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DSM-IV Personality Disorders and Their Axis I Correlates in the South African Population

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Diagnostic and Statistical Manual of Mental Disorders, axis I disorders · Personality disorders, prevalence · South Africa

Abstract
Background: The prevalence of personality disorders (PD) in the South African population is largely unknown. Thus, we undertook to estimate prevalence, demographic correlates, co-morbidity and treatment rates of DSM-IV PD among South Africans. ***Sampling and Methods:*** A three-stage probability sample design was used. Of the 4,433 interviews obtained, based on quality control criteria, 4,315 interviews were retained for analysis. All participants were screened for PD and axis I disorders with the World Health Organisation Composite International Diagnostic Interview. The multiple imputation method was then used to estimate prevalence. ***Results:*** The multiple imputation prevalence estimate in the total sample was 6.8%. All three PD clusters were significantly co-morbid with each other and with other axis I disorders. Male gender was the only significant predictor of PD. Of note was the finding that less than one fifth of participants with a possible PD diagnosis had received treatment for a mental health or substance abuse problem in the previous 12 months. ***Conclusion:*** The high co-morbidity of PD with axis I disorders in South Africa is consistent with previous reports elsewhere. However, more research is indicated to determine the reasons for the higher prevalence of cluster A disorders than of cluster B and C disorders in this population.

Introduction

Personality disorders (PD) are amongst the most prevalent of psychiatric disorders, and they frequently co-occur with one another as well as with other psychiatric disorders [1, 2], in particular with DSM-IV axis I disorders [3, 4]. PD have been associated with a number of adverse consequences in the general population, including marital problems, occupational difficulties, criminality [5–7] and the high use of costly mental health services [8]. As such, they are associated with a significant burden, not only on the individual with the disorder, but on society at large. Furthermore, they are related to poorer outcomes in patients with other psychiatric and substance use disorders [9, 10]. Despite this, they are underresearched compared to other mental health problems [11–13].

Most studies assessing prevalence rates of PD have focused on clinical populations [14–16]. Lenzenweger et al. [17] presented the first high-quality estimate of PD in a

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non-clinical population (11%). Since then, a number of studies have attempted to determine prevalence rates in community samples. In the United States, community prevalence rates ranging from 9% [18, 19] to 15.7% [20] have been found. Similarly, in Europe, rates of 10.0% in Germany [21], 11.2% in Sweden [22] and 13.4% in Norway [23] have been documented. Comparatively lower rates have been reported in Britain (4.4%) by Coid et al. [24] and in Australia (6.6%) [25]. These differences could in part be explained by the use of different study methodologies and measures. For example, in the US, a rate of 9% was reported by both studies using the International Personality Disorders Examination (IPDE) [18, 19], whereas the study by Crawford et al. [20] used the Structured Clinical Interview for DSM-IV (SCID-II) to make a PD diagnosis.

There have been few reports of rates of PD in low- and middle-income countries. For example, a 6.7% prevalence was found in a group of normal Brazilian controls [26], while the prevalence of personality dysfunction in a study of senior high school students in Beijing was found to be 5.6% [27]. In a sample of Egyptian university students, more than a quarter (26.1%) were found to have at least 1 PD [28]. Although the latter 2 studies both used translated versions of the Personality Diagnostic Questionnaire, the student samples differed, e.g. in respect of age. Thus, again these differences may potentially be explained by methodological differences.

Nonetheless, the epidemiological investigation of PD in South Africa and Africa as a whole has largely been neglected. The South African Stress and Health Study (SASH) was a national probability sample of adult South Africans living in both households and hostel quarters, with data obtained between January 2002 and June 2004 [29]. This provided an opportunity to estimate the prevalence of PD in the South African population. The aims of this study were to: (1) estimate the prevalence of DSM-IV PD; (2) examine demographic correlates of PD; (3) assess co-morbidity with axis I disorders; (4) estimate treatment rates for DSM-IV PD in this population.

Methods

Sample

Full details of the sampling are provided in a previous paper [29]. In brief, individuals of all racial and ethnic backgrounds were included in the study. Hostel quarters were included to maximize coverage of young working-age males, but the sample did not include individuals in institutions or in the military. The sample was selected using a three-stage probability sample design. The first stage involved selecting a stratified probability sample of primary sampling areas equivalent to counties in the US or the UK based on the 2001 South African Census of Enumeration Areas (EA). The EA were sampled with probabilities proportionate to population size. The second stage involved selecting an equal-probability sample of housing units within each EA. The third stage involved selecting one random adult respondent from each sample housing unit. Interviewers selected a single adult respondent at random using the Kish procedure for objective respondent selection [30]. A total sample of 5,089 households was selected for SASH. Field interviews were obtained with 4,433 (87.1%) of the designated respondents. Based on quality control criteria, 4,315 of the field interviews were retained for use in the analysis. Table 1 displays the sociodemographic distribution of the sample.

Table 1. Sociodemographic distribution of the South African sample compared to the population

	Unweighted %	Weighted %	2001 census %
Sex			
Male	39.8	46.3	46.8
Female	60.2	53.7	53.2
Age			
20–34	47.1	47.2	45.5
35–49	31.2	30.4	30.5
50–64	15.8	16.9	15.3
65+	5.9	5.5	8.7
Race			
African	76.2	76.2	79.0
Coloured	12.9	10.4	8.9
Indian or Asian	3.7	3.4	2.5
White	7.2	10.0	9.6
Province			
Eastern Cape	14.2	13.1	13.3
Free State	9.7	6.2	6.2
Guateng	13.6	23.0	22.2
Kwazulu Natal	17.2	19.5	20.2
Limpopo	9.6	10.5	10.5
Mpumalanga	9.5	6.6	6.6
Northern Cape	5.4	1.9	1.3
North West	10.4	8.3	8.3
Western Cape	10.3	11.1	10.8

Diagnostic Interview

The diagnostic interview used in the SASH was the World Health Organization (WHO) Composite International Diagnostic Interview version 3.0 (CIDI) [31], a fully structured lay-administered interview that generates diagnoses according to the criteria of both the DSM-IV and the ICD-10 diagnostic systems. In view of time constraints, however, the interview excluded a number of disorders (e.g. specific phobia, impulse control disorders other than intermittent explosive disorder). DSM-IV criteria are used in the current report. Interviewers were trained in the administration of the CIDI in centralized group sessions lasting one

Table 2. Prevalence of PD

Personality disorder	Sample size	Basic statistics for number of cases with disorder in 10 MI data sets					Prevalence	
		average	SD	CV	minimum	maximum	estimate, %	SE
Cluster A	4,315	137.6	16.4	11.9	112.0	170.0	3.4	0.5
Cluster B	4,315	58.6	7.9	13.5	47.0	75.0	1.5	0.3
Cluster C	4,315	102.9	12.3	11.9	79.0	123.0	2.5	0.5
Any	4,315	272.3	22.6	8.3	247.0	317.0	6.8	0.7

CV = Coefficient of variation.

Table 3. Odds of other PD

Personality cluster	Cluster B		Cluster C	
	OR	95% CI	OR	95% CI
Cluster A	21.5*	7.2, 64.9	13.1*	4.5, 38.6
Cluster B			11.0*	3.0, 40.5

Results represent odds of having multiple-cluster disorders. Models were not adjusted for sociodemographic effects.

* Significant at the 0.05 level.

week. The interviews were conducted face-to-face in six different languages: English, Afrikaans, Zulu, Xhosa, Northern Sotho and Tswana. The protocol, including all recruitment, consent and field procedures, were approved by the Human Subjects Committees of the University of Michigan, Harvard Medical School, and by a single-project assurance of compliance from the Medical University of South Africa that was approved by the National Institute of Mental Health. Interviews lasted an average of three and a half hours, with some requiring more than one visit to complete.

Statistical Analysis

The person-level SASH data was weighted to adjust for differential probabilities of selection within households, differential non-response, and for residual discrepancies between the sample and the population on a profile of census demographic and geographic variables. These weights were used in all data analyses. Data analysis was carried out using SAS and SAS-callable SUDAAN software to adjust estimates of statistical significance for the weighting and clustering of the data. Statistical methods include standard estimates of prevalence, and the calculation of odds ratios (OR). Statistical significance was evaluated using 0.05-level two-sided tests, which adjusted for the weighting and clustering of the data.

In the World Mental Health (WMH) United States survey (NCS-R), clinical reappraisal interviews with the IPDE were carried out with a probability subsample of 214 respondents, oversampling those who screened positive on the IPDE screening questions. The data were weighted to adjust for this oversampling. DSM-IV diagnoses based on the clinical interviews were generated for any cluster A PD, any cluster B PD, any cluster C PD and any PD (including PD not otherwise specified, which was not included in any of the three clusters). Ten clinical pseudo samples were created using the US validity sample by selecting 214 cases for each sample with replacements from the 214 cases in the clinical sample. Predicted probabilities of the four IPDE diagnoses were assigned, based on the results of stepwise logistic regression in each of these 10 samples. The multiple imputation (MI) method was used to assign predicted diagnoses of clinician-assessed IPDE diagnoses to WMH respondents, including SASH respondents, who did not participate in the reappraisal interviews [32]. Prediction accuracy was excellent for all four of these equations in the South African sample, with area under the receiver operator characteristic curve (AUC), a prevalence-free measure of classification accuracy, 0.9396 for cluster A, 0.9572 for cluster B, 0.8971 for cluster C and 0.8808 for any PD.

Results

Prevalence of Personality Disorders

The prevalence estimate for any personality disorder was 6.8% (SE = 0.7), and 3.4% (SE = 0.5), 1.5% (SE = 0.3) and 2.5% (SE = 0.5) for cluster A, B and C personality disorders, respectively (table 2).

Co-Morbidity

In addition, for those with any personality disorder, the odds of having a personality disorder from another cluster were significant (table 3). There was a significant association of cluster B PD with cluster A PD (OR = 21.5; 95% CI = 7.2, 64.9), cluster C PD with cluster A PD (OR = 13.1; 95% CI = 4.5, 38.6) and cluster C PD with cluster B (OR = 11.0; 95% CI = 3.0, 40.5).

All PD were associated with DSM-IV axis 1 disorders with the mean OR as follows: cluster A: 3.06, cluster B: 7.83, and cluster C: 4.96, and medians of 2.65, 10.60 and

Table 4. Comorbidity with DSM-IV 12-month disorders

Disorder group	12-month disorder	Cluster A		Cluster B		Cluster C		Any	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Anxiety	any anxiety disorder	4.4*	1.8, 11.0	8.2*	3.5, 18.8	5.9*	2.2, 15.6	5.7*	3.3, 9.7
Mood	any mood disorder	2.0	0.6, 6.6	2.3	0.6, 8.6	5.3*	2.2, 12.5	4.4*	1.9, 10.4
Impulse	any impulse disorder	2.8	0.4, 17.6	13.0*	3.4, 49.5	3.7	0.6, 22.5	3.6*	1.0, 12.7
Substance	any substance disorder	2.5*	1.0, 5.9	20.9*	6.7, 64.8	1.8	0.3, 11.2	2.7*	1.1, 7.1
Composite	exactly one	3.0*	1.3, 6.9	9.9*	3.2, 30.3	3.6*	1.6, 8.2	3.3*	1.9, 5.6
	exactly two	3.7*	1.1, 12.3	25.5*	7.3, 89.0	7.1*	2.0, 24.9	5.7*	2.2, 14.7
	three or more	3.7	0.3, 53.5	47.8*	9.4, 242.5	8.0*	1.1, 56.1	n.a.	n.a.
	any disorder	3.2*	1.6, 6.6	15.2*	5.5, 42.0	4.7*	2.3, 9.5	4.2*	2.5, 7.1

OR based on logistic regression models adjusted for age and sex. Exactly one, exactly two, and three or more fit together in a single model. Any anxiety, mood, impulse, substance and any disorder fit in separate models.

* Significant at the 0.05 level; n.a. = results unavailable due to lack of cases with both personality and DSM-IV disorders.

Table 5. Conditional prevalence with DSM-IV 12-month disorders

Disorder group	12-month disorder	Cluster A				Cluster B				Cluster C				Any			
		row %	row SE	column %	column SE	row %	row SE	column %	column SE	row %	row SE	column %	column SE	row %	row SE	column %	column SE
Anxiety	any anxiety disorder	9.9	3.4	13.0	4.2	8.2	2.6	25.3	7.4	10.7	3.9	19.4	6.6	22.6	4.0	15.1	2.9
Mood	any mood disorder	4.9	2.0	7.2	3.4	3.1	1.5	10.6	5.6	9.3	2.7	18.2	5.7	18.5	4.8	13.4	3.7
Impulse	any impulse disorder	9.9	6.9	5.4	3.9	14.2	7.3	18.1	8.6	8.9	6.2	6.8	4.9	21.0	8.9	5.8	2.6
Substance	any substance disorder	9.7	3.1	16.7	5.5	12.4	3.8	49.4	12.0	5.1	3.0	11.8	6.9	18.4	5.7	15.6	4.5
Composite	exactly one disorder	7.5	1.9	22.2	6.4	4.9	1.6	33.2	9.2	6.1	2.1	24.0	6.7	14.8	2.7	21.8	3.7
	exactly two disorders	9.5	4.2	8.6	3.9	11.8	4.9	24.9	9.6	11.2	5.1	13.7	5.8	23.2	6.5	10.5	3.2
	three or more disorders	9.9	9.7	2.1	2.0	20.3	9.6	10.4	5.4	11.9	8.3	3.7	2.9	35.8	13.5	4.0	1.6
	any disorder	8.1	1.7	32.9	7.3	7.3	1.7	68.5	9.6	7.5	1.9	41.5	8.1	17.8	2.9	36.2	5.1

Row percentages represent the amount of respondents with each axis I disorder who meet criteria for the PD. Column percentages represent the amount of respondents with the PD that meet criteria for the axis I disorder.

4.50, respectively. Cluster A PD were significantly associated with substance use disorders, cluster B PD were significantly associated with impulse and substance use disorders and cluster C PD were significantly associated with mood disorders (table 4). All 3 clusters were significantly associated with anxiety disorders.

The range of OR with axis I disorders was quite narrow for clusters A and C, suggesting that the strength of the associations for these PD with axis I disorders are similar. However, there was more differentiation in OR for cluster B, with any substance disorder having the highest and any mood disorder having the lowest OR.

Table 6. Sociodemographic predictors

Sociodemographic predictor	Cluster A			Cluster B			Cluster C			Any		
	OR	95% CI	p value	OR	95% CI	p value	OR	95% CI	p value	OR	95% CI	p value
Sex (female)	0.2	0.1, 0.4	0.000	1.0	0.3, 2.7	0.942	0.6	0.2, 1.6	0.233	0.4	0.2, 0.6	0.000
Age (standardized)	0.9	0.6, 1.3	0.537	0.8	0.5, 1.4	0.502	1.1	0.8, 1.7	0.505	0.9	0.7, 1.2	0.407
Education (standardized)	0.8	0.5, 1.1	0.128	0.8	0.6, 1.3	0.408	0.8	0.6, 1.2	0.292	0.9	0.6, 1.1	0.222
Employment (other)	1.0	0.5, 1.9	0.988	0.7	0.3, 2.0	0.537	0.9	0.3, 2.6	0.805	1.0	0.6, 1.6	0.996
Income (standardized)	0.8	0.3, 2.0	0.546	1.0	0.6, 1.6	0.858	0.6	0.1, 5.3	0.587	0.8	0.5, 1.5	0.462
Marital status (not married)	1.2	0.6, 2.5	0.539	1.7	0.6, 4.9	0.296	1.3	0.7, 2.4	0.457	1.3	0.8, 2.2	0.274

Sociodemographic predictors fit simultaneously in a single model.

Table 7. Prevalence of 12-month treatment among those with PD

Treatment sector	Cluster A		Cluster B		Cluster C		Any	
	%	SE	%	SE	%	SE	%	SE
Psychiatrist	2.5	2.3	4.2	3.2	2.9	2.2	3.1	1.4
Other mental health	1.7	1.7	1.7	2.0	1.1	1.3	2.1	1.3
Any mental health	3.0	2.5	4.8	3.6	3.4	2.5	3.9	1.5
General medical	14.7	4.8	12.7	6.3	15.1	5.4	13.4	2.9
Human service	2.8	1.8	4.2	5.1	6.3	3.9	4.7	1.7
CAM	3.9	3.1	2.7	3.2	6.0	3.9	4.7	2.4
Any treatment	18.9	5.3	19.6	7.5	22.3	6.7	19.9	4.0

Percentages represent respondents seeking treatment among those with personality disorder. CAM = Complementary and alternative medicine.

Patients with three or more disorders were more likely to have co-morbid anxiety disorders.

These high OR indicate that a large proportion of the population (36.2%) with PD also meets the criteria for an axis I disorder (table 5). Cluster A and cluster B PD most commonly co-occur with substance disorders (16.7 and 49.4%, respectively) followed by anxiety disorders (13 and 25.3%, respectively). Cluster C PD most often co-occur with anxiety disorders (19.4%), followed by mood disorders (18.2%). Those with a cluster B PD were more likely than those with a cluster A or C PD to meet criteria for more than one axis I disorder. Approximately a quarter of individuals (24.9%) with a cluster B PD met criteria for two axis I disorders and 10.4% met criteria for three or more axis I disorders.

The conditional prevalence of a PD was fairly similar for respondents with any anxiety disorder (22.6%), any mood disorder (18.5%), any impulse control disorder (21.0%) and any substance disorder (18.4%). Respondents with three or more axis I disorders were more likely than those with fewer axis I disorders to be diagnosed with a PD.

Sociodemographic Correlates of DSM-IV PD

Sociodemographic predictors of PD, including gender, age, education, employment, income and marital status, are shown in table 6. All, except gender, were nonsignificant, with male gender predicting cluster A PD (OR = 0.2; 95% CI = 0.1, 0.4) and any PD (OR = 0.4; 95% CI = 0.2, 0.6).

Treatment

Over the past 12 months, 19.9% of respondents with a PD had received treatment for mental health or substance use problems (table 7). The majority sought treatment from general medical providers rather than from mental

Table 8. Odds of 12-month treatment

Model	Treatment sector	Cluster A		Cluster B		Cluster C		Any	
		odds	95% CI	odds	95% CI	odds	95% CI	odds	95% CI
I	Psychiatrist	1.2	0.1, 20.0	2.4	0.3, 20.0	1.5	0.2, 8.8	2.0	0.6, 6.3
	Other mental health	1.5	0.2, 13.3	1.2	0.1, 13.7	0.8	0.1, 11.9	1.9	0.4, 8.7
	Any mental health	1.0	0.1, 10.6	1.8	0.2, 16.5	1.2	0.2, 6.2	1.8	0.7, 4.4
	General medical	1.7	0.7, 3.9	1.3	0.4, 4.2	1.5	0.6, 4.1	1.5	0.9, 2.6
	Human service	0.8	0.2, 3.7	0.8	0.0, 29.3	1.8	0.4, 8.8	1.5	0.7, 3.3
	CAM	0.9	0.1, 9.1	0.6	0.0, 7.2	1.6	0.3, 8.2	1.3	0.4, 4.6
	Any treatment	1.4	0.7, 3.1	1.4	0.5, 3.7	1.6	0.7, 3.8	1.5	0.9, 2.6
II	Psychiatrist	0.9	0.0, 16.3	1.3	0.1, 10.6	1.0	0.2, 6.1	1.4	0.4, 4.8
	Other mental health	1.0	0.1, 9.6	0.5	0.0, 5.8	0.5	0.0, 7.1	1.2	0.2, 6.2
	Any mental health	0.8	0.1, 8.5	0.9	0.1, 8.5	0.8	0.2, 4.2	1.3	0.5, 3.4
	General medical	1.5	0.6, 3.6	0.9	0.3, 3.1	1.3	0.5, 3.5	1.3	0.7, 2.3
	Human service	0.7	0.2, 3.2	0.5	0.0, 20.6	1.4	0.3, 6.9	1.2	0.5, 2.8
	CAM	0.8	0.1, 8.4	0.4	0.0, 5.3	1.3	0.2, 6.9	1.1	0.3, 4.2
	Any treatment	1.2	0.5, 2.8	0.9	0.3, 2.5	1.3	0.5, 3.1	1.3	0.7, 2.2

Results represent odds of treatment given each personality disorder. Separate models: model I adjusted for sex and age; model II adjusted for sex, age and any axis I disorder.

CAM = Complementary and alternative medicine. * Significant at the 0.05 level.

health (i.e. psychiatrist, psychologist, social worker), human service (i.e. social services agency, religious counsellor) or complementary/alternative practitioners. Approximately half of all patients were seen in two treatment sectors, as indicated by the sum of treatment percentages across sectors being roughly one and a half times the number of cases that received any treatment.

The proportion of respondents with PD who were in treatment was higher (not significantly) than that of demographically matched respondents without PD (see model I, table 8). Adjusting for co-morbid axis I disorders did not alter this proportion significantly (see model II, table 8).

Discussion

The SASH study found that 6.8% of South Africans suffer from a DSM-IV PD. Although this rate is lower than most studies in the developed world, it is consistent with findings in Australia [25], as well as those in low- and middle-income countries, i.e. Brazil and China [26, 27]. The difference in prevalence might be explained by the use of different methodologies; however, the rate reported here is also lower than the 9% prevalence rate documented in the US [18], where a similar methodology was used. Differences in prevalence rates between countries could also be attributable, in part, to cultural, financial and economic development differences between countries.

Estimates of the prevalence of individual PD in previous US and British community studies have not been altogether consistent. Lenzenweger et al. [18] and Coid et al. [24] found cluster C to be most prevalent followed by clusters A and B. Samuels et al. [19] found cluster B to be most prevalent, followed by clusters C and A. In this study cluster A was found to be most prevalent (3.4%), followed by cluster C (2.5%). Cluster B was the least prevalent (1.5%). Although this differs from the aforementioned studies, the rate of cluster B PD is similar to the rate of 1.5% documented by [18]. Our findings that cluster A PD are the most prevalent of the PD and cluster B PD are the least prevalent is interesting, in view of the finding that cluster A PD are the least frequently seen in clinical populations (owing to lower treatment-seeking behaviour in this subtype) and cluster B PD the most frequently seen [16].

In line with earlier findings [33], all PD clusters were significantly associated with the others: cluster A and B PD were most closely associated, followed by clusters A and C, and lastly clusters B and C. Our findings also suggest that PD are highly co-morbid with axis I disorders in

the South African population – 36.2% of individuals with a PD also meet criteria for an axis I disorder, and 14.5% meet the criteria for more than one axis I disorder. This co-morbidity is broadly consistent with the results of previous clinical [4, 5, 16] and epidemiological [18] studies. In this study, PD was associated with all four axis I disorders, with the relationship with anxiety being the strongest.

Our results are consistent with findings of Samuels et al. [19] and Lenzenweger et al. [18], who found that cluster B PD are most likely to be co-morbid with axis I disorders. Depue and Lenzenweger [34, 35] note that this could be because the dysregulation in the underlying negative affect and constraint systems, which governs the erratic and impulsive symptoms of cluster B PD, might be a more important determinant of axis I disorders than clusters A or C. In addition, consistent with earlier studies, we found little differentiation in the strength of the associations between cluster A and C PD across the different axis I disorders. However, there was a great deal more variability in the associations between cluster B PD and axis I disorders, with substance use disorders having the strongest association. Thus, mechanisms underlying co-morbidity of PD with axis I may be similar in both developed and developing world contexts as these seem to be universal relationships.

The absence of significant sociodemographic correlates of PD is noteworthy. Previous research has suggested that younger age, lower socio-economic status, male gender and being single, amongst others, are all predictors of PD. In our sample, only male gender was predictive of a PD, and in particular of cluster A PD. This is in line with a number of other studies, which have found that PD are generally more prevalent in men [19, 24]. Although the preponderance of males may be due to the high rates of antisocial PD (cluster B), Samuels et al. [19] found more males to have both cluster A and B PD, and Coid et al. [24] found all PD to be more prevalent in males.

Disturbingly, only 19.9% of individuals diagnosed with a possible PD diagnosis in this community sample had received treatment for a mental health or substance problem in the previous twelve months. Although this is a higher percentage than that of the demographically matched respondents without PD, it is lower than most studies in developed countries [18, 22, 25]. The majority of people with axis II disorders in the community are not receiving help for their disorders. This could be due to a lack of services or to a lack of awareness of these disorders in the community as well as in health care providers. Some authors have pointed out that treatment seeking is related to a number of clinical and demographic factors [36, 37], including the presence of axis I disorders. Zimmerman et al. [16] suggest that PD as a group should be assessed in every patient since their presence can influence the course and treatment of presenting axis I disorders.

These results need to be interpreted in the context of the limitation that PD were assessed comprehensively only in a subsample of US respondents who received IPDE clinical reappraisal interviews. Clinical diagnoses were then imputed for the South African sample. Concern about this limitation is reduced by the fact that the AUC of imputation equations was consistently high. In addition, the MI method adjusts for the imprecision in parameter estimates introduced by imputation. Prevalence is estimated without bias with MI, whereas MI estimates of associations involving PD are conservative [18]. Thus, this study indirectly estimates the PD prevalence rate in this population, and as such the estimate of 6.8% is a conservative one.

A second limitation concerns the possibility that individuals with an axis I or II disorder might have been more likely to decline participation in this study, resulting in an underestimation of prevalence rates. However, our overall response rate was high and the data were weighted to account for underrepresentation of axis I disorders. Given the co-morbidity of axis I and axis II disorders, this methodological refinement might have helped to offset, in part, the non-participation of PD-affected individuals [18]. Nonetheless, it remains conceivable that these prevalence rates are somewhat underestimated. A third limitation is that the WMH-CIDI, in particular the personality disorders module, has not been validated in this population.

Within the context of these limitations, these findings emphasize that high co-morbidity with axis I disorders appears to be a universal phenomenon, and, given this, there is the possibility that PD affect the onset, persistence and severity of co-morbid axis I disorders, and may complicate their treatment. However, our finding that cluster A disorders are more prevalent than clusters B and C disorders is unusual and further work is needed to determine what local features might help to explain these data. Nonetheless, these findings contribute to our current understanding of the epidemiology of PD across cultures and stages of industrial and economic development.

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