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Research paper

# The assessment of transdiagnostic dimensions of emotional disorders: Validation of the Multidimensional Emotional Disorders Inventory (MEDI) in adolescents with subthreshold anxiety and depression



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| Keywords:<br>Transdiagnostic<br>Adolescents<br>Psychometric<br>Validation<br>MEDI<br>Subclinical symptoms<br>Emotional disorders | Background:The transdiagnostic approach to psychopathology has emerged as an alternative to traditional<br>taxonomic approaches. The Multidimensional Emotional Disorders Inventory (MEDI) is a specifically designed<br>self-report to measure the transdiagnostic dimensions proposed by Brown and Barlow (2009). This study aims to<br>analyse the psychometric properties of the MEDI scores in adolescents with subthreshold anxiety and depression.<br><i>Method:</i> The sample consisted of a total of 476 students. The mean age was 13.77 years ( $SD = 1.43$ ) (range 10 to<br>18 years), 73.9 % were females. Several questionnaires assessing positive affect, negative affect, mental health<br>difficulties, and quality of life were used.<br><i>Results:</i> The original 9-factor structure of the MEDI scores using McDonald's Omega, ranging from 0.58 to<br>0.87. The MEDI dimensions were associated with psychopathology, positive affect, negative affect, and quality of<br>life.<br><i>Limitations:</i> Reliance on self-reported data, a cross-sectional design limiting temporal assessment, and a 73.9 %<br>female gender imbalance.<br><i>Conclusion:</i> The MEDI scores showed adequate psychometric properties among adolescents with subclinical<br>emotional symptoms. The results found might have potential clinical implications for conceptualization,<br>assessment, intervention, and prevention of emotional disorders at both clinical and research levels. |

### 1. Introduction

Modern taxonomic systems, such as the Diagnostic and Statistical Manual of Mental Disorders 5th edition, Text Revision (DSM-5-TR, American Psychiatric Association, 2022) and the International Statistical Classification of Diseases and Related Health Problems 11th (ICD-11, World Health Organization, 2019), rely on categorical diagnoses and are based on a 'common cause' framework (Conway et al., 2019; Nesse, 2023). These categorical diagnostic systems have shaped the conceptualization, assessment, and treatment of mental health disorders. However, the higher rates of comorbidity (Kessler et al., 2011; McGrath et al., 2020), the heterogeneity within diagnosis or low reliability across diagnoses (Brown and Barlow, 2009; Wilshire et al., 2021), among other factors, highlight the significant limitations of these taxonomic classifications (Dalgleish et al., 2020; Kendler, 2022). In addition, empirical knowledge of the mechanisms underlying mental disorders and their clinical utility remains limited (Evans et al., 2021).

There is a growing understanding that such psychiatric nosologies may no longer be useful in research and therapeutic practice (Finsrud et al., 2022; Wampold, 2015). As a result, alternative classification approaches have been emerged (Bullis et al., 2019; Sauer-Zavala et al., 2017). The Research Domain Criteria (RDoC; Insel et al., 2010), the

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Hierarchical Taxonomy of Psychopathology (HiTOP; Kotov et al., 2017), the network model (Borsboom, 2017), and the transdiagnostic approaches (Dalgleish et al., 2020) are some examples. These approaches provide new perspectives on the genesis, maintenance, clinical management, and recovery from experiences of disabling mental distress (Conway et al., 2019; Dalgleish et al., 2020; Fonseca-Pedrero et al., 2019; Widiger, 2021). However, further development is needed to consolidate their clinical utility (Blanchard and Heeren, 2022; Fried and Cramer, 2017; Rosellini and Brown, 2019). In addition, these new viewpoints are clearly related. For instance, RDoC is a transdiagnostic research framework for studying mental disorders along shared dimensions (Paschali et al., 2022), where adolescents mental health problems can be understood as complex dynamic systems (i.e., network model). These modern perspectives attempt to capture and understand the complexity of mental health disorders.

Transdiagnostic approaches (e.g., the Unified Protocol for Transdiagnostic Treatment of Emotional Disorders or the Modular Approach to Therapy for Anxiety, Depression, Trauma, or Conduct Problems in children) provide unique insights into understanding mental health disorders beyond the established diagnostic taxonomy (e.g., DSM, ICD). By adopting a dimensional perspective, transdiagnostic approaches explore the underlying psychological processes that are common across different mental disorders (Eaton et al., 2023). They also open alternate conceptualizations of the processes involved in mental health (Fonseca-Pedrero et al., 2023a). These transdiagnostic approaches hold significant implications for advancing our comprehension of mental health and promoting the implementation of novel diagnostic, therapeutic, and recovery strategies (Cano-Vindel et al., 2022). The transdiagnostic treatments have demonstrated their main efficacy in treating depressive and anxiety disorders, in both adults (Andersen et al., 2016; Barlow et al., 2017; Carlucci et al., 2021; Cassiello-Robbins et al., 2020; Newby et al., 2015; Sakiris and Berle, 2019; Schaeuffele et al., 2024) and children and adolescents (Ehrenreich-May et al., 2009; Ehrenreich-May et al., 2017; García-Escalera et al., 2020; Kennedy et al., 2019, 2021; Mohajerin et al., 2023).

Brown and Barlow (2009) proposed the hybrid dimensionalcategorical approach to emotional disorders by comprising 12 hierarchical dimensions empirically linked to DSM diagnostic categories (Barlow et al., 2017; Ehrenreich-May et al., 2018; Rosellini and Brown, 2019). This model has served as a theoretical framework for the development of the Unified Protocol for Transdiagnostic Treatment of Emotional Disorders in Adults (UP; Barlow et al., 2018) and in Children and Adolescents (UP-C and UP-A, respectively; Ehrenreich-May et al., 2018). The UP consists of the following five core treatment modules: a) mindful emotion awareness, b) cognitive flexibility, c) identifying and preventing patterns of emotion avoidance, d) increasing awareness and tolerance of emotion related physical sensations, and e) interoceptive and situational emotion-focused exposures (Barlow et al., 2011; Ehrenreich-May et al., 2018). The main goal of these treatments is to reduce the comorbid symptomatology of different emotional disorders by focusing on one of the higher temperamental dimensions of the Brown and Barlow (2009), namely neuroticism/behavioural inhibition (Ehrenreich-May et al., 2009; Steele et al., 2018).

Given the clinical impact of the UP versions, it is crucial to develop and validate measurement instruments that allow for the analysis of transdiagnostic dimensions for emotional disorders. In this regard, Rosellini and Brown (2019) developed the Multidimensional Emotional Disorders Inventory (MEDI) to measure the dimensions proposed by Brown and Barlow (2009) and to unify assessment and intervention within a single theoretical framework. The MEDI consists of 49 Likerttype items that measure the nine dimensions of the model (Rosellini and Brown, 2019): 1) Neurotic temperament [NT]; 2) Positive temperament [PT]; 3) Depressed mood [DM]; 4) Autonomic arousal [AA]; 5) Somatic anxiety [SOM]; 6) Social anxiety [SOC]; 7) Intrusive cognitions [IC]; 8) Traumatic re-experiencing [TRM]; and 9) Avoidance [AVD]. The first two dimensions are higher-level or temperamental dimensions that allow for categorization into psychopathological profiles. The remaining dimensions are lower-level dimensions that differentiate the phenotype or symptomatic focus of the emotional disorder (Rosellini et al., 2015). These transdiagnostic profiles from the MEDI enable the categorization of individuals into phenotypes that converge with the diagnostic categories of the DSM, providing valuable complementary information for psychological intervention and research on emotional disorders (Boettcher et al., 2020; Rosellini et al., 2015; Rosellini and Brown, 2014, 2019).

Previous research has analyzed the psychometric properties of the MEDI scores among adult populations in both the United States (Rosellini and Brown, 2019) and Spain (Osma et al., 2023). Factorial analyses of the MEDI scores have found a 9-factor structure. In addition, satisfactory levels of reliability, along with evidence of convergent and discriminant validity of the MEDI dimensions with other self-report measures were obtained. For instance, Osma et al. (2023) examined the associations of MEDI dimensions with specific questionnaires for anxiety, depression, neuroticism, extraversion, somatic anxiety, fear of negative evaluation, obsessing, trauma, and experiential avoidance. The clinical utility of the MEDI dimensions and profiles compared with DSM diagnosis has also been investigated in prior research involving adults (Boettcher et al., 2020; Quilez-Orden et al., 2023; Rosellini et al., 2015). It is important to continue validating the MEDI scores in other populations of interest such as adolescence as well as in individuals at high risk for emotional disorders prior to clinical debut. Likewise, it is necessary to continue analyzing the relationship of the MEDI scores with psychopathology, quality of life, and affective variables within the tripartite model proposed by Clark and Watson (1991) of depression and anxiety.

Emotional disorders and symptoms constitute one of the major public health challenges among youths. Previous literature indicates a significant increase in the incidence of most emotional disorders during adolescence (12-18 years), particularly anxiety and depression disorders (Rapee et al., 2019; Shorey et al., 2022; Solmi et al., 2022; World Health Organization, 2022). Moreover, experiencing mental health problems before the age of 14 has been linked to a higher risk of adult mental disorders (Mulraney et al., 2021). Detecting these symptoms early in adolescence is crucial because undetected or underestimated emotional problems at this stage are more likely to become persistent (Merikangas et al., 2010). Furthermore, the high comorbidity between emotional symptoms and disorders is noteworthy; consequently, adolescents with anxiety symptoms are also at a higher risk of experiencing depression symptoms, and vice versa (Balázs et al., 2013; Canals et al., 2019). Additionally, the impact of emotional symptoms in adolescence is significant on a personal, family, school, and socio-sanitary levels (GBD 2019 Mental Disorders Collaborators, 2022; World Health Organization, 2022). Thus, the importance of addressing emotional symptoms and disorders during adolescence from a transdiagnostic perspective has been emphasized (González-Roz et al., 2023; Kennedy et al., 2021). However, to date, the MEDI has not yet been validated in adolescent populations. Consequently, there has been limited progress evaluating the validity of dimensional approaches to emotional disorder classification as well as a lack of true parsimony between assessment and transdiagnostic treatments for emotional disorders in adolescents.

Within this context, the main objective of this study was to validate the MEDI in a large sample of adolescents with subthreshold anxiety and depression. The specific aims were to: a) explore the internal structure of the MEDI scores; b) analyse the reliability of the MEDI scores; c) analyse the association between MEDI scores and positive and negative affect, psychopathology, and quality of life. In line with previous literature, it was hypothesized that the 9-factor model of the MEDI would have adequate goodness-of-fit indices. We also expected that the reliability estimation of the MEDI scores would be adequate. Finally, we expected that MEDI scores would be positively associated with emotional and behavioural difficulties, and negatively with well-being and health related quality of life.



Fig. 1. Flow chart of the participants selection process.

## 2. Methods

## 2.1. Participants

The sample for the screening phase comprised 8746 students belonging to 85 schools and 532 classrooms from different provinces of Spain (La Rioja, Andalucía, Madrid, Galicia, Murcia, Asturias, Comunidad Valenciana and Castilla-La Mancha) that participated in the project. The students attended various public and charter educational centers for compulsory secondary education and vocational training, representing diverse socioeconomic backgrounds.

Out of the initial 8746 adolescents who participated in the screening phase, 475 selected at-risk adolescents with a moderate score in both the PHQ-9 and GAD-7 (between 10 and 15 points) agreed to participate in a study examining the effectiveness of UP-A transdiagnostic intervention in educational contexts. The exclusion criteria were a) having been

diagnosed with a mental disorder or alcohol and/or substance dependence disorder, b) the presence of high risk of suicidal behaviour, c) having a medical disease or condition that prevents the participant from participating in the psychological treatment, d) receiving another psychological treatment while the study is ongoing, e) increases and/or changes in participants' medication if they are receiving pharmacological treatment during the study, and f) not completing or improperly completing (e.g., acquiescence, random response) baseline or post assessments. A flow chart illustrating the step-by-step process of including/excluding participants is depicted in Fig. 1.

The final sample, comprising 352 (73.9 %) females and 123 (25.8 %) males, had a mean age of 13.77 years (SD = 1.432), ranging from 10 to 18 years. The age distribution was as follows: 10 years, n = 1; 11 years, n = 2; 12 years, n = 99; 13 years, n = 124; 14 years, n = 115; 15 years, n = 66; 16 years, n = 50; 17 years, n = 18; 18 years, n = 1.

#### 2.2. Instruments

The Multidimensional Emotional Disorder Inventory (MEDI; Rosellini and Brown, 2019). The MEDI is a self-report questionnaire used to assess the transdiagnostic dimensions of emotional disorders. As previously stated, the MEDI is made up of a total of 49 items which evaluate nine dimensions of emotional disorders: 1) Neurotic temperament [NT, example item "I get upset by trivial things"]; 2) Positive temperament [PT, example item "It doesn't take much to make me laugh"]; 3) Depressed mood [DM, example item "I am disappointed in myself"]; 4) Autonomic arousal [AA, example item "I have been experiencing breathlessness"]; 5) Somatic anxiety [SOM, item example "Other people would consider some of my thoughts to be odd"]; 6) Social anxiety [SOC, example item "Unexpected physical sensations scare me"]; 7) Intrusive cognitions [IC, example item "I am uncomfortable mingling at social events"]; 8) Traumatic re-experiencing [TRM, example item "I cannot stop thinking about horrific things that I have experienced or seen"]; and 9) Avoidance [AVD, example item "I cope with unpleasant thoughts, feelings, or images by trying to distract myself"]. It was developed to have a 9-point Likert response scale (0 = not at all characteristic of me; 8 = totally characteristic of me). The validated Spanish version of the MEDI for adults was employed in the present study (Osma et al., 2021).

The Generalized Anxiety Disorder 7-item Scale (GAD-7; Spitzer et al., 2006). The GAD-7 assesses the presence of generalized anxiety disorder (GAD) symptoms in the past two weeks. The answers are rated on a 4-point Likert response scale (0 = not at all; 3 = nearly every day). Total scores ranging from 0 to 21 may be classified into four severity groups (Spitzer et al., 2006): minimal (0–4), mild (5–9), moderate (10–14), and severe (15–20). The Spanish version of the GAD-7 scores has shown adequate psychometric properties among adolescents (Casares et al., 2024).

The Patient Heath Questionnaire-9 (PHQ-9; Kroenke et al., 2001). The PHQ-9 is a self-report questionnaire used to explore the presence of major depression disorder symptoms in the past two weeks. The answers of each PHQ-9 item are rated on a 4-point Likert response scale (0 = not at all; 3 = nearly every day). The total score ranges between 0 and 27 points, with the original cut-off point set at  $\geq 10$  to determine the presence of major depression (Kroenke et al., 2001). The validated Spanish version of PHQ-9 was used in the present study (Fonseca-Pedrero et al., 2023b).

The Positive and Negative Affect Schedule for Children-Short form (PANAS-C; Ebesutani et al., 2012). The PANAS-C is made up of two factors designed to measure Positive affect and Negative affect. The 10 items have a Likert-type format (1 = very little or not at all, 5 = extremely or a lot). Five items evaluate PA through adjectives such as: Cheerful, lively, happy, energetic and proud; and another five the NA: Depressed, angry, fearful, scared and sad. The PANAS-C assesses how people feel during the last weeks. This instrument has shown adequate psychometric quality in previous studies with Spanish adolescents (Aritio-Solana et al., 2022).

The Strengths and Difficulties Questionnaire (SDQ) self-report version (Goodman, 1997). The SDQ is a self-report questionnaire that is widely used for the assessment of different emotional and behavioural problems related to mental health in adolescents. The SDQ is made up of a total of 25 statements distributed across five subscales: Emotional symptoms, Conduct problems, Hyperactivity, Peer problems, and Prosocial behaviour. The first four subscales yield a Total difficulties score. In this study we used a Likert-type response format with three options (0 = not true, 1 = somewhat true, 2 = certainly true). The validated Spanish version of the SDQ was used in the present study (Ortuño-Sierra et al., 2022).

*The KIDSCREEN-10 Index* (KS-10; Index; Ravens-Sieberer et al., 2010). The KS-10 is an instrument developed and validated to assess health-related quality of life in children and adolescents aged 8 to 18 years. It presents a total of 10 questions in a 5-choice Likert response format (ranging from 1 = not at all to 5 = extremely). The validity and reliability of KS have been proven in the European population (Ravens-

#### Sieberer et al., 2010).

The Oviedo Infrequency Scale-revisited (INF-OV-R; Fonseca-Pedrero et al., 2019). The INF-OV-R was administered to participants in order to detect those who responded in a random, pseudorandom or dishonest manner. The INF-OV-R is a self-report instrument consisting of 10 items in a dichotomous scale format (yes/no). Students with more than two incorrect responses on the INF-OV-R scale were excluded from the sample.

## 2.3. Procedure

The research was approved by the Ethical Committee of Clinical Research of La Rioja (CEICLAR number of the project PI 552). Excepting the MEDI, the tests were administered in the screening phase collectively, through personal computers, in groups of 10 to 30 students, during normal school hours and also in a classroom specially prepared for this purpose. Then, the MEDI was administered in those participants at-risk one week after the screening phase. It was conducted through personal electronic devices in reduced groups of 10 to 15 students, outside normal school hours, and in a classroom specially prepared for this purpose. No incentive was provided for their participation. For participants under 16, parents were asked to provide a written informed consent in order for their child to participate in the study. Participants were informed of the confidentiality of their responses and of the voluntary nature of the study. This study take part of the PSICE project (Evidence-based Psychology in Educational Contexts), in order to Examining the UP-A's effectiveness (Fonseca-Pedrero et al., 2023c).

#### 2.4. Data analyses

First, we calculated the descriptive statistics of the MEDI dimensions. Second, we examined the psychometric properties of the MEDI scores according to psychometric guidelines (Sireci and Benítez, 2023). In order to analyse the internal structure of the MEDI, several factorial models were examined via confirmatory factor analysis (CFA) and Exploratory Structural Equation Modeling (ESEM). In model a) we aimed to assess whether the 49 items loaded on a unidimensional latent structure. In model b), based on previous studies (Osma et al., 2021, 2023; Rosellini and Brown, 2019), a model with nine first-order correlated factors was tested. In Model c) a hierarchical model with nine firstorder factors (subscale level), predicted by a second-order factor was examined. In Model d) a nine first-order correlated factors model using ESEM was tested. The 4-factor structure proposed by Osma et al. (2021) was not considered due to the lack of demonstrated improvement in the model fit compared to the original structure in previous studies and the absence of supporting theoretical framework. Diagonally Weighted Least Squares estimator was used for models a and b, while the Maximum Likelihood Method estimator was used for models c and d. The following goodness-of-fit indices were employed: Chi-square ( $\chi$ 2), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA) and 90 % Confidence interval (CI), and the Standardized Root Mean Square Residual (SRMR). Hu and Bentler (1999) suggested that RMSEA should be 0.06 or less for a good model fit and CFI and TLI should be 0.95 or more, though any value over 0.90 tends to be considered acceptable. For SRMR, values <0.08 indicate good model fit (Yu and Muthén, 2002). Third, reliability estimation of the MEDI scores was estimated using McDonald's Omega. Fourth, the associations between MEDI dimensions and PANAS-C, SDQ and KS-10 were calculated using Pearson correlations and Bonferroni correction. SPSS 28, MPLUS 7.4, and JASP 0.18.2.0 were used for data analyses.

#### 3. Results

#### 3.1. Descriptive statistics and correlations between the MEDI dimensions

Descriptive statistics for the MEDI dimensions and mental health

#### Table 1

Descriptive statistics and reliability of the Multidimensional Emotional Disorders Inventory dimensions and other mental health indicators.

|                         | Mean  | SD    | Skewness | Kurtosis | Range | McDonald's $\omega$ (95 % CI) |
|-------------------------|-------|-------|----------|----------|-------|-------------------------------|
| NT                      | 21.85 | 8.05  | -0.18    | -0.54    | 0–40  | 0.68 (0.64–0.73)              |
| PT                      | 21.81 | 7.73  | -0.02    | -0.37    | 1-40  | 0.71 (0.67-0.75)              |
| DM                      | 15.39 | 8.75  | 0.53     | -0.23    | 0-40  | 0.80 (0.77-0.82)              |
| AA                      | 12.94 | 8.89  | 0.55     | -0.42    | 0-40  | 0.78 (0.74-0.81)              |
| SOM                     | 14.68 | 7.21  | 0.41     | -0.16    | 0-40  | 0.58 (0.52-0.62)              |
| SOC                     | 16.16 | 10.61 | 0.34     | -0.86    | 0-40  | 0.87 (0.85-0.89)              |
| IC                      | 18.95 | 11.66 | 0.37     | -0.69    | 0-48  | 0.85 (0.83-0.87)              |
| TRM                     | 14.04 | 10.48 | 0.62     | -0.64    | 0-40  | 0.87 (0.85-0.89)              |
| AVD                     | 24.73 | 11.69 | 0.25     | -0.49    | 0-54  | 0.71 (0.68-0.75)              |
| PANAS-C Positive affect | 15.35 | 3.90  | 0.02     | -0.06    | 5-25  | 0.88 (0.86-0.90)              |
| PANAS-C Negative affect | 13.35 | 3.59  | 0.11     | -0.35    | 5–24  | 0.65 (0.60-0.69)              |
| SDQ                     | 16.48 | 4.41  | 0.03     | 0.44     | 0–29  | 0.67 (0.64–0.74)              |
| KIDSCREEN-10            | 31.53 | 5.97  | 0.22     | 0.06     | 17–50 | 0.74 (0.71–0.78)              |

Note. NT = Neurotic temperament; PT = Positive temperament; DM = Depressed mood; AA = Autonomic arousal; SOM = Somatic anxiety; SOC = Social anxiety; IC = Intrusive cognitions; TRE = Traumatic re-experiencing; AVD = Avoidance; PANAS-C Positive affect = Positive and Negative Affect Schedule for Children, positive affect total score; PANAS-C Negative affect = Positive and Negative Affect Schedule for Children-brief, negative affect total score; SDQ = The Strengths and Difficulties Questionnaire, total difficulties score.

| Table 2 | 2 |
|---------|---|
|---------|---|

Pearson correlation matrix between Multidimensional Emotional Disorder Inventory dimensions.

|            | 1      | 2       | 3      | 4      | 5      | 6      | 7      | 8      | 9 |
|------------|--------|---------|--------|--------|--------|--------|--------|--------|---|
| 1. NT (1)  | 1      |         |        |        |        |        |        |        |   |
| 2. PT (2)  | -0.005 | 1       |        |        |        |        |        |        |   |
| 3. DM (3)  | 0.493* | -0.297* | 1      |        |        |        |        |        |   |
| 4. AA (4)  | 0.502* | -0.096  | 0.537* | 1      |        |        |        |        |   |
| 5. SOM (5) | 0.428* | 0.231*  | 0.242* | 0.272* | 1      |        |        |        |   |
| 6. SOC (6) | 0.455* | -0.245* | 0.443* | 0.357* | 0.283* | 1      |        |        |   |
| 7. IC (7)  | 0.559* | -0.067  | 0.586* | 0.635* | 0.383* | 0.398* | 1      |        |   |
| 8. TRM (8) | 0.511* | -0.048  | 0.494* | 0.609* | 0.389* | 0.352* | 0.763* | 1      |   |
| 9. AVD (9) | 0.553* | 0.142*  | 0.426* | 0.506* | 0.488* | 0.440* | 0.619* | 0.605* | 1 |

*Note.* NT = Neurotic temperament; PT = Positive temperament; DM = Depressed mood; AA = Autonomic arousal; SOM = Somatic anxiety; SOC = Social anxiety; IC = Intrusive cognitions; TRE = Traumatic re-experiencing; AVD = Avoidance.

\* Bonferroni correction:  $p \leq .005$ .

#### Table 3

Goodness-of-fit indices of the factorial models tested.

| Model   | $\chi^2$ | df   | CFI   | TLI   | RMSEA (IC 90 %)     | SRMR  |
|---|----------|------|-------|-------|---------------------|-------|
| One dimension (item level)  | 3.919.55 | 1127 | 0.920 | 0.917 | 0.072 (0.070–0.075) | 0.085 |
| Nine first-order factors (item level)                             | 1.912.12 | 1091 | 0.977 | 0.975 | 0.040 (0.037–0.043) | 0.060 |
| Second order factor and nine first-order factors (subscale level) | 301.58   | 26   | 0.856 | 0.801 | 0.149 (0.134–0.145) | 0.076 |
| Nine first-order factors, ESEM (item level)                       | 9215.12  | 1176 | 0.958 | 0.937 | 0.030 (0.026–0.034) | 0.024 |

Note. ESEM = Exploratory Structural Equation Modeling;  $\chi^2$  = Chi squared; df = degrees of freedom; CFI = Comparative Fit Index; CI = Confidence interval; TLI = Tucker Lewis Index; RMSEA = Root mean square error of approximation; SRMR = Standardized root mean square residual.

indicadors are shown in Table 1. The correlations among the 9 dimensions of the MEDI are displayed in Table 2. The NT dimension exhibited significant positive moderate correlations with all the MEDI dimensions, with the exception of PT. The PT dimension showed weak negative correlations with DM, and SOC, while exhibited significant positive correlations with SOM and AVD.

#### 3.2. Confirmatory factor analysis of the MEDI items

The goodness-of-fit indices for the factorial model tested are shown in Table 3. As can be seen in Table 3, the single-order nine-factor model showed the best goodness-of-fit indices compared to other competing models. The nine first-order factor model based on ESEM showed adequate goodness-of-fit indices; however, the items of the nine theoretically proposed dimensions were not related to the 9 factors resulting from the model tested. In addition, multiple cross-loadings were found in more than one latent factor and ten factor loadings were found that were not statistically significant. The standardized item factor loadings for the single-order nine-factor model in the total sample are shown in Table 4. All items exhibited statistically significant factor loadings, surpassing the established cutoff point of 0.30, except for items 19 and 38 within the SOM dimension.

#### 3.3. Reliability estimation of the MEDI scores

The dimensions of MEDI indicated a satisfactory level of internal consistency of the scores estimated using McDonald's omega ( $\omega$ ), ranging from 0.58 (SOM) to 0.87 (TRM) (see Table 1). Only items 19 and 38 showed item discrimination indices under 0.30.

## 3.4. Evidence based on relationships with external variables

We also studied the correlation coefficients between the MEDI dimensions and different mental health psychometric indicators. As shown in Table 5, all dimensions of the MEDI, except PT, significantly correlated with the Negative affect of the PANAS-C. Conversely, the

#### Table 4

Standardized factor loadings of the Multidimensional Emotional Disorder Inventory items.

| Ítem    | NT   | РТ   | DM   | AA   | SOM    | SOC  | IC   | TRM  | AVD  |
|---------|------|------|------|------|--------|------|------|------|------|
| 1       | 0.52 |      |      |      |        |      |      |      |      |
| 10      | 0.38 |      |      |      |        |      |      |      |      |
| 16      | 0.66 |      |      |      |        |      |      |      |      |
| 32      | 0.59 |      |      |      |        |      |      |      |      |
| 35      | 0.52 |      |      |      |        |      |      |      |      |
| 2       |      | 0.49 |      |      |        |      |      |      |      |
| 17      |      | 0.54 |      |      |        |      |      |      |      |
| 24      |      | 0.88 |      |      |        |      |      |      |      |
| 33      |      | 0.52 |      |      |        |      |      |      |      |
| 36      |      | 0.40 |      |      |        |      |      |      |      |
| 3       |      |      | 0.70 |      |        |      |      |      |      |
| 11      |      |      | 0.77 |      |        |      |      |      |      |
| 25      |      |      | 0.55 |      |        |      |      |      |      |
| 37      |      |      | 0.63 |      |        |      |      |      |      |
| 43      |      |      | 0.70 |      |        |      |      |      |      |
| 4       |      |      |      | 0.51 |        |      |      |      |      |
| 13      |      |      |      | 0.73 |        |      |      |      |      |
| 18      |      |      |      | 0.70 |        |      |      |      |      |
| 26      |      |      |      | 0.57 |        |      |      |      |      |
| 44      |      |      |      | 0.64 | 0.54   |      |      |      |      |
| б<br>10 |      |      |      |      | 0.54   |      |      |      |      |
| 19      |      |      |      |      | -0.042 |      |      |      |      |
| 28      |      |      |      |      | 0.49   |      |      |      |      |
| 45      |      |      |      |      | 0.21   |      |      |      |      |
| 7       |      |      |      |      | 0.47   | 0.72 |      |      |      |
| ,<br>14 |      |      |      |      |        | 0.75 |      |      |      |
| 22      |      |      |      |      |        | 0.78 |      |      |      |
| 41      |      |      |      |      |        | 0.70 |      |      |      |
| 47      |      |      |      |      |        | 0.84 |      |      |      |
| 5       |      |      |      |      |        |      | 0.59 |      |      |
| 12      |      |      |      |      |        |      | 0.78 |      |      |
| 21      |      |      |      |      |        |      | 0.70 |      |      |
| 30      |      |      |      |      |        |      | 0.74 |      |      |
| 40      |      |      |      |      |        |      | 0.67 |      |      |
| 46      |      |      |      |      |        |      | 0.70 |      |      |
| 8       |      |      |      |      |        |      |      | 0.77 |      |
| 20      |      |      |      |      |        |      |      | 0.62 |      |
| 29      |      |      |      |      |        |      |      | 0.77 |      |
| 39      |      |      |      |      |        |      |      | 0.79 |      |
| 48      |      |      |      |      |        |      |      | 0.80 |      |
| 9       |      |      |      |      |        |      |      |      | 0.33 |
| 15      |      |      |      |      |        |      |      |      | 0.51 |
| 23      |      |      |      |      |        |      |      |      | 0.46 |
| 27      |      |      |      |      |        |      |      |      | 0.49 |
| 31      |      |      |      |      |        |      |      |      | 0.37 |
| 34      |      |      |      |      |        |      |      |      | 0.49 |
| 42      |      |      |      |      |        |      |      |      | 0.52 |
| 49      |      |      |      |      |        |      |      |      | 0.65 |

Note. NT = Neurotic temperament; PT = Positive temperament; DM = Depressed mood; AA = Autonomic arousal; SOM = Somatic anxiety; SOC = Social anxiety; IC = Intrusive cognitions; TRE = Traumatic re-experiencing; AVD = Avoidance.

All standardized factor loadings estimated were statistically significant (p < .01).

Positive affect correlated positively with the PT dimension of the MEDI and negatively with DM dimension. All MEDI dimensions exhibited significant and positive correlations with Total difficulties on the SDQ, except for the PT dimension, which showed a negative correlation. Lastly, quality of life, as measured by the KS-10, was positively related to PT and negatively related to DM, AA, SOC, IC and TRM.

## 4. Discussion

The transdiagnostic approach proposed by Brown and Barlow (2009) for emotional disorders has led to the development of the UP-A (Ehrenreich-May et al., 2018), a psychological treatment that has been shown to be effective for reducing symptoms of anxiety and depression in adolescents across different settings. The MEDI, a psychological assessment tool specifically designed to measure the dimensions outlined in Brown and Barlow's theoretical model, has been validated in clinical populations of adults and a community sample of university

students (Osma et al., 2021, 2023; Rosellini and Brown, 2014). However, to date, the MEDI has not yet been validated in adolescent populations. Thus, the main goal was to examine the psychometric properties of the MEDI scores in a large sample of adolescents with subthreshold anxiety and depression.

According to previous studies (Osma et al., 2021, 2023; Rosellini and Brown, 2014), the original 9-factor factorial structure has shown adequate goodness-of-fit indices in this sample compared to the unifactorial and a second-order factor model. In addition, a nine first-order correlated factors model tested, using ESEM, presented adequate goodness-of-fit indices, however some inconsistencies were found. The ESEM approach makes it possible to overcome certain limitations of the CFA measurement model, and it would be advantageous to use it in clinical measures. Regarding the item factor loadings of the original 9factor factorial model, unlike previous research (Osma et al., 2023; Rosellini and Brown, 2014), item 19 exhibited a negative factor loading, and both items 19 and 38 from the SOM dimension fell below the

#### Table 5

Pearson correlations between the Multidimensional Emotional Disorder Inventory dimensions and mental health indicators.

|     | PANAS-C<br>Positive affect | PANAS-C<br>Negative affect | SDQ    |   | KIDSCREEN-10 |   |
|-----|----------------------------|----------------------------|--------|---|--------------|---|
| NT  | -0.027                     | 0.203 *                    | 0.198  | * | -0.053       |   |
| PT  | 0.330 *                    | -0.055                     | -0.158 | * | 0.290        | * |
| DM  | -0.228 *                   | 0.182 *                    | 0.190  | * | -0.259       | * |
| AA  | -0.099 *                   | 0.214 *                    | 0.257  | * | -0.124       | * |
| SOM | 0.037                      | 0.089                      | 0.123  | * | 0.006        |   |
| SOC | -0.117                     | 0.121 *                    | 0.207  | * | -0.121       | * |
| IC  | -0.076                     | 0.220 *                    | 0.331  | * | -0.153       | * |
| TRM | -0.073                     | 0.150 *                    | 0.264  | * | -0.143       | * |
| AVD | -0.007                     | 0.194 *                    | 0.194  | * | -0.024       |   |
|     |                            |                            |        |   |              |   |

*Note.* NT = Neurotic temperament; PT = Positive temperament; DM = Depressed mood; AA = Autonomic arousal; SOM = Somatic anxiety; SOC = Social anxiety; IC = Intrusive cognitions; TRE = Traumatic re-experiencing; AVD = Avoidance; PANAS-C Positive affect = Positive and Negative Affect Schedule for Children, positive affect total score; PANAS-C Negative affect = Positive and Negative Affect Schedule for Children-brief, negative affect total score; SDQ = The Strengths and Difficulties Questionnaire, total difficulties score.

Bonferroni correction:  $p \leq .005$ .

threshold of 0.30. This could indicate a difficulty in the understanding of these items by adolescents, since in other studies with adults that used the Spanish version (Osma et al., 2021, 2023), the factor loadings of these items were adequate. Study of the underlying structure revealed that MEDI items were grouped in a theoretical structure of nine first-order factors. This study provides new evidence in the underlying structure of the MEDI in adolescents with subthreshold anxiety and depression.

The McDonald's Omega coefficients for the various scales of the MEDI ranged from 0.58 to 0.87, indicating satisfactory internal consistency ( $\omega > 0.7$ ) (Watkins, 2017) across all dimensions, except for NT ( $\omega$ = 0.68) and SOM ( $\omega$  = 0.58). These levels of internal consistency differ from previous studies wherein all dimensions exhibited acceptable values (Osma et al., 2021), or where only NT (Osma et al., 2023) or AVD (Rosellini and Brown, 2019) showed slight deviations from the 0.70 threshold. This may be associated with participants' lack of comprehension of items 19 and 38 within this dimension. NT exhibited a moderate positive correlation with all lower-order dimensions, as observed in the recent study by Osma et al. (2023). Consistent with previous research (Osma et al., 2021, 2023; Rosellini and Brown, 2014), PT scores were found to negatively correlate with DM and SOC, although we did not observe the previously reported negative correlations with IC and TRM. Furthermore, prior studies did not identify significant negative correlations between PT scores and SOM and AVD.

Complementary to previous research (Osma et al., 2021, 2023; Rosellini and Brown, 2014), this study examined the relationships between the primary and secondary dimensions of the MEDI and other variables related to mental health and well-being. First, by exploring the relationships between the two main scales of the MEDI (NT and PT) and the positive and negative affect scales of the PANAS-C, convergent validity evidence of between dimensions were established. These findings support the underlying models of Brown and Barlow (2009) and the tripartite model (Clark and Watson, 1991). As expected, NT and Negative affect showed positive correlations with each other and exhibited similar relationships with the secondary dimensions of the MEDI. The same pattern was observed between PT and Positive affect. The only difference is that the Positive affect scale of the PANAS-C demonstrated a negative correlation with NT, whereas in our results, this negative correlation previously reported in other studies between NT and PT (Osma et al., 2021, 2023; Rosellini and Brown, 2014) did not reach significance. Second, the relationships found between the psychopathology and MEDI scores provide evidence for the validity of the MEDI as a transdiagnostic tool to assess various mental health difficulties. These findings are congruent with previous studies where SDQ seems to be useful in capturing the transdiagnostic dimensions of different mental disorders (Bryant et al., 2020; Grasso et al., 2022). Third, the associations between well-being and health-related quality of life, measured by the KS-10, and MEDI dimensions showed that PT, might provide information about the presence or severity of emotional disorders, as suggested by Brown and Barlow (2009). The DM, AA, SOC, IC, and TRM dimensions were negatively associated with quality of life, providing further insight into the adverse effects on adolescents' subjective well-being. Adolescents with mental health problems show significantly impaired health-related quality of life, which affects educational, family, and social domains (Ravens-Sieberer et al., 2008, 2010).

These results throw new light on this research field that help improving the understanding of transdiagnostic dimensions. The results found might have potential clinical implications for conceptualization, assessment, intervention, and prevention emotional disorders at both clinical and educational settings. Transdiagnostic approaches are presented as tentative and valid alternatives to respond to diverse concerns about the current diagnostic systems (e.g., DSM, ICD) (Dalgleish et al., 2020). Deeper understanding of MEDI scores among adolescents at high risk for anxiety and depression disorders increases the effectiveness of the assessment of emotional disorders, allowing us to better understand transdiagnostic processes, and might inform the design and implementation of tailored transdiagnostic interventions. Study transdiagnostic cognitive and emotional factors and its links with risk and protective factors may provide a step-in order to prevent the development of multiple psychopathologies across developmental stages of emerging psychopathology. In addition, assess transdiagnostic dimensions beyond clinical walls, such as educational contexts, opening new possibilities for routine screening to improve the early and reliable identification of emotional disorders. As pointed out by the WHO (2021) prevention efforts in schools should be a priority and involve universal, selective and indicated prevention. The school setting has a role to play in promoting mental health and providing a safe an emotionally healthy environment. Investing in preventive transdiagnostic strategies might have the potential to enhance the psychological well-being of young people (Fusar-Poli et al., 2021).

The present study is not exempt of limitations. First, the use of solely self-reported information limits the conclusions drawn from this work. Second, the study is cross-sectional, precluding an examination of the temporal stability of MEDI dimensions. Finally, the gender imbalance, with 73.9 % of the sample identified themselves as female, represents a limitation for the study. This limitation is a common occurrence in research involving populations with emotional issues, given the higher prevalence among the female gender (World Health Organization, 2022).

The MEDI seems to be a brief tool with adequate psychometric properties to assess transdiagnostic dimensions of emotional disorders in adolescents with subthreshold depression and anxiety. In this context, and following the approach proposed by Rosellini and Brown (2019) and other previous investigations (Boettcher et al., 2020; Quilez-Orden et al., 2023; Rosellini et al., 2015), future studies should focus on the utilization of mixture modeling to explain and establish dimensional profiles of emotional psychopathology. In addition, follow-up studies would allow for the examination of the stability of MEDI dimensions over time, providing insights into the developmental trajectories of emotional symptoms across developmental stages. Furthermore, analyzing the links with protective and risk factors (e.g., bullying, suicidal behaviors) (Álvarez-Marín et al., 2022; Butler et al., 2022), as well as adding new psychometric models and digital assessment procedures (Elosua et al., 2023), to prevent mental health disorders in young people are relevant lines for future research.

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#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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We the undersigned declare that this manuscript is original, has not been published before and is not currently being considered for publication elsewhere. We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

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