



Universiteit  
Leiden  
The Netherlands

## Model-based PID-5 domain clusters and levels of impairment in self and interpersonal functioning

Bastiaens, T.; Wilderjans, T.F.; Bogaerts, A.; Lowyck, B.; Luyckx, K.; Hert, M. de; ... ; Claes, L.

### Citation

Bastiaens, T., Wilderjans, T. F., Bogaerts, A., Lowyck, B., Luyckx, K., Hert, M. de, ... Claes, L. (2021). Model-based PID-5 domain clusters and levels of impairment in self and interpersonal functioning. *Personality And Individual Differences*, 171.  
doi:10.1016/j.paid.2020.110477

Version: Publisher's Version

License: [Licensed under Article 25fa Copyright Act/Law \(Amendment Taverne\)](#)

Downloaded from: <https://hdl.handle.net/1887/3594310>

**Note:** To cite this publication please use the final published version (if applicable).



## Model-based PID-5 domain clusters and levels of impairment in self and interpersonal functioning

Tim Bastiaens<sup>a,\*</sup>, Tom F. Wilderjans<sup>b,c,d</sup>, Annabel Bogaerts<sup>c</sup>, Benedicte Lowyck<sup>a,e</sup>,  
Koen Luyckx<sup>c,f</sup>, Marc De Hert<sup>a,e,g</sup>, Dominique Vanwalleghem<sup>a</sup>, Laurence Claes<sup>c,h</sup>

<sup>a</sup> University Psychiatric Center KU Leuven, Leuvensesteenweg 517, 3070 Kortenberg, Belgium

<sup>b</sup> Methodology and Statistics Research Unit, Institute of Psychology, Faculty of Social and Behavioral Sciences, Leiden University, Pieter de la Court Building, Wassenaarseweg 52, 2333 AK Leiden, the Netherlands

<sup>c</sup> Faculty of Psychology and Educational Sciences, KU Leuven, Tiensestraat 102, Box 3713, 3000 Leuven, Belgium

<sup>d</sup> Leiden Institute for Brain and Cognition (LIBC), Leids Universitair Medisch Centrum (LUMC), 2300 RC Leiden, the Netherlands

<sup>e</sup> KU Leuven, Department of Neurosciences, Leuven, Belgium

<sup>f</sup> UNIBS, University of the Free State, Bloemfontein, South Africa

<sup>g</sup> Antwerp Health Law and Ethics Chair - AHLEC, University Antwerp, Antwerp, Belgium

<sup>h</sup> University of Antwerp, Faculty of Medicine and Health Sciences, Antwerp, Belgium

### ARTICLE INFO

#### Keywords:

PID-5

AMPD

Personality clusters

Psychopathy

### ABSTRACT

In the DSM-5 Section III Alternative Model for Personality Disorders (AMPD), the severity of personality pathology (criterion A) and the presence of pathological personality trait domains and facets (criterion B) are assessed independently. Recent studies have challenged this assumption of independence but the interplay between criterion A and criterion B remains subject of further research. Using model-based cluster analysis on the criterion B trait domains, we compared criterion B trait domain clusters with respect to criterion A severity measures. Results revealed a six-cluster solution. Four of the six clusters represented a gradual increase in criterion B trait domains, paralleling an increase in criterion A severity. Two clusters did not follow this pattern: an Anxious-Detached type exhibiting overall high criterion A severity scores, and an emotionally stable psychopathy type exhibiting a number of low criterion A severity scores. Our findings indicate that criterion B domain clusters are informative of criterion A severity, relevant for future conceptualizations of the AMPD.

### 1. Introduction

The Alternative Model for Personality Disorders (AMPD) is a two-tier dimensional conceptualization of personality pathology described in Section III of the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013). Its first component (criterion A) conceptualizes severity and defines the level of self and interpersonal functioning in terms of impairment in Identity, Self-Direction, Empathy and Intimacy. Its second component (criterion B) conceptualizes descriptive personality features defined by five higher-order personality domains overarching 25 personality facets. These five higher-order domains theoretically represent the pathological version of the Five Factor Model domains (FFM; Costa Jr & McCrae, 1992), with PID-5 Negative Affectivity corresponding to Neuroticism, PID-5 Detachment (inversely keyed) to Extraversion, PID-5 Antagonism

(inversely keyed) to Agreeableness, PID-5 Disinhibition (inversely keyed) to Compulsivity, and PID-5 Psychoticism to Openness. Criterion A is measured through various operationalizations of the Level of Personality Functioning Scale (LPFS; American Psychiatric Association, 2013; Bender, Morey, & Skodol, 2011; A.E. Skodol et al., 2011). Criterion B is operationalized by means of the Personality Inventory for DSM-5 (PID-5; American Psychiatric Association, 2013; R.F. Krueger, Derringer, Markon, Watson, & Skodol, 2012). To date, the AMPD resides in DSM-5 Section III and thus co-exists with the traditional categorical approach to personality disorders (PDs) represented in DSM-5 Section II.

While evidence has accumulated documenting the construct validity of various LPFS-measures (Morey, 2017; Waugh et al., 2017) and of the PID-5 (B. Bach, Maples-Keller, Bo, & Simonsen, 2016; R.F. Krueger & Markon, 2014) separately, a number of combined variable-centered studies have demonstrated considerable overlap between severity

\* Corresponding author at: Leuvensesteenweg 517, 3070 Kortenberg, Belgium.

E-mail address: [Tim.Bastiaens@upckuleuven.be](mailto:Tim.Bastiaens@upckuleuven.be) (T. Bastiaens).

<https://doi.org/10.1016/j.paid.2020.110477>

Received 20 August 2020; Received in revised form 21 October 2020; Accepted 23 October 2020

Available online 3 November 2020

0191-8869/© 2020 Elsevier Ltd. All rights reserved.

ratings (criterion A) and trait ratings (criterion B) (Berghuis, Kamphuis, & Verheul, 2012; Hentschel & Pukrop, 2014). The difficulties encountered when trying to empirically separate traits from severity has led a number of authors to question the AMPD in its current form. R.F. Krueger and Markon (2014) for example, have suggested limiting a future version of the AMPD to the DSM-5 criterion B trait model, while Zimmermann et al. (2015) advocate defining criterion B maladaptive traits as behavioral manifestations of underlying and explanatory criterion A impairments, or vice versa (conceptualizing criterion A impairment as the consequence of criterion B maladaptive traits). Still others suggest organizing the AMPD within a transdiagnostic model (Widiger et al., 2019), i.e. a mapping of symptoms and syndromes based on empirical covariation, transcending a priori categorization paradigms like DSM.

The present study aims to further investigate the relation between criterion A and B by adopting a person-centered approach on the Criterion B PID-5 domains. As opposed to a variable-centered methodology, a person-centered approach endeavors to identify personality prototypes that have similar response patterns across personality dimensions. While clustering studies on PID-5 are currently lacking, person-centered research on its non-pathological FFM counterpart generally results in three- to five-cluster solutions. The three-cluster solution is typically composed of an Overcontrolled type (high Neuroticism, low Extraversion, and moderate to high Conscientiousness), an Undercontrolled type (high Neuroticism, low Conscientiousness and low Agreeableness), and a Resilient type (average to low Neuroticism scores and average to high Conscientiousness, Agreeableness and Extraversion). The three-cluster solution has been replicated in non-clinical (Mertz & Roesch, 2012) as well as clinical samples (Graña, Muñoz, & Navas, 2009) and has been associated with differentiating comorbidity (Bohane, Maguire, & Richardson, 2017) and specific therapeutic implications (Gazzillo et al., 2013). Recently, a four-cluster solution was described by Li et al. (2020), consisting of a Resilient type and an Undercontrolled type, supplemented with an Insecure-Resilient type (characterized by high Neuroticism and relatively high Extraversion and Conscientiousness, and conceptualized as resilient but potentially emotionally unstable) and an Agentic-Resilient type (characterized by moderate to low Neuroticism, High Extraversion and low Conscientiousness and conceptualized as driven by individualistic goals and irresponsible). Most recently, Kerber, Roth, and Herzberg (2020) described a five-cluster solution, consisting of a Resilient, Undercontrolled and Overcontrolled type, supplemented with a Vulnerable-Resilient type in accordance with Li et al.'s (2019) Insecure-Resilient type, and a Reserved type (characterized by low Extraversion, low Neuroticism, low Openness, high Agreeableness and high Conscientiousness).

Earlier studies have related FFM personality types to severity of personality pathology. Weinberger (1998), for example, has associated his Resilient-like ('Self-Assured') type with currently understood indicators of *no* impairment in DSM-5 AMPD criterion A functioning (i.e. 'mature defense mechanisms'), his Overcontrolled-like ('Repressive') type with currently understood *mild to moderate* levels of impairment (i.e. 'neurotic defense mechanisms'), and his Undercontrolled-like ('Reactive') type with currently understood *severe* levels of impairment (i.e., 'immature defense mechanisms'). More recent research on severity of personality pathology and trait combinations using other than FFM instruments has yielded similar results (e.g., Eurelings-Bontekoe et al., 2010).

In summary, the current study aims (1) to investigate whether person-centered personality clusters can be identified when analyzing criterion B, PID-5 domain data, and (2) to examine whether these criterion B, PID-5 clusters display differentiating and meaningful patterns in criterion A level of self and interpersonal functioning. Regarding the first aim, we expect to replicate the three to five personality clusters found in the FFM person-centered approach. In relation to the second aim, we hypothesize that the highest level of criterion A impairment will manifest itself in the Undercontrolled cluster and the lowest in the

Resilient cluster, with the Overcontrolled cluster situated in between. We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study.

## 2. Method

### 2.1. Participants and procedure

Two hundred forty-two adult Flemish non-clinical individuals were recruited by master students in Psychology and volunteered to take part in the study in 2017. To obtain a sample representative of the population, participants were directly contacted using closed envelopes that specified gender and age based on the data of the National Institute for Statistics (NIS). Each participant filled in the questionnaires and an informed consent form explaining the purpose of the study and guaranteeing anonymity. The one hundred ninety-seven participants who all completed the PID-5 (of whom 50.3% were female) were included in the final sample, with a mean age of 42.5 ( $SD = 14.4$ , range 18–67). The study was approved by the Ethical Committee (SMEC) of the KU Leuven, Faculty of Psychology and Educational Sciences (Belgium).

### 2.2. Measures

#### 2.2.1. Personality inventory for DSM-5 (PID-5; Krueger et al., 2012)

The PID-5 (Dutch translation: De Clercq et al., 2011) is a self-report questionnaire developed to represent criterion B of the DSM-5 AMPD. Its 220 items are rated on a 4-point Likert scale ranging from 0 (*not at all true*) to 3 (*very true*) and group into 25 primary facet scales and five higher-order domains: Negative Affectivity, Detachment, Antagonism, Disinhibition and Psychoticism. Regarding the Dutch version of the PID-5, favorable reliability and validity results are described by Bastiaens et al. (Bastiaens, Claes, et al., 2016; Bastiaens, Smits, et al., 2016) in a community and a clinical sample. In the current study, Cronbach's alphas for the five domain scales were 0.91 (Negative affectivity), 0.93 (Detachment), 0.92 (Antagonism), 0.93 (Disinhibition), and 0.95 (Psychoticism).

#### 2.2.2. Five-item screening scale for personality disorder (FISSPD; Skodol et al., 2011)

The FISSPD is a very brief self-report LPFS-measure developed to represent criterion A of the DSM-5 AMPD in a single score. It consists of five items in an *agree* (1) / *disagree* (0) format. In our current study, items were first translated from English to Dutch, followed by an independent backward translation, which was subsequently compared with the original version and iteratively adapted. In the current sample, the five items yielded a Cronbach's alpha of 0.82.

#### 2.2.3. Severity indices of personality pathology –118 (SIPP-118; Verheul et al., 2008)

The SIPP-118 (Dutch translation and validation: Verheul et al., 2008) is a self-report measure of 118 items, measuring criterion A related core components of personality functioning more elaborately. Items are scored on a 4-point Likert scale ranging from 1 (*fully disagree*) to 4 (*fully agree*). The 118 items group into 16 facet scales and five higher-order domains: self-control, identity integration, relational capacities, social concordance and responsibility. In the current sample, the Cronbach's alphas for the five higher-order domains were 0.94, 0.95, 0.92, 0.92, and 0.89 respectively. The facet scores showed Cronbach's alphas between 0.62 (Respect) and 0.85 (Self-Respect), with a median value of 0.77.

### 2.3. Analyses

To investigate the presence of PID-5 domain level clusters in the data, a Model-Based Cluster (MBC) analysis (Banfield & Raftery, 1993; Fraley & Raftery, 1998) on the z-scored PID-5 domain scores was performed by means of the *mclust* package version 5.4.2 (Scrucca et al.,

2016) in Rstudio (version 1.1.456) and R (version 3.5.1). In particular, MBC estimates a mixture of Gaussian distributions that optimally fits the data at hand by searching for the best model across a predefined set of models that differ in the volume, shape and orientation of their cluster distributions (i.e., the EII, VII, EEI, VEI, EVI, VVI, EEE, EVE, VEE, VVE, EEV, VEV, EVV, and VVV model; see [Scrucca et al., 2016](#)). We fitted all fourteen models with the number of clusters ranging from 1 to 9 (i.e., 126 models in total) and selected the model with largest Bayesian Information Criterion (BIC) as this solution optimally balances model complexity and the fit of the model to the data. Sometimes convergence problems were encountered (see appendix A), which resulted in no estimates for the model parameters and BIC value. In these cases, as a way out, we applied Bayesian regularization as recommended in [Fraley and Raftery \(2003\)](#). Participants were assigned to a cluster by inspecting the posterior probabilities, which indicate for each subject the probability of belonging to each cluster, and allocating a subject to the cluster for which his/her posterior probability was the largest.

Differences between resulting clusters regarding age and gender were assessed through an ANOVA and a Pearson’s chi-square test of independence, respectively. MANOVAs and MANCOVAs, (controlling for age) were performed to investigate mean differences between clusters in PID-5 domain scores, as well as their FISSPD and SIPP-118 scores. Scheffé’s post-hoc comparisons ( $p < .05$ ) were run to investigate which (pairs of) clusters statistically differed from each other. All analyses were performed using SPSS version 22.

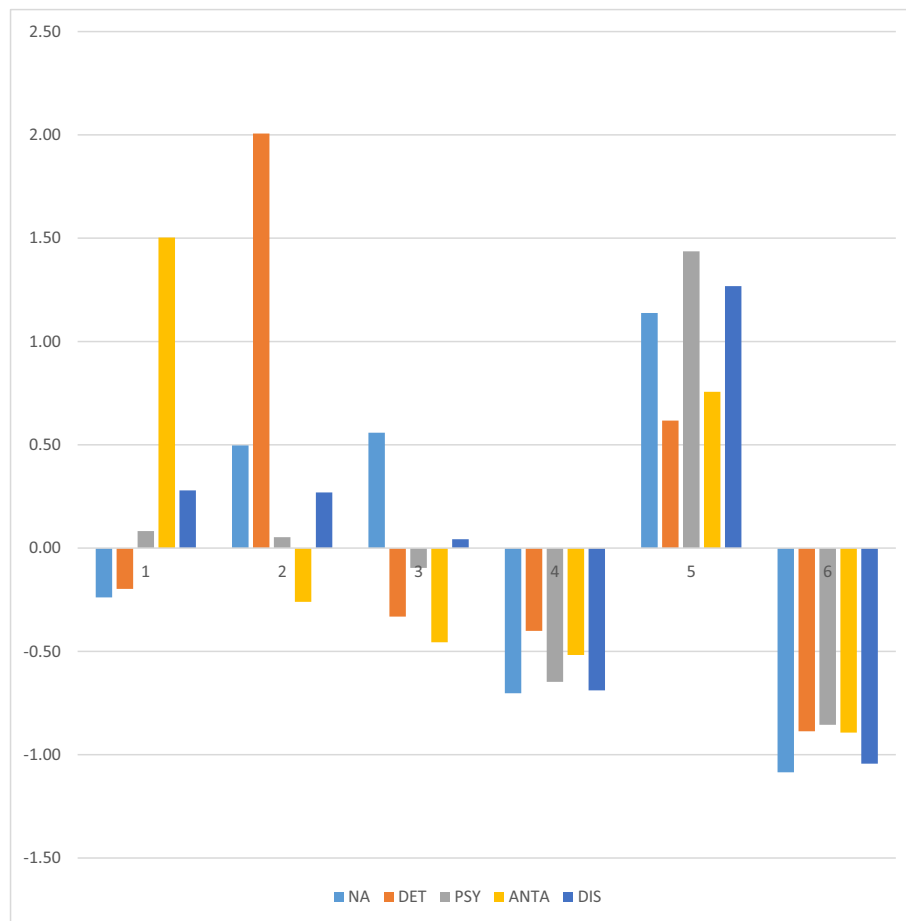
### 3. Results

#### 3.1. Cluster analysis

Model-based cluster analysis results -with and without Bayesian regularization- on the z-scored data are depicted in Appendix A. Using the z-transformed data with regularization, a six-cluster solution was favored (VII: spherical distribution with variable volume) with a BIC value of  $-2375.68$ . This six-cluster solution ([Fig. 1](#)) consists of (1) a low Anxiety / high Antagonism cluster (Cl1; Confident-Disagreeable,  $n = 26$ , 13.2%), (2) a very high Detachment / high Anxiety cluster (Cl2; Anxious-Detached,  $n = 17$ , 8.6%), (3) a high Anxiety / low Antagonism cluster (Cl3; Anxious-Agreeable,  $n = 32$ , 16.2%), (4) an overall low cluster (Cl4; Resilient,  $n = 61$ , 31.0%), (5) an overall high cluster (Cl5; Undercontrolled,  $n = 40$ , 20.3%), and (6) an overall very low cluster (Cl6; Very Resilient,  $n = 21$ , 10.7%).

#### 3.2. Differences between clusters in mean PID-5 domain scores

The MANOVA showed an overall effect of cluster membership on PID-5 domain scores [Wilk’s Lambda = 0.04,  $p < .001$ ,  $F(25, 696.18) = 38.42$ , partial  $\eta^2 = 0.48$ ]. The univariate ANOVAs also showed significant cluster membership differences on each individual PID-5 domain ([Table 1](#)). Post-hoc comparisons statistically discerned the Confident-Disagreeable cluster as the highest in Antagonism, the Anxious-Detached cluster as the highest in Detachment, and the Undercontrolled cluster as the highest in Disinhibition, Psychoticism, and Negative Affectivity ([Table 1](#)).



**Fig. 1.** Model-based (with Bayesian regularization) six-cluster solution on z-scored PID-5 domain scores (VII: spherical distributions with variable volumes). NA = Negative Affectivity, DET = Detachment, PSY=Psychoticism, ANTA = Antagonism, DIS = Disinhibition.

**Table 1**  
Means (standard deviations) of the PID-5 domain scores in function of cluster membership.

	Cluster 1 low anxiety / high antagonism		Cluster 2 very high detachment / high anxiety		Cluster 3 high anxiety / low antagonism		Cluster 4 overall low		Cluster 5 overall high		Cluster 6 overall low- low		F	partial $\eta^2$	Post-hoc Comparisons $p < .05$
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD			
PID-5															
Z(Negative Affectivity)	-0.24	0.56	0.50	0.66	0.56	0.48	-0.70	0.50	1.14	0.96	-1.09	0.24	63.42***	0.62	5 > 3, 2 > 1 > 6 5,3,2 > 4
Z(Detachment)	-0.20	0.58	2.01	0.60	-0.33	0.54	-0.40	0.53	0.62	1.02	-0.89	0.18	53.67***	0.58	2 > 5 > 1,3,4,6 1 > 6
Z(Antagonism)	1.50	0.63	-0.26	0.56	-0.46	0.46	-0.52	0.51	0.76	0.95	-0.89	0.23	63.67***	0.62	1 > 5 > 2,3,4,6
Z(Disinhibition)	0.28	0.68	0.27	0.48	0.04	0.71	-0.69	0.49	1.27	0.89	-1.04	0.15	59.59***	0.61	5 > 2, 1,3 > 4,6
Z(Psychoticism)	0.08	0.58	0.05	0.58	-0.10	0.58	-0.65	0.25	1.44	1.06	-0.86	0.10	65.74***	0.63	5 > 1,2,3 > 4,6

PID-5 = Personality Inventory for DSM-5. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

3.3. Differences between clusters in gender and age

Mean age and female/male ratio's per cluster are depicted in Fig. 2. Age displayed a significant effect on PID-5 domain scores, on FISSPD scores and on SIPP-118 scores. Therefore, all MANOVAs were repeated controlling for age and yielded similar results. Age clearly differed between clusters [ $F(5, 191) = 5.19, p < .001, \text{partial } \eta^2 = 0.12$ ], with the Anxious-Detached cluster and the Very Resilient cluster both demonstrating a significantly higher mean age than the Anxious-Agreeable cluster. Clusters also significantly differed in gender [ $\chi^2(5, N = 197) = 16.06, p < .001$ ], with 30.8% females in the Confident-Disagreeable cluster versus 75.0% females in the Anxious-Agreeable cluster.

3.4. Differences between clusters in mean FISSPD and SIPP-118 domain scores

Cluster membership displayed a significant effect on FISSPD scores [ $F(5, 191) = 16.62, p < .001, \text{partial } \eta^2 = 0.30$ ] and on SIPP-118 domain scores [Wilk's Lambda = 0.28,  $F(25, 692.46) = 11.46, p < .001, \text{partial } \eta^2 = 0.23$ ]. Concerning the FISSPD, post-hoc comparisons showed that the Undercontrolled cluster scored significantly higher on impairment in comparison to the Confident-Disagreeable cluster and the (Very) Resilient clusters, that did not significantly differ from one another (Table 2).

The univariate ANOVAs showed significant differences between cluster membership with respect to all SIPP-118 higher-order domains.

The Undercontrolled cluster demonstrated the lowest mean score on SIPP-118 Responsibility and, together with the Anxious-Detached cluster, the lowest mean scores on SIPP-118 Self-Control, Identity Integration, and Social Concordance. The Anxious-Detached cluster performed significantly worse than the Undercontrolled cluster only on Relational Functioning. On all five SIPP-118 domains, both Resilient clusters presented the highest mean scores, significantly differing from the Undercontrolled cluster and the Anxious-Detached cluster (Table 2).

3.5. Differences between clusters in mean SIPP-118 facet scores

Cluster membership displayed an overall effect on SIPP-118 facet scale scores [Wilk's Lambda = 0.19,  $F(80, 846.76) = 4.36, p < .001, \text{partial } \eta^2 = 0.28$ ]. The univariate ANOVAs were significant for all SIPP-118 facet scales as well (Table 2). In the post-hoc comparisons, the Undercontrolled cluster together with the Anxious-Detached cluster displayed the highest mean scores on SIPP-118 facet level impairment, significantly differing from the (Very) Resilient clusters that showed the lowest scores. Contrary to the Anxious-Agreeable cluster, the Confident-Disagreeable cluster displayed a significantly higher mean score on Stable Self-image in comparison to both the Anxious-Detached as well as the Undercontrolled cluster. At the same time, the Confident-Disagreeable cluster scored second to last on both Responsibility facets (i.e., Thrust-worthiness and Responsible Industry).

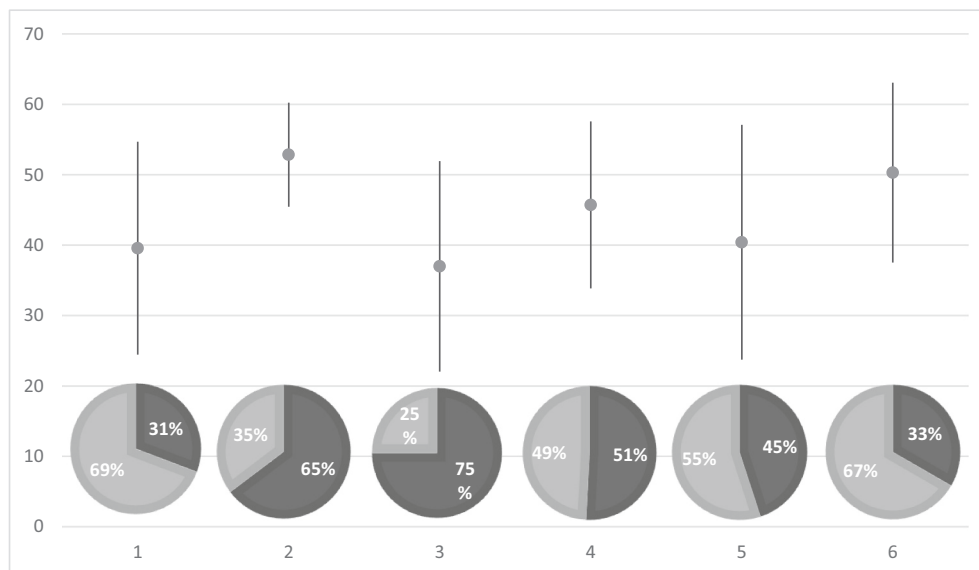


Fig. 2. Mean age  $\pm$  1SD and female (grey)/male (black) ratio per cluster.

**Table 2**  
Means and standard deviations of the FISSPD and SIPP-118 scales in function of cluster membership.

	Cluster 1 low anxiety / high antagonism		Cluster 2 very high detachment / high anxiety		Cluster 3 high anxiety / low antagonism		Cluster 4 overall low		Cluster 5 overall high		Cluster 6 overall low- low		F	partial $\eta^2$	Post-hoc comparisons $p < .05$
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD			
FISSPD	0.42	0.44	0.95	0.53	0.71	0.57	0.21	0.36	0.99	0.73	0.15	0.36	15.98	0.30	5 > 1,4,6 2,3 > 4,6
<i>SIPP-118</i>															
Self-control domain	6.11	0.49	5.57	0.70	5.87	0.62	6.38	0.56	5.14	0.72	6.47	0.41	26.00	0.41	6,4 > 3,2,5 1,3 > 5
Emotion Regulation	3.54	0.40	3.15	0.55	3.33	0.43	3.63	0.37	2.95	0.50	3.68	0.34	16.25	0.30	6,4 > 2,5 1,3 > 5
Effortful control	3.28	0.47	3.19	0.52	3.15	0.47	3.50	0.42	2.63	0.55	3.45	0.35	18.76	0.33	4 > 3,5 6,1,2,3 > 5
Identity Integration domain	5.24	0.37	4.21	0.46	4.98	0.40	5.34	0.36	4.37	0.65	5.52	0.21	41.84	0.52	6,4 > 3,2,5 1,3 > 2,5
Self-respect	3.64	0.39	2.78	0.50	3.30	0.45	3.63	0.35	2.92	0.65	3.73	0.26	22.33	0.37	6,4,1,3 > 2,5
Stable self-image	3.54	0.41	3.07	0.50	3.38	0.46	3.74	0.31	2.99	0.49	3.86	0.17	25.14	0.40	6,4 > 3,2,5 1 > 2,5 3 > 5
Self-reflexive functioning	3.55	0.34	2.90	0.53	3.36	0.40	3.64	0.34	3.00	0.52	3.78	0.24	21.78	0.36	6 > 3,5,2 4,1,3 > 5,2
Enjoyment	3.55	0.42	2.62	0.62	3.44	0.40	3.59	0.37	2.98	0.61	3.71	0.25	21.17	0.36	6,4,1,3 > 5,2
Purposefulness	3.70	0.23	3.03	0.43	3.54	0.33	3.71	0.31	3.07	0.53	3.82	0.19	26.20	0.41	6,4,1,3 > 5,2
Responsibility domain	5.08	0.57	5.16	0.31	5.39	0.49	5.61	0.37	4.59	0.71	5.71	0.31	25.62	0.40	6 > 2,1 > 5 4 > 1,5
Responsible industry	3.16	0.51	3.20	0.37	3.42	0.42	3.58	0.31	2.83	0.56	3.71	0.24	20.99	0.36	6 > 2,1,5 4 > 1,5 3 > 5
Trustworthiness	3.45	0.37	3.52	0.22	3.65	0.28	3.73	0.26	3.20	0.45	3.74	0.23	16.19	0.30	4 > 1,5 6,3,2 > 5
Relational functioning domain	5.29	0.62	3.92	0.52	5.20	0.43	5.37	0.48	4.71	0.73	5.71	0.31	29.16	0.43	6,4,1,3 > 5 > 2
Intimacy	3.36	0.59	2.23	0.63	3.24	0.44	3.29	0.52	3.18	0.57	3.61	0.32	15.26	0.29	6,1,4,3,5 > 2
Enduring relationships	3.57	0.44	2.66	0.43	3.55	0.40	3.65	0.37	3.15	0.57	3.87	0.21	23.44	0.38	6,4,1,3 > 5,2
Feeling recognized	3.42	0.39	2.77	0.44	3.30	0.37	3.56	0.34	2.88	0.50	3.65	0.33	24.07	0.39	6,4,1,3 > 5,2
Social concordance domain	6.28	0.46	5.73	0.52	6.42	0.44	6.64	0.46	5.73	0.66	6.83	0.37	24.91	0.40	6 > 1,5,2 4,3,1 > 5,2
Aggression regulation	3.72	0.36	3.66	0.32	3.83	0.26	3.86	0.29	3.47	0.49	3.92	0.13	8.59	0.18	6,4,3 > 5
Frustration tolerance	3.08	0.39	2.75	0.53	3.06	0.43	3.34	0.38	2.74	0.46	3.52	0.18	17.45	0.32	6 > 1,3,2,5 4 > 2,5
Cooperation	3.46	0.38	2.71	0.42	3.43	0.31	3.49	0.35	3.02	0.49	3.73	0.20	22.63	0.37	6,4,1,3 > 5,2
Respect	3.34	0.36	3.17	0.34	3.45	0.31	3.60	0.33	3.08	0.39	3.64	0.36	14.46	0.28	6,4 > 2,5 3 > 5

FISSPD = Five-Item Screening Scale for Personality Disorder. SIPP-118 = Severity Indices of Personality Pathology. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

#### 4. Discussion

The current study investigated model-based PID-5 domain clusters and their relation with levels of impairment in self and interpersonal functioning. We first examined emergent clusters, and subsequently explored their associations with criterion A measures. Our results help to advance the current research and theorizing in several ways.

First, the model-based six cluster solution revealed clinically recognizable constellations, consisting of two versions of a Resilient type, an Anxious-Agreeable type, a Confident-Disagreeable type, an Anxious-Detached type and an Undercontrolled type. Interestingly, no Overcontrolled type was found. As the FFM Conscientiousness / clinical Compulsivity trait domain plays a pivotal role in the Overcontrolled/Undercontrolled distinction, it is conceivable that this directly relates to the ongoing discussion regarding the status of the PID-5 Disinhibition domain as inversely-keyed Compulsivity trait domain (or its nonclinical counterpart FFM Conscientiousness). Indeed, from conception on, the inclusion of a separate Compulsivity trait domain (i.e., in addition to Disinhibition) in the DSM-5 trait model has been debated in the literature (Krueger et al., 2012; Skodol et al., 2011). Most interestingly, recent research convincingly recommends a precisely in this way Modified PID-5 Brief Form Plus (PID5BF+ M) instrument as the trait measure for the future DSM-5.1 AMPD (Bach et al., 2020; Kerber et al., 2019). Therefore,

it will be very informative to compare the current cluster solution to the one performed on the PID5BF+ M as its proposed DSM-5.1 successor. Within the constraints of a currently lacking Compulsivity trait domain however, our current PID-5 model-based six-factor cluster solution shows very clear analogies to the FFM cluster solutions reported by Kerber et al. (2020), as well Li et al. (2019): next to the replication of the classic Resilient type(s) and the Undercontrolled type, our PID-5 Anxious-Agreeable type matches Kerber et al.'s (2020) FFM Vulnerable-Resilient type, as well as Li et al.'s (2020) FFM Insecure-Resilient type, and our PID-5 Confident-Disagreeable type equals Li et al.'s (2020) Agentic-Resilient type.

Second, four of the six clusters, respectively the Very Resilient, the Resilient, the Anxious-Agreeable, and the Undercontrolled cluster, appear to show a similarity in their representation of a gradual increase in descriptive personality pathology, as well as in criterion A severity. As such, our findings indicate that criterion B domain clusters are informative of criterion A severity, relevant for future conceptualizations of the AMPD. Importantly however, the two remaining clusters (the Anxious-Detached cluster and the Confident-Disagreeable cluster) did not merely represent intermediate steps in impairment level.

The Anxious-Detached cluster displayed a severity level comparable to the Undercontrolled cluster. Of note, the worse performance of the Anxious-Detached cluster in comparison to the Undercontrolled cluster

on Relational functioning cannot be attributed merely to one of its comprising PID-5 domain levels, as in variable-centered research relational functioning impairment correlates primarily with Antagonism scores rather than with Detachment scores (Zimmermann et al., 2015).

The Confident-Disagreeable cluster, with its relatively favorable FISSPD and Stable Self-image scores and its unfavorable Trustworthiness and Responsible Industry scores, exhibited less other interpersonal pathology (i.e., Relational Functioning, Social Concordance) than could have been expected from a variable-centered point of view, considering its comprising PID-5 Antagonism domain score on itself (Zimmermann et al., 2015). Taken together, the Confident-Disagreeable cluster might be thought of as a non-clinical variant of the Emotionally Stable psychopathy subtype described by Hicks et al. (2004) within their forensic sample, or as the successful psychopathy type described by Wallace, Heym, Sumnich, and Fido (2020) in their general population sample.

Limitations of current study need to be addressed. First, the sample was limited in number and confined to non-clinical participants. Future validation studies will show to which extent the current clusters can be replicated in larger and clinical samples, show measurement invariance in relation to variables that are theoretically expected not to co-vary, as well as differentiate between variables that can serve as construct validation criteria. Also in relation to the limited sample size, the PID-5 factor structure was assumed based on previous validation studies of the Dutch version of the PID-5 (confirmed in community as well as clinical samples; Bastiaens, Claes, et al., 2016; Bastiaens, Smits, et al., 2016), rather than tested again. Second, measures of criterion B and criterion A were obtained through self-report. Third, we used a cross-sectional design to investigate the relationship between criterion B and criterion

A. While other cross-sectional designs also show evidence for considerable overlap, Roche (2018) finds evidence for incremental validity of the two criteria approach when applied in a study of temporal dynamics using repeated measures data.

Notwithstanding these limitations, the current study reveals a PID-5 model-based six cluster solution that can be tied in with Kerber et al.'s (2020) and Li et al.'s FFM findings. While the clusters represent a gradual increase in descriptive personality pathology as well as in criterion A level of impairment, they are supplemented with an Anxious-Detached type exhibiting overall high criterion A severity scores, and an emotionally stable psychopathy type exhibiting a number of low criterion A severity scores. Future personality and personality pathology research that combines current and future PID-5 descriptors is a promising avenue towards a better understanding of not only the descriptive building blocks of, but indeed also the dynamics of pathological personality features.

**Funding**

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**CRediT authorship contribution statement**

Tim Bastiaens, Laurence Claes: Conceptualization, Writing and Editing. Tom Wilderjans: Methodology. Benedicte Lowyck, Annabel Bogaerts, Marc De Hert, Dominique Vanwalleghem, Koen Luyckx: Reviewing and Editing.

**Appendix A. Results Mclust using Z-score data**

Model without regularization  
Bayesian Information Criterion (BIC):

	EII	VII	EEI	VEI	EVI	VVI	EEE	EVE	VEE	VVE	EEV	VEV	EVV	VVV
1	-2821.995	-2821.995	-2843.128	-2843.128	-2843.128	-2843.128	-2551.359	-2551.359	-2551.359	-2551.359	-2551.359	-2551.359	-2551.359	-2551.359
2	-2605.009	-2424.043	-2615.344	-2433.827	-2609.694	-2400.432	-2555.290	-2524.559	-2391.148	-2395.905	-2509.575	-2390.853	-2515.097	-2403.845
3	-2518.587	-2386.982	-2555.610	-2382.574	-2565.254	-2332.289	-2520.528	-2528.389	-2383.761	-2386.160	-2494.775	-2424.591	-2535.397	-2427.216
4	-2576.903	-2383.659	-2522.642	-2394.595	-2569.579	NA	-2521.186	-2502.996	-2394.263	-2402.606	-2539.338	-2428.411	-2544.317	-2488.139
5	-2519.186	-2382.034	-2470.003	-2367.417	-2580.553	NA	-2552.881	-2526.672	-2401.455	-2431.944	-2502.828	-2441.296	-2608.282	-2447.971
6	-2550.877	-2370.269	-2467.074	-2376.385	-2529.736	NA	-2521.334	-2541.206	-2393.366	-2460.829	-2562.368	-2523.878	-2607.780	-2521.915
7	-2500.809	-2381.389	-2498.697	-2379.594	-2536.962	NA	-2488.204	-2537.079	-2416.931	-2487.620	-2546.422	-2532.628	-2654.024	-2590.880
8	-2512.544	-2386.282	-2518.494	-2392.379	-2535.872	NA	-2573.379	-2604.222	-2431.659	-2517.353	-2633.913	-2566.360	-2656.405	-2690.136
9	-2487.878	-2408.912	-2505.115	-2415.645	-2576.416	NA	-2532.994	-2534.074	-2440.845	-2561.510	-2726.854	-2633.167	-2737.961	-2761.060

Top 3 models based on the BIC criterion:

VVI,3	VEI,5	VII,6
-2332.289	-2367.417	-2370.269

Model with regularization.  
Bayesian Information Criterion (BIC):

	EII	VII	EEI	VEI	EVI	VVI	EEE	EEV	VEV	VVV
1	-2822.080	-2822.080	-2844.115	-2844.115	-2844.115	-2844.115	-2553.392	-2553.392	-2553.392	-2553.392
2	-2605.215	-2424.249	-2616.156	-2434.152	-2610.315	-2403.996	-2557.921	-2511.198	-2392.598	-2415.191
3	-2577.210	-2389.064	-2556.409	-2383.227	-2555.041	-2430.657	-2523.639	-2496.117	-2433.416	-2481.424
4	-2519.056	-2385.751	-2523.471	-2395.362	-2569.934	-2452.031	-2524.657	-2504.771	-2440.059	-2561.645
5	-2519.858	-2385.693	-2517.359	-2379.214	-2525.945	-2433.849	-2556.973	-2540.946	-2458.742	-2626.406
6	-2551.772	-2375.677	-2467.820	-2390.671	-2534.842	-2457.862	-2525.623	-2604.986	-2540.487	-2675.562
7	-2566.000	-2388.330	-2499.385	-2391.700	-2563.267	-2479.664	-2480.224	-2606.995	-2587.773	-2755.175
8	-2464.577	-2394.592	-2522.713	-2403.293	-2611.855	-2516.161	-2579.002	-2620.388	-2647.795	-2837.294
9	-2489.514	-2423.878	-2505.824	-2424.136	-2627.643	-2554.974	-2538.858	-2693.460	-2710.715	-2980.246

## Top 3 models based on the BIC criterion:

VII,6	VEI,5	VEI,3
-2375.677	-2379.214	-2383.227

## References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.
- Bach, B., Kerber, A., Aluja, A., Bastiaens, T., Keeley, J. W., Claes, L., ... Zimmermann, J. (2020, January 11). International assessment of DSM-5 and ICD-11 personality disorder traits: Toward a common nosology in DSM-5.1. *Psychopathology*. <https://doi.org/10.31234/osf.io/qcwsb>. Advance online publication.
- Bach, B., Maples-Keller, J. L., Bo, S., & Simonsen, E. (2016). The alternative DSM-5 personality disorder traits criterion: A comparative examination of three self-report forms in a Danish population. *Personality Disorders, Theory, Research, and Treatment*, 7, 124–135. <https://doi.org/10.1037/per0000162>.
- Banfield, J. D., & Raftery, A. E. (1993). Model-based Gaussian and non-Gaussian clustering. *Biometrics*, 49, 803–821. <https://doi.org/10.2307/2532201>.
- Bastiaens, T., Claes, L., Smits, D., De Clercq, B., De Fruyt, F., Rossi, G., ... De Hert, M. (2016). The construct validity of the Dutch personality inventory for DSM-5 personality disorders (PID-5) in a clinical sample. *Assessment*, 23, 42–51. <https://doi.org/10.1177/1073191115575069>.
- Bastiaens, T., Smits, D., De Hert, M., Vanwalleghem, D., & Claes, L. (2016). DSM-5 section III personality traits and section II personality disorders in a Flemish community sample. *Psychiatry Research*, 238, 290–298. <https://doi.org/10.1016/j.psychres.2016.02.056>.
- Bender, D. S., Morey, L. C., & Skodol, A. E. (2011). Toward a model for assessing level of personality functioning in DSM-5, part I: A review of theory and methods. *Journal of Personality Assessment*, 93, 332–346. <https://doi.org/10.1080/00223891.2011.583808>.
- Berghuis, H., Kamphuis, J. H., & Verheul, R. (2012). Core features of personality disorder: Differentiating general personality dysfunctioning from personality traits. *Journal of Personality Disorders*, 26, 704–716. <https://doi.org/10.1521/pe.2012.26.5.704>.
- Bohane, L., Maguire, N., & Richardson, T. (2017). Resilients, overcontrollers and undercontrollers: A systematic review of the utility of a personality typology method in understanding adult mental health problems. *Clinical Psychology Review*, 57, 75–92. <https://doi.org/10.1016/j.cpr.2017.07.005>.
- Costa, P. T., Jr., & McCrae, R. R. (1992). The five-factor model of personality and its relevance to personality disorders. *Journal of Personality Disorders*, 6, 343–359. <https://doi.org/10.1521/pedi.1992.6.4.343>.
- De Clercq, B., De Fruyt, F., Mervielde, I., Krueger, R. F., & Markon, K. (2011). *Official Dutch translation of the personality inventory for DSM-5 (PID-5)* (Unpublished manuscript).
- Eurelings-Bontekoe, E. H., Luyten, P., IJssennagger, M., van Vreeswijk, M., & Koelen, J. (2010). Relationship between personality organization and Young's cognitive model of personality pathology. *Personality and Individual Differences*, 49, 198–203. <https://doi.org/10.1016/j.paid.2010.03.034>.
- Fraley, C., & Raftery, A. E. (1998). How many clusters? Which clustering method? Answer via model-based cluster analysis. *The Computer Journal*, 41, 578–588. <https://doi.org/10.1093/comjnl/41.8.578>.
- Fraley, C., & Raftery, A. E. (2003). Enhanced software for model-based clustering, discriminant analysis, and density estimation: MCLUST. *Journal of Classification*, 20, 263–286.
- Gazzillo, F., Lingiardi, V., Peloso, A., Giordani, S., Vesco, S., Zanna, V., Filippucci, L., & Vicari, S. (2013). Personality subtypes in adolescents with anorexia nervosa. *Comprehensive Psychiatry*, 54, 702–712. <https://doi.org/10.1016/j.comppsy.2013.03.006>.
- Graña, J. L., Muñoz, J. J., & Navas, E. (2009). Normal and pathological personality characteristics in subtypes of drug addicts undergoing treatment. *Personality and Individual Differences*, 46, 418–423. <https://doi.org/10.1016/j.paid.2008.11.011>.
- Hentschel, A. G., & Pukrop, R. (2014). The essential features of personality disorder in DSM-5: The relationship between criteria A and B. *Journal of Nervous and Mental Disease*, 202, 412–418. <https://doi.org/10.1097/NMD.0000000000000129>.
- Hicks, B. M., Markon, K. E., Patrick, C. J., Krueger, R. F., & Newman, J. P. (2004). Identifying psychopathy subtypes on the basis of personality structure. *Psychological Assessment*, 16, 276–288. <https://doi.org/10.1037/1040-3590.16.3.276>.
- Kerber, A., Schultze, M., Wright, A. G., Spitzer, C., Krueger, R., Knaevelsrud, C., & Zimmermann, J. (2019). *Development of a short and reliable measure for DSM-5 and ICD-11 maladaptive personality traits using ant colony optimization algorithms*. <https://doi.org/10.31234/osf.io/rsw54>.
- Krueger, R. F., Derringer, J., Markon, K. E., Watson, D., & Skodol, A. E. (2012). Initial construction of a maladaptive personality trait model and inventory for DSM-5. *Psychological Medicine*, 42, 1879–1890. <https://doi.org/10.1017/S0033291711002674>.
- Krueger, R. F., & Markon, K. E. (2014). The role of the DSM-5 personality trait model in moving toward a quantitative and empirically based approach to classifying personality and psychopathology. *Annual Review of Clinical Psychology*, 10, 477–501.
- Li, Y., He, L., Zhuang, K., Wu, X., Sun, J., Wei, D., & Qiu, J. (2020). Linking personality types to depressive symptoms: A prospective typology based on neuroticism, extraversion and conscientiousness. *Neuropsychologia*, 136, 1–9. <https://doi.org/10.1016/j.neuropsychologia.2019.107289>.
- Mertz, E. L., & Roesch, S. C. (2012). A latent profile analysis of the five factor model of personality: Modelling trait interactions. *Personality and Individual Differences*, 51, 915–919.
- Morey, L. C. (2017). Development and initial evaluation of a self-report form of the DSM-5 Level of Personality Functioning Scale. *Psychological Assessment*, 29, 1302–1308. <https://doi.org/10.1037/pas0000450>.
- Roche, M. J. (2018). Examining the alternative model for personality disorder in daily life: Evidence for incremental validity. *Personality Disorders, Theory, Research, and Treatment*, 9, 574–583. <https://doi.org/10.1037/per0000295>.
- Scrucca, L., Fop, M., Murphy, T. B., & Raftery, A. E. (2016). Mclust 5: Clustering, classification and density estimation using Gaussian finite mixture models. *The R Journal*, 8, 289–317.
- Skodol, A. E., Bender, D. S., Oldham, J. M., Clark, L. A., Morey, L. C., Verheul, R., ... Siever, L. J. (2011). Proposed changes in personality and personality disorder assessment and diagnosis for DSM-5 part II: Clinical application. *Personality Disorders, Theory, Research, and Treatment*, 2, 23–40. <https://doi.org/10.1037/a0021892>.
- Verheul, R., Andrea, H., Berghout, C. C., Dolan, C., Busschbach, J. J. V., van der Kroft, P. J. A., ... Fonagy, P. (2008). Severity indices of personality problems (SIPP-118): Development, factor structure, reliability, and validity. *Psychological Assessment*, 20, 23–34. <https://doi.org/10.1037/1040-3590.20.1.23>.
- Waugh, M. H., Hopwood, C. J., Krueger, R. F., Morey, L. C., Pincus, A. L., & Wright, A. G. (2017). Psychological assessment with the DSM-5 alternative model for personality disorders: Tradition and innovation. *Professional Psychology: Research and Practice*, 48, 79–89. <https://doi.org/10.1037/pro0000071>.
- Weinberger, D. A. (1998). Defenses, personality structure, and development: Integrating psychodynamic theory into a typological approach to personality. *Journal of Personality*, 66, 1061–1080. <https://doi.org/10.1111/1467-6494.00042>.
- Widiger, T. A., Bach, B., Chmielewski, M., Clark, L. A., DeYoung, C., Hopwood, C. J., Kotov, R., Krueger, R. F., Miller, J. D., Morey, L. C., Mullins-Sweatt, S. N., Patrick, C. J., Pincus, A. L., Samuel, D. B., Selbom, M., South, S. C., Tackett, J. L., Watson, D., Waugh, M. H., ... Thomas, K. M. (2019). Criterion A of the AMPD in HiTOP. *Journal of Personality Assessment*, 101, 345–355. DOI:<https://doi.org/10.1080/00223891.2018.1465431>.
- Zimmermann, J., Böhnke, J. R., Eschstruth, R., Mathews, A., Wenzel, K., & Leising, D. (2015). The latent structure of personality functioning: Investigating criteria A from the alternative model for personality disorders in DSM-5. *Journal of Abnormal Psychology*, 124, 532–548. <https://doi.org/10.1037/abn0000059>.

## Web references

- Kerber, A., Roth, M., & Herzberg, P. (2020, February 3). Personality types revisited – a comprehensive algorithmic approach to an integration of prototypical and dimensional constructs of personality description. PsyArXiv Preprints. doi: 10.31234/osf.io/c3qbe.
- Wallace, L., Heym, N., Sumnich, A., & Fido, D. (2020, April 3). A systematic review on the current conceptualisations of successful psychopathy. PsyArXiv Preprints. doi: 10.31234/osf.io/wkjrj.