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Validation of the Interpersonal Relationships in Eating Disorders (IR-ED) Scale in an Eating Disorder Sample

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ABSTRACT

Objective: Interpersonal problems have been identified as a plausible mechanism underlying the onset and maintenance of eating disorders. The Interpersonal Relationships in Eating Disorders (IR-ED) scale is the first eating disorders-specific measure of interpersonal problems, which was developed in a nonclinical sample. The aims of the current study were to (a) confirm the factor structure of the IR-ED within a large clinical sample, (b) investigate measurement invariance of the IR-ED across nonclinical and clinical samples, (c) examine the convergent validity of the IR-ED using a generic measure of interpersonal problems, and (d) investigate the incremental clinical utility of the IR-ED in uniquely predicting eating disorder symptomatology.

Method: Treatment-seeking individuals ($N = 437$) completed the IR-ED at their initial assessment appointment at a specialist eating disorder outpatient service.

Results: A multiple-group confirmatory factor analysis supported an invariant bifactor structure comprising a general interpersonal problems factor and two group factors—Avoidance of Body Evaluation and Food-Related Interpersonal Tension. Convergent validity was demonstrated by a large, statistically significant correlation with a generic measure of interpersonal problems ($r = 0.62$, $p < 0.001$). A series of structural equation models further revealed unique incremental predictive utility of the IR-ED for eating disorder symptomatology.

Discussion: The IR-ED has strong psychometric properties and may prove beneficial in the assessment, formulation, and treatment of eating-specific interpersonal problems among patients with eating disorders.

1 | Introduction

Interpersonal problems are commonly defined as difficulties in how one relates to or interacts with significant others (Sullivan 1953). Interpersonal problems have been causally implicated in the onset and maintenance of several psychological presentations, including generalized anxiety disorder (Eng and Heimberg 2006), depression (Petty, Sachs-Ericsson, and Joiner 2004), panic disorder, agoraphobia (Kleiner and Marshall 1987), autism spectrum disorder (Travis and Sigman 1998), and borderline personality disorder (Lazarus et al. 2014). There are also strong associations between interpersonal functioning and eating disorder psychopathology (Fairburn, Cooper, and Shafran 2003; Murphy et al. 2012; Rieger

Summary

- Interpersonal problems are common among individuals with eating disorders.
- However, previous measures of interpersonal problems have not measured such difficulties unique to eating disorder populations.
- This study confirms the factor structure and psychometric properties of an eating-specific measure of interpersonal problems that can be used to inform the assessment, formulation, and individualized treatment of eating-specific interpersonal problems among eating-disordered patients.

et al. 2010), with greater interpersonal difficulties associated with increased problematic eating behaviors in nonclinical and clinical samples (e.g., Arcelus et al. 2013; Lieberman et al. 2001; Tanofsky-Kraff, Wilfley, and Spurrell 2000) and interventions focusing on interpersonal functioning demonstrating efficacy, particularly for binge eating presentations (Murphy et al. 2012; Wilfley et al. 2002).

Fairburn, Cooper, and Shafran' (2003) transdiagnostic model conceptualizes transdiagnostic and disorder-specific processes underlying the onset and maintenance of eating disorders, including anorexia nervosa, bulimia nervosa, binge-eating disorder, and eating disorder not otherwise specified. Fairburn, Cooper, and Shafran (2003) highlight core maintaining mechanisms, namely, the over-evaluation and over-control of eating, weight, and shape, whilst delineating four additional interrelated maintaining processes; clinical perfectionism, core low-self-esteem, mood intolerance, and interpersonal difficulties. It is theorized that interpersonal problems involving fear or avoidance of body-related evaluations from others, family tension, longstanding interpersonal conflict, and/or withdrawal from social environments that magnify concerns about eating, weight, and shape, may undermine an individual's self-esteem, and in turn, intensify the tendency to use dietary restraint as a means of establishing a sense of control. Interpersonal models also emphasize the role that reciprocal relationships between interpersonal disputes and deficits, negative self-evaluation and low core self-esteem, and eating disorder behaviors, play in maintaining eating disorders (Rieger et al. 2010). Research has found some interpersonal styles (e.g., submissiveness, social inhibition, nonassertiveness) to be associated with higher levels of eating disorder psychopathology at baseline, and to predict poorer treatment outcomes, in people with anorexia nervosa ($N = 218$, Carter, Kelly, and Norwood 2012). While these models and findings suggest that interpersonal problems may contribute to the onset and perpetuation of eating disorder psychopathology, thus serving as a plausible treatment target (Fairburn, Cooper, and Shafran 2003; Murphy et al. 2012), it remains unclear whether there are interpersonal problems specific to the maintenance of eating disorders, or whether general interpersonal problems relevant to emotional disorders more broadly are adequate for eating disorder formulations and treatment plans.

Research investigating interpersonal problems in eating disorders has typically used generic measures of interpersonal functioning, such as the Inventory of Interpersonal Problems-32 (IIP-32; Barkham, Hardy, and Startup 1996). McEvoy et al.'s (2013) cross-sectional study with a mixed-diagnosis treatment-seeking eating disorder sample ($N = 339$) found that three of the eight IIP-32 subscales (i.e., finding it hard to be sociable, being too caring, and finding it hard to be supportive) uniquely predicted variance in eating disorder psychopathology. More recently, Raykos, McEvoy, and Fursland (2017) cross-sectional study with a mixed-diagnosis treatment-seeking eating disorder sample ($N = 306$) only found an indirect relationship between generic socializing difficulties, as measured by the IIP-32, and eating disorder psychopathology. Specifically, socializing problems were indirectly associated with eating disorder symptoms via self-esteem, anxiety, and depression symptoms. These findings suggest that generic interpersonal measures are only weakly and indirectly associated with measures of eating disorder symptoms and may lack the specificity required to adequately encapsulate eating-specific interpersonal problems among clinical populations. A specific measure of interpersonal difficulties commonly experienced by those with eating disorders may hold greater clinical utility in the assessment, formulation, planning, and evaluation of treatment outcomes (e.g., Jones et al. 2019). For example, generic interpersonal problem measures do not directly assess commonly observed eating disorder-related interpersonal problems, such as efforts taken to avoid social situations within which body and eating evaluation could occur, and interpersonal disputes around food consumption. An eating disorder-specific measure of interpersonal problems could also shed light on why people with eating disorders find it hard to be sociable and supportive of others (McEvoy et al. 2013; e.g., excessive expectations of eating, weight, and shape-related evaluation and eating pressure from others), and how these interpersonal styles may interfere with treatment outcomes (Carter, Kelly, and Norwood 2012; e.g., interpersonal avoidance may prevent individuals from challenging these expectations). If so, such a measure would be valuable for individualized case formulation, treatment planning, and outcome monitoring.

A preliminary cross-sectional study developed a novel measure of eating-specific interpersonal problems, the Interpersonal Relationships in Eating Disorders scale (IR-ED; Jones et al. 2019). In a nonclinical undergraduate sample ($N = 396$), IR-ED total score was more strongly correlated with eating disorder psychopathology as measured by Eating Disorder Examination-Questionnaire (EDE-Q, Fairburn and Beglin 2008) global scores ($r = 0.66$) than the IIP-32 ($r = 0.47$), suggesting the new measure may have greater predictive validity. The IR-ED total score demonstrated high internal consistency ($\alpha = 0.93$) and strong test–retest reliability for both males ($r = 0.80$) and females ($r = 0.90$), and could discriminate between undergraduates and a clinical eating disorder sample ($N = 107$).

Jones et al.'s (2019) exploratory factor analysis of the IR-ED revealed a three-factor solution comprising *Food-Related Isolation* (e.g., secrecy surrounding eating in front of others, resulting in an increased likelihood of avoiding social situations that involve eating), *Avoidance of Body Evaluation* (e.g., withdrawal from social situations where one's body may be evaluated by others), and *Food-Related Interpersonal Tension* (e.g., the impact of one's eating behaviors on interactions with others, and associated interpersonal disputes,

Jones et al. 2019). A confirmatory factor analysis (CFA) in a second undergraduate sample revealed that the three factors were correlated, and the researchers then evaluated a bifactor model comprising a general factor underlying all items and three group factors. Bifactor models allow all items to load on a common factor ("interpersonal problems" in this case), as well as on separate group factors that explain additional unique variance in the items (see Figure 1). This implies that while in general individuals with some interpersonal problems are more likely to experience other interpersonal problems (shared variance captured by the common factor), beyond this common variance there may also be some interpersonal problems that tend to cluster together (captured by the group factors). The bifactor model fit the data best, however loadings for the Food-Related Isolation group factor were weak (ranging from <0.01 to 0.21) and a structural equation model that included the Food-Related Isolation as a predictor of eating disorder psychopathology would not converge. This suggests that while the bifactor structure fit best of the models Jones et al. (2019) considered, the group factor structure may not be optimal and would benefit from revision.

Importantly, the factor structure of the IR-ED has not been evaluated in a treatment-seeking clinical sample, so it remains unclear whether the bifactor structure and clinical utility of the IR-ED scores in predicting eating disorder psychopathology extends to clinical samples. It is also an open question whether it is sufficient for researchers and practitioners to calculate IR-ED

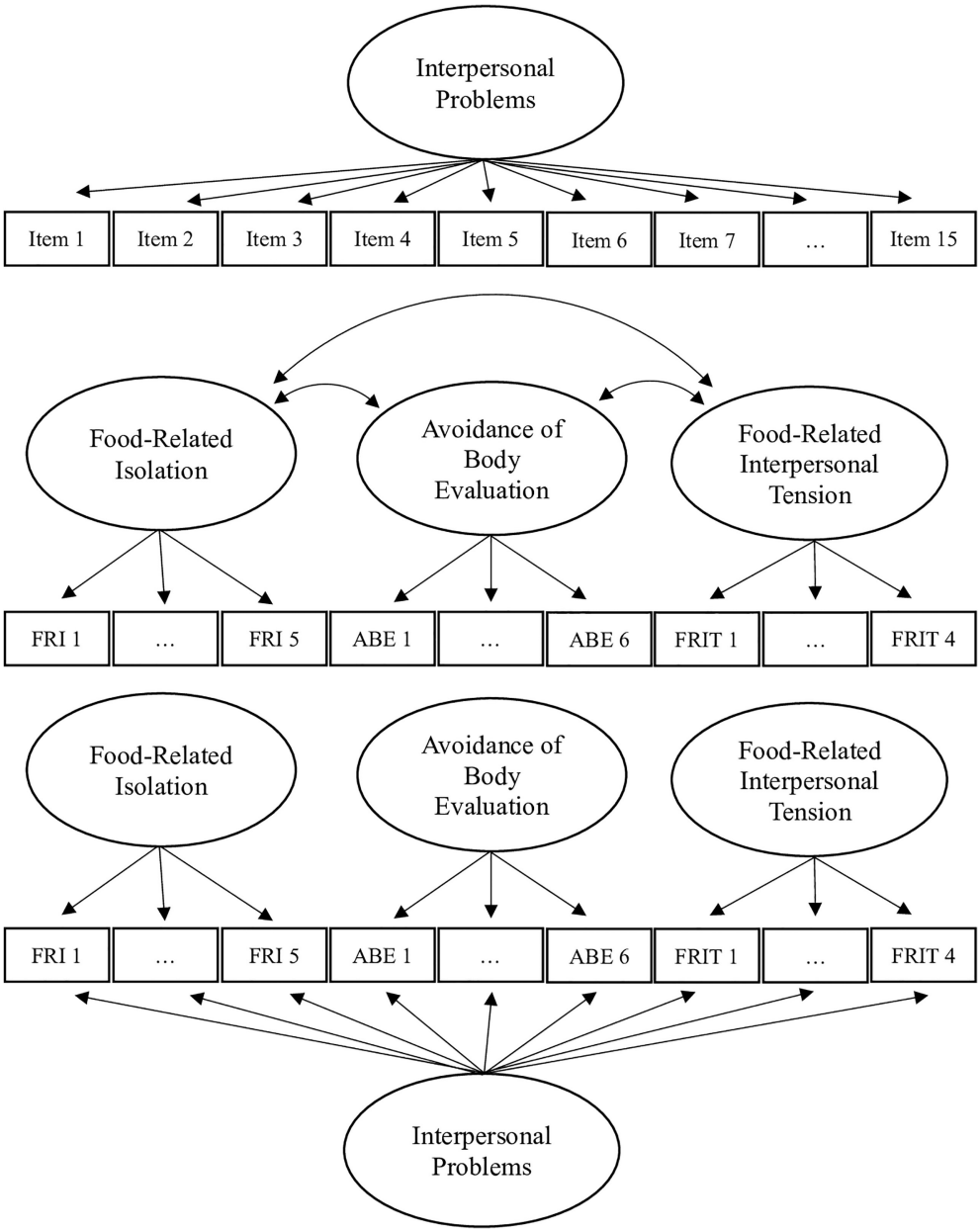

FIGURE 1 | All items load on a general interpersonal problems factor in the one-factor model (top). Items only load on their respective factor in the correlated three-factor model (middle). All items load on the general and group factors in the bifactor model (bottom). Correlations between the group factors are only freed in the three-factor model. ABE = avoidance of body evaluation; FRI = food-related isolation; FRIT = food-related interpersonal tension.

total scores, or whether computing subscale scores adds value by enabling better prediction of other variables. Further, the significant differences in IR-ED mean scores between clinical and nonclinical samples in Jones et al.'s (2019) study may reflect genuine group differences or variability in scale properties (e.g., how items are interpreted and responded to). While not necessarily a pre-requisite (Robitzsch and Lüdtke 2023), measurement invariance between clinical and nonclinical samples facilitates interpretation of IR-ED mean differences as genuine differences, thus allowing for stronger inferences about the role interpersonal problems may play in eating disorders (Jones et al. 2019; Tonta et al. 2020).

The current study aimed to: (a) evaluate the factor structure of the IR-ED in a large clinical sample and determine whether subscales should be scored, (b) investigate measurement invariance of the IR-ED across nonclinical and clinical samples, (c) examine convergent validity with a generic measure of interpersonal problems, and (d) investigate the incremental predictive utility of IR-ED scores for eating disorder psychopathology.

It was hypothesized that: (a) based on Jones et al.'s (2019) findings, a bifactor structure comprising a general interpersonal problems factor with either two (Avoidance of Body Evaluation, Food-Related Interpersonal Tension) or three (adding Food-Related Isolation) group factors would provide a good fit in a clinical sample, (b) the structure would be invariant across clinical and nonclinical samples, (c) the IR-ED total and subscale scores would be significantly correlated with the IIP-32, and (d) the IR-ED would uniquely predict core eating disorder psychopathology, after controlling for generic measures of interpersonal problems (e.g., the IIP-32), additional maintaining mechanisms (e.g., clinical perfectionism, core low-self-esteem, mood intolerance) as outlined in the transdiagnostic model of eating disorders (Fairburn, Cooper, and Shafran 2003), and co-occurring anxiety and depression symptoms.

2 | Method

2.1 | Participants

Clinical data were extracted from a historical database of treatment-seeking individuals ($N = 437$; 96.3% female) referred to a specialized eating disorder outpatient service. Nonclinical data were from Jones et al. (2019, $N = 396$, mean age = 21.76, SD = 6.13, range = 17–69 years, 77% female, 22% male, 1% "other gender"). The clinical sample had a confirmed Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association 2013) eating disorder diagnosis using the Eating Disorder Examination Interview (Fairburn and Cooper 1993) and clinical interview, and ranged from 16 to 66 years ($M = 24.53$ years; SD = 9.46). Body mass index (BMI; weight (kg)/height $(m)^2$) ranged from 14.46 to 51.30 ($M = 22.01$; SD = 5.01). The most common principal diagnosis was Other Specified Feeding or Eating Disorder ($n = 147$, 34%), followed by anorexia nervosa ($n = 144$, 33%), bulimia nervosa ($n = 124$, 28%), unspecified feeding or eating disorder ($n = 19$, 4%), and avoidant restrictive food intake disorder ($n = 3$, 1%). Exclusion criteria: current psychosis, schizophrenia, significant substance abuse or dependence, BMI below 14 kg/m^2, or significant medical instability. Most participants ($n = 346$, 79.18%) identified as having an Anglo/European background, followed by Asian ($N = 25$, 5.72%). See Data S1 for an extended Methods section.

2.2 | Materials

The 15-item *Interpersonal Relationships in Eating disorders* (IR-ED, Jones et al. 2019) assesses eating-specific interpersonal problems on a 5-point Likert scale ranging from *not at all* (1) to *all the time* (5) over the previous 28 days. The 32-item *Inventory of Interpersonal Problems* (IIP-32, Barkham, Hardy, and Startup 1996) is a self-report measure of eight broad domains of interpersonal difficulties with items rated using a 5-point Likert scale ranging from *not at all* (0) to *extremely* (4). The IIP-32 global scale score had high internal reliability within the current sample ($\omega = 0.89$). The 28-item *Eating Disorder Examination-Questionnaire* 6.0 (EDE-Q, Fairburn and Beglin 2008) assesses eating disorder psychopathology using a 7-point Likert scale ranging from *complete absence of feature* (0) to *acute presentation of feature* (6) with reference to the past 28 days. The EDE-Q has four subscales: dietary restraint, eating concerns, weight concerns, and shape concerns, which were averaged to produce a global EDE-Q score. EDE-Q global and subscale scores demonstrated high internal reliability within the current sample ($\omega = 0.78$ to 0.92).

The 10-item *Clinical Perfectionism Questionnaire* (CPQ-10, Prior et al. 2018) assesses clinical perfectionism using a 4-point Likert scale ranging from *not at all* (1) to *all the time* (4), and had high internal reliability within the current sample ($\omega = 0.85$). The *Patient-Reported Outcomes Measurement Information System-Depression and Anxiety* (*PROMIS-D* and *PROMIS-A*) (Pilkonis et al. 2011) subscales each have eight items using a 5-point Likert scale ranging from *never* (1) to *always* (5). Both demonstrated high internal consistency within the current sample (PROMIS-A $\omega = 0.94$; PROMIS-D $\omega = 0.95$). The *Rosenberg Self-Esteem Scale* (*RSES*, Rosenberg 1965) is a 10-item self-report measure assessing global self-esteem using a 4-point Likert scale ranging from *strongly agree* (0) to *strongly disagree* (3). The RSES scores demonstrated high internal consistency within the current sample ($\omega = 0.87$). The 11-item *Tolerance of Mood States* (TOMS, Allen, McLean, and Byrne 2012) assesses tolerance to or engagement in maladaptive behaviors in response to intense mood states using a 5-point Likert scale ranging from *never* (1) to *always* (5). TOMS scores demonstrated modest internal consistency within the current sample ($\omega = 0.62$).

2.3 | Procedure

All patients attending the Centre for Clinical Interventions were provided with an information and consent form, and completed the self-report measures as part of routine clinical assessment. Only patients who signed the consent form were included in this study. Ethical approval was granted from the North Metropolitan Area Health Service Mental Health Human Research Ethics Committee (HREC, RGS6345), with reciprocal approval from Curtin University HREC (HRE2023-0562).

2.4 | Data Analysis

We used Welch (unequal-variance) *t*-tests and computed the standardized mean difference (Cohen's *d*) to compare clinical and nonclinical samples across outcome variables, and interpreted *ds* of 0.2, 0.5, and 0.8 as small, medium, and large (Cohen 1998). CFA using weighted least squares mean and variance adjusted (WLSMV) estimation in MPLUS 8.0 (Muthén and Muthén 2017) was used to verify the latent structure of the IR-ED. WLSMV provides nonbiased estimates for ordinal data (Flora and Curran 2005; Li 2016), and thus was appropriately given that we treated the IR-ED's 5-point rating scale data as ordinal. The relative fit of the bifactor model evaluated by Jones et al. (2019) was compared to unidimensional and three-factor (correlated) models (see Figure 1). The chi-square goodness of fit statistic (χ^2), the Tucker-Lewis index (TLI, >0.95), comparative fit index (CFI, >0.95), and the root mean square error of approximation (RMSEA, <0.06) were used to evaluate excellent fit (Hu and Bentler 1999; Tabachnick and Fidell 2013). A chi-square difference test was used to compare nested models. Please see Data S1 for more details about bifactor model coefficients.

Configural invariance (e.g., items loading on the same factors across groups, suggesting consistent structural organization of the construct), metric invariance (e.g., comparable strength of loadings on factors across groups), and scalar invariance (e.g., consistent factor loadings and equivalent item [mean] intercepts across groups) were established if overall model fit was acceptable, and satisfied at least two of the following criteria: (a) nonsignificant change in χ^2 from the prior model, (b) a CFI change ≤ -0.002, and (c) McDonald's Non-Centrality Index (McNCI; McDonald 1989) cut-off value based on the number of items and factors in the model (Meade and Lautenschlager 2004). When violations of measurement invariance were observed, partial invariance was assessed (Putnick and Bornstein 2016).

Convergent validity was assessed using correlation coefficients (95% CIs) between the IR-ED, the IIP-32, and the EDE-Q. Structural equation models examined the incremental predictive validity of latent IR-ED general and group factors in uniquely predicting ED core psychopathology (EDE-Q), beyond a general measure of interpersonal problems (IIP-32), additional maintaining mechanisms (CPQ-10, RSES, TOMS), and co-occurring anxiety (PROMIS-A) and depression (PROMIS-D) symptoms. See Data S1 for handling of missing data.

3 | Results

3.1 | Descriptive Statistics and Convergent Validity

See Table 1 for descriptive statistics and bivariate correlations. The 15-item IR-ED total score was strongly correlated with the IIP-32 ($r = 0.62$) and the Avoidance of Body Evaluation subscale ($r = 0.63$), followed by the Food-Related Isolation ($r = 0.48$) and Food-Related Interpersonal Tension subscales ($r = 0.27$). The pattern was similar when examining correlations with other variables (e.g., EDE-Q).

3.2 | Clinical vs. NonClinical Means

The clinical group had substantially higher mean IR-ED total and subscale scores than the non-clinical sample (all *ds* >1, see Table 2). Differences between the samples on the IR-ED were larger than on the IIP-32 and EDE-Q, suggesting the IR-ED was better at discriminating between the samples.

3.3 | IR-ED Measurement Models

The unidimensional model provided poor fit to the data (Table 3). The three-factor (correlated) model provided excellent fit on the CFI and TLI, but not on the RMSEA. The bifactor model comprising a general interpersonal problems factor and three group factors failed to converge. The latent variable covariance matrix was not positive definite, with the output indicating that the model failed to estimate item loadings on group factor one (Food-Related Isolation). Given Food-Related Isolation group factor loadings were also problematic in Jones et al. (2019), Food-Related Isolation items were constrained to load solely onto the general IR-ED factor.

The revised model had an excellent model fit on the CFI and TLI, and all indices were slightly superior to the three-factor model (bifactor revised 1 in Table 3). All item loadings were statistically significant across for the group factors and the general factor. Modification indices were examined for the best-fitting a priori model (i.e., the bifactor model that replicated Jones et al.'s 2019, model) and revealed that the solution could be improved by allowing item 12 to load on the Food-Related Interpersonal Tension group factor, which made theoretical sense given the reference to interpersonal conflict and resulted in excellent model fit (bifactor revised 2 in Table 3). The improvement to model fit was significant, $\chi^2_{\text{diff}}(1) = 53.703$, $p < 0.001$.

All items had substantial loadings on the general factor (>0.40), two-thirds of common variance was explained by the general factor (ECV = 0.66), and the omega hierarchical reliability coefficient was high (0.80, see Table 4). This suggests that the IR-ED is somewhat multidimensional, but that there is a strong common source of variance (a global interpersonal problems in eating disorders factor) that underlies all items, and that the IR-ED total score can reliably measure that construct.

Items tended to have lower loadings on the Avoidance of Body Evaluation group factor than the general factor, and the ECV (0.37) and omega hierarchical subscale reliability coefficient ($\omega_{HS} = 0.33$) were low. This indicates that Avoidance of Body Evaluation subscale scores primarily reflect general factor variance rather than being a reliable measure of a narrower *avoidance of body evaluation* facet. In contrast, Food-Related Interpersonal Tension subscale items tended to load more strongly on the Food-Related Interpersonal Tension group factor than the general factor, three-fifths of the explained common variance (0.59) reflected the narrow *food related interpersonal tension* construct, and the omega hierarchical subscale coefficient was reasonable for a subscale ($\omega_{HS} = 0.53$).

TABLE 1 | Descriptive statistics and bivariate correlations for observed variable outcome measures in the clinical sample ($N = 437$).

Measures	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(1) IR-ED Total	3.27	0.94	—														
(2) IR-ED FRI	3.25	1.13	0.90	—													
(3) IR-ED ABE	3.40	1.12	0.87	0.72	—												
(4) IR-ED FRIT	3.04	1.18	0.71	0.52	0.35	—											
(5) IIP-32 Total	1.78	0.60	0.62	0.48	0.63	0.27	—										
(6) EDE-Q Global	4.05	1.32	0.64	0.54	0.66	0.34	0.44	—									
(7) EDE-Q Eating	3.62	1.42	0.58	0.52	0.59	0.30	0.39	0.88	—								
(8) EDE-Q Weight	4.29	1.50	0.60	0.48	0.66	0.29	0.45	0.93	0.75	—							
(9) EDE-Q Shape	4.75	1.36	0.61	0.48	0.70	0.28	0.44	0.92	0.75	0.91	—						
(10) EDE-Q Restraint	3.54	1.66	0.48	0.45	0.42	0.34	0.29	0.84	0.65	0.65	0.66	—					
(11) CPQ-10	25.40	6.69	0.47	0.36	0.45	0.28	0.38	0.40	0.34	0.39	0.38	0.34	—				
(12) PROMIS-A	66.24	9.28	0.50	0.43	0.47	0.32	0.54	0.47	0.48	0.44	0.44	0.35	0.43	—			
(13) PROMIS-D	65.16	8.75	0.58	0.46	0.57	0.34	0.55	0.57	0.55	0.55	0.55	0.41	0.37	0.72	—		
(14) RSES	20.39	5.59	−0.50	−0.40	−0.54	−0.24	0.55	−0.50	−0.42	−0.52	−0.53	−0.32	−0.32	−0.46	−0.68	—	
(15) TOMS	3.22	0.59	0.43	0.32	0.48	0.17	0.53	0.55	0.53	0.53	0.54	0.37	0.35	0.55	0.62	−0.50	—

Note: All $ps < 0.01$.

Abbreviations: CPQ-10 = clinical perfectionism questionnaire; EDE-Q = eating disorder examination questionnaire: Total score, eating, weight, shape, dietary restraint subscales; IIP-32 = inventory of interpersonal problems; PROMIS = patient-reported outcomes measurement information system: anxiety and depression subscales; IR-ED = interpersonal relationships in eating disorders scale: total score, food-related isolation, avoidance of body evaluation, and food-related interpersonal tension subscales; RSES = Rosenberg self-esteem scale; TOMS = tolerance of mood states.

TABLE 2 | Mean (SD) values and obtained *t*-test results across key outcome variables for clinical and nonclinical samples.

Variables	Clinical	Nonclinical	*d*	95% CI
IR-ED Total	3.27 (0.94)	1.84 (0.77)	1.69	1.52–1.87
IR-ED FRI	3.24 (1.11)	1.64 (0.79)	1.65	1.50–1.81
IR-ED ABE	3.40 (1.12)	2.12 (1.00)	1.22	1.06–1.38
IR-ED FRIT	3.04 (1.18)	1.78 (0.83)	1.25	1.09–1.41
IIP-32	1.78 (0.60)	1.19 (0.65)	1.10	0.80, 1.10
EDE-Q Global	4.05 (1.32)	2.01 (1.46)	0.75	0.61–0.89
EDE-Q Eating	3.62 (1.42)	1.24 (1.37)	1.00	0.85–1.14
EDE-Q Weight	4.29 (1.50)	2.44 (1.75)	0.52	0.38–0.66
EDE-Q Shape	4.75 (1.36)	2.71 (1.77)	0.66	0.52–0.80
EDE-Q Restraint	3.54 (1.66)	1.64 (1.59)	0.56	0.42–0.69

Note: *p*s for all comparisons were < 0.001.
Abbreviations: Δ^b = Glass's Delta; 95% CI = 95% confidence intervals; d^a = Cohen's *d*; EDE-Q = eating disorder examination questionnaire: Total score, eating, weight, shape, dietary restraint subscales; IIP-32 = inventory of interpersonal problems; IR-ED = Interpersonal relationships in eating disorders scale: Total score, Food-Related Isolation, avoidance of body evaluation, and food-related interpersonal tension subscales.

TABLE 3 | Goodness-of-fit statistics for competing IR-ED measurement models.

	Model Fit				
Measurement model	χ^2 **(df)**	***p***	**CFI**	**TLI**	**RMSEA (90% CI)**
(1) Unidimensional	1435.73 (90)	<0.001	0.836	0.808	0.185 (0.177, 0.193)
(2) Three-factor (correlated)	442.54 (87)	<0.001	0.957	0.948	0.097 (0.088, 0.106)
(3) Bifactor revised 1	370.70 (80)	<0.001	0.965	0.953	0.091 (0.082, 0.101)
(4) Bifactor revised 2	239.75 (79)	<0.001	0.980	0.974	0.068 (0.058, 0.078)

Abbreviations: χ^2 = Chi square; CFI = Comparative fit index; RMSEA (90% CI) = Root mean square error of approximation and corresponding 90% confidence intervals; TLI = Tucker-Lewis Index.

3.4 | Measurement Invariance

The revised bifactor model demonstrated configural invariance, $\chi^2(158) = 410.03$, NCI = 0.86, CFI = 0.986. Full metric invariance cannot be computed when estimating models with categorical variables using the WLSMV estimator in MPlus (Stark, Chernyshenko, and Drasgow 2006). Accordingly, given that the steps in the measurement invariance analysis proceed from least to most restrictive (configural, metric, scalar), full metric invariance was assumed, with analyses proceeding to the assessment of scalar invariance. Full scalar invariance was supported, $\chi^2(223) = 491.57$, NCI = 0.85, CFI = 0.985, as the fit indices did not substantially worsen between the models, $\Delta CFI^b = 0.001$, $\Delta\gamma = 0.18$, $\Delta\chi^2 = 81.54$, $p = 0.08$.

3.5 | Structural Equation Models

Similar to Jones et al. (2019), Model 1 predicted core eating disorder psychopathology (indicated by EDE-Q eating, weight, and shape concerns and dietary restraint) by the general IR-ED factor and the Avoidance of Body Evaluation and Food-Related Interpersonal Tension group factors. This model provided an excellent fit to the data, $\chi^2(138) = 399.84$, CFI = 0.962, TLI = 0.953, RMSEA = 0.066 (90% CI = 0.058–0.073). The IRED general factor (0.60, $p < 0.001$) and Avoidance of Body Evaluation group factor (0.41, $p < 0.001$) significantly predicted eating disorder pathology (36% and 17% of the variance, respectively), whereas the Food-Related Interpersonal Tension group factor did not (0.07, $p = 0.075$, <1%). The model accounted for 53% of the variance in eating disorder psychopathology.

To examine the independent contribution of the IR-ED general factor and Avoidance of Body Evaluation group factor beyond other factors in Fairburn, Cooper, and Shafran's (2003) model, after removing the Food-Related Interpersonal Tension group factor the IIP-32, CPQ-10, RES, and TOMS were included as additional predictors, with covariances freed between predictors (except between the IR-ED general and Avoidance of Body Evaluation group factors). This model provided a poor fit to the data, $\chi^2(208) = 1429.92$, CFI = 0.827, TLI = 0.790, RMSEA = 0.116 (90% CI = 0.110–0.122). Nonetheless, the TOMS (0.32, $p < 0.001$, 10% of the variance), IIP-32 (−0.18, $p = 0.002$, 3%), the IRED general factor (0.48, $p < 0.001$, 23%) and Avoidance of Body Evaluation group factor (0.39, $p < 0.001$, 15%) were unique predictors, whereas the CPQ (0.06, $p = 0.16$, <1%) and RSES (−0.09, $p = 0.053$, <1%) were not (total = 62% of the variance). The zero-order correlation

TABLE 4 | Standardized factor loadings for the unidimensional, three-factor (Correlated) and revised bifactor measurement models of the IR-ED.

		Nonclinical/Clinical			Three-factor correlated			Bifactor model			
	Item	Mean	SD	Unidimensional	F1	F2	F3	General	F1	F2	F3
(1)	I find it hard to spend time with others because I worry what they think about my body	2.00/3.19	1.06/1.35	0.74		0.81		0.63	—	0.54	
(2)	I avoid social situations where eating is involved	1.51/3.22	0.90/1.30	0.72	0.76			0.77	—		
(3)	I avoid getting into conversations with others about food	1.45/3.15	0.89/1.40	0.64	0.69			0.71	—		
(4)	I avoid socializing with people who are likely to comment on my body or appearance	2.17/3.43	1.26/1.45	0.73		0.80		0.69	—	0.37	
(5)	Other people try to pressure me into eating differently	1.98/3.12	1.14/1.37	0.69			0.81	0.47	—		0.65
(6)	I avoid intimacy because I worry what others will think of my body	2.12/3.35	1.22/1.44	0.59		0.66		0.49	—	0.50	
(7)	I avoid certain activities that would mean other people might judge my body	2.37/3.49	1.32/1.41	0.66		0.73		0.53	—	0.59	
(8)	My pattern of eating often leads to disagreements or tension with others	1.62/3.09	0.96/1.36	0.75			0.89	0.57	—		0.63
(9)	Other people try to pressure me into changing my eating	1.68/2.86	0.97/1.43	0.76			0.85	0.42	—		0.80
(10)	My eating patterns make it hard for me to socialize as much as I would like to	1.59/3.23	1.01/1.43	0.80	0.84			0.85	—		
(11)	Other people worry about what I eat	1.84/3.02	1.03/1.40	0.63			0.76	0.41	—		0.67
(12)	I prefer to eat alone to avoid conflict with others about what I eat	1.66/3.41	1.05/1.44	0.71	0.76			0.70	—		0.32
(13)	Worrying about my weight and appearance makes it difficult to feel really "connected" when I am with other people	2.05/3.50	1.24/1.32	0.81		0.88		0.78	—	0.29	
(14)	My eating patterns cause me to withdraw from others	1.56/3.24	0.93/1.41	0.86	0.90			0.92	—		

(Continues)

TABLE 4 | (Continued)

	Item	Nonclinical/Clinical		Unidimensional	Three-factor correlated			Bifactor model			
		Mean	SD		F1	F2	F3	General	F1	F2	F3
(15)	It is difficult to meet new people as I worry they are judging me or my appearance	1.99/3.22	1.201.48	0.75		0.81		0.64	—	0.54	
	Coefficient omega							$\omega_t = 0.96$		$\omega s = 0.91$	$\omega s = 0.91$
				ECV				0.66		0.37	0.59
				PUC				0.76			
				$\omega_{H/HS}$				0.80		0.33	0.53

Note: Item ranges were 1 to 5 on all items for non-clinical and clinical samples. Skewness ranged from absolute values of 0.14 to 1.89 for the nonclinical sample, and from 0.03 to 0.52 for the clinical sample.
Abbreviations: ω = Omega; ωs = Omega Subscale; ω_H = Omega Hierarchical; ECV = Explained Common Variance; F1 = Food-Related Isolation (FRI); F2 = Avoidance of Body Evaluation (ABE); F3 = Food-Related Interpersonal Tension (FRIT); IR-ED = Interpersonal Relationships in Eating Disorders Scale; PUC = Percent Uncontaminated Correlations.

between the IIP-32 and eating disorder psychopathology was positive and moderate ($r = 0.44$, $p < 0.01$), so the negative association was likely to be a statistical artifact of the regression (suppressor effect) due to the relatively high correlation between the IIP-32 and IR-ED ($r = 0.62$, $p < 0.01$). Removing the IIP-32 from this model did not alter the significant effects and only reduced the total variance explained in the outcome by 2%. On the other hand, removing the IR-ED factors from the model reduced the total variance explained in the outcome by 17% (to 45%), and the IIP-32 was no longer a significant predictor (0.08, $p = 0.17$). Thus, the IR-ED appears to have incremental validity, whereas the IIP-32 does not.

Removing the CPQ and RSES from the model continued to yield a poor fit, $\chi^2(176) = 1342.50$, CFI = 0.834, TLI = 0.802, RMSEA = 0.123 (90% CI = 0.117–0.129), although all predictors remained statistically significant (IR-ED general factor = 0.52, Avoidance of Body Evaluation = 0.42, TOMS = 0.35, IIP-32 = −0.16, $ps \leq 0.008$, 27%, 18%, 12%, 3% of the variance). The residual correlation matrix was inspected to identify sources of misfit and potential model improvement. Most (68%) correlations were <0.10, with 18% between 0.10 and <0.15, 9% between 0.15 and <0.20, and the remainder (6%) between 0.20 and 0.29. All correlations above 0.20, with one exception (0.21 between IR-ED 11 and EDE-Q weight concerns subscale) were between IR-ED items, but given the excellent fit of the bifactor model these were not freed. No other correlations were considered substantive enough or theoretically justifiable to free. The IR-ED general factor and Avoidance of Body Evaluation group factor were moderately correlated with the IIP-32 ($rs = 0.47$, $ps < 0.001$) and the TOMS (0.54 and 0.37, respectively, $ps < 0.001$). Two final models were run that included the IR-ED general factor, Avoidance of Body Evaluation group factor, TOMS, and IIP-32 as well as either anxiety (PROMIS-A) or depression (PROMIS-D), as predictors. In the first model, anxiety was not a significant unique predictor (0.08, $p = 0.053$, <1%), but all other predictors remained significant ($ps \leq 0.003$). In the second model depression was a unique predictor (0.14, $p = 0.001$, 2%), as were all other predictors ($ps \leq 0.003$).

4 | Discussion

4.1 | Factor Structure of the IR-ED in a Clinical Sample

Results revealed a bifactor structure for the IR-ED within a large clinical eating disorder sample, comprising a strong general interpersonal problems factor. This finding was consistent with Jones et al. (2019), who also found all items loaded strongly on a general factor, indicating that IR-ED items measure a replicable common construct that can be reliably measured by the IR-ED total score, despite the measure having some multidimensionality.

The group factor structure in the current study was broadly consistent with the factor structure established in a nonclinical sample (Jones et al. 2019), but differed in important ways. Jones et al. found a bifactor model with a Food-Related Interpersonal Tension group factor that had weak loadings; we

had to eliminate the factor completely for the model to converge. This suggests the Food-Related Interpersonal Tension group factor items are relatively pure measures of the general factor, rather than measuring a narrower construct. Another important difference between the models was that item 12, which was originally allocated to the Food-Related Isolation factor in the nonclinical sample, was moved to the Food-Related Interpersonal Tension factor in the clinical sample as doing so substantially improved model fit. Jones et al. (2019) found that items tended to have higher loadings on the Avoidance of Body Evaluation group factor than the general factor, whereas Food-Related Interpersonal Tension group factor loadings tended to be smaller than those on the general factor. We found the opposite in our clinical sample. This is not unusual; methodologic research has found it is typical for loadings on the general factor to be consistently strong, but for the group factor structure and loadings to be less stable between samples (Forbes et al. 2021). Our findings may therefore reflect a limitation of bifactor methodology rather than substantive differences in the structure of the scales between clinical and nonclinical samples.

4.2 | How Should the IR-ED Be Scored?

The evidence from the current study and Jones et al. (2019) strongly supports averaging all items in the IR-ED to compute a total score that measures interpersonal problems that are specific to eating disorders. All items have high loadings on a common general factor, the total score measures these problems reliably, discriminates well between clinical and nonclinical samples, and correlates strongly with measures of related constructs such as the IIP-32 and EDE-Q. The Food-Related Isolation, Avoidance of Body Evaluation, and Food-Related Interpersonal Tension subscale scores should not generally be scored. The bifactor analyses did not support the existence of a Food-Related Isolation group factor. The Avoidance of Body Evaluation subscale was found to primarily measure the general IR-ED factor, and the Avoidance of Body Evaluation subscale and the total score had similar correlations with other measures (EDE-Q, IIP-32, CPQ-10, PROMIS), suggesting the Avoidance of Body Evaluation subscale lacks utility beyond the total score. The Food-Related Interpersonal Tension subscale should not be scored because the current study and Jones et al. (2019) found that correlations between the Food-Related Interpersonal Tension subscale and related constructs were considerably lower than between the IR-ED total score and those variables, and thus the Food-Related Interpersonal Tension subscale reduces rather than enhances validity. In summary, there is a strong evidence that the IR-ED produces reliable and valid total scores, but computing the subscales should be avoided.

Whereas we recommend against calculated *observed* ABE subscale scores (i.e., by summing the ABE items), it may still be useful to incorporate a *latent* ABE factor in structural equation models. It is impossible for observed subscale scores to separate general from specific variance, whereas latent variable modeling techniques can calculate error-free group factor scores independent of general variance. The structural equation models in the current study and Jones et al. (2019) suggest that latent Avoidance of Body Evaluation factor scores may provide incremental predictive validity beyond the general factor, and may be worth including as predictors in latent variable models. The consistency of the unique contribution of the latent Avoidance of Body Evaluation factor across these two studies increases confidence that at the latent level that the tendency to avoid socializing to avoid body scrutiny is an important subcomponent of interpersonal problems with eating disorders.

4.3 | Measurement Invariance Across Clinical and Nonclinical Samples

The psychometric structure of the IR-ED was invariant across clinical and nonclinical samples. Extending upon previous literature (Jones et al. 2019), such findings suggest that the IR-ED consistently assesses eating-specific interpersonal problems across both individuals with and without elevated eating disorder psychopathology. Accordingly, observed differences in latent and observed IR-ED mean scores likely indicate genuine group differences in eating-specific interpersonal problems across clinical and nonclinical samples, rather than being attributed to interpretation or response bias based on the presence of eating disorder psychopathology (Cheung and Rensvold 2016; Putnick and Bornstein 2016).

4.4 | Theoretical and Clinical Implications

The current findings extend the literature and are consistent with theoretical models that describe eating disorder-specific interpersonal problems as a potential mechanism underlying the onset and maintenance of eating disorder psychopathology (Fairburn, Cooper, and Shafran 2003; Hartmann, Zeeck, and Barrett 2010; Mason et al. 2022, Rieger et al. 2010). The IR-ED may therefore prove beneficial in the assessment, case formulation, treatment planning, and subsequent evaluation of therapeutic outcomes among clinical eating disorder populations (Jones et al. 2019).

Recent innovations in cognitive behavioral therapy for eating disorders, such as 10-session cognitive behavioral therapy for eating disorders (CBT-T; Waller et al. 2019), include intervention components that specifically target body evaluation avoidance using behavioral experiments. For example, patients are asked to approach situations that they would normally avoid due to body image concerns and test their predictions to assess whether feared outcomes will come true (e.g., that "people will laugh at me if I wear a bathing suit at the beach"). The importance of these techniques is supported by our finding that at the latent level avoidance of bodily evaluation is uniquely associated with eating disorder psychopathology. Deliberate exposure to scrutiny to challenge negative expectancies with respect to others' reactions, along with developing emotion regulation skills to enhance coping with negative affect and build tolerance to uncertainty during these exposures, may be important treatment targets to address this avoidance. If this component is specifically targeted in treatment, there may be value in scoring the Avoidance of Body Evaluation subscale to monitor change, with the understanding that these items are correlated with the other IR-ED items. The inclusion of family members and significant others in therapy may also enhance treatment outcomes

by providing opportunities to directly modify relational patterns underlying food-related interpersonal tension (Boland et al. 2022; Gilbert and Meyer 2005; Heruc et al. 2020).

4.5 | Limitations and Future Directions

Several limitations of the current study must be considered. First, replications in additional clinical samples are required. Second, the current study relied solely on the use of self-report measures, which provide unique insight into one's subjective experience of interpersonal problems but may be subject to interpretation biases (e.g., denial, overestimation, underestimation; Passi, Bryson, and Lock 2002; Puccio et al. 2017). Future research should incorporate objective behavioral assessments of interpersonal behavior, as well as perspectives of family members or significant others, to ensure a comprehensive clinical assessment of interpersonal functioning. Doing so may also provide insight into how such difficulties change throughout treatment among those with eating disorders (Hartmann, Zeeck, and Barrett 2010). Third, given the cross-sectional nature of the study, the causal and indirect effects of eating-specific interpersonal problems on the onset and maintenance of eating disorder psychopathology remain unclear. Future prospective cohort, experimental, and intervention studies will allow for stronger temporal and causal inferences to be drawn. It will be important for future longitudinal research to investigate whether the IR-ED items or scales can predict the onset of eating disorder psychopathology, or whether they are a consequence of eating disorders. It may be, for example, that avoidance of bodily evaluation is an early warning sign for subsequent food-related isolation and interpersonal tension, or these factors may develop at a similar stage in the development of an eating disorder. There will also be value in future research examining the degree to which interpersonal problems change during existing evidence-based treatments, and whether interpersonal problems adversely impact on trajectories of change. Fourth, eating-specific interpersonal difficulties have been shown to vary across cultural contexts (Miller and Pumariega 2001) and diagnostic categories (e.g., anorexia nervosa and bulimia nervosa; Hartmann, Zeeck, and Barrett 2010), so future research should evaluate the psychometric properties of the IR-ED cross-culturally and transdiagnostically. Fifth, the structural equation models predicting eating disorder psychopathology with all of the measures provided poor fit to the data, so further research is required to understand sources of misspecification. Although the purpose of those models in this study was to examine incremental predictive validity, models that consider both direct and indirect effects between the variables in future research may be particularly fruitful for improving understanding of the relationships between the factors.

4.6 | Concluding Comments

The current study confirms the factor structure and psychometric properties of an eating-specific measure of interpersonal problems, the IR-ED, within a clinical eating disorder sample. Relative to more generic measures of interpersonal problems, the IR-ED may prove beneficial in the assessment, formulation, and individualized treatment of eating-specific interpersonal problems as a plausible factor underlying the onset and maintenance of eating disorders.

Author Contributions

Sophia R. Lego: conceptualization, formal analysis, investigation, methodology, writing – original draft. **Bronwyn C. Raykos:** conceptualization, methodology, writing – review and editing. **Kate E. Tonta:** conceptualization, formal analysis, methodology, supervision. **David M. Erceg-Hurn:** data curation, formal analysis, investigation, methodology, writing – review and editing. **Glenn Waller:** conceptualization, investigation, methodology, writing – review and editing. **Peter M. McEvoy:** conceptualization, formal analysis, investigation, methodology, project administration, supervision, writing – review and editing.

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Ethics Statement

This study was conducted according to the guidelines of the Declaration of Helsinki. Ethical approval was granted from the Curtin Human Research Ethics Committee (HRE2022-0133) for the current study. Approval for quality assurance and evaluation was also obtained from the North Metropolitan Health Service Mental Health Human Research Ethics Committee (33238).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Restrictions are placed on the data by the custodian, so they are unable to be shared.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.