Psychiatry Research 261 (2018) 565–573

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

A taxometric investigation of psychopathy in women

Jean-Pierre Guay[a,b,*], Raymond A. Knight[c], John Ruscio[d], Robert D. Hare[e,f]

[a] School of Criminology and International Center for Comparative Criminology, University of Montréal, Montréal, Québec, Canada
[b] Philippe-Pinel Institute of Montréal, Montréal, Québec, Canada
[c] Department of Psychology, Brandeis University, Waltham, MA, USA
[d] Department of Psychology, College of New Jersey, Ewing, NJ, USA
[e] Department of Psychology, University of British Columbia, Vancouver, British Columbia, Canada
[f] Darkstone Research Group, Vancouver, British Columbia, Canada

ARTICLE INFO

Keywords:
Psychopathy
PCL-R
PCR: SV
PCL: YV
Taxometrics
Latent structure
Antisocial behaviour
Female offenders

ABSTRACT

The taxonomic status of psychopathy is the topic of considerable research interest. The latent structure of psychopathy will latent structure will guide the determination of the best assessment approaches, maximize the reliability and validity, will help to establish optimal cutting scores that minimize decision errors and will also facilitate the selection of the best research designs to advance the study of the construct. In the present study, taxometric analyses were used for assessing taxonicity, and they were applied to Psychopathy Checklist-Revised (PCL-R) ratings of 1218 female offenders. Hare's four-factor solution to the PCL-R was used as the bases of the analyses. The results of the various analytical strategies obtained dimensional solutions and corroborated that for females, as well as for males, psychopathy as measured by the PCL-R, may best be conceptualized as distinct configurations of extreme scores on personality traits rather than as a distinct, nonarbitrary class. These results reaffirm the fact that cut-off scores of are arbitrary in nature.

1. Introduction

Psychopathy is a clinical construct defined by a cluster of interpersonal, affective, and behavioral traits and behaviors, including deception, manipulation, irresponsibility, impulsivity, stimulation-seeking, poor behavioral control, shallow affect, lack of empathy, guilt or remorse, and a range of unethical and antisocial behaviors not necessarily criminal. The modern conception of psychopathy is based firmly on a rich clinical tradition (e.g., Cleckley, 1941, 1976; Karpman, 1955; Arieti, 1963; Berrios, 1996; see historical overviews by Millon et al., 1998; Hare, 2003; Felthous and Saß, 2007; Hervé, 2007). The writings of Cleckley (1941, 1976) have been particularly influential in providing a framework for much of the research conducted over the last 50 years (Hare and Neumann, 2008; Lilienfeld et al., 2015a; Crego and Widiger, 2016).

1.1. Taxometrics and psychopathy

One important question about the construct of psychopathy involves the nature of its latent structure, specifically whether psychopathy is distributed as a dimension or category. Whereas in dimensional models psychopathic individuals are conceptualized as extreme variants, in categorical models they are conceived as qualitatively different from non-psychopaths. The taxometric analyses developed by Paul Meehl and his collaborators (Meehl and Yonce, 1994, 1996; Waller and Meehl, 1998; Meehl, 2004) have become the most widely accepted methods for investigating the latent structure of various constructs. Multiple studies have examined the taxometric structure of psychopathy. Early Psychopathy Checklist-Revised (PCL-R: Hare, 1991, 2003) studies found evidence that its Impulsive/Antisociality factor was distributed as a taxon (Harris et al., 1994; Skilling et al., 2001, 2002). These results are now known to be attributable to methodological and sampling problems (Edens et al., 2006; Guay et al., 2007; Walters et al., 2011). After resolving those issues, a review of the research conducted on adult males revealed clear evidence of dimensionality. The results were based on measures of the PCL family (Edens et al., 2006; Guay et al., 2007; Walters et al., 2007b, 2007c, 2011), self-report measures of psychopathy (Guay and Knight, 2003; Marcus et al., 2004; Walters et al., 2008) and on psychopathy-related measures (Walters et al., 2014). The results also consistently support dimensionality in taxometric studies of adolescents (Murrie et al., 2007; Edens et al., 2011; Walters, 2014).

* Correspondence to: School of Criminology University of Montréal, C.P. 6128, Succursale Centre-ville, Montréal, QC, Canada, H3C 3J7.
E-mail address: jean-pierre.guay@umontreal.ca (J.-P. Guay).

https://doi.org/10.1016/j.psychres.2018.01.015
Received 28 June 2017; Received in revised form 14 November 2017; Accepted 9 January 2018

1.2. Taxometric studies with women

The issue of whether psychopathy is distributed as a taxon or a dimension has not been thoroughly investigated in women. To our knowledge, there are only four taxometric studies of psychopathy in female samples, three based on self-report measures and one on the PCL: SV.

Walters and colleagues explored the distribution of psychopathy-related scales in females in three of these four studies (Walters et al., 2007a, 2007c, 2008). All three found evidence for dimensional distributions. One used the Levenson Self Report Psychopathy scale (Levenson et al., 1995) in subsample of 555 women incarcerated in high-, medium-, and low-security institutions as part of a national mental health prevalence study involving 14 different federal correctional institutions (Walters et al., 2008). The second (Walters et al., 2007a) evaluated 464 female offenders on four subscales of the Personality Assessment Inventory (PAI: Antisocial Features [ANT] scale, Antisocial, Behaviors [ANT-A], Egocentricity [ANT-E], and Stimulus Seeking [ANT-S]; Morey, 2007). The third study by Walters et al. (2007c) combined four different samples totalling 735 women rated on the Psychopathy Checklist: Screening Version (PCL: SV; Hart et al. (1995)). In the fourth study, John (2009) used the Psychopathic Personality Inventory-Revised responses (PPI-R; Lilienfeld and Widows, 2005) of 367 incarcerated women to examine the latent structure at the factor level (Fearless Dominance, Self-Centered Impulsivity, and Cold-Heartedness) with MAMBAC and MAXEIG procedures. Again, no evidence for taxonic structure emerged.

Finally, Walters et al. (2007c) conducted a taxometric analysis of the PCL: SV with a pooled sample of 2230 male and female offenders and forensic/psychiatric patients (1505 males, 735 females). The results "uncovered consistent support for dimensional latent structure in PCL: SV-defined psychopathy" (p. 337). Further, these results applied to subsamples (men, women, Whites, Blacks, hospital patients, jail/prison inmates, file review with an interview, file review without an interview" (p. 330). The authors noted that, "The presence of dimensionality, however, does not preclude the use of cut scores. We would argue that cut scores can be helpful in both research and clinical contexts as long as the user recognizes that the cut score does not represent a taxonic boundary or that the group identified as psychopathic does not represent a natural category" (Walters et al., 2007c, p. 337).

The determination of whether the core latent structure of a construct like psychopathy is distributed as a dimension or a taxon has important practical and theoretical implications (Ruscio and Ruscio, 2004a; Edens et al., 2006). Knowledge of a syndrome's latent structure will guide the choice of assessment approaches that will maximize the reliability and validity of clinical judgments and will help to establish optimal cutting scores that minimize decision errors. It will also facilitate the selection of the best research designs to advance the study of the construct. Thus, the conclusion of whether or not psychopathy constitutes a taxon has important implications both for clinical assessment and for research on its etiology and development in both men and women.

Although the distribution of psychopathy for males at the phenotypic levels assessed in behavioral rating scales and self-report measures appears solidly dimensional rather than taxonic, the issue for females requires more research. The results obtained by Walters et al. (2007b) and Walters et al. (2007c) suggest a dimensional solution, but these studies used the PCL: SV rather than the more widely-used PCL-R, which serves as the international standard for assessing the psychopathy construct (see overview by Hare et al., 2013). The prevalence, structure, behavioral manifestations, neurobiology, and correlates of this measure of psychopathy are well researched in males, but less so in females.

Scores on PCL-R scales are often slightly lower for female offenders than for male offenders (e.g., Hare, 2003; Kennealy et al., 2007; Sturek et al., 2008; Neumann and Hare, 2008; Harenski et al., 2014; Tuente et al., 2014; Tsang et al., 2015). This discrepancy may reflect actual differences in prevalence or in sex-related issues involving physical, cultural, socioeconomic, political, and legal factors.

The reliability of scores on the PCL scales among female offenders typically is as high as it is for males (e.g., Hare, 2003; Salekin et al., 2005; Warren and South, 2006; Schrum and Salekin, 2006; Kennealy et al., 2007; Vitale et al., 2002; Walters et al., 2007b; Harenski et al., 2014). Similarly, the factor structure for females is generally comparable to that commonly observed for males, with some minor differences (Neumann et al., 2007, 2015; Neumann and Hare, 2008; Kosson et al., 2013). At the item level, items reflecting the Lifestyle and Antisocial facets (Factor 2) were more prone to display greater differential item functioning and to be less informative than were the Interpersonal and Affective facet items (Factor 1). There also were sex differences in the functioning of some items, suggesting that women and men differ in some aspects of the psychopathy construct or in the ways in which they express psychopathic features, especially antisocial-externalizing tendencies and various relational forms of aggression (Verona and Vitale, 2006).

Discussion of the literature on sex differences in the external correlates of the PCL-R and its derivatives is beyond the scope of this article. Detailed analyses and reviews are available elsewhere (Salekin et al., 1998; Cale and Lilienfeld, 2002; Vitale et al., 2002; Hare, 2003; Richards et al., 2003; Warren et al., 2003; Verona and Vitale, 2006; Warren and South, 2006; McKeown, 2010; Lehmann and Ittel, 2012; Book et al., 2013; Forth et al., 2013; Hare et al., 2013; Warren and Burnette, 2013; Tuente et al., 2014; Cunliffe et al., 2016). In general, the psychometric properties and external correlates of the PCL-R and its derivatives are similar for women and men.

1.3. The present study

Advances in taxometric analyses (Ruscio et al., 2004) have introduced bootstrapped sampling distributions of taxometric results using sample-specific simulated taxonic and dimensional comparison data and curve-fit indices to guide visual examination. In the present study we added these decision guides to Meehl's multiple consistency tests strategy for assessing taxonicity (Meehl, 1995). We applied these procedures to PCL-R ratings of female offenders sampled from multiple forensic settings. The basis for the analyses was Hare's (2003) four-factor solution for the PCL-R. We hypothesized that the latent structure of psychopathy as measured by the PCL-R is dimensional when using a large sample of incarcerated female offenders.

2. Method

2.1. Participants

Participants in this study were 1218 female prison inmates (553 African-Americans) incarcerated in North American institutions. Data were collected from six different samples across Canada (British Columbia and Ontario) and the United States (Wisconsin, Maryland, and Missouri). For a more detailed description of the sample composition and procedures, see Hare (2003, pp. 54–56). Vitale et al. (2002) provided Sample 1, which comprised 438 female inmates (215 Caucasians, 223 African-Americans) from a state prison in Wisconsin, with a mean (*SD*) PCL-R score of 18.2 (7.3). Richards et al. (2003) contributed Sample 2, which included 411 women (141 Caucasians, 270 African-Americans) incarcerated in a maximum-security prison in Maryland and screened for or enrolled in a year-long substance abuse program as part of a treatment effectiveness study. Their mean PCL-R score was 17.8 (6.9). Sample 3 contained 75 female inmates (56 Caucasians, 19 Natives) from minimum-, medium-, and maximum-security facilities in British Columbia, with a mean PCL-R score of 24.3 (7.4). Neary (1990) supplied Sample 4, which comprised 120 female inmates (60 Caucasians, 60 African-Americans) incarcerated in Missouri, with a mean

Table 1
PCL-R descriptive statistics.

	Mean	SD	Skewness	Kurtosis	*d*	*r*(tot)	*r*(tax)	*r*(comp)
Summative[a]	17.2	6.9	0.04	−0.78	2.92	0.37	−0.07	0.14
Interpersonal facet	3.3	2.2	0.37	−0.71	1.46	0.36	0.20	0.27
Affective facet	4.0	2.3	−0.02	−1.00	1.58	0.41	0.19	0.32
Lifestyle facet	5.8	2.5	−0.29	−0.78	1.66	0.30	0.05	0.22
Antisocial facet	4.2	2.5	0.22	−0.70	1.60	0.25	0.06	0.18

Note. *SD* = standard deviation, *d* = Cohen's *d* as a measure of indicator validity, *r*(tot) = mean inter-indicator correlation for total sample, *r*(tax) = mean inter-indicator correlation for the putative taxon, *r*(comp) = mean inter-indicator correlation for the putative complement.

[a] Only the 18 items that comprise the four facets are included. If all 20 items are included the mean PCL-R score is 19.0 (*SD* = 7.5).

PCL-R score of 21.1 (6.5). Sample 5 included 74 female inmates from a federal/provincial correctional center in British Columbia, with a mean PCL-R score of 22.8 (8.1). Finally, Loucks and Zamble (2000) furnished Sample 6, which was a representative sample of 100 female offenders admitted to the Correctional Service of Canada in Ontario, with a mean PCL-R score of 18.2 (9.1). Table 1 contains the descriptive statistics for the pooled sample.

2.2. The PCL-R

Psychopathy was assessed with the Psychopathy Checklist-Revised PCL-R (Hare, 1991, 2003) using a semi-structured interview and file information. The mean score for the entire sample was 19.0 (*SD* = 7.5), and the ICC was 0.94.

To produce the various within- and between-factor scores for taxometric analyses, we used the four-factor solution of the PCL-R (Hare, 2003). Although we used each item for the taxometric solutions calculated within each factor, we generated summative scales to produce indicators for each factor in the between-factor taxometric solutions.

2.3. Analyses

2.3.1. Taxometric analyses and simulations

Until recently, methods for determining the latent structure of a variable have been primitive and unconvincing (Meehl, 1999). Meehl (Meehl and Yonce, 1994, 1996; Waller and Meehl, 1998) developed a family of independent statistical techniques that permits a test of taxonic hypotheses and allows exploration of the latent structure of psychological constructs. The taxometric methods have the potential to distinguish types from continua as well as to determine whether a discriminable group or taxon or a simple dimension better accounts for the manifest variation on a scale. By the term taxon we mean a naturally occurring group, not one that has been arbitrarily constructed for convenience.

We performed three taxometric procedures: MAMBAC (Mean Above Minus Below A Cut; Meehl and Yonce, 1994), MAXEIG (MAXimum EIGenvalue; Waller and Meehl, 1998), and L-Mode (Latent Mode; Waller and Meehl, 1998). MAMBAC was performed using composite input indicators (i.e., selecting one of the *k* variables to serve as the output indicator and summing the remaining *k* – 1 variables to serve as the input indicator for each of *k* analyses). To accommodate the constrained indicator response scales, we calculated 50 equally spaced cutting scores beginning and ending with at least 25 cases from each end of the input indicator (larger values were used as necessary to stabilize the shapes near the ends of the curves). We calculated 10 internal replications for each curve to reduce the obfuscating influence of cutting between equal-scoring cases, as described in Ruscio et al. (2006). Generally, curves generated by taxonic solutions tend to have a single peak, whereas those generated by dimensional constructs tend to be concave or dish-shaped (Meehl and Yonce, 1994).

MAXEIG was calculated using composite input indicators (in the same way, and for the same reason, as in MAMBAC), except for the primary series of analyses. In that instance, there was sufficient response variation to perform MAXEIG in the more traditional manner (i.e., selecting one of the *k* variables to serve as the input indicator and using the remaining *k* – 1 variables as output indicators for each of *k* analyses). Each analysis used 25 windows that overlapped 90% with adjacent subsamples, and 10 internal replications. Once again, we did not smooth curves. We examined full panels of curves to ensure that the averaged curve fairly represented the overall pattern of results. Again, curves supportive of a taxonic solution should be peaked, whereas they are irregular, flat, or concave for dimensional solutions.

We used a third procedure (L-Mode, for Latent Mode; Waller and Meehl, 1998) only for the indicators in the primary analyses that possessed sufficient variation to render a factor analysis meaningful. These three procedures are based on semi-independent mathematical derivations and therefore can contribute non-redundant evidence of latent structure. As for the graphical representation, bimodal curves are indicative of a taxonic solution, whereas unimodal curves are indicative of a dimensional one. We generated results with Ruscio and Wang (2017) taxometric software package for R language (see Table 2 for the Command lines).

We approached the issue of base rate using three different strategies. First, because findings about the prevalence of psychopathy remain divergent, we performed analyses with no specified base rate. Second, we performed analyses with a theoretical threshold based on two different cutoffs, namely 25 and 30, the two most commonly used cutoffs for females (Beryl et al., 2014). Third, using the previously obtained results, we estimated base rates using the base rate classification method proposed by Ruscio (2009). We estimated taxon base rates using the mean of the MAMBAC and the MAXEIG base rates.

2.3.2. Analyses of comparison data

As a supplement to the inspection of taxometric results that can aid interpretation in ambiguous circumstances, we used bootstrap methods.

Table 2
R command lines.

```
RunTaxometrics (Summ4, seed = 1, n.pop = 1e+05, n.samples = 100, reps = 1,
    MAMBAC = TRUE, assign. MAMBAC = 1, n.cuts = 50, n.end = 25, MAXEIG =
    TRUE, assign. MAXEIG = 1, windows = 50, overlap = .9, LMode = TRUE,
    mode.l = −0.001, mode.r = 0.001, MAXSLOPE = FALSE)
RunTaxometrics (Summ425, seed = 1, n.pop = 1e+05, n.samples = 100, reps = 1,
    MAMBAC = TRUE, assign. MAMBAC = 1, n.cuts = 50, n.end = 25, MAXEIG =
    TRUE, assign. MAXEIG = 1, windows = 50, overlap = .9, LMode = TRUE,
    mode.l = −0.001, mode.r = 0.001, MAXSLOPE = FALSE)
RunTaxometrics (Sum430, seed = 1, n.pop = 1e+05, n.samples = 100, reps = 1,
    MAMBAC = TRUE, assign. MAMBAC = 1, n.cuts = 50, n.end = 25, MAXEIG =
    TRUE, assign. MAXEIG = 1, windows = 50, overlap = .9, LMode = TRUE,
    mode.l = −0.001, mode.r = 0.001, MAXSLOPE = FALSE)
RunTaxometrics (Summ4356, seed = 1, n.pop = 1e+05, n.samples = 100, reps =
    1, MAMBAC = TRUE, assign. MAMBAC = 1, n.cuts = 50, n.end = 25, MAXEIG
    = TRUE, assign. MAXEIG = 1, windows = 50, overlap = .9, LMode = TRUE,
    mode.l = −0.001, mode.r = 0.001, MAXSLOPE = FALSE)
```

MAMBAC: mean above minus below a sliding cut; MAXCOV: maximum covariance; L-MODE: latent model.
R program by John Ruscio: https://ruscio.pages.tcnj.edu/taxometrics/.

This involved generating samples of taxonic and dimensional comparison data that reproduce the sample size, indicator distributions, and indicator correlations in a sample of research data, and submitting each bootstrap sample to the same taxometric analyses as the research data. Comparison data were generated using an updated version of the algorithm outlined in Ruscio and Ruscio (2004a) and Ruscio et al. (2004). Using these comparison data we generated a Comparison Curve Fit Index (CCFI) with values ranging from 0 to 1, with lower values suggesting better fit for dimensional structures and higher values suggesting better fit for taxonic structures. The index is distributed symmetrically at about a mean of 0.50, which represents equivalent fit for both structures. It is important to note that the CCFI indexes the relative fit of taxonic and dimensional structural models, not the absolute goodness of fit of either model. In a preliminary test of this type of curve-fit index (Ruscio and Ruscio, 2004b), latent structure was correctly classified with high precision in analyses of Meehl and Yonce's (1994) 700 samples of taxonic and dimensional data. In a Monte Carlo study that includes a much broader range of data conditions (Ruscio et al., 2007), this index significantly outperformed several of the most popular taxometric consistency tests. To benefit fully from convergence of methods, we calculated mean CCFI coefficient index for MAMBAC, MAXEIG and L-Mode. In Monte Carlo analyses Ruscio et al. (2010) found that an average CCFI score lower than 0.45 accurately revealed a dimensional structure in 99.6% of cases, whereas an average CCFI higher than 0.55 accurately revealed a taxonic structure in 99.3% of the cases.

3. Results

3.1. Pre-taxometric analyses

Pre-taxometric analyses determined if our data met the minimal requirements for performing taxometric analyses (Walters, 2014). First, there should be a minimum of 300 participants (Meehl, 1995); our sample consisted of 1218 female offenders. Second, indicators have to be quasi-continuum indicators; that is composed of four or more ordered categories (Walters and Ruscio, 2009). The summed indicators comprised 12–30 ordered categories. Third, the mean inter-indicator

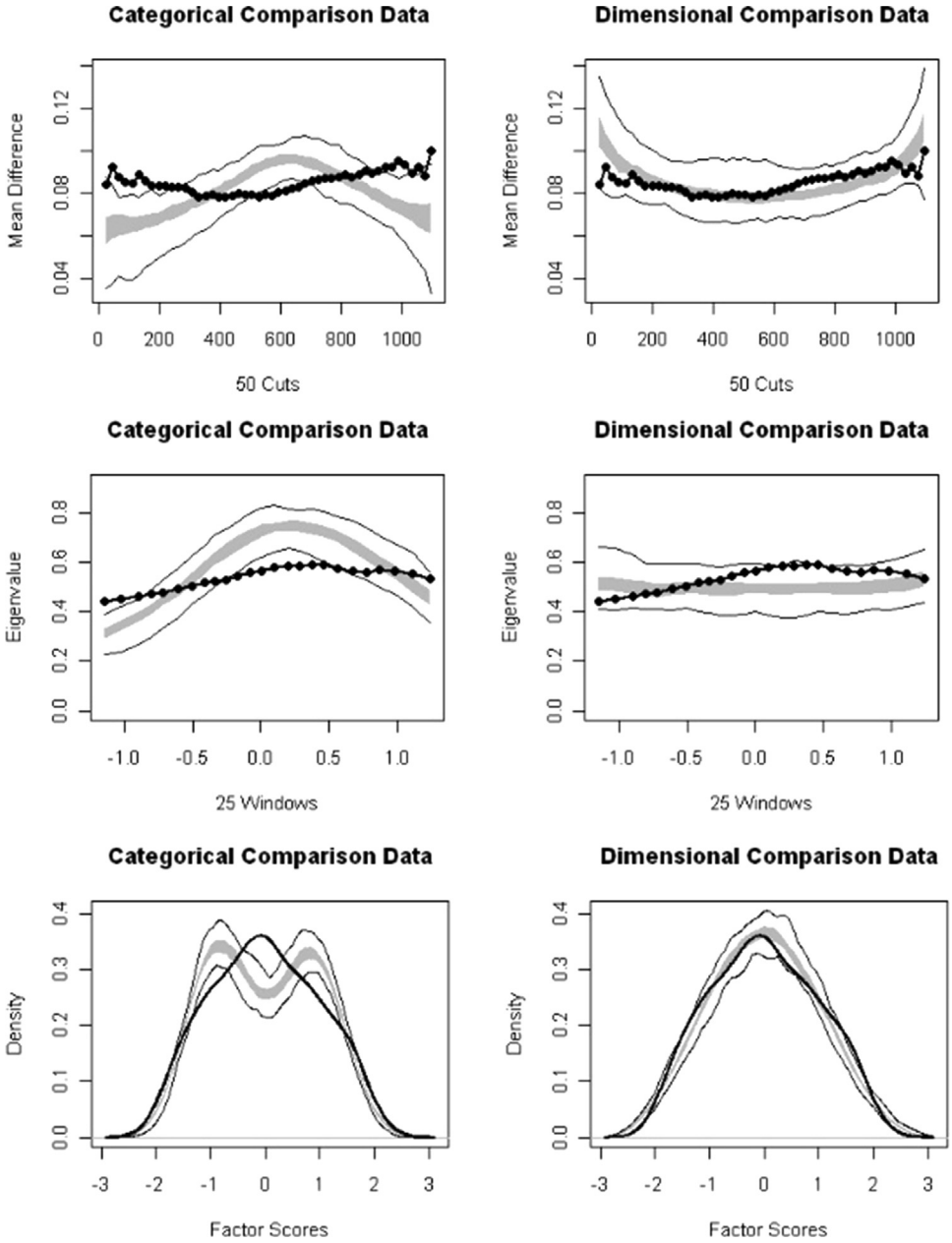

Fig. 1. Average MAMBAC, MAXEIG and L-Mode curves for the research data, simulated taxonic data, and simulated dimensional data for the four-facet PCL-R item-based model of psychopathy with no base rate specified.

Table 3
Summary of the taxometric analyses.

	MAMBAC		MAXEIG		L-mode		
	CCFI	BR	CCFI	BR	CCFI	BR	Mean CCFI
Theoretical cut-off							
No supplied base rate	0.312	0.454	0.347	0.407	0.288	0.503	0.316
> = 25 total score (26.3%)	0.607	0.353	0.309	0.359	0.288	0.522	0.402
> = 30 total score (10.3%)	0.531	0.353	0.408	0.359	0.438	0.522	0.456
Base rate classification method (35.6%)	0.655	0.353	0.308	0.359	0.229	0.522	0.398

correlation should exceed 0.30, and the mean inter-indicator correlations for the putative taxon and complement subgroups should not exceed 0.30 (Meehl, 1995). With the exception of the Antisocial facet (r = 0.24) and Factor 2 (r = 0.25), mean inter-indicator correlation surpassed 0.30 in the total sample, and the mean inter-indicator correlation fell below 0.30 in both the putative taxon and complement groups. Fourth, each indicator should differentiate between the putative taxon and complement groups at $d \geq 1.25$. Results provided in Table 1 indicate that our data met these conditions.

3.2. Summative, overall taxometrics of psychopathy

In all series of analyses, we created composite indicators in accordance with Hare's (2003) four-facet model. The items in each facet were summed to yield one indicator for each facet. These analyses were primary in the sense that the structure of PCL-R psychopathy was represented by all four facets: Interpersonal, Affective, Lifestyle, and Antisocial.

Fig. 1 depicts the results for MAMBAC, MAXEIG, and L-Mode

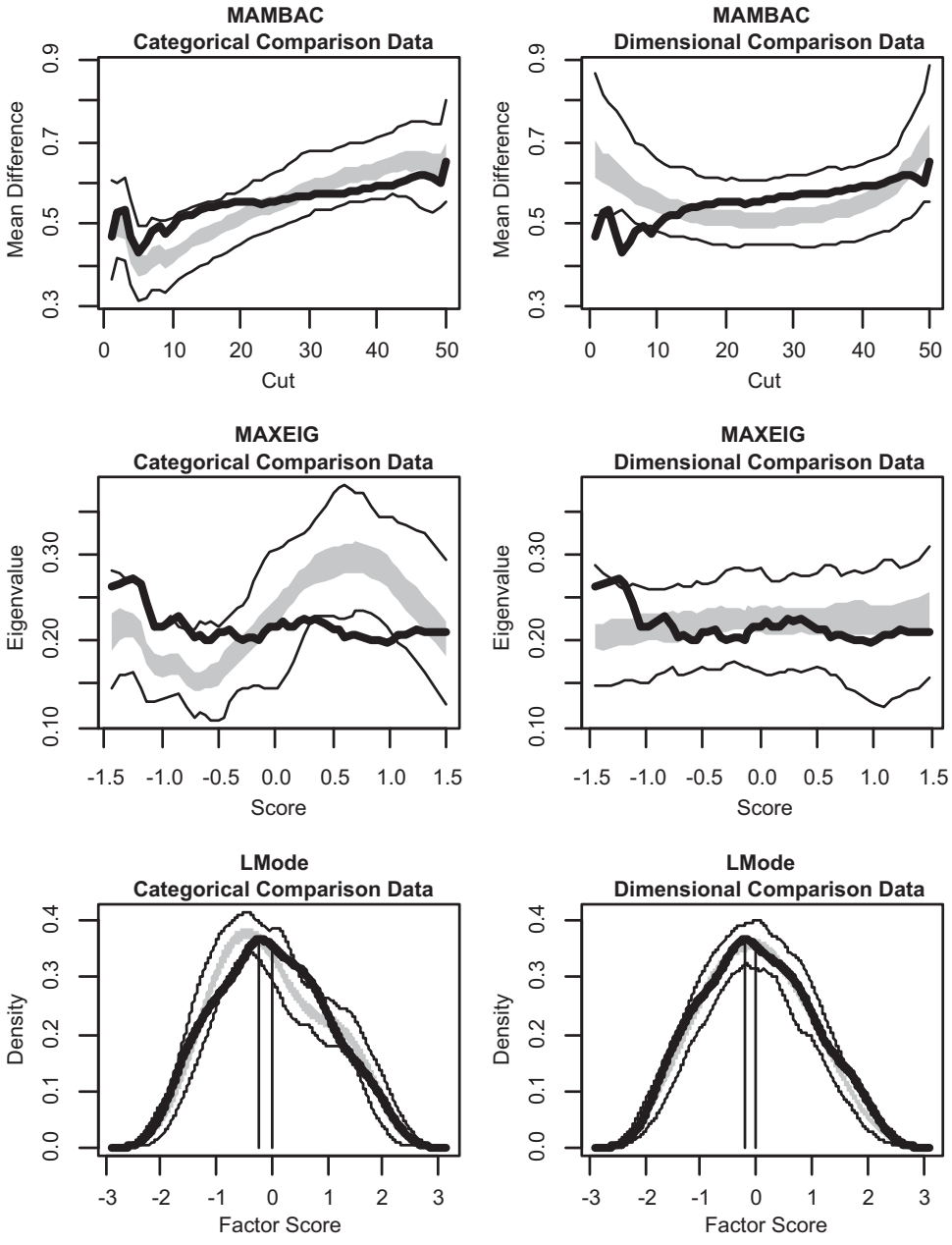

Fig. 2. Average MAMBAC, MAXEIG and L-Mode curves for the research data, simulated taxonic data, and simulated dimensional data for the four-facet PCL-R item-based model of psychopathy with a base rate based on a cut off of 25.

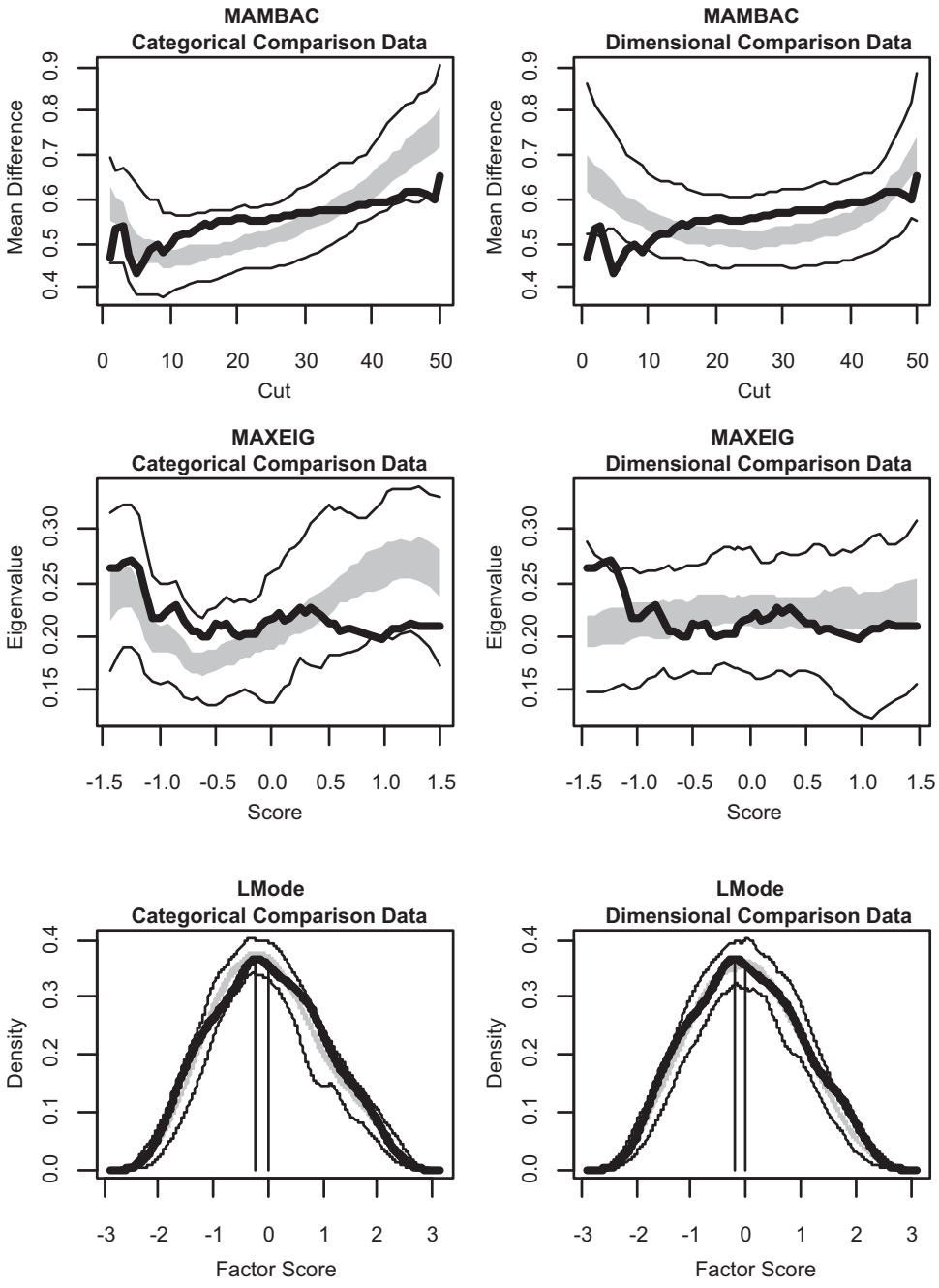

Fig. 3. Average MAMBAC, MAXEIG and L-Mode curves for the research data, simulated taxonic data, and simulated dimensional data for the four-facet PCL-R item-based model of psychopathy with a base rate based on a cut off of 30.

analyses of the four summative facets without a supplied base rate. The depictions of their curves are consistent with what one would expect for dimensional structure, and are quite similar to the curves generated using the simulated dimensional comparison data. No taxonic peaks emerged. This same conclusion was also reflected in the CCFI values for the full and adjusted summative analyses presented in Table 3. Mean CCFIs across the three taxometric analyses were all solidly in the dimensional range (below 0.45), and the total mean CCFI of 0.316.

For the second series of analyses for the four facets, we used and supplied two different estimated base rates. First, we used base rates estimated on a cut-off score of 30. Fig. 2 depicts these results. For the third series of analyses presented in Fig. 3, we used base rates estimated on a cut-off score of 25.

Results of the MAMBAC analyses presented in Figs. 2 and 3 showed curves that are consistent with a taxonic structure. On the other hand, results of the MAXEIG and L-Mode showed clear support for dimensionality. Mean CCFIs (Table 3) also converged on a dimensional structure for the 25 cut-off score (mean CCFI = 0.402), but were ambiguous for the 30 cut-off score (mean CCFI = 0.456).

Results presented in Fig. 4 are based on the base rate classification method. We used the mean of the MAMBAC and the MAXEIG estimated base rates (35.6%) to assign individuals with the highest PCL-R total scores to the putative taxon group or the putative complement group. Again, whereas the MAMBAC results showed a taxonic solution, the two other set of analyses showed CCFI compatible with a dimensional solution. The final mean CCFI for this set of analyses was also compatible with a dimensional solution. Thus, the majority of evidence suggested that the four facets of psychopathy do not support the presence of a taxonic construct in females. Rather, individual differences appear more consistent with dimensional structure.

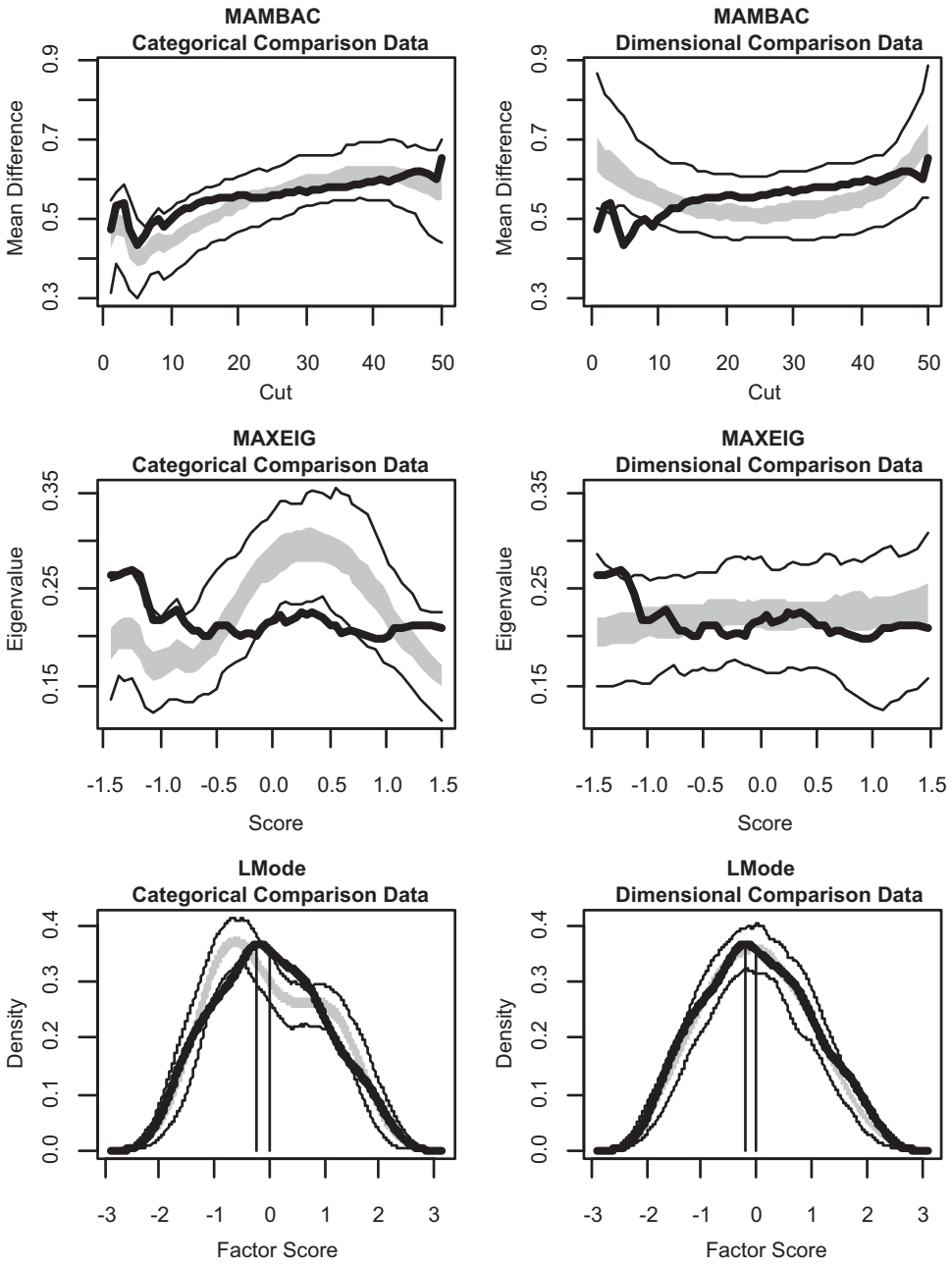

Fig. 4. Average MAMBAC, MAXEIG and L-Mode curves for the research data, simulated taxonic data, and simulated dimensional data for the four-facet PCL-R item-based model of psychopathy with base rate classification method.

4. Discussion

Studies on the latent structure of psychopathy in men have consistently supported the hypothesis that psychopathy, at least as measured in phenotypic behaviors or self-reports, is distributed dimensionally. Studies of the latent structure of psychopathy in women have been far less frequent, as have been studies of psychopathy in women in general. The objective of the current study was to investigate the latent structure of psychopathy as measured by the PCL-R in a large sample of female offenders. Consistent with other taxometric investigations of psychopathy on male offenders using the PCL-R, and with female offenders using the PCL: SV (Walters et al., 2007b, 2007c), the present results for women generally support a dimensional latent structure for psychopathy. As in males, psychopathy in females may be conceptualized better as a quantitative than a qualitative difference. Of all analyses, only the MAMBAC curves with supplied class supported a taxonic structure. All mean curve-fit indexes supported a clear dimensional structure, except for the cut-off score of 30, which showed ambiguous results, slightly above the 0.45 threshold for dimensional results.

There are several implications of these results. From a theoretical point of view, our results generally suggest that psychopathy, as well as personality disorders in general, may be best conceptualized as configurations of extreme scores on personality traits, affective and cognitive competences, or neurobiological processes that exist on a continuum with normal functioning (e.g., Widiger, 1993; Widiger and Costa, 1994). Conceiving of psychopathy as a dimension carries several implications about optimal strategies for studying the disorder. It argues in favour of moving away from extreme group designs that assume a categorical structure of discrete groups (Preacher et al., 2005) and from attempting to distinguish psychopaths from nonpsychopaths or even trichotomizing PCL-R scores for comparison purposes (Lilienfeld, 1994). Conclusions rather argue toward dimensional designs, such as the quantitative, latent trait model-based approach proposed by Krueger et al. (2005) in explicating the comorbidity among externalizing disorders. The dimensionalization of psychopathy is also

consistent with the recent increase in research on subclinical manifestations of psychopathy (Jones and Figueredo, 2013; Lilienfeld et al., 2015b; Mathieu et al., 2015; Mathieu et al., in press) and suggests the importance of such research for unravelling etiological factors of the components of psychopathy.

The clinical implications are also important. Results that support a dimensional structure for psychopathy in both men and women remind us that the cut-off scores of 25 or 30 are arbitrary in nature. Indeed, if such cut-offs are useful, particularly for sentencing, they do not show real differences in kind but only in degree for the two offender groups identified. Aside from potential loss of power (Cohen, 1983), such a dichotomization could result in spurious associations and inflated effect sizes. From this perspective, it would be useful to consider several cut-off scores for the PCL-R, each one being useful for different decisions (Walters et al., 2007b; Walters, 2014). In practice, such a decision process demands that we create measures for psychopathy traits that possess adequate discriminative power along the whole continuum of the measure rather than focusing on discriminative power at only specific cut-points (Widiger and Clark, 2000).

Practically and especially in forensic settings where the "psychopathy" label has severe negative connotations, it might be appropriate to change the terminology we use to describe psychopathy measures in clinical and forensic settings. Hare, Table 2.1, p. 31) (2003) has in fact made this suggestion, with five descriptors based on the PCL-R score (Very High, High, Moderate, Low, and Very Low).

The current study is not without its limits. The main limit concerns the use of a single instrument, in this case the PCL-R. Indeed, such an approach exposed us to the potential problem of mono-operational bias (Shadish et al., 2002). However, other studies using self-reports have obtained similar results (Walters et al., 2008). It is essential that we conduct studies for both males and females using either cognitive or affective performance measures or biological measures that covary with psychopathic traits (e.g., Walters et al., 2015). These might each capture method variances at different levels of analysis from observational and self-report measures and might provide a different perspective on the latent structure of psychopathy. Finally, the present study focuses on incarcerated female offenders. A more diverse sample including offenders followed in the community or even non-adjudicated offenders could offer better generalizability. From the existing data, even with their limitations, only a dimensional structure is evident.

As a final point, Ruscio (2007) noted that, "It is possible that the structure of psychopathy may be more complex, containing both taxonic and dimensional features: Within a nonpsychopathic group, a set of dimensions may capture individual differences on psychopathy-relevant traits, but hardcore psychopaths deviate substantially on multiple dimensions and form their own group" (p. 1589). Recent latent profile analyses of the PCL-R factors have identified a profile with very high scores on all factors (Mokros et al., 2015; Hare, 2016). Whether or not this particular profile reflects a taxon is a matter for further research.

Acknowledgements

The authors would like to thank Kylie Neufeld for her assistance in preparing this manuscript. Robert Hare receives royalties from the sale of the PCL-R and its derivatives.

References

Arieti, S., 1963. Psychopathic personality: some views on its psychopathology and psychodynamics. Compr. Psychiatry 4, 301–312.
Berrios, G.E., 1996. The History of Mental Symptoms: Descriptive Psychopathology Since the Nineteenth Century. Cambridge University Press, Cambridge, UK.
Beryl, R., Chou, S., Völlm, B., 2014. A systematic review of psychopathy in women within secure settings. Pers. Individ. Differ. 71, 185–195.
Book, A.S., Forth, A.E., Clark, H.J., 2013. The Hare psychopathy checklist: youth version. In: Archer, R.P., Wheeler, E.M. (Eds.), Forensic Uses of Clinical Assessment Instruments, 2nd ed. Routledge, New York, pp. 266–290.
Cale, E.M., Lilienfeld, S.O., 2002. Sex differences in psychopathy and antisocial personality disorder. A review and integration. Clin. Psychol. Rev. 22, 1179–1207.
Cleckley, H., 1941. The Mask of Sanity. Mosby, St. Louis, MO.
Cleckley, H., 1976. The Mask of Sanity, 5th ed. Mosby, St. Louis, MO.
Cohen, J., 1983. The cost of dichotomization. Appl. Psychol. Meas. 7, 249–253.
Crego, C., Widiger, T.A., 2016. Cleckley's psychopaths: revisited. J. Abnorm. Psychol. 125, 75–87.
Cunliffe, T.B., Gacono, C.B., Smith, J.M., Kivisto, A.J., Meloy, J.R., Taylor, E.E., 2016. Assessing psychopathy in women. In: Gacono, C.B. (Ed.), The Clinical and Forensic Assessment of Psychopathy, 2nd ed. Routledge, New York, pp. 167–190.
Edens, J.F., Marcus, D.K., Lilienfeld, S.O., Poythress, N.G., 2006. Psychopathic, not psychopath: taxometric evidence for the dimensional structure of psychopathy. J. Abnorm. Psychol. 115, 131–144.
Edens, J.F., Marcus, D.K., Vaughn, M.G., 2011. Exploring the taxometric status of psychopathy among youthful offenders: is there a juvenile psychopath taxon? Law Hum. Behav. 35, 13–24.
Felthous, A.R., Saß, H., 2007. International Handbook on Psychopathic Disorders and the Law. Wiley, New York, NY.
Forth, A.E., Bo, S., Kongerslev, M., 2013. Assessment of psychopathy: the Hare Psychopathy Checklist measures. In: Kiehl, K., Sinnott-Armstrong, W. (Eds.), Handbook on Psychopathy and Law. Oxford University Press, New York, NY, pp. 5–33.
Guay, J.P., Knight, R.A., 2003. Assessing the Underlying Structure of Psychopathy Factors using Taxometrics. Poster presented at the Developmental, Neuroscience Perspectives on Psychopathy, Madison, Wisconsin.
Guay, J.P., Ruscio, J., Knight, R.A., Hare, R.D., 2007. A taxometric analysis of the latent structure of psychopathy: evidence for dimensionality. J. Abnorm. Psychol. 116, 701–716.
Hare, R., D., Black, P., Walsh, Z., 2013. The PCL-R: forensic applications and limitations. In: Archer, R.P., Wheeler, E.M.A. (Eds.), Forensic Use of Clinical Assessment Instruments, 2nd ed. Routledge, New York, pp. 230–265.
Hare, R.D., 1991. The Psychopathy Checklist-Revised Manual. Multi-Health Systems, Toronto, ON.
Hare, R.D., 2003. The Psychopathy Checklist-Revised Technical Manual, 2nd ed. Multi-Health Systems, Toronto, ON.
Hare, R.D., 2016. Psychopathy, the PCL-R, and criminal justice: some new findings and current issues. Can. Psychol. 57, 21–34.
Hare, R.D., Neumann, C.S., 2008. Psychopathy as a clinical and empirical construct. Annu. Rev. Clin. Psychol. 4, 217–246.
Harenski, C.L., Edwards, B.G., Harenski, K.A., Kiehl, K.A., 2014. Neural correlates of moral and non-moral emotion in female psychopathy. Front. Hum. Neurosci. 8, 741.
Harris, G.T., Rice, M.E., Quinsey, V.L., 1994. Psychopathy as a taxon: evidence that psychopaths are a discrete class. J. Consult. Clin. Psych. 62, 387–397.
Hart, S., Cox, D., Hare, R.D., 1995. Manual for the Psychopathy Checklist: Screening Version (PCL: SV). Multi-Health Systems, Toronto ON.
Hervé, H., 2007. Psychopathic subtypes: historical and contemporary perspectives. In: Yuille, J.C., Hervé, H. (Eds.), The Psychopath: Theory, Research, and Practice. Erlbaum, Mahwah, NJ, pp. 431–460.
John, S.L., 2009. The Taxometric Analysis of Psychopathy in an Incarcerated Female Population. ProQuest Dissertations Publishing, Sam Houston State University.
Jones, D.N., Figueredo, A.J., 2013. The core of darkness: Uncovering the heart of the dark triad. Eur. J. Personal. 27, 521–531.
Karpman, B., 1955. Criminal psychodynamics: a platform. Arc. Crim. Psychodyn. 1, 3–100.
Kennealy, P.J., Hicks, B.M., Patrick, C.J., 2007. Validity of factors of the Psychopathy Checklist-Revised in female prisoners: discriminant relations with antisocial behavior, substance abuse, and personality. Assessment 14, 323–340.
Kosson, D.S., Neumann, C.S., Forth, A.E., Salekin, R.T., Hare, R.D., Krischer, M.K., Sevecke, K., 2013. Factor structure of the Hare Psychopathy Checklist: youth Version (PCL: yv) in adolescent females. Psychol. Assess. 25, 71–83.
Krueger, R.F., Markon, K.E., Patrick, C.J., Iacono, W.G., 2005. Externalizing psychopathology in adulthood: a dimensional-spectrum conceptualization and its implications for DSM-V. J. Abnorm. Psychol. 114, 537–550.
Lehmann, A., Ittel, A., 2012. Aggressive behavior and measurement of psychopathy in female inmates of German prisons- a preliminary study. Int. J. Law Psychiat. 35, 190–197.
Levenson, M.R., Kiehl, K.A., Fitzpatrick, C.M., 1995. Assessing psychopathic attributes in a noninstitutionalized population. J. Personal. Soc. Psychol. 68, 151–158.
Lilienfeld, S.O., 1994. Conceptual problems in the assessment of psychopathy. Clin. Psychol. Rev. 14, 17–38.
Lilienfeld, S.O., Watts, A.L., Smith, S.F., Berg, J.M., Latzman, R.D., 2015a. Psychopathy deconstructed and reconstructed: identifying and assembling the personality building blocks of Cleckley's chimera. J. Pers. 83, 593–610.
Lilienfeld, S.O., Watts, A.L.S., F, S., 2015b. Successful psychopathy: a scientific status report. Curr. Dir. Psychol. Sci. 24, 298–303.
Lilienfeld, S.O., Widows, M.R., 2005. Psychopathic Personality Inventory–Revised: Professional Manual. Psychological Assessment Resources, Lutz, FL.
Loucks, A., Zamble, E., 2000. Predictors of criminal behavior and prison misconduct in serious female offenders. Empir. Appl. Crim. Justice Rev. 1, 1–47.
Marcus, D.K., John, S.L., Edens, J.F., 2004. A taxometric analysis of psychopathic personality. J. Abnorm. Psychol. 113, 626–635.
Mathieu, C., Babiak, P., Hare, R.D., in press. Psychopathy in the workplace, in: Felthous, A.R., Sa, H. (Eds.), International Handbook on Psychopathic Disorders and the Law, 2nd ed. Wiley, NY.
Mathieu, C., Neumann, C., Babiak, P., Hare, R.D., 2015. Corporate psychopathy and the

full-range leadership model. Assessment 22, 267–278.
McKeown, A., 2010. Female offenders: assessment of risk in forensic settings. Aggress. Violent Behav. 15, 422–429.
Meehl, P.E., 2004. What's in a taxon? J. Abnorm. Psychol. 113, 39–43.
Meehl, P.E., Yonce, L.J., 1994. Taxometric analysis: I. Detecting taxonicity with two quantitative indicators using means above and below a sliding cut (MAMBAC procedure). Psychol. Rep. 74, 1059–1274.
Meehl, P.E., Yonce, L.J., 1996. Taxometric analysis: II. Detecting taxonicity using covariance of two quantitative indicators in successive intervals of a third indicator (MAXCOV PROCEDURE). Psychol. Rep. 78, 1091–1227.
Meehl, P.E., 1995. Bootstraps taxometrics: solving the classification problem in psychopathology. Am. Psychol. 50, 266–275.
Meehl, P.E., 1999. Clarifications about taxometric method. J. Appl. Prev. Psychol. 8, 165–174.
Millon, T., Simonsen, E., Birket-Smith, M., Davis, R.D., 1998. Psychopathy: Antisocial, Criminal, and Violent Behavior. Guildford Press, Guilford, NY.
Mokros, A., Hare, R.D., Neumann, C.S., Santtila, P., Habermeyer, E., Nitschke, J., 2015. Variants of psychopathy in adult male offenders: a latent profile analysis. J. Abnorm. Psychol. 124, 372–386.
Murrie, D.C., Marcus, D.K., Douglas, K.S., Lee, Z., Salekin, R.T., Vincent, G., 2007. Youth with psychopathy features are not a discrete class: a taxometric analysis. J. Child Psychol. Psychiatry 48–714-23.
Neary, A., 1990. DSM-III and Psychopathy Checklist Assessment of Antisocial Personality Disorder in Black and White Female Felons (Unpublished doctoral dissertation). University of Missouri, St. Louis, MO.
Neumann, C.S., Hare, R.D., 2008. Psychopathic traits in a large community sample: links to violence, alcohol use, and intelligence. J. Consult. Clin. Psychol. 76, 893–899.
Neumann, C.S., Hare, R.D., Newman, J.P., 2007. The super-ordinate nature of the Psychopathy Checklist. J. Personal. Disord. 21, 102–117.
Neumann, C.S., Hare, R.D., Pardini, D.A., 2015. Antisociality and the construct of psychopathy: data from across the globe. J. Pers. 83, 678–692.
Preacher, K.J., Rucker, D.D., MacCallum, R.C., Nicewander, W.A., 2005. Use of the extreme groups approach: a critical reexamination and new recommendations. Psychol. Methods 10, 178–192.
Richards, H.J., Casey, J.O., Lucente, S.W., 2003. Psychopathy and treatment response in incarcerated female substance abusers. Crim. Justice Behav. 30, 251–276.
Ruscio, J., 2007. Taxometric analysis: an empirically grounded approach to implementing the method. Crim. Justice Behav. 34, 1588–1622.
Ruscio, J., 2009. Assigning cases to groups using taxometric results: an empirical comparison of classification techniques. Assessment 16, 55–70.
Ruscio, J., Haslam, N., Ruscio, A.M., 2006. Introduction to the Taxometric Method: A Practical Guide. Erlbaum, Mahwah, NJ.
Ruscio, J., Ruscio, A.M., 2004a. A conceptual and methodological checklist for conducting a taxometric investigation. Behav. Ther. 35, 403–447.
Ruscio, J., Ruscio, A.M., 2004b. Clarifying boundary issues in psychopathology: the role of taxometrics in a comprehensive program of structural research. J. Abnorm. Psychol. 113, 24–38.
Ruscio, J., Ruscio, A.M., Keane, T.M., 2004. Using taxometric analysis to distinguish a small latent taxon from a latent dimension with positively skewed indicators: the case of Involuntary Defeat Syndrome. J. Abnorm. Psychol. 113, 145–154.
Ruscio, J., Ruscio, A.M., Meron, M., 2007. Applying the bootstrap to taxometric analysis: generating empirical sampling distributions to help interpret results. Multivar. Behav. Res. 42, 349–386.
Ruscio, J., Walters, G.D., Marcus, D.K., Kaczetow, W., 2010. Psychol. Assess. 22, 5–21.
Ruscio, J., Wang, S.B., 2017. RTaxometrics: Taxometric Analysis. R package version 2.3. Available at https://CRAN.R-project.org/package=RTaxometrics.
Salekin, R.T., Leistico, A.R., Trobst, K.K., Schrum, C.L., Lochman, J.E., 2005. Adolescent psychopathy and personality theory–the interpersonal circumplex: expanding evidence of a nomological net. J. Abnorm. Child Psychol. 33, 445–460.
Salekin, R.T., Rogers, R., Ustad, K.L., Sewell, K.W., 1998. Psychopathy and recidivism among female inmates. Law Hum. Behav. 22, 109–128.
Schrum, C.L., Salekin, R.T., 2006. Psychopathy in adolescent female offenders: an item response theory analysis of the Psychopathy Checklist: youth Version. Behav. Sci. Law 24, 39–63.
Shadish, W.R., Cook, T.D., Campbell, D.T., 2002. Experimental and Quasi-Experimental Design for Generalized Causal Inference. Houghton-Mifflin, Boston, MA.
Skilling, T.A., Quinsey, V.L., Craig, W.M., 2001. Evidence of a taxon underlying serious antisocial behavior in boys. Crim. Justice Behav. 28, 450–470.
Skilling, T.A., Harris, G.T., Rice, M.E., Quinsey, V.L., 2002. Identifying persistently antisocial offenders using the Hare Psychopathy Checklist and the DSM Antisocial personality disorder criteria. Psychol. Assess. 14, 27–38.
Sturek, J.C., Loper, A.B., Warren, J.I., 2008. Psychopathy in female inmates: the SCID-II Personality Questionnaire and the PCL-R. Psychol. Serv. 5, 309–319.
Tsang, S., Schmidt, K.M., Vincent, G.M., Salekin, R.T., Moretti, M.M., Odgers, C.L., 2015. Assessing psychopathy among justice involved adolescents with the PCL: yv: An item response theory examination across gender. Personal. Disord. 6, 22–31.
Tuente, S.K., de Vogel, V., Stam, J., 2014. Exploring the criminal behavior of women with psychopathy: results from a multicenter study into psychopathy and violent offending in female forensic psychiatric patients. Int. J. Forensic Ment. 13, 311–322.
Verona, E., Vitale, J., 2006. Psychopathy in women: assessment, manifestations. In: Patrick, C.J. (Ed.), Handbook of Psychopathy. Guilford Press, New York, pp. 415–436.
Vitale, J.E., Smith, S.S., Brinkley, C.A., Newman, J.P., 2002. The reliability and validity of the Psychopathy Checklist-Revised in a sample of female offenders. Crim. Justice Behav. 29, 202–231.
Waller, N.G., Meehl, P.E., 1998. Multivariate Taxometric Procedures: Distinguishing Types from Continua. Sage, Newbury Park, CA.
Walters, G.D., 2014. The latent structure of psychopathy in male adjudicated delinquents: a cross-domain taxometric analysis. Personal. Disord. 5, 348–355.
Walters, G.D., Brinkley, C.A., Magaletta, P.R., Diamond, P.M., 2008. Taxometric analysis of the Levenson Self-Report Psychopathy Scale. J. Pers. Assess. 90, 491–498.
Walters, G.D., Diamond, P.M., Magaletta, P.R., Geyer, M.D., Duncan, S.A., 2007a. Taxometric analysis of the antisocial features scale of the personality assessment Inventory in federal prison inmates. Assessment 14, 351–360.
Walters, G.D., Duncan, S.A., Mitchell-Perez, K., 2007b. The latent structure of psychopathy: a taxometric investigation of the Psychopathy Checklist-Revised in a heterogeneous sample of male prison inmates. Assessment 14, 270–278.
Walters, G.D., Ermer, E., Knight, R.A., Kiehl, K.A., 2015. Paralimbic biomarkers in a taxometric analysis of psychopathy: Does changing the indicators change the conclusion? Personal. Disord 6, 41–42.
Walters, G.D., Gray, N.S., Jackson, R.L., Sewell, K.W., Rogers, R., Taylor, J., Snowden, R.J., 2007c. A taxometric analysis of the Psychopathy Checklist: screening Version (PCL: sv): Further evidence of dimensionality. Psychol. Assess. 19, 330–339.
Walters, G.D., Marcus, D.K., Edens, J.F., Knight, R.A., Sanford, G., 2011. In search of the psychopathic sexuality taxon: indicator size does matter. Behav. Sci. Law 29, 1–17.
Walters, G.D., Ruscio, J., 2009. To sum or not to sum: taxometric analysis with ordered categorical assessment items. Psychol. Assess. 21, 99–111.
Warren, J.I., Burnette, M., 2013. The multifaceted construct of psychopathy: association with APD, clinical, and criminal characteristics among male and female inmates. Int. J. Forensic Ment. 12, 265–273.
Warren, J.I., Burnette, M., South, C.S., Chauhan, P., Bale, R., Friend, R., Van Patten, I., 2003. Psychopathy in women: structural modeling and co-morbidity. Int. J. Law Psychiat. 26, 223–242.
Warren, J.I., South, S.C., 2006. Comparing the constructs of antisocial personality disorder and psychopathy in a sample of incarcerated women. Behav. Sci. Law 24, 1–20.
Widiger, T.A., 1993. The DSM-III-R categorical personality disorder diagnoses: a critique and an alternative. Psychol. Inq. 4, 75–90.
Widiger, T.A., Clark, L.A., 2000. Toward DSM-V and the classification of psychopathology. Psychol. Bull. 126, 946–963.
Widiger, T.A., Costa, P.T., 1994. Personality and personality disorders. J. Abnorm. Psychol. 103, 78–91.