A Bifactorial Solution to the Psychopathy Checklist Screening Version in a Sample of Civil Psychiatric Patients

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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: The results suggest that two general factors should be taken into account when interpreting the PCL:SV for clinical purposes.

Keywords: PCL: SV; Bifactorial Modelling; Confirmatory Factor Analysis; Psychopathy.

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, whereas Factor 2 reflects 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 & Mulvey, 2001), there is some against it (e.g., Dolan & Anderson, 2003; Forth et al., 1996).

More recent research suggests that either a three (Cooke & 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) 3-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 a 'lifestyle' facet and an 'antisocial' facet. Studies that are even more recent have found a good fit for this 4-factor model (e.g., Forth et al., 2003; Neumann & Hare, 2008; Vitacco et al., 2006; Žukauskienė et al., 2010). Association between the four-factors is, however, generally high – for example 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., Flores-Mendoza et al., 2008; Patrick et al., 2007) 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 (see 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 model approach in that subfactors are not subsumed by the general factor(s) but are, instead, 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: (a) the domain being modelled is saturated by one or more broad factor(s) that reflects the common variance running among all scale items, and (b) 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 other more specific constructs that are not accounted for by the general factor(s).

Patrick et al. (2007) found that a bifactor model including a single general "psychopathy" factor and three subfactors factors (interpersonal, affective, and impulsivity) provided a better fit to the data than alternative models tested. Similarly, Flores-Mendoza et al. (2008) reported that the bifactorial solution was a better representation of the data than any other tested model in a sample of 124 male prisoners. The later 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 (see Cooke et al., 1999; Debowska et al., 2014; Forth et al., 1996; Flores-Mendoza et al., 2008; Hare, 2003; Harpur et al., 1989; Neuman & Hare, 2008; Patrick et al., 2007), including bifactor models which have not previously been empirically tested but are in-line with theoretical formulations.

Method

Sample

Participants were 1,136 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, 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 or other drug abuse or dependence or personality disorder. A total of 1,695 patients met the inclusion criteria, but just 71% agreed to participate (for more information on the data collection method and sample 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 PCL: SV, we were left with data for analysis from 871 patients (502 men, 369 women).

Measures

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*, 2 *applies*). The PCL: SV has good reliability and validity and is strongly related to the PCL-R (Cooke et al., 1999; Guy & 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).

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

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

Psychiatric symptoms. The Brief Symptom Inventory (BSI; Derogatis, 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 confirmatory factor analytic (CFA) techniques, along with confirmatory bifactor modelling (see 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 & Muthen, 1998 – 2010)

with maximum likelihood (ML) 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 four

subordinate factors (interpersonal, affective, lifestyle, 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 (Boduszek

et al., 2013; Boduszek et al., 2012; Bollen, 1989; Brown, 2006).

   Model 1 is a one-factor solution in which the twelve 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 (see 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 as above). 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.

Figure 1

Model 8: Bifactor model of the PCL:SV
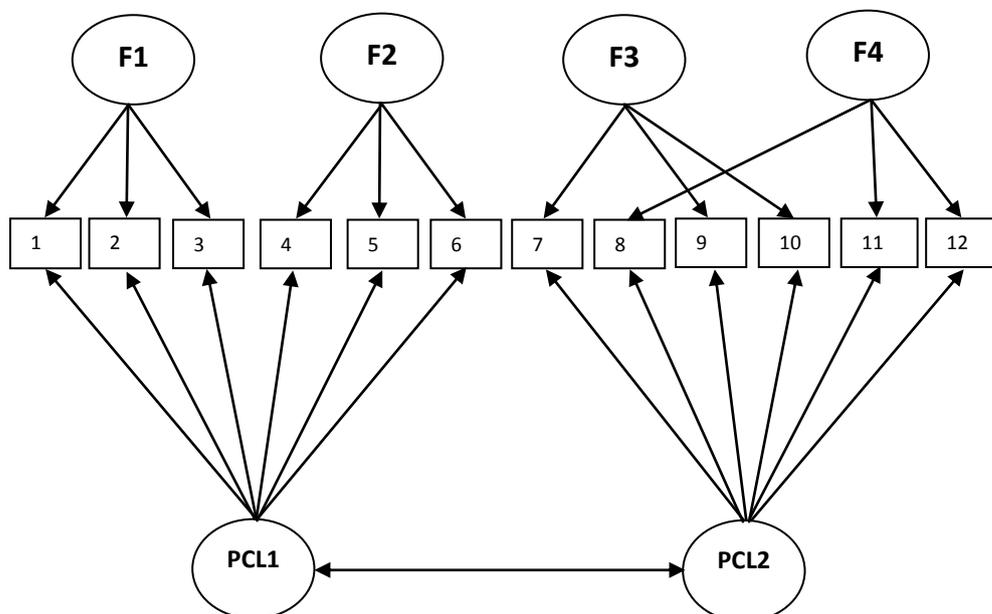
NB: PCL1 = general factor 1 (Interpersonal-Affective), PCL2 = general factor 2 (Antisocial-Lifestyle), F1 = Interpersonal, F2 = Affective, F3 = Antisocial, F4 = Lifestyle.

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 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, 1990) and the Tucker Lewis Index (TLI; Tucker & Lewis, 1973) are measures of how much better the model fits the data compared to a baseline model where all variables are uncorrelated. For these indices, values above 0.95 indicate good model fit (Bentler, 1990; Hu & Bentler, 1999). In addition, two more absolute indices are presented: the standardised root mean-square residual (SRMR: Joreskog & Sorborn, 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 & Bentler, 1999; Joreskog & Sorbom, 1993). Furthermore, the Akaike Information Criterion (AIC; 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 in this sample were between the ages of 18–40 years ($M = 29.86$, $SD = 6.20$). The mean total PCL:SVscore is 8.52 ($SD = 5.61$, Median = 8, Min = 0, Max = 24), and 72 participants are above the cut-off score of 14. The mean general factor 1 score is 3.11 (SD = 2.99, Median = 2, Min = 0, Max = 12); while the mean general factor 2 score is 5.41 ($SD =$

3.30, Median = 5, Min = 0, Max = 12). Cronbach's alpha coefficients for general factor 1 and general factor 2 are 0.84 and 0.82, respectively.

Model Results

Table 1 shows the fit indices and comparative fit indices of the ten alternative models of the PCL: SV. Based on these findings, 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. This model (Model 8), which includes two general factors of psychopathy and four subordinate factors, was determined to be a good approximation of the covariation matrix in the obtained data based upon 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 ($\chi^2 = 60.06$, $p = 0.03$; RMSEA 0.04 [90% CI 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 loading were all in the expected direction and all items displayed factor loading above 0.4. Further inspection of the factor loadings for the four subordinate factors provides critical information regarding the appropriateness of including these factors in the scoring of the PCL: SV. Reise et al. (2010) advise 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 grouping 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 factor 1 is significantly, if weakly, associated with neuroticism ($r = 0.10$), openness ($r = -0.11$), conscientiousness ($r = -0.19$), 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.

Table 1

Fit Indices for Ten Alternative Models of the PCL: SV

	χ^2	df	CFI	TLI	RMSEA	SRMR	AIC
Models							
1factor	967.98*	54	.76	.72	.14	.08	19418.97
Correlated 2 factors	514.18*	53	.89	.86	.10	.05	18967.17
Correlated 3 factors	230.72*	24	.93	.89	.10	.05	13937.92[+]
Correlated 4 factors	357.61*	48	.92	.90	.09	.05	18820.60
1 higher-order factor, 4 correlated factors	486.20*	50	.89	.86	.10	.06	18945.19
2 higher-order factors, 4 correlated factors	357.72*	49	.92	.90	.09	.05	18818.71
Bifactorial with 1 general + 4 subordinate factors	245.51*	42	.95	.92	.08	.05	18720.49
Bifactorial with 2 general + 4 subordinate factors	104.84*	41	.98	.98	.04	.02	18581.83
Bifactorial with 1 general + 3 subordinate factors	374.27*	45	.92	.88	.09	.06	18843.26
Bifactorial with 2 general + 3 subordinate factors	165.59*	44	.97	.96	.06	.04	18636.57

Note. $N = 871$; χ^2 = chi square goodness of fit statistic; df = degrees of freedom; RMSEA = Root-Mean-Square Error of Approximation; CI = Confidence Interval; AIC = Akaike Information Criterion; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; SRMR = Standardized Square Root Mean Residual. * Indicates χ^2 are statistically significant ($p < .05$). [+] 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).

Table 2

Standardized 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	.72***				.61***	
2. Grandiose	.19				.48***	
3. Deceitful	.11				.68***	
4. Lacks remorse		.47***			.78***	
5. Lacks empathy		.43***			.61***	
6. Doesn't accept responsibility		.17**			.79***	
7. Impulsive			.11*			.71***
9. Lack goals			.56***			.51***
10. Irresponsibility			.35***			.70***
8. Poor behavioural controls				.15*		.62***
11. Adolescent antisocial behaviour				.90**		.48***
12. Adult antisocial behaviour				.22**		.73***

Note. Factor loadings are statistically significant at *** $p < .001$, ** $p < .01$, * $p < .05$

Table 3

Relationships between PCL: SV factors and external variables

Variable	F1	F2	F3	F4	PCL1	PCL2
NEO-Neuroticism	-.06	.01	.11**	.07	-.02	.10**
NEO-Extraversion	.12**	-.02	-.03	.02	.05	.01
NEO-Openness	.06	-.10**	-.12**	-.08*	-.02	-.11**
NEO-Agreeableness	-.24**	-.34**	-.29**	-.37**	-.32**	-.36**
NEO-Conscientiousness	.02	-.06	-.19**	-.14**	-.02	-.19**
WAIS-R	-.08*	-.22**	-.29**	-.20**	-.17**	-.28**
BIS Motor	.10**	.17**	.24**	.27**	.15**	.29**
BIS non-planning	.10**	.15**	.33**	.31**	.14**	.36**
BIS cognitive	.01	.09**	.19**	.20**	.06	.22**
BPRS Activation	.12**	.17**	.17**	.15**	.16**	.18**
BPRS thought disturbance	.10**	.09*	.07*	.08*	.11**	.08*
BPRS hostile-suspiciousness	.09*	.17**	.09**	.21**	.15**	.17**
BPRS Anergia	-.10**	.06	.03	-.04	-.02	-.01
BPRS anxiety-depression	-.01	.01	.08*	.08*	.01	.09*
Number of violent acts	.12**	.21**	.18**	.24**	.18**	.23**
Crime against people	.05	.07*	.06	.07*	.07	.07
Crime against property	.16**	.17**	.14**	.14**	.18**	.17**

Note. ** $p < .01$, * $p < .05$

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, 1999) and because inaccurate factor conceptualisations may result in unstable estimates of reliability (see 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 (see Boduszek et al., 2012, 2013), we examined 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, 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 2-factor characterisation of psychopathy. Furthermore, it is consistent with the notion that psychopathy is not a unitary construct, but is instead a combination of two continuous independent, however statistically correlated, latent factors. To the extent that the bifactorial solution is more parsimonious that

other tested models, the results of this study suggest supporting the utility of two general

factors model of psychopathy for clinical interpretive purposes. This is important because

delineating the latent variables that define a construct is necessary to inform risk assessment

and treatment options. Although the present findings suggest that antisocial tendencies

(general factor 2) are important features of the psychopathy construct, further research is

warranted in this area. For instance, research is needed to determine whether antisocial

tendencies are simply a consequence of other psychopathic traits, or whether antisocial

features influence the nature and development of other psychopathic features (general factor

1).

The appropriateness of this factorial solution was 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 external variables. 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 contexts. Failing to control for systematic

error variance which arises due to the presence of the subordinate factors could not only

prevent identification of a theoretically consistent and logical factor structure, but ultimately

lead to inaccurate interpretations about the relationships between the scale factors and various

external 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 & 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 investigation of the factor structure of the PCL: SV with one large group of recently discharged psychiatric patients. We found that the PCL: SV 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 external variables, and provided empirical support for the value of adopting a bifactor modelling approach when assessing the dimensionality of this measure.

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