate Correlations Between Sex, Suicide Variables, Major Depressive Disorder, and Alcohol-Involvement Variables for Koreans*

| Variable                 | 1    | 2    | 3     | 4     | 5      | 6      | 7     |
|--------------------------|------|------|-------|-------|--------|--------|-------|
| 1. Sex                   | ---- | -.02 | -.01  | -.13  | -.21** | .41**  | -.06  |
| 2. Ideation              |      | ---- | .31** | .36** | -.11   | .05    | .40** |
| 3. Attempt               |      |      | ----  | .23** | -.11   | .18**  | .34** |
| 4. MDD                   |      |      |       | ----  | -.07   | -.05   | .59** |
| 5. Age Initiation        |      |      |       |       | ----   | -.31** | -.07  |
| 6. Max Ever <sup>a</sup> |      |      |       |       |        | ----   | .04   |
| 7. AD Symptoms           |      |      |       |       |        |        | ----  |

<sup>a</sup>Square root transformation. \*  $p < .05$ . \*\*  $p < .01$

Table 4

*Bivariate Correlations Between Sex, Suicide Variables, Major Depressive Disorder, and Alcohol-Involvement Variables for Whites*

| Variable                 | 1    | 2    | 3     | 4     | 5    | 6      | 7     |
|--------------------------|------|------|-------|-------|------|--------|-------|
| 1. Sex                   | ---- | -.03 | -.12  | -.13  | -.00 | .39**  | -.17* |
| 2. Ideation              |      | ---- | .31** | .42** | -.05 | .02    | .51** |
| 3. Attempt               |      |      | ----  | .41** | .06  | -.04   | .40** |
| 4. MDD                   |      |      |       | ----  | .09  | .01    | .65** |
| 5. Age Initiation        |      |      |       |       | ---- | -.39** | .04   |
| 6. Max Ever <sup>a</sup> |      |      |       |       |      | ----   | -.00  |
| 7. AD Symptoms           |      |      |       |       |      |        | ----  |

<sup>a</sup>Square root transformation. \*  $p < .05$ . \*\*  $p < .01$

Table 5

*Lifetime Suicide Variables, Major Depressive Disorder, and Alcohol-Involvement Variables by Sex and Ethnicity*

| Group   | Suicidal<br>Ideation<br>(%) | Suicide<br>Attempts<br>(%) | MDD<br>(%) | <u>Age<br/>Initiation<br/>(Years)</u> |           | <u>Max Ever<br/>(Drinks)</u> |           | <u>AD<br/>Symptoms<br/>(Number)</u> |           |
|---------|-----------------------------|----------------------------|------------|---------------------------------------|-----------|------------------------------|-----------|-------------------------------------|-----------|
|         |                             |                            |            | <i>M</i>                              | <i>SD</i> | <i>M</i>                     | <i>SD</i> | <i>M</i>                            | <i>SD</i> |
| Whole   | 36.4                        | 4.3                        | 10.1       | 16.6                                  | 2.81      | 11.1                         | 9.10      | 0.9                                 | 1.60      |
| Women   | 38.0                        | 5.9                        | 13.9       | 16.9                                  | 2.76      | 8.2                          | 6.12      | 0.6                                 | 1.21      |
| Men     | 34.9                        | 2.7                        | 6.4        | 16.3                                  | 2.83      | 13.8                         | 10.53     | 1.2                                 | 1.84      |
| Chinese | 40.7                        | 2.7                        | 6.6        | 16.9                                  | 3.32      | 6.7                          | 5.94      | 0.4                                 | 0.96      |
| Korean  | 38.5                        | 5.8                        | 11.5       | 16.9                                  | 2.62      | 12.0                         | 10.45     | 1.1                                 | 1.60      |
| White   | 30.3                        | 4.1                        | 11.8       | 16.0                                  | 2.38      | 14.0                         | 8.58      | 1.4                                 | 1.87      |

Table 6

*Lifetime Suicide Variables, Major Depressive Disorder, and Alcohol-Involvement Variables for Six Subgroups*

| Group   | Suicidal<br>Ideation<br>(%) | Suicide<br>Attempts<br>(%) | MDD<br>(%) | <u>Age<br/>Initiation<br/>(Years)</u> |           | <u>Max Ever<br/>(Drinks)</u> |           | <u>AD<br/>Symptoms<br/>(Number)</u> |           |
|---------|-----------------------------|----------------------------|------------|---------------------------------------|-----------|------------------------------|-----------|-------------------------------------|-----------|
|         |                             |                            |            | <i>M</i>                              | <i>SD</i> | <i>M</i>                     | <i>SD</i> | <i>M</i>                            | <i>SD</i> |
| Chinese |                             |                            |            |                                       |           |                              |           |                                     |           |
| Women   | 43.0                        | 5.4                        | 9.7        | 17.3                                  | 3.22      | 6.0                          | 6.37      | 0.2                                 | 0.69      |
| Men     | 38.2                        | 0.0                        | 3.4        | 16.5                                  | 3.39      | 7.5                          | 5.37      | 0.5                                 | 1.16      |
| Korean  |                             |                            |            |                                       |           |                              |           |                                     |           |
| Women   | 39.2                        | 5.9                        | 15.7       | 17.4                                  | 2.35      | 8.0                          | 5.10      | 0.7                                 | 1.29      |
| Men     | 37.7                        | 5.7                        | 7.5        | 16.4                                  | 2.75      | 15.9                         | 12.54     | 1.2                                 | 1.83      |
| White   |                             |                            |            |                                       |           |                              |           |                                     |           |
| Women   | 31.5                        | 6.5                        | 16.3       | 16.0                                  | 2.44      | 10.5                         | 6.12      | 0.9                                 | 1.43      |
| Men     | 29.1                        | 1.9                        | 7.8        | 16.0                                  | 2.34      | 17.1                         | 9.28      | 2.1                                 | 2.09      |

Table 7

*Standardized and Unstandardized Path Coefficients for the Alcohol-Involvement Indicators for Six Subgroups*

| Group   | <u>Age Initiation<sup>b</sup></u> |           | <u>Max Ever</u> |           | <u>AD Symptoms</u> |           |
|---------|-----------------------------------|-----------|-----------------|-----------|--------------------|-----------|
|         | <i>S</i>                          | <i>US</i> | <i>S</i>        | <i>US</i> | <i>S</i>           | <i>US</i> |
| All     | -.351*                            | -.989     | .818*           | 1.020     | .696*              | 1.107     |
| Women   | -.440*                            | -1.215    | .710*           | .717      | .613*              | .740      |
| Men     | -.286*                            | -.810     | .728*           | 1.337     | .824*              | 1.094     |
| Chinese | -.156                             | -.518     | .784*           | .776      | .558*              | .534      |
| Korean  | -.378*                            | -.988     | .817*           | 1.067     | .723*              | 1.160     |
| White   | -.475*                            | 1.133     | .826*           | .927      | .636*              | 1.190     |

Note. All values are corrected for non-normality. No overall fit indices were computed due to models being just-identified. \*  $p < .05$ .



Table 8

*Polyserial and Polychoric Correlations and Standard Errors for Full Target Model for All Participants*

| Variable                     | 1    | 2    | 3    | 4    | 5    |
|------------------------------|------|------|------|------|------|
| 1. Suicidal Ideation         | ---- | .66  | -.07 | .01  | .12  |
| 2. Major Depressive Disorder |      | ---- | .04  | .06  | .13  |
| 3. Age Drinking Initiation   |      |      | ---- | -.29 | -.25 |
| 4. Max Ever                  |      |      |      | ---- | .57  |
| 5. AD Symptoms               |      |      |      |      | ---- |

Table 9

*Standardized and Unstandardized Path Coefficients for the Full Target Model Performed Separately Across Sex and Ethnicity*

| Group                | <u>Suicidal Ideation</u> |            | <u>MDD<sup>a</sup></u> | <u>Age Initiation</u> |           | <u>Max Ever</u> |           | <u>AD Symptoms</u> |           |
|----------------------|--------------------------|------------|------------------------|-----------------------|-----------|-----------------|-----------|--------------------|-----------|
|                      | <i>AI</i>                | <i>MDD</i> |                        | <i>S</i>              | <i>US</i> | <i>S</i>        | <i>SU</i> | <i>S</i>           | <i>US</i> |
| Whole                | .010                     | .656*      | 1.00                   | -.352*                | .124      | .785*           | .616      | .726*              | .527      |
| Women <sup>b</sup>   | -.112                    | .688       | 1.00                   | -.379                 | .144      | .731            | .537      | .626               | .392      |
| Men                  | .027                     | .685*      | 1.00                   | -.292*                | .085      | .809*           | .654      | .740*              | .547      |
| Chinese <sup>b</sup> | .195                     | .533       | 1.00                   | -.087                 | .008      | .437            | .191      | 1.00               | 1.00      |
| Korean               | .134                     | .703*      | 1.00                   | -.372*                | .138      | .851*           | .724      | .694*              | .482      |
| White                | -.032                    | .732*      | 1.00                   | -.490*                | .240      | .791*           | .626      | .659*              | .434      |

<sup>a</sup>The  $r^2$  value cannot be estimated as the metric was set at 1.00. <sup>b</sup>Individual parameters not interpretable due to poor overall model fit. \* $p < .05$ .

Table 10

*Polyserial and Polychoric Correlations and Standard Errors for Full Target Model for Women*

| Variable                     | 1    | 2    | 3    | 4    | 5    |
|------------------------------|------|------|------|------|------|
| 1. Suicidal Ideation         | ---- | -.29 | -.25 | .15  | -.01 |
| 2. Major Depressive Disorder |      | ---- | .57  | .16  | -.02 |
| 3. Age Drinking Initiation   |      |      | ---- | .25  | .11  |
| 4. Max Ever                  |      |      |      | ---- | .66  |
| 5. AD Symptoms               |      |      |      |      | ---- |

Table 11

*Polyserial and Polychoric Correlations and Standard Errors for Full Target Model for Men*

| Variable                     | 1    | 2    | 3    | 4    | 5    |
|------------------------------|------|------|------|------|------|
| 1. Suicidal Ideation         | ---- | -.29 | -.25 | -.13 | -.13 |
| 2. Major Depressive Disorder |      | ---- | .57  | .13  | .06  |
| 3. Age Drinking Initiation   |      |      | ---- | .09  | .14  |
| 4. Max Ever                  |      |      |      | ---- | .69  |
| 5. AD Symptoms               |      |      |      |      | ---- |

Table 12

*Polyserial and Polychoric Correlations and Standard Errors for Full Target Model for Chinese*

| Variable                     | 1    | 2    | 3    | 4    | 5    |
|------------------------------|------|------|------|------|------|
| 1. Suicidal Ideation         | ---- | -.29 | -.25 | .22  | -.07 |
| 2. Major Depressive Disorder |      | ---- | .57  | .23  | .08  |
| 3. Age Drinking Initiation   |      |      | ---- | .09  | .24  |
| 4. Max Ever                  |      |      |      | ---- | .55  |
| 5. AD Symptoms               |      |      |      |      | ---- |

Table 13

*Polyserial and Polychoric Correlations and Standard Errors for Full Target Model for Koreans*

| Variable                     | 1    | 2    | 3    | 4    | 5    |
|------------------------------|------|------|------|------|------|
| 1. Suicidal Ideation         | ---- | -.29 | -.25 | -.09 | -.14 |
| 2. Major Depressive Disorder |      | ---- | .57  | -.08 | .06  |
| 3. Age Drinking Initiation   |      |      | ---- | .06  | .12  |
| 4. Max Ever                  |      |      |      | ---- | .70  |
| 5. AD Symptoms               |      |      |      |      | ---- |

Table 14

*Polyserial and Polychoric Correlations and Standard Errors for Full Target Model for Whites*

| Variable                     | 1    | 2    | 3     | 4    | 5    |
|------------------------------|------|------|-------|------|------|
| 1. Suicidal Ideation         | ---- | -.29 | -.25  | .15  | -.06 |
| 2. Major Depressive Disorder |      | ---- | -.09* | .01  | .01  |
| 3. Age Drinking Initiation   |      |      | ----  | .15  | .16  |
| 4. Max Ever                  |      |      |       | ---- | .73  |
| 5. AD Symptoms               |      |      |       |      | ---- |

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