A bifactorial solution to the Psychopathy Checklist: Screening Version in a sample of civil psychiatric patients

DANIEL BODUSZEK[1], KATIE DHINGRA[2], PHILIP HYLAND[3] AND AGATA DEBOWSKA[4],   [1]University of Huddersfield, Huddersfield, UK; [2]Manchester Metropolitan University, Manchester, UK; [3]National College of Ireland, Dublin, Ireland; [4]University of Chester, Chester, UK

ABSTRACT

Background *There is considerable debate about the underlying factor structure of the Psychopathy Checklist: Screening Version (PCL: SV). An established view is that it reflects a unitary construct underpinned by two correlated factors. More recent research has, however, undermined this conceptualisation.*

Aims *Our aim was to compare 10 competing models of the PCL: SV in a sample of civil psychiatric patients.*

Method *Ten distinct factor models were specified and tested using conventional confirmatory factor analytic techniques, along with confirmatory bifactor modelling.*

Results *A bifactor model, including two general factors (interpersonal–affective and antisocial–lifestyle), and four subordinate factors (interpersonal, affective, antisocial and lifestyle) provided the best fit to the data. The reliability of the conceptualisation was supported through the use of composite reliability, and the differential relationships exhibited between the general factors and measures of personality, impulsivity and mental health.*

Conclusions *Our findings provide further weight to taking the two general psychopathy factors into account when interpreting the PCL: SV for clinical purposes. Copyright © 2015 John Wiley & Sons, Ltd.*

Introduction

The Psychopathy Checklist: Screening Version (PCL: SV; Hart et al., 1995) is a 12-item version of the Psychopathy Checklist-Revised (PCL-R; Hare, 1991),

created for use as a stand-alone instrument for research with non-offenders, or as a screen for psychopathy in offender populations. It was developed to assess a unitary psychopathy construct formed by two correlated factors ($r \sim 0.50$ Hare, 1991). Factor 1 reflects interpersonal and affective traits; factor 2, a socially deviant lifestyle. Although there is some evidence for this two-factor structure (e.g. Harpur et al., 1989; Hart et al., 1995; Skeem and Mulvey, 2001), there is some against it (e.g. Forth et al., 1996; Dolan and Anderson, 2003).

More recent research suggests that either a three-factor (Cooke and Michie, 2001) or four-factor model (Hare, 2003) may better represent the structure of the PCL: SV than the two-factor approach. Cooke and Michie's (2001) three-factor model divided the original factor 1 into an interpersonal factor (*arrogant and deceitful interpersonal style*) and an affective factor (*deceitful affective experience*) and combined the original factor 2 items (except for the antisocial behaviour items) to form an *impulsive and irresponsible behaviour style* factor. In Hare's (2003) four-factor model, factor 1 of the original two-factor model is divided into 'interpersonal' and 'affective' facets, and factor 2 is into 'lifestyle' and 'antisocial' facets. Even more recent studies have found a good fit for this four-factor model (e.g. Forth et al., 2003; Vitacco et al., 2006; Neumann and Hare, 2008; Žukauskienė et al., 2010). Association between the four factors is, however, generally high (e.g. from $r = 0.45$ between interpersonal and antisocial latent variables to $r = 0.99$ between lifestyle and antisocial latent variables; Žukauskienė et al., 2010), implying the presence of a higher-order psychopathy factor or a general factor with four method factors.

The inconsistent and unsatisfactory model fit reported in the literature suggests that traditional confirmatory factor analysis (CFA) methods are not sufficient to explain the dimensionality of the PCL: SV. Thus, some researchers (e.g. Patrick et al., 2007; Flores-Mendoza et al., 2008) have used an alternative model structure to the PCL-R, which may yield a theoretically and statistically satisfactory solution. This involves the application of bifactor modelling (Reise et al., 2010). Within a bifactorial modelling approach, covariation among items is presumed to be explained by both 'general factors' (the source of common variance running through all measure items) and separate uncorrelated grouping factors that reflect the unique coherency among particular subgroups of items. Thus, the bifactor approach differs from the higher-order approach in that subfactors are not subsumed by the general factor(s) but remain uncorrelated and distinct. Consequently, if a bifactor model is found to provide a statistically superior fit to the data than alternative models tested, this indicates that (1) the domain being modelled is saturated by one or more broad factor(s) that reflect common variance running through all scale items and (2) specific scales in the domain are also saturated by other specific (i.e. residual) uncorrelated factors that reflect additional common variance among clusters of items, typically, with highly similar content. Thus, in a bifactor model, each scale is a measure of the general factor(s), but some scales also index more specific constructs not thus accounted for.

Patrick et al. (2007) found that a bifactor model including a single general 'psychopathy' factor and three subordinate factors (interpersonal, affective and impulsivity) provided a better fit to the data than alternative models tested. Flores-Mendoza et al. (2008) reported that the bifactorial solution better represented the data than any other model tested among 124 male prisoners. The latter had, however, removed non-significant loadings from their model, which may suggest that their solution was a poor approximation of their data.

Our aim was to provide a more accurate determination of the optimal number of factors necessary to explain the dimensionality of the PCL: SV. We therefore investigated a series of theoretically plausible models of the underlying structure of the PCL: SV (Harpur et al., 1989; Forth et al., 1996; Cooke et al., 1999; Hare, 2003; Patrick et al., 2007; Flores-Mendoza et al., 2008; Neumann and Hare, 2008; Debowska et al., 2014), including bifactor models that have not previously been empirically tested but are in line with theoretical formulations.

Method

Sample

Participants were 1136 civil psychiatric patients sampled from one of three acute inpatient hospitals as part of the MacArthur Violence Risk Assessment Study. Inclusion criteria were age 18–40 years; having English as a first language; having been hospitalised for less than 21 days; and having a records diagnosis of schizophrenia, schizophreniform disorder, schizoaffective disorder, major depression, dysthymia, mania, brief reactive psychosis, delusional disorder, alcohol and/or other drug abuse or dependence and/or personality disorder. A total of 1695 patients met the inclusion criteria, but just 71% agreed to participate (for more information on sample recruitment and characteristics, see Monahan et al., 2001). For our study, we used data from baseline and two follow-up interviews. After excluding data from participants who had not been administered the PCL: SV, we had data for analysis from 871 patients (502 men and 369 women).

Measures

Psychopathy

Psychopathy was assessed by trained raters using the 12-item PCL: SV (Hart et al., 1995), using semi-structured interviews supplemented by records data. Each item is rated on a 3-point scale [0 (*does not apply*), 1 (*applies to a certain extent*) and 2 (*applies*)]. The PCL: SV has good reliability and validity and is strongly related to the PCL-R (Cooke et al., 1999; Guy and Douglas, 2006).

Criminal behaviour

Three items were used as an indication of criminal behaviour. The first was arrests for crimes against persons and the second crimes against property, both coded dichotomously from official criminal records. The third reflected several categories of violent behaviour in the 10 weeks prior to baseline interview (for details, see Monahan et al., 2001).

NEO-Five Factor Inventory, Short Form

The NEO-Five Factor Inventory, Short Form (Costa and McCrae, 1992) is a 60-item inventory that taps the 'Big 5' dimensions of personality: neuroticism, extraversion, openness, agreeableness and conscientiousness. Items that composed these scales had acceptable levels of internal consistency.

Wechsler Abbreviated Scale of Intelligence

The Wechsler Abbreviated Scale of Intelligence (Wechsler, 1999) produces an estimate of general intelligence, with higher scores indicating greater intellectual ability.

Psychiatric symptoms

The Brief Symptom Inventory (Derogatis and Spencer, 1993) is a 16-item rating scale used to assess psychiatric symptoms along a 7-point scale at the time of interview. Its subscales are activation, thought disturbance, hostile–suspiciousness, anergia and anxiety–depression.

Analysis

The dimensionality of the PCL: SV was investigated through the use of conventional CFA techniques, along with confirmatory bifactor modelling (Reise, et al., 2010). Ten alternative models of the latent factor structure of the PCL: SV were specified and estimated using MPLUS version 6.12 (Muthen and Muthen, 1998–2010) with maximum likelihood estimation. Six of these models were 'traditional' in CFA terms. Within these models, items were restricted to load only onto a single factor; while in the bifactor models, each item was allowed to load onto one or two general factors and either three or four subordinate factors (interpersonal, affective, lifestyle and antisocial), as recommended by Reise, et al (2010). Thus, in bifactor models, each item is a measure of the general factor, as well as more specific constructs that are not correlated with the general factor. In all cases, measurement error terms remained uncorrelated, as suggested in previous research (Bollen, 1989; Brown, 2006; Boduszek et al., 2012; Boduszek et al., 2013).

Model 1 is a one-factor solution in which the 12 items of the PCL: SV load onto a single latent variable of psychopathy. Model 2 is a correlated two-factor model in which the two latent variables are represented by psychopathy factor 1 (interpersonal–affective; items 1, 2, 3, 4, 5 and 6) and psychopathy factor 2

(antisocial–lifestyle; items 7, 8, 9, 10, 11 and 12). Model 3 is a correlated three-factor model in which the three latent variables of psychopathy are represented by an interpersonal factor (items 1, 2 and 3), an affective factor (items 4, 5 and 6) and a lifestyle factor (items 7, 9 and 10). Model 4 is a correlated four-factor model in which the four latent variables of psychopathy are represented by an interpersonal factor (items 1, 2 and 3), an affective factor (items 4, 5 and 6), a lifestyle factor (items 7, 9 and 10) and an antisocial factor (items 8, 11 and 12). Models 5 and 6 are higher-order models with one and two superordinate latent factors, respectively. Model 7 is a bifactor conceptualisation containing five latent factors: a single general factor of psychopathy and four subordinate factors represented by interpersonal, affective, antisocial and lifestyle latent variables (items loading as above). Model 8 (Figure 1) is also a bifactor conceptualisation containing six latent variables: two general factors (factor 1 – items 1, 2, 3, 4, 5 and 6; factor 2 – items 7, 8, 9, 10, 11 and 12) and four subordinate factors (items as in model 4). Model 9 is a bifactor conceptualisation containing four latent factors: a single general factor of psychopathy and three subordinate factors represented by interpersonal, affective and lifestyle latent variables (items loading the same as previously mentioned). Model 9 is another bifactor conceptualisation containing two general factors (factor 1 – items 1, 2, 3, 4, 5 and 6; factor 2 – items 7, 8, 9, 10, 11 and 12) and three subordinate factors (items as in model 3). Within a bifactor model, the grouping factors are restricted to be uncorrelated with each other and uncorrelated with the general factors. For the purposes of model identification, the variance of each factor is set to 1.0.

The overall fit of each model and the relative fit between models were assessed using a range of goodness-of-fit statistics. The chi-square (χ^2) statistic assesses the sample and implied covariance matrix; a model with good fit is indicated by a
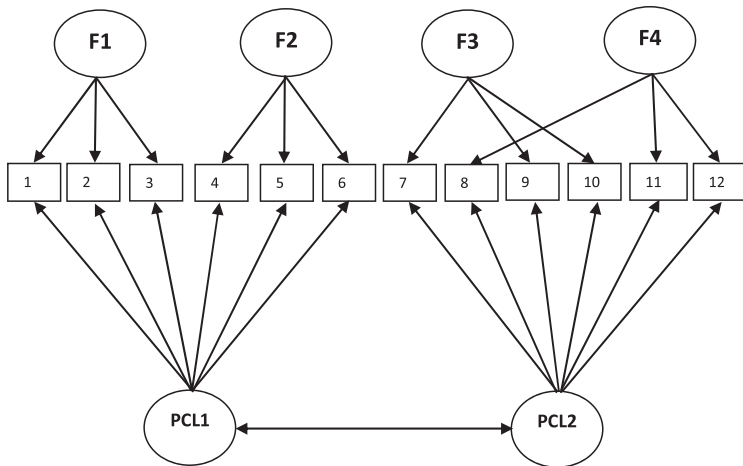

Figure 1: Model 8: bifactor model of the PCL: SV with two general factor and four subordinate factors

non-significant result. As the chi-square statistic is strongly associated with sample size, however, good models tend to be over-rejected. Therefore, Tanaka (1987) suggested that a model should not be rejected simply on the basis of a significant chi-square result. The comparative fit index (CFI; Cronbach, 1951) and the Tucker–Lewis index (TLI; Tucker and Lewis, 1973) are measures of how much better the model fits the data compared with a baseline model where all variables are uncorrelated. For these indices, values above 0.95 indicate good model fit (Bentler, 1990; Hu and Bentler, 1999). In addition, two more absolute indices are presented: the standardised root-mean-square residual (SRMR; Joreskog and Sorbom, 1981) and the root-mean-square error of approximation (RMSEA; Steiger, 1990). Ideally, these indices should be less than 0.05 to suggest good fit (Bentler, 1990; Hu and Bentler, 1999; Joreskog and Sorbom, 1981). Furthermore, the Akaike information criterion (Akaike, 1974) was used to evaluate the alternative models, with the smaller value indicating the best fitting model.

Results

General characteristics of the sample

Participants were aged 18–40 years [mean 29.86, standard deviation (SD) 6.20]. The mean total PCL: SV score was 8.52 (SD 5.61, median 8, range 0–24); 72 participants scored above the cut-off score of 14. The mean general factor 1 score was 3.11 (SD 2.99, median 2, range 0–12), and the mean general factor 2 score was 5.41 (SD 3.30, median 5, range 0–12). Cronbach's alpha coefficients for general factor 1 and general factor 2 were 0.84 and 0.82, respectively.

Model results

Table 1 shows the fit indices and CFIs of the 10 alternative models of the PCL: SV. Models 1 to 6 and 9 were rejected as poor approximations of the data. Models 7, 8 and 10 were found to provide good representations, with model 8 providing the best fit to the data. Model 8, which includes two general factors of psychopathy and four subordinate factors, was a good approximation of the covariation matrix in the data obtained, based on all fit indices. In an analysis including only the women in the sample, the bifactorial solution was again statistically superior to the alternative models tested (χ^2 = 60.06, p = 0.03; RMSEA 0.04 [90% confidence interval 0.02–0.05]; SRMR 0.03; CFI 0.99; TLI 0.98).

The adequacy of bifactor model (total sample) can also be determined in relation to its parameter estimates. As shown in Table 2, all items displayed statistically significant ($p < 0.001$) factor loadings on the two general psychopathy factors. Factor loadings were all in the expected direction, and all items displayed factor loading above 0.4. Further inspection of the factor loadings for the four

Table 1: Fit indices for 10 alternative models of the PCL: SV

Models	χ^2	d.f.	CFI	TLI	RMSEA	SRMR	AIC
1 factor	967.98*	54	0.76	0.72	0.14	0.08	19,418.97
Correlated 2 factors	514.18*	53	0.89	0.86	0.10	0.05	18,967.17
Correlated 3 factors	230.72*	24	0.93	0.89	0.10	0.05	13,937.92[+]
Correlated 4 factors	357.61*	48	0.92	0.90	0.09	0.05	18,820.60
1 higher-order factor, 4 correlated factors	486.20*	50	0.89	0.86	0.10	0.06	18,945.19
2 higher-order factors, 4 correlated factors	357.72*	49	0.92	0.90	0.09	0.05	18,818.71
Bifactorial with 1 general + 4 subordinate factors	245.51*	42	0.95	0.92	0.08	0.05	18,720.49
Bifactorial with 2 general + 4 subordinate factors	104.84*	41	0.98	0.98	0.04	0.02	18,581.83
Bifactorial with 1 general + 3 subordinate factors	374.27*	45	0.92	0.88	0.09	0.06	18,843.26
Bifactorial with 2 general + 3 subordinate factors	165.59*	44	0.97	0.96	0.06	0.04	18,636.57

Note: N = 871; PCL: SV = Psychopathy Checklist: Screening Version; χ^2 = chi-square goodness-of-fit statistic; d.f. = degrees of freedom; RMSEA = root-mean-square error of approximation; AIC = Akaike information criterion; CFI = comparative fit index; TLI = Tucker–Lewis index; SRMR = standardised root-mean-square residual.
*Indicates χ^2 are statistically significant ($p < 0.05$).
[+]As the 3-factor model is based on a different set of items and, therefore, a different covariance matrix, direct statistical comparison of this model with the alternative models tested is not possible (Brown, 2006; Kline, 1998).

subordinate factors provides critical information regarding the appropriateness of including these factors in the scoring of the PCL: SV. Reise et al. (2010) advised that when items load strongly onto a general factor (or factors), and less strongly on each of the subordinate factors, this demonstrates the superiority of the general factors over the subordinate factors in the conceptualisation of the factor structure of the scale, and thus its related scoring scheme. Alternatively, when items load as strongly (or more strongly) onto each of the respective subordinate factors than onto the general factor, creation of subscales based on these factors can be considered appropriate.

As outlined in Table 2, factor loadings for each subordinate factor were poorer than those on the two general factors. These parameter estimate results provide strong support for the supremacy of a model containing two general factors, and the presence of four substantively meaningful subordinate factors. The two general factors were moderately correlated ($r = 0.45$). The four grouping factors were kept uncorrelated as suggested by Reise et al. (2010).

Further analysis examined the relationships between the PCL: SV factors and external variables (Table 3). Results indicate that general factor 2 but not general

Table 2: Standardised factor loadings for the four subordinate (F1–F4) and two general factors (PCL1 and PCL2) of the PCL: SV

Item	F1	F2	F3	F4	PCL1	PCL2
1. Superficial	0.72***				0.61***	
2. Grandiose	0.19				0.48***	
3. Deceitful	0.11				0.68***	
4. Lacks remorse		0.47***			0.78***	
5. Lacks empathy		0.43***			0.61***	
6. Does not accept responsibility		0.17**			0.79***	
7. Impulsive			0.11*			0.71***
9. Lack goals			0.56***			0.51***
10. Irresponsibility			0.35***			0.70***
8. Poor behavioural controls				0.15*		0.62***
11. Adolescent antisocial behaviour				0.90**		0.48***
12. Adult antisocial behaviour				0.22**		0.73***

Note: PCL: SV = Psychopathy Checklist: Screening Version.
***Factor loadings are statistically significant at $p < 0.001$.
**Factor loadings are statistically significant at $p < 0.01$.
*Factor loadings are statistically significant at $p < 0.05$.

factor 1 is significantly, if weakly, associated with neuroticism ($r = 0.10$), openness ($r = -0.11$), conscientiousness ($r = -0.19$), Barratt Impulsiveness Scale (BIS) cognitive ($r = 0.22$), and anxiety–depression ($r = 0.09$).

Reliability analysis

Composite reliability calculations indicate that the general factor 1 ($\rho c = 0.84$) and general factor 2 ($\rho c = 0.86$) of the PCL: SV possesses satisfactory composite reliability.

Discussion

Crucial to the study of any psychological construct is the clear delineation of its underlying structure. This is necessary not only for the interpretation of scores on a measure but also because dimensions of a construct may differentially relate to external variables (Reise et al., 2010) and because inaccurate factor conceptualisations may result in unstable estimates of reliability (Shevlin et al., 2000). Our study was carried out to provide a methodologically rigorous investigation of the dimensionality of the PCL: SV (Hart et al., 1995), a frequently used measure of personality traits, which has been at the centre of much debate with respect to the appropriate latent structure of the scale. Based on the inappropriateness of including correlated measurement errors in factorial models (Boduszek et al., 2012; 2013), we examined

Table 3: Relationships between PCL: SV factors and external variables

Variable	F1	F2	F3	F4	PCL1	PCL2
NEO-Neuroticism	−0.06	0.01	0.11**	0.07	−0.02	0.10_{**}
NEO-Extraversion	0.12**	−0.02	−0.03	0.02	0.05	0.01
NEO-Openness	0.06	−0.10**	−0.12**	−0.08*	−0.02	−0.11**
NEO-Agreeableness	−0.24**	−0.34**	−0.29**	−0.37**	−0.32**	−0.36**
NEO-Conscientiousness	0.02	−0.06	−0.19**	−0.14**	−0.02	$−0.19_{**}$
WAIS-R	−0.08*	−0.22**	−0.29**	−0.20**	−0.17**	−0.28**
BIS Motor	0.10**	0.17**	0.24**	0.27**	0.15**	0.29_{**}
BIS Non-planning	0.10**	0.15**	0.33**	0.31**	0.14**	0.36**
BIS Cognitive	0.01	0.09**	0.19**	0.20**	0.06	0.22**
BPRS Activation	0.12**	0.17**	0.17**	0.15**	0.16**	0.18**
BPRS Thought disturbance	0.10**	0.09*	0.07*	0.08*	0.11**	0.08*
BPRS Hostile–suspiciousness	0.09*	0.17**	0.09**	0.21**	0.15**	0.17**
BPRS Anergia	−0.10**	0.06	0.03	−0.04	−0.02	−0.01
BPRS Anxiety–depression	−0.01	0.01	0.08*	0.08*	0.01	0.09*
Number of violent acts	0.12**	0.21**	0.18**	0.24**	0.18**	0.23**
Crime against people	0.05	0.07*	0.06	0.07_{*}	0.07	0.07
Crime against property	0.16**	0.17**	0.14**	0.14**	0.18**	0.17**

Note: PCL: SV = Psychopathy Checklist: Screening Version; WAIS-R = Wechsler Adult Intelligence Scale-Revised; BIS = Barratt Impulsiveness Scale; BPRS = Brief Psychiatric Rating Scale.
**$p < 0.01$;
*$p < 0.05$.

the 10 conceptualisations of the structure of the PCL: SV, including four bifactorial solutions.

Fit indices indicated that the bifactor model with two general factors (*interpersonal–affective* and *antisocial–lifestyle*) and four independent subordinate factors (interpersonal, affective, antisocial and lifestyle), each of which account for unique variance in their respective set of items over and above the variance accounted for by the general factors, was a superior representation of the underlying factor structure of the PCL: SV than the alternative factor solutions tested. This suggests that the PCL: SV represents a two-dimensional construct with four distinct domains of item content (subordinate factors) that, among general psychiatric patients, vary independently from the general factors. This conceptualisation is theoretically satisfying as it is consistent with Hare's (1991) earlier two-factor characterisation of psychopathy and with the notion that psychopathy is not a unitary construct. This bifactorial solution is more parsimonious than other models tested, so our results also add support for its value for clinical interpretations. This is important because delineating the latent variables that define a construct is necessary to inform risk assessment and treatment options. Although our findings suggest that

antisocial tendencies (general factor 2) are important features of the psychopathy construct, further research is needed to determine whether these tendencies are simply a consequence of other psychopathic traits, or whether they may influence development of other psychopathic features (general factor 1).

The appropriateness of this factorial solution was further supported by the differential relationship between the two general factors and measures of personality, impulsivity and mental health. As suggested by Carmines and Zeller (1979), if factors measure substantially different dimensions, they should differentially relate to variables external to the construct. We found that only general factor 2 was significantly related to neuroticism, openness, conscientiousness, BIS cognitive and anxiety–depression.

Parameter estimates also highlight the need to consider two meaningful general factors when applying the PCL: SV in research. Failing to control for systematic error that could arise owing to the presence of the subordinate factors could not only prevent identification of a theoretically consistent and logical factor structure but also ultimately lead to inaccurate interpretations about relationships between scale factors and other variables. Future research should, therefore, seek to compare the predictive effect of PCL: SV modelled as a four-factor structure, as is currently standard practice, and the predictive effect of the two general factors when the four subordinate factors are modelled and controlled for within the bifactorial conceptualisation. The two general factors also showed good reliability, as assessed using composite reliability (Novick and Lewis, 1967).

It is important to note that our analysis was based on data from adult general psychiatric patients who had completed very short inpatient admissions after a mental health crisis; our findings may not be generalisable to any other group. Future research might apply the same statistical approaches to data from people who never require hospital admission for mental disorder, people with primary personality disorder, offender patients and/or adolescents and, in particular, check whether such approaches actually provide any improvement in capacity to aid assessment of risk of maladaptive or criminal behaviour.

In conclusion, we rigorously investigated the factor structure of the PCL: SV with one large group of recently discharged psychiatric patients. We found that it has two general factors, on which the items of the original two-factor model load (six items on each factor), along with four separate subordinate factors on which the items of the four-factor model load. We also found that the two general factors are differentially associated with variables external to the psychopathy construct and provided empirical support for the value of adopting a bifactor modelling approach when assessing the dimensionality of this measure.

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Address correspondence to: Katie Dhingra, Department of Psychology, Manchester Metropolitan University, Manchester, M15 6GX, UK. Email: K.Dhingra@mmu.ac.uk