The global prevalence of personality disorders in community settings: A systematic review and meta-regression analysis

Abstract

Background

Personality Disorders (PDs) are increasingly recognised as a mental health priority area in many countries. Nevertheless, there are no systematic reviews examining the global prevalence of PDs, and whether rates differ in high and low and middle-income countries (LAMICs).

Method

We searched PsycINFO, MEDLINE, EMBASE, and PubMed databases from January 1980 to May 2018. Two authors independently screened abstracts and full text articles. Studies were quality assessed with the Joanna Briggs Institute Critical Appraisal Tool. We used meta-analysis to estimate pooled prevalence rates, and meta-regression to estimate the effects of study methodology on estimate variability.

Results

We identified 31 community studies from 21 different countries. Twenty-five studies were included in the final analysis. The worldwide pooled prevalence of any PD was 7.5 % (95% Confidence Intervals: 5.6, 9.5), with greater rates in high (9.2%; 95% CI: 7.0, 10.8%) compared to LAMI (4.1%; 95% CI =2.7, 5.5%) countries. There was significant heterogeneity across pooled estimates. Study design and study country remained significant moderators of estimates in the multiple meta-regression model. Prevalence rates of Cluster-A PDs were very similar in high and LAMI countries (3.5% *vs* 3.7%), while rates of Cluster B (3.5% *vs* 1.6%) and C PDs (6.6% *vs* 3.4%) were greater in high income countries.

Conclusions

Our meta-analysis indicates that PDs are prevalent globally and affect people across most regions of the world. Lower rates in LAMICs could be partly attributable to methodological factors. Public

health strategies are needed to address the unmet needs of individuals with PDs, particularly in LAMICs where support is very limited.

Introduction

Before the 1960s, personality disorder (PD) was viewed as an unreliable diagnosis of limited clinical utility. PDs (including Clusters A, B and C) are now recognised as important conditions, which are associated with morbidity, premature mortality, and great costs to society (Tyrer, Mulder et al. 2010, Moran, Romaniuk et al. 2016).

A recent narrative review reported relatively high rates of PDs (4.4% - 21.5%) in community populations across England, Wales, Scotland, Western Europe, Norway, Australia, and the US (Quirk, Berk et al. 2016). To the best of our knowledge, however, there are no reviews examining global prevalence of PDs, and whether rates vary between high and low-and middle-income (LAMI) countries.

These questions are important for several reasons. First, over 80% of the global population live in LAMICs, and mental health is now recognised as a public health priority in these areas (Patel 2007). Nevertheless, personality disorders are not included within the scope of policy-informing initiatives, such as the WHO Mental Health Gap Action Programme (Bruckner, Scheffler et al. 2011) and the Global Burden of Diseases Project (Quirk, Williams et al. 2015). Second, PDs are often under-recognised in clinical practice, particularly in LAMICs where stigma and misunderstanding surrounds the diagnosis (Tyrer, Reed et al. 2015, Santana, Coelho et al. 2018). Third, it is unclear whether (and how) diagnostic tools and treatment modalities need to be culturally tailored for LAMICs (Ryder, Sunohara et al. 2015, Ronningstam, Keng et al. 2018). Finally, personality disorders are characterised by high levels of mental, physical, and functional impairment (Winsper, Marwaha et al. 2015, Moran, Romaniuk et al. 2016). Neglecting their effects at the population level could impede progress in reducing the burden of disability (Quirk, Williams et al. 2015).

The current review addresses the following research questions:

- What is the global pooled prevalence of any PD, and Clusters A, B, and C PD in community settings?
- Do pooled prevalence rates differ between high and LAMI countries?
- Do methodological factors (population characteristics, sample characteristics, study methods, and assessment methods) explain variability in prevalence estimates across studies?

Method

Review structure

We used PRISMA (Moher, Shamseer et al. 2015) guidelines as a framework. The protocol was registered with PROSPERO prior to conducting searches and updated before data extraction (registration number: CRD42017065094).

Search strategy

We searched PsycINFO, MEDLINE, EMBASE, and PubMed from January 1980 to May 2017 for articles published in any language. We updated the search on the 24th May 2018. We combined the following three search strings: (Personality disorder* OR Axis-II) AND (Prevalen* OR rate* OR frequency OR percentage) AND (epidemiolog* OR communit* OR general population OR population OR student* OR healthy sample OR normal population OR representative sample*). We inspected the reference lists of retrieved articles and cross-referenced our findings against published reviews (Paris 2010, Sansone and Sansone 2011, Quirk, Berk et al. 2016). C.W. and A.B

independently screened 100% of the abstracts for full text retrieval, and 100% of the full text articles for inclusion in the review.

Inclusion criteria

1. The study provided a prevalence figure for any PD or a Cluster A, B, or C PD;

2. Participants were adolescents or adults (≥mean age 12 years) from a community (or school) population;

3. Studies used interviews or self-report questionnaires. We included self-report questionnaires in the first instance to examine impact on prevalence estimates (Oltmanns, Rodrigues et al. 2014);

4. Studies published in any language;

5. Studies published in peer-reviewed journals.

Exclusion criteria

1. Studies in clinical, medical, psychiatric, or prison settings;

2. Studies with biased samples (e.g., chronic pain groups);

3. Case control studies as they involve strongly selected samples (Simon, Czobor et al. 2009);

4. Studies with less than 100 participants (Van Os, Linscott et al. 2009);

5. Studies with diagnoses based on clinical records/administrative databases (Polanczyk, De Lima et al. 2007);

6. Reviews;

7. Studies below the quality assessment threshold (< 4 points)

Data extraction and quality assessment

We developed a data extraction form to record: prevalence rates and standard errors (or data to calculate these figures); year of study; country of study (and World Bank classification); sample: number, age, and sex proportion; sample frame, including origin, recruitment approach and

estimation approach; assessment method; evaluation instrument, e.g., SCID-II; and diagnostic criteria. e.g., DSM-IV.

Full text articles adhering to the inclusion criteria were quality assessed by CW. We used an adapted version of the Joanna Briggs Institute Critical Appraisal Tool for prevalence reviews (Munn, Moola et al. 2014). Each study was rated on eight categories: 1) representativeness of target population; 2) recruitment of participants; 3) sample size; 4) description of study subjects and setting; 5) coverage of identified sample; 6) objectivity of assessment; 7) reliability of the assessment; and 8) appropriate statistical analysis. We calculated a quality score for each study ranging from 0 to 8. Studies scoring 4 or above were included in the final review.

Data analysis

Meta-analysis

We used *STATA version 14*. Pooled prevalence was computed across studies using the *metan* command. A random effects model was chosen as we were using real-world data, which is expected to have variable population parameters (Winsper, Ganapathy et al. 2013). We assessed heterogeneity across studies with the I^2 statistic (reported with a *p* value). We pooled prevalence rates of any personality disorder (PD). 'Any PD' referred to the presence of one or more categorical PD as defined in each of the studies. We then pooled the prevalence of three PD clusters. Cluster A includes any categorical paranoid, schizotypal, or schizoid PD. Cluster B includes any categorical histrionic, borderline, narcissistic or antisocial PD. Cluster C includes any categorical avoidant, dependent or obsessive compulsive PD (American Psychiatric Association 2013).

Sensitivity analysis

We conducted sensitivity analysis to evaluate the influence of each study on pooled prevalence using the *metaninf* command (Taylor and Kim-Cohen 2007). We also examined whether self-report

questionnaires inflated PD prevalence figures (Dereboy, Güzel et al. 2014, Oltmanns, Rodrigues et al. 2014) by comparing pooled rates between self-report questionnaire and interview studies.

Sub-analyses and meta-regression analysis

We used sub-analysis and meta-regressions to examine the impact of study characteristics on PD prevalence estimates. We selected study factors *a priori* based on previous reviews on mental health prevalence (Steel, Marnane et al. 2014, Polanczyk, Salum et al. 2015) and the assessment of PDs specifically (Banerjee, Gibbon et al. 2009, Beckwith, Moran et al. 2014, Tyrer, Reed et al. 2015). We considered the following factors:

Population characteristics

1. Country of study - broad (1= high income; 2= LAMI)

2. Country of study – breakdown (1=Asia; 2 = other LAMICs; 3=Europe; 4=North America; 5=Australia). We separated Asian studies from other LAMIC studies, as we anticipated lower rates in these countries (Steel, Marnane et al. 2014, Ronningstam, Keng et al. 2018).

2. Study year (1 = before 2000; 2 = 2000-2009; 3 = 2010 onwards)

Sample characteristics

1. Sample size (1= <1000; 2= 1000-4999; 3= 5000-9999; 4 =10 000+)

Study methods

1. Sampling (1=country or large city/area weighted to represent population; 2=medium or small city/area with complex sampling to improve representativeness; 3=small area/sample with no complex sampling approach).

2. Study design (1=one-step assessment; 2= two-step assessment)

Assessment methods

1. Diagnostic criteria (1=ICD 8/9/10; 2=DSM-III/R; 3=DSM-IV)

2. Assessor (1=interview by trained lay person; 2=interview by experienced clinician/psychiatrist)

3. Study instruments (1=clinical interview; 2=SCID-II; 3=IPDE; 4=SIDP-IV/R; 5=other, i.e., assessment only used in one study).

We conducted univariate meta-regressions for each factor. Covariates associated with heterogeneity at the $p<0.05$ level were included in the multivariate analysis.

Results

Of the original 3879 abstracts, 533 articles were selected for full text review. There was an acceptable level of agreement between raters (*Kappa* = 0.80). The updated search yielded a further 458 abstracts, of which 20 full text articles were retrieved for inspection. Three articles were identified by hand search. In total there were 556 full text articles. Of the full text articles, 55 fulfilled our initial inclusion criteria (prior to the quality assessment). Inter-rater reliability was acceptable (*Kappa* = 0.82). The authors discussed discrepancies at the abstract and full text stage, most of which related to duplicate data and whether the study sample was biased (**Figure 1**).

Description of studies

Thirty-one studies from twenty-one different countries reached our quality assessment threshold. See **Table 1** for an overview, including sample description, sampling frame, and diagnostic approach. One study from the WHO World Mental Health Surveys (Huang, Kotov et al. 2009) provided eight independent prevalence estimates. Most studies were published in English language, excepting one German (Barnow, Stopsack et al. 2010), one Icelandic (Lindal and Stefansson 2009) and four Chinese (Huang, Liu et al. 2002, Fu, Yao et al. 2008, Qi, Xu et al. 2009, Liu and Ning 2010) articles. CW extracted data from the German and Icelandic publications using *Google Translate*. A.W translated and extracted data from the Chinese publications.

Quality assessment of included studies

Please refer to **Supplementary Table 1** for an overview of the quality assessment. Lower scores indicate higher chance of bias in prevalence estimates (Munn, Moola et al. 2014) rather than study quality *per se*. Eleven studies scored between 4 and 4.5 out of 8; sixteen scored between 5 and 6 out of 8; and four scored 7 out of 8. Generally, self-report questionnaire studies, e.g. , Lindal and Stefansson (2009) and those with less robust recruitment strategies, e.g., Maier, Lichtermann et al. (1992) yielded the lowest scores.

Sensitivity analysis

We included twenty-eight studies (35 individual prevalence estimates) in the initial meta-analysis of any PD. Inspection of the funnel plot highlighted one study (Hickling and Walcott 2013) as an outlier. Sensitivity analysis (**Supplementary Table 2**) confirmed that removing this study had a relatively substantive effect on the overall pooled prevalence, thus we excluded from further analysis. The five self-report questionnaire studies (11.2%; 95% CI: 2.8, 19.6%) yielded markedly higher pooled prevalence rates than the twenty-five interview studies (7.5%; 95% CI: 5.6, 9.5%) and were thus excluded from the final analysis. This left twenty-two studies providing twenty-nine prevalence estimates for the meta-analysis of any PD. Eleven of these studies also reported on a Cluster A, B or C PD. One reported on just Cluster B PD (Fu, Yao et al. 2008), and one on just Cluster C PD (Liu and Ning 2010).

Pooled prevalence of any personality disorder

The global pooled prevalence of any PD was 7.5% (95% CIs: 5.6-9.5). There was substantial heterogeneity among estimates ($I^2 = 99.7\%$, $p < .001$). We thus conducted our pre-planned analysis of study level moderators on inter-study heterogeneity.

Sub-analyses and univariate meta-regressions according to methodological factors

See **Table 2** for results of the sub-analyses and univariate meta-regressions. Pooled prevalence rates were significantly greater in high income compared to LAMI countries (according to both broad and finer-grained categories: **Figure 2**). LAMICs predicted significantly lower pooled prevalence rates than high income countries accounting for 18.9% of between study variance. Asian studies predicted significantly lower pooled prevalence rates than European, North American and Australian studies, accounting for 38.4% of between study variance. Two-stage assessments yielded significantly lower pooled prevalence rates than one-stage assessments, accounting for 37.8% of between study variance.

Multiple meta-regression

In the multiple meta-regression analysis, study design and country (Asia *vs* Australia only) remained significant predictors of heterogeneity (study design: $\beta = -.042$, $p = .046$; study country: $\beta = .085$, $p=.022$). The broader distinction between high and LAMI countries did not remain a significant predictor of heterogeneity in the multiple metaregression analysis ($\beta = -.012$, $p=0.60$). This final model accounted for just under half of the heterogeneity in prevalence rates across studies (Adjusted R-squared: 46.3%).

Prevalence of Cluster A, B and C PDs

See **Figure 3** for an overview of Cluster A, B and C PD prevalence rates by country classification. Twelve studies (19 estimates) examined Cluster-A prevalence (pooled prevalence: 3.6 %; 95% CIs: 2.9, 4.2; I^2 =91.0%). Two studies (7 estimates) reported prevalence rates in LAMI countries (3.7%; 95% CI =2.6, 4.8%; I^2 =78.4%) and eleven (12 estimates) in high income countries (pooled prevalence 3.5%; 95% CI: 2.7, 4.3%; I^2 =93.0%).

Twelve studies (19 estimates) reported Cluster B prevalence (2.7%; 95% CIs: 1.6, 3.7; I^2 =98.3%). Three studies (8 estimates) reported prevalence rates in LAMI countries (1.5%; 95% CI =1.0, 2.0%; I^2 =80.8%) and eleven (12 estimates) in high income countries (pooled prevalence 3.5%; 95% CI: 2.1, 4.9%; I^2 =98.3%).

Twelve studies (19 estimates) reported Cluster C prevalence (5.2%; 95% CIs: 3.9, 6.6; I^2 =98.0%). Three studies (8 estimates) reported prevalence rates in LAMI countries (3.4%; 95% CI =1.9, 4.9%; I^2 =93.6%) and ten (11 estimates) in high income countries (pooled prevalence 6.6%; 95% CI: 4.4, 8.7%; I^2 =98.7%).

Discussion

We identified thirty-one community studies assessing the prevalence of any PD (or Cluster A, B, or C-PD) from twenty-one different countries. Twenty-two of these studies were included in the final meta-analysis for any PD, and twelve for the meta-analyses of Cluster A, B and C-PDs respectively. The global pooled prevalence of any PD was 7.5% (95% CI: 5.6-9.5). We found significant heterogeneity across studies, which was partly explained by study design (two-stage *vs* one-stage assessment) and study country (Asian *vs* Australian studies).

To the best of our knowledge this is the first worldwide-pooled prevalence estimate of PDs in the community, and exceeds global period prevalence rates of mood (5.4%) and anxiety (6.7%) disorders (Steel, Marnane et al. 2014). The pooled prevalence of any PD was considerably lower in LAMI (4.1%) than high income (9.2%) countries. Similarly, Cluster B (3.5% *vs* 1.5%) and C (6.6% *vs* 3.4%) PDs were less common in LAMI countries. There are several plausible explanations for these findings.

First, there may exist a lower population risk in LAMICs due to key cultural or other protective factors (Cheng, Huang et al. 2010, Steel, Marnane et al. 2014, Gawda and Czubak 2017). Sub-analysis showed that LAMI Asian countries had the lowest pooled prevalence (2.0%), which mirrors previous findings of lower rates in Asia for depression and anxiety (Ferrari, Somerville et al. 2013, Steel, Marnane et al. 2014). In relation to PDs specifically, core problems such as emotion dysregulation and interpersonal dysfunction may be less likely within cultural contexts emphasising collectivism and conformity. Indeed, the diagnosis of borderline personality disorder is often met with skepticism in China due to a perceived mismatch between core symptoms and cultural setting (Ronningstam, Keng et al. 2018). Second, current diagnostic tools and criteria may underestimate the prevalence of PDs in LAMICs (Steel, Silove et al. 2009). Two Asian studies conducted by Western psychiatrists reported strikingly low PD prevalence rates in China (Cheung 1991) and Bangladesh (Hosain, Chatterjee et al. 2007). In contrast, the WHO mental health survey reported a prevalence of 4.1% in China when using the cross-cultural International Personality Disorder Examination tool (World Health Organization 1997, Huang, Kotov et al. 2009). Other LAMI countries (also from the WHO survey) had a pooled prevalence of 6.0%, which is largely comparable to the pooled estimate for Europe. While the use of uniform (cross-cultural) assessment tools may improve inter-country comparisons, researchers should also consider cultural nuances in symptom clusters, which could moderate aetiology and illness presentation (Soh and Keng 2018). Third, differences in pooled prevalence could be partly attributable to methodological confounders. Study design was a strong predictor of heterogeneity in both univariate and multiple meta-regression analysis, while high versus LAMI country became a non-significant predictor in the final multivariate model. Thus, study design may have confounded the effect of study country on prevalence estimate (i.e., all one-step studies were from high income countries potentially inflating the gap between high and LAMI countries).

Only Cluster-A PDs were equally common in high (3.5%) and LAMI (3.7%) countries.

The relatively high global prevalence of Cluster-A PDs contrasts with low presentation of these disorders in clinical settings (Soeteman, Roijen et al. 2008). These three PDs (paranoid, schizoid and schizotypal) often receive the least research attention (Bateman, Gunderson et al. 2015) despite being associated with chronic physical comorbidities including cardiovascular disease and arthritis (Quirk, Berk et al. 2016).

We found that the pooled prevalence of any PD was especially high in Australia (15.6%). This finding should be interpreted with caution, due to the paucity of studies and wide variability in prevalence estimates across studies. Quirk, Berk et al. (2017) found a prevalence of 21.8% in an age-stratified female cohort originally established to describe the epidemiology of osteoporosis. Moran, Coffey et al. (2006) reported a prevalence of 18.6% (according to informant report) in a nationally representative longitudinal cohort of young people. Jackson and Burgess (2000) found a more conservative prevalence of 6.5% in the Australian National Survey of Mental Health and Wellbeing. As personality disorders are increasingly recognised as a mental health priority in Australia, we anticipate the collection of more representative data (Chanen, Sharp et al. 2017, Grenyer, Ng et al. 2017).

Methodological considerations and limitations

There are several limitations that should be noted when considering our review findings. First, we identified substantial inter-study heterogeneity across all models with high and significant I^2 values. Pooled prevalence estimates were similarly heterogeneous in previous reviews on ADHD (Polanczyk, De Lima et al. 2007) and common mental disorders (Steel, Marnane et al. 2014, Polanczyk, Salum et al. 2015). Heterogeneity can affect the stability and interpretability of pooled prevalence estimates (Steel, Marnane et al. 2014). However, I^2 may be artificially inflated when pooling epidemiological studies, which tend to have large sample sizes thus lower within study

variation (Higgins 2008, Coory 2009). Second, only two of our *a priori* selected covariates had a significant impact on variability of estimates. Other factors, such as diagnostic assessment, had an impact on pooled prevalence in the sub-analysis, but were not significant predictors in the meta-regression. Although we conducted a comprehensive search, we were only able to identify a relatively small number of epidemiological studies highlighting the lack of research in this area. This could have limited our power to detect significant moderators, and fully disentangle the confounding effects of inter-related moderators (Lipsey 2003). Third, there were some potential moderating factors we could not include in our analysis due to insufficient data, or a difficulty in constructing meaningful categories. Factors such as age, sex, urbanicity, and socioeconomic status, for example, could have an impact on PD prevalence rates (Torgersen, Kringlen et al. 2001, Huang, Kotov et al. 2009). Fourth, because of the limited number of studies, we had to construct relatively crude categories for some moderators. For example, 'LAMICs' covered a wide variety of countries (both low-middle and high-middle) and included megacities (Santana, Coelho et al. 2018) and rural areas (Hosain, Chatterjee et al. 2007), which varied widely in prevalence rates. Finally, we only pooled categorical PD prevalence figures. The assumption that PDs are categorical is highly contested. Nevertheless, the DSM-5 has retained the ten discrete PDs (Ryder, Sunohara et al. 2015) and personality disorder can be described as a unitary construct (Quirk, Berk et al. 2016). Future epidemiological studies should use both categorical and dimensional measures in anticipation of potential changes to diagnostic systems (Hopwood, Kotov et al. 2018).

Conclusions

Epidemiological research on personality disorders is relatively sparse, with a particular paucity of data from less developed regions (Santana, Coelho et al. 2018). Pooled rates of PDs (except Cluster A) are lower in LAMICs. Whether this represents a lower population risk or an underestimation due

to methodological artefacts remains unclear. Future studies should further investigate potential sources of divergence using culturally secure assessment techniques (Balaratnasingam and Janca 2017). Narrative based assessments and visual aids may be more appropriate than symptom checklists for non-Western cultures (Balaratnasingam, Anderson et al. 2015), and could help community mental health workers identify PDs in areas where psychiatrists are unavailable (Agyapong, Osei et al. 2015).

PDs are common across many areas of the world and should be recognised as an important contributor to population mental health and disease burden (Tyrer, Mulder et al. 2010, Quirk, Berk et al. 2016). Personality pathology continues to be overlooked in clinical practice (Newton-Howes, Clark et al. 2015) particularly in LAMICs where resources are limited (Agyapong, Osei et al. 2015) and PDs are surrounded by misunderstanding and stigma (Huang, Kotov et al. 2009, Santana, Coelho et al. 2018). Though PDs are now considered treatable (Chanen, Sharp et al. 2017) the evidence base is underdeveloped with an over emphasis on borderline personality disorder (Bateman, Gunderson et al. 2015). Moving forward, we need more accurate and representative data to underpin the development of mental health care reform, including an emphasis on early intervention (Winsper, Lereya et al. 2016, Chanen, Sharp et al. 2017, Grenyer, Ng et al. 2017).

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