DISENTANGLING ALCOHOL-SPECIFIC ALCOHOL USE DISORDER CRITERIA

FROM EXTERNALIZING PSYCHOPATHOLOGY USING AN EMPIRICALLY

DRIVEN APPROACH

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DISENTANGLING ALCOHOL-SPECIFIC ALCOHOL USE DISORDER CRITERIA FROM EXTERNALIZING PSYCHOPATHOLOGY USING AN EMPIRICALLY DRIVEN APPROACH

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a candidate for the degree of doctor of philosophy of clinical psychology,

and hereby certify that, in their opinion, it is worthy of acceptance.

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DEDICATION

       I would like to acknowledge my family for all their love and support throughout my graduate journey. My degree reflects all their sacrifices, love, and generosity towards me. Thank you all for helping me complete this milestone and shaping who I am. I am forever grateful. I would also like to thank my undergraduate mentors and peer-mentors who shared wisdom that helped guide me through graduate school.

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ABSTRACT

Within current mental disorder classification systems, alcohol use disorder (AUD) and psychopathology, more broadly, are conceptualized as distinct categorical disorders. Recent classification research has focused on commonalities across disorders to better understand psychopathology, with many arrangements combining AUD with other externalizing disorders, like conduct disorder and antisocial personality disorder. However, the focus on commonalities of AUD with externalizing disorders may preclude insight into possible unique aspects of AUD that can inform AUD classification and treatment targets. The present study aimed to identify AUD symptoms more uniquely associated to alcohol use (versus an externalizing process), using a newly developed analytic procedure, combinatorial optimization. First, we identified AUD symptom sets based on standard and alcohol-specific consumption measures. The symptom sets were then compared to existing diagnostic measures and AUD correlates to determine whether distinct relationships between standard and alcohol-specific symptom sets emerged. Results indicated standard AUD symptom sets outperformed alcohols-specific sets in most cases, with more robust relationships between standard sets and AUD correlates These findings have several clinical and research implications, such as the importance of accounting for externalizing processes in the classification and treatment of AUD. Future research is necessary to determine how to best target unique processes integral to AUD.

Chapter 1: Introduction

The current *Diagnostic and Statistical Manual of Mental Disorders,* 5th edition (DSM-5; American Psychiatric Association [APA], 2013) classification system is primarily categorical, based on the assumption that prescribed diagnostic boundaries represent distinct mental disorders. However, high rates of co-occurrence across disorders (e.g., Newman, Moffitt, Caspi, & Silva, 1998; Caspi et al., 2014) and heterogeneity within disorders (e.g., Lilenfield & Treadway, 2016), give rise to the possibility that borders surrounding psychopathology have limited validity, and these borders may insufficiently capture underlying psychological constructs.

Recent classification models have focused on the dimensional nature of psychopathology, highlighting the common variance across disorders (e.g., Caspi et al., 2014; Kotov et al., 2017). The goal of these dimensional approaches is to better categorize complex psychological constructs based on commonalities; thus, the uniqueness and specificity within disorders are largely ignored. Given the complex nature of psychopathology, the unique variance associated with disorders likely provides important insight into the etiological processes underlying specific presentations of these broader dimensions. The unique variance may be related to discrete psychological constructs specific to a disorder. These "uncommon" constructs may affect the manifestation of a disorder, in turn, affecting prognosis, treatment course, and specific treatment targets. Thus, understanding both common and unique associations of psychopathology is likely to resolve key aspects of psychopathological constructs rather than approaches that focus primarily on common associations across psychopathology.

Alcohol use disorder (AUD) is an example of a disorder likely to benefit from examinations of common *and* unique components. AUD is a heterogenous construct with

high rates of co-occurrence with several disorders. Dimensional psychopathology models classify AUD with disorders characterized by poor self-control, impulsivity, and aggression, or externalizing disorders (Caspi et al., 2014; Kotov et al., 2017). This classification focuses on AUD's shared variance with externalizing disorders and does not highlight disorder-specific factors associated with AUD. A recent investigation of genetic mechanisms underlying alcohol dependence symptoms found three distinct genetic factors that were differentially associated with externalizing disorders (Kendler et al, 2012). The results from this study support the notion that there are AUD factors strongly related to other externalizing disorders as well as unique factors that are substantially less related.

The current project focuses on AUD's conceptualization in the fifth edition of the *Diagnostic and Statistical Manual* (DSM-5; American Psychiatric Association [APA], 2013) and its relationship with externalizing psychopathology. The goal of this project is to disentangle alcohol-specific AUD criteria from AUD criteria more related to general externalizing psychopathology to improve AUD classification. If alcohol-specific AUD criteria can be identified, this could have important implications for AUD research, prognosis, treatment, and prevention efforts.

DSM-5 AUD

In the DSM-5 (APA, 2013) AUD is defined by a collection of behavioral and physical symptoms. These symptoms include physiological symptoms, like withdrawal and tolerance, that are predicated on prolonged alcohol exposure (see Appendix A, Supplemental Table 1 for criteria definitions). It also includes compulsive symptoms, like physical/psychological problems and quit/cut down, which are theorized to be indicators

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of uncontrollable use. Further, symptoms include negative psychosocial consequences from alcohol use, like impaired role functioning (i.e., role interference) and substantial time spent obtaining, using, or recovering from the effects of alcohol (i.e., time spent). In total there are 11 DSM-5 criteria that define AUD (Appendix A, Supplemental Table 1). To meet criteria for AUD, an individual must endorse at least two symptoms. Based on the number of symptoms endorsed, a severity grading is given, such that endorsement of two-to-three symptoms constitutes a mild AUD, four-to-five symptoms constitutes a moderate AUD, and six or more symptoms constitutes severe AUD (APA, 2013). Factor analytic studies indicate the 11 criteria form a robust unitary construct (Hasin et al., 2013), providing support for a unidimensional classification. Although these studies identify a unitary structure, there still exists great heterogeneity across criteria.

Heterogeneity of AUD Criteria

As noted, DSM-5 AUD is comprised of a cluster of behavioral and physical symptoms, several of which are based on consequences. It has been argued that consequence-based AUD symptoms (and substance use disorder [SUD] symptoms, more generally) can be poor indicators of addiction. Martin and colleagues (2014) note consequence-based symptoms can have multiple causal factors that might not even be caused (or exacerbated) by alcohol use in some cases. For example, the social problems and role interference criteria are based on impaired social and work functioning due to preoccupation with and excessive use of alcohol. However, these consequences could also be due to disinhibitory processes shared across externalizing psychopathology, or general impulsivity traits unrelated to psychopathology, and may simply reflect more pervasive tendencies to act heedlessly.

One study found modest variations in the relationship between DSM-5 AUD symptoms and other externalizing disorders (McDowell, Verges, & Sher, 2019). Specifically, consequence-based symptoms (i.e., social problems and role interference) and continued use despite physical/psychological problems had stronger relationships with other externalizing disorders, and weaker associations with a measure of alcohol consumption. Conversely, tolerance and failed attempts to quit/cut down alcohol use were generally less associated with other externalizing psychopathology and more related to alcohol consumption. Therefore, current AUD classification likely includes indicators of an externalizing process and physiological alcohol dependence. The notion that symptoms of AUD are differentially related to neuroadaptations to alcohol and to an externalizing process is not a recent development; indeed, the heterogeneity of AUD has been studied for decades.

Historical AUD Subtypes

Prior to dimensional models of AUD (and psychopathology, more generally) two major groupings, or subtypes, of alcoholics were consistently observed. One subtype is typically characterized by physiological dependence on alcohol, while the other is characterized by poor self-control or disinhibition. Knight (1937) provided one of the first subtypes, which was motivated by "wide variations in severity and character of drinking" that he believed were important to delineate for classification and prognosis (Knight, 1937, pg. 244). To reach this aim, he proposed two subtypes: essential alcoholics and reactive alcoholics. The essential alcoholics were thought to have an "alcoholic personality," with characteristics like early onset of drinking, high craving, comorbid drug use, unreliability, irresponsibility, poor relationships, and poor prognosis

(Knight 1937). The essential alcoholic subtype aligns closely with a subtype characterized by poor self-control/disinhibition. The reactive alcoholics subtype, on the other hand, was characterized by later onset of drinking, minimal (or no) comorbid drug use, responsibility, reliability, drinking for relief, and better prognosis (Knight, 1937). The reactive alcoholics shared characteristics more closely associated with physiological dependence, rather than poor self-control. Since Knight's (1937) conceptualization, several other subtype models have been described (Appendix A, Supplemental Table 2). Although later models were not restricted to two subtypes (e.g., Jellinek, 1960; Zucker, 1986), all models included at least two subtypes differentiated by disinhibitory traits.

Jellinek (1960), Zucker (1986), Cloninger (1987), and Babor and colleagues (1992) also developed alcoholic subtypes that are delineated by disinhibitory traits (Appendix A, Supplemental Table 2). Jellinek's (1960) gamma alcoholics were characterized by initial psychological dependence, and later physiological dependence on alcohol. Gamma alcoholics had high psychological vulnerability (i.e., presence of neurotic response patterns and other psychological disorders) and loss of control (Jellinek, 1960). In contrast, delta alcoholics were characterized by initial physical dependence, with the possibility of later development of psychological dependence (Jellinek, 1960). Delta alcoholics were also characterized by low psychological vulnerability and an inability to abstain from alcohol. Based on these descriptions, gamma alcoholics' characteristics closely resemble disinhibitory traits, whereas delta alcoholics tend to be more alcohol-specific (i.e., more related to physiological dependence). Antisocial (Zucker, 1986), Type II (Cloninger, 1987), and Type B (Babor et al., 1992) are also based on disinhibitory traits. Indeed, these subtypes are characterized

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by early onset of alcohol problems, greater/more severe negative consequences, and disinhibitory characteristics, like high novelty seeking, distractible, and presence of antisocial behavior (Supplemental Table 2). Conversely, developmentally cumulative (Zucker, 1986), Type I (Cloninger, 1987), and Type A (Babor et al., 1992) alcoholics are characterized by later onset of drinking, fewer alcohol-related physical and social consequences, and low disinhibitory traits (e.g., less distress with family, low novelty seeking, lower antisocial behavior; Appendix A, Supplemental Table 2). These historical subtypes of AUD attempted to capture the heterogeneity within AUD, noting AUD's close association with an externalizing process and unique characteristics associated with a physiological dependence on alcohol. In recent years, the shared variance among AUD and disinhibitory disorders (or externalizing disorders) has becoming increasingly important in psychiatric nosology. The common variance among AUD and disinhibitory disorders is explained by the externalizing spectrum.

AUD and the Externalizing Spectrum

The externalizing spectrum comprises a range of mental disorders characterized by high disinhibition, aggression, and impulsivity. The externalizing spectrum includes childhood oppositional defiant disorder (ODD), conduct disorder (CD), and attention deficit/hyperactivity disorder (ADHD), as well as adult substance use disorders (SUDs [including AUD]), and antisocial personality disorder (ASPD; Krueger et al., 2002). Co-occurrence among AUD, CD, and ASPD tends to occur at rates higher than chance and are typically moderately-to-highly correlated (e.g., Kendler, Prescott, Myers, & Neale, 2003; Kessler, Chiu, Demler, & Walters, 2005; Krueger, 1999a, Krueger, McGue & Iacono, 2001; Merikangas et al., 1998). Along with robust bivariate associations among

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externalizing disorders, disorders within the spectrum are risk factors for one another. For example, having either childhood CD or adult antisocial behavior is associated with increased odds of having a SUD diagnosis (Compton et al., 2005; Nock, Kazdin, Hiripi, & Kessler, 2007). The bivariate relationships among externalizing disorders suggests significant shared covariation among these disorders.

Early evidence for a shared underlying externalizing construct comes from factor analytic studies of childhood psychopathology symptoms. Achenbach (1966; 1978; 1979) noted two distinct factors in childhood psychopathology, one factor called the internalizing factor, which included anxiety, depression, and fear-related symptoms, while the other factor, the externalizing factor, included CD and ODD symptoms, and disinhibitory traits. Since this early work, the factor structure has been recovered in adult populations and expanded to include adult disinhibitory disorders, like ASPD and SUDs (e.g., Krueger, 1999a; Krueger et al., 2002; Krueger et al., 2007). The more recent investigations of the externalizing spectrum also noted shared features across externalizing disorders, with the most prominent shared feature being personality.

Personality traits, like impulsivity, high novelty seeking, aggression, low control, reward dependence, and low harm avoidance have been associated with externalizing disorders (e.g., Krueger et al., 2007; Sher & Trull, 1994). In childhood, presence of these personality traits is associated with later development of AUD (e.g., Cloninger, Sigvardsson, & Bohman, 1988). In the Cloninger et al. (1988) study, high novelty-seeking and low harm avoidance predicted early-onset of AUD. In another study comparing personality traits of individuals with and without AUD, individuals with AUD had greater stress reactivity, alienation, aggression, and negative emotionality, with lower

constraint and control (McGue, Slutske, Taylor, & Iacono 1997). The personality traits associated with AUD have also been associated with other externalizing disorders. High aggression, high negative emotionality, and low constraint in childhood and late adolescence have also been shown to significantly predict CD, ASPD, and SUD onset (Krueger, 1999b; Krueger et al., 1996). Other studies of personality and externalizing disorders have also noted the predictive role of personality traits (e.g., impulsivity, aggression, high novelty seeking, low control) in the onset of SUDs and other externalizing disorders (e.g., Krueger et al., 2007; Sher & Trull, 1994). In sum, these studies highlight the contributions of personality in the shared variance across externalizing disorders. Although these studies indicate personality's shared role in the manifestation of externalizing disorders, they do not indicate whether externalizing disorders have shared etiological processes.

Genetic studies of externalizing disorders have noted shared and distinct genetic and environmental factors. For example, early adoption studies of alcoholism found an additive genetic factor for alcohol abuse and antisocial personality (Cadoret, O'Gorman, Troughton, & Haywood,1985; Cadoret, Troughton, & O'Gorman, 1987). The authors noted genetic liability from first-degree relatives were independent for alcoholism and antisocial personality; however, the familial factors were correlated, and presence of alcohol abuse or antisocial personality inferred risk for the other disorder (Cadoret et al., 1985; Cadoret et al., 1987). This suggests there are both shared and independent genetic liabilities for alcoholism and antisocial personality. Other researchers have also indicated an additive and distinct genetic factor underlying AUD and ASPD using family study designs. Kendler, Davis, and Kessler (1997) examined the genetic and environmental

structure underlying AUD and ASPD, highlighting independent and shared genetic liability for SUDs (including AUD) and ASPD, while noting the role of nonshared environmental factors. Likewise, twin studies provide further evidence of shared and unique genetic and environmental factors underlying externalizing disorders.

Slutske and colleagues (1998) conducted one of the first large-scale twin studies to better examine the degree to which common genetic influences account for associations between AUD and CD. The authors reported most of the variation between AUD and CD is accounted for by additive genetic effects and some nonshared environmental effects (Slutske et al., 1998). In a more recent twin study examining the genetic association across AUD, drug use disorders (DUDs), adult antisocial behavior, and CD, a robust shared genetic factor was recovered, along with a more modest nonshared environmental contributions that were specific to adult antisocial behavior and CD exclusively (Kendler et al., 2003). Further, Kendler and colleagues (2003) noted disorder-specific genetic factors associated with AUD and DUD. Combined, these results suggest there is a strong common genetic factor underlying externalizing disorders, with distinct etiological environmental and genetic influences across disorders.

Kendler and colleagues (2012) represent one of the few examinations of AUD-specific genetic factors. Three genetic factors were recovered: excessive drinking/tolerance, loss of control/social dysfunction, and withdrawal/continued use despite physical or psychological problems. The genetic factors were differentially associated with other externalizing disorders, such that the loss of control/social dysfunction had the strongest association with cannabis dependence and CD, while the tolerance/excess drinking factor was most weakly associated with cannabis dependence

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and CD symptoms (Kendler et al., 2012). These results suggest there are unique factors underlying AUD which are differentially related to other forms of externalizing psychopathology.

Although there is evidence for unique alcohol-specific factors underlying AUD, recent psychopathology classification models have focused on AUD's shared variance with externalizing disorders. Caspi and colleagues (2014) examined the structure of psychopathology to assess the degree of dimensionality across categorical conditions. Using multiple factor analytic approaches, three higher-order factor structures were recovered: internalizing, externalizing, and thought disorder factors (Caspi et al., 2014). The externalizing factor was recovered in all approaches and comprised AUD, cannabis use disorder, DUDs, tobacco dependence, and CD/adult antisocial behavior.

Most recently, the Hierarchical Taxonomy of Psychopathology (HiTOP) consortium model was developed the goal of devising a hierarchical dimensional classification system that provides greater clinical utility over traditional approaches (Conway et al., 2019; Kotov, Krueger, & Watson, 2018; Kotov et al., 2017). In this model, AUD is grouped within the "externalizing disinhibited" spectra, which includes a substance abuse (comprised of AUD and DUDs) and antisocial behavior (comprised of ASPD, CD, and other externalizing disorders) subfactor (Kotov et al., 2017; 2018). Within this approach substance abuse is considered a component of disinhibited externalizing, and there is limited information on unique components of substance abuse. Taken together, dimensional models of AUD primarily focus on the shared variance with externalizing, precluding insight into the unique aspects of AUD.

Approach

Much of the recent research in AUD classification refinement have focused on the shared variance with externalizing disorders. However, given the heterogenous nature of AUD symptoms, their varied associations with other externalizing psychopathology, and the multiple genetic risk factors underlying alcohol dependence symptoms, there are likely unique AUD indicators that are not currently elucidated in classification models.

A better understanding of alcohol-specific indicators can inform our understanding of the latent structure of AUD. Alcohol-specific indicators may be more related to physiological dependence on alcohol. If this is the case, clinical research using alcohol-specific indicators could translate to better basic clinical research that focuses on physiological alcohol dependence, rather than disinhibitory traits related to an externalizing process. Additionally, identification of alcohol-specific indicators can inform recent efforts by the National Institutes of Health to develop a framework linking psychobiological systems to adaptive and maladaptive functioning, known as the Research Domain Criteria (RDoC; Cuthbert & Insel, 2013; Insel et al., 2010). Alcohol-specific indicators would theoretically be more closely tied to biological systems given it indicates neuroadaptations from prolonged alcohol exposure, further enhancing classification refinement.

Moreover, alcohol-specific indicators could have implications for prognosis, treatment, and prevention efforts. Individuals who endorse AUD symptoms more associated with externalizing psychopathology may be quantitively different than those who endorse AUD symptoms less related to externalizing, and more related to physiological alcohol dependence. Additionally, individuals with comorbid externalizing and AUD traits may require different treatment approaches. For example, individuals

with AUD and co-occurring externalizing traits may benefit from treatment that targets externalizing traits (e.g., impulsivity, aggressiveness, irresponsibility, etc.) in addition to targeting AUD symptoms. Treatment for "purer" AUD may focus primarily on techniques for reducing (or abstaining) from alcohol. Finally, prevention approaches could vary as a function of AUD symptom presentation. Individuals with externalizing and AUD traits are likely to have a different etiological process than individuals with AUD-specific traits. Thus, these individuals could have different risk factors, which would require different approaches to prevention. In sum, a better understanding of specific AUD symptomatology can greatly improve diagnostic refinement of AUD. The current project aims to address this issue by using combinatorial optimization (Loeffelman et al., 2020) to identify an AUD diagnostic scheme that is less related to shared externalizing traits. We anticipate AUD symptoms previously found to have weaker associations with externalizing characteristics (e.g., tolerance, quit/cut down) will be included as "alcohol-specific" indicators, while symptoms more strongly related to an externalizing process (e.g., social problems, time spent) will not be included.

Chapter 2: Method

Samples

  Data from two large nationally representative samples were used to derive and/or validate optimal solutions. The National Epidemiological Survey on Alcohol and Related Conditions (NESARC; Grant et al., 2003; Grant & Kaplan, 2005) is a large cross-sectional study of US non-institutionalized citizens aged 18 years and older. NESARC consists of two waves, the first in 2001-2002 (NESARC Wave 1; Grant et al., 2003) and a follow-up in 2004-2005 (NESARC Wave 2; Grant & Kaplan, 2005). The current study uses data solely from NESARC Wave 2 (hereafter referred to as NESARC) because the DSM-5 AUD craving criterion is only assessed during follow-up. Participants who consumed at least one alcoholic beverage in the past year and were at least 21 years-old[1] were included in the sample (*N*=22,160). Additionally, participants with missing data on project measures (described below) were excluded from analyses, resulting in a final sample of *N*=22,103. NESARC was used as the validation sample in the current study.

  NESARC-III is an independent nationally representative sample of US non-institutionalized citizens aged 18 years and older. Participants who consumed at least one alcoholic drink in the past year and were at least 21 years-old were included in the second sample (*N*=24,773).[2] After excluding individuals with missing data on project measures, the final NESARC-III sample was *N*=24,354. NESARC-III was used to derive alternate diagnostic schemes and in a separate validation procedure (described in Analytic Procedure section). Sample characteristics for both data sets are presented in Table 1.

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[1] Given NESARC Wave 2 was a follow-up, the lowest age of most past-year drinkers was 21 years-old, with a small majority (*n*=17, 0.09% [SE=0.02]) aged 20. Therefore, 21 and older was selected as the minimum age to increase consistency across the two samples in the study.

[2] In NESARC-III, the 21-year-old age minimum excluded *n*=1005 (4.55% [SE=0.20]) past-year drinkers.

Measures

Measures were assessed using the *Alcohol Use Disorder and Associated Disabilities Interview Schedule-Fourth Edition* (AUDADIS-IV; Grant et al., 2001) and AUDADIS-5 (Grant et al., 2011). The AUDADIS-IV and AUDADIS-5 (hereafter referred to as AUDADIS) are semi-structured interviews used to assess AUD and a range of comorbid psychological disorders for the NESARC and NESARC-III samples, respectively. Items consistent across AUDADIS version were used in analyses.

Optimization Diagnostic Set

The optimization diagnostic set is the set of items to be reduced via combinatorial optimization. The relationship of these items with relevant correlates is used to reduce the item set. This is described in greater detail in the Analytic Procedure section.

The 11 DSM-5 AUD (APA, 2013) criteria were used as the optimization diagnostic set. Items used to assess AUD criteria were consistent across NESARC and NESARC-III. Past-year endorsement of one item within each criterion constituted positive endorsement, except for the "withdrawal" criterion. Endorsement of either two of eight withdrawal items, or one relief/avoidance from withdrawal, constituted positive endorsement. See Supplemental Table 1 for criteria prevalence rates.

Optimization Criteria

Optimization criteria are indicators of the construct of interest underlying the optimization diagnostic set (i.e., full item-set). In the current study, the optimization criteria are indicators of AUD, the same construct underlying AUD criteria (i.e., the optimization diagnostic set). Scores on optimization criteria are used to select reduced item-sets.

Heavy alcohol consumption. The first optimization criterion is heavy alcohol consumption, a known correlate of AUD that has a causal role in the neurobiological changes exhibited in alcohol dependence (Rehm et al., 2013a, 2013b). Heavy alcohol consumption also has a robust monotonic relationship with DSM-5 criterion count (e.g., Dawson et al., 2010; Lane & Sher, 2015; Saha et al., 2007). Further, it has successfully identified reduced AUD diagnostic-sets that perform comparably or better than existing AUD diagnostic approaches (Boness et al., 2019; Loeffelman et al., 2020; Stevens et al., 2019).

Alcohol consumption was measured using items genetically associated with heavy drinking behavior (Agrawal et al., 2009; Agrawal et al., 2011). Items were past-year drinking frequency, usual amount of alcohol consumed on drinking days, maximum number of drinks in a single day, binge (4+/5+ drinks in single episode) frequency, intoxication frequency, exceeding daily drinking limits (National Institute on Alcohol Abuse and Alcoholism, 2004) frequency, and maximum number of drinks in a 24-hour period. An EFA was conduction on consumption items and 1-factor solution best fit the data (Supplemental Tables 3a-b). Factors scores from the solution were used as the alcohol consumption measure (Supplemental Tables 3a-b).

"Alcohol-specific" consumption. The second optimization criterion is an alcohol-specific, or "pure," measure of heavy alcohol consumption that excludes variance accounted for by co-occurring externalizing psychopathology. The alcohol-specific consumption measure served as a proxy for a consumption measure "less contaminated" by the underlying externalizing mechanism.

To create this measure, externalizing behavior was measured via adult antisocial behavior (AAB), CD, and impulsivity behaviors.[3] Impulsivity items related to intimate/sexual relationships, spending, and "other" impulsive behavior were included to broaden the scope of the externalizing behavior measure, as impulsivity is a known personality characteristic associated with externalizing behavior (e.g., Krueger et al., 1996; Krueger et al., 2002). ASPD was assessed using seven DSM-5 lifetime AAB symptoms. CD was assessed using 14 of the 15 DSM-5 CD symptoms. The "has broken into someone else's house, building, or car" criterion was not assessed in the AUDADIS. Impulsivity items included sexual behavior, gambling/overspending, and general impulsive acts. An exploratory factor analysis (EFA) was conducted on the AAB, CD, and impulsivity items to derive factor scores. A single factor solution best fit the data (Supplemental Tables 4a-b). Factor scores from the solution were then used to measure externalizing behavior (Supplemental Tables 4a-b).

Variance associated with the externalizing behavior measure was then partialed from the heavy alcohol consumption measure (M_{NEASRC}=0.044, SE_{NESARC}=0.004; $M_{NEASRC-III}$=-0.029, $SE_{NESARC-III}$=0.011) described in the section above. Externalizing behavior and the standard heavy consumption variable were correlated 0.32 in NESARC and 0.29 in NESARC-III. The resulting residualized alcohol consumption measure (M_{NESARC}=0.043, SE_{NESARC}=0.005; $M_{NESARC-III}$= -0.022, $SE_{NESARC-III}$=0.011) was used as the alcohol-specific measure.

External Validators

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[3] Although adult antisocial behavior and conduct disorder do not fully represent the externalizing spectrum, they represent the only externalizing disorders available in both versions of the AUDADIS aside from substance use disorders. Given the high degree of overlap across alcohol and drug use disorders, drug use disorders were not included in the measure of externalizing psychopathology.

External validators were used to assess the validity of alternative diagnostic schemes. Validators were known correlates of AUD, which included risk factors, commonly co-occurring conditions, and recent functioning. External validator prevalence rates across samples are provided in Supplemental Table 5.

Age of first drink < 15. A binary measure of age of first drink was created such that individuals who reported a drinking onset prior to age 15 were positively coded.

Drug use. A binary variable measured whether participants reported past-year drug use. Substances assessed were sedatives, cannabis, opioids, heroin, cocaine, stimulant, hallucinogen, inhalants/solvents, and "other" drugs. Endorsement of any of those substances constituted drug use.

Family history. Family history of alcoholism, drug use disorder, and behavioral problems were included as external correlates. Participants who indicated their biological mother or father had a history of alcohol problems were positively coded as a family history of alcoholism. Family history of drug problems was based on positive endorsement of biological parent living in the home having a history of problematic drug use. Family history of behavioral problems was based on positive endorsement of a biological parent in the home having a lifetime history of behavioral problems.

Treatment utilization. Two binary treatment utilization measures will be constructed. The first is lifetime alcohol treatment, in which participants who endorsed alcohol treatment in the past year were positively coded. The second treatment utilization was lifetime drug treatment, which positively coded individuals who endorsed drug treatment.

Mental health. A binary mood disorders variable assessed whether a participant had at least one past-year mood disorder. Participants who had past-year dysthymia, major depressive disorder, and/or bipolar I disorder were positively coded for having a mood disorder. Additionally, a binary anxiety disorders variable determined whether a participant had at least one past-year anxiety disorder. Participants with a past-year panic disorder, agoraphobia, generalized anxiety disorder, social phobia, and/or specific phobia were positively coded for having an anxiety disorder.

Psychosocial problems. Past-year financial, employment, interpersonal, and legal problems were used as psychosocial indexes. In NESARC, financial problems were assessed using an item which asked about past-year major financial crisis, bankruptcy, and inability to pay bills on time. The corresponding item in NESARC-III exclusively asked about bankruptcy. Participants who endorsed the financial problems item were positively coded. Employment problems was a single item based on whether participants had trouble with boss/co-workers, were unemployed and searching for a job for at least one month, and fires or laid off from a job in the past year. Endorsement of any items constituted past-year employment problems. Interpersonal problems were measured via past-year endorsement of partner separation (i.e., divorce, separation, end of steady relationship) and serious problems with a neighbor, friend, or relative. Participants who endorsed either item were positively coded. Finally, legal problems were assessed via single item which indicated whether participants had serious trouble with the police or law in the past year.

Recent functioning. The Short Form 12 Health Survey Version 2 (SF-12v2; Ware, Kosinski, & Keller, 1996; Ware et al., 2002) is a 12 item self-report measuring assessing

general health outcomes over the past four weeks. The AUDADIS provides norm-based scores for the SF-12v2 subscales, which is a standardized to a mean of 50 (range=0 to 100) using standard norm-based scoring techniques (Ware et al., 2002). Impairment was measured via three SF-12v2 subscales: (1) mental health, (2) physical functioning, and (3) social functioning subscales. SF-12v2 were reverse scored, such that high scores indicate greater impairment, and lower scores indicate lower impairment.

Established Diagnostic Approaches

The general and alcohol-specific solutions were each compared to established diagnostic approaches to determine compare incremental improvement in fit. The diagnostic approaches included DSM-IV dependence (APA, 1994), DSM-5 AUD (APA, 2013), *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* alcohol dependence (ICD-10; World Health Organization [WHO], 1992), ICD-11 alcohol dependence (WHO, 2020), and Wakefield's Harmful Dysfunction (Wakefield & Schmitz, 2014; 2015; hereafter referred to as Wakefield's HD) diagnoses. For ICD-10 dependence, ICD-11 dependence, and Wakefield's HD, several DSM-5 AUD criteria were combined to recreate the diagnostic schemes.

Analytic Procedure

Combinatorial optimization can be used to derive reduced AUD criteria sets that best differentiate diagnostic groups based on AUD-specific correlates, such as heaviness of consumption (e.g., Boness et al., 2019; Steinley et al., 2016; Loeffelman et al., 2020). The current study uses this approach to derive optimal solutions that are based on a standard heavy consumption measure and an alcohol-specific heavy consumption measure that accounts for co-occurring externalizing traits. The steps employed in the

combinatorial optimization analyses are outlined below and more detailed descriptions are provided elsewhere (Loeffelman et al., 2020; Stevens et al., 2019).

Data Preparation and Constraints

Prior to optimization, a set of variables are selected for "clustering," or item-reduction. Additionally, one or more other variables are used to derive the reduced item-set. The "clustering" items (cluster assignment defined by accompanying diagnostic rule) classify a diagnosis (i.e., absent/present), while the "derivation" variables differentiate diagnostic groups. The "derivation" variables are also referred to as optimization criteria because they are used to best categorize, or optimize, diagnostic groups. All possible combinations of "clustering" items and thresholds (i.e., cutoff scores) are used to classify groups. The item-combination and accompanying threshold that best distinguishes groups on the "derivation" variable(s) is considered the optimal solution. Optimization criteria should be correlated with the initial item-set and have similar characteristic structures. In other words, optimization criteria should be measures that can establish construct validity (Cronbach & Meehl, 1955), therefore serving as valid indicators of the underlying construct of interest.

The present study uses 11 DSM-5 AUD criteria as the initial item-set, and two separate optimization criteria: heavy alcohol consumption (hereinafter referred to as standard consumption) and alcohol-specific consumption, which controls for co-occurring externalizing psychopathology (hereinafter referred to as alcohol-specific consumption). To better understand the unique aspects of AUD, the standard alcohol consumption measure and alcohol-specific measure independently derived optimized diagnostic-sets, (i.e., optimal solutions).

The combinatorial optimization procedure supports the inclusion of constraints on candidate solutions. Constraints were used to ensure each candidate diagnostic-rule had a minimum base rate that aligned with national AUD prevalence. Base rates were based on published AUD estimates for mild and above (17.1%), moderate and above (7.1%), and severe (3.3%) severity gradings (Grant et al., 2015).[4]

In total, three different base rates were used, with each base rate constraint used in independent optimization procedures. This resulted in three separate optimization procedures for each of the two optimization criteria (i.e., 6 optimization analyses). Combinatorial optimizations were completed in MATLAB (MATLAB, 2018).

Step 1: *K-fold Cross-validation*

This study's optimization procedure derived optimal solutions using a single data set. K-fold cross-validation was used to minimize the likelihood of overfitting the dataset (Rodriquez et al., 2010; Stone, 1974). Thus, NESARC-III data was randomly partitioned into five (i.e., k=5) non-overlapping folds. One-fold was selected as the hold out sample, or test set, and the remaining four folds were used as the training set.

Complete enumeration of candidate decision rules was completed on the training set. Complete enumeration involved the calculation of all possible item combinations across every item-set size (i.e., n=1…n=11) with every conceivable rule (i.e., threshold) for the 11 DSM-5 AUD criteria. See Appendix B for a complete enumeration example.

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[4] Given that the alcohol-specific alcohol consumption measure accounts for co-occurring externalizing psychopathology, we completed supplemental analyses with three alternative base rates to account for the potential reduction in prevalence rates. It is unclear what percentage of AUD prevalence rates are attributable to an underlying externalizing mechanism, therefore, we conservatively reduced base rates by half. This resulted in the following base rate minimums: mild and above (8.55%), moderate and above (3.55%), and severe (1.65%). The base rates were used separately for the standard and alcohol-specific analyses, resulting in six additional analyses. The results from theses alternative analyses are provided in Appendix A, Supplemental Tables 6-15.

The performance of candidate decision rules was evaluated in the test set (i.e., k-1 folds) which is described in step 2 below. Each fold served as a hold-out sample, resulting in five repetitions.

Step 2: *Calculate Diagnostic Groups' Degrees of Separation*

In the second step, the degree of separation between diagnostic groups (i.e., present/absent) on optimization criteria was compared in the test set. In other words, the "diagnosed" and "undiagnosed" groups were compared on either the standard heavy consumption measure or alcohol-specific consumption for each candidate decision rule. Cohen's *d* assessed the mean-level difference between diagnostic groups on optimization criteria (i.e., standard consumption and alcohol-specific consumption).

Step 3: *Rank Order Diagnostic Criteria Sets and Rules*

Following the calculation of diagnostic group separation for each candidate rule, potential rules were ranked based on their Cohen's *d* value. Higher Cohen's *d* values suggest greater separation between diagnostic groups on the optimization criterion. Candidate rules, or candidate solutions, with higher Cohen's *d* values were given lower rankings, with the solution with the highest Cohen's *d* ranked as one.

Step 4: *Identify Optimal Solution*

Step 4a: Within Iteration. The candidate solution with the lowest average rank across training folds (i.e., 4 folds) is identified. This process is completed for each of the five repetitions, once for each time a fold is used as the hold-out set. The solution with the lowest average rank across the five repetitions is considered the optimal solution within an iteration.

Step 4b: Across Iterations. To further minimize overfitting the data, steps 1-4a were completed 1000 times. Across the 1000 iterations, the optimal solution that most frequently had the lowest average rank (i.e., most frequently optimal) was selected as the final optimal solution.

Step 5: *External Validation*

Step 5a: Performance of Optimal Solution in NESARC. The first part of external validation examined the performance of the optimal solution in an independent sample, NESARC. The optimization procedure (without the 1000 iterations) was completed in NESARC and the Cohen's *d* of the selected optimal solution was evaluated and compared to the NESARC-III Cohen's *d* value. Comparable performance across samples would suggest the optimal solution may be generalizable to other data sets.

Step 5b: Optimal Solution Performance with Existing Approaches. The second part compared the performances of the standard and alcohol-specific optimal solutions with external correlates. To do this, optimal solutions were compared to established AUD diagnostic measures that serves as the "gold standard." The level of agreement with these measures assessed how closely aligned optimal solutions were with existing measures. Agreement analyses were conducted in Mplus (version 7.4; Muthén & Muthén 2015) SAS (version 9.4; SAS Institute Inc., 2013). Additionally, the predictive utility over and beyond standard AUD measures when predicting relevant AUD correlates (e.g., family history, age of first drink) was assessed for each optimal solution. Predictive utility analyses were completed in SUDAAN (Research Triangle Institute, 2012). Agreement and predictive utility provided an index to compare the performance of the standard alcohol consumption and alcohol-specific solutions to each other.

Chapter 3: Results

Optimal Solutions

A standard heavy alcohol consumption measure and alcohol-specific heavy consumption measure (i.e., heavy alcohol consumption with variance associated with externalizing symptoms partialed out) were used to derive distinct optimal diagnostic solutions, or rules, with the goal to identify alcohol-specific AUD symptomatology distinct from externalizing psychopathology. The combinatorial optimization procedure (Stevens et al., 2019; Loeffelman et al., 2020) used three base rates to calculate three separate optimal solutions for each consumption measure. Base rates were based on mild, moderate, and severe AUD estimates (Grant et al., 2015). In total, six independent combinatorial optimization analyses were completed.[5] The performances of optimal solutions in NESARC-III (i.e., derivation sample) were compared to performance in NESARC (i.e., validation sample). Diagnostic rules obtained from each analysis is listed in Table 2 and described below.

Mild Solutions

Mild AUD prevalence rate is estimated at 17.1% (Grant et al., 2015). Under this constraint, the standard consumption measure had 23 candidate optimal solutions (i.e., 23 different optimal solutions across 1000 iterations). The selected final standard mild optimal solution had the lowest rank in 24.2% of iterations with a median Cohen's *d* of 1.9 in NESARC-III (i.e., derivation sample) and 1.6 in the NESARC (i.e., validation sample). The solution included 9 of 11 possible criteria – tolerance, quit/cut down,

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[5] Six additional analyses were conducted using three alternative base rates. The base rates served as conservative prevalence estimates of AUD without externalizing traits and were calculated by reducing each severity estimate by half. See Supplemental Table 6 for a full list of the optimal solutions using all six base rates.

larger/longer, craving, time spent, give up activities, physical/psychological problems, hazardous use, and social problems – with a threshold of two (Table 2). The alcohol-specific consumption measure had 30 candidate optimal solutions. The alcohol-specific mild optimal solution had the lowest rank in 21.2% of iterations with a Cohen's *d* of 1.6 in both samples (Table 2). The alcohol-specific solution also had a set size of 9 with a threshold of two, which included eight overlapping symptoms with the standard solution. The alcohol-specific symptom set excluded craving and included withdrawal.

Moderate Solutions

Moderate solutions were estimated based on the published prevalence of 7.1% (Grant et al., 2015). The standard consumption measure had 10 candidate optimal solutions. Two solutions were selected as optimal due to their comparable performance across the 1000 iterations (Table 2). Standard moderate I and standard moderate II had lowest rank in 35.3% and 34.9% of iterations, respectively, the same Cohen's *d* value of 2.5 in NESARC-III, and comparable Cohen's *d* values in NESARC (2.40 and 2.39, respectively; Table 2). Both solutions had a symptom set size of five and threshold of two, with four overlapping symptoms. Standard moderate I included tolerance, time spent, physical/psychological problems, role interference, and social problems, whereas standard moderate II excluded role interference and included the give up activities criterion.

The alcohol-specific measure had 9 candidate optimal solutions. The same two optimal solutions from the standard consumption measure were also the top optimal solution for the alcohol-specific measure. Specifically, alcohol-specific moderate I (which is the same as standard moderate II) had the lowest rank in 39.4% of iterations,

and alcohol-specific moderate II (i.e., standard moderate I) had the lowest rank in 30.4%. Both solutions had median Cohen's d of 2.21 in NESARC-III and Cohen's d of 2.4 in NESARC (Table 2). Results indicate no difference in moderate optimal solutions when using a standard versus alcohol-specific consumption measure. Therefore, moderate optimal solutions were not compared in subsequent external validation analyses.

Severe Solutions

Severe optimal solutions were calculated using the published 3.3% prevalence (Grant et al., 2015). There were 15 candidate optimal solution for the standard consumption measure. The selected standard severe optimal solution had the lowest rank in 57.9% of iterations, a median Cohen's d of 2.9 in NESARC-III, and Cohen's d of 3.0 in NESARC. The solution included four criteria – tolerance, time spent, physical/psychological problems, and social problems – with a threshold of three. The alcohol-specific consumption measure had 13 candidate optimal solutions. The optimal alcohol-specific severe solution had the lowest rank in 56.5% of the 1000 iterations, a median Cohen's d=2.6 in NESARC-III, and Cohen's d=3.0 in NESARC. This alcohol-specific solution was nested within the standard severe optimal solution and included two criteria, tolerance and time spent, with a threshold of two.

Agreement with Existing AUD Diagnoses

The standard and alcohol-specific optimal solutions were then each compared to DSM-IV alcohol dependence, DSM-5 AUD, ICD-10 alcohol dependence, ICD-11 alcohol dependence, and Wakefield's HD to ascertain validity in NESARC and NESARC-III samples. High agreement between optimal solutions and existing AUD diagnoses would indicate optimal solutions are capturing similar underlying constructs.

Agreement measures were tetrachoric correlation (r^*), weighted kappa (k), and phi (φ) which are presented in Table 3.[6]

Standard and alcohol-specific tetrachoric correlations with established measures were comparable at the mild and severe level (Table 3). This was also the case for kappa and phi coefficients. The level of agreement between solutions and established measures varied by severity grading. Specifically, mild solutions had greatest agreement with DSM-5 AUD and ICD-11 alcohol dependence, middling agreement with DSM-IV and ICD-10, and poorest agreement with Wakefield's HD. Severe solutions tended to have lower agreement with established diagnoses and a different pattern of association. Severe solutions had strongest agreement with Wakefield's HD, DSM-IV, and ICD-10, and much poorer agreement for DSM-5 and ICD-11. Agreement was generally stronger in NESARC-III (i.e., derivation sample) versus NESARC.

Predictive Utility over Existing Approaches

Predictive utility was measured by examining improvement in fit from a model with an optimal solution and existing diagnostic approach predicting an external validator, compared to the existing approach alone. Improvement in fit between the alcohol-specific and standard alcohol solution analyses were then compared. For example, a regression of DSM-IV dependence predicting drug use was estimated. This fit was subtracted from a joint predictor model in which DSM-IV dependence *and* the alcohol-specific solution predicted drug use. This process was completed separately for the standard solution. The solution that yielded the larger fit improvement was considered

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[6] Table 3 displays agreement statistics between optimal solutions and existing diagnostic schemes only. See Supplemental Tables 7-9 in Appendix A for agreement statistics that include agreement among solutions.

to have greater predictive utility. Age, sex, and race/ethnicity were included in all models. Change in fit, as measured by chi-square and R^2, assessed predictive utility. Logistic models used the likelihood-ratio chi-squared test and R^2 of the dependent variable to compared nested models. For models with continuous variables (i.e., recent functioning), the Wald's chi-square and R^2 of the external validators was used to compare models.

Given there is no statistical measure to compare two sets of chi-square difference scores, the critical chi-square for a 1 degree of freedom change (alpha = 0.05) of 3.84 was used as a proxy. If the difference between standard and alcohol-specific solutions' difference scores were greater than 3.84, the solution with the higher chi-square difference score was considered to have greater predictive utility.

Tables 4-9 detail the results from independent and joint predictor models. Specifically, Tables 4-5 include results for age of first drink < 15, drug use, family history, and treatment utilization analyses in NESARC and NEASRC-III samples, respectively. Results for mental health and psychosocial problems analyses are presented Table 6 for NESARC and Table 7 for NESARC-III. Tables 8-9 provide recent functioning analyses in NESARC and NESARC-III, respectively.

Across analyses, there was minimal change in R^2, therefore, the primary measure of predictive utility was based on chi-square differences scores. A solution was considered to have generally greater utility when it yielded better improvement in fit across most existing approaches (i.e., > 50%, or 3+). The sections below describe dominant trends in solution comparisons.

Age of First Drink < 15

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Overall, standard solutions had greater predictive utility compared to alcohol-specific solutions (Tables 4-5). At the mild level, standard solution had greater predictive utility across samples. At the severe level, the alcohol-specific solution demonstrated greater predictive utility in NESARC, though the standard solution was dominant in NESARC-III.

Drug Use

The standard solutions tended to have better predictive utility across samples (Tables 4-5). The exception was at the mild level in NESARC, in which the alcohol-specific solution had greater predictive utility of drug use (Table 4).

Family History

Family history of alcohol, drug, and behavioral problems were examined independently (Tables 4-5). For family history of alcohol problems, standard solutions tended to have greater predictive utility across samples, with more pronounced effects at the severe level. Regarding family history of drug problems, standard and alcohol-specific solutions tended to have comparable improvement in fit. Finally, for behavioral problems, standard solutions generally had greater predictive utility.

Treatment Utilization

Substance use treatment utilization was examined using two independent measures of lifetime alcohol and drug treatment. Alcohol and drug treatment utilization were best predicted by standard solutions overall (Tables 4-5). The only exception was for drug treatment in NESARC at the severe level, such that the alcohol-specific mild solution had greater predictive utility (Table 4).

Mental Health

The standard solutions generally had greater predictive utility over alcohol-specific solutions when predicting past-year mood and anxiety (Tables 6-7). This tended to be more pronounced at the severe level in both samples.

Psychosocial Problems

Past-year financial, employment, interpersonal, and legal problems were used as separate indicators of psychosocial problems. Overall, there were no dominant trends between standard and alcohol-specific solutions for psychosocial problems. For financial problems, the alcohol-specific solutions had greater predictive utility in NESARC across severity (Table 6). In NESARC-III, there was minimal improved fit for standard and alcohol-specific solutions when predicting financial problems (Table 7). Employment problems were best predicted by standard solutions at the mild level across samples (Tables 6-7). At the severe level, standard and alcohol-specific solutions performed comparably with no dominant trends across samples. For interpersonal problems, there were no dominant patterns across samples or severity levels. In NESARC, at the mild level, the alcohol-specific solution had greater predictive utility, and standard and alcohol-specific solutions performed comparably at the severe level (Table 6). In NESARC-III, standard and alcohol-specific solutions performed comparably at the mild level, and the standard solution yielded better predictive utility at the severe level (Table 7). Finally, for legal problems, the alcohol-specific *mild* solution had greater predictive utility in NESARC (Table 6), whereas standard and alcohol-specific solutions were comparable at the mild level in NESARC-III (Table 7). At the severe level, the standard solutions had greater predictive utility across samples (Tables 6-7).

Recent Functioning

Past four-week impairment from social, mental health, and physical functioning were also examined (Tables 8-9). For social functioning, there was a severity effect, such that across samples, the alcohol-specific *mild* solution tended to have better predictive utility, whereas the standard *severe* solution had better predictive utility. Mental health tended to be best predicted by standard solutions across samples, with more pronounced performance at the severe level. For physical functioning, the alcohol-specific solutions tended to yield greater predictive utility across samples, with greater performance at the mild level. Of note, there were several negative chi-square values between mild optimal solutions and established diagnostic approaches for social functioning and mental health validators.

Chapter 4: Discussion

The current study aimed to find unique indicators of AUD less contaminated by an externalizing process. To do this, we used a recently developed cluster analytic approach called combinatorial optimization (Loeffelman et al., 2020; Steinley et al., 2016; Stevens et al., 2019), which was designed to identify alternative diagnostic schemes using indicators of a disorder. We developed alternative AUD diagnostic schemes, or optimal solutions, using two separate measures of alcohol consumption: a heavy alcohol consumption composite and an alcohol-specific consumption composite that partialed out variance associated with other externalizing psychopathology (e.g., Krueger, 1999a; Krueger, 1999b; Krueger et al., 1996). Optimal solutions were derived based on published mild, moderate, and severe AUD prevalence.[7] Separate optimal solutions were derived using the standard consumption and alcohol-specific consumption measures for each base rate, resulting in six separate combinatorial optimizations. It was anticipated alcohol-specific solutions would include AUD criteria previously associated with a strong externalizing component (e.g., social problems) and exclude those less tied to co-occurring externalizing traits (e.g., tolerance). We explored standard and alcohol-specific diagnostic schemes' relationships with established AUD diagnoses (e.g., DSM-5 AUD) and correlates (e.g., age of first drink < 15) to understand the degree to which alcohol-specific indicators were elucidated.

Optimal Solutions

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[7] Additional analyses were conducted using base rates that were reduced by half to account for theoretically lower base rate of AUD that accounts for co-occurring externalizing psychopathology. The results from these analyses can be found in Supplemental Tables 6-15 in Appendix A.

Results yielded distinct standard and alcohol-specific solutions across mild and severe severity only. Moderate solutions were the same regardless of the consumption measure, which precluded exploration of differences between standard and alcohol-specific solutions. At the mild prevalence, two distinct optimal solutions were derived for the standard and alcohol-specific measures. Both solutions had similar prevalence rates and degrees of separation (i.e., Cohen's *d*) across samples. The two solutions had a symptom set size of 9 and threshold of two. Considerable symptom overlap across solutions (i.e., 8 of 9 symptoms) suggest limited alcohol-specific versus standard distinction between symptom-sets at the mild level. The primary distinction was the standard solution's inclusion of the craving criterion and alcohol-specific solution's inclusion of withdrawal.

Both craving and withdrawal are based on physiological changes from substance use; however, craving has unique associations with externalizing characteristics that could explain the differences between the standard and alcohol-specific solutions. Craving can be conceptualized as an indicator of prolonged substance use, such that chronic use is theorized to significantly alter reward networks in the brain, leading to increase salience to substance cues and craving (e.g., Robinson & Berridge, 1993). Additionally, research has noted strong positive associations between impulsivity facets and craving (e.g., Franken, 2002; Zilberman, Tavares, & el-Guebaly, 2003; Joos et al., 2012), suggesting that craving is also strongly linked to impulsivity. Indeed, joint associations of craving with physiological dependence and impulsivity, as measured by alcohol consumption and externalizing psychopathology, respectively, have also been noted in the literature (McDowell, Verges, & Sher, 2019). Given that the standard mild

solution includes more variance associated with externalizing characteristics, like impulsivity, it is not surprising that this was a unique indicator for the standard solution. Similarly, withdrawal is conceptualized to be an inherent consequence of prolonged alcohol use, or physiological dependence (e.g., DSM-5, APA, 2013); therefore, its inclusion in the alcohol-specific solution supports the notion that it may be a specific indicator of AUD.

Standard and alcohol-specific solutions at the severe level also had similar prevalence and group separation on consumption measures. The standard severe solution had a set size of four with a threshold of three, while the alcohol-specific severe solution had a set size of two and threshold of two. As with mild solutions, there was considerable overlap between solutions, such that the alcohol-specific solution was nested within the standard solution. The standard solution had two additional criteria, continued use despite physical/psychological problems and social problems, which distinguished it from the alcohol-specific solution.

The physical/psychological and social problems criteria have been shown to have stronger associations with externalizing psychopathology relative to other AUD criteria (Kendler et al., 2012; McDowell, Verges, & Sher, 2019). Item response theory investigations of AUD severity support the notion that physical/psychological problems, social problems, as well as time spent criteria tend to be in the middle-to-high end of the severity continuum (Beseler, Taylor, & Leeman, 2010; Dawson, Saha, & Grant, 2010; Saha, Stinson, & Grant, 2007). These results suggest physical/psychological problems and social problems criteria may have a stronger externalizing component relative to other criteria and serve as important indicators of severe AUD.

Agreement with Existing Approaches

The standard and alcohol-specific solutions tended to have similar agreement with existing diagnostic schemes (i.e., DSM, ICD, and Wakefield's HD), providing evidence of construct validity. Agreement patterns between optimal solutions and established diagnoses were consistent across tetrachoric correlations, kappa estimates, and phi coefficients. Mild solutions had greatest agreement with DSM-5 AUD (mild or greater) and ICD-11 alcohol dependence, moderate agreement with ICD-10 and DSM-IV alcohol dependence, and poorest agreement with Wakefield's HD. The reverse was true for severe solutions, which exhibited fair agreement with Wakefield's HD, DSM-IV, and ICD-10, and much poorer agreement with DSM-5 and ICD-11. These associations are likely direct functions of prevalence rates. DSM-5 AUD and ICD-11 dependence have the highest prevalence rates, followed by ICD-10, DSM-IV, and Wakefield's HD. The prevalence rates for mild and severe solutions were in direct relation to the prevalence rates of established measures. This suggests agreement was based more on severity, or base rate, rather than differences between standard and alcohol-specific diagnostic schemes.

Predictive Utility over Existing Approaches

The predictive utility of optimal solutions over existing diagnostic approaches when predicting known correlates of AUD was examined to determine whether standard and alcohol-specific were differentially related to these external validators.

Validators More Associated with Standard Solutions

Age of first drink < 15, drug use, family history of alcohol and behavioral problems, treatment utilization, and mental health problems tended to be best predicted

by the standard consumption solutions, which is consistent with historical AUD subtypes. Earlier drinking onset, co-occurring psychopathology, poor finances, employment, and legal problems characterize many externalizing alcohol subtypes (Babor et al., 1992; Cloninger 1987; Knight, 1937; Morey & Skinner, 1986; Zucker, 1987; Supplemental Table 2). The age of first drink association is particularly robust, given early drinking initiation has consistently been associated with externalizing traits (e.g., King, Iacono, & McGue, 2004; McGue et al., 2001; Zernicke, Cantrell, Fin, & Lucas, 2010). Additionally, externalizing AUD subtypes are posited to have poorer prognosis, which may explain the greater association with treatment utilization. Although family history of psychopathology is not consistently characterized across externalizing subtypes, it is noted in Antisocial Alcoholism and Type B subtypes (Babor et al., 1992; Zucker, 1987). Our results indicate characteristics, like drug use, positive psychiatric family history, treatment, and co-occurring mental health problems, are best predicted by a diagnostic algorithm that includes variance associated with co-occurring externalizing traits. This suggests the relationship between these correlates and AUD is partially driven by an underlying externalizing process.

Validators Associated with Alcohol-specific Solutions

Physical functioning was the only external validator best predicted by alcohol-specific solutions. This effect was more robust in NESARC-III, with more mixed associations in NESARC. The strong association between poor physical functioning may be driven by the distinct diagnostic schemes of alcohol-specific solutions. Specifically, the alcohol-specific mild solution includes the withdrawal criterion, which subsumes alcohol withdrawal syndrome. Alcohol withdrawal syndrome includes physical

symptoms that range from mild (e.g., nausea, vomiting, sweating) to severe (e.g., seizures, hand tremors; APA, 2013). The alcohol-specific severe solution required positive endorsement of tolerance and time spent. Tolerance was included as an indicator in all solutions, which may indicate an effect of the time spent criterion, or its endorsement in conjunction with tolerance. Time spent has commonly been found to be a more severe indicator of AUD relative to other criteria (Beseler, Taylor, & Leeman, 2010; Dawson, Saha, & Grant, 2010; Saha, Stinson, & Grant, 2007). Given that time spent is a required criterion in the alcohol-specific severe solution, and optional in the standard severe solution, time spent likely contributed to the increased association with physical functioning. Although there is no clear direct link between time spent and physical functioning, time spent may identify individuals with more severe AUD who are more likely to have co-occurring physical problems. Severe alcoholism is related to a myriad of problems, like cardiovascular, gastrointestinal, liver, and respiratory complications (e.g., Keaney et al., 2011; Whiteford et al., 2013). Therefore, the severity of the alcohol-specific severe solution may be tapping into physical complications related to more severe alcoholism. Additionally, time spent preoccupied by alcohol use may limit time spent for physical activity, further contributing to poor physical health. Indeed, studies have noted less severe AUD is associated with physical activity, while more severe AUD is sometimes related to reduced physical activity (e.g., Lisha et al., 2013; Vancampfort et al., 2015). Thus, time spent may be an indicator of poor physical activity as well.

Validators with Mixed Standard and Alcohol-specific Associations

Less clear distinctions were present between standard and alcohol-specific solutions' performance when predicting family history of drug problems, psychosocial problems, and social functioning.

Family history of drug problems and interpersonal problems had comparable improved fit between standard and alcohol-specific solutions in both samples, which suggests there is no clear distinction in associations. For remaining psychosocial problems, more complex associations were present. Specifically, financial problems were best predicted by the alcohol-specific solution in NESARC, and both standard and alcohol-specific solutions had minimal improved fit in NESARC-III. This is unanticipated given that financial problems are often associated with externalizing alcoholism subtypes (e.g., Babor 1992; Cloninger, 1987). However, this association may be due to financial problems operationalization, which only uses past-year assessment. Individuals diagnosed only under the standard solutions may be more likely to have ongoing financial problems that would not be captured in the past year. The lack of any significant improvement in fit in NESARC-III is likely the result of the financial problem item's limited scope, namely, it only assessed for bankruptcy. Given the low base rate of bankruptcy in the sample, associations with all solutions were not elucidated.

For employment problems, the standard mild solutions had greater predictive utility, though solutions were more comparable at the severe level. Notably, the standard severe solution in NESARC-III had greater predictive utility for two of five established diagnoses, and neither solution yielded predictive utility for two diagnoses. Although the NESARC sample had comparable predictive utility among solutions at the severe level, when differences between solutions were significant, the standard solutions typically had

stronger associations. This suggests employment problems may be best predicted by the standard solutions. Specifically, the externalizing component within standard solutions may contribute to difficulties at work beyond that of alcohol-related problems.

Regarding legal problems, solutions generally performed comparably at the mild level while the standard severe solutions had greater associations at the severe grading. Legal problems related to alcohol use been associated with greater AUD severity (e.g., Kahler, Hoeppner, & Jackson, 2009; Proudfoot, Baillie, & Teesson, 2006). Although the legal problems item is not related to substance use, it may be more prevalent among individuals with severe AUD. Additionally, legal problems is a hallmark characteristic of externalizing AUD subtypes, and inherent in CD and AAB. Therefore, legal problems related to an underlying externalizing process may be more prominent at a severe level.

There were also mixed associations for recent social functioning. The standard solution had better predictive utility at the severe level. Social impairment from alcohol use is a relatively more severe indicator of problematic use (e.g., Saha et al., 2006) that was only included in the standard severe solution. Therefore, the stronger relationship with the standard solution would be expected.

Implications

Alcohol-specific solutions tended to have similar agreement as standard solutions with established AUD diagnostic approaches and lower predictive utility when predicting most AUD correlates. The standard solutions had greater predictive utility at all severity levels for most AUD correlates. This suggests that much of the relationship between AUD and its common correlates is better captured when an externalizing component is present. Conceptually, this makes sense given that the standard solutions were more

related to co-occurring psychopathology (i.e., externalizing disorders), indicating greater severity and likely poorer prognosis among those diagnosed. Individuals with co-occurring externalizing traits may have more adverse alcohol-related consequences and specific treatments needs that would benefit from an augmented treatment approach.

Currently, cognitive behavioral therapy (CBT), motivational interviewing/motivational enhancement therapy (MET), relapse prevention, 12-step models, contingency management, medication-assisted treatment, and moderation/harm-reduction based therapies are considered some of the "gold standards" for alcohol and/or drug treatment (e.g., Dutra et al., 2008; Glasner-Edwards & Rawson, 2010; Jhanjee, 2014). Interventions like CBT and MET often include biofeedback and/or psychoeducation about substance use patterns. These interventions could be augmented by including a greater focus on impulsivity, such as its role in substance use and dysfunction more generally, as well as specific skills to manage impulsive behaviors. Indeed, some work has demonstrated utility in targeting impulsivity during CBT for individuals at risk for substance use disorders (Conrod, 2016). Additionally, mindfulness and mindfulness-based approaches, like Acceptance and Commitment Therapy (ACT), could foster greater awareness of impulsive traits and mitigate substance use and other psychosocial problems. Indeed, early evidence suggests mindfulness (Chiesa & Serretti, 2014) and ACT (Lee et al., 2015; Luoma et al., 2012) enhance treatment retention, reduce stigma/shame, and decrease substance use. More research is needed to determine how substance use treatment may best address externalizing characteristics, like impulsivity.

Our findings also provide support for AUD's inclusion with other externalizing disorders/traits in classification models. The robust relationships among AUD correlates

and standard versus alcohol-specific solutions highlight the substantial contribution of an externalizing process on alcohol-related dysfunction. However, recent classification studies, like HiTOP (Kotov et al., 2017) and the p-factor model (Caspi et al., 2014), could still benefit from examining both common and unique factors of AUD, and other disorders generally, given that there appear to be some distinct alcohol-specific relationships. Although the present study did not find many alcohol-specific relationships, or indicators, this does not mean unique indicators do not exist in nature.

Finally, inclusion of either standard or alcohol-specific solutions with established approaches improved model prediction of external correlates for most models. This provides additional support for the use of combinatorial optimization in diagnostic refinement. Combinatorial optimization has previously been shown to identify subsets of substance use disorder symptoms that equally (or better) predict relevant correlates compared to existing diagnostic approaches (Boness et al., 2019; Loeffelman et al., 2020; Stevens et al., 2019). Our findings support the notion that combinatorial optimization is a promising tool for empirically driven classification that identifies symptoms most related to important indices of a disorder.

Limitations and Future Directions

The present study aimed to better understand alcohol-specific indicators of AUD by identifying alternative AUD diagnostic schemes less associated with externalizing characteristics. Our findings indicate most common AUD correlates are more associated with AUD diagnostic schemes which include variance related to externalizing characteristics. Strengths of the study include use of two large nationally representative

samples, a novel cluster analytic and machine learning approach, and robust exploration of several influential AUD correlates and diagnostic schemes.

Additionally, there were several noteworthy limitations. Although NESARC and NESARC-III are rich data sets with large samples, some of the constructs measured had low base rates. More specifically, several external validators had base rates less of than 7%: legal problems, alcohol treatment, drug treatment, financial problems (in NESARC-III only), and family history of drug problems (in NESARC only; Supplemental Table 5). Future research using a clinical sample with higher prevalence of these correlates could mitigate some of the methodological challenges in the current study. There was also a high degree of overlap between optimal solutions and existing AUD diagnostic measures. This may have introduced multicollinear into external validation models and limited the stability of estimates. Further, optimal solutions provided minimal added variance (as measured by R^2) over existing approaches, likely due to the high degree of overlap. Alternative analytic approaches that do not involve highly correlated predictors could be used in future studies.

Moreover, our measure of externalizing traits was limited to AAB and CD symptoms primarily, with the addition of three impulsivity items. The externalizing spectrum is multifaceted and incorporates psychopathology and personality traits (e.g., Krueger et al., 2007). NESARC/NESARC-III samples do not have personality measures which greatly limited our assessment of externalizing. Future research should include psychometrically sound measures of impulsivity that is multifaceted, like the UPPS-P (Lyman et al., 2006). This is important given that impulsivity is a critical component of the externalizing construct (e.g., Cloninger et al., 1988; Krueger, 1999b; Krueger et al.,

2007). Additionally, AAB and CD have low base rates which further limited our ability to account for the variance associated with an underlying externalizing process. This was reflected in the minimal differences between the standard (M_{NEASRC}=0.044, SE_{NESARC}=0.004; $M_{NEASRC\text{-}III}$=-0.029, $SE_{NESARC\text{-}III}$=0.011) and alcohols-specific M_{NESARC}=0.043, SE_{NESARC}=0.005; $M_{NESARC\text{-}III}$= -0.022, $SE_{NESARC\text{-}III}$=0.011) consumption measures. A more comprehensive externalizing measures would likely capture greater variance in consumption and possibly elucidate more distinct differences.

Further, our study focused exclusively on AUD's association with externalizing traits given the strong evidence of a shared underlying construct. However, AUD and substance use disorders, more broadly, are also known to have associations with internalizing disorders, like depression and anxiety (Hussong et al., 2012). Although internalizing associations do not appear to be as robust as externalizing associations (e.g., Anker et al., 2017; Farmer et al., 2016), disentangling both internalizing and externalizing associations could provide greater insight into alcohol-specific aspects of AUD.

Finally, it is unclear whether AUD is truly distinct from an underlying externalizing mechanism. In other words, AUD without co-occurring externalizing traits may not exist within nature. We attempted to distinguish between the two concepts by partialing out variance related to externalizing psychopathology from an alcohol consumption measure and comparing it to a standard consumption measure. Nevertheless, it can be argued that the remaining variance may not be conceptually meaningful. Further, the standard optimal solutions are generally more likely to be related to other corelates due to its greater variation. Given that AUD subtyping via externalizing

traits has long been discussed in the AUD literature, the answer likely requires future

research to better understand the mechanisms underlying AUD.

In sum, the present study found AUD correlates were best predicted by AUD

diagnostic schemes that included variance associated with externalizing

psychopathology. We attempted to identify alcohol-specific indicators of AUD and found

some evidence that was limited to one correlate (i.e., physical functioning) with some

variations based on severity grading (e.g., social function) or sample (e.g., financial

problems). Identifying unique aspects of AUD has important implications for

classification and treatment approaches. Future research is needed better understand

unique aspects of AUD and could benefit from the use of clinical samples and alternative

analytic approaches.

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Table 1

Demographic Characteristics

Variable		NESARC (*N*=22,103)			NESARC-III (*N*=24,354)		
		Frequency	%	*SE*	Frequency	%	*SE*
Sex	Male	10301	51.99	0.19	11292	50.61	0.39
	Female	11722	48.01	0.19	13062	49.39	0.39
Race	White (non-Hispanic)	13946	74.97	0.23	13595	68.97	0.73
	Black (non-Hispanic)	3406	9.16	0.17	4831	10.54	0.58
	Native American/Alaskan Native (non-Hispanic)	350	3.23	0.05	341	1.57	0.13
	Asian American/Pacific Islander (non-Hispanic)	495	10.66	0.10	1040	4.95	0.41
	Hispanic	3826	1.98	0.09	4547	13.98	0.62
Age		Mean	*SE*		Mean	*SE*	
		45.28	0.07		45.60	0.21	

Note. NESARC = National Epidemiologic Survey on Alcohol and Related Conditions Wave 2; NESARC-III = National Epidemiologic Survey on Alcohol and Related Conditions-III. Frequency = count of unweighted responses; % = weighted percentages that account for complex sampling design of data sets; SE = Standard error; Mean = weighted mean that accounts for complex sampling design.

Table 2
Optimal Solutions and Established Diagnostic Measures

	DSM-5 AUD Criteria													NESARC (N=22,103)				NESARC-III (N=24,354)				
	TL	WD	CD	LL	CR	TS	GU	PP	RI	HU	SP	Thresh.	Set Size	n	%	SE	Cohen's d	n	%	SE	Opt. %	Med. Cohen's d
Standard Mild	X		X	X	X	X	X	X		X	X	2	9	3165	14.8	0.15	1.6	4273	16.4	0.37	24.2	1.9
Alcohol-specific Mild	X	X	X	X		X	X	X		X	X	2	9	3374	15.7	0.16	1.6	4295	16.4	0.38	21.2	1.6
Standard Moderate I	X					X		X	X		X	2	5	900	4.2	0.08	2.4	1734	6.4	0.22	35.3	2.6
Standard Moderate II	X					X	X	X			X	2	5	891	4.2	0.08	2.4	1728	6.3	0.22	34.9	2.6
Alcohol-specific Moderate I	X					X	X	X			X	2	5	891	4.2	0.08	2.4	1728	6.3	0.22	39.4	2.2
Alcohol-specific Moderate II	X					X		X	X		X	2	5	900	4.2	0.08	2.4	1734	6.4	0.22	30.4	2.2
Standard Severe	X					X		X			X	3	4	384	1.8	0.05	3.0	811	2.9	0.14	57.9	2.9
Alcohol-specific Severe	X					X						2	2	1175	5.4	0.10	3.0	870	3.1	0.13	56.5	2.6
DSM-IV	X	X	X	X		X	X	X				3	7	1415	6.6	0.10	--	2293	8.5	0.26	--	--
DSM-5	X	X	X	X	X	X	X	X	X	X	X	2	11	3483	16.2	0.16	--	4647	17.9	0.40	--	--
ICD-10	X	X		X		X		X				3	6	1242	5.7	0.10	--	2384	9.0	0.27	--	--
ICD-11		X		X			X					2	3	2434	11.2	0.15	--	3516	13.3	0.35	--	--
Wakefield's HD		D	D		D		H	H	H		H	1H + 1D	7	658	3.1	0.07	--	1242	4.4	0.17	--	--

Note. DSM-5 AUD = *Diagnostic and statistical manual, 5th edition*, alcohol use disorder; NESARC = National Epidemiologic Survey on Alcohol and Related Conditions Wave 2; NESARC-III = National Epidemiologic Survey on Alcohol and Related Conditions-III.

TL = tolerance; WD = withdrawal; CD = quit/cut down; LL = larger/longer; CR = craving; TS = time spent; GU = give up activities; PP = continued use despite physical/psychological problems; RI = role interference; HU = hazardous use; SP = social problems; Set size = number of symptoms in a given diagnostic scheme; Thresh. = threshold, or number of symptoms needed for positive diagnosis; % = weighted percentage that accounts for complex survey design; SE = standard error; Opt. % = percentage of times solution was selected as optimal (i.e., highest Cohen's d value/lowest rank across solutions) across 1000 iterations of combinatorial optimization procedure; Med. Cohen's d = median Cohen's d value across 1000 iterations of combinatorial optimization procedure.

X = criterion included in diagnostic scheme; H = Wakefield harm criterion; D = Wakefield dysfunction criterion.

DSM-IV = *Diagnostic and statistical manual, 4th edition*, alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition*, alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction.

Table 3
Agreement Statistics of Optimal Solutions with Established Diagnostic Measures

	DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	N	**NIII**	**N**	**NIII**	**N**	**NIII**	**N**	**NIII**	**N**	**NIII**
Tetrachoric correlations										
Standard Mild	0.64	0.69	0.95	0.95	0.59	0.71	0.76	0.80	0.41	0.48
Alcohol-specific Mild	0.62	0.69	0.98	0.95	0.57	0.71	0.81	0.85	0.41	0.48
Standard Severe	0.51	0.55	0.31	0.38	0.55	0.54	0.38	0.44	0.59	0.46
Alcohol-specific Severe	0.48	0.58	0.30	0.37	0.52	0.56	0.37	0.45	0.44	0.63
Weighted kappa estimates										
Standard Mild	0.58	0.64	0.95	0.95	0.52	0.67	0.75	0.80	0.30	0.37
Alcohol-specific Mild	0.55	0.65	0.98	0.95	0.49	0.67	0.80	0.84	0.29	0.38
Standard Severe	0.41	0.50	0.17	0.25	0.46	0.48	0.25	0.34	0.56	0.62
Alcohol-specific Severe	0.38	0.47	0.16	0.24	0.43	0.45	0.24	0.32	0.42	0.45
Phi coefficients										
Standard Mild	0.64	0.69	0.95	0.95	0.59	0.71	0.76	0.80	0.41	0.48
Alcohol-specific Mild	0.62	0.69	0.98	0.95	0.57	0.71	0.81	0.85	0.41	0.48
Standard Severe	0.51	0.58	0.31	0.38	0.55	0.56	0.38	0.45	0.58	0.63
Alcohol-specific Severe	0.48	0.55	0.30	0.37	0.52	0.54	0.37	0.44	0.44	0.46

Note. DSM-IV = *Diagnostic and statistical manual, 4th edition,* alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition,* alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction.
N = National Epidemiologic Survey on Alcohol and Related Conditions Wave 2; NIII = National Epidemiologic Survey on Alcohol and Related Conditions-III.
All estimates were statistically significant ($p<0.05$).

Table 4

Age of First Drink < 15, Drug Use, Family History, and Treatment Utilization Regression Models in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Age of First Drink < 15 (n=1488)														
Standard Mild	1.81	1.55-2.11	256.34	0.01	12.64	0.00	3.92	0.00	17.83	0.00	11.34	0.00	25.59	0.00
Alcohol-specific Mild	1.74	1.49-2.03	248.07	0.01	9.63	0.00	0.30	0.00	14.17	0.00	4.57	0.00	20.56	0.00
Standard Severe	3.37	2.44-4.66	255.45	0.01	19.15	0.00	39.38	0.00	18.81	0.00	32.39	0.00	12.39	0.00
Alcohol-specific Severe	3.74	2.72-5.14	265.50	0.01	27.18	0.00	48.13	0.00	26.85	0.00	40.63	0.00	28.00	0.00
DSM-IV	2.26	1.84-2.77	267.98	0.01	--	--	--	--	--	--	--	--	--	--
DSM-5	1.76	1.51-2.05	253.17	0.01	--	--	--	--	--	--	--	--	--	--
ICD-10	2.28	1.83-2.84	260.83	0.01	--	--	--	--	--	--	--	--	--	--
ICD-11	1.89	1.58-2.26	254.75	0.01	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	3.04	2.35-3.93	275.12	0.01	--	--	--	--	--	--	--	--	--	--
Drug Use (n=7104)														
Standard Mild	2.61	2.35-2.90	2173.81	0.09	190.87	0.01	0.16	0.00	214.47	0.01	127.04	0.01	331.57	0.01
Alcohol-specific Mild	2.64	2.38-2.94	2214.50	0.10	230.22	0.01	0.04	0.00	253.95	0.01	143.45	0.01	366.97	0.02
Standard Severe	4.39	3.34-5.76	1801.73	0.08	15.31	0.00	43.51	0.00	10.60	0.00	37.20	0.00	20.87	0.00
Alcohol-specific Severe	3.69	2.74-4.97	1751.80	0.08	5.27	0.00	23.51	0.00	2.64	0.00	18.42	0.00	22.33	0.00
DSM-IV	3.26	2.85-3.72	2038.40	0.09	--	--	--	--	--	--	--	--	--	--
DSM-5	2.66	2.40-2.95	2237.04	0.10	--	--	--	--	--	--	--	--	--	--
ICD-10	3.47	3.02-3.99	2024.73	0.09	--	--	--	--	--	--	--	--	--	--
ICD-11	2.66	2.37-2.98	2081.53	0.09	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	4.21	3.45-5.13	1914.81	0.08	--	--	--	--	--	--	--	--	--	--
Family History of Alcohol Problems (n=5216)														
Standard Mild	1.65	1.47-1.86	349.60	0.02	35.06	0.00	3.56	0.00	43.13	0.00	24.63	0.00	52.39	0.00

Table 4

Age of First Drink < 15, Drug Use, Family History, and Treatment Utilization Regression Models in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
	Estimates		Fit		DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
					Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Alcohol-specific Mild	1.59	1.42-1.79	338.01	0.02	29.38	0.00	2.35	0.00	36.80	0.00	13.34	0.00	44.61	0.00
Standard Severe	2.70	2.09-3.49	309.81	0.01	20.72	0.00	37.32	0.00	19.88	0.00	31.91	0.00	11.37	0.00
Alcohol-specific Severe	2.26	1.71-2.99	276.65	0.01	6.55	0.00	17.26	0.00	5.76	0.00	13.28	0.00	6.31	0.00
DSM-IV	1.88	1.62-2.19	332.94	0.02	--	--	--	--	--	--	--	--	--	--
DSM-5	1.62	1.44-1.82	349.88	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	1.91	1.63-2.24	324.44	0.01	--	--	--	--	--	--	--	--	--	--
ICD-11	1.68	1.48-1.90	334.97	0.02	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.52	2.05-3.10	346.16	0.02	--	--	--	--	--	--	--	--	--	--
Family History of Drug Problems (n=1188)														
Standard Mild	1.56	1.31-1.87	308.24	0.01	21.62	0.00	0.08	0.00	15.65	0.00	12.83	0.00	14.01	0.00
Alcohol-specific Mild	1.56	1.30-1.87	309.42	0.01	22.78	0.00	0.07	0.00	17.04	0.00	13.98	0.00	15.04	0.00
Standard Severe	2.42	1.69-3.48	303.02	0.01	16.90	0.00	13.13	0.00	11.69	0.00	14.79	0.00	5.36	0.00
Alcohol-specific Severe	2.37	1.63-3.47	300.38	0.01	14.76	0.00	11.58	0.00	10.08	0.00	12.96	0.00	7.40	0.00
DSM-IV	1.44	1.12-1.85	286.64	0.01	--	--	--	--	--	--	--	--	--	--
DSM-5	1.57	1.32-1.87	311.54	0.01	--	--	--	--	--	--	--	--	--	--
ICD-10	1.62	1.24-2.10	294.25	0.01	--	--	--	--	--	--	--	--	--	--
ICD-11	1.47	1.18-1.83	295.51	0.01	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.20	1.66-2.90	308.10	0.01	--	--	--	--	--	--	--	--	--	--
Family History of Behavior Problems (n=1707)														
Standard Mild	1.67	1.40-2.00	270.37	0.01	38.84	0.00	3.51	0.00	32.45	0.00	23.26	0.00	33.82	0.00
Alcohol-specific Mild	1.57	1.32-1.87	257.56	0.01	26.33	0.00	5.23	0.00	21.79	0.00	11.11	0.00	23.64	0.00
Standard Severe	2.05	1.40-3.01	232.61	0.01	7.41	0.00	6.52	0.00	4.42	0.00	6.77	0.00	2.11	0.00

Table 4

Age of First Drink < 15, Drug Use, Family History, and Treatment Utilization Regression Models in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Alcohol-specific Severe	1.78	1.16-2.72	222.84	0.01	2.24	0.00	2.08	0.00	0.80	0.00	2.08	0.00	0.95	0.00
DSM-IV	1.52	1.24-1.87	231.60	0.01	--	--	--	--	--	--	--	--	--	--
DSM-5	1.63	1.37-1.93	267.35	0.01	--	--	--	--	--	--	--	--	--	--
ICD-10	1.66	1.33-2.08	239.06	0.01	--	--	--	--	--	--	--	--	--	--
ICD-11	1.56	1.30-1.87	247.23	0.01	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.05	1.52-2.76	245.64	0.01	--	--	--	--	--	--	--	--	--	--
Alcohol Treatment (n=1201)														
Standard Mild	5.54	4.71-6.52	966.35	0.05	120.91	0.01	24.16	0.00	143.92	0.01	90.32	0.00	233.76	0.01
Alcohol-specific Mild	5.26	4.45-6.23	935.14	0.04	112.17	0.01	1.09	0.00	134.20	0.01	53.36	0.00	213.17	0.01
Standard Severe	14.43	11.10-18.76	805.16	0.04	89.63	0.00	210.65	0.01	75.22	0.00	161.36	0.01	62.66	0.00
Alcohol-specific Severe	9.09	6.76-12.21	599.31	0.03	22.03	0.00	93.97	0.00	14.71	0.00	61.03	0.00	29.00	0.00
DSM-IV	7.94	6.68-9.45	1007.81	0.05	--	--	--	--	--	--	--	--	--	--
DSM-5	5.34	4.52-6.30	951.49	0.05	--	--	--	--	--	--	--	--	--	--
ICD-10	8.53	7.10-10.24	1003.03	0.05	--	--	--	--	--	--	--	--	--	--
ICD-11	5.99	5.10-7.02	960.37	0.05	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	13.07	10.36-16.49	1003.80	0.05	--	--	--	--	--	--	--	--	--	--
Drug Treatment (n=547)														
Standard Mild	3.18	2.46-4.12	403.74	0.02	14.61	0.00	2.55	0.00	13.23	0.00	13.56	0.00	31.61	0.00
Alcohol-specific Mild	3.25	2.50-4.21	412.79	0.02	21.81	0.00	7.13	0.00	20.10	0.00	14.94	0.00	38.33	0.00
Standard Severe	7.31	4.95-10.80	394.77	0.02	23.29	0.00	58.93	0.00	16.51	0.00	46.39	0.00	10.69	0.00
Alcohol-specific Severe	5.63	3.63-8.72	349.41	0.02	7.97	0.00	31.13	0.00	4.21	0.00	21.73	0.00	7.21	0.00
DSM-IV	4.73	3.54-6.31	442.31	0.03	--	--	--	--	--	--	--	--	--	--

Table 4

Age of First Drink < 15, Drug Use, Family History, and Treatment Utilization Regression Models in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
DSM-5	3.15	2.43-4.08	406.31	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	5.33	3.98-7.13	461.08	0.03	--	--	--	--	--	--	--	--	--	--
ICD-11	3.53	2.68-4.63	412.59	0.02	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	7.80	5.55-10.97	472.37	0.03	--	--	--	--	--	--	--	--	--	--

Note. DSM-IV = *Diagnostic and statistical manual, 4th edition,* alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition,* alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction.

Fit change = change in fit from single predictor model to joint predictor model.

OR = odds ratio estimate; 95% CI = 95% confidence interval for odds ratio estimate; Chi-sq. = log-likelihood ratio chi-square; Chi-sq. values > 3.84 chi-square critical value (*df*=1; alpha=0.05) were considered significant.

-- = not applicable; Cells highlighted orange = Standard Mild/Severe change in chi-square in joint predictor models greater than respective Alcohol-specific Mild/Severe change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05); Cells highlighted blue = Alcohol-specific Mild/Severe change in chi-square in joint predictor models greater than respective Standard Mild/Severe change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05).

Table 5

Age of First Drink < 15, Drug Use, Family History, and Treatment Utilization Regression Models in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Age of First Drink < 15 (n=2339)														
Standard Mild	2.19	1.92-2.50	455.90	0.02	68.19	0.00	13.97	0.00	57.26	0.00	44.95	0.00	95.91	0.00
Alcohol-specific Mild	2.01	1.76-2.30	407.79	0.02	33.56	0.00	1.39	0.00	25.06	0.00	9.80	0.00	59.41	0.00
Standard Severe	3.15	2.54-3.91	383.03	0.02	29.92	0.00	49.40	0.00	27.95	0.00	42.05	0.00	24.79	0.00
Alcohol-specific Severe	2.88	2.31-3.58	351.03	0.01	16.68	0.00	32.82	0.00	15.51	0.00	26.40	0.00	25.97	0.00
DSM-IV	2.32	2.00-2.68	401.99	0.02	--	--	--	--	--	--	--	--	--	--
DSM-5	2.11	1.85-2.40	442.48	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	2.35	2.04-2.72	416.06	0.02	--	--	--	--	--	--	--	--	--	--
ICD-11	2.15	1.89-2.44	418.67	0.02	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.86	2.41-3.39	399.77	0.02	--	--	--	--	--	--	--	--	--	--
Drug Use (n=10208)														
Standard Mild	2.82	2.57-3.09	2261.50	0.09	269.19	0.01	2.00	0.00	230.22	0.01	148.30	0.01	441.99	0.02
Alcohol-specific Mild	2.70	2.46-2.97	2199.01	0.09	220.21	0.01	3.67	0.00	183.90	0.01	87.97	0.00	387.25	0.01
Standard Severe	4.35	3.49-5.42	1792.47	0.07	28.75	0.00	58.94	0.00	24.91	0.00	49.17	0.00	47.72	0.00
Alcohol-specific Severe	3.61	2.94-4.43	1713.62	0.07	9.14	0.00	29.35	0.00	7.23	0.00	21.87	0.00	51.97	0.00
DSM-IV	3.21	2.83-3.63	2032.48	0.08	--	--	--	--	--	--	--	--	--	--
DSM-5	2.84	2.59-3.11	2322.39	0.09	--	--	--	--	--	--	--	--	--	--
ICD-10	3.30	2.92-3.72	2083.50	0.08	--	--	--	--	--	--	--	--	--	--
ICD-11	2.87	2.58-3.18	2153.67	0.08	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	3.91	3.31-4.62	1881.43	0.07	--	--	--	--	--	--	--	--	--	--
Family History of Alcohol Problems (n=7605)														
Standard Mild	1.84	1.67-2.02	682.79	0.03	32.92	0.00	0.88	0.00	26.40	0.00	18.59	0.00	82.18	0.00
Alcohol-specific Mild	1.87	1.69-2.06	695.31	0.03	38.89	0.00	5.00	0.00	31.90	0.00	16.96	0.00	89.08	0.00

Table 5

Age of First Drink < 15, Drug Use, Family History, and Treatment Utilization Regression Models in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²
Standard Severe	3.25	2.71-3.91	651.21	0.03	39.29	0.00	91.71	0.00	39.83	0.00	70.66	0.00	33.78	0.00
Alcohol-specific Severe	2.49	2.09-2.96	553.87	0.02	5.13	0.00	33.84	0.00	5.50	0.00	20.68	0.00	17.52	0.00
DSM-IV	2.34	2.09-2.62	727.64	0.03	--	--	--	--	--	--	--	--	--	--
DSM-5	1.85	1.68-2.03	701.77	0.03	--	--	--	--	--	--	--	--	--	--
ICD-10	2.33	2.09-2.60	737.26	0.03	--	--	--	--	--	--	--	--	--	--
ICD-11	2.00	1.81-2.22	711.13	0.03	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	3.06	2.61-3.59	714.94	0.03	--	--	--	--	--	--	--	--	--	--
Family History of Drug Problems (n=2577)														
Standard Mild	1.62	1.43-1.85	1517.30	0.06	11.83	0.00	1.29	0.00	11.11	0.00	4.58	0.00	24.16	0.00
Alcohol-specific Mild	1.64	1.44-1.86	1521.24	0.06	14.23	0.00	3.04	0.00	13.51	0.00	4.01	0.00	26.62	0.00
Standard Severe	2.15	1.74-2.65	1494.63	0.06	7.16	0.00	19.22	0.00	8.07	0.00	13.13	0.00	3.60	0.00
Alcohol-specific Severe	1.94	1.55-2.42	1477.71	0.06	1.98	0.00	9.99	0.00	2.47	0.00	5.67	0.00	4.18	0.00
DSM-IV	1.85	1.60-2.13	1523.05	0.06	--	--	--	--	--	--	--	--	--	--
DSM-5	1.61	1.42-1.83	1519.72	0.06	--	--	--	--	--	--	--	--	--	--
ICD-10	1.82	1.59-2.09	1522.11	0.06	--	--	--	--	--	--	--	--	--	--
ICD-11	1.72	1.51-1.96	1527.77	0.06	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.34	1.93-2.84	1530.54	0.06	--	--	--	--	--	--	--	--	--	--
Family History of Behavior Problems (n=3536)														
Standard Mild	1.61	1.45-1.79	646.98	0.03	14.74	0.00	0.32	0.00	5.14	0.00	0.78	0.00	29.37	0.00
Alcohol-specific Mild	1.64	1.48-1.81	653.95	0.03	18.82	0.00	2.40	0.00	7.82	0.00	0.37	0.00	33.59	0.00
Standard Severe	2.37	1.95-2.88	634.90	0.03	16.44	0.00	34.13	0.00	11.45	0.00	20.42	0.00	10.98	0.00
Alcohol-specific Severe	2.03	1.67-2.47	601.83	0.03	3.81	0.00	14.86	0.00	1.86	0.00	6.37	0.00	7.57	0.00
DSM-IV	1.87	1.65-2.12	656.03	0.03	--	--	--	--	--	--	--	--	--	--

Table 5
Age of First Drink < 15, Drug Use, Family History, and Treatment Utilization Regression Models in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
DSM-5	1.62	1.46-1.80	655.14	0.03	--	--	--	--	--	--	--	--	--	--
ICD-10	1.98	1.75-2.24	684.37	0.03	--	--	--	--	--	--	--	--	--	--
ICD-11	1.82	1.64-2.03	686.48	0.03	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.34	1.99-2.76	664.50	0.03	--	--	--	--	--	--	--	--	--	--
Alcohol Treatment (n=1772)														
Standard Mild	5.49	4.84-6.23	1340.21	0.05	152.21	0.01	19.23	0.00	125.82	0.00	91.08	0.00	255.37	0.01
Alcohol-specific Mild	5.39	4.70-6.18	1313.18	0.05	133.28	0.01	11.93	0.00	107.79	0.00	55.11	0.00	232.57	0.01
Standard Severe	10.86	8.85-13.34	1147.08	0.05	109.19	0.00	251.16	0.01	111.15	0.00	190.05	0.01	65.13	0.00
Alcohol-specific Severe	7.96	6.54-9.68	922.08	0.04	35.22	0.00	132.50	0.01	37.09	0.00	87.71	0.00	57.89	0.00
DSM-IV	7.20	6.20-8.36	1362.55	0.05	--	--	--	--	--	--	--	--	--	--
DSM-5	5.44	4.79-6.19	1345.44	0.05	--	--	--	--	--	--	--	--	--	--
ICD-10	7.24	6.22-8.43	1394.86	0.06	--	--	--	--	--	--	--	--	--	--
ICD-11	5.98	5.22-6.86	1352.85	0.05	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	11.38	9.55-13.55	1432.84	0.06	--	--	--	--	--	--	--	--	--	--
Drug Treatment (n=861)														
Standard Mild	3.61	3.00-4.35	473.87	0.02	46.69	0.00	1.70	0.00	39.80	0.00	24.55	0.00	83.47	0.00
Alcohol-specific Mild	3.36	2.76-4.09	441.87	0.02	27.60	0.00	1.24	0.00	21.75	0.00	4.37	0.00	61.12	0.00
Standard Severe	5.32	3.99-7.08	392.83	0.02	22.08	0.00	55.23	0.00	23.19	0.00	41.30	0.00	12.19	0.00
Alcohol-specific Severe	4.16	3.08-5.60	326.31	0.01	4.20	0.00	23.85	0.00	4.82	0.00	14.66	0.00	8.22	0.00
DSM-IV	4.31	3.52-5.28	472.90	0.02	--	--	--	--	--	--	--	--	--	--
DSM-5	3.70	3.07-4.46	490.22	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	4.31	3.51-5.28	479.97	0.02	--	--	--	--	--	--	--	--	--	--
ICD-11	3.86	3.18-4.69	481.24	0.02	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	5.80	4.62-7.29	478.39	0.02	--	--	--	--	--	--	--	--	--	--

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Table 5

Age of First Drink < 15, Drug Use, Family History, and Treatment Utilization Regression Models in NESARC-III Sample

	Single Predictor Models				DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²

Note. DSM-IV = *Diagnostic and statistical manual, 4th edition,* alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition,* alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction.

Fit change = change in fit from single predictor model to joint predictor model.

OR = odds ratio estimate; 95% CI = 95% confidence interval for odds ratio estimate; Chi-sq. = log-likelihood ratio chi-square; Chi-sq. values > 3.84 chi-square critical value (*df*=1; alpha=0.05) were considered significant.

-- = not applicable; Cells highlighted orange = Standard Mild/Severe change in chi-square in joint predictor models greater than respective Alcohol-specific Mild/Severe change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05); Cells highlighted blue = Alcohol-specific Mild/Severe change in chi-square in joint predictor models greater than respective Standard Mild/Severe change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05).

Table 6
Mental Health and Psychosocial Problems Regression Models in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Mood (n=2456)														
Standard Mild	2.62	2.31-2.97	887.01	0.04	36.63	0.00	6.92	0.00	31.87	0.00	10.16	0.00	93.98	0.00
Alcohol-specific Mild	2.56	2.26-2.90	885.23	0.04	42.02	0.00	0.51	0.00	37.26	0.00	1.82	0.00	94.14	0.00
Standard Severe	6.60	5.02-8.67	852.92	0.04	52.05	0.00	122.42	0.01	33.66	0.00	83.58	0.00	32.14	0.00
Alcohol-specific Severe	6.24	4.65-8.38	822.11	0.04	42.43	0.00	103.52	0.00	26.50	0.00	68.49	0.00	49.03	0.00
DSM-IV	3.85	3.27-4.53	953.96	0.04	--	--	--	--	--	--	--	--	--	--
DSM-5	2.56	2.27-2.89	891.82	0.04	--	--	--	--	--	--	--	--	--	--
ICD-10	4.48	3.79-5.28	1006.56	0.04	--	--	--	--	--	--	--	--	--	--
ICD-11	3.20	2.82-3.63	975.21	0.04	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	5.99	4.82-7.43	957.90	0.04	--	--	--	--	--	--	--	--	--	--
Anxiety (n=2974)														
Standard Mild	2.20	1.95-2.49	736.94	0.03	30.11	0.00	1.14	0.00	28.61	0.00	10.00	0.00	65.29	0.00
Alcohol-specific Mild	2.17	1.92-2.45	737.52	0.03	35.09	0.00	1.40	0.00	33.56	0.00	3.44	0.00	66.66	0.00
Standard Severe	4.33	3.25-5.77	674.59	0.03	22.99	0.00	63.95	0.00	13.44	0.00	42.74	0.00	7.47	0.00
Alcohol-specific Severe	3.96	2.89-5.43	645.39	0.03	14.54	0.00	47.08	0.00	7.39	0.00	29.31	0.00	13.83	0.00
DSM-IV	3.06	2.57-3.63	780.50	0.03	--	--	--	--	--	--	--	--	--	--
DSM-5	2.21	1.96-2.50	754.37	0.03	--	--	--	--	--	--	--	--	--	--
ICD-10	3.44	2.88-4.10	811.69	0.04	--	--	--	--	--	--	--	--	--	--
ICD-11	2.59	2.25-2.97	794.11	0.04	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	4.79	3.81-6.03	810.81	0.04	--	--	--	--	--	--	--	--	--	--
Financial Problems (n=3139)														
Standard Mild	2.29	2.03-2.58	1233.64	0.05	53.25	0.00	5.37	0.00	55.06	0.00	27.29	0.00	104.03	0.00
Alcohol-specific Mild	2.28	2.03-2.56	1242.60	0.05	63.95	0.00	4.71	0.00	65.71	0.00	23.39	0.00	111.84	0.00
Standard Severe	4.77	3.54-6.41	1170.12	0.05	40.38	0.00	82.50	0.00	30.07	0.00	63.78	0.00	29.11	0.00

Table 6

Mental Health and Psychosocial Problems Regression Models in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
	Estimates		Fit		DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
					Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²
Alcohol-specific Severe	5.05	3.72-6.86	1173.38	0.05	46.46	0.00	87.08	0.00	35.77	0.00	68.08	0.00	56.31	0.00
DSM-IV	2.92	2.49-3.43	1234.44	0.05	--	--	--	--	--	--	--	--	--	--
DSM-5	2.25	2.00-2.53	1238.62	0.05	--	--	--	--	--	--	--	--	--	--
ICD-10	3.20	2.73-3.76	1252.28	0.06	--	--	--	--	--	--	--	--	--	--
ICD-11	2.49	2.18-2.83	1247.36	0.06	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	4.17	3.36-5.16	1224.77	0.05	--	--	--	--	--	--	--	--	--	--
Employment Problems (n=4287)														
Standard Mild	1.81	1.62-2.03	1653.62	0.07	29.61	0.00	6.03	0.00	41.12	0.00	18.10	0.00	86.04	0.00
Alcohol-specific Mild	1.75	1.57-1.94	1640.10	0.07	25.62	0.00	0.98	0.00	36.06	0.00	6.58	0.00	76.12	0.00
Standard Severe	2.91	2.19-3.87	1582.20	0.07	11.02	0.00	38.75	0.00	10.02	0.00	26.64	0.00	16.87	0.00
Alcohol-specific Severe	3.04	2.26-4.07	1583.39	0.07	13.93	0.00	41.03	0.00	12.77	0.00	28.76	0.00	30.86	0.00
DSM-IV	2.32	2.03-2.65	1675.33	0.07	--	--	--	--	--	--	--	--	--	--
DSM-5	1.77	1.59-1.98	1651.68	0.07	--	--	--	--	--	--	--	--	--	--
ICD-10	2.35	2.03-2.71	1659.68	0.07	--	--	--	--	--	--	--	--	--	--
ICD-11	1.95	1.73-2.20	1666.31	0.07	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.60	2.11-3.21	1607.96	0.07	--	--	--	--	--	--	--	--	--	--
Interpersonal Problems (n=2636)														
Standard Mild	2.32	2.06-2.62	828.28	0.04	62.28	0.00	3.87	0.00	74.58	0.00	29.44	0.00	143.20	0.01
Alcohol-specific Mild	2.32	2.05-2.63	839.09	0.04	74.25	0.00	3.69	0.00	86.60	0.00	27.47	0.00	153.32	0.01
Standard Severe	3.87	2.94-5.10	719.07	0.03	19.72	0.00	45.96	0.00	17.33	0.00	33.28	0.00	34.42	0.00
Alcohol-specific Severe	3.93	2.95-5.23	714.81	0.03	20.65	0.00	45.03	0.00	18.13	0.00	32.57	0.00	46.49	0.00
DSM-IV	2.80	2.38-3.28	802.78	0.04	--	--	--	--	--	--	--	--	--	--
DSM-5	2.30	2.03-2.60	836.51	0.04	--	--	--	--	--	--	--	--	--	--
ICD-10	2.87	2.46-3.36	792.12	0.04	--	--	--	--	--	--	--	--	--	--

Table 6
Mental Health and Psychosocial Problems Regression Models in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
ICD-11	2.49	2.20-2.83	833.78	0.04	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.94	2.34-3.70	710.58	0.03	--	--	--	--	--	--	--	--	--	--
Legal Problems (n=346)														
Standard Mild	4.43	3.26-6.03	364.45	0.02	28.04	0.00	0.41	0.00	36.03	0.00	29.50	0.00	57.91	0.00
Alcohol-specific Mild	4.55	3.42-6.04	371.96	0.02	35.46	0.00	0.04	0.00	43.64	0.00	32.33	0.00	64.35	0.00
Standard Severe	9.62	6.45-14.37	357.76	0.02	34.76	0.00	63.49	0.00	32.63	0.00	59.32	0.00	28.92	0.00
Alcohol-specific Severe	8.08	5.34-12.22	323.12	0.01	20.24	0.00	43.25	0.00	18.13	0.00	38.84	0.00	25.21	0.00
DSM-IV	5.57	4.04-7.69	371.03	0.02	--	--	--	--	--	--	--	--	--	--
DSM-5	4.66	3.51-6.19	378.05	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	5.68	4.13-7.81	363.69	0.02	--	--	--	--	--	--	--	--	--	--
ICD-11	4.20	3.12-5.64	344.24	0.02	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	7.64	5.43-10.75	361.85	0.02	--	--	--	--	--	--	--	--	--	--

Note. DSM-IV = *Diagnostic and statistical manual, 4th edition,* alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition,* alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction.
Fit change = change in fit from single predictor model to joint predictor model.
OR = odds ratio estimate; 95% CI = 95% confidence interval for odds ratio estimate; Chi-sq. = log-likelihood ratio chi-square; Chi-sq. values > 3.84 chi-square critical value (*df*=1; alpha=0.05) were considered significant.
-- = not applicable; Cells highlighted orange = Standard Mild/Severe change in chi-square in joint predictor models greater than respective Alcohol-specific Mild/Severe change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05); Cells highlighted blue = Alcohol-specific Mild/Severe change in chi-square in joint predictor models greater than respective Standard Mild/Severe change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05).

Table 7
Mental Health and Psychosocial Problems Regression Models in NESARC-III Sample

| | Single Predictor Models | | | | Joint Predictor Models | | | | | | | | | |
| | Estimates | | Fit | | DSM-IV Fit Change | | DSM-5 Fit Change | | ICD-10 Fit Change | | ICD-11 Fit Change | | Wakefield's HD Fit Change | |
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Mood (n=3568)														
Standard Mild	2.31	2.08-2.56	846.39	0.03	36.03	0.00	10.42	0.00	29.22	0.00	20.08	0.00	96.49	0.00
Alcohol-specific Mild	2.22	2.00-2.47	815.25	0.03	21.89	0.00	0.42	0.00	16.29	0.00	2.60	0.00	75.72	0.00
Standard Severe	4.04	3.36-4.86	793.17	0.03	38.31	0.00	104.12	0.00	40.25	0.00	73.63	0.00	29.18	0.00
Alcohol-specific Severe	3.04	2.50-3.70	678.58	0.03	4.10	0.00	38.50	0.00	4.92	0.00	20.51	0.00	13.22	0.00
DSM-IV	3.02	2.70-3.36	902.03	0.04	--	--	--	--	--	--	--	--	--	--
DSM-5	2.25	2.04-2.49	843.11	0.03	--	--	--	--	--	--	--	--	--	--
ICD-10	2.99	2.67-3.34	909.32	0.04	--	--	--	--	--	--	--	--	--	--
ICD-11	2.55	2.30-2.83	884.32	0.04	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	3.99	3.45-4.61	883.57	0.04	--	--	--	--	--	--	--	--	--	--
Anxiety (n=3272)														
Standard Mild	1.88	1.63-2.16	679.35	0.03	25.61	0.00	2.21	0.00	18.54	0.00	8.01	0.00	53.41	0.00
Alcohol-specific Mild	1.80	1.58-2.05	656.20	0.03	13.77	0.00	1.24	0.00	8.44	0.00	0.01	0.00	38.04	0.00
Standard Severe	2.93	2.45-3.50	650.00	0.03	23.67	0.00	52.20	0.00	22.52	0.00	36.05	0.00	16.50	0.00
Alcohol-specific Severe	2.60	2.13-3.16	611.88	0.02	9.66	0.00	30.56	0.00	9.14	0.00	18.49	0.00	16.10	0.00
DSM-IV	2.24	1.96-2.57	690.43	0.03	--	--	--	--	--	--	--	--	--	--
DSM-5	1.87	1.63-2.14	685.49	0.03	--	--	--	--	--	--	--	--	--	--
ICD-10	2.27	1.98-2.60	703.24	0.03	--	--	--	--	--	--	--	--	--	--
ICD-11	2.07	1.81-2.36	708.32	0.03	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.84	2.39-3.37	690.48	0.03	--	--	--	--	--	--	--	--	--	--
Financial Problems (n=298)														
Standard Mild	1.06	0.74-1.53	17.45	0.00	0.74	0.00	2.33	0.00	0.32	0.00	1.48	0.00	0.59	0.00
Alcohol-specific Mild	1.24	0.87-1.76	18.96	0.00	0.22	0.00	1.36	0.00	0.60	0.00	0.09	0.00	0.10	0.00
Standard Severe	1.98	1.14-3.42	22.63	0.00	3.46	0.00	4.36	0.00	4.43	0.00	3.61	0.00	1.77	0.00
Alcohol-specific Severe	1.66	0.87-3.15	19.79	0.00	0.95	0.00	1.69	0.00	1.43	0.00	1.20	0.00	0.49	0.00
DSM-IV	1.33	0.89-1.97	19.17	0.00	--	--	--	--	--	--	--	--	--	--
DSM-5	1.17	0.82-1.66	18.27	0.00	--	--	--	--	--	--	--	--	--	--
ICD-10	1.24	0.82-1.88	18.40	0.00	--	--	--	--	--	--	--	--	--	--
ICD-11	1.27	0.89-1.80	19.08	0.00	--	--	--	--	--	--	--	--	--	--

Table 7

Mental Health and Psychosocial Problems Regression Models in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²
Wakefield's HD	1.68	1.04-2.71	21.25	0.00	--	--	--	--	--	--	--	--	--	--
Employment Problems (n=6584)														
Standard Mild	1.74	1.60-1.89	2048.48	0.08	32.80	0.00	6.25	0.00	29.99	0.00	24.29	0.00	91.72	0.00
Alcohol-specific Mild	1.64	1.50-1.78	2006.11	0.08	12.37	0.00	4.52	0.00	10.26	0.00	1.89	0.00	59.98	0.00
Standard Severe	2.13	1.78-2.55	1939.21	0.08	2.36	0.00	22.31	0.00	3.22	0.00	14.07	0.00	6.34	0.00
Alcohol-specific Severe	1.97	1.64-2.37	1916.65	0.08	0.22	0.00	12.72	0.00	0.52	0.00	6.67	0.00	9.65	0.00
DSM-IV	2.07	1.85-2.31	2061.80	0.08	--	--	--	--	--	--	--	--	--	--
DSM-5	1.71	1.58-1.85	2047.20	0.08	--	--	--	--	--	--	--	--	--	--
ICD-10	2.03	1.82-2.27	2061.49	0.08	--	--	--	--	--	--	--	--	--	--
ICD-11	1.80	1.64-1.98	2045.42	0.08	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.26	1.92-2.66	1996.76	0.08	--	--	--	--	--	--	--	--	--	--
Interpersonal Problems (n=3986)														
Standard Mild	2.32	2.09-2.57	1161.20	0.05	93.44	0.00	5.36	0.00	83.02	0.00	51.38	0.00	190.42	0.01
Alcohol-specific Mild	2.32	2.10-2.57	1163.09	0.05	94.87	0.00	6.11	0.00	84.41	0.00	44.31	0.00	191.50	0.01
Standard Severe	3.44	2.89-4.11	1033.67	0.04	36.21	0.00	65.16	0.00	36.21	0.00	53.70	0.00	61.49	0.00
Alcohol-specific Severe	3.02	2.50-3.65	978.56	0.04	15.99	0.00	37.97	0.00	16.19	0.00	28.73	0.00	49.41	0.00
DSM-IV	2.55	2.26-2.87	1097.15	0.04	--	--	--	--	--	--	--	--	--	--
DSM-5	2.30	2.08-2.54	1171.33	0.05	--	--	--	--	--	--	--	--	--	--
ICD-10	2.55	2.25-2.88	1108.73	0.04	--	--	--	--	--	--	--	--	--	--
ICD-11	2.35	2.11-2.63	1133.67	0.05	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.70	2.30-3.17	997.88	0.04	--	--	--	--	--	--	--	--	--	--
Legal Problems (n=490)														
Standard Mild	3.80	2.99-4.84	476.11	0.02	36.71	0.00	7.12	0.00	42.61	0.00	31.51	0.00	78.20	0.00
Alcohol-specific Mild	3.77	2.95-4.82	473.74	0.02	35.18	0.00	5.55	0.00	40.94	0.00	27.05	0.00	76.13	0.00
Standard Severe	6.27	4.85-8.10	464.85	0.02	35.76	0.00	58.09	0.00	42.31	0.00	53.42	0.00	52.54	0.00
Alcohol-specific Severe	5.16	3.84-6.95	424.57	0.02	16.81	0.00	34.71	0.00	21.09	0.00	30.11	0.00	35.95	0.00
DSM-IV	4.05	3.14-5.21	457.78	0.02	--	--	--	--	--	--	--	--	--	--
DSM-5	3.69	2.89-4.70	470.49	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	3.77	2.97-4.79	444.86	0.02	--	--	--	--	--	--	--	--	--	--

Table 7

Mental Health and Psychosocial Problems Regression Models in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
ICD-11	3.51	2.73-4.52	449.79	0.02	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	4.33	3.35-5.59	418.21	0.02	--	--	--	--	--	--	--	--	--	--

Note. DSM-IV = *Diagnostic and statistical manual, 4th edition,* alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition,* alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction.

Fit change = change in fit from single predictor model to joint predictor model.

OR = odds ratio estimate; 95% CI = 95% confidence interval for odds ratio estimate; Chi-sq. = log-likelihood ratio chi-square; Chi-sq. values > 3.84 chi-square critical value (*df*=1; alpha=0.05) were considered significant.

-- = not applicable; Cells highlighted orange = Standard Mild/Severe change in chi-square in joint predictor models greater than respective Alcohol-specific Mild/Severe change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05); Cells highlighted blue = Alcohol-specific Mild/Severe change in chi-square in joint predictor models greater than respective Standard Mild/Severe change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05).

Table 8

Recent Functioning Regression Models in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	β	SE	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Social Functioning														
Standard Mild	3.20	0.24	425935.96	0.03	3494.32	0.00	2149.29	0.00	3733.79	0.00	-397.02	0.00	14684.35	0.01
Alcohol-specific Mild	3.15	0.22	422918.79	0.03	4867.42	0.00	-399.82	0.00	4727.92	0.00	1155.14	0.00	15448.75	0.01
Standard Severe	8.03	0.76	428935.05	0.03	6051.87	0.00	25788.41	0.01	5607.99	0.00	19552.59	0.01	3209.60	0.00
Alcohol-specific Severe	7.49	0.89	422026.88	0.02	2687.89	0.00	19556.36	0.01	2115.96	0.00	13482.57	0.00	5246.31	0.00
DSM-IV	5.08	0.37	443206.33	0.03	--	--	--	--	--	--	--	--	--	--
DSM-5	3.12	0.22	426822.60	0.03	--	--	--	--	--	--	--	--	--	--
ICD-10	5.98	0.41	443738.51	0.03	--	--	--	--	--	--	--	--	--	--
ICD-11	4.13	0.29	443941.52	0.03	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	7.56	0.62	438946.52	0.03	--	--	--	--	--	--	--	--	--	--
Mental Health														
Standard Mild	3.88	0.23	359828.61	0.05	361072.35	0.00	2466.55	0.00	485.09	0.00	-2454.33	0.00	-1830.95	0.01
Alcohol-specific Mild	3.88	0.22	358470.70	0.05	302.76	0.00	-167.11	0.00	44.99	0.01	-2843.10	0.00	-1765.09	0.01
Standard Severe	8.27	0.87	362711.53	0.04	6599.21	0.00	4429.39	0.01	3387.22	0.00	3742.53	0.00	910.97	0.00
Alcohol-specific Severe	7.96	0.97	363259.87	0.04	6293.36	0.00	4445.11	0.01	2733.28	0.00	3137.88	0.00	2296.08	0.00
DSM-IV	6.02	0.38	359192.69	0.05	--	--	--	--	--	--	--	--	--	--
DSM-5	3.87	0.22	359315.97	0.05	--	--	--	--	--	--	--	--	--	--
ICD-10	6.46	0.40	359057.89	0.05	--	--	--	--	--	--	--	--	--	--
ICD-11	4.76	0.27	368333.36	0.05	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	8.47	0.58	367331.91	0.05	--	--	--	--	--	--	--	--	--	--
Physical Functioning														
Standard Mild	1.56	0.22	423825.73	0.10	6512.79	0.00	6904.13	0.00	7391.19	0.00	2401.58	0.00	15081.10	0.00

Table 8

Recent Functioning Regression Models in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
	Estimates		Fit		DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
					Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	β	SE	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Alcohol-specific Mild	1.54	0.21	432407.41	0.10	13072.04	0.00	48.40	0.00	13504.45	0.00	892.68	0.00	23105.02	0.00
Standard Severe	4.72	0.72	423735.44	0.10	8898.85	0.00	11471.58	0.00	7831.53	0.00	5768.09	0.00	14657.74	0.00
Alcohol-specific Severe	4.59	0.76	409970.60	0.10	1496.70	0.00	4692.06	0.00	1164.38	0.00	843.89	0.00	5198.40	0.00
DSM-IV	2.58	0.31	423186.95	0.10	--	--	--	--	--	--	--	--	--	--
DSM-5	1.51	0.21	438191.62	0.10	--	--	--	--	--	--	--	--	--	--
ICD-10	2.96	0.33	422971.27	0.10	--	--	--	--	--	--	--	--	--	--
ICD-11	2.29	0.24	456328.65	0.10	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	3.93	0.49	415404.36	0.10	--	--	--	--	--	--	--	--	--	--

Note. DSM-IV = *Diagnostic and statistical manual, 4th edition,* alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition,* alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction.
Fit change = change in fit from single predictor model to joint predictor model.
SE = standard error; Chi-sq. = Wald F chi-square; Chi-sq. values > 3.84 chi-square critical value (*df*=1; alpha=0.05) were considered significant.
-- = not applicable; Cells highlighted orange = Standard Mild/Severe change in chi-square in joint predictor models greater than respective Alcohol-specific Mild/Severe change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05); Cells highlighted blue = Alcohol-specific Mild/Severe change in chi-square in joint predictor models greater than respective Standard Mild/Severe change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05).

Table 9

Recent Functioning Regression Models in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models									
	Estimates		Fit		DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
					Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solutions	β	SE	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Social Functioning														
Standard Mild	3.16	0.20	229587.98	0.02	2083.70	0.00	166.67	0.00	1769.85	0.00	1326.13	0.00	5924.87	0.00
Alcohol-specific Mild	3.10	0.21	231831.76	0.02	5466.26	0.00	6300.18	0.00	4142.76	0.00	5530.05	0.00	8013.08	0.00
Standard Severe	7.23	0.55	227116.94	0.03	3791.55	0.00	6226.81	0.01	4729.87	0.00	4854.86	0.01	4250.22	0.00
Alcohol-specific Severe	6.26	0.56	222609.51	0.02	1387.07	0.00	2802.85	0.00	1865.00	0.00	1676.18	0.00	2815.41	0.00
DSM-IV	5.00	0.32	231575.89	0.03	--	--	--	--	--	--	--	--	--	--
DSM-5	3.09	0.20	230181.91	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	4.97	0.31	230378.59	0.03	--	--	--	--	--	--	--	--	--	--
ICD-11	3.93	0.23	230528.76	0.03	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	6.93	0.38	225581.67	0.03	--	--	--	--	--	--	--	--	--	--
Mental Health														
Standard Mild	4.05	0.24	266325.16	0.04	2230.59	0.00	1781.89	0.00	2091.56	0.00	659.98	0.00	3834.93	0.01
Alcohol-specific Mild	3.92	0.23	267890.67	0.04	2860.13	0.00	-21.59	0.00	3131.31	0.00	973.67	0.00	4603.89	0.01
Standard Severe	7.96	0.53	265146.76	0.04	2640.42	0.00	4196.36	0.01	3110.21	0.00	3442.52	0.01	2820.59	0.00
Alcohol-specific Severe	6.35	0.52	259660.20	0.03	86.16	0.00	784.37	0.00	812.54	0.00	373.20	0.00	1295.27	0.00
DSM-IV	5.58	0.32	267925.04	0.04	--	--	--	--	--	--	--	--	--	--
DSM-5	4.03	0.23	267456.12	0.04	--	--	--	--	--	--	--	--	--	--
ICD-10	5.61	0.30	265529.47	0.04	--	--	--	--	--	--	--	--	--	--
ICD-11	4.72	0.25	267169.76	0.04	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	7.79	0.36	266446.14	0.04	--	--	--	--	--	--	--	--	--	--
Physical Functioning														
Standard Mild	1.07	0.18	220765.28	0.09	2818.43	0.00	770.30	0.00	1563.72	0.00	6131.52	0.00	1184.80	0.00

Table 9

Recent Functioning Regression Models in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solutions	β	SE	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Alcohol-specific Mild	0.92	0.18	220599.47	0.09	4160.60	0.00	376.07	0.00	2117.17	0.00	4266.92	0.00	1339.41	0.00
Standard Severe	2.39	0.38	223055.62	0.09	1601.82	0.00	4754.66	0.00	2880.76	0.00	2534.96	0.00	1816.95	0.00
Alcohol-specific Severe	2.13	0.45	224450.57	0.09	4175.24	0.00	7449.02	0.00	6232.54	0.00	4371.71	0.00	5134.26	0.00
DSM-IV	1.81	0.23	221705.99	0.09	--	--	--	--	--	--	--	--	--	--
DSM-5	0.99	0.17	220038.13	0.09	--	--	--	--	--	--	--	--	--	--
ICD-10	1.71	0.24	219529.46	0.09	--	--	--	--	--	--	--	--	--	--
ICD-11	1.55	0.19	219909.04	0.09	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.73	0.32	221838.01	0.09	--	--	--	--	--	--	--	--	--	--

Note. DSM-IV = *Diagnostic and statistical manual, 4th edition,* alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition,* alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction.

Fit change = change in fit from single predictor model to joint predictor model.

SE = standard error; Chi-sq. = Wald F chi-square; Chi-sq. values > 3.84 chi-square critical value (*df*=1; alpha=0.05) were considered significant.

-- = not applicable; Cells highlighted orange = Standard Mild/Severe change in chi-square in joint predictor models greater than respective Alcohol-specific Mild/Severe change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05); Cells highlighted blue = Alcohol-specific Mild/Severe change in chi-square in joint predictor models greater than respective Standard Mild/Severe change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05).

Appendices

Appendix A. Supplemental Tables

Supplemental Table 1
DSM-5 Alcohol Use Disorder Criteria and Prevalence Rates

Criterion	Description	NESARC (*N*=22,103)			NESARC-III (*N*=24,354)		
		Freq.	%	SE	Freq.	%	SE
Tolerance	Tolerance, as defined by either of the following: (a) a need for markedly increased amounts of alcohol to achieve intoxication or desired effect or (b) a markedly diminished effects with continued use of the same amount of alcohol.	1851	8.18	0.11	2433	9.02	0.26
Quit/Cut Down	There is a persistent desire or unsuccessful efforts to cut down or control alcohol use.	2807	12.34	0.12	3427	12.60	0.29
Larger/Longer	Alcohol is often taken in larger amounts or over a longer period than was intended.	3057	14.61	0.15	3669	14.28	0.35
Time Spent	A great deal of time is spent in activities necessary to obtain alcohol, use alcohol, or recover from its effects.	626	3.04	0.07	1322	4.69	0.18
Give Up Activities	Important social, occupational, or recreational activities are given up or reduced because of alcohol use.	216	0.99	0.04	495	1.63	0.09
Physical/Psychological Problems	Alcohol use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by alcohol.	1126	5.32	0.08	1809	6.69	0.21
Withdrawal	Withdrawal as manifested by either of the following: (a) the characteristic withdrawal syndrome for alcohol or (b) alcohol (or closely related substance, such as benzodiazepine) is taken to relieve or avoid withdrawal symptoms.	1720	7.90	0.11	2689	10.02	0.29
Role Interference	Recurrent alcohol use resulting in a failure to fulfill major role obligations at work, school, or home.	239	1.09	0.04	478	1.65	0.10
Hazardous Use	Recurrent alcohol use in situations in which it is physically hazardous.	2352	11.07	0.12	2731	11.03	0.30

Supplemental Table 1
DSM-5 Alcohol Use Disorder Criteria and Prevalence Rates

Criterion	Description	NESARC (*N*=22,103)			NESARC-III (*N*=24,354)		
		Freq.	**%**	**SE**	**Freq.**	**%**	**SE**
Social Problems	Continued alcohol use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of alcohol.	532	2.48	0.07	1187	4.29	0.17
Craving	Craving, or a strong desire or urge to use alcohol.	924	4.26	0.09	2706	10.50	0.31

Note. NESARC = National Epidemiologic Survey on Alcohol and Related Conditions Wave 2; NESARC-III = National Epidemiologic Survey on Alcohol and Related Conditions-III. Freq. = unweighted frequency. % = weighted percentages that account for complex sampling design of data sets. *SE* = Standard error.

Supplemental Table 2

Historical Alcoholic Subtype Characteristics

Author	Subtype Descriptions	
	Non-Disinhibitory Subtypes	Disinhibitory Subtypes
Babor et al. (1992)	Type A	Type B
	❖ Later onset of drinking ❖ Fewer alcohol-related physical and social consequences ❖ Characteristics: less psychopathological dysfunction, less distress at work, less distress with family	❖ Early onset of drinking ❖ More serious alcohol-related consequences ❖ Characteristics: high distress/stress, co-occurring psychiatric disorders, higher childhood and familial risk factors for alcoholism
Cloninger (1987)	Type I	Type II
	❖ Later onset of drinking ❖ Frequent loss of control ❖ Infrequent ability to abstain ❖ Characteristics: low novelty seeking, rigid, orderly, loyal, attentive to details	❖ Earlier age of onset ❖ Frequent inability to abstain ❖ Frequent negative consequence when drinking (i.e. fights and arrests) ❖ Characteristics: high novelty seeking, impulsive, excitable, disorderly, distractible
Jellinek (1960)	Delta	Gamma
	❖ Physical dependence mainly ❖ Inability to abstain from alcohol ❖ Low to non-existent psychological vulnerability (i.e. vulnerability to other psychopathologies)	❖ Psychological dependence first followed by development of physiological dependence ❖ Loss of control when consuming alcohol ❖ High psychological vulnerability (i.e. vulnerability to other psychopathologies)
Knight (1937)	Reactive alcoholics	Essential alcoholics
	❖ Later onset of drinking ❖ Compulsive style of consumption – consume alcohol for normality/relief ❖ Characteristics: reliable, responsible, independent	❖ Early onset of drinking ❖ Interpersonal issues (do not maintain long term relationships) ❖ Characteristics: unreliable, irresponsible, lack of sincerity

Supplemental Table 2
Historical Alcoholic Subtype Characteristics

Author	Subtype Descriptions	
	Non-Disinhibitory Subtypes	Disinhibitory Subtypes
Zucker (1986)	Developmentally cumulative alcoholism	Antisocial alcoholism
	❖ Cumulative extension of adolescent drinking patterns	❖ Early onset of alcohol problems and antisocial behavior
	❖ Not social-class specific	❖ Frequently of low social class
	❖ In adulthood antisocial behavior is not persistent (i.e., antisocial behavior decreases with age)	❖ Consistent presence of antisocial activity from childhood to adulthood
	❖ Some interpersonal problems (e.g. marital troubles) related to alcohol use	❖ Social/personal and legal difficulties

Supplemental Table 3a
Exploratory Factor Analysis of Heavy Alcohol Consumption Items

	NESARC (*N*=22,103)						NESARC-III (*N*=24,354)					
Model	**Number of parameters**	**Chi-square**	**df**	**p-value**	**TLI**	**CFI**	**Number of parameters**	**Chi-square**	**df**	**p-value**	**TLI**	**CFI**
1-Factor	18	1002.518	9	0.000	0.787	0.872	18	1920.811	9	0.000	0.604	0.762
2-Factor	--	--	--	--	--	--	--	--	--	--	--	--
3-Factor	--	--	--	--	--	--	27	0.172	0	0.000	1.000	1.000
Eigenvalues	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**
	3.380	0.831	0.571	0.556	0.431	0.231	3.461	0.841	0.555	0.507	0.396	0.241

Note. NESARC = National Epidemiologic Survey on Alcohol and Related Conditions Wave 2; NESARC-III = National Epidemiologic Survey on Alcohol and Related Conditions-III.

df = degrees of freedom; TLI = Tucker-Lewis index; CFI = Comparative fit index.

Factor model accounted for complex sampling design. Rotation used was Geomin.

NESARC 2- and 3-factor models did not converge. NESARC-III 2-factor model did not converge.

Supplemental Table 3b

Standardized Factor Score Means from One-Factor Solution of Alcohol Consumption
Items

	NESARC (*N*=22,103)		NESARC-III (*N*=24,354)	
	M	**SE**	**M**	**SE**
Drinking frequency	0.43	0.01	0.46	0.01
Usual amount of alcohol consumed on drinking days	0.82	0.01	0.79	0.01
Maximum number of drinks in a single day	0.87	0.01	0.84	0.01
Binge frequency	0.65	0.01	0.71	0.01
Intoxication frequency	0.63	0.01	0.70	0.01
Exceeding daily drinking limits frequency	0.68	0.01	0.66	0.01

Note. NESARC = National Epidemiologic Survey on Alcohol and Related Conditions
Wave 2; NESARC-III = National Epidemiologic Survey on Alcohol and Related
Conditions-III.
M = standardized factor score mean; SE = standard error.
NESARC model fit: Chi-square = 1002.539, *df*=9, p<0.001, root mean square error of
approximation = 0.071, Tucker-Lewis index = 0.787, Comparative fit index = 0.872
NESARC-III model fit: Chi-square = 1920.768, *df*=9, p<0.001, root mean square error of
approximation = 0.093, Tucker-Lewis index = 0.762, Comparative fit index = 0.604
p = 0.000 for all standardized factor score means.

Supplemental Table 4a
Exploratory Factor Analysis of Externalizing Behavior Items

Model	NESARC (*N*=22,103)						NESARC-III (*N*=24,354)					
	Number of parameters	Chi-square	df	p-value	TLI	CFI	Number of parameters	Chi-square	df	p-value	TLI	CFI
1-Factor	24	3668.248	252	0.000	0.953	0.957	24	4114.915	252	0.000	0.946	0.951
2-Factor	47	2189.171	229	0.000	0.971	0.976	47	2487.429	229	0.000	0.966	0.971
3-Factor	69	1314.129	207	0.000	0.982	0.986	69	1305.604	207	0.000	0.981	0.986
4-Factor	90	780.301	186	0.000	0.989	0.993	90	731.769	186	0.000	0.990	0.993
5-Factor	110	397.982	166	0.000	0.995	0.997	110	412.134	166	0.000	0.995	0.997
6-Factor	129	280.694	147	0.000	0.997	0.998	129	319.697	147	0.000	0.996	0.998
Eigenvalues	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**
	11.008	2.014	1.460	1.167	1.012	0.866	12.011	1.807	1.451	1.165	0.893	0.757

Note. NESARC = National Epidemiologic Survey on Alcohol and Related Conditions Wave 2; NESARC-III = National Epidemiologic Survey on Alcohol and Related Conditions-III.

df = degrees of freedom; TLI = Tucker-Lewis index; CFI = Comparative fit index.

Factor model accounted for complex sampling design. Rotation used was Geomin.

Supplemental Table 4b
Standardized Factor Score Means from One-Factor Solution of Conduct Disorder (CD) Criteria, Adult Antisocial Behavior (AAB) Criteria, and Borderline Personality Disorder (BPD) Impulsivity Items

	NESARC (*N*=22,103)		NESARC-III (*N*=24,354)	
	M	SE	M	SE
AAB Criteria				
Failure to conform to social norms with respect to lawful behaviors, as indicated by repeatedly performing acts that are grounds for arrest.	0.82	0.01	0.78	0.01
Deceitfulness, as indicated by repeated lying, use of aliases, or conning others for personal profit or pleasure.	0.71	0.01	0.73	0.01
Impulsivity or failure to plan ahead.	0.62	0.01	0.67	0.01
Irritability and aggressiveness, as indicated by repeated physical fights or assaults.	0.83	0.01	0.93	0.01
Reckless disregard for safety of self or others.	0.64	0.01	0.70	0.01
Consistent irresponsibility, as indicated by repeated failure to sustain consistent work behavior or honor financial obligations	0.64	0.01	0.67	0.01
Lack of remorse, as indicated by being indifferent to or rationalizing having, hurt, mistreated, or stolen from another.	1.00	0.01	0.85	0.01
CD Criteria				
Often bullies, threatens, or intimidates others.	0.69	0.02	0.65	0.01
Often initiates physical fights.	0.73	0.02	0.75	0.02
Has used a weapon that can cause serious physical harm to others (e.g., a bat, brick, broken bottle, knife, gun).	0.72	0.03	0.71	0.02
Has been physically cruel to people.	0.68	0.02	0.73	0.01
Has been physically cruel to animals.	0.58	0.02	0.56	0.02
Has stolen while confronting a victim (e.g., mugging, purse snatching, extortion, armed robbery).	0.66	0.11	0.72	0.04
Has forced someone into sexual activity.	0.46	0.11	0.62	0.06
Has deliberately engaged in fire setting with the intention of causing serious damage.	0.63	0.03	0.65	0.02
Has deliberately destroyed others' property (other than by fire setting).	0.71	0.02	0.74	0.02

Supplemental Table 4b

Standardized Factor Score Means from One-Factor Solution of Conduct Disorder (CD) Criteria, Adult Antisocial Behavior (AAB) Criteria, and Borderline Personality Disorder (BPD) Impulsivity Items

	NESARC (N=22,103)		NESARC-III (N=24,354)	
	M	**SE**	**M**	**SE**
Has broken into someone else's house, building, or car.	0.80	0.04	0.82	0.03
Often lies to obtain goods or favors or to avoid obligations (i.e., "cons" others).	0.64	0.01	0.63	0.01
Has stolen items of nontrivial value without confronting a victim (e.g., shoplifting, but without breaking and entering; forgery).	0.62	0.02	0.61	0.02
Has run away from home overnight at least twice while living in the parental or parental surrogate home, or once without returning for a lengthy period.	0.59	0.02	0.62	0.02
Is often truant from school, beginning before age 13 years.	0.57	0.02	0.53	0.02
BPD Impulsivity Criterion Items				
Have you ever gotten into sexual relationships quickly or without thinking about the consequences?	0.47	0.02	0.66	0.02
Have you had a problem with gambling or spending too much money?	0.47	0.02	0.60	0.01
Have you often become frantic when you thought that someone you really cared about was going to leave you?	0.50	0.02	0.74	0.01

Note. NESARC = National Epidemiologic Survey on Alcohol and Related Conditions Wave 2; NESARC-III = National Epidemiologic Survey on Alcohol and Related Conditions-III.
M = standardized factor score mean; SE=standard error.
NESARC Wave 2 model fit: Chi-square = 2973.68, *df*=252, p<0.001, root mean square error of approximation = 0.022, Tucker-Lewis index = 0.941, Comparative fit index = 0.949.
NESARC-III model fit: Chi-square = 1920.768, *df*=252, p<0.001, root mean square error of approximation = 0.022, Tucker-Lewis index = 0.941, Comparative fit index = 0.946
p = 0.000 for all standardized factor score means.

Supplemental Table 5
External Validator Prevalence Rates

	NESARC (*N*=22,103)			NESARC-III (*N*=24,354)		
	n	**%**	**SE**	**n**	**%**	**SE**
Age of first drink < 15	1488	6.95	0.10	2339	9.58	0.24
Drug use	7104	32.87	0.18	10208	42.24	0.63
Family history of alcohol problems	5216	22.94	0.17	7605	31.97	0.41
Family history of drug problems	1188	5.32	0.08	2577	9.83	0.26
Family history of behavioral problems	1707	7.49	0.12	3536	15.25	0.32
Alcohol treatment	1201	5.81	0.10	1772	6.91	0.20
Drug treatment	547	3.43	0.07	861	3.31	0.16
Mood	2456	10.53	0.10	3568	13.68	0.34
Anxiety	2974	12.82	0.12	3272	13.51	0.31
Financial problems	3139	12.51	0.14	298	1.09	0.09
Employment problems	4287	18.86	0.16	6584	25.04	0.39
Interpersonal problems	2636	10.96	0.12	3986	13.95	0.31
Legal problems	346	1.46	0.05	490	1.66	0.10
	M	**SE**		**M**	**SE**	
Social functioning	47.60	0.03		48.85	0.10	
Mental health functioning	48.35	0.04		48.29	0.09	
Physical functioning	47.68	0.03		48.40	0.11	

Note. NESARC = National Epidemiologic Survey on Alcohol and Related Conditions Wave 2; NESARC-III = National Epidemiologic Survey on Alcohol and Related Conditions-III. % = weighted percentages that account for complex sampling design of data sets; SE = Standard error; Mean = weighted mean that accounts for complex sampling design.

Supplemental Table 6
Optimal Solutions for Alternative Mild (Base Rate =8.55%), Moderate (Base Rate=3.55%), and Severe (Base Rate=1.65%) Severity

	DSM-5 AUD Criteria													**NESARC**				**NESARC-III**				
Solution	**TL**	**WD**	**CD**	**LL**	**CR**	**TS**	**GU**	**PP**	**RI**	**HU**	**SP**	**Thresh.**	**Set Size**	**n**	**%**	**SE**	**Cohen's d**	**n**	**%**	**SE**	**Opt %**	**Med. Cohen's d**
Standard Mild Alt.	X		X		X	X		X		X	X	3	7	1175	5.43	0.1	2.24	2129	7.97	0.25	66.5	2.38
Alcohol-specific Mild Alt.	X		X		X	X		X		X	X	3	7	1175	5.43	0.1	2.24	2129	7.97	0.25	47.4	2.05
Standard Moderate Alt.	X					X		X		X		3	3	384	1.82	0.05	3.01	870	3.05	0.13	78.1	2.92
Alcohol-specific Moderate Alt.	X					X		X		X		3	3	384	1.82	0.05	3.01	870	3.05	0.13	73.4	2.59
Standard Severe Alt.	X	X				X	X			X	X	5	6	155	0.75	0.03	3.64	411	1.46	0.08	37.4	3.16
Alcohol-specific Severe Alt.	X	X		X	X	X		X				6	6	135	0.62	0.03	3.56	405	1.4	0.08	70.4	2.86

Note. DSM-5 AUD = *Diagnostic and statistical manual, 5th edition*, alcohol use disorder; NESARC = National Epidemiologic Survey on Alcohol and Related Conditions Wave 2; NESARC-III = National Epidemiologic Survey on Alcohol and Related Conditions-III.

TL = tolerance; WD = withdrawal; CD = quit/cut down; LL = larger/longer; CR = craving; TS = time spent; GU = give up activities; PP = continued use despite physical/psychological problems; RI = role interference; HU = hazardous use; SP = social problems; Set size = number of symptoms in a given diagnostic scheme; Thresh. = threshold, or number of symptoms needed for positive diagnosis; % = weighted percentage that accounts for complex survey design; SE = standard error; Opt. % = percentage of times solution was selected as optimal (i.e., highest Cohen's d value/lowest rank across solutions) across 1000 iterations of combinatorial optimization procedure; Med. Cohen's *d* = median Cohen's d value across 1000 iterations of combinatorial optimization procedure. Alt. = alternative; X = criterion included in diagnostic scheme.

Supplemental Table 7

Tetrachoric Correlations of Optimal Solutions and Established Diagnostic Approaches

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Standard Mild		0.91	0.66	0.59	0.59	0.40	0.39	0.27	0.27	0.69	0.95	0.71	0.80	0.48
2. Alcohol-specific Mild	0.93		0.67	0.59	0.59	0.40	0.39	0.28	0.27	0.69	0.95	0.71	0.85	0.48
3. Standard/Alcohol-specific Mild Alt.	0.58	0.56		0.81	0.81	0.60	0.56	0.41	0.41	0.78	0.63	0.81	0.71	0.63
4. Standard Mod I/Alcohol-specific Mod II	0.50	0.48	0.79		0.98	0.68	0.66	0.47	0.46	0.75	0.56	0.75	0.65	0.67
5. Standard Mod II/Alcohol-specific Mod I	0.50	0.48	0.79	0.98		0.68	0.66	0.47	0.46	0.75	0.56	0.75	0.65	0.67
6. Alcohol-specific Severe	0.31	0.30	0.52	0.62	0.63		0.75	0.68	0.67	0.58	0.38	0.56	0.45	0.63
7. Standard Severe/Standard Mod Alt. /Alcohol-specific Mod Alt.	0.33	0.32	0.57	0.65	0.65	0.73		0.63	0.69	0.55	0.37	0.54	0.44	0.46
8. Standard Severe Alt.	0.21	0.20	0.36	0.42	0.42	0.59	0.62		0.68	0.40	0.26	0.39	0.31	0.52
9. Alcohol-specific Severe Alt.	0.19	0.18	0.33	0.38	0.38	0.61	0.58	0.70		0.39	0.26	0.38	0.30	0.51
10. DSM-IV	0.64	0.62	0.74	0.68	0.69	0.48	0.51	0.33	0.30		0.65	0.86	0.78	0.64
11. DSM-5	0.95	0.98	0.55	0.48	0.47	0.30	0.31	0.20	0.18	0.60		0.67	0.84	0.46
12. ICD-10	0.59	0.57	0.77	0.72	0.73	0.52	0.55	0.35	0.32	0.84	0.56		0.80	0.63
13. ICD-11	0.76	0.81	0.64	0.57	0.57	0.37	0.38	0.25	0.22	0.75	0.81	0.69		0.54
14. Wakefield's HD	0.41	0.41	0.60	0.63	0.63	0.44	0.59	0.48	0.42	0.60	0.40	0.64	0.49	

Note. Alt. = alternative; Mod = moderate; DSM-IV = *Diagnostic and statistical manual, 4th edition*, alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition*, alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction.
NESARC estimates below diagonal; NESARC-III estimates above diagonal.
All correlations were significant ($p<0.05$).

Supplemental Table 8

Weighted Kappa Estimates of Optimal Solutions and Established Diagnostic Approaches

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Standard Mild		0.91	0.61	0.51	0.51	0.26	0.28	0.14	0.13	0.64	0.95	0.67	0.80	0.37
2. Alcohol-specific Mild	0.93		0.61	0.51	0.51	0.26	0.28	0.14	0.14	0.65	0.95	0.67	0.84	0.38
3. Standard/Alcohol-specific Mild Alt.	0.50	0.47		0.80	0.80	0.49	0.53	0.29	0.28	0.78	0.57	0.80	0.68	0.60
4. Standard Mod I/Alcohol-specific Mod II	0.40	0.38	0.78		0.98	0.61	0.63	0.36	0.35	0.74	0.48	0.73	0.60	0.66
5. Standard Mod II/Alcohol-specific Mod I	0.40	0.38	0.78	0.97		0.61	0.64	0.36	0.35	0.74	0.47	0.74	0.60	0.66
6. Alcohol-specific Severe	0.18	0.17	0.44	0.56	0.56		0.75	0.59	0.65	0.47	0.24	0.45	0.32	0.45
7. Standard Severe/Standard Mod Alt. /Alcohol-specific Mod Alt.	0.33	0.18	0.49	0.59	0.60	0.73		0.63	0.62	0.50	0.25	0.48	0.34	0.62
8. Standard Severe Alt.	0.08	0.08	0.23	0.30	0.30	0.55	0.57		0.68	0.27	0.13	0.26	0.18	0.44
9. Alcohol-specific Severe Alt.	0.07	0.06	0.20	0.25	0.25	0.54	0.50	0.69		0.26	0.12	0.25	0.17	0.43
10. DSM-IV	0.58	0.55	0.74	0.66	0.67	0.38	0.41	0.19	0.16		0.60	0.86	0.76	0.64
11. DSM-5	0.95	0.98	0.46	0.37	0.37	0.16	0.17	0.08	0.06	0.53		0.62	0.83	0.35
12. ICD-10	0.52	0.49	0.77	0.71	0.72	0.43	0.46	0.22	0.19	0.84	0.48		0.78	0.58
13. ICD-11	0.75	0.80	0.59	0.50	0.50	0.24	0.25	0.11	0.09	0.72	0.79	0.65		0.45
14. Wakefield's HD	0.30	0.29	0.58	0.63	0.62	0.42	0.56	0.38	0.31	0.56	0.28	0.60	0.39	

Note. Alt. = alternative; Mod = moderate; DSM-IV = *Diagnostic and statistical manual, 4th edition*, alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition*, alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction.

NESARC estimates below diagonal; NESARC-III estimates above diagonal.

All kappa estimates were significant ($p<0.05$).

Supplemental Table 9

Phi Coefficients of Optimal Solutions and Established Diagnostic Approaches

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Standard Mild		0.91	0.66	0.59	0.59	0.39	0.40	0.27	0.27	0.69	0.95	0.71	0.80	0.48
2. Alcohol-specific Mild	0.93		0.67	0.59	0.59	0.39	0.40	0.27	0.27	0.69	0.95	0.71	0.85	0.48
3. Standard/Alcohol-specific Mild Alt.	0.58	0.56		0.81	0.81	0.56	0.60	0.41	0.40	0.78	0.63	0.80	0.71	0.63
4. Standard Mod I/Alcohol-specific Mod II	0.50	0.48	0.79		0.98	0.66	0.68	0.47	0.46	0.75	0.56	0.75	0.65	0.67
5. Standard Mod II/Alcohol-specific Mod I	0.50	0.48	0.79	0.97		0.66	0.68	0.47	0.46	0.75	0.56	0.75	0.65	0.67
6. Alcohol-specific Severe	0.31	0.30	0.52	0.62	0.62		0.75	0.63	0.69	0.55	0.37	0.54	0.44	0.46
7. Standard Severe/Standard Mod Alt. /Alcohol-specific Mod Alt.	0.19	0.32	0.57	0.65	0.65	0.73		0.68	0.67	0.58	0.38	0.56	0.45	0.63
8. Standard Severe Alt.	0.21	0.20	0.36	0.42	0.42	0.59	0.62		0.68	0.40	0.26	0.39	0.31	0.52
9. Alcohol-specific Severe Alt.	0.19	0.18	0.33	0.38	0.38	0.61	0.58	0.70		0.39	0.26	0.38	0.30	0.51
10. DSM-IV	0.64	0.62	0.74	0.68	0.69	0.48	0.51	0.33	0.30		0.65	0.86	0.78	0.64
11. DSM-5	0.95	0.98	0.54	0.48	0.47	0.30	0.31	0.20	0.18	0.60		0.67	0.84	0.46
12. ICD-10	0.59	0.57	0.77	0.72	0.73	0.52	0.55	0.35	0.32	0.84	0.56		0.80	0.63
13. ICD-11	0.76	0.81	0.64	0.57	0.57	0.37	0.38	0.25	0.22	0.75	0.81	0.69		0.54
14. Wakefield's HD	0.41	0.41	0.60	0.63	0.63	0.44	0.58	0.48	0.42	0.60	0.40	0.64	0.49	

Note. Alt. = alternative; Mod = moderate; DSM-IV = *Diagnostic and statistical manual, 4th edition*, alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition*, alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction.
NESARC estimates below diagonal; NESARC-III estimates above diagonal.
All phi coefficients were significant ($p<0.05$).

Supplemental Table 10

Age of First Drink, Drug Use < 15, Family History, and Treatment Utilization Regression Models for Alternative Severe Optimal Solutions in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Age of First Drink < 15 (n=1488)														
Standard Severe Alt.	4.49	2.78-7.27	234.79	0.01	19.45	0.00	32.92	0.00	18.95	0.00	28.22	0.00	8.31	0.00
Alcohol-specific Severe Alt.	5.03	3.17-8.00	234.88	0.01	21.51	0.00	34.35	0.00	21.03	0.00	29.85	0.00	11.64	0.00
DSM-IV	2.26	1.84-2.77	267.98	0.01	--	--	--	--	--	--	--	--	--	--
DSM-5	1.76	1.51-2.05	253.17	0.01	--	--	--	--	--	--	--	--	--	--
ICD-10	2.28	1.83-2.84	260.83	0.01	--	--	--	--	--	--	--	--	--	--
ICD-11	1.89	1.58-2.26	254.75	0.01	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	3.04	2.35-3.93	275.12	0.01	--	--	--	--	--	--	--	--	--	--
Drug Use (n=7104)														
Standard Severe Alt.	7.94	5.22-12.08	1753.69	0.08	29.78	0.00	51.18	0.00	25.70	0.00	46.44	0.00	16.58	0.00
Alcohol-specific Severe Alt.	6.69	4.07-11.00	1714.82	0.07	16.98	0.00	32.41	0.00	14.14	0.00	28.85	0.00	9.46	0.00
DSM-IV	3.26	2.85-3.72	2038.40	0.09	--	--	--	--	--	--	--	--	--	--
DSM-5	2.66	2.40-2.95	2237.04	0.10	--	--	--	--	--	--	--	--	--	--
ICD-10	3.47	3.02-3.99	2024.73	0.09	--	--	--	--	--	--	--	--	--	--
ICD-11	2.66	2.37-2.98	2081.53	0.09	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	4.21	3.45-5.13	1914.81	0.08	--	--	--	--	--	--	--	--	--	--
Family History of Alcohol Problems (n=5216)														
Standard Severe Alt.	2.79	1.82-4.28	264.12	0.01	8.93	0.00	17.09	0.00	8.32	0.00	24.84	0.00	1.15	0.00
Alcohol-specific Severe Alt.	2.89	1.83-4.57	260.20	0.01	8.49	0.00	15.71	0.00	7.94	0.00	13.24	0.00	1.90	0.00

Supplemental Table 10

Age of First Drink, Drug Use < 15, Family History, and Treatment Utilization Regression Models for Alternative Severe Optimal Solutions in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
DSM-IV	1.88	1.62-2.19	332.94	0.02	--	--	--	--	--	--	--	--	--	--
DSM-5	1.62	1.44-1.82	349.88	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	1.91	1.63-2.24	324.44	0.01	--	--	--	--	--	--	--	--	--	--
ICD-11	1.68	1.48-1.90	334.97	0.02	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.52	2.05-3.10	346.16	0.02	--	--	--	--	--	--	--	--	--	--
Family History of Drug Problems (n=1188)														
Standard Severe Alt.	3.00	1.71-5.26	294.86	0.01	12.37	0.00	11.21	0.00	9.53	0.00	11.93	0.00	3.44	0.00
Alcohol-specific Severe Alt.	3.91	2.29-6.70	303.88	0.01	20.44	0.00	18.74	0.00	17.02	0.00	19.69	0.00	9.87	0.00
DSM-IV	1.44	1.12-1.85	286.64	0.01	--	--	--	--	--	--	--	--	--	--
DSM-5	1.57	1.32-1.87	311.54	0.01	--	--	--	--	--	--	--	--	--	--
ICD-10	1.62	1.24-2.10	294.25	0.01	--	--	--	--	--	--	--	--	--	--
ICD-11	1.47	1.18-1.83	295.51	0.01	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.20	1.66-2.90	308.10	0.01	--	--	--	--	--	--	--	--	--	--
Family History of Behavior Problems (n=1707)														
Standard Severe Alt.	2.81	1.58-5.00	232.65	0.01	11.16	0.00	10.72	0.00	8.76	0.00	10.85	0.00	4.13	0.00
Alcohol-specific Severe Alt.	2.52	1.30-4.89	224.16	0.01	5.89	0.00	5.79	0.00	4.34	0.00	5.82	0.00	1.72	0.00
DSM-IV	1.52	1.24-1.87	231.60	0.01	--	--	--	--	--	--	--	--	--	--
DSM-5	1.63	1.37-1.93	267.35	0.01	--	--	--	--	--	--	--	--	--	--
ICD-10	1.66	1.33-2.08	239.06	0.01	--	--	--	--	--	--	--	--	--	--
ICD-11	1.56	1.30-1.87	247.23	0.01	--	--	--	--	--	--	--	--	--	--

Supplemental Table 10

Age of First Drink, Drug Use < 15, Family History, and Treatment Utilization Regression Models for Alternative Severe Optimal Solutions in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Wakefield's HD	2.05	1.52-2.76	245.64	0.01	--	--	--	--	--	--	--	--	--	--
Alcohol Treatment (n=1201)														
Standard Severe Alt.	24.22	14.93-39.30	646.36	0.03	86.77	0.00	162.94	0.01	77.22	0.00	132.14	0.01	33.08	0.00
Alcohol-specific Severe Alt.	24.46	14.89-40.18	588.25	0.03	69.87	0.00	132.33	0.01	62.14	0.00	106.72	0.00	30.99	0.00
DSM-IV	7.94	6.68-9.45	1007.81	0.05	--	--	--	--	--	--	--	--	--	--
DSM-5	5.34	4.52-6.30	951.49	0.05	--	--	--	--	--	--	--	--	--	--
ICD-10	8.53	7.10-10.24	1003.03	0.05	--	--	--	--	--	--	--	--	--	--
ICD-11	5.99	5.10-7.02	960.37	0.05	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	13.07	10.36-16.49	1003.80	0.05	--	--	--	--	--	--	--	--	--	--
Drug Treatment (n=547)														
Standard Severe Alt.	11.96	6.50-22.02	362.71	0.02	29.25	0.00	53.15	0.00	24.22	0.00	44.59	0.00	9.09	0.00
Alcohol-specific Severe Alt.	14.73	7.86-27.61	368.11	0.02	35.26	0.00	58.91	0.00	30.15	0.00	50.53	0.00	16.12	0.00
DSM-IV	4.73	3.54-6.31	442.31	0.03	--	--	--	--	--	--	--	--	--	--
DSM-5	3.15	2.43-4.08	406.31	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	5.33	3.98-7.13	461.08	0.03	--	--	--	--	--	--	--	--	--	--
ICD-11	3.53	2.68-4.63	412.59	0.02	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	7.80	5.55-10.97	472.37	0.03	--	--	--	--	--	--	--	--	--	--

Note. Alt. = alternative; DSM-IV = *Diagnostic and statistical manual, 4th edition,* alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition,* alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction. Fit change = change in fit from single predictor model to joint predictor model.

Supplemental Table 10

Age of First Drink, Drug Use < 15, Family History, and Treatment Utilization Regression Models for Alternative Severe Optimal Solutions in NESARC Sample

Single Predictor Models						**Joint Predictor Models**											
						DSM-IV		**DSM-5**		**ICD-10**		**ICD-11**		**Wakefield's HD**			
		Estimates		**Fit**		**Fit Change**		**Fit Change**		**Fit Change**		**Fit Change**		**Fit Change**			
Solution	**OR**	**95% CI**		**Chi-sq.**	**R^2**	**Chi-sq.**	**R^2**	**Chi-sq.**	**R^2**	**Chi-sq.**	**R^2**	**Chi-sq.**	**R^2**	**Chi-sq.**	**R^2**		

OR = odds ratio estimate; 95% CI = 95% confidence interval for odds ratio estimate; Chi-sq. = log-likelihood ratio chi-square; Chi-sq. values > 3.84 chi-square critical value (*df*=1; alpha=0.05) were considered significant.

-- = not applicable; Cells highlighted orange = Standard Severe Alt. change in chi-square in joint predictor models greater than Alcohol-specific Severe Alt. change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05); Cells highlighted blue = Alcohol-specific Severe Alt. change in chi-square in joint predictor models greater than Standard Severe Alt. change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05).

Supplemental Table 11

Age of First Drink < 15, Drug Use, Family History, and Treatment Utilization Regression Models for Alternative Severe Optimal Solutions in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Age of First Drink < 15 (n=2339)														
Standard Severe Alt.	4.32	3.30-5.66	369.84	0.02	44.00	0.00	61.16	0.00	42.79	0.00	54.89	0.00	29.19	0.00
Alcohol-specific Severe Alt.	3.41	2.63-4.42	322.07	0.01	18.22	0.00	30.77	0.00	17.64	0.00	26.09	0.00	8.11	0.00
DSM-IV	2.32	2.00-2.68	401.99	0.02	--	--	--	--	--	--	--	--	--	--
DSM-5	2.11	1.85-2.40	442.48	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	2.35	2.04-2.72	416.06	0.02	--	--	--	--	--	--	--	--	--	--
ICD-11	2.15	1.89-2.44	418.67	0.02	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.86	2.41-3.39	399.77	0.02	--	--	--	--	--	--	--	--	--	--
Drug Use (n=10208)														
Standard Severe Alt.	5.94	4.47-7.89	1685.61	0.07	32.50	0.00	54.67	0.00	30.42	0.00	47.73	0.00	24.97	0.00
Alcohol-specific Severe Alt.	5.61	4.00-7.88	1666.50	0.07	26.50	0.00	46.57	0.00	24.71	0.00	40.23	0.00	19.55	0.00
DSM-IV	3.21	2.83-3.63	2032.48	0.08	--	--	--	--	--	--	--	--	--	--
DSM-5	2.84	2.59-3.11	2322.39	0.09	--	--	--	--	--	--	--	--	--	--
ICD-10	3.30	2.92-3.72	2083.50	0.08	--	--	--	--	--	--	--	--	--	--
ICD-11	2.87	2.58-3.18	2153.67	0.08	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	3.91	3.31-4.62	1881.43	0.07	--	--	--	--	--	--	--	--	--	--
Family History of Alcohol Problems (n=7605)														
Standard Severe Alt.	3.52	2.71-4.58	550.03	0.02	22.61	0.00	51.89	0.00	23.28	0.00	14.08	0.00	8.50	0.00
Alcohol-specific Severe Alt.	3.21	2.50-4.12	529.72	0.02	14.67	0.00	39.49	0.00	15.24	0.00	29.38	0.00	3.62	0.00
DSM-IV	2.34	2.09-2.62	727.64	0.03	--	--	--	--	--	--	--	--	--	--
DSM-5	1.85	1.68-2.03	701.77	0.03	--	--	--	--	--	--	--	--	--	--

Supplemental Table 11
Age of First Drink < 15, Drug Use, Family History, and Treatment Utilization Regression Models for Alternative Severe Optimal Solutions in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
ICD-10	2.33	2.09-2.60	737.26	0.03	--	--	--	--	--	--	--	--	--	--
ICD-11	2.00	1.81-2.22	711.13	0.03	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	3.06	2.61-3.59	714.94	0.03	--	--	--	--	--	--	--	--	--	--
Family History of Drug Problems (n=2577)														
Standard Severe Alt.	2.60	1.93-3.51	1483.91	0.06	11.05	0.00	20.31	0.00	11.81	0.00	15.86	0.00	4.00	0.00
Alcohol-specific Severe Alt.	2.29	1.70-3.08	1471.28	0.06	5.15	0.00	12.07	0.00	5.68	0.00	8.69	0.00	0.60	0.00
DSM-IV	1.85	1.60-2.13	1523.05	0.06	--	--	--	--	--	--	--	--	--	--
DSM-5	1.61	1.42-1.83	1519.72	0.06	--	--	--	--	--	--	--	--	--	--
ICD-10	1.82	1.59-2.09	1522.11	0.06	--	--	--	--	--	--	--	--	--	--
ICD-11	1.72	1.51-1.96	1527.77	0.06	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.34	1.93-2.84	1530.54	0.06	--	--	--	--	--	--	--	--	--	--
Family History of Behavior Problems (n=3536)														
Standard Severe Alt.	2.51	1.88-3.36	597.56	0.03	9.82	0.00	20.12	0.00	7.60	0.00	12.76	0.00	2.87	0.00
Alcohol-specific Severe Alt.	2.40	1.85-3.13	591.23	0.03	7.28	0.00	16.36	0.00	5.44	0.00	9.87	0.00	1.47	0.00
DSM-IV	1.87	1.65-2.12	656.03	0.03	--	--	--	--	--	--	--	--	--	--
DSM-5	1.62	1.46-1.80	655.14	0.03	--	--	--	--	--	--	--	--	--	--
ICD-10	1.98	1.75-2.24	684.37	0.03	--	--	--	--	--	--	--	--	--	--
ICD-11	1.82	1.64-2.03	686.48	0.03	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.34	1.99-2.76	664.50	0.03	--	--	--	--	--	--	--	--	--	--
Alcohol Treatment (n=1772)														
Standard Severe Alt.	15.91	12.03-21.06	968.60	0.04	122.81	0.00	226.00	0.01	125.47	0.00	183.03	0.01	53.23	0.00

Supplemental Table 11

Age of First Drink < 15, Drug Use, Family History, and Treatment Utilization Regression Models for Alternative Severe Optimal Solutions in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Alcohol-specific Severe Alt.	13.37	10.01-17.87	882.64	0.04	85.27	0.00	173.94	0.01	87.77	0.00	136.56	0.01	27.96	0.00
DSM-IV	7.20	6.20-8.36	1362.55	0.05	--	--	--	--	--	--	--	--	--	--
DSM-5	5.44	4.79-6.19	1345.44	0.05	--	--	--	--	--	--	--	--	--	--
ICD-10	7.24	6.22-8.43	1394.86	0.06	--	--	--	--	--	--	--	--	--	--
ICD-11	5.98	5.22-6.86	1352.85	0.05	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	11.38	9.55-13.55	1432.84	0.06	--	--	--	--	--	--	--	--	--	--
Drug Treatment (n=861)														
Standard Severe Alt.	7.34	5.32-10.13	368.87	0.02	37.18	0.00	65.02	0.00	38.34	0.00	53.75	0.00	17.45	0.00
Alcohol-specific Severe Alt.	6.27	4.45-8.83	334.47	0.01	22.15	0.00	44.76	0.00	23.17	0.00	35.48	0.00	6.80	0.00
DSM-IV	4.31	3.52-5.28	472.90	0.02	--	--	--	--	--	--	--	--	--	--
DSM-5	3.70	3.07-4.46	490.22	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	4.31	3.51-5.28	479.97	0.02	--	--	--	--	--	--	--	--	--	--
ICD-11	3.86	3.18-4.69	481.24	0.02	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	5.80	4.62-7.29	478.39	0.02	--	--	--	--	--	--	--	--	--	--

Note. Alt. = alternative; DSM-IV = *Diagnostic and statistical manual, 4th edition,* alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition,* alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction.

Fit change = change in fit from single predictor model to joint predictor model.

OR = odds ratio estimate; 95% CI = 95% confidence interval for odds ratio estimate; Chi-sq. = log-likelihood ratio chi-square; Chi-sq. values > 3.84 chi-square critical value (*df*=1; alpha=0.05) were considered significant.

-- = not applicable; Cells highlighted orange = Standard Severe Alt. change in chi-square in joint predictor models greater than Alcohol-specific Severe Alt. change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05); Cells highlighted blue = Alcohol-specific Severe Alt. change in chi-square in joint predictor models greater than Standard Severe Alt. change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05).

Supplemental Table 12

Mental Health and Psychosocial Problems Regression Models for Alternative Severe Optimal Solutions in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Mood (n=2456)														
Standard Severe Alt.	9.74	6.46-14.68	770.50	0.03	50.69	0.00	94.80	0.00	39.02	0.00	71.33	0.00	18.57	0.00
Alcohol-specific Severe Alt.	10.07	6.64-15.26	746.91	0.03	43.88	0.00	81.66	0.00	33.98	0.00	61.48	0.00	19.39	0.00
DSM-IV	3.85	3.27-4.53	953.96	0.04	--	--	--	--	--	--	--	--	--	--
DSM-5	2.56	2.27-2.89	891.82	0.04	--	--	--	--	--	--	--	--	--	--
ICD-10	4.48	3.79-5.28	1006.56	0.04	--	--	--	--	--	--	--	--	--	--
ICD-11	3.20	2.82-3.63	975.21	0.04	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	5.99	4.82-7.43	957.90	0.04	--	--	--	--	--	--	--	--	--	--
Anxiety (n=2974)														
Standard Severe Alt.	6.05	3.91-9.36	628.91	0.03	27.15	0.00	53.99	0.00	20.42	0.00	40.58	0.00	5.43	0.00
Alcohol-specific Severe Alt.	4.73	3.01-7.41	585.75	0.03	10.33	0.00	27.04	0.00	6.66	0.00	18.46	0.00	0.73	0.00
DSM-IV	3.06	2.57-3.63	780.50	0.03	--	--	--	--	--	--	--	--	--	--
DSM-5	2.21	1.96-2.50	754.37	0.03	--	--	--	--	--	--	--	--	--	--
ICD-10	3.44	2.88-4.10	811.69	0.04	--	--	--	--	--	--	--	--	--	--
ICD-11	2.59	2.25-2.97	794.11	0.04	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	4.79	3.81-6.03	810.81	0.04	--	--	--	--	--	--	--	--	--	--
Financial Problems (n=3139)														
Standard Severe Alt.	6.24	4.16-9.36	1098.39	0.05	32.27	0.00	57.32	0.00	26.28	0.00	46.41	0.00	12.02	0.00
Alcohol-specific Severe Alt.	5.82	3.74-9.05	1070.76	0.05	22.06	0.00	41.45	0.00	17.58	0.00	32.92	0.00	8.56	0.00

Supplemental Table 12
Mental Health and Psychosocial Problems Regression Models for Alternative Severe Optimal Solutions in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
DSM-IV	2.92	2.49-3.43	1234.44	0.05	--	--	--	--	--	--	--	--	--	--
DSM-5	2.25	2.00-2.53	1238.62	0.05	--	--	--	--	--	--	--	--	--	--
ICD-10	3.20	2.73-3.76	1252.28	0.06	--	--	--	--	--	--	--	--	--	--
ICD-11	2.49	2.18-2.83	1247.36	0.06	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	4.17	3.36-5.16	1224.77	0.05	--	--	--	--	--	--	--	--	--	--
Employment Problems (n=4287)														
Standard Severe Alt.	3.23	1.98-5.25	1535.03	0.07	7.34	0.00	21.42	0.00	6.70	0.00	15.31	0.00	3.55	0.00
Alcohol-specific Severe Alt.	2.90	1.83-4.60	1518.53	0.07	3.24	0.00	12.64	0.00	2.84	0.00	8.39	0.00	1.48	0.00
DSM-IV	2.32	2.03-2.65	1675.33	0.07	--	--	--	--	--	--	--	--	--	--
DSM-5	1.77	1.59-1.98	1651.68	0.07	--	--	--	--	--	--	--	--	--	--
ICD-10	2.35	2.03-2.71	1659.68	0.07	--	--	--	--	--	--	--	--	--	--
ICD-11	1.95	1.73-2.20	1666.31	0.07	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.60	2.11-3.21	1607.96	0.07	--	--	--	--	--	--	--	--	--	--
Interpersonal Problems (n=2636)														
Standard Severe Alt.	4.88	3.36-7.11	670.49	0.03	18.13	0.00	34.13	0.00	16.50	0.00	26.59	0.00	15.22	0.00
Alcohol-specific Severe Alt.	4.84	3.17-7.37	656.22	0.03	14.26	0.00	27.37	0.00	12.93	0.00	21.14	0.00	12.99	0.00
DSM-IV	2.80	2.38-3.28	802.78	0.04	--	--	--	--	--	--	--	--	--	--
DSM-5	2.30	2.03-2.60	836.51	0.04	--	--	--	--	--	--	--	--	--	--
ICD-10	2.87	2.46-3.36	792.12	0.04	--	--	--	--	--	--	--	--	--	--
ICD-11	2.49	2.20-2.83	833.78	0.04	--	--	--	--	--	--	--	--	--	--

Supplemental Table 12

Mental Health and Psychosocial Problems Regression Models for Alternative Severe Optimal Solutions in NESARC Sample

		Single Predictor Models			Joint Predictor Models										
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
		Estimates		Fit	Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Wakefield's HD	2.94	2.34-3.70	710.58	0.03	--	--	--	--	--	--	--	--	--	--
Legal Problems (n=346)														
Standard Severe Alt.	14.68	8.65-24.94	326.38	0.01	38.34	0.00	59.11	0.00	36.46	0.00	55.36	0.00	21.51	0.00
Alcohol-specific Severe Alt.	14.56	8.00-26.46	302.28	0.01	29.33	0.00	45.98	0.00	27.82	0.00	42.64	0.00	17.18	0.00
DSM-IV	5.57	4.04-7.69	371.03	0.02	--	--	--	--	--	--	--	--	--	--
DSM-5	4.66	3.51-6.19	378.05	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	5.68	4.13-7.81	363.69	0.02	--	--	--	--	--	--	--	--	--	--
ICD-11	4.20	3.12-5.64	344.24	0.02	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	7.64	5.43-10.75	361.85	0.02	--	--	--	--	--	--	--	--	--	--

Note. Alt. = alternative; DSM-IV = *Diagnostic and statistical manual, 4th edition,* alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition,* alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction.

Fit change = change in fit from single predictor model to joint predictor model.

OR = odds ratio estimate; 95% CI = 95% confidence interval for odds ratio estimate; Chi-sq. = log-likelihood ratio chi-square; Chi-sq. values > 3.84 chi-square critical value (*df*=1; alpha=0.05) were considered significant.

-- = not applicable; Cells highlighted orange = Standard Severe Alt. change in chi-square in joint predictor models greater than Alcohol-specific Severe Alt. change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05); Cells highlighted blue = Alcohol-specific Severe Alt. change in chi-square in joint predictor models greater than Standard Severe Alt. change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05).

Supplemental Table 13
Mental Health and Psychosocial Problems Regression Models for Alternative Severe Optimal Solutions in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Mood (n=3568)														
Standard Severe Alt.	4.36	3.39-5.62	679.71	0.03	24.27	0.00	61.43	0.00	25.64	0.00	44.50	0.00	7.62	0.00
Alcohol-specific Severe Alt.	4.15	3.21-5.37	663.88	0.03	19.04	0.00	52.41	0.00	20.28	0.00	37.08	0.00	4.69	0.00
DSM-IV	3.02	2.70-3.36	902.03	0.04	--	--	--	--	--	--	--	--	--	--
DSM-5	2.25	2.04-2.49	843.11	0.03	--	--	--	--	--	--	--	--	--	--
ICD-10	2.99	2.67-3.34	909.32	0.04	--	--	--	--	--	--	--	--	--	--
ICD-11	2.55	2.30-2.83	884.32	0.04	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	3.99	3.45-4.61	883.57	0.04	--	--	--	--	--	--	--	--	--	--
Anxiety (n=3272)														
Standard Severe Alt.	3.08	2.36-4.02	589.60	0.02	13.60	0.00	29.85	0.00	13.32	0.00	21.08	0.00	3.96	0.00
Alcohol-specific Severe Alt.	3.03	2.34-3.94	585.21	0.02	12.21	0.00	27.58	0.00	11.97	0.00	19.27	0.00	3.31	0.00
DSM-IV	2.24	1.96-2.57	690.43	0.03	--	--	--	--	--	--	--	--	--	--
DSM-5	1.87	1.63-2.14	685.49	0.03	--	--	--	--	--	--	--	--	--	--
ICD-10	2.27	1.98-2.60	703.24	0.03	--	--	--	--	--	--	--	--	--	--
ICD-11	2.07	1.81-2.36	708.32	0.03	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.84	2.39-3.37	690.48	0.03	--	--	--	--	--	--	--	--	--	--
Financial Problems (n=298)														
Standard Severe Alt.	2.74	1.32-5.65	24.40	0.00	5.26	0.00	6.17	0.00	6.02	0.00	6.18	0.00	3.48	0.00
Alcohol-specific Severe Alt.	2.84	1.36-5.94	24.76	0.00	5.62	0.00	6.53	0.00	6.39	0.00	5.86	0.00	3.82	0.00
DSM-IV	1.33	0.89-1.97	19.17	0.00	--	--	--	--	--	--	--	--	--	--

Supplemental Table 13
Mental Health and Psychosocial Problems Regression Models for Alternative Severe Optimal Solutions in NESARC-III Sample

	Single Predictor Models				**Joint Predictor Models**									
					DSM-IV		**DSM-5**		**ICD-10**		**ICD-11**		**Wakefield's HD**	
	Estimates		**Fit**		**Fit Change**		**Fit Change**		**Fit Change**		**Fit Change**		**Fit Change**	
Solution	**OR**	**95% CI**	**Chi-sq.**	**R²**	**Chi-sq.**	**R²**	**Chi-sq.**	**R²**	**Chi-sq.**	**R²**	**Chi-sq.**	**R²**	**Chi-sq.**	**R²**
DSM-5	1.17	0.82-1.66	18.27	0.00	--	--	--	--	--	--	--	--	--	--
ICD-10	1.24	0.82-1.88	18.40	0.00	--	--	--	--	--	--	--	--	--	--
ICD-11	1.27	0.89-1.80	19.08	0.00	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	1.68	1.04-2.71	21.25	0.00	--	--	--	--	--	--	--	--	--	--
Employment Problems (n=6584)														
Standard Severe Alt.	2.40	1.84-3.12	1907.34	0.08	4.98	0.00	19.06	0.00	5.79	0.00	13.66	0.00	2.99	0.00
Alcohol-specific Severe Alt.	2.58	2.00-3.32	1915.35	0.08	8.29	0.00	24.41	0.00	9.29	0.00	18.42	0.00	5.70	0.00
DSM-IV	2.07	1.85-2.31	2061.80	0.08	--	--	--	--	--	--	--	--	--	--
DSM-5	1.71	1.58-1.85	2047.20	0.08	--	--	--	--	--	--	--	--	--	--
ICD-10	2.03	1.82-2.27	2061.49	0.08	--	--	--	--	--	--	--	--	--	--
ICD-11	1.80	1.64-1.98	2045.42	0.08	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.26	1.92-2.66	1996.76	0.08	--	--	--	--	--	--	--	--	--	--
Interpersonal Problems (n=3986)														
Standard Severe Alt.	4.00	3.07-5.21	958.65	0.04	29.87	0.00	49.79	0.00	30.25	0.00	42.08	0.00	29.44	0.00
Alcohol-specific Severe Alt.	3.24	2.54-4.13	913.65	0.04	11.18	0.00	24.97	0.00	11.50	0.00	19.47	0.00	9.31	0.00
DSM-IV	2.55	2.26-2.87	1097.15	0.04	--	--	--	--	--	--	--	--	--	--
DSM-5	2.30	2.08-2.54	1171.33	0.05	--	--	--	--	--	--	--	--	--	--
ICD-10	2.55	2.25-2.88	1108.73	0.04	--	--	--	--	--	--	--	--	--	--
ICD-11	2.35	2.11-2.63	1133.67	0.05	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.70	2.30-3.17	997.88	0.04	--	--	--	--	--	--	--	--	--	--

Supplemental Table 13
Mental Health and Psychosocial Problems Regression Models for Alternative Severe Optimal Solutions in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	OR	95% CI	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Legal Problems (n=490)														
Standard Severe Alt.	7.28	5.18-10.24	419.88	0.02	28.46	0.00	44.87	0.00	32.27	0.00	40.84	0.00	27.51	0.00
Alcohol-specific Severe Alt.	7.35	5.17-10.45	416.34	0.02	27.65	0.00	43.41	0.00	31.33	0.00	39.54	0.00	24.77	0.00
DSM-IV	4.05	3.14-5.21	457.78	0.02	--	--	--	--	--	--	--	--	--	--
DSM-5	3.69	2.89-4.70	470.49	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	3.77	2.97-4.79	444.86	0.02	--	--	--	--	--	--	--	--	--	--
ICD-11	3.51	2.73-4.52	449.79	0.02	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	4.33	3.35-5.59	418.21	0.02	--	--	--	--	--	--	--	--	--	--

Note. Alt. = alternative; DSM-IV = *Diagnostic and statistical manual, 4th edition,* alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition,* alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = *Wakefield's Harmful Dysfunction.*
Fit change = change in fit from single predictor model to joint predictor model.
OR = odds ratio estimate; 95% CI = 95% confidence interval for odds ratio estimate; Chi-sq. = log-likelihood ratio chi-square; Chi-sq. values > 3.84 chi-square critical value (*df*=1; alpha=0.05) were considered significant.
-- = not applicable; Cells highlighted orange = Standard Severe Alt. change in chi-square in joint predictor models greater than Alcohol-specific Severe Alt. change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05); Cells highlighted blue = Alcohol-specific Severe Alt. change in chi-square in joint predictor models greater than Standard Severe Alt. change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05).

Supplemental Table 14
Recent Functioning Regression Models for Alternative Severe Optimal Solutions in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	β	SE	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²	Chi-sq.	R²
Social Functioning														
Standard Severe Alt.	9.76	1.35	412233.33	0.02	6483.60	0.00	17453.19	0.01	5881.32	0.00	15450.30	0.00	-655.14	0.00
Alcohol-specific Severe Alt.	10.48	1.42	397254.29	0.02	-1379.38	0.00	5204.92	0.01	-1068.96	0.00	3102.56	0.00	-639.33	0.00
DSM-IV	5.08	0.37	443206.33	0.03	--	--	--	--	--	--	--	--	--	--
DSM-5	3.12	0.22	426822.60	0.03	--	--	--	--	--	--	--	--	--	--
ICD-10	5.98	0.41	443738.51	0.03	--	--	--	--	--	--	--	--	--	--
ICD-11	4.13	0.29	443941.52	0.03	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	7.56	0.62	438946.52	0.03	--	--	--	--	--	--	--	--	--	--
Mental Health														
Standard Severe Alt.	11.26	1.33	359861.66	0.04	5017.17	0.00	3511.42	0.01	3518.64	0.00	3835.00	0.01	1223.32	0.00
Alcohol-specific Severe Alt.	11.65	1.32	353739.76	0.03	-1052.06	0.00	-1031.21	0.01	-418.05	0.00	-1517.27	0.00	216.40	0.00
DSM-IV	6.02	0.38	359192.69	0.05	--	--	--	--	--	--	--	--	--	--
DSM-5	3.87	0.22	359315.97	0.05	--	--	--	--	--	--	--	--	--	--
ICD-10	6.46	0.40	359057.89	0.05	--	--	--	--	--	--	--	--	--	--
ICD-11	4.76	0.27	368333.36	0.05	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	8.47	0.58	367331.91	0.05	--	--	--	--	--	--	--	--	--	--
Physical Functioning														
Standard Severe Alt.	4.92	1.04	402314.10	0.10	1864.50	0.00	2885.49	0.00	1312.85	0.00	1157.85	0.00	1049.67	0.00
Alcohol-specific Severe Alt.	5.93	1.15	400542.49	0.10	1018.68	0.00	2270.62	0.00	854.88	0.00	219.29	0.00	423.91	0.00

Supplemental Table 14

Recent Functioning Regression Models for Alternative Severe Optimal Solutions in NESARC Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	β	SE	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
DSM-IV	2.58	0.31	423186.95	0.10	--	--	--	--	--	--	--	--	--	--
DSM-5	1.51	0.21	438191.62	0.10	--	--	--	--	--	--	--	--	--	--
ICD-10	2.96	0.33	422971.27	0.10	--	--	--	--	--	--	--	--	--	--
ICD-11	2.29	0.24	456328.65	0.10	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	3.93	0.49	415404.36	0.10	--	--	--	--	--	--	--	--	--	--

Note. Alt. = alternative; DSM-IV = *Diagnostic and statistical manual, 4th edition,* alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition,* alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction. Fit change = change in fit from single predictor model to joint predictor model.

SE = standard error; Chi-sq. = Wald F chi-square; Chi-sq. values > 3.84 chi-square critical value (*df*=1; alpha=0.05) were considered significant.

-- = not applicable; Cells highlighted orange = Standard Severe Alt. change in chi-square in joint predictor models greater than Alcohol-specific Severe Alt. change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05); Cells highlighted blue = Alcohol-specific Severe Alt. change in chi-square in joint predictor models greater than Standard Severe Alt. change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05).

Supplemental Table 15

Recent Functioning Regression Models for Alternative Severe Optimal Solutions in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models									
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	β	SE	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
Social Functioning														
Standard Severe Alt.	8.32	0.72	220235.86	0.02	798.86	0.00	2173.90	0.01	1302.30	0.00	1916.07	0.00	756.85	0.00
Alcohol-specific Severe Alt.	8.20	0.73	220734.80	0.02	1083.37	0.00	2584.15	0.01	1535.50	0.00	2034.32	0.00	1071.11	0.00
DSM-IV	5.00	0.32	231575.89	0.03	--	--	--	--	--	--	--	--	--	--
DSM-5	3.09	0.20	230181.91	0.02	--	--	--	--	--	--	--	--	--	--
ICD-10	4.97	0.31	230378.59	0.03	--	--	--	--	--	--	--	--	--	--
ICD-11	3.93	0.23	230528.76	0.03	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	6.93	0.38	225581.67	0.03	--	--	--	--	--	--	--	--	--	--
Mental Health														
Standard Severe Alt.	8.87	0.64	266778.76	0.03	6852.60	0.00	8240.80	0.00	7859.70	0.00	8033.30	0.00	7032.56	0.00
Alcohol-specific Severe Alt.	8.68	0.64	262710.88	0.03	3594.64	0.00	4865.19	0.00	4108.02	0.00	4356.16	0.00	2130.37	0.00
DSM-IV	5.58	0.32	267925.04	0.04	--	--	--	--	--	--	--	--	--	--
DSM-5	4.03	0.23	267456.12	0.04	--	--	--	--	--	--	--	--	--	--
ICD-10	5.61	0.30	265529.47	0.04	--	--	--	--	--	--	--	--	--	--
ICD-11	4.72	0.25	267169.76	0.04	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	7.79	0.36	266446.14	0.04	--	--	--	--	--	--	--	--	--	--
Physical Functioning														
Standard Severe Alt.	1.34	0.44	218380.05	0.09	-67.91	0.00	253.44	0.00	-88.49	0.00	36.42	0.00	174.74	0.00
Alcohol-specific Severe Alt.	2.07	0.53	219841.25	0.09	538.60	0.00	1791.42	0.00	839.95	0.00	830.78	0.00	499.16	0.00

Supplemental Table 15
Recent Functioning Regression Models for Alternative Severe Optimal Solutions in NESARC-III Sample

	Single Predictor Models				Joint Predictor Models										
					DSM-IV		DSM-5		ICD-10		ICD-11		Wakefield's HD	
	Estimates		Fit		Fit Change		Fit Change		Fit Change		Fit Change		Fit Change	
Solution	β	SE	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2	Chi-sq.	R^2
DSM-IV	1.81	0.23	221705.99	0.09	--	--	--	--	--	--	--	--	--	--
DSM-5	0.99	0.17	220038.13	0.09	--	--	--	--	--	--	--	--	--	--
ICD-10	1.71	0.24	219529.46	0.09	--	--	--	--	--	--	--	--	--	--
ICD-11	1.55	0.19	219909.04	0.09	--	--	--	--	--	--	--	--	--	--
Wakefield's HD	2.73	0.32	221838.01	0.09	--	--	--	--	--	--	--	--	--	--

Note. Alt. = alternative; DSM-IV = *Diagnostic and statistical manual, 4th edition,* alcohol dependence; DSM-5 = *Diagnostic and statistical manual, 5th edition,* alcohol use disorder (mild or above); ICD-10 = *International Statistical Classification of Diseases and Related Health Problems, 10th revision,* alcohol dependence; ICD-11 = *International Statistical Classification of Diseases and Related Health Problems, 11th revision,* alcohol dependence; Wakefield's HD = Wakefield's Harmful Dysfunction. Fit change = change in fit from single predictor model to joint predictor model.
SE = standard error; Chi-sq. = Wald F chi-square; Chi-sq. values > 3.84 chi-square critical value (*df*=1; alpha=0.05) were considered significant.
-- = not applicable; Cells highlighted orange = Standard Severe Alt. change in chi-square in joint predictor models greater than Alcohol-specific Severe Alt. change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05); Cells highlighted blue = Alcohol-specific Severe Alt. change in chi-square in joint predictor models greater than Standard Severe Alt. change in chi-square by at least 3.84 (critical chi-square value, *df*=1; alpha=0.05).

Appendix B. Complete Enumeration Example

Initial item-set *n*=3, with items *a, b, c*

Complete enumeration combinations (*N*=12):

Combination #	1	2	3	4	5	6	7	8	9	10	11	12
Item set size (*n*)	1	1	1	2	2	2	2	2	2	3	3	3
Items	*a*	*b*	*c*	*a, b*	*a, b*	*a, c*	*a, c*	*b, c*	*b, c*	*a, b, c*	*a, b, c*	*a, b, c*
Threshold	1/1	1/1	1/1	1/2	2/2	1/2	2/2	1/2	2/2	1/3	2/3	3/3

VITA

Yoanna McDowell was raised in Connecticut. She completed her undergraduate degree in psychology with a minor in addictions studies at Syracuse University. She then went on to attain a doctorate in clinical psychology at the University of Missouri-Columbia. During her graduate training, her research largely focused on psychiatric classification of alcohol use disorder (AUD). Her most recent work applies statistical optimization to disentangle AUD and co-occurring externalizing psychopathology to inform AUD classification. She has also collaborated on several grant-funded projects related to alcohol use, including evaluating alcohol-related assessment instruments, investigating cognitive deficits following extreme drinking episodes, and examining racial/ethnic health disparities in AUD diagnosis. Clinically, she has worked in outpatient settings with children, adolescents, and adults with a broad range of mental disorders. She has experience with cognitive-behavioral therapy, dialectical behavior therapy, and motivational interviewing. Ms. McDowell plans to pursue an integrated research and clinical career in a medical, or academic, setting.