DSM-IV Antisocial Personality Disorder and Conduct Disorder: Evidence for Taxonic Structures Among Individuals With and Without Substance Use Disorders in the General Population

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ABSTRACT. Objective: The categorical-dimensional status of DSM-IV (*Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*) conduct disorder (CD) and antisocial personality disorder (ASPD) is a source of controversy. This study examined whether the underlying structure of DSM-IV CD and ASPD was dimensional or categorical (taxonic) among individuals with and without substance use disorders. **Method:** Using a national large representative survey of U.S. adults ($n = 43,093$), taxometric analyses of DSM-IV CD and ASPD diagnostic criteria were conducted on the total sample and among those with and without substance use disorders. **Results:** Results of three taxometric procedures were consistent in showing that the structures underlying DSM-IV CD and ASPD were clearly taxonic in the total sample and among individuals with and without substance use disorders. Comparison curve fit

indices exceeded 0.57 for each model. **Conclusions:** Taxonic findings of the present study were in contrast to the dimensional results of prior taxometric research among incarcerated samples with substantial comorbidity of antisocial syndromes and substance use disorders. Results supported the categorical representation and diagnostic thresholds of ASPD and CD as defined in DSM-IV and DSM-5. That the structure of ASPD and CD may be taxonic suggests that further research on these disorders use group comparative designs in which samples with and without these disorders are compared in terms of sociodemographic and clinical correlates, comorbidity, and treatment utilization. The taxonic structure of ASPD and CD may contribute to future research on causal processes through which these antisocial syndromes develop. (*J. Stud. Alcohol Drugs*, 75, 496–509, 2014)

MODERN DEFINITIONS OF PSYCHOPATHY and related conditions can be traced back to Cleckley (1976), who viewed psychopathy as a personality disorder characterized by selfishness, superficiality, guiltlessness, weak impulse control, and affective characteristics. Hare (1996) advanced Cleckley's notion that psychopathic personality disorder was qualitatively distinct from simple law breaking or criminality by developing empirically derived assessment measures of the former construct. Consistent with the medical tradition of categorical diagnoses, conduct disorder (CD) and antisocial personality disorder (ASPD) in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5; American Psychiatric Association, 2013), and its predecessors since the DSM-III (American Psychiatric Association, 1980), are also viewed as qualitatively distinct clinical syndromes. Many others consider psy-

chopathy and related constructs as dimensional or as extreme ends of a continuum of normal personality variation (Coghill and Sonuga-Barke, 2012; Livesley et al., 1994; Widiger and Costa, 1994). Currently, the categorical-dimensional status of psychopathy, ASPD, CD, and other personality psychopathology is controversial. Resolution of this issue could contribute to further research on etiology classification, prevention, and treatment.

As noted by Haslam (2003), rigorous methods are needed to compare categorical versus dimensional models of particular personality disorders. Taxometric procedures (Meehl, 1995a; Waller and Meehl, 1998) are particularly well suited to this task and have recently gained popularity because of their ability to explicitly test the validity of dimensional and categorical models simultaneously (Haslam and Kim, 2002; Trull and Durrett, 2005). Although

Received: June 28, 2013. Revision: October 22, 2013.

This research was supported by National Institute on Drug Abuse (NIDA) Grant 5F31DA025377 (to Bradley T. Kerridge) and National Institute on Alcohol Abuse and Alcoholism (NIAAA) Grants U01AA018111 and K05AA014223 (to Deborah S. Hasin). The National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) was funded by the NIAAA with supplemental support from NIDA. Support is also acknowledged from the In-

tramural Program, NIAAA, National Institutes of Health. The views and opinions expressed in this report are those of the authors and should not be construed to represent the views of any of the sponsoring agencies of the government.

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other statistical models, such as cluster analysis and finite and factor mixture models, can also be used to differentiate taxa from continua, each has difficulty identifying the correct number of latent classes, and, once found, difficulties arise in their interpretation (Bock, 1996; Grove, 1991; Lore, 1994; McLachlan and Basford, 1988; McLachlan and Peel, 2001; Ruscio, 2004). To date, there exists no common acceptance of the best criteria to resolve these issues (Nyland et al., 2008). These other statistical approaches also do not allow identification of a cut point with which cases can be sorted into taxon and complement groups.

Most taxometric studies on antisocial behavior have been grounded in the traditional clinical construct of psychopathy (Cleckley, 1976) defined by interpersonal (e.g., lack of remorse, callousness, egocentricity), impulsivity, and antisocial behaviors, including early behavioral problems and affective characteristics (e.g., low mood). Several clinical rating scales designed to assess psychopathy have been used in taxometric research, including various versions of the Psychopathology Checklist (PCL) and its revisions, the PCL-Revised and the PCL-Antisocial Process Screening Device (Frick and Hare, 2001; Hare 1993), antisocial subscales of the Personality Assessment Interview (Morey, 2007), and the Levenson Self-Report Psychopathology Scale (Levenson et al., 1995). Within this tradition, eight studies conducted among adult jail and/or prison inmates (Dana, 1990; Edens et al., 2006; Guay et al., 2007; Marcus et al., 2004; Walters, 2009; Walters et al., 2007a, 2007b, 2007c, 2008) and two studies (Edens et al., 2011; Murrie et al., 2007) conducted among adolescents in juvenile correctional facilities consistently yielded evidence of dimensionality of psychopathy.

Four taxometric studies of antisocial behavior were conducted using assessment instruments that approximated DSM-IV-defined CD or ASPD (American Psychiatric Association, 1994). Marcus et al. (2006) administered the Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II; First et al., 1997) to 1,146 male prison inmates and individuals court ordered to residential drug treatment and showed that DSM-IV ASPD was structurally dimensional. Marcus et al. (2008) examined the structure of ASPD among 6,795 subjects comprising alcoholics, their relatives, and controls from the Collaborative Study on Genetics and Alcoholism (Edenberg et al., 2005). DSM-IV diagnoses of ASPD, derived from the Semi-Structured Assessment for the Genetics of Alcoholism (Bucholz et al., 1994), were found to be dimensional. In two recent studies (Walters, 2011; Walters and Ruscio, 2013), caregivers completed the Behavioral Problems Index (Peterson and Zill, 1986) measuring, in part, childhood antisocial behaviors found in DSM-IV CD, for youths participating in the National Longitudinal Survey of Youth-Child Data (Center for

Human Resource Research, 2009). In these two studies, CD was better represented as continuous rather than categorical.

Only five of the 20 taxometric studies to date have found evidence of taxonicity. Using a school-based sample of 1,111 boys ($M_{age} = 8$ years), Skilling et al. (2001) found taxonic results for DSM-IV CD. Vasey et al. (2005) found similar results among a sample comprising 386 normal children, children referred for severe emotional/behavioral problems, and adolescents in a juvenile justice diversion program. One adult study (Skilling et al., 2002) conducted among 74 male inmates concluded that both DSM-IV ASPD and CD were taxonic. Harris et al. (1994) also found evidence for taxonic structures of DSM-III CD and ASPD among 694 male offenders in maximum security prisons, of which 361 were found guilty by reason of insanity. Three of these studies share the use of DSM-III or DSM-IV measures of CD and/or ASPD; but, in each instance, diagnostic criteria were scored from psychological, case management, and administrative files (Harris et al., 1994; Skilling et al., 2001, 2002). One unique taxometric study (Ayers, 2000) examined the latent structure of ASPD as measured by Factor 2 of the PCL-Revised (containing many antisocial behavior indicators) and the Personality Diagnostic Questionnaire-Revised (Hyler et al., 1992) among primarily male substance users being treated in a Veterans Affairs Medical Center and outpatient methadone clinic. This study also found taxonicity of ASPD.

Although the previous studies provided useful information, methodological limitations characterize this literature. First, very few taxometric studies were conducted in general population samples, and even fewer used assessment instruments explicitly designed to measure DSM criteria. Second, taxometric studies that found taxonic structures underlying CD and ASPD (Ayers 2000; Harris et al., 1994; Skilling et al., 2001, 2002; Vasey et al., 2005) relied on visual inspections of taxometric graphs and use of the Goodness of Fit Index (Waller and Meehl, 1998). These methods are less rigorous than the more recently developed comparison curve fit index (CCFI; Ruscio, 2004), which systematically compares the fit of taxometric data to simulated taxonic and dimensional data. A recent review of taxometric studies of personality psychopathology showed that use of the CCFI is less likely to yield taxometric results than the older methods (Haslam et al., 2012).

Third, 14 of the 20 studies of psychopathy, CD, and ASPD were conducted among jail/prison inmates or adolescents in juvenile detention facilities. Taxometric analysis requires sampling procedures that recruit participants representatively across all symptom levels of a disorder (Beauchaine, 2007). The prevalence and severity of antisocial syndromes are likely to be greater among incarcerated samples than others; thus, taxometric work in these samples is akin to searching for a taxon in a largely taxonic group, obscuring the taxonic structure of the underlying disorders.

Taxometric findings of dimensionality among incarcerated samples may also be unreliable as the result of high comorbidity between substance use disorders (SUDs) and ASPD and CD in these settings. Although prevalence rates of SUDs are unknown among national samples of adolescent detention facilities, national surveys of state and federal prisons (Mumola and Karberg, 2006) and jails (Karberg and James, 2005) show rates of any drug use disorder (abuse and/or dependence) in the year preceding incarceration to be 53% among state prison inmates, 45% among federal prison inmates, and 68.0% among jail inmates. Lifetime rates of SUDs, although not assessed in these surveys, would be expected to exceed 80%. The studies of Marcus et al. (2008) included individuals preselected for alcohol dependence and their relatives at high risk for alcoholism, and the Marcus et al. (2006) study conducted partly among individuals in SUD treatment shared high, although unspecified, levels of comorbidity between CD and ASPD and SUDs. Because of this aspect of these samples, some of the respondents' antisocial behaviors may have resulted from their SUDs (e.g., illegal selling or thefts to obtain money for substances). Reporting of antisocial behaviors as consequences of SUDs may have obscured the identification of ASPD or CD taxa in studies that found support for dimensionality of ASPD or CD.

The present study was designed, in part, to address sampling issues in the prior taxometric literature on ASPD and CD. Using the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC; Grant et al., 2004), the underlying structure of DSM-IV ASPD and CD was directly assessed in the total sample and separately among subgroups with and without DSM-IV SUDs. We hypothesized that the latent structure underlying ASPD and CD constructs would be taxonic (categorical) in the total sample and among subgroups with and without SUDs because this nationally representative survey included respondents with a wider range of antisocial symptomatology than observed among incarcerated samples. The underlying structure of ASPD and CD among respondents with an SUD was also predicted to be taxonic because this subsample is representative of all individuals with an SUD. These individuals demonstrate a wide range of SUDs, from mild to severe, unlike incarcerated or SUD treatment samples that overrepresent individuals whose SUD symptomatology is severe.

Method

Sample

The Wave 1 NESARC is a nationally representative face-to-face survey of 43,093 respondents ages 18 years and older and is described in detail elsewhere (Grant et al., 2004). The target population was the civilian, noninstitutionalized population residing in the 50 United States and the District of

Columbia. The NESARC oversampled Black and Hispanic subjects and adults ages 18–24 years. The overall response rate was 81%.

All potential NESARC respondents were informed in writing about the nature of the survey, the statistical uses of the data, the voluntary aspects of their participation, and the federal laws that rigorously provided for the strict confidentiality of identifiable survey information. Respondents consenting to participate after receiving this information were interviewed. The research protocol, including informed consent procedures, received full ethical review and approval from the U.S. Census Bureau and the U.S. Office of Management and Budget.

Antisocial behavioral syndromes

All diagnoses were made using the Alcohol Use Disorder and Associated Disabilities Interview Schedule–DSM-IV Version (AUDADIS-IV; Grant et al., 2001). The AUDADIS-IV is a fully structured diagnostic interview designed for administration by experienced nonclinical interviewers. A lifetime diagnosis of ASPD required meeting at least three of seven DSM-IV criteria for adult antisocial behaviors and evidence of CD before age 15 years. Evidence for CD was defined as meeting at least 3 of 12 DSM-IV criteria for childhood antisocial behaviors. Respondents were diagnosed with lifetime CD only if they met three or more criteria representing childhood antisocial behaviors but did not meet criteria for ASPD. (DSM-IV definitions of ASPD and CD are the same as those in the DSM-5.) Respondents who met criteria for neither ASPD nor CD were considered to have no DSM-IV antisocial behavioral syndrome.

Indicators for adult antisocial behaviors used in the taxometric analyses were the seven dichotomous DSM-IV criteria representing adult antisocial behaviors along with 12 of the 15 CD criteria. Two CD criteria, “stealing while confronting a victim” and “forcing someone into sexual activity,” were endorsed too infrequently (sample sizes, 47 and 14) to be suitable for taxometric analyses, whereas one CD criterion, “breaking into someone's house, building, or office,” was not directly measured on the AUDADIS-IV. Indicators for CD input into the taxometric analyses were the 12 dichotomous CD criteria. There were 30 and 31 symptom items underlying the 7 adult ASPD and 12 childhood CD criteria, respectively, with 1–9 symptom items operationalizing each criterion.

Test–retest reliability of AUDADIS-IV categorical diagnoses and dimensional item scales of ASPD and CD was assessed in a general population sample (Grant et al., 2003). Reliability of ASPD diagnosis was good ($\kappa = .67$), as were intraclass correlation coefficients (.60) for dimensional ASPD criteria items. Convergent validity of these diagnoses was good to excellent (Goldstein et al., 2007a, 2007b; Grant et al., 2004).

Substance use disorders

The AUDADIS-IV separately assesses DSM-IV criteria for alcohol- and other drug-specific abuse and dependence for 10 classes of drugs: sedatives, tranquilizers, opiates (other than heroin), stimulants, hallucinogens, cannabis, cocaine (including crack), inhalants/solvents, heroin, and other drugs. The withdrawal criterion of the alcohol and other drug dependence diagnoses was also drug specific and measured as a syndrome, thus requiring the specified number of symptoms according to each respective DSM-IV withdrawal category. Alcohol- and other drug-specific abuse and dependence diagnoses were aggregated to yield any substance abuse and/or dependence diagnosis used to classify respondents in this study.

Consistent with DSM-IV, lifetime abuse diagnoses required respondents to meet at least one of four abuse criteria at any point preceding the interview and were precluded by a diagnosis of dependence. AUDADIS-IV dependence diagnoses required respondents to satisfy at least three of seven dependence criteria during the past year or before. Diagnoses of dependence before the past year were required to satisfy the DSM-IV time clustering criteria: at least three dependence symptoms must have occurred within the same year.

The good to excellent reliability and validity of the AUDADIS-IV alcohol and drug use disorder criteria and diagnoses ($\kappa = .53-.79$) are well documented in numerous psychometric studies (Canino et al., 1999; Chatterji et al., 1997; Grant et al., 1995; Hasin et al., 1997a, 1997b, 2003; Muthén et al., 1993; Nelson et al., 1999; Vraiti et al., 1998). These include clinical reappraisals conducted by psychiatrists and clinical (Canino et al., 1999) and general population samples (Cottler et al., 1997) collected in several countries as part of the World Health Organization/National Institutes of Health International Study on Reliability and Validity.

Statistical analyses

Dichotomous indicators. The use of dichotomous indicators was suggested by Meehl as early as 1965. Since then, concern has been expressed (Miller, 1996) that the use of dichotomous input under very rare circumstances can yield false evidence of a latent taxon or, alternatively, the identification of a pseudo-taxonic plot using the taxonic procedures (Meehl, 1995a). Meehl and Yonce (1994) questioned the theoretical basis for this concern, noting that dichotomous output indicators are formally identical to the preferred quantitative output because the general covariance mixture theorem is distribution free. This is true for any pair of real numbers, including those that take on only two values. This concern has been rebutted by Monte Carlo work showing that taxometric procedures can be used confidentially with dichotomous data with demonstrated validity and acceptably

low levels of nuisance covariance (Ruscio, 2004). Further, two comprehensive reviews of taxometric studies of a wide range of psychopathology conducted before 2011 showed no tendency for taxometric procedures that used dichotomous indicators to yield higher rates of taxonicity (Haslam and Kim, 2002; Haslam et al., 2012).

Base rate. In taxometric analyses, the taxon must be sufficiently large to identify a taxon if indeed it exists. Meehl's rule of thumb for the estimated taxon base rate (proportion of taxon members in a sample) was $p \geq .10$ (Meehl and Yonce, 1994). However, recent Monte Carlo simulation studies have shown that the absolute number of taxon members may be more important than the estimated base rate (Ruscio, 2009; Ruscio and Ruscio, 2004). These studies indicated that a taxon sample size of 100–200, with taxon base rates between 0.0025 and 0.01, was suitable to establish a valid taxon when the total sample size of the study exceeded 10,000 (as in the present study).

Indicator validity and nuisance covariance. Indicators selected for taxometric analysis must possess sufficiently high validity and be correlated at acceptably low levels within the taxon and complement groups. Indicator validity in taxometric analyses is expressed in terms of the difference in indicator means within the taxon and complement groups, standardized by the pooled within-group variance, a metric known as Cohen's d (Cohen, 1992; Ruscio, 2004). Indicators with a mean separation of approximately 1.2 SD or greater should effectively differentiate taxon and complement groups (Beauchaine and Beauchaine, 2002; Meehl, 1995a). Potential nuisance covariance, or residual correlations not accounted for by group membership, is assessed by examining the average within-group (taxon, complement) correlations among indicators. Monte Carlo simulation studies suggest that taxometric methods are robust to moderate levels of nuisance covariance or within-group (taxon and complement) correlations among indicators of less than 0.30 (Meehl, 1995b; Ruscio et al., 2011). In contrast, indicator variables in the total sample should be positively associated if indeed the indicators do represent multiple facets of a target construct (Ruscio et al., 2011).

Indicator validities and nuisance covariances were estimated using diagnostic status for ASPD and CD, as a priori classifications (Beauchaine, 2007; Ruscio, 2009). Taxometric analyses used the same a priori diagnostic classifications based on DSM-IV, allowing class membership to be defined. Simulated categorical comparison data were also generated using the same a priori classifications to ensure that identical populations of comparison data were being produced across the three taxometric procedures.

Taxometric analyses. Three taxometric procedures were conducted for CD and ASPD in the total sample and among those with and without any SUD using Ruscio's TaxProg (Ruscio 2010) programs in the R statistical program language (Ihaka and Gentleman, 1996). The first taxometric

procedure was the mean above minus below a cut (MAMBAC) procedure (Meehl and Yonce, 1994). The MAMBAC procedure starts with assigning one indicator (i.e., diagnostic criterion) to the role of input variable and another indicator (i.e., diagnostic criterion) to the role of output variable, each indicator serving in turn as the input indicator with each other indicator serving as the output indicator. Then, a cut is made on the input indicator distribution. Each cut divides the data into two groups: cases falling above and cases falling below the cut score. The average score on the output variable is then calculated for each group. Mean differences are plotted along the y -axis of the MAMBAC graph, with the number of cases along the x -axis. Next, the cut is made further up the input indicator and the difference between groups is again calculated. The cut continues to move progressively higher until it reaches the top of the distribution. MAMBAC curves show how mean differences for cases above and below the cut vary with the location of the cut points. We selected 50 cuts at equally spaced intervals between cases, beginning and ending 25 cases from either extreme. This procedure was repeated for each input–output indicator pair, yielding 342 curves associated with 19 ASPD indicators ($n(n - 1)$) and 132 curves associated with 12 CD indicators. For the purpose of presentation, each set of curves is averaged to produce a single aggregate MAMBAC curve. Generally, taxonic constructs produce peaked MAMBAC curves, whereas dimensional structures appear concave up or nonpeaked (Meehl and Yonce, 1994). All MAMBAC procedures used 10 internal replications to smooth the shape of the MAMBAC curve (Ruscio, 2004).

The second taxometric procedure was maximum eigenvalue (MAXEIG) (Meehl and Yonce, 1994). MAXEIG tests whether indicators of a construct covary because of a mixture of two underlying groups (taxonic structure) or loadings on a common latent factor (dimensional structure). The MAXEIG procedure was used in which two indicators in turn served as output indicators, whereas the remaining indicators served as a composite input variable. MAXEIG examines the association between output indicators within subsamples of cases ordered along an input indicator that forms the x -axis of the MAXEIG graph. Each indicator serves as input, whereas all other indicators serve as a composite output indicator. The first (largest) eigenvalue of the covariance matrix of the output indicator is then calculated and plotted along the y -axis of the MAXEIG graph for each subsample, producing 19 (n) curves associated with the ASPD analyses and 12 curves associated with the CD analyses, each of which were averaged. Cases were divided into 25 ordered, fixed-sized subsamples that overlapped 90.0% with adjacent subsamples as shown on the x -axis. Similar to MAMBAC, 10 replications were used. For prototypical categorical data, the MAXEIG curve is expected to be peaked (Ruscio et al., 2007). A nonpeaked MAXEIG curve suggests a dimensional construct (Waller and Meehl, 1998).

The third taxometric procedure was L-Mode. This procedure conducts a principle axis factor analysis on the indicator variables and identifies the latent structure by calculating factor scores for all cases using a one-factor latent variable model (Ruscio et al., 2011). The resultant L-Mode graph is the factor score density plot. For categorical data, the prototypical L-Mode graph is bimodal, each mode corresponding to a unimodal distribution of factor scores. For dimensional data, the prototypical L-Mode graphs show unimodal distributions of factor scores.

Taxometric graphs often deviate from their prototypical shape because of factors like levels of indicator validity, rendering interpretation difficult. It is therefore recommended to simulate via bootstrapping sets of taxonic and dimensional comparison data using the same taxometric analyses used for the research data: in this case, 100 simulated data sets for taxonic structure and 100 simulated data sets for dimensional structure. Importantly, the resulting simulated data sets account for the distribution and correlation characteristics of research data (mean, standard deviations, indicator correlations), differing only in their latent structure (Ruscio et al., 2007). Once the comparison data are generated and plotted, a CCFI is calculated to quantify the similarity of taxometric graphs yielded by the research data to those derived from the simulated taxonic versus dimensional data (Ruscio, 2004; Ruscio and Ruscio, 2004; Ruscio, 2010; Ruscio and Kaczetow, 2009). A CCFI value of .50 supports equally good fit between the data and simulated dimensional and taxonic models, whereas values of .0 to less than .50 support dimensionality and values above .50 to 1.0 support taxonicity.

Results

Indicator validity, nuisance covariance, and a priori base rates. The average Cohen's d exceeded 1.2 in all taxometric models examined in this study (Table 1). With one exception, all of the individual indicators associated with each model also exceeded 1.2. Seven of the 19 antisocial behavior indicators associated with ASPD model among respondents with SUDs failed to meet this standard (Cohen's $d = 0.63$) associated with one indicator, with the remaining six Cohen's d 's of 1.00–1.18 closely approximating the 1.2 standard. As shown in Table 1, average indicator correlations were very low in both taxon and complement groups ($r = -.03$ –.10) but higher in the total sample ($r = .10$ –.18) for each taxometric model. With regard to the taxometric analyses of ASPD, taxon base rates were .031, .085, and .010 for the total sample and among respondents classified with and without SUDs, respectively. Corresponding base rates associated with the CD analyses were .010, .014, and .010, respectively.

MAMBAC, MAXEIG, and L-Mode. Taxometric curves generated by MAMBAC and MAXEIG procedures for ASPD and CD for the total sample and among those classified with and without an SUD are shown in Figures 1–4.

TABLE 1. Taxometric parameters estimates and fit statistics: DSM-IV antisocial personality disorder and conduct disorder among respondents with and without substance use disorders

Models	Average correlation (range) among indicators			Average Cohen's <i>d</i>	Taxon base rate	CCFI			<i>M</i> CCFI
	Total sample	Taxon	Complement			MAMBAC	MAXEIG	L-Mode	
Antisocial personality disorder									
Total respondents (<i>N</i> = 43,093)	0.18 (0.04–0.58)	0.02 (-0.15–0.49)	0.08 (-0.01–0.56)	2.09	.031	.914	.860	.712	.829
Respondents with substance use disorders (<i>n</i> = 12,707)	0.17 (0.04–0.54)	0.02 (-0.14–0.48)	0.06 (-0.01–0.53)	1.35	.085	.926	.889	.658	.824
Respondents without substance use disorders (<i>n</i> = 30,386)	0.12 (0.02–0.56)	-0.01 (-0.25–0.48)	0.07 (-0.01–0.54)	2.76	.010	.798	.612	.512	.640
Conduct disorder									
Total respondents (<i>N</i> = 43,093)	0.16 (0.04–0.32)	-0.02 (-0.25–0.30)	0.09 (0.01–0.28)	3.50	.010	.601	.440	.649	.560
Respondents with substance use disorders (<i>n</i> = 12,707)	0.17 (0.13–0.54)	-0.02 (-0.24–0.29)	0.10 (-0.00–0.33)	2.58	.014	.796	.505	.523	.608
Respondents without substance use disorders (<i>n</i> = 30,386)	0.10 (0.02–0.27)	-0.03 (-0.29–0.48)	0.04 (-0.01–0.20)	3.60	.010	.723	.748	.771	.747

Notes: DSM-IV = *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*; CCFI = comparison curve fit index; MAMBAC = mean above minus below a cut; MAXEIG = maximum eigenvalue.

Average CCFIs across the three taxometric procedures were .829, .824, and .640 for ASPD and .560, .608, and .747 for CD, all reflecting taxonicity of ASPD. Corresponding L-Mode curves (not shown) were all clearly bimodal, consistent with taxonic findings in the MAMBAC and MAXEIG procedures.

Discussion

This study found that the underlying latent structure of DSM-5 ASPD and CD was clearly taxonic, and this result generalized to subgroups with and without DSM-IV SUDs. These results contrast sharply with studies that found dimensionality underlying psychopathy, ASPD, and CD (Edens et al., 2006, 2011; Guay et al., 2007; Murrie et al., 2007; Walters, 2009; Walters et al., 2007a, 2007b, 2007c, 2008). This discrepancy may reflect reliance on adult inmate or juvenile detention center samples in prior studies that overrepresented individuals with severe antisocial syndromes. This sampling design may have obscured the taxonic structures of psychopathy, ASPD, and CD.

The taxonic findings of the present study highlight the importance of the relationship between sampling methodology and comorbidity in taxometric research on psychopathy, ASPD, and CD. High rates of comorbidity between antisocial syndromes and SUDs among adolescents and adults in correctional facilities and adults in SUD treatment may have obscured the taxonicity of ASPD or CD if individuals without those antisocial syndromes reported antisocial behaviors as consequences of excessive substance use or SUDs. The taxonic structures of ASPD and CD in this study among respondents with SUDs contrast markedly with the dimensionality found in incarcerated and SUD treatment samples. The reason for this is twofold. First, antisocial symptomatology

is likely to be severe in incarcerated samples. Second, SUD symptomatology among individuals with SUDs in representative samples of the general population ranges from mild to severe, unlike incarcerated or treated samples, in which symptomatology is likely to be severe. The broader range of SUD pathology in the current sample likely reduced the degree of endorsement of antisocial behaviors as consequences of an individual's comorbid SUD. This explanation is supported by the findings of taxonicity underlying CD and ASPD among individuals without SUDs in which there was no possibility of endorsing antisocial behaviors as consequences of excessive substance use or a comorbid SUD.

It is difficult to point to the consistency of the taxonicity of ASPD and CD in the present study and similar evidence from earlier studies. Three of the five studies (Harris et al., 1994; Skilling et al., 2001; Vasey et al., 2005) were conducted among incarcerated adults, adolescents in juvenile detention facilities, or adolescents with severe emotional/behavioral problems, whereas one study was conducted among males in SUD treatment (Ayers, 2000). Although three of these studies (Harris et al., 1994; Skilling et al., 2001, 2002) used indicators approximating DSM-5 criteria, information reflecting the criteria was gathered from chart reviews, raising questions about indicator validity. All of these studies also used older, taxometric strategies—including goodness-of-fit indices to measure fit, base rate comparison to identify taxonicity, and/or visual inspection to determine taxometric curves—thus compromising their taxonic conclusions regarding the latent structures of ASPD and CD.

The structural results of the present study may have major implications for classification in psychiatry. They support the categorical representation and diagnostic thresholds of DSM-IV and DSM-5 ASPD and CD. These results remained

FIGURE 1. Average mean above minus below a cut (MAMBAC curves): *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV), antisocial personality disorder in the total sample and among respondents with and without substance use disorders. Thick lines show results from the empirical data, thin lines represent the area bounding the minimum and maximum values of the taxonomic or dimensional comparative data, and gray bands (when visible) represent ± 1 SDs from the mean of the data points obtained from the comparative data.

Total sample

Respondents with substance use disorders

Respondents without substance use disorders

FIGURE 2. Average MAXEIG curves: *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV), antisocial personality disorder in the total sample and among respondents with and without substance use disorders. Thick lines show results from the empirical data, thin lines represent the area bounding the minimum and maximum values of the taxonic or dimensional comparative data, and gray bands (when visible) represent ± 1 SDs from the mean of the data points obtained from the comparative data.

Total sample

Respondents with substance use disorders

Respondents without substance use disorders

FIGURE 3. Average mean above minus below a cut (MAMBAC curves): *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)*, conduct disorder in the total sample and among respondents with and without substance use disorders. Thick lines show results from the empirical data, thin lines represent the area bounding the minimum and maximum values of the taxonic or dimensional comparative data, and gray bands (when visible) represent ± 1 SDs from the mean of the data points obtained from the comparative data.

FIGURE 4. Average MAXEIG curves: *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)*, conduct disorder in the total sample and among respondents with and without substance use disorders. Thick lines show results from the empirical data, thin lines represent the area bounding the minimum and maximum values of the taxonic or dimensional comparative data, and gray bands (when visible) represent ± 1 SDs from the mean of the data points obtained from the comparative data.

consistent when subgroups of the population, defined by SUD status, were examined. Taken together, these findings suggest that ASPD and CD may be distinct disorders and may be validly differentiated from one another and from the SUDs that are highly comorbid with both antisocial syndromes. The debate over the role of dimensions in DSM-5 has included recommendations to retain dimensional information in addition to setting diagnostic thresholds (Helzer et al., 2007; Kraemer, 2007). Examples are the DSM-5 SUDs that retain diagnostic cutoffs but additionally define severity levels of the disorders. Future epidemiologic research could evaluate whether a dimensional measurement of severity adds significantly to the categorical diagnosis of ASPD and CD, thus contributing to an evidence-based classification system.

Many researchers have underscored the importance of taxometric research in informing causal theories, highlighting the inextricable link between classification and theory (Cronbach and Meehl, 1955; Edens et al., 2011; Ruscio and Ruscio, 2008). Dimensional variation underlying antisocial syndromes may arise from many small genetic and environmental influences that either accumulate or interact. A large literature shows that the categories found in the present study have both environmental and genetic variances (e.g., Baker et al., 2007; Slutske, 2001; Tuvblad et al., 2006). Thus, etiology may stem from a threshold effect (requiring a critical threshold on a stressor to be surpassed before a disorder develops), nonlinear interaction (requiring synergism of multiple causal factors), or developmental bifurcation (requiring separation into discrete classes from an initial nontaxonic state) (Meehl, 1992). Consistent with this, Meehl (1992, p. 148) cautioned that “equating a taxon with disease entity with specific etiology is unwarranted.” Thus, the taxonic results of this study (after replication) could be used in examining causal processes arising from threshold effects, nonlinear interaction, and developmental bifurcation along with alternative multifactorial models of causation through which CD and ASPD develop.

Results of this study have implications for research design and statistical analyses of ASPD and CD. That the latent structure of ASPD and CD may be taxonic suggests that future research on these disorders use group comparative designs in which samples of individuals with ASPD or CD are compared with those without these disorders on prevalence, sociodemographic and clinical correlates, comorbidity, and treatment utilization. Although the use of comparative designs in the study of ASPD and CD is common in epidemiology and psychiatry, they have been proceeded in the past by studying manifest or observable distributions and associations of these disorders without regard to whether manifest structures of these disorders match their latent structures.

Limitations of the present study are noted. As in most prior taxometric studies of ASPD and CD, this study is subject

to mono-operational bias (Shadish et al., 2002). Taxometric analyses are ideally performed on indicators derived from several independent domains (e.g., self-report, biological, genetic, environmental) (Meehl and Golden, 1982). Future research should incorporate indicators at multiple levels of analysis because they may reflect processes that are more closely related to the etiology of ASPD and CD. Consistent with all taxometric research conducted to date, unweighted data were used. However, because the NESARC uniquely sampled from each U.S. county/county equivalent, differences between weighted and unweighted data were small, suggesting little impact on study findings. Information on childhood antisocial behaviors was based on self-report among adults, and this study relied on cross-sectional data. Longitudinal studies of youths are required to more precisely determine those factors that differentiate individuals with childhood/adolescent antisocial behaviors who exhibit a lifelong pattern of antisocial conduct characterized by ASPD and those in whom such behaviors are limited to childhood or early adolescence.

Conclusion

This study found that DSM-IV (and DSM-5) ASPD and CD may represent distinct classes of individuals that can be differentiated from one another, those without either disorder, and those with comorbid SUDs. This study highlights the need for appropriate sampling procedures for testing taxometric hypotheses by recruiting across a wide range of severity in symptomatology for ASPD and CD, with a representative proportion of participants at each symptom level and with due consideration for the impact of these comorbid disorders. Future methodologically stringent taxometric research on ASPD and CD will continue to contribute to the evidence base for classification systems and have important implications for etiology, assessment, treatment, and prevention.

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