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Examining the factor structure of the 40-item Defense Style Questionnaire among adults with depression: an individual participant data meta-analysis

Frederik J. Wienicke,[1] William J. Burk,[2] Erkki Heinonen,[3,4] Olavi Lindfors,[4] Tommi Härkänen,[4] Paul Knekt,[4] Sampo Sarvasmaa,[5] Luciano Dias de Mattos Souza,[6] Karen Jansen,[6] Ricardo Azevedo da Silva,[6] Érico Nobre dos Santos,[6] Jack J. M. Dekker,[7,8] Jaap Peen,[7] Henricus L. Van,[9] John Christopher Perry,[10] William M. van der Veld,[2] Ednei Soares,[1] Jan Spijker,[1,11] Ellen Driessen[1,11]

[1]Department of Clinical Psychology, Behavioral Science Institute, Radboud University, Nijmegen, Netherlands; [2]Department of Developmental Psychology, Behavioral Science Institute, Radboud University, Nijmegen, Netherlands; [3]Department of Psychology, University of Oslo, Norway; [4]Finnish Institute for Health and Welfare, Helsinki, Finland; [5]Helsinki University Hospital, Finland; [6]Department of Health and Behavior, Catholic University of Pelotas, Brazil; [7]Department of Research, Arkin Mental Health Care, Amsterdam, Netherlands; [8]Department of Clinical, Neuro and Developmental Psychology, Amsterdam Public Health Research Institute, Vrije Universiteit Amsterdam, Netherlands; [9]NPI, Arkin Mental Health Care, Amsterdam, Netherlands; [10]Department of Psychiatry, McGill University, Institute of Community & Family Psychiatry, Jewish General Hospital, Montreal, Canada; [11]Depression Expertise Center, Pro Persona Mental Health Care, Nijmegen, Netherlands

Abstract

The 40-item Defense Style Questionnaire (DSQ-40) is frequently used to measure defense mechanisms in adults with depression because of its brevity and efficient assessment. However, previous research has yielded inconsistent results concerning its factor structure, with one- (overall defensive functioning), three- (mature, neurotic, immature), and four- (mature, neurotic, immature, image-distorting) factor solutions being reported. Therefore, we examined the DSQ-40's latent structure across different samples. Using multigroup confirmatory factor analysis (CFA), we tested the one-, three-, and four-factor solutions using baseline data from three research projects of psychodynamic psychotherapy for depressed adults (N=667; mean age 33.9; standard deviation [SD]=9.3; 79.0% female). Configural invariance across samples was evaluated, and model fit was compared using multiple fit indices. Across samples, the three- and four-factor models outperformed the one-factor model, with the four-factor model providing the best relative fit; however, it fell short of conventional model fit thresholds. Separate CFAs found the four-factor model showing the best relative fit in two samples, and the three-factor model in one, but all models failed to meet acceptable fit criteria. Several defense mechanisms showed weak standardized loadings, high inter-factor correlations, and cross-loadings. These findings indicate that the DSQ-40 lacks a stable factor structure in adults with depression and raise important questions about the instrument's construct validity, suggesting that its subscale scores cannot be assumed to validly represent the theorized defense categorizations in this population. Further psychometric refinement and evaluation are needed to determine the DSQ-40's suitability for both clinical and research applications.

Key words: defense mechanisms, Defense Style Questionnaire, DSQ-40, factor structure, depression.

Correspondence to: Frederik J. Wienicke, M.Sc., Radboud University, Behavioral Science Institute, Department of Clinical Psychology, Thomas van Aquinostraat 4, 6525 GD Nijmegen, Netherlands.
Tel.: +31 (0) 24 361 10 92. E-mail: fritz.wienicke@ru.nl

Introduction

First proposed by Sigmund Freud (1926/1959) and later expanded by Anna Freud (1936/1966), the theory of defense mechanisms is among the most widely accepted psychodynamic concepts (Cramer, 2000). Defense mechanisms are commonly defined as unconscious psychological processes that protect the individual from excessive anxiety or emotional distress caused by internal or external stressors (American Psychiatric Association [APA], 1994). They are thought to operate along a continuum of adaptiveness, which Vaillant (1971) described as a developmental hierarchy ranging from immature to neurotic to mature defenses. As individuals develop psychologically, they tend to rely less on immature (*e.g.*, denial) defenses and more on neurotic (*e.g.*, undoing) and eventually mature (*e.g.*, humor) defenses, the latter being associated with greater emotional flexibility and psychological well-being (Cramer, 2000; Vaillant, 1971).

The clinical utility of defense mechanisms was acknowledged through the inclusion of the Defensive Functioning Scale in the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM; APA, 1994). Research on defense mechanisms

has further highlighted their prognostic, diagnostic, and therapeutic relevance. Prognostically, the predominant use of immature defenses has been linked to poorer psychosocial adjustment and more severe psychopathology (Bond *et al.*, 1983; Vaillant, 1976), whereas mature defenses have been associated with better interpersonal functioning and long-term health (Malone *et al.*, 2013; Vaillant, 1971). Diagnostically, distinct defense mechanism profiles have been shown to map onto specific personality disorders; for instance, individuals with borderline personality disorder frequently display elevated levels of immature defenses and low levels of adaptive defenses (Bond *et al.*, 1994; Perry *et al.*, 2013). Therapeutically, defense mechanisms have been found to predict short- and long-term treatment outcomes (de Roten *et al.*, 2021; Euler *et al.*, 2025; Laaksonen *et al.*, 2014), as well as risk for dropout (Hauck *et al.*, 2007; Mullen *et al.*, 1999). Taken together, these findings highlight the importance of accurate measurement of defense mechanisms.

The current "gold standard" for assessing defense mechanisms is through observer ratings of video recordings or transcripts. Instruments such as the Defense Mechanism Rating Scale (DMRS; Perry & Cooper, 1989) and the Q-sort method for identifying ego defenses (Roston *et al.*, 1992) have proven effective in reliably capturing behavioral manifestations of the unconscious processes (Bond, 2004). However, these methods are resource-intensive and require substantial training and time to administer, which limits their applicability in large-scale research projects or routine clinical settings (Cramer, 1998).

Because of these limitations, self-report instruments have been developed as a time-efficient assessment alternative. Although defense mechanisms are, by definition, unconscious, self-report measures aim to assess their conscious derivatives, such as behavior patterns (Cramer, 1998). This approach is based on the assumption that the repeated use of specific defense mechanisms leaves traces in an individual's belief system and behaviors, such that endorsement of items measuring certain beliefs or behaviors can indicate which defense mechanisms an individual frequently uses (Andrews *et al.*, 1993). However, this indirect assessment relies heavily on the individual's capacity for introspection and is therefore susceptible to response distortions (Bond, 2004).

One of the most widely used self-report instruments for assessing defense mechanisms is the Defense Style Questionnaire (DSQ), although other self-report instruments are available, such as the Defense Mechanism Rating Scale - Self Report-30 (DMRS-SR-30; Di Giuseppe *et al.*, 2020). First developed in the 1980s (Bond *et al.*, 1983), the original 67-item DSQ version was based on Vaillant's hierarchical classification of defense mechanisms into mature, neurotic, and immature defense styles (Vaillant, 1971). Subsequent revisions seeking to improve alignment with the DSM glossary of defense mechanisms and reduce overlap with psychiatric symptoms produced a 40-item version (DSQ-40) assessing 20 defense mechanisms (Andrews *et al.*, 1993).

Despite its widespread use, previous studies have questioned the DSQ-40's proposed three-factor structure of mature, neurotic, and immature defense styles. In a psychiatric outpatient sample, Trijsburg *et al.* (2000) failed to replicate this structure. Instead, they found that defense mechanisms as measured with the DSQ-40 were best represented as unidimensional. Similarly, in an adolescent psychiatric outpatient sample, Ruuttu *et al.* (2006) failed to replicate the three-factor solution, finding a four-factor structure of mature, neurotic, immature, and image-distorting defense styles instead. These inconsistent findings underscore the need for further psychometric investigation into the instrument's latent factor structure.

This is particularly relevant for research on individuals with depression, a highly prevalent condition in which defense mechanisms are frequently examined for their proposed involvement in onset, maintenance, and treatment response. For instance, a recent meta-analysis investigated whether individuals with depression differ from nonclinical controls in their use of mature, immature, and neurotic defenses (Fiorentino *et al.*, 2024). Findings consistently showed greater use of immature defense styles in depressed individuals, which may serve as a marker for the disorder and a target for intervention (Fiorentino *et al.*, 2024). Of the 14 identified studies, the majority (10/14) used the DSQ-40. However, given the concerns about the DSQ-40's factor structure, further research is needed to clarify whether it can capture theoretically meaningful distinctions in defense mechanisms in this population.

Therefore, this study aimed to examine which of the previously proposed factor structures (*i.e.*, one-, three-, or four-factor model) best represents the latent factor structure of the DSQ-40 in adults with depression. To this end, we conducted an individual participant data (IPD) meta-analysis, which involves pooling and analyzing participant-level data from multiple studies. Compared to single studies, this approach increases statistical power, improves detection of weaker associations, and enhances generalizability (Lambert *et al.*, 2002). In contrast to conventional meta-analyses, which rely on aggregate data extracted from publications, IPD meta-analysis allows for consistent model specifications across studies and testing configural invariance, *i.e.*, whether the same factor structure holds across different study samples (Brown *et al.*, 2015). Because of these benefits, we considered IPD meta-analysis the most suitable approach for our research question.

Methods

Design

This study comprised secondary data analysis using an IPD meta-analytic approach and was preregistered at https://osf.io/94vfx/overview. This article follows the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA)-IPD guidelines for reporting IPD meta-analyses (Stewart *et al.*, 2015; for PRISMA-IPD checklist, see *Supplementary Table 1*).

Data source

This study used data collected as part of a larger IPD meta-analytic project, which has been registered at the PROSPERO international prospective register of systematic reviews (No. CRD42017056029). The full protocol outlining the data collection procedures, including the search strategy, study selection, and data acquisition, is described in Driessen *et al.* (2018). In summary, participant-level data were collected from studies that examined short-term psychodynamic psychotherapy (STPP) for depression. Relevant studies were identified through systematic literature searches in multiple databases, including PubMed, PsycINFO, Embase, and Cochrane's Central Register of Controlled Trials up until January 1, 2025. Eligibility criteria required studies to assess depressive symptoms with standardized instruments, include adult patients, and examine the efficacy of STPP. Depression was defined as either meeting diagnostic criteria for a unipolar mood disorder or scoring above the cut-off for clinically significant symptoms on a standardized depression measure. Two raters independently screened titles, abstracts, and full texts, resolving any disagreements by consensus. STPP experts verified that the included studies met

STPP criteria. Authors of the eligible studies were contacted using a multi-step protocol (Driessen *et al.*, 2018) and asked to share their de-identified participant-level data after signing a data-sharing agreement. Datasets were inspected to ensure that the data received matched the data reported in the publication, and were checked for any invalid, out-of-range, or inconsistent items. In case of discrepancy, the original authors were contacted for clarification. To be eligible for inclusion in the current project, studies were also required to have administered the DSQ at baseline and include individual defense mechanism scores in their datasets. Participants with all DSQ items missing were excluded from the study.

Measures

The DSQ-40 (Andrews *et al.*, 1993) is a self-report scale consisting of 40 items, with two items each assessing one of 20 defense mechanisms (Table 1). Items such as "*I get more satisfaction from my fantasies than from real life*" (defense mechanism of autistic fantasy) are rated on a 9-point Likert scale ranging from 1 = "*strongly disagree*" to 9 = "*strongly agree*". Scores for individual defense mechanisms are calculated by averaging the two corresponding items, with higher scores indicating greater use of the given defense mechanism. In addition, higher-order factor scores for mature, neurotic, immature, and image-distorting defense styles can be computed by averaging the defense mechanism scores contributing to these factors (Table 1). The test-retest reliability for the 20 defense mechanisms ranges from low to good (r=.38 to .85; Andrews *et al.*, 1993). Face validity of the DSQ-40 has been supported in previous studies through expert ratings (Andrews *et al.*, 1993; Trijsburg *et al.*, 2000). Findings on the convergent validity of the DSQ have been mixed. Prout *et al.* (2022) found small-to-moderate correlations between the defense styles assessed by the DSQ and DMRS-SR-30. Compared with the observer-rated DMRS, the DSQ developers reported modest but significant correlations between the defense styles on the two instruments (Bond *et al.*, 1989). Van *et al.* (2009b) found no such association with the observer-rated developmental profile (Abraham *et al.*, 2001), although they did observe a modest correlation for overall defensive functioning. Perry and Høglend (1998) also reported a small-to-moderate correlation between overall defensive functioning as assessed by the DSQ and the observer-rated DMRS.

Data analysis

All analyses were conducted in R (R Core Team, 2020) using the lavaan package (Rosseel, 2012). Multigroup confirmatory factor analyses (CFA) were conducted to test the three previously proposed factor structures of the DSQ-40: a one-factor model (Trijsburg *et al.*, 2000), a three-factor model (Andrews *et al.*, 1993), and a four-factor model (Ruuttu *et al.*, 2006). Robust maximum likelihood estimation was used to estimate the models (Schmitt, 2011), and missing data were handled using full-information maximum likelihood (Lee & Shi, 2021). Factor loadings were considered meaningful if ≥0.40 with $p<.05$. Model fit was evaluated using the Satorra-Bentler scaled χ^2 test (Satorra & Bentler, 2001), fit indices including robust comparative fit index (CFI), robust Tucker-Lewis Index (TLI), robust root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR), and the scaled Bayesian Information Criterion (BIC). Following Hu and Bentler

Table 1. Previously proposed factor structures of the Defense Style Questionnaire and means and standard deviations in the included samples.

Defense mechanism	Trijsburg *et al.* (2000)	Andrews *et al.* (1993)	Ruuttu *et al.* (2006)	Dekker *et al.* (2008)/ Van *et al.* (2009a)		Dos Santos *et al.* (2020)		Knekt & Lindfors (2004)	
				M	SD	M	SD	M	SD
Humor	ODF	Mature	Mature	4.65	2.11	4.12	2.26	5.76	1.84
Suppression	ODF	Mature	Mature	4.29	1.95	3.38	2.03	3.72	1.99
Sublimation	ODF	Mature	Mature	5.01	1.86	4.90	1.99	4.77	1.93
Anticipation	ODF	Mature	Mature	5.07	1.53	5.91	2.13	5.35	1.61
Rationalization	ODF	Immature	Mature	4.41	1.49	4.22	2.05	–	–
Isolation	ODF	Immature	Image-distorting	4.30	2.28	4.92	2.46	4.05	2.22
Dissociation	ODF	Immature	Image-distorting	4.80	1.85	2.63	1.57	2.21	1.27
Devaluation	ODF	Immature	Image-distorting	4.87	1.60	3.59	1.62	3.63	1.49
Splitting	ODF	Immature	Image-distorting	4.86	1.91	5.00	2.06	3.73	1.78
Denial	ODF	Immature	Image-distorting	3.44	1.64	2.69	1.68	2.71	1.45
Autistic fantasy	ODF	Immature	Immature	4.60	2.14	5.15	2.66	5.83	2.61
Displacement	ODF	Immature	Immature	4.07	2.05	5.01	2.05	4.34	1.90
Passive aggression	ODF	Immature	Immature	3.88	1.61	4.37	1.95	3.67	1.76
Somatization	ODF	Immature	Immature	5.72	1.77	5.75	2.40	5.06	2.16
Acting out	ODF	Immature	Immature	4.72	2.11	5.35	2.45	5.40	1.96
Projection	ODF	Immature	Immature	4.67	1.90	4.07	2.00	4.01	1.81
Reaction formation	ODF	Neurotic	Neurotic	4.95	1.89	4.48	2.02	4.56	1.73
Idealization	ODF	Neurotic	Neurotic	3.99	1.92	4.05	2.03	3.15	1.99
Pseudo-altruism	ODF	Neurotic	Neurotic	6.35	1.52	5.52	1.86	4.82	1.68
Undoing	ODF	Neurotic	Neurotic	5.58	1.99	4.72	2.05	4.66	1.97

Adapted from: Hovanesian, S., Isakov, I., & Cervellione, K. L. (2009). Defense Mechanisms and Suicide Risk in Major Depression. Archives of Suicide Research, 13(1), 74-86. doi: 10.1080/13811110802572171.

M, mean; SD, standard deviation; ODF, overall defensive functioning; –, defense mechanisms assessed using different items and therefore excluded for comparability.

(1999), thresholds for good fit were defined as CFI/TLI>0.95, RMSEA<0.06, and SRMR<0.08.

Model comparisons of the one-, three-, and four-factor multigroup CFAs followed a two-stage approach. First, we compared the one-factor model, nested within the three- and four-factor models, against these more complex models using likelihood ratio tests. Second, we compared the three- and four-factor models, which are non-nested, using the BIC, with ΔBIC>10 interpreted as strong evidence in favor of the model with the lower BIC. Once the best-fitting model was identified, we evaluated its overall fit using the aforementioned fit indices.

We also conducted CFAs for each sample using the aforementioned approach, again testing the three models independently and comparing them to identify the best-fitting solution. These analyses were exploratory, as they were not preregistered. To further improve model fit, we iteratively added residual covariances based on modification indices, restricting these to theoretically plausible within-factor defense mechanisms. These modifications were applied separately to the best-fitting model within each sample. In cases where this did not yield an acceptable model fit, we evaluated individual defense mechanisms for potential removal. Defense mechanisms with standardized factor loadings <.40 and R^2 values <.20 (Comrey & Ley, 1992) were removed iteratively, with the model re-estimated after each removal to assess changes in overall fit.

Additionally, we conducted *post hoc* analyses to test a two-factor solution, as proposed by Prout *et al.* (2018). These analyses were not included in the project's preregistration, as this two-factor structure was derived from a non-clinical convenience sample, whereas the one-, three-, and four-factor solutions examined in the primary analyses were originally proposed and evaluated in clinical samples (Andrews *et al.*, 1993; Ruuttu *et al.*, 2006; Trijsburg *et al.*, 2000). The two-factor model was therefore examined exploratively only, using the same procedures as described above.

Results

Included studies

In total, four studies (N=762) from the IPD database (Driessen *et al.*, 2018; *Supplementary Figure 1* for the PRISMA-IPD flowchart) met the eligibility criteria for this work (Dekker *et al.*, 2008; Dos Santos *et al.*, 2020; Knekt & Lindfors, 2004; Van *et al.*, 2009a). The studies by Dekker *et al.* (2008) and Van *et al.* (2009a) represent two arms of the same research project, with one subset of participants randomized to treatment conditions (Dekker *et al.*, 2008) and another subset selecting their preferred treatment (Van *et al.*, 2009a). Apart from randomization, study procedures were identical for both subsets. Therefore, their data were analyzed as one sample.

The characteristics of the four studies are presented in Table 2. Two studies focused on adults with a depressive episode (Dekker *et al.*, 2008; Van *et al.*, 2009a) and two on adults with major depressive disorder (Dos Santos *et al.*, 2020; Knekt & Lindfors, 2004). Across these samples, a total of 667 participants completed the DSQ-40 at the baseline assessment (see Table 1 for the means and standard deviations [SD] of the defense mechanisms per sample). The sample was predominantly female (79.0%), cohabiting or married (48.0%), had completed secondary education (35.4%), and was employed (52.8%). The mean age of participants was 33.94 years (SD=9.28, range: 18-60).

Two studies (Dekker *et al.*, 2008; Van *et al.*, 2009a) used the

Table 2. Baseline characteristics of the included studies.

Variable	Dekker *et al.* (2008)		Dos Santos *et al.* (2020)		Knekt & Lindfors (2004)		Van *et al.* (2009a)		Total	
Sample size	100		210		306		51		667	
Country	Netherlands		Brazil		Finland		Netherlands			
Depression inclusion criteria	Depressive episode		Major depressive disorder		Major depressive disorder		Depressive episode			
Age, mean (SD)	37.30 (8.91)		34.45 (11.18)		32.13 (6.87)		36.12 (11.50)		33.94 (9.28)	
	N	%	N	%	N	%	N	%	N	%
Gender										
Male	28	28.0	33	15.7	72	23.5	7	13.7	140	21.0
Female	72	72.0	177	84.3	234	76.5	44	86.3	527	79.0
Marital status										
Single	48	49.5	59	28.1	131	42.8	24	48.0	262	39.5
Cohabiting or married	34	35.1	122	58.1	142	46.4	20	40.0	318	48.0
Separated, divorced, or widowed	15	15.5	29	13.8	33	10.8	6	12.0	83	12.5
Education level										
Basic education	26	28.3	56	26.7	29	9.5	12	24.0	187	28.4
Secondary education	35	38.0	90	42.9	87	28.4	11	22.0	233	35.4
Vocational education	25	27.2	45	21.4	97	31.4	22	44.0	179	27.2
Tertiary education	6	6.5	19	9.0	93	30.4	5	10.0	59	9.0
Employment status										
Working	–	–	111	53.3	155	52.4	–	–	267	52.8
Studying	–	–	22	10.5	92	31.1	–	–	114	22.5
Not working or studying	–	–	76	36.2	49	16.6	–	–	125	24.7

SD, standard deviation; –, not applicable or not assessed in a given study. Due to missing data, the number of participants per variable may not sum to the total sample size for each study.

Dutch version of the DSQ-40 (Trijsburg *et al.*, 2000) that includes two additional items measuring the defense mechanism of repression, which are not included in the original version of the DSQ-40 (Trijsburg *et al.*, 2000). To enable the pooling of data across studies, this defense mechanism was excluded from analysis. One study (Dos Santos *et al.*, 2020) used the Brazilian-Portuguese version of the DSQ-40 (Blaya *et al.*, 2004), and one study (Knekt & Lindfors, 2004) used the Finnish version of the DSQ-88 (Sammallahti *et al.*, 1994). The DSQ-40 is nested within the DSQ-88, with two exceptions: rationalization is assessed using different items, and autistic fantasy is measured using only one item (Sammallahti *et al.*, 1994). In the present study, analyses of the Knekt & Lindfors (2004) sample were therefore restricted to those DSQ-88 items that directly correspond to the DSQ-40. However, due to the different items used to assess rationalization and autistic fantasy, data from Knekt & Lindfors (2004) were excluded from the multigroup CFAs to ensure data consistency across samples.

Multigroup confirmatory factor analyses

Table 3 shows the results of the model comparison of the one-, three-, and four-factor solutions; model fit indices are shown in *Supplementary Table 2*. Across the three included studies, the multigroup CFA indicated that both the three- and four-factor solutions outperformed the one-factor solution, with the four-factor solution providing the best overall fit. However, the fit indices of this model did not meet commonly accepted thresholds ($\chi^2(328)=572.94$, $p<.001$, CFI=0.74, TLI=0.70, RMSEA=0.07, SRMR=0.09), so configural invariance could not be established, indicating that the factor structure was not consistent across the different samples. Therefore, separate exploratory CFAs were conducted for each sample.

Confirmatory factor analyses per sample

Dekker et al., *2008; Van* et al., *2009a*

The model comparison indicated that the three- and four-factor solutions outperformed the one-factor solution, and the four-factor solution provided the best overall fit to the DSQ-40 data from Dekker *et al.* (2008) and Van *et al.* (2009a) (Table 3). However, overall model fit of the four-factor model was poor ($\chi^2(164)=308.51$, $p<.001$, CFI=0.68, TLI=0.63, RMSEA=0.08, SRMR=0.09; *Supplementary Table 2*). The model's standardized factor loadings indicated that several defense mechanisms had weak loadings on their intended factor (*e.g.*, displacement, somatization, isolation; *Supplementary Table 3*). Furthermore, the modification indices suggested several cross-loadings. For example, pseudo-altruism was suggested to load on both the image-distorting and immature factor; undoing and projection were both suggested to load on the mature factor (see online: *Supplementary R Markdown*). Adding residual covariances or removing poorly performing defenses did not substantially improve model fit (*Supplementary R Markdown*).

Dos Santos et al., *2020*

For the Dos Santos *et al.* (2020) sample, the four-factor solution provided the best fit relative to the one- and three-factor models (Table 3), although overall fit remained below acceptable thresholds ($\chi^2(164)=265.41$, $p<.001$, CFI=0.80, TLI=0.77, RMSEA=0.06, SRMR=0.08; *Supplementary Table 2*). Several defenses showed weak standardized loadings (*e.g.*, pseudo-altruism, somatization, and splitting; *Supplementary Table 3*). Additionally, modification indices indicated cross-loadings for multiple defenses, including dissociation (on the immature, mature, and neurotic factors), reaction formation (on the immature and image-distorting factors), and undoing (on the immature and mature factors; *Supplementary R Markdown*). Neither the inclusion of residual covariances nor the removal of weakly loading defenses led to notable improvements in model fit (*Supplementary R Markdown*).

Knekt & Lindfors, 2004

The model comparison indicated the three-factor solution was the best fit for the Knekt & Lindfors (2004) sample relative to the one- and four-factor models (Table 3), although fit indices remained well below acceptable thresholds ($\chi^2(149)=374.56$, $p<.001$, CFI=.61, TLI=.55, RMSEA=.07, SRMR=.08; *Supplementary Table 2*). As in the previous samples, several items demonstrated weak standardized loadings on their intended factors, particularly isolation, dissociation, and acting out (*Supplementary Table 3*). Modification indices further suggested cross-loadings for dissociation (on the mature and neurotic factors), undoing and autistic fantasy (on the mature factor), and pseudo-altruism (also on the mature factor; *Supplementary R Markdown*). Attempts to improve model fit by adding residual covariances resulted in a modest improvement, but still a poor fit. Similarly, removing poorly performing defenses led to somewhat better fit indices, yet these remained below acceptable thresholds (*Supplementary R Markdown*).

Table 3. Model comparisons of the 1-, 3-, and 4-factor solutions.

Sample	Comparison	$\Delta\chi^2$ (Δdf)	p-value	BIC (Model A)	BIC (Model B)	Preferred model
Combined[a]	1-factor *vs.* 3-factor[b]			38240.95	38065.24	3-factor
	1-factor *vs.* 4-factor	732.49 (12)	<.001			4-factor
	3-factor *vs.* 4-factor			38065.24	37984.45	4-factor
Dekker *et al.* (2008)/Van *et al.* (2009a)	1-factor *vs.* 3-factor	49.38 (3)	<.001			3-factor
	1-factor *vs.* 4-factor	104.13 (6)	<.001			4-factor
	3-factor *vs.* 4-factor			15898.29	15883.74	4-factor
Dos Santos *et al.* (2020)	1-factor *vs.* 3-factor[b]			22182.47	22077.91	3-factor
	1-factor *vs.* 4-factor[b]			22182.47	22007.43	4-factor
	3-factor *vs.* 4-factor			22077.91	22007.43	4-factor
Knekt & Lindfors (2004)	1-factor *vs.* 3-factor	63.49 (3)	<.001			3-factor
	1-factor *vs.* 4-factor	63.06 (6)	<.001			4-factor
	3-factor *vs.* 4-factor			31401.67	31413.99	3-factor

$\Delta\chi^2$, Satorra-Bentler scaled chi-square difference; BIC, Bayesian information criterion. Model A and Model B, respectively, refer to the first- and second-factor solutions named in the comparison column. [a]Data from Knekt & Lindfors (2004) were excluded because of differences in items assessing rationalization. [b]Likelihood ratio tests comparing the models could not be computed due to an invalid scaling correction factor. Therefore, model comparisons were based on BIC values.

Post-hoc analyses

In the multigroup CFA of the combined DSQ-40 data, the two-factor model fit the data better than the one-factor model but worse than the three- and four-factor models, with overall fit indices below accepted thresholds ($\chi^2(338)=642.84$, $p<.001$, CFI=.66, TLI=.62, RMSEA=.08, SRMR=.10; *Supplementary R Markdown*). Similar results were observed in the separate sample CFAs, where the two-factor model again outperformed the one-factor model but not the three- or four-factor models, and showed inadequate fit in the Dos Santos *et al.* (2020) ($\chi^2(169)=321.36$, $p<.001$, CFI=.67, TLI=.63, RMSEA=.07, SRMR=.10) and Knekt *et al.* (2004) samples ($\chi^2(151)=445.28$, $p<.001$, CFI=.50, TLI=.43, RMSEA=.08, SRMR=.09). In the Dekker *et al.* (2008) and Van *et al.* (2009a) sample, the model comparison indicated that the two-factor solution was the best fitting; however, the BIC difference relative to the four-factor model (the previously best fitting model) was small ($\Delta BIC=5.43$), and absolute model fit remained below acceptable thresholds ($\chi^2(169)=321.49$, $p<.001$, CFI=.65, TLI=.61, RMSEA=.08, SRMR=.10; *Supplementary R Markdown*).

Discussion

This study examined the factor structure of the DSQ-40 across three samples of adults with depression. The results of the multigroup CFAs, based on two samples, showed that the four-factor model (mature, neurotic, immature, image-distorting) provided the best relative fit. However, model fit indices fell short of conventional thresholds, so configural invariance could not be established, indicating that a reliable factor structure of the DSQ-40 could not be confirmed across the three samples. Therefore, separate CFAs were conducted for each sample. The four-factor solution showed the best relative fit in the Dekker *et al.* (2008)/Van *et al.* (2009a) and Dos Santos *et al.* (2020) samples, while the three-factor model (mature, neurotic, immature) was favored in the Knekt & Lindfors (2004) sample. Nonetheless, none of these models met the criteria for acceptable fit. In all samples, several defense mechanisms demonstrated weak factor loadings, and modification indices consistently indicated cross-loadings. Although exploratory adjustments, such as adding residual covariances or removing poorly performing items, led to modest improvements, no model achieved adequate fit in any of the samples.

Our findings contrast with previous studies that reported acceptable fit for one- (Trijsburg *et al.*, 2000), three- (Andrews *et al.*, 1993), and four-factor models (Ruuttu *et al.*, 2006) of the DSQ-40. A possible explanation for these discrepancies is that the factor structure of the DSQ-40 may be sample-dependent, with characteristics such as diagnostic group, symptom severity, patient age group, or setting influencing results. The DSQ-40 was originally developed and validated in a mixed sample including individuals with various anxiety disorders and from the general population (Andrews *et al.*, 1993). By contrast, the present study focused on adults with depression enrolled in psychodynamic treatment studies, a group that likely represents a distinct population. A recent study aiming to validate the DSQ-40 in a forensic psychiatric population also failed to replicate the three-factor solution (Tapp *et al.*, 2018), indicating the potential absence of a consistent factor structure across different samples.

Beyond sample characteristics, issues with the DSQ-40's items may also have contributed to the lack of acceptable model fit. While the mature defense mechanisms tended to load adequately on their designated factor, many others exhibited weak or inconsistent loadings. This suggests that several DSQ-40 items may not meaningfully reflect the underlying latent construct they are intended to measure. This may be due to poor item wording, shifts in meaning from the original item introduced by translation to another language, or variability in how defense mechanisms manifest across individuals or cultures (Békés *et al.*, 2023). Relatedly, many models showed cross-loadings, indicating that some defense mechanisms, as measured with the DSQ-40, loaded on more than one defense style. This ambiguity could again be due to measurement issues or reflect that some defense mechanisms differ in their level of adaptiveness, potentially influenced by factors such as culture, linguistic differences, belief systems, or social norms. Supporting this, research on another self-report scale assessing defense mechanisms, the Life Style Index (Plutchik *et al.*, 1979), found that only six out of the original eight factors could be replicated in a Thai sample, with differences attributed to cultural and religious influences (Tori & Bilmes, 2002).

Strengths and limitations

Several strengths of this study should be noted. First, to the researchers' knowledge, this is the first study to examine the factor structure of the DSQ-40 using an IPD meta-analytic approach. This method offers greater statistical power compared to single studies, improves the detection of weaker associations, and enhances the generalizability of results. Moreover, unlike conventional meta-analyses, IPD enables standardized model specifications across studies and testing for configural invariance. Second, examining the factor structure across samples from different countries contributes to the cross-cultural evaluation of the DSQ-40, with the inclusion of a Brazilian sample supporting culturally diverse research beyond North American and European populations. Third, preregistration of the analysis plan and availability of the analysis code strengthen the study's transparency and promote reproducibility.

However, the findings of this study should be interpreted in light of its limitations. First, while the total sample size was sufficient for multigroup CFA, the CFAs based on single study samples were likely underpowered, falling below the recommended minimum of 300 participants (Comrey & Ley, 1992), with the exception of the Knekt & Lindfors (2004) sample. Second, one of the included studies (Knekt & Lindfors, 2004) used the DSQ-88 instead of the DSQ-40 to assess defense mechanisms. We restricted analyses to the corresponding DSQ-40 item set; however, the two versions differ in item phrasing for rationalization, and only one item is used to assess autistic fantasy in the DSQ-88. While these differences are relatively minor, we cannot rule out that they might have influenced the results. As such, we cannot be sure that the three-factor solution was the relatively best-fitting in the Knekt & Lindfors (2004) sample. Third, the sample consisted entirely of adults with depression enrolled in psychodynamic treatment studies, which may limit the generalizability of the results to other populations. Fourth, it remains uncertain whether the instability of the factor structure also applies to earlier DSQ versions (*e.g.*, 67-, 72-, or 88-item).

Scientific implications and future directions

Limitations notwithstanding, this study's findings have several implications for the use of the DSQ-40 in depression research. The lack of a reliable factor structure, weak factor loadings, and cross-loadings across samples raises questions about the appropriateness of using this instrument in this population. Theoretical distinctions between mature, neurotic, immature, and image-distorting defense

styles may not be adequately represented by the current items. Caution is therefore warranted when interpreting DSQ-40 defense style scores in clinical and research settings involving adults with depression. Alternatively, the DMRS-SR-30 (Di Giuseppe *et al.*, 2020) may be used. The DMRS-SR-30 has shown promising psychometric properties, including support for its factor structure (Prout *et al.*, 2022); however, its latent factor structure has yet to be established in clinically depressed populations.

Our findings also highlight the need for further systematic psychometric evaluation and possible revision of the DSQ-40. Future research should include large, diverse clinical samples from different treatment settings and cultural contexts, particularly from non-North American and European countries. Such research may use advanced psychometric methods such as item response theory. Moreover, future studies should develop and test revised versions of the DSQ-40 that retain only items with strong performance. Ideally, a coordinated multi-country validation study would then assess the revised instrument alongside other established measures of defense mechanisms to establish a stable, replicable factor structure and confirm its suitability for clinical and research use in adults with depression. This validation work should also examine and clarify the instrument's convergent validity through comparison with observer-rated measures of defense mechanisms.

Conclusions

This study found that none of the previously proposed factor structures (one-, three-, or four-factor solution) shows acceptable fit across three clinically similar samples of adults with depression from different cultural contexts. These findings raise concerns about the DSQ-40's appropriateness to assess defense mechanisms and question the interpretability of its defense style scores in this population. Further psychometric evaluation in larger samples is needed to clarify the instrument's factor structure and determine its suitability for clinical and research use among adults with depression.

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Online supplementary material:

Supplementary Figure 1. PRISMA individual participant data flowchart (1st January 2025).

Supplementary Table 1. PRISMA individual participant data checklist.

Supplementary Table 2. Model fit indices for the 1-, 3-, and 4-factor (multigroup) confirmatory factor analyses.

Supplementary Table 3. Standardized factor loadings in the best-fitting models of the DSQ-40 per sample.

Supplementary R Markdown.

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Ethics approval and consent to participate: Institutional Review Board (IRB) approval was not required for this project, as anonymized data from completed treatment studies were used. However, IRB approval may have been necessary for investigators to share their individual participant data (IPD), depending on their institution's policies. It was the responsibility of each participating research group to obtain IRB approval if required by their institution. By signing the data sharing agreement, investigators confirmed that the data had been collected and would be transferred in compliance with all applicable local and international laws and regulations. They also declared that all IPD had been anonymized to ensure that no personal data would be transferred.

Availability of data and materials: the syntax for the analyses can be found on the project's Open Science Framework page (https://osf.io/94vfx/overview). The collective anonymized individual participant database developed for this study, along with a data dictionary and related documentation, is available for use by other researchers. Requests can be directed to the corresponding author. Access with limited investigator support will be granted following all authors' approval of a study proposal and signing of a data access agreement.

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