ALCOHOL USE DISORDERS (AUDS) AMONG UNIVERSITY STUDENTS:

A PSYCHOMETRIC ANALYSIS OF CRAVING UTILIZING THE

ADOLESCENT-OBSESSIVE COMPULSIVE DRINKING

SCALE (A-OCDS) AND PROPOSED DSM-5

AUD CRITERIA

By

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To the Faculty of Washington State University:

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Abstract

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Although craving is a new criterion to the DSM-5, craving has an extensive history with the International Classification of Diseases (ICD). Several models of craving have been articulated including behavioral learning, cognitive expectancy and neurobiological. These models contributed to a psychobiological three-pathway understanding of reward craving, coping craving and obsessive craving. Within these theoretical models, several craving measurement instruments have been constructed and validated. One of the most utilized craving instruments is the Obsessive Compulsive Drinking Scale (OCDS) that has been translated into several languages. A revised instrument was also constructed for use with adolescents: the *Adolescent-Obsessive Compulsive Drinking Scale* (A-OCDS). This study examined the construct validity of A-OCDS with university students and usefulness of craving as a new symptom for alcohol use disorder in DSM-V. *Participants*: Participants were students at Washington State University (WSU), a large land-grant university in the Northwest (*N*= 301). *Methods*: The Mplus statistical

software was used to perform the confirmatory factor analysis. The confirmatory factor analysis was used to determine the global fit of a two-factor model for the A-OCDS craving measure as well as to analyze the proposed DSM-5 and DSM-IV-TR alcohol use disorder criteria. *Results*: The results support an interference and irresistibility two-factor model of the A-OCDS measure of craving. The results also support the A-OCDS as a means of assessing craving in the proposed DSM-5 alcohol use disorder diagnosis. The A-OCDS in the IRT analysis showed good discrimination and difficulty values that were comparable to the other DSM-5 criteria. Additionally, the results support the proposed change for the DSM-5 as the new model showed a better global fit and stronger probit coefficients. Finally, the proposed DSM-5 model with a single dimension of severity showed greater ability to differentiate between potential moderate and severe alcohol use disorders.

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CHAPTER ONE

INTRODUCTION

Although craving is a new criterion to the DSM-5, craving has an extensive history with the International Classification of Diseases (ICD). Several models of craving have been articulated including behavioral learning, cognitive expectancy and neurobiological. These models contributed to a psychobiological three-pathway understanding of reward craving, coping craving and obsessive craving. Within these theoretical models, several craving measurement instruments have been constructed and validated. One of the most utilized craving instruments is the Obsessive Compulsive Drinking Scale (OCDS) that has been translated into several languages. A revised instrument was also constructed for use with adolescents: the *Adolescent-Obsessive Compulsive Drinking Scale* (A-OCDS). However, the A-OCDS has not been validated with a university student population. With the DSM-5 AUD criteria now including craving, a validation of the A-OCDS would facilitate diagnostic accuracy.

Given the increased prevalence rates and negative consequences of alcohol consumption among university students, screening for at-risk alcohol consumption with the DSM-5 AUD criteria may help direct services and evidence-based interventions. This paper will review the recent literature on university student drinking, summarize the critique of the DSM-IV-TR abuse and dependence categories, and describe the DSM-5 AUD changes. This paper will then review relevant research on craving including the historical origins connected with the ICD, theoretical models of craving, empirical craving research, and methods of measuring craving with specific attention to the OCDS and the A-OCDS. This review concludes with specific research questions for the current investigation.

Alcohol Use among University Students

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Recent research on alcohol use among young adults ages 18-25 highlights the changing patterns of alcohol use as well as re-emphasizes the negative consequences of alcohol use. Among full-time college students an estimated 20% (approximately 1.6 million) meet diagnostic criteria for an Alcohol Use Disorder (AUD; 12.3% abuse and 7.3% dependence), which is slightly above rates of non-students in the same age group (19.2%) and markedly above national rates (7.2% of individuals 12 and older in the general population; 4.1% abuse, 3.1% dependence; CSACU, 2007; Wu, Pilowsky, Schlenger, Hasin, 2007).

The National Institute on Drug Abuse (NIDA) report, *Monitoring the Future: National survey result on drug use, 1975-2010,* also indicated chronic heavy use of alcohol among college students. In 2010, binge drinking was reported by 37% of students (men 44%; women 32%), which was similar to their 1993 rate. However, non-college peers reported a rate of 28% in 2010. Heavy drinking appears to peak during college (i.e., 7% of 8th graders, 16% of 10th graders, 23% of 12th graders, 36% of young adults and 33% of 29-30-year-olds reported heavy drinking). Additionally, college students have shown a decrease in daily drinking from its height in 1980 (6.5%) to its lowest point in 2010 (2.7%), suggesting that college students tend to confine their drinking to weekend binge situations rather than daily consumption (Johnson, 2011).

Similar to patterns of heavy drinking, there was an increase in negative consequences of alcohol use among university students. Alcohol-related unintentional injury deaths among U.S. university students ages 18-24 increased 3% per 100,000 (from 1,440 to 1,825) between 1998 and 2005. There was also an increase from 41.7% to 44.7% of college students who reported heavy drinking (5 or more drinks for men, 4 or more drinks for women), and reports of driving under the influence of alcohol increased from 26.5% to 28.9%. There was no change in rates of

personal injury while intoxicated (599,000), being hit or assaulted by another drinking college student (696,000), or being a victim of an alcohol-related sexual assault or rape (97,000) between 2001-2005 (Hingson, Zha and Weitzman, 2009).

To understand the etiology of problematic college drinking, researchers have investigated emergent patterns of alcohol use among high school students that predict rates of alcohol consumption during college. The National Center on Addiction and Substance Abuse at Columbia University, which published *Wasting the Best and Brightest: Substance Abuse at America's Colleges and Universities* (2007), more recently examined adolescent substance use in their report *Adolescent Substance Use: America's #1 Health Problem.* The findings stated that 9 out of 10 people who meet criteria for a substance use disorder began using substances before they turned 18. Furthermore, 28.1% of those who began substance use before age 15 reported developing an AUD, compared to 4.3% of those who delayed use until 21 years of age or older. Notably, 72.5% of high school students reported that they have drunk alcohol; 65.1% have used more than one substance; and 46.1% reported that they are current users of one or more substances, which is significantly higher than the rates of obesity (34.2%), symptoms of depression (18.3%) or having experienced bullying (28.1% for 9th grades, 19.9% for 12th graders). Additionally, the frequency of high school students with a diagnosable substance use disorder is 11.9% affecting 1.6 million.

Pre-college alcohol use predicts drinking levels during the first-year of college particularly well. High school students who were identified as heavy drinkers increased in their frequency, quantity and peak alcohol use after the transition to college. Among high school students who did not engage in heavy episodic drinking during high school, 25% elevated their alcohol use to heavy episodic drinking during their first-year of college. Additionally, 40-50%

of high school students who enter college without having consumed alcohol start drinking their freshman year (Borsari, Murphy and Barnett, 2007).

The prevalence rates of university heavy drinking as well as the pattern of use before and after the transition to college suggest that effective evaluation and identification of at-risk drinkers would help reduce personal and social harm. Evidence-based interventions studies suggest that proper screening is an effective mechanism for intervention and reduction of problematic drinking on college campuses. The NIAAA's initiative to reinforce evidence-based approaches in college alcohol prevention supported programs that identify and assist problem drinkers including The Alcohol Skills Training Program (Baer et al., 1992) and the Brief Alcohol Screening and Intervention for College Students (BASICS) program (Baer et al., 2001; Marlatt et al., 1998). These programs identified problematic high-risk drinking along with a combination of motivational strategies and cognitive-behavioral skills training (Dejong, Larimer, Wood and Hartman, 2009).

Health center screening on college campuses has also demonstrated effectiveness in identifying high risk drinking with the heavy episodic drinking criterion (5 or more drinking for male with a 2 hours period and 4 or more for females). Schaus, Sole, McCoy, Mullett, Bolden, Sivasithamparam et al. (2009) found that non-heavy drinkers, heavy drinkers and frequent heavy drinkers (heavy drinking 3 or more times in the last 2 weeks) reported scores of 10, 14, and 23 on the Rutgers Alcohol Problems Index. It was also noted that although the frequent heavy drinkers were only 20% of the sample, they accounted for 31% of the harmful outcomes. They concluded that the heavy drinking measure as well as a frequency of heavy drinking provided an efficient and effective means of identifying those most in need of intervention.

This research indicates that alcohol use among university students has continued to escalate with increased rates of chronic heavy drinking. Negative consequences or personal and social harm on college campus related to alcohol consumption is a persistent problem. Additionally, high school drinking patterns predict at-risk college use. As a means of harm reduction, interventions that are triggered by quality screening are effective at reducing problematic drinking. The screenings conducted to assess alcohol use problems are associated with identifying those persons that meet criteria for DSM-IV-TR (2000) alcohol abuse and dependence. However, this system of classifying AUDs has received much criticism.

DSM-IV Alcohol Use Disorders: Abuse & Dependence-A Summary of the Critique

The current diagnostic system has undergone extensive psychometric analysis since its publication in 1992. Li, Hewitt and Grant (2007) in their thirty-year retrospective on the alcohol dependence syndrome argued that the research evidence does not support two distinct categories. They suggested that a continuum of severity with one quantifiable dimension of alcohol use problems best describes the pattern of research findings.

Factor analytic studies have shown that the abuse criteria of "legal problems" displayed weak loading while "time spent drinking or recovery from its effects" and "giving up activities due to alcohol use" had the highest loadings. Additionally, several criteria cross-loaded on the abuse and dependence factors. "Failure to fulfill role obligations" and "continued to drink despite social problems" which were identified as abuse criteria in the DSM-IV-TR (2000) loaded more heavily on the dependence factor while "drinking larger amounts over a longer period of time" and "withdrawal", which were identified as dependence criteria in the DSM-IV-TR (2000), loaded more heavily on the abuse factor (Harford and Muthen, 2001). Factor analytic studies have also shown that the two factors (1) Abuse and (2) Dependence are highly

correlated (>.90) such that a one factor solution better represents both the abuse and dependence criteria (Wu, Pan, Blazer, Tai, Stitzer, Brooner, et al., 2009; Proudfoot, Baillie, and Teeson, 2006).

Longitudinal clinical studies also provided little support for a nosological system with two categories. Rather these studies suggested that in practice the course of alcohol use problems varies (Hasin, Van Rossem, McCloud, and Endicott, 1997; Schuckit, Smith, & Landi, 2000). Schuckit, Smith, Danko, Bucholtz, Reich, and Bierut (2001), for example, conducted a five-year clinical course evaluation of men and women (N=1,346) participating in the Collaborative Study on the Genetics of Alcoholism. The findings suggested that abuse is not a prodromal stage for dependence as only 3.5% of those meeting criteria for abuse went on to develop dependence at follow-up, which was not significantly different from those who had no diagnosis at baseline and went on to develop dependence at follow-up (2.5%). Of those who met criteria for dependence at baseline, 37% met criteria at follow-up. Additionally, about one-third of those meeting criteria for alcohol dependence and half of those meeting criteria for abuse had no symptoms at follow-up. These findings are also consistent with a one-factor model.

The research findings that showed a high correlation of the abuse and dependence along with the low loading of the legal criterion and cross loading of abuse and dependence criteria lends support for a change in the AUD construct. The criticism of the DSM-IV two categories has culminated in a revised system issued with the proposed DSM-5 AUD criteria.

Proposed Changes for DSM-5 Alcohol Use Disorder: A Re-emergence of "Craving"

The proposed changes for the DSM-5 include a reorganization of the diagnostic criteria for AUDs (American Psychiatric Association [APA], 2010). The proposed changes call for a shift from two categories (dependence and abuse) to a single category: Alcohol Use Disorder

(AUD) which requires at least two of the eleven criteria met within the last 12-months for diagnosis: (1) recurrent failure to fulfill role obligations, (2) recurrent alcohol use in hazardous situations, (3) continued use despite social or interpersonal problems caused or exacerbated by alcohol use, (4) tolerance, (5) withdrawal, (6) consuming alcohol in larger amounts or over longer periods, (7) persistent desire or unsuccessful attempts to cut down, (8) great deal of time spent to obtain alcohol, use alcohol, or recover from its effects, (9) important social, occupational, or recreational activities given up because of alcohol use, (10) alcohol use despite persistent or recurrent physical or psychological problems cause or exacerbated by alcohol, and (11) craving or strong desire or urge to use alcohol. Additionally, specifiers were suggested to denote severity ("moderate" denotes meeting 2-3 criteria while "severe" denotes 4 or more criteria), and with or without physiological dependence as evidenced by either tolerance or withdrawal (criteria 4 and 5).

The proposed changes drop the abuse criteria for recurrent alcohol-related legal problems and include cravings. De Bruijn, Van Den Brink, De Graaf, and Vollebergh (2006) supported the inclusion of alcohol craving as a method to increase the discriminant validity of alcohol use disorder diagnoses. Additionally, subjective reports of cravings induced by alcohol-related cues are correlated with increased blood flow and dopamine release in parts of the brain reward pathway (Heinz, Beck, Grusser, Grace and Wrase, 2009). This move is consistent with the overall proposed changes of the DSM-5 towards dimensions of severity over categories and the increased use of biological markers to substantiate and increase the physiological evidence for various disorders (Regier, 2007; Charney, Barlow, Botteron, et al., 2002).

Additionally, the proposed inclusion of "craving" is congruent with the broader agenda of the DSM-5 to reduce the gaps between the DSM and International Classification of Diseases

(ICD) published by the World Health Organization (WHO; Rounsaville et al., 2002). Saunders and Schuckit (2007) noted "considerable effort was made during the development of the DSM-IV and ICD-10 to ensure as far as possible that the major substance use diagnoses represented the same condition" (p. xxii). However, differences have remained between the ICD and DSM AUDs. Notably, the ICD-10 utilizes the harmful use designation (.1) and the strong urge to take the drug description within the dependence syndrome (.2), while the DSM-IV-TR utilizes the abuse category as well as the negative social consequences. The WHO's next revision of the ICD-11 is expected in 2015, and with the international use of both systems in research and clinical practice there is again an effort to have two parallel systems. There is emergent research being conducted to determine whether the DSM or ICD diagnostic classifications and criteria are "closer to the research evidence" (Rounsaville et al., 2002, p.14). Although "craving" is a newly proposed addition to the DSM-5, craving is not a new construct; it has approximately a sixty-year history within the research literature and specifically from the WHO.

Craving: Historical Context within the WHO & ICD

In 1954, the World Health Organization (WHO) held a joint session of the Expert Committee on Alcohol and the Expert Committee on Mental Health from September 27th to October 2nd. One of the key items on the agenda was "The 'Craving' for alcohol" (World Health Organization, 1955, p. 35). E.M. Jellinek attended that joint session as a consultant on Alcoholism for the WHO and described the debate and challenge with regards to "craving for alcohol" noting that the term was often used carelessly in psychiatric papers of his day to "mean not a specific craving for alcohol but a desire for those effects which alcohol produces" (Jellinek, 1955, p. 36). Jellinek also described two different mechanisms that produce craving: (1) the withdrawal symptoms after a heavy bout of drinking indicate a physical demand for alcohol and

(2) the accumulation of tension between two drinking episodes in which the alcoholic wants to feel "different." Additionally, Jellinek suggested that pharmacological treatments are effective to "pull the alcoholic together or quiet him during or immediately following his acute episode" when he is experiencing withdrawal symptoms but does "not stop the desire of the alcoholic to 'feel different' after a while" (Jellinek, 1955, p. 38).

Harris Isbell, also an attendee of the joint session, articulated the two "kinds" of craving as physical or non-symbolic craving and symbolic craving. He suggested that the physical craving is due to "physiological alterations" while the symbolic craving was thought to be "responsible for initial abuse, and for relapse after abstinence…chiefly psychological in origin" (Harris, I., 1955, p. 42).

In the summary statement by the Joint Expert Committees on Mental Health and on Alcoholism, it was suggested the term "craving" be avoided in scientific literature due to the ambiguity of the term in vernacular usage. They suggested "physical dependence" resulting from withdrawal symptoms and being "psychologically dependent" on alcohol to relieve psychological tension were more precise terms to describe "craving." In addition, they make note of social pressure as a causal factor of relapse as well as "physiopathological conditions" that reduce "the higher personality from which the inhibition of primitive tendencies derives" such as concussion, epilepsy, psychoses and metabolic disorders (WHO, 1955, p.65).

In 1948, the League of Nations and an internal division called the Health Organization was reformulated to become the United Nations with its division of the World Health Organization. In that year, the WHO published the 6th revision of the International Classification of Diseases (ICD-6) which included for the first time codes for "Mental, Psychoneurotic, and Personality Disorders" among which alcohol was noted two times: alcoholic psychosis (307),

and alcoholism (322). The codes for alcohol remained the same in the 7th edition (WHO, 1955; Room, 1998).

However, the ICD-8 (1965) signified a more substantive revision of categories, subcategories, and code numbers. The primary categories of alcohol-related conditions articulated in the ICD-8 were: (1) Alcoholism (303) with three subcategories Episodic excessive drinking (.0), Habitual excessive drinking (.1), and Alcoholic Addiction (.2) and (2) Alcoholic psychosis with subcategories for various alcoholic psychoses (i.e., Delirium tremens) (WHO, 1965; Room, 1998).

The ICD-9 (1975) revised the alcohol disorders yet again; this time with three primary categories: Non-dependent abuse of drugs with a decimal designation for alcohol intoxication and hangover (.0), Alcohol dependence syndrome (303), and Alcohol psychosis (291) with alcohol withdrawal syndrome a decimal designation (.8) within this category (WHO, 1975; Room, 1998).

The ICD-10 (1992) reformulated the alcohol classifications with greater specificity noting: Acute intoxication (F1x.0), Harmful Use (F1x.1), Dependent Syndrome (F1x.2), Withdrawal state (F1x.3), Withdrawal state with delirium (F1x.4), Psychotic disorder (F1x.5), Amnesic disorder (F1x.6), and Residual and late-onset psychotic disorder (F1x.7). Within the diagnostic guidelines for the ICD-10 (1992) the dependence syndrome was described as:

> A cluster of physiological, behavioural, and cognitive phenomena in which the use of a substance or a class of substances takes on a much higher priority for a given individual than other behaviours that once had greater value. A central descriptive characteristic of the dependence syndrome is the desire (often strong, sometimes overpowering) to take psychoactive drugs (which may or may not have been medically

prescribed), alcohol, or tobacco (ICD-10, 1992).

Additionally, the ICD-10 (1992) indicated that a dependence syndrome is diagnosable if three of six criteria are met within a year. Criterion "a" states that there is "a strong desire or sense of compulsion to take the substance." The other criteria correspond to (2) difficulty controlling intake, (3) withdrawal symptoms, (4) tolerance, (5) decrease in other activities/increase in time obtaining or recovering from the effects, (6) persistent use despite harmful physical and/or psychological effects (WHO, 1992).

The term "craving" is not explicitly used in the coding system of ICD-10 or the guideline of terms. However, one could reasonably state that both the description of dependence syndrome and the criterion "a" are characteristic of what the Joint Committee discussed as "craving." The ICD-10 Diagnostic Criteria for Research (1993) does explicitly utilize the term "craving" as a criterion of the withdrawal state for opioids, cocaine, stimulants, and nicotine (WHO, 1993).

The 1975 WHO group of "Investigators on Criteria for Identifying and Classifying Disabilities Related to Alcohol Consumption," comprised of G. Edwards, M. Gross and R. Room among others, produced multiple working papers that furthered the understanding of alcohol related disorders. The notable contribution of this group was the semantic reformulation of alcoholism into the more scientifically defined "alcohol-dependence syndrome" that also subsumed Jellinek's "types of alcoholism" suggesting that the "observed differences could be better interpreted as culturally, environmentally or personally patterned manifestations of the fundamental alcohol-dependence syndrome" (Jellinek, 1960; Edwards, 1976 p. 1366). In addition to describing behavior patterns consistent with diagnosing alcohol-dependence syndrome, this committee also placed an importance on the "subjective report of an awareness of difficulty" characterized in three specific areas: impairment of control, craving, and drink centeredness. Craving was described as a "familiar concept" that may "hide very considerable complexity." Craving was further described:

The craving may be experienced as a greatly heightened desire for drinking or for the

experience of intoxication, or as something of much lesser intensity. The same individual

may experience craving of very different intensity on different occasions: the cues that

precipitate craving typically include the experience of intoxication itself, the experience of

withdrawal symptoms, and various situational and internal (affective) cues. When the

dependent individual has been sober for a period of days he will usually report that he then

has no craving (and this often to his surprise), but the craving is more or less easily reinstated

if he drinks again or experiences other personally relevant cues (Edwards, 1976, p. 1370).

Robin Room (1998) noted that by 1980 both ICD-9 (1975) and the DSM-III (1980) had replaced

"alcoholism" with "dependence." Room (1998) also described the historical context that contributed

to differences between the two systems which was influenced by the "movement in American

Psychiatry towards operationalization and measurement in psychiatric nosology" that excluded

"introspective criteria" such as a "sense of compulsion" while including social consequences in the

diagnostic criteria for dependence (p. 313).

Although the DSM-III (1980), the DSM-III-R (1987), and the DSM-IV (1994) each

articulated two alcohol use disorder categories (dependence and abuse) their specific diagnostic

criteria and formulation varied considerably. The craving component described as a "sense of

compulsion" was not strictly enumerated. However, a loss of control was articulated in behavioral

terms in the DSM-III (1980) category of pathological use specifically: (2) in ability to cut down or

stop drinking, and (3) repeated efforts to control or reduce excessive drinking by "going on the

wagon" (period of temporary abstinence) or restricting drinking to certain times of day. The DSM-

III-R (1987) revision again utilized behavioral criteria that imply the subjective state of loss of

control. However, in this version, the subjective state of loss of control was paired with a behavior

descriptor articulated explicitly within the alcohol dependence criteria stated as (2) a persistent desire

or one or more unsuccessful attempts to cut down or control substance use. The DSM-IV (1994)

revised the specific criteria for abuse and dependence with greater attention to behavioral criteria. However the criterion (2) was maintained as a criterion for dependence. Additionally, the DSM-IV-TR (2000) had no changes from the previous version.

This historical account of the revision of both the DSM and ICD describes one portion of story of "craving." From the mid-1970's with the articulation of the alcohol dependence syndrome of Edwards and Gross (1976) to the release of the proposed change for the DSM-5 (2010), there was an increase of empirical research with mixed results that helps explain the thirty year lag between the two systems on "craving." Several theoretical models of craving were articulated during this period including behavior learning, biological withdrawal, cognitive expectancy, neuroadaptive and a three-pathway biopsychological model.

Theoretical Models of Craving

The behavior-learning model incorporated classical and operant conditioning theory to explaining craving for alcohol. Rankin, Hodgson, and Stockwell (1979) conducted exploratory research that was foundational in later cue-craving studies. The results contributed to the construct of craving as subjective, measurable and indicative of observable behavior during experimental conditions albeit in the home. Their research dispelled the belief that "one drink, one drunk" noting that studies showed that alcoholics given ethanol in various situations did not lose control. High and low craving conditions were tested with subjective, physiological and behavioral measures. The results supported a significant relationship between reported desire and drinking speed such that the higher the level of reported desire, the faster the drinking speed.

However, Kozlowski and Wilkinson (1987) discussed the "use and misuse of the concept of craving" arguing against the Rankin et al. formulation of "craving" as a parallel to "fear," suggesting that craving implies a state of greater intensity more akin to "terror." They advocated for a dimension of desire in which "craving" would occupy a place on the higher end of the

spectrum. They critiqued the Shiffman-Jarvik Craving Scale, a measurement instrument used to access "craving" (a DSM-III criteria for withdrawal symptoms for Tobacco), noting the spectrum ranges from aversion to use cigarettes to urges to use cigarettes. It was suggested that craving does not support a negative loading while terms such as "urge and disposition" were more indicative of a continuum. Beyond the semantic argument, the critique focused on the various models of craving suggesting that research needs to clarify whether "craving" is a "subjective state associated with specific interoceptive and exterocetive cues" or "one of array of withdrawal symptoms that decay monotonically as a function of the duration of abstinence" and, as such, differing research methods would better access these contrasting conceptualizations of "craving" (p. 35).

The majority of responses to the Kozlowski and Wilkinson (1987) article argued in favor of "craving" on various grounds. Tim Stockwell (1987) noted the similarity with "obsessional hand-washers who are under going response prevention and cue exposure treatment" and concluded with a reference to Rankin's claim that there is no better word than "craving" (p. 44). Marlatt (1987) responded with "craving is a desirable term" denoting a motivational state in contrast to a behavioral intension to consume. Marlatt sought to move the definition away from the physiological withdrawal syndrome to emphasize the psychological phenomena associated with anticipation and psychological attachment linked with Eastern Buddhist tradition of suffering. West (1987) also responded to the critique that a measure with multiple items that are not explicitly asking about craving "confuses the dispositional issue." He clearly described his factor analytic approach noting that combining several items produces a stronger measure when the items correlate highly with each other.

The research of the 1990s contributed to the craving literature with behavior learning, cognitive, and biological models. Drummond et al. (1990) built upon the withdrawal syndrome of Edwards & Gross (1976) to explain craving as a process of behavioral learning such that pairing an unconditioned stimulus (the sight and smell of alcohol) with an unconditioned response (falling blood alcohol levels) produces a conditioned stimulus that then evokes a state of craving, a learned response to withdrawal symptoms. Craving after abstinence is explained as an elicited response from a conditioned stimulus. A. Marlat and A.T. Beck contributed to the cognitive conceptualization of craving by distinguishing urges, sudden impulses to consume, from cravings, subjective desires to experience the effects. This cognitive craving was articulated as expectancies (Beck et. al, 1993; Larimer, Palmer, & Marlatt, 1999).

The improvements of neuro-imaging technology produced complex understandings of brain structure and function that resulted in more nuanced biological models of craving. Anton (1999; 1995) described a biologically based neuroadaptive model of craving as a response to the changes in brain function to the presence of alcohol as well as the physiological imbalance associated with withdrawal symptoms. Anton (1999) identified multiple brain areas associated with "craving" (i.e., the nucleus acumens, amygdala, and frontal cortex and specifically dorsal lateral prefrontal cortex) along with the various neurotransmitters (i.e., dopamine, glutamate, GABA, serotonin and endogenous opiates). This neuroadaptive model of craving indicated various points of dysregulation such that "craving" does not have a single mechanism.

An integrative model of craving by Verheul, Van de Brink and Gerrlings (1999) posited a three-pathway psychobiological model of craving for alcohol based on a review of the research literature. Integrating affective factors (positive affect craving and negative affect craving) with motivational factors (internal and external positive and negative reinforcement), cognitive factors

(positive affect-enhancement motives and negative affect-coping motives), psychophysiological findings, and neurochemical findings, they identified reward craving, relief craving, and obsessive craving as pathways to craving. It was also suggested that measurement instruments assess these pathways and treatments be specific to the type of craving.

Building upon the previous contributions to the craving research literature, the journal *Addiction* published a supplemental edition on "craving" in August 2000 that summarized the relevant theories, research, and obstacles as well as suggested potential future directions for research. Within that issue Lowman, Hunt, Litten and Drummond (2000) wrote a review article that discussed the work of the National Institute of Drug Abuse (NIDA) and the National Institute on Alcohol Abuse and Addiction (NIAAA) during the 1990s to conceptualize and establish research in basic and clinical science of "craving." Li (2000) described the phenomenological models in which "craving" is associated with dependence. Koob (2000), Littleton (2000) and Samson (2000) articulated the behavioral learning or conditioning theory that utilized principles of reinforcement to conceptualize the construct of "craving." Robinson and Berridge (2000) contributed a description of an incentive-sensitization theory of "craving" built upon an understanding of neuroadaptations to repeated drug consumption. Grace (2000) reviewed a neurobiological model of craving based on the tonic/phasic model of dopamine system regulation. Niaura (2000) articulated the cognitive social learning theory of "craving" in which expectancies shaped alcohol seeking/consumption behavior. Tiffany & Conklin (2000) reviewed cue reactivity and relapse studies and also described a cognitive processing model of "craving."

The theoretical research on craving has contributed to multiple models that help to explain the mechanism of craving. The multiple models could suggest ambiguity or a lack of

parsimony with the construct of craving. However, despite this multivalent approach to defining craving there have been advances in craving research within the last decade that have led to a better understanding of substance use disorders and their treatments.

Empirical Research on Craving

The empirical "craving" research has supported and clarified theories of craving from various psychological perspectives (e.g., biological, behavioral and cognitive). Additionally, lines of craving research have contributed to the development of psychopharmacological interventions that target specific "craving" mechanisms. Lastly, the craving research has produced psychometric studies on various instruments designed to measure the construct of craving.

Genetic Craving Studies

Ehlers and Wilhelmsen (2005) examined the genome of the U.S. Mission Indians looking for a chromosomal contribution to alcohol dependence. Chromosome 5 was reportedly linked with "craving for alcohol" among the Mission Indians. Hahn et al. (2006) also examined the contribution of genetic variation to "craving" with the alcohol expectancy model. Among alcohol dependent Taiwanese who possessed the ALDH2*2 allele (normally associated as a protective factor due to the reduced rate of alcohol metabolism resulting in an elevated blood level of acetaldehyde that is processed as physiological distress), higher positive alcohol outcome expectancies were reported than those with variants of the allele that facilitate ethanol metabolism.

Wildenberg et al. (2007) examined the polymorphism of the μ-opioid receptor gene that binds to β-endorphins, a precursor to the release of DA in the nucleus accumbens, with ingestion of alcohol or drugs as well as substance cues. The Asp40 variant (G allele) binds three times

more tightly than the more common Asn40 (A allele) to β-endorphins delaying the release of DA. The results show that the G allele participants reported higher levels of craving than the A allele group as well as higher rates of life time drug use.

Lenz et al. (2009) also examined gene polymorphism specifically looking at androgen receptor gene in men that is coded for by trinucleotide repeat CAG. The short form of this gene is associated with depression and prostate cancer while the long form is linked with neurological disease and impaired fertility. The results showed that the reduced length androgen receptor gene was significantly correlated with higher rates of reported craving.

Brain Imaging Studies

Brain imaging studies has also contributed to a more rigorous understanding of the mechanisms of craving. Olbrich et al. (2006) conducted a PET scan study to investigate "craving" that showed increased blood flow in the ventral putamen as well as activation of the insula, doralateral prefrontal cortex and cerebellum related to cue-induced alcohol "craving." These brain areas are indicative of brain reward mechanisms, memory and attention processes.

Park et al. (2007) utilized a fMRI scan to examine brain activation associated with "craving." Brain activation of the fusiform gyri, temporal gyri, parahipocampal gyrus, uncus, frontal gyri, and precuneus were correlated with craving among alcohol use disorder subjects compared with controls. These results supported the idea that the limbic system that may play a role in reward craving; the hippocampus involved with learning and memory; and the precuneus linked with episodic memory retrieval associated with conditioned stimuli.

Sinha and Li (2007) also conducted a fMRI study with a stress-induced as well as a cue-induced "craving" with findings that suggested that areas of the corticostriatal limbic system are activated during both conditions. Altered hippocampus and anterior cingulate may represent

difficulty with stress coping while increased dorsal striatum activity would suggest high craving. The findings may indicate a marker for assessing efficacious treatments.

Wrase et al. (2008) examined brain volumes of reward-related regions that were correlated with craving, and risk of relapse. Alcohol-dependent participants displays reduced amygdala, hippocampus, and ventral striatum volumes with increase craving compared to controls. In addition, decreased amygdala volume and increased craving level discriminated between alcohol-dependent participants that relapsed compared to those that abstained from use.

Heinz, Beck, Grusser, Grace and Wrase (2009) reviewed brain imaging studies that identified dysfunction of the dopaminergic, glutametergic, and opioidergic neurotransmission in the ventral striatum linked with the reward system as correlated with "craving," attention, expectancy, and memory. The relationship of neurotransmitter dysfunction to cue-induced brain activation and prospective risk of relapse were associated with low dopamine synthesis and reduced dopamine D2-receptors in the ventral striatum.

Wedekinf et al. (2010) studied the correlation between serotonergic function and substance craving in detoxified alcohol-dependent males. The results indicated that alcohol dependent males exhibit reduced tryptophan metabolism, a precursor of serotonin. In particular, the participants who possessed the long allele of the serotonin transporter gene demonstrated an increased impairment of tryptophan metabolism. It was also noted that a dysregulated serotonergic system might produce "craving" to avoid depressive and anxiety symptoms as regular alcohol results in short-term increase in serotonin.

Behavioral, Biological, and Cognitive models of Craving

Little, Stephens, Ripley, Borlikova, Duka, Schubert, et al. (2005) described the behavioral learning model of craving. The effects of exposure to alcohol and withdrawal cycles

fit with behavioral models of conditioning and reinforcement. The effects of alcohol consumption can act as both a positive and negative reinforcement. The stimulation of the pleasure pathway resulting in the dopamine flooding response and euphoria found in substance use is a positive reinforcer. The process to remove the negative consequences such a pain, discomfort, psychological distress, and neurological depletion of dopamine in order to be relieved even temporarily is a negative reinforcer.

Additionally, understanding the biological effects of alcohol use has fostered distinct neurobiological models of craving. Sapolsky (2004) reported that a study of lab rats showed bursts of dopamine occur just before behavior. The strength of the pleasure pathway can be increased with intermittent reinforcement. The sense of control and the transience of uncertainty created pleasurable conditions rather than stressful conditions. Glucocorticoid secretion and amygdala stimulation also stimulate the release of dopamine in the pleasure pathway. A moderate amount of glucocorticoids or emotional activation results in the maximum dopamine response while extended secretion of glucocorticoids and a prolonged fight/flight response will likely result in dopamine depletion accompanied by depressive symptoms.

An understanding of stress hormone response added to the biological model of craving. Two neuropeptides are associated with the neurochemistry of regulating alcohol-related stress: corticotropin-releasing factor (CRF), which is mediated by the hypothalamic-pituitary-adrenal (HPA)-axis and correlated with increased stress-response and negative affect and neuropeptide Y (NPY) which is linked with a reduction in stress. CRF is found to increase during withdrawal and while NPY is associated with the motivation system that promotes continued drinking for relief and relapse under stress for the anxiolytic effects. The prolonged use of alcohol leads to a dysregulation of these two neuropeptides such that the homeostatic norm gives way to an

allostatic load being placed upon the reward pathway of the brain (Valdez and Koob, 2004).

Other research has highlighted the dysregulation of glucose levels in the blood as contributing to the stress-relief patterns that trigger the pleasure pathway in the addictive cycle. Leggio, Ray, Kenna, and Swift (2009) suggested that blood glucose is a simple and easily accessible biomarker that is highly correlated with a "reward deficiency syndrome" (RDS) characterized by alterations in the dopamine response system. Hyperglycemic subjects showed significantly elevated rates of alcohol use pretreatment and an increased likelihood of relapse during the first eight-weeks of treatment.

The cognitive model of craving has examined craving, alcohol drinking motives, and attention bias among heavy social drinkers who endorsed coping as their motive for consumption under conditions in which stressors increased subjective anxiety and subjective craving. During visual cue tests, those that again endorsed the motive coping had an attention bias for alcohol-related cues. The findings support the relationship between negative affect, craving, substance seeking, and substance use. The results suggest that the attention component of craving operates automatically and unconsciously to mediate and reduce experienced stress (Field, Munafo, and Franken, 2009).

The research of the last decade has contributed to the theoretical understanding of craving from behavioral, biological and cognitive perspectives (Skinner & Aubin, 2010). The reliable findings support an understanding of craving as conditioned by positive and negative reinforcement, a response to dysregulated neurobiological systems that are correlated with stress hormones and blood-glucose levels, and as having an attention component that operates out of awareness to reduce stress. There have been arrays of pharmacological treatment studies based on the developed craving models that have proven to be efficacious in reducing craving and

thereby increasing the number of days abstinent.

Pharmacological treatments for craving

Pharmacological treatment studies that target craving represent an emerging area of research based upon well-formulated models of craving. These therapies have the potential to be individualized to suit the type of craving that increases a person's risk of relapse. The neurobiological model suggests that not all craving is the same such that a person may experience a single type of craving (i.e., reward, coping, or obsessive) or a combination. Sophisticated drug therapies can target each of theses types of craving often times with more than one drug per type.

Addolorato, Leggio, Abenavoli, and Gasbarrini (2005) reviewed the neurochemical aspects of "craving" including the three-pathway model of reward, coping and obsessive craving. Specific pharmacotherapies were recommended for each type of craving: naltrexone for reward craving; acamprosate, baclofen for relief craving; and SSRI, baclofen, topiramate, and ondansetron for obsessive craving.

Increases in stress during sobriety enhanced craving, which is correlated with higher risk of relapse as well. The research suggests that in early phase of abstinence susceptibility to relapse is greater with increased levels of environmental stressors. The increased stress response, anxiety symptoms and likelihood to drinking were correlated with higher levels of CRF. A variety of pharmacological interventions have been tested to arrest the CRF response to stress and reduce anxiety, craving and alcohol consumption. Flumazenil, CRF1-receptor antagonists, and buspirone all reduced agitation associated with anxiety and alcohol drinking in rats (Breese, Chu, Dayas, Funk, Knapp, Koob, et al., 2005).

Additionally, a biological model of craving that includes cannabinoid CB1 and $GABA_B$

receptors also helped explain the efficacy of drug treatment to reduce craving. Findings showed that increased alcohol consumption increases the synthesis of endocannabinoids and down regulates brain CB1 receptors. Consistent with these findings pharmacotherapies that produced the inhibition of CB1 reduced alcohol consumption in rats and mice. The $GABA_B$ receptor agonist, baclofen, was also found to decrease alcohol consumption in animal subjects under craving conditions (Rodd, Anstrom, Knapp, Racz, Zimmer, Serra, et al., 2005). Human subject studies have found similar results regarding baclofen in clinical trials, with alcohol dependent patients having advanced liver disease (Addolorato, Leggio, Cardone, Ferrulli and Gasbarrini, G., 2002).

More recently, Martinotti (2010) conducted a randomized double-blind comparison trial of Pregabalin (PRE) versus naltrexone (NAL) for treating alcohol dependence. Pregabalin is a structural analogue of GABA while Naltrexone is an opioid antagonist that mainly acts at the μ-opioid receptor. The results showed that Pregabalin was more effective on the measure of days abstinent (PRE 81.6 vs. 74.1). On measures of craving and psychiatric symptom there was no significant difference.

Pharmacological therapies have shown efficacy in reducing craving that results from different pathways. The ability to reduce craving may not be limited by the biological knowledge of what stimulates craving and what biological targets would be effective to attenuate that craving, but rather the ability to effectively and efficiently assess craving.

Psychological Measures of Craving

Several measurement instruments of craving have been developed. Flannery, Poole, Gallop, and Volpicelli (2003) examined three assessment instruments for alcohol craving: (1) the Penn Alcohol Craving Scale (PACS), (2) the Alcohol Urge Questionnaire (AUQ), (3) the Items

1-6 of the Obsessive subscale (OBS) of the Obsessive Compulsive Drinking Scale (OCDS). In a double-blind 9-month trial (n = 183), placebo-controls and a naltrexone (100 mg/day) group used these assessments to report craving 1-2 times per week. The three craving scales were better predictors of alcohol use the following week than consumption rate the week prior to assessment.

The most widely used craving instrument is the OCDS. Morgan, Morgenstern, Blanchard, Labouvie, and Bux (2004) examined the psychometric properties of the OCDS. The OCDS was developed from the Yale-Brown Obsessive Compulsive Scale (Y-BOCS) as a measure of addictive alcohol thoughts and behaviors. The OCDS is a 14-item instrument with three primary factors: alcohol related thoughts, impaired control over drinking, and psychosocial disturbances. Each item has five possible responses (0-4) corresponding to increasing intensity. There are two subscales to measure obsessions and compulsions. The test-retest reliability was high (r = .96). The OCDS was found to correlate with alcohol problem severity. Additionally, the OCDS has been shown to have better predictive validity over shorter intervals of time (1-week) and less effective at longer-term follow-up (3-months). The OCDS is designed for alcohol assessments while the OCDS-R is valid and reliable for drug use in general. The OCDS-R is a 10-item instrument that measures one global factor---urges to use substances (Anton, Moak, and Latham, 1995).

De Wildt, Lehert, Schippers, Nakovics, Mann and van den Brink, W. (2005) investigated the use of the OCDS internationally. Participants from the Netherlands, Belgium, France, Switzerland, and Germany were included in this study (N = 343). In the factor analysis a four-factor solution was the best fit for the data including drinking obsessions, alcohol consumption, automaticity for drinking, and interference due to drinking. Three theoretical models were tested against the observed data: an Obsessive-Compulsive model, an Inhibition model and a Cognitive

Behavioral model. The four-factor solution is consistent with cognitive behavioral model. These findings support the evaluation of self-efficacy and coping behaviors, which influence thoughts and feelings associated with craving. Additionally, the OCDC has been validated in Italy (Janiri, Calvosa, Dario, Pozzi, Ruggeri, Addolorato, et al., 2004), Japan (Tatsuzawa, Yoshimasu, Moriyama, Furusawa, andYoshino, 2002) and Mexico (Cordero, Solis, Cordero, Torruco, and Cruz-Fuentes, 2009).

Deas, Roberts, Randall, and Anton (2001) found that the obsessive and compulsive dimensions of alcohol craving that have been described by and tested on adults also exist in adolescents and young adults. The OCDS was revised for adolescents with the creation of the A-OCDS. Questions were rephrased such that "impulsive" and "anxiety" was replaced with "strong desires" and "irritable." The A-OCDS was found to have two dimensions with internally consistent subscales for interference and irresistibility. The A-OCDS was also found to be effective in identifying problem drinkers.

Deas, Roberts, Randall, and Anton (2002) conducted a follow-up study of the A-OCDS (n = 380) utilizing confirmatory factor analysis (CFA). A two-factor solution was the best fit for the data. Loading for the items ranged from moderate to high (.56-.87) with a moderate correlation between the factors (.72). The A-OCDS can detect obsessive thoughts about alcohol and compulsive drinking behavior that are indicators of elevated craving. The two subscales of the A-OCDS of interference and irresistibility can be used to screen for problem drinking. An interference score of 1 or an irresistibility score of 6 indicates a greater than 50% likelihood of being a problem drinker (five or more drinks in the last two weeks on two or more occasions).

Thomas and Deas (2005) examined the usefulness of the A-OCDS in assessing adolescent craving in a controlled setting in response to craving conditions and alcohol cue

reactivity. Participants were alcohol-dependent adolescents, age 14-19 (N = 28). The cue

exposure consisted of three conditions: water, a preferred alcoholic beverage, and apple juice.

The A-OCDS total score did provide an indication of the severity of craving and the likelihood

of reacting to alcohol related cues. The A-OCDS was a better predictor of reactivity that average

number of drinking and percent of days abstinent, similar to the OCDS for adults. These finding

suggest that the A-OCDS measure may also be a valid measure for the assessment of the DSM-5

AUD craving criterion among university students which is the focus of the current investigation.

Summary of Findings

The changes in the proposed DSM-5 AUD criteria include craving as an indicator of a

clinical alcohol disorder. The current DSM-IV abuse and dependence categories have not

proved valid in a series of research studies. The unidimensional approach of the new AUD

system is supported by factor analytic studies. Although, craving is new to the DSM-5, the

craving construct was formally discussed as early as 1955 in conjunction with the development

of the revision of the WHO's ICD. The connection of craving to both reward and withdrawal

symptoms articulated by E.M. Jellinek (1955) has been supported with the development of

behavioral learning, neurobiological, and cognitive craving models. The integrative three-

pathway craving model developed a psychobiological understanding of reward craving, coping

craving and obsessive craving. The development and efficacy of pharmacological treatment

have also supported these multiple etiologies of craving with the potential for targeted treatment

for the dysregulated system. The psychometric study of the assessment of craving has validated

multiple craving instruments with the OCDS being widely used in domestic and international

research. Additionally, the A-OCDS was developed to assess craving with adolescents.   Within

the current context in which 44%-32% of university students chronically engage in heavy

drinking and experience alarming rates of negative consequences, an effective and efficient screening tool can lead to targeted evidence-based interventions for at-risk university students.

Purpose of the Study

The proposed changes to the DSM-5 Alcohol Use Disorder diagnoses add craving as a criterion. Because the proposal does not offer guidance on how to measure craving, validated craving instruments are needed. Additionally, testing the prevalence rates between the DSM-IV-TR and the proposed DSM-5 alcohol use disorders will help clarify the impact of the changes. This study will test the psychometric properties of the A-OCDS with a university undergraduate sample, which has not previously been conducted. Second, this study will compare the rates of diagnoses within this university sample utilizing both the DSM-IV-TR criteria and the proposed DSM-5 criteria. Specifically, this study will thus use (1) CFA to evaluate the A-OCDS, (2) CFA to evaluate the structure of the proposed DSM-5 AUD criteria with approximately 300 university students who had an alcohol-related sanction through the University's Office of Student Conduct, and (3) compare the prevalence rates between the DSM-IV-TR and the proposed DSM-5 AUD. The current study is the first to use these procedures with the proposed DSM-5 AUD criteria with university students.

Analysis 1. Confirmatory Factor Analysis (CFA) was used to test whether the two-factor model of the A-OCDS provides a good fit (figure 1). A two-factor model with interference and irresistibility was tested with the expectation that it will provide a good fit and a better fit than the one-factor model. In addition to the global fit of the two-factor model, the item properties (loadings, difficulty and discrimination values) were also examined to determine the quality of the items (i.e., how much of the latent craving dimension is necessary for a positive response to

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the item and what is the strength of the relationship of the item to the factor). This approach also has the advantage of placing individuals' scores along a continuum of craving.

Analysis 2. Confirmatory Factor Analysis (CFA) was used with the proposed DSM-5 criteria to determine if the one-factor model provides a good fit with the addition of the craving criterion (figure 2). In addition to the global fit of the one factor model, the symptom properties (loadings, difficulty and discrimination values) were also examined to determine the quality of the symptoms (i.e., how much of the latent alcohol use dimension is necessary for a positive response to the item and what is the strength of the relationship of the item to the factor). This approach also has the advantage of placing individuals' scores along a continuum of alcohol use.

Analysis 3. Because the alcohol use items measured in the study included the proposed DSM-5 symptoms as well as symptoms for DSM-IV-TR, these analyses were also repeated with the DSM-IV-TR symptoms in order to compare both models.

CHAPTER 2

METHOD

Participants and Procedures

Participants were students at Washington State University (WSU), a large land-grant university in the Northwest. This study utilized survey data collected through WSU Alcohol and Drug Counseling, Assessment, and Prevention Services (ADCAPS). Students who violated WSU Substance Policies were required by the Office of Student Conduct to complete a survey with questions that assess the criteria for abuse and dependence according to the DSM-IV-TR, demographic data, family history of substance use, as well as attitudes about substance use. During the 2010-2011 academic year approximately 300 individuals completed the Impact online survey.

Measure

The Impact survey is comprised of multiple instruments designed to measure rates of consumption, negative consequences of alcohol, alcohol expectancies, perception of drinking norms, protective factors and family history of drinking problems. The Impact survey contains the *Quantity/Frequency/Peak indices of drinking* (Dimeff et al., 1999), which measures the rate both in frequency and quantity of consumption of alcohol. The Impact survey includes the *Rutgers Alcohol Problem Index* (RAPI; White and Labouvie, 1989) and *Young Adult Problem Screening Test* (Hurlbut & Sher, 1992), which both assess negative consequence from drinking alcohol. Positive expectancies and perception of drinking norms about alcohol are gathered through the use of *The Comprehensive Effects of Alcohol* (CEOA; Fromme, Stroot, Kaplan, 1993) instrument. The *Brief Drinker Profile* (BDP; Miller & Marlatt, 1984) is also utilized to gather family history of drinking problems. Additionally, an alcohol use problems checklist

(Table 5) similar to the DSM-IV checklist (Forman, R.F., Svikis, D., Montoya, I.D., Blaine, J., 2004; Hudziak et al, 1993) was used at assess whether the DSM-IV-TR (2000) 4 abuse and 7 dependence diagnostic criteria and the proposed DSM-5 AUD criteria were met with the exception of the craving criterion. In order to assess the proposed DSM-5 craving criterion, *The Adolescent-Obsessive Compulsive Drinking Scale* (Table 4; A-OCDS; Deas, D., Roberts, J., Randall, C., & Anton, R., 2001) was used.

CHAPTER THREE

RESULTS

Demographic Information for the College Students surveyed

The average age of the 301 college students surveyed was 19.16 (*SD=1.30)* with the

minimum age 18 and two participants indicated they were more than 25-years-old. Fifty-three

percent were male and 47% female, and 75% of the sample identified themselves as "white/non-

Hispanic", 9.3% as "Asian/Pacific Islander," 5.3% "Hispanic" and 3.7% "Black/Non-Hispanic".

Twenty-nine percent reported an affiliation with a Greek fraternity or sorority, and 18%

indicated participation in intercollegiate sports. When asked, "How many days per week do you

typically have something alcoholic to drink?" 57% of the sample indicated 1-2 times per week.

When asked, "During the past two weeks, on how many occasions have you consumed 5 or more

drinks during one sitting?" 14% reported once, 9% indicated twice, and 5% reported three or

four times per week. A total of 22.6% reported that they consumed alcohol 1-2 times in the last

30 days, while 25% reported 3-5 times, 15% reported 6-9 times, and 7% reported 10-19 times in

the last 30 days.   When asked about driving under the influence, 2.4% reported they had and

6.3% stated they had ridden in a car when the driver was drunk. Additionally, 83% of students

sampled reported they did not have marijuana in the last 30 days.

Preliminary Item Analysis

Table 5 shows the percentage of responses for the fourteen-item A-OCDS questionnaire

used in the initial portion of this study. The range of affirmative responses varied from 5% for

Item 4 (When you are not drinking alcohol, how upset are you about these ideas, thoughts, strong

desires or images of alcohol?) to 85% for Item 8 (How many days a weeks do you consume

alcohol?). Table 7 shows the percentage of "Yes" responses for the fifteen-item questionnaire

used in this study. The range of "Yes" responses varied from 2.7% for Item 3 (Have you ever

been in need of medical attention or hospitalization when using alcohol or drugs?) to 49.5% for

Item 4 (Have ever been charged with a MIP, MIC, DUI?).

Item 16 of the Impact survey is based on the scoring rubric for the A-OCDS, which

indicates a 50% likelihood of heavy drinking when a respondent selects one interference or three

irresistibility items. Additionally, in the CFA, Item 6 (Have you ever been charged with

possession of an illegal substance or possession of paraphernalia?) was not included as it

pertained exclusively to drug use.

Analytic Strategy

Confirmatory factor analysis (CFA) was used to examine the latent structure of the

Adolescent-Obsessive Compulsive Drinking Scale (A-OCDS) and the Alcohol use disorder

criteria for the proposed DSM-5 and DSM-IV-TR. Confirmatory factor analysis assumes that

the structural organization of the responses to the symptoms is best represented by a latent

continuous variable(s) (i.e., a quantitative factor or factors).

Confirmatory Factor Analysis

The Mplus statistical software was used to perform the confirmatory factor analysis. The

confirmatory factor analysis was used to determine the global fit of a two-factor model for the

A-OCDS craving measure as well as to analyze the proposed DSM-5 and DSM-IV-TR alcohol

use disorder criteria. The robust weighted least squares estimation procedure (WLSMV) was

used to evaluate the global fit of the one- and two-factor models. Global model fit was evaluated

with the comparative fit index (CFI, minimum study criterion of .90 with .95 or higher being

ideal), root-mean-square error of approximation (RMSEA, study criterion of .06 or lower) and

the weighted mean square residual (WRMR, study criterion of 1.00 or less, see Brown, 2006 for a more lengthy discussion of these measures of global model fit).

It was expected that with the initial analysis of the A-OCDS craving measure that the two-factor model would provide a good fit in an absolute fit and the two-factor model would result in a meaningful improvement in fit over the one-factor model. In addition, it was expected that the correlation between the Interference and Irresistibility latent factors in the two-factor model would not be too high (i.e., a correlation .85 or higher) further validating the two-factor model.

In the second analysis, the proposed DSM-5 AUD model was tested and it was expected that the one-factor model would provide a good fit in an absolute fit. The item-factor loadings (i.e., probit coefficients) were also examined for the one-factor proposed DSM-5 model. The probit coefficient squared represents the amount of the variance in the underlying latent response variable accounted for by the latent factor. For the loadings to be meaningful, each of the loadings needs to be substantial (.60 or higher) and statistically significant. The examination of the item-factor loadings provided information on how strongly each of the symptoms relates to the factor. In addition, the IRT item difficulty and discrimination values were examined for the one factor model.

In the third analysis, the DSM-IV-TR AUD model was tested and it was expected that the two-factor DSM-IV-TR model would not result in a meaningful improvement in fit over the one-factor proposed DSM-5 AUD model. In addition, it was expected that the correlation between the abuse and dependence latent factors in the two-factor DSM-IV-TR model would be too high (i.e., a correlation .85 or higher) to justify the abuse and dependence factors as representing separate dimensions.

This pattern of results—the two-factor Interference and Irresistibility model for the A-OCDS craving measure provides a good fit, the one-factor proposed DSM-5 model provides a good fit in a global sense, the two-factor DSM-IV-TR model does not result in a meaningful improvement in fit over the one-factor proposed DSM-5 model, the item factor loadings in the one-factor proposed DSM-5 model are substantial and significant, and the one-factor proposed DSM-5 model does not contain any localized areas of poor fit (see Brown, 2006)—would provide strong support for the validity of the A-OCDS with university students and further validate the proposed DSM-5 AUD construct.

Model Fit

CFA-Probit Link – A-OCDS

The two-factor model provided a good fit, χ^2 (74) = 148.02, p < .0000, CFI = .981, RMSEA = .058 (.044-.071), and WRMR 0.937. The correlation between the two factors (interference and irresistibility) was .806. Correlated errors were factored into the model between items 1 and 2, 1 and 14, as well as between items 7 and 8. The one-factor model did not provide a good fit χ^2 (77) = 365.93, p < .0000, CFI = .92, RMSEA = .112 (.100-.123), and WRMR = 1.656.

Table 6 shows the completely standardized probit coefficients for the two-factor model for the A-OCDS. The completely standardized probit coefficients for the first factor, Interference, were greater than .60. The second factor, Irresistibility, had probit coefficients ranging from 0.514-0.838. Item six, "How successful are you in stopping or changing these thoughts about alcohol when you are not drinking?" displayed the highest loading (0.961) on the interference latent factor while item 14, "How much control do you have over drinking alcohol?" provided the highest loading (0.838) on the irresistibility latent factor. Additionally, the

correlation between the two factors was .806, which further supports the two-factor model for the A-OCDS.

CFA on proposed DSM-5 AUD Model

The proposed DSM-5 AUD one-factor model provided a good fit, χ^2 (65) = 108.552, p < .0000, CFI = .968, RMSEA = .047 (.031-.062), and WRMR 0.955. Table 7 shows the completely standardized probit coefficients for the one-factor model for the proposed DSM-5 Alcohol Use Disorder diagnosis. The completely standardized probit coefficients ranged from 0.575-0.929. Additionally, the single factor and binary response pattern of the items allowed for an IRT analysis in which the discrimination values ranged from 0.703-2.505 while the difficulty values ranged from 0.587-2.516.

CFA on the DSM-IV-TR AUD Model

The DSM-IV-TR two-factor model provided also provided a good fit, χ^2 (78) = 118.974, p < .0000, CFI = .958, RMSEA = .042 (.026-.056), and WRMR 0.933. Table 8 shows the completely standardized probit coefficients for the two-factor model for the DSM-IV-TR AUD diagnosis. The completely standardized probit coefficients ranged from 0.246-0.929. Additionally, the correlation between the two factors was 0.871, a correlation too high to justify two separate factors (Brown, 2001).

Comparison of Diagnostic Rates for the DSM-IV-TR & DSM-5 AUDs

Table 10 shows the diagnostic rates according to the response rates for the DSM-IV-TR model of abuse and dependence and the DSM-5 one-factor model of moderate and severe as well as with or without physiological dependence. The DSM-IV-TR diagnostic model showed 97 respondents (32%) met criteria for dependence and 204 respondents (67%) met criteria for abuse for a total of 100% of respondents meeting criteria for an alcohol use disorder. The DSM-5

diagnostic model showed 87 respondents (25.5%) met criteria for a moderate AUD while 116 respondents (34%) met criteria for a severe AUD. For this group of 203 respondents, a total of 121 respondents would be diagnosed with physiological dependence. The total number of AUD diagnoses with the DSM-5 model was 203 (67%) respondents.

CHAPTER FOUR

DISCUSSION

The primary findings of this study are: (a) an interference and irresistibility two-factor model for the A-OCDS provided a good fit with the correlation between the two factors meeting the minimum criterion for discriminant validity; (b) utilizing the A-OCDS to evaluate the craving criterion, a one-factor model for the proposed DSM-5 AUD diagnosis also provided a good fit; (c) the correlation between the two factors in the DSM-IV-TR was too high to justify two separate factors; and (d) in comparing the AUD diagnostic rates for the DSM-IV-TR to the DSM-5 models, there is approximately a one-third decrease in those who met criteria for an AUD.

The results of this study support the validity of the A-OCDS as an instrument to assess craving among university students.   The obsessive and compulsive latent constructs of alcohol craving among college students are further supported by the significant loadings of the interference and irresistibility items respectively. The two-factors are somewhat correlated with one another which is to be expected but the correlation was not too high and as such a two-factor construct provides a good fit in the global sense. The loadings were slightly higher for the interference latent factor than for the irresistibility latent factor. The items with the irresistibility latent factor required the addition of correlated errors to strengthen the model. Items 1 and 2, 1 and 14, and 7 and 8 included correlated errors respectively. Item 2 is a direct follow-up of question 1 such that a significant correlation is understandable. Additionally, items 7 and 8 refer to the quantity and frequency of alcohol consumption. And finally item 1, "How much of your time in a day when you're not drinking alcohol do you have ideas, thoughts, strong desires or images related to drinking?" and item 14, "How much control do you have over drinking

alcohol?", also required the addition of a correlated error.

The critical scoring values for the A-OCDS were used to determine if the craving criterion was met for the proposed DSM-5 AUD diagnosis. The proposed DSM-5 construct was tested and shown to provide a good fit in the global sense. The weakest factor loading was for item-11: "Have you had a desire or made unsuccessful attempts to cut down or stop your alcohol or drug use?" which may be a function of the relative short duration of heavy episodic drinking such that fewer university student endorse a desire to "cut down or stop" their substance use. The highest factor loading was item 15: Have you been treated for any physical or psychological condition that was caused or made worse by drinking or using?" which suggests the latent factor accounts for more of the variance of item 15 than any other item in this construct.

Additionally, when examining the discrimination and difficulty values produced by the item response analysis for the proposed DSM-5 construct, the craving criterion as assessed by the A-OCDS functioned in a similar fashion as the other items (see Figure 3). As such, the A-OCDS adds to the strength of the over all construct acting in concert with the other criteria rather than being an outlier at the low or high end of difficulty or discrimination. Item 11 (described above) is the least discriminating and item 15 (also described above) is the most discriminating. Item 14: "Have you ever had so much to drink that the next day you could not remember what you had said or done?" is the item with the least difficulty and item 9: "After you stopped your alcohol or drug use, have you ever experienced the following? (i.e., sweats, shakiness, anxiety, rapid heartbeat, depression or disturbed sleep)" displays the greatest difficulty. This pattern of results again supports the use of the A-OCDS to assess craving as part of the overall proposed DSM-5 AUD diagnosis.

In results for the proposed DSM-5 and the DSM-IV-TR AUD constructs show a difference in diagnostics rates. The proposed-DSM-5 AUD construct showed a reduction in those who met criteria for an AUD by about 33%. This pattern of reduced rates was seen for predominately for those who met criteria for a moderate (those who met 2-3 criteria) rather than for severe (those who met 4 or more criteria) specifier for the proposed DSM-5 AUD diagnosis. The DSM-IV-TR seems to have more participants who meet criteria for abuse than dependence in part because the abuse category only requires one of the four abuse criteria to be met while the proposed DSM-5 moderate category require a minimum of two criteria to be met before diagnosis. This difference seems to account for the majority of cases that are subthreshold with the proposed DSM-5 AUD construct.

Craving is the "new" criteria included in the proposed DSM-5 alcohol use disorder diagnoses. The results of this study support the latent two-factor model of the A-OCDS measure of craving. The results also support the A-OCDS as a means of assessing craving in the proposed DSM-5 alcohol use disorder diagnosis. The craving criterion as assessed by the A-OCDS in the item response analysis showed discrimination and difficulty rates comparable to the other criteria analyzed in this study. Additionally, the proposed DSM-5 AUD one-factor model showed a stronger global fit and with higher factor loading than the two-factor DSM-IV-TR AUD model. Finally, the proposed DSM-5 model with a single dimension of severity shows a greater ability to differentiate between potential moderate and severe alcohol use disorders than the DSM-IV-TR AUD abuse and dependence model.

These findings are consistent with Deas, Roberts, Randall, and Anton (2002) who found a two-factor, interference and irresistibility, structure for the A-OCDS measure of craving. The findings support the use of the A-OCDS with university students to assess the AUD criterion of

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craving within the proposed DSM-5 AUD. Additionally, these results support the changes to the alcohol use disorder diagnostic category in the proposed DSM-5.

Additional Research

Future research should seek to assess the function of the A-OCDS with a larger sample of university students and determine if there is invariance with respect to gender among university student. Additionally, further research is needed to develop instruments to assess craving along the two other dimensions of reward craving and relief craving in addition to the obsessive craving assess by the OCDS and A-OCDS. Ultimately, an integrated instrument that is based on this broader theoretical understanding of craving as three-dimensional (reward, relief, and obsessive) would facilitate a more through assessment of craving that may be used in the assessment of an alcohol use disorder along the proposed DSM-5 criteria.

Limitations

It should be noted that the sample of university students used in this study represents a convenience rather than a random sample from a specified population. However, the findings appear to be robust given the similar results in previous studies on the A-OCDS (Deas et al., 2002) as well as broader studies examining the latent structure of alcohol use disorders (Muthen, B. 2006, Lynskey et al. 2005, Proudfoot et al. 2006).

Conclusion

These findings support the use of the A-OCDS with university students. The latent two-factor, irresistibility and interference, structure of the A-OCDS measure of craving was validated. The A-OCDS was also supported as a means of assessing craving in alcohol use disorder proposed DSM-5. The A-OCDS showed a comparable rate of discrimination and difficulty with the other criteria in the proposed DSM-5 AUD. Furthermore, the results support

the change from the DSM-IV-TR abuse and dependence categories to the proposed DSM-5 single category indicating severity and physiological dependence. Taken together, these findings provide a better understanding of the pattern of alcohol use among university students and support the changes proposed for the DSM-5.

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Table 1: The *Adolescent Obsessive Compulsive Drinking Scale* (A-OCDS)

1. How much of your time in a day when you're not drinking alcohol do you have ideas, thoughts, strong desires or images related to drinking?
   - (0) None
   - (1) Less than 1 hour a day
   - (2) ½ of the day
   - (3) More than ½ of the day
   - (4) Most of the day

2. How frequently do these thoughts occur?
   - (0) Never
   - (1) Less than 8 times a day
   - (2) Greater than 8 times a day
   - (3) Greater than 8 times per day and during most hours of the day
   - (4) Too many times to count

3. How much do these ideas, thoughts, strong desires, or images related to drinking alcohol get in the way of your social activities, family activities or school work? Are there things that you don't do because of them (i.e. sports, family outings, etc.?)?
   - (0) Thoughts of drinking never get in the way-I can function.
   - (1) Thoughts of drinking get in way a little bit, but they cause me no problems.
   - (2) Thoughts of drinking definitely get in the way, but I can manage.
   - (3) I have trouble with family, friends, or school because of these thoughts.
   - (4) Thoughts of drinking totally get in the way of friendships and family life.

4. When you are not drinking alcohol, how upset are you about these ideas, thoughts, strong desires or images of alcohol?
   - (0) I don't get upset
   - (1) I am a little upset, but I can make it.
   - (2) I get upset a lot, but I can manage.
   - (3) I get upset a lot, and it is hard to manage.
   - (4) I get so upset I cannot manage

5. How hard do you try to resist these thought of alcohol or try to ignore or get the thoughts of alcohol out of your mind when you are not drinking? (Tell how hard you try, not whether you succeed or fail.)
   - (0) My thoughts are so minimal; I don't have to try to resist.
   - (1) I make an effort to always resist.
   - (2) I try to resist most of the time.
   - (3) I make some effort to resist.
   - (4) I give in to all such thoughts without attempting to control them, even when I don't want to give in.

6. How successful are you in stopping or changing these thoughts about alcohol when you are not drinking?

       (0) I am completely successful in stopping or changing these thoughts if I have them.
       (1) I am usually able to stop or change these thoughts when I make an effort or concentrate.
       (2) I am sometime able to stop or change these thoughts.
       (3) I am rarely successful in stopping these thoughts, but I can change these thoughts if I try real hard.
       (4) I am rarely able to change these thoughts even for a moment.

7. How many drinks of alcohol do you drink each day?
     (0) None
     (1) Less than 1 drink per day
     (2) 1-2 drinks per day
     (3) 3-7 drinks per day
     (4) 8 per more drinks per day

8. How many days each week do you drink alcohol?
     (0) None
     (1) No more than 1 day per week
     (2) 2-3 days per week
     (3) 4-5 days per week
     (4) 6-7 days per week

9. How much does your drinking alcohol get in the way of your school work? Do you miss school, use alcohol before or at school or experience a decline in grades? (If you are not currently in school, how much of your performance would be affected if your were in school?)
     (0) Drinking never gets in the way-I can function normally.
     (1) Drinking gets in the way a little bit with my school work, but my overall performance is okay.
     (2) Drinking definitely gets in the way with my school performance, but I can still manage.
     (3) Drinking really hurts my school performance.
     (4) Drinking totally gets in the way of my school performance.

10. How much does your drinking alcohol get in the way of your social or family functioning? (Have you missed or stopped attending family functions, changed friends, lost interest in hobbies?)
     (0) Drinking never gets in the way-I can function normally.
     (1) Drinking gets in the way a little bit with my social or family activities, but my overall is okay.
     (2) Drinking definitely gets in the way with my social or family activities, but I can still manage.
     (3) Drinking really gets in the way of my social or family performance.

(4) Drinking totally gets in the way of my social or family performance.

11. If you were prevented from drinking alcohol when you wanted to drink, how irritable, upset or nervous would you become?

    (0) I would not feel irritable, upset, or nervous.
    (1) I would become a little irritable, upset, or nervous.
    (2) The irritability would increase, but I can still manage.
    (3) I would get very irritable, nervous or upset.
    (4) I would get so irritable, nervous or upset that I would lose it.

12. How hard do you try to avoid using alcoholic beverages? (Only tell how hard you try to avoid drinking, not whether you were successful or not.)

    (0) My drinking is no minimal; I don't need to try that hard.
    (1) I make an effort to always avoid drinking.
    (2) I try to avoid drinking most of the time.
    (3) Sometimes I make an effort to avoid drinking.
    (4) I usually give in to drinking without trying to control or stop it even when I don't want to give in.
    (5) I always give in to all drinking.

13. How strong is your desire to drink alcoholic beverages?

    (0) I have no desire.
    (1) I have some desire to drink.
    (2) I have a strong desire to drink.
    (3) I have a very strong desire to drink.
    (4) The desire to drink is overwhelming.

14. How much control do you have over drinking alcohol?

    (0) I have total control over drinking. I can take it or leave it.
    (1) I am usually able to control my drinking without difficulty.
    (2) It is difficult for me to control my drinking, but I often do.
    (3) I must drink and can only put it off if I try very hard.
    (4) It is hard to put off drinking even for a moment.

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- Please contact her to obtain her permission if you wish to use the A-OCDS.

Table 2: Impact Substance Use Disorder Criteria Questionnaire

1.	Have you ever missed school or work because of your alcohol or drug use?	A1*
2.	Have your grades been effected by your alcohol or drug use	A1
3.	Have you ever been in need of medical attention or hospitalization when using alcohol or drugs?	A2
4.	Have you ever been charged with a MIP, minor in consumption or DUI?	A3
5.	Have you ever had conflicts with friends, roommates, or significant others due to your alcohol or drugs?	A4
6.	Have you ever been charged with possession of an illegal substance or possession of paraphernalia?	A3
7.	Has your alcohol or drug use ever damaged a relationship with someone you cared about?	A4
8.	Have you noticed that it takes more alcohol or any other drug than it once did to get the desired effect?	D1
9.	After you stopped your alcohol or drug use, have you ever experienced the following? (i.e., sweats, shakiness, anxiety, rapid heartbeat, depression or disturbed sleep)	D2
10.	Have you ever drunk more than you intended or found yourself intoxicated when you hadn't intended?	D3
11.	Have you had a desire or made unsuccessful attempts to cut down or stop your alcohol or drug use?	D4
12.	Have you ever spent most of the day using alcohol or drugs or getting over the effects?	D5
13.	Have you ever been unable to do something you had planned because you were drinking or using drugs, or recovering from their effects.	D6
14.	Have you ever had so much to drink that the next day you could not remember what you had said or done?	D7
15.	Have you been treated for any physical or psychological condition that caused or made worse by drinking or using?	D7

* A = Abuse criteria, D = Dependence criteria as stated in the DSM-IV-TR

Table 3: A-OCDS Response Rate (Response Percentages for Items)

Response Item	0	1	2	3	4
1	60.8%	37.9	.7	.7	
2	68.4	29.9	1.0	.7	
3	91.0	6.0	1.7	.3	
4	95.0	4.0	.7	.3	
5	89.7	7.3	1.7	1.0	.3
6	92.7	6.3	.7	.3	
7	49.8	43.9	4.7	1.3	.3
8	15.6	48.2	34.2	1.0	1.0
9	82.7	14.6	1.7	.3	.7
10	91.4	7.3	1.0	.3	
11	75.1	20.6	4.0	.3	
12	65.1	10.0	10.6	12.6	1.7
13	32.9	62.5	4.3	.3	
14	78.7	18.3	2.3	.3	.3

Table 4: Substance Use Disorder Criteria

Item	Description	Yes	No
1	Have you ever missed school or work because of your alcohol or drug use?	19.6%	80.4
2	Have your grades been effected by your alcohol or drug use	13.0	87.0
3	Have you ever been in need of medical attention or hospitalization when using alcohol or drugs?	2.7	97.3
4	Have you ever been charged with a MIP, minor in consumption or DUI?	49.5	50.5
5	Have you ever had conflicts with friends, roommates, or significant others due to your alcohol or drugs?	21.9	78.1
6	Have you ever been charged with possession of an illegal substance or possession of paraphernalia?	6.3	93.7
7	Has your alcohol or drug use ever damaged a relationship with someone you cared about?	9.0	91.0
8	Have you noticed that it takes more alcohol or any other drug than it once did to get the desired effect?	35.2	64.8
9	After you stopped your alcohol or drug use, have you ever experienced the following? (i.e., sweats, shakiness, anxiety, rapid heartbeat, depression or disturbed sleep)	6.6	93.4
10	Have you ever drunk more than you intended or found yourself intoxicated when you hadn't intended?	48.8	51.2
11	Have you had a desire or made unsuccessful attempts to cut down or stop your alcohol or drug use?	16.6	83.4
12	Have you ever spent most of the day using alcohol or drugs or getting over the effects?	21.9	77.7
13	Have you ever been unable to do something you had planned because you were drinking or using drugs, or recovering from their effects.	16.6	83.4
14	Have you ever had so much to drink that the next day you could not remember what you had said or done?	42.2	57.8
15	Have you been treated for any physical or psychological condition that caused or made worse by drinking or using?	2.3	97.7
16	Craving (as indicated by the A-OCDS scores of 50% or greater probability of problem drinking)	18.6	81.4

Table 5: CFA Global Fit Statistics for A-OCDS

Model	df	χ^2	CFI	WRMR	RMSEA
1-factor	77	365.927	0.926	1.656	0.112(0.100-0.123)
2-factor	74	148.022	0.981	0.937	0.058 (0.044-0.071)

Table 6: CFA for A-OCDS Standardized Model Results

F1 By	Loading	S.E.	Est./S.E.	Two-Tailed P-value
I3	0.830	0.043	19.436	0.000
I4	0.736	0.060	12.246	0.000
I5	0.751	0.044	17.241	0.000
I6	0.961	0.041	23.205	0.000
I9	0.762	0.053	14.423	0.000
I10	0.824	0.044	18.637	0.000
F2 By				
I1	0.790	0.028	28.742	0.000
I2	0.671	0.047	14.412	0.000
I7	0.514	0.055	9.299	0.000
I8	0.599	0.052	11.495	0.000
I11	0.750	0.045	16.810	0.000
I12	0.579	0.047	12.410	0.000
I13	0.790	0.028	28.742	0.000
I14	0.838	0.037	22.491	0.000
F2 with F1	0.806	0.041	19.814	0.000

Table 7: CFA for DSM-5 AUD Standardized Model Results

Item F1 by	Loading	S.E.	Discrimination	Difficulty
I1	0.752	0.051	1.142(0.18)	1.138(0.14)
I2	0.765	0.060	1.187(0.23)	1.476(0.18)
I5	0.727	0.052	1.058(0.16)	1.066(0.14)
I7	0.734	0.080	1.081(0.26)	1.829(0.25)
I8	0.646	0.054	0.846(0.12)	0.587(0.12)
I9	0.598	0.100	0.745(0.19)	2.516(0.48)
I10	0.589	0.055	0.728(0.11)	0.050(0.12)
I11	0.575	0.076	0.703(0.14)	1.686(0.28)
I12	0.765	0.043	1.189(0.16)	1.006(0.12)
I13	0.873	0.037	1.787(0.32)	1.111(0.11)
I14	0.674	0.051	0.913(0.13)	0.290(0.11)
I15	0.929	0.081	2.505(1.59)	2.143(0.28)
I16	0.817	0.039	1.418(0.21)	1.092(0.12)

Table 8: CFA DSM-IV-TR AUD Standardized Model Results

Item	Loading	S.E.
F1 by		
I1	0.776	0.039
I2	0.798	0.062
I3	0.458	0.204
I4	0.246	0.084
I5	0.776	0.039
I7	0.781	0.078
F2 by		
I8	0.627	0.042
I9	0.630	0.099
I10	0.627	0.042
I11	0.586	0.076
I12	0.769	0.045
I13	0.902	0.039
I14	0.929	0.049
I15	0.817	0.088
F1 with F2	0.871	

Table 9: CFA proposed-DSM-5 & DSM-IV-TR Global Fit Statistics

Model	df	χ^2	CFI	WRMR	RMSEA	F2 with F1
DSM-IV-TR 2-factor	78	118.974	0.958	0.933	0.042(0.026-0.056)	0.871
DSM-IV-TR 1-factor	77	127.846	0.946	0.969	0047(0.032-0.061)	
Proposed DSM-5 1-factor	65	108.552	0.968	0.955	0.047(0.031-0.062)	

Table 10: Diagnostic Comparison DSM-IV-TR & DSM-5

	Abuse	Dependence	AUD Moderate	AUD Severe	Physiological Dependence	AUD Total
DSM-IV-TR	204(67%)	97(32%)	--	--	--	301(100%)
DSM-5	--	--	87 (26%)	116(34%)	121(27/94)	203(67%)

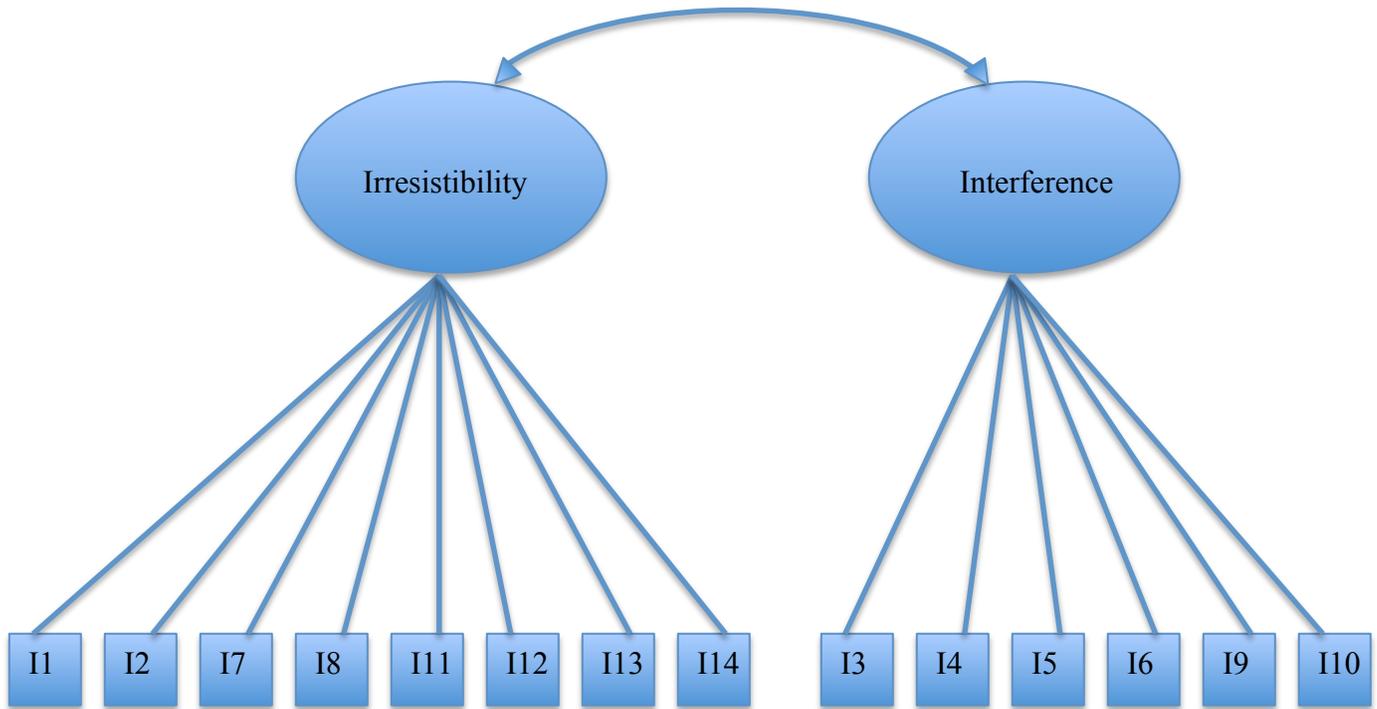*Figure 1.* Factor Analysis Model of the A-OCDS

Figure 2. Factor Analysis Model Diagram (Item Response Theory)

How many factors underlie the correlations among the items?

Continuous Latent Factor
The latent variable that determines data structure is continuous.
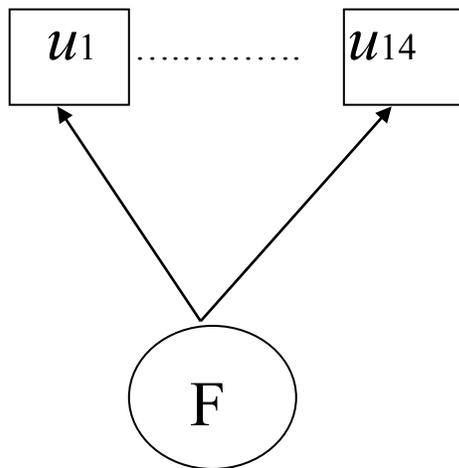Concerned with the **structure of variables** (their correlations)

Figure 3. Item Response Curves (Item Response Theory)