Measuring the Behavioural Manifestations of Generalised Anxiety in Adolescents: Applying Network Psychometrics to the Worry Behaviors Inventory

Abstract

Background. Research into Generalised Anxiety Disorder (GAD) has historically focused on its cognitive and somatic elements, whilst behavioural manifestations have been overlooked. The development of the Worry Behaviors Inventory (WBI; Mahoney et al., 2016) addressed this gap, but this scale has not yet been validated for use with adolescents.

Aims. This study evaluated the WBI's psychometric properties in a community population of 13-18 year-olds.

Methods. Four hundred and forty-five young people completed the WBI. Data were randomly split into two samples; exploratory graph analysis (EGA) was applied to the first, and the emergent structure was subsequently confirmed with factor analysis (CFA). Convergent and divergent validity, measurement invariance across gender and age, and the sensitivity and specificity of the WBI in distinguishing low and moderate/severe generalised anxiety, were assessed.

Results. EGA identified a unidimensional structure with high consistency, and this was partly supported by CFA. However, pre-registered exploratory analyses revealed that the two-factor structure of the WBI (i.e., the original model identified in adult populations), also provided good fit to the data. Convergent validity was demonstrated, whilst evidence for divergent validity and measurement invariance was mixed.

Conclusions. This study established the psychometric properties of the WBI with adolescents, providing empirical support for both uni- and correlated two-factor models. Implications for theory, practice, and further research are discussed – in particular, the scope for co-developing an adapted version of the WBI with input from young people with lived experience, that better aligns with the unique psychosocial context of adolescence.

Key words: behaviours, GAD, adolescents, psychometric, worry, exploratory graph analysis

1. Introduction

Generalised Anxiety Disorder (GAD) is one of the most common mental health problems experienced by adolescents (Sadler et al., 2018). It is distinct from other anxiety disorders; rather than being centred on the avoidance of a specific feared stimulus (e.g., interpersonal interactions in social anxiety disorder, or separation from an attachment figure in separation anxiety disorder), it is characterised by excessive worry that is diffuse and hard to control. Reflecting this, avoidance is not listed as a defining feature of GAD in DSM-5 (American Psychiatric Association, 2013). However, this is at odds with the definition of worry as a cognitive phenomenon with behavioural consequences (Borkovec, 1998), and evidence showing that adults (Beesdo-Baum et al., 2012; Brown & Tung, 2018; Coleman et al., 2011; Mahoney et al., 2016; Mahoney, Hobbs, Newby, et al., 2018a, 2018b; Schut et al., 2001) and adolescents (Beesdo-Baum et al., 2019) with GAD engage in a myriad of 'safety-seeking' behaviours. Although carried out with the aim of abating a feared outcome, these prevent the disconfirmation of negative beliefs - and by extension, the amelioration of anxiety (Dugas et al., 2022; Gústavsson et al., 2021; Hebert & Dugas, 2019; Salkovskis, 1991; Wells, 1995). They are sometimes referred to as 'subtle avoidance behaviours', as they are discreet actions employed within a feared situation (Salkovskis et al., 1996; Thwaites & Freeston, 2005); for instance, arriving to every event with a Plan B, C and D, or delaying making decisions about worry triggers. These actions are related to, yet distinct from, direct avoidance of the situation altogether, which also features in the maintenance of worry and anxiety (Clark, 1989; Salkovskis, 1991).

Reflecting the importance of behavioural processes in GAD, Mahoney et al. (2016) developed the Worry Behaviors Inventory (WBI) for adults - a self-report measure with promising psychometric properties, although lacking somewhat in its specificity to GAD. Covering both safety-seeking and avoidance behaviours across two subscales, the 10-item WBI has satisfactory internal consistency (Mahoney et al., 2016) and treatment sensitivity (Green et al., 2021; Mahoney, Hobbs, Newby, et al., 2018b; Mahoney et al., 2019) in adults, and can discriminate between individuals with and without a probable diagnosis of GAD (Mahoney et al., 2016; Mahoney, Hobbs, Newby, et al., 2018b, 2018a; Mahoney et al., 2019). Evidence for divergent validity is strong for the total score and Safety-Seeking

Behaviours subscale, although the Avoidance subscale correlates with equal strength to GAD and depression (Mahoney et al., 2016; Mahoney, Hobbs, Newby, et al., 2018b, 2018a) – perhaps reflective of the commonality of avoidance across the internalising and mood disorders (Mahoney et al., 2016). However, WBI scores mediate the relationship between key psychological variables (intolerance of uncertainty, cognitive avoidance, and metacognitive beliefs) and GAD symptoms (Mahoney, Hobbs, Williams, et al., 2018). Therefore, despite lacking optimal broad specificity (i.e., ability to distinguish GAD patients from those with other anxiety or mood disorders; Garber & Hollon, 1991), the WBI has strong explanatory power for the phenomenology of GAD.

Although safety-seeking and avoidance behaviours play a part in adolescent GAD (Beesdo-Baum et al., 2019), and at surface-level the WBI appears suitable for this population, its psychometric properties have not yet been established in this age group. To address this gap, the current study assessed the validity of the WBI in a community sample of adolescents – capitalising on evidence that worry varies on a continuum of severity in the general population, from minor to levels considered clinically significant (Ruscio et al., 2001). Traditionally, researchers aiming to assess a questionnaire's properties would use exploratory or confirmatory factor analytic methods to identify its latent (underlying) variables. However, there are methodological concerns associated with these techniques – for example, the reliance on rules of thumb or subjective criteria (e.g., Scree plots) – and consequently, item assignments often differ across studies (Auerswald & Moshagen, 2019). Consequently, novel and robust methodologies are gaining momentum – most notably, Exploratory Graph Analysis (EGA; Golino et al., 2022; Golino & Epskamp, 2017), a relatively recent addition to the measurement validation toolbox that sits within the field of network psychometrics. With key benefits including regularisation procedures to filter out residual 'noise', visual representation of item clusterings, and automatic identification of dimensionality without the need for researcher input (Golino & Epskamp, 2017). EGA has been shown to meet or surpass the accuracy of extant factor analytic methods (Cosemans et al., 2022; Golino et al., 2020; Markos & Tsigilis, 2024) and thus has considerable potential for the development and validation of measures of cognitive, behavioural, and affective constructs. To further enhance the robustness of results, the emergent model was cross-validated with confirmatory factor analysis (CFA; Serafim et al., 2025).

This study had three aims:

1) To explore the clustering of WBI items using EGA.
2) To confirm the structure proposed by EGA with CFA.
3) To establish the validity of the WBI for use in adolescent populations. More specifically, to assess whether:
    a. The WBI shows convergent validity with measures of generalised anxiety symptoms and other psychological processes related to GAD (intolerance of uncertainty, negative metacognitive beliefs about worry, and negative problem orientation).
    b. The WBI shows divergent validity, such that its correlations with generalised anxiety symptoms are stronger than its correlations with symptoms of panic or depression.
    c. The WBI can discriminate between adolescents with low and moderate/severe generalised anxiety symptoms.
    d. The WBI shows measurement invariance across gender and age.

2. Methods

2.1. Participants

Eligible participants were 13-18 year-olds (in UK school years 9-13) who attended participating schools and community/youth organisations. There were no other exclusion criteria, as we wished to represent a diverse range of young people.

2.2. Ethical statement

Ethical approval was granted by the University of Oxford (R94040/RE004), and the study abided by the Ethical Principles of Psychologists and Code of Conduct as set out by the BABCP and BPS. All participants provided informed assent (plus parental consent) or consent, depending on age. The analysis plan was pre-registered on OSF (https://osf.io/6jyvk/).

2.3. Procedures

Prior to data collection, three females aged 13-17 years with lived experience of generalised anxiety provided feedback on the suitability of the wording, relevance, and comprehensibility of study materials. All WBI items were deemed suitable, and thus no adaptations were needed to this scale. Several minor edits were made to other measures (e.g., replacing *"kids"* with *"people my age"*).

Informed opt-out parent/carer consent and adolescent assent was obtained for young people in school years 9 to 11 (aged 13-16 years), whilst participants in school years 12 and 13 (aged 16-18 years) were classed as competent youths able to provide their own informed consent. Adolescents reported basic demographic information (age, gender, free school meal status (used as a proxy for socioeconomic status, SES) and ethnicity) and completed anonymous questionnaires either on paper forms or via a secure online platform (Qualtrics). Two attention checks were included, in which the correct response (e.g., "strongly disagree") had to be identified amongst four similar options. All data collection took place during school hours or within regular sessions of the youth organisation, under the supervision of a member of the research team.

2.4. Measures

Generalised Anxiety Disorder (GAD-7). The GAD-7 is a self-report measure of generalised anxiety symptoms which was developed for adults (Spitzer et al., 2006), but has since been validated for use with adolescents (Guzick et al., 2024; Löwe et al., 2008; Mossman et al., 2017; Romano et al., 2022; Tiirikainen et al., 2019). Each item (e.g., *"Not being able to stop or control worrying"*) is rated on a 4-point scale according to its frequency over the past two weeks. Total scores range from 0-21 and in line with existing psychometric studies, ≥ 10 was set as the threshold for at least moderate generalised anxiety symptoms (Casares et al., 2024; Guzick et al., 2024; Tiirikainen et al., 2019).

Worry Behaviors Inventory (WBI). The WBI is a self-report measure of the behaviours associated with GAD (Mahoney et al., 2016). It comprises 10 items assessing safety-seeking and avoidance behaviours (e.g., *"I avoid situations or people that worry me"*). Items are

rated on a 5-point scale with total scores ranging from 0-40 (comprising 0-28 for the safety-seeking and 0-12 for avoidance subscales, as defined by Mahoney et al., 2016), and the scale has been validated in clinical and community adult populations (Mahoney, Hobbs, Newby, et al., 2018a, 2018b).

Short Mood and Feelings Questionnaire (SMFQ). The SMFQ is a 13-item self-report measure of the cognitive, emotional, and physiological symptoms of depression in children and young people (Angold et al., 1995) which has been widely used in research (e.g., Rhew et al., 2010; Thabrew et al., 2018). In this study, it was used to determine the divergent validity of the WBI. Its items (e.g., *"I felt miserable or unhappy"*) are rated on a 3-point scale from 0 ("*Not true*") to 2 ("*True*"), with total scores ranging from 0-26 and the threshold for at least moderate depression set at SMFQ total ≥ 11 (McKenzie et al., 2011; Patton et al., 2008).

Panic Disorder Severity Scale for Children (PDSS-C). The PDSS-C is a 7-item measure of the frequency of panic symptoms, and associated distress, anticipatory anxiety, avoidance, and functional impairment that has been validated for use with adolescents (Elkins et al., 2014). Each item is rated from 0 to 4, with higher sum scores indicating more severe panic symptoms. As there is no published adolescent-specific threshold for the PDSS-C, the presence of at least moderate panic symptoms was based on the adult cut-off score of 8 (Shear et al., 2001). It was used in this study to assess the divergent validity of the WBI.

Intolerance of Uncertainty Scale for Children – 5-item version (IUSC-5). A 5-item version of the IUSC (Comer et al., 2009), which addresses emotional, cognitive and behavioural responses to uncertainty, was used to assess the convergent validity of the WBI. This version of the IUSC was developed by Fialko et al. (2012) and whilst not formally validated, has shown good internal consistency in clinical and non-clinical child and adolescent populations (Fialko et al., 2012; Perrin et al., 2019). Items (e.g., *"I can't be relaxed if I don't know what will happen tomorrow"*) are rated on a 5-point scale, with sum scores ranging from 5-25.

Negative Problem Orientation Questionnaire – 5-item version (NPOQ-5). The 5-item version of the NPOQ was used to determine the convergent validity of the WBI; this brief

scale was developed by Perrin et al. (2019) and comprises statements drawn from the adult questionnaire (Robichaud & Dugas, 2005). Whilst not thoroughly validated, the NPOQ-5 has shown excellent internal consistency in a clinical child and adolescent sample (Perrin et al., 2019). Items (e.g., *"I often doubt my ability to solve problems"*) are rated from 1-5 with higher scores are indicative of lower confidence in one's ability to solve problems, and a greater tendency to view problems as insurmountable.

Beliefs About Uncontrollability and Danger Subscale from the Metacognitions Questionnaire-Adolescent version (MCQ-A). This six-item subscale from the MCQ-A (Cartwright-Hatton et al., 2004) captures adolescents' beliefs in the threat posed by worry (e.g., *"When I start worrying, I cannot stop")*, and therefore was used in this study to assess the convergent validity of the WBI. Items are rated on a 4-point scale, with sum scores ranging from 4-16 and higher scores indicative of more negative appraisals of worry. The MCQ-A is recommended for use with adolescent populations given its strong psychometric properties (Myers et al., 2019).

3. Statistical Analyses

3.1. Missing Data

Questionnaires with > 10% missing items were excluded, and where ≤ 10% of data were missing, items were pro-rated with the participants' mean of the items that they did complete for that questionnaire. Little's (1988) Missing Completely at Random (MCAR) test was conducted and followed up with descriptive checks – e.g., comparing subsets of data with and without missing values to identify group-level demographic differences. The proportion of complete questionnaires ranged from 97.3% to 84.3% (see Supplementary Materials, Table S1), and pro-rating occurred in only 13 instances.

3.2. Statistical Plan

Initial Analyses

Analyses were conducted with R v.4.5.1 (R Core Team, 2025). Following preliminary checks to assess missing data, distribution, and the internal consistency of (sub)scales, the

dataset was randomly divided into two with the split_data function from the ‘dplyr’ package (Wickham et al., 2023). One sample was used for EGA and the second for CFA (see S2 for demographic and descriptive statistics by sample), whilst the full dataset was used for assessment of validity and measurement invariance. Rates of endorsement and floor/ceiling effects (defined as > 15% of scores falling at the top or bottom of the scale; Terwee et al., 2007) were evaluated for the WBI. Pearson’s correlations between variables were calculated.

Phase One – Exploratory Graph Analysis

Before conducting EGA, weighted topological overlap (wTO) was calculated; this metric quantifies the overlap between nodes’ shared connections, and should be minimised to increase network stability (Christensen et al., 2023). Subsequently, EGA was conducted with the ‘EGAnet’ package, following the four-step approach of Golino and Christensen (2019). The GLASSO method and ‘walktrap’ community detection algorithm were used, and structural stability was assessed using non-parametric bootstrapping ('bootEGA'; Christensen & Golino, 2021). Five hundred bootstrapped models were generated, from which median partial correlations were derived and used to estimate a typical network with metrics of structural consistency, item stability, and revised network loadings (Christensen et al., 2025).

Phase Two – Confirmatory Factor Analysis

CFA, adopting the weighted least squares mean and variance adjusted method (WLSMV), cross-validated the model determined by EGA. Multiple fit indices were computed: chi-squared goodness of fit, standardised root mean square residual (SRMR), root mean square error of approximation (RMSEA), the comparative fit index (CFI) and the Tucker-Lewis Index (TLI). The guidelines for acceptable fit were CFI or TLI ≥0.95, RMSEA < 0.05, and SRMR < 0.08, of which at least two had to be achieved for the model to be deemed adequate (Hu & Bentler, 1998, 1999; Schreiber et al., 2006). The chi-squared statistic is reported for completeness but should be interpreted with caution given its sensitivity to trivial model misfits at large sample sizes (Alavi et al., 2020). Indeed, all fit indices can be influenced by incidental parameters (e.g., the magnitude of factor loadings)

and thus should not be interpreted as ‘golden rules’ (Beierl et al., 2018; Flores-Kanter et al., 2021).

We also pre-registered an exploratory CFA; if the best-fitting model identified by EGA differed to the two-factor model proposed by Mahoney et al. (2016), we planned to also assess the fit of the latter.

Phase Three – Validity and Measurement Invariance

Pearson’s correlations were assessed to determine convergent and divergent validity, and Steiger’s z-test was checked for significant differences between dependent correlations. WBI scores were compared across groups of adolescents who reported ‘low’ or ‘moderate/severe’ generalised anxiety, panic, and depression symptoms, respectively. Receiver Operating Characteristic (ROC) analyses evaluated the sensitivity and specificity of the WBI’s ability to discriminate between the low and moderate/severe generalised anxiety groups. Finally, the measurement invariance of the WBI across gender and age was assessed with multiple group CFA (Milfont & Fischer, 2010). For the latter, participants in school years 9-11 were categorised as ‘younger adolescents’ and those in school years 12-13 comprised the ‘older adolescents’ group. Full invariance was concluded if the first three stages were established (as residual invariance is typically too constrained to achieve in practice; Wang et al., 2018), and partial invariance was deemed present if at least two items showed invariant loadings and thresholds (Gregorich, 2006).

4. Results

4.1. Sample Characteristics

Of the 537 adolescents who took part, 445 (82.9%) passed at least one attention check and thus comprised the final sample. The demographic composition of the study population was approximately representative of the UK in terms of ethnicity (Office for National Statistics, 2022), although the proportion receiving free school meals fell just short of the national average (Department for Education, 2025; see Table 1).

Participants who failed both attention checks were significantly younger than those who passed at least one (M = 14.32 years and M = 15.78 years, respectively; (t(93.90) = 9.39, p < .001, d = 0.88, 95% CI [0.58-1.17]). There were no significant differences in gender (p =.26, Cramer's V = 0.02 [0.00-1.00]) or SES (p = .313, Cramer's V = 0.006, 95% CI [0.00-1.00]); see S3 in the Supplementary Materials.

[insert Table 1 here]

4.2. Preliminary Checks

Table 2 provides descriptive and internal consistency statistics for the full dataset (n = 445; see S4 for scatter plots). Little's test suggested that data were not missing completely at random; participants with incomplete data were significantly younger (t (202.76) = 4.77, p < .001, d = 0.51, 95% CI [0.29-0.73]) and more likely to be male (c^2 (1) = 25.10, p < .001, Cramer's V = 0.24, 95% CI [0.16-1.00]) than those without. Ten outliers were identified but retained, as they were deemed to reflect true variation in the data (as a pre-registered sensitivity check, all analyses were repeated without outliers; see S5). No floor/ceiling effects were identified for the total WBI score (see S6). Item endorsement is presented in Table 3.

[insert Table 2 here]

[insert Table 3 here]

There were no significant differences in demographics or symptom measures between the two randomly sampled groups.

4.3. Sample 1: Bootstrapped Exploratory Graph Analysis (bootEGA)

Figure 1 shows the typical network generated by bootEGA, which supports a single factor structure of the WBI (CI around the median = 0.84). This was replicated across 92% of bootstrap samples.[1]

[insert Figure 1 here]

Four item pairs (items 2 and 9, and items 7 and 8) had wTO values exceeding the pre-registered threshold (both = .32); however, no items were collapsed as the 10-item single-factor structure already had robust structural consistency. This was evidenced by exact replication across bootstrap samples surpassing 90% (Flores-Kanter et al., 2021; Ribeiro Santiago et al., 2022), and high item stability (see S7).

Factor loadings are reported in Table 4. According to Christensen et al.'s (2025) criteria, three items had strong loadings (items 8, 9 and 2), five had moderate loadings (items 10, 6, 3, 7, and 4), and two (items 5 and 1) were only weakly associated with the single dimension.

[insert Table 4 here]

4.4. Sample 2: Confirmatory Factor Analysis

Of all the fit indices for the uni-dimensional model, only SRMR was of an acceptable level (0.069); none of the remaining scaled metrics satisfied Hu and Bentler's (1999) criterion for good model fit (c^2 (35) = 91.7, $p < .001$), RMSEA = 0.122), and scaled CFI and TLI ≤ 0.95 (CFI = 0.931 and TLI = 0.912). However, standardised factor loadings ranged from 0.49 - 0.80 (see Table 4) and therefore universally exceeded Floyd and Widaman's (1995) threshold of at least .30 for meaningful items. Residuals ranged from 0.36-0.76.

[1] Golino et al. (2020) suggest that to test whether a factor is unidimensional, the parameters of the EGA model should be adjusted such that the number of variables (nvar) is equal to the number in the dimension being tested. As an unplanned exploratory analysis, we therefore computed an EGA model with nvar = 10 (rather than the default of nvar = 4), and retrieved the same unidimensional structure.

4.5. Sensitivity Analyses

Analyses were repeated with outliers removed, revealing no major differences relative to the primary analysis with the exception of a slightly higher optimal cut-off score (see S5).

A second CFA was conducted for the correlated two-factor model proposed by Mahoney et al. (2016). Once again, the scaled c^2 goodness-of-fit test was significant ($c^2(34) = 89.4$, $p < .001$) and scaled RMSEA exceeded the 0.05 threshold (0.085). However, all other indices suggested a good fit (SRMR = 0.053, CFI = 0.967, TLI = 0.957). Standardised item loadings ranged from 0.50-0.81 for the Safety-Seeking behaviours factor, and 0.62-0.73 for the Avoidance factor (see Table 4), and the standardised latent correlation between the two factors was large ($r = .73$). A scaled c^2 difference test comparing the single and two-factor models was significant, confirming that the more complex two-factor model was the better fit (c^2 (34) = 52.06, $p < .001$). The internal consistency of both subscales was good (Avoidance, a = .72 and w = .74; Safety-Seeking Behaviours, a = .84 and w = .85).

4.6. Convergent Validity, Divergent Validity, and Measurement Invariance

Significant positive correlations were present between the WBI total score and symptoms of GAD, panic and depression, in addition to cognitive variables related to GAD (intolerance of uncertainty, negative problem orientation, and negative metacognitive beliefs about worry; see S8 in the Supplementary Materials). Correlations were significantly stronger between WBI and GAD symptom scores, than between WBI and panic or depression symptom scores (Steiger's z = 6.02, $p < .001$ and z = 4.54, $p < .001$, respectively). At item level, *9 ("I overplan activities")* showed the strongest correlation with the GAD-7 ($r = .52$), and items 2 (*"I make plans 'just in case'"*), 6 (*"I check to make sure nothing bad has happened"*) and 9 had the highest item-total correlations (all $r = .71$; see S9 in the Supplementary Materials).

WBI scores were significantly higher in the moderate/severe generalised anxiety group (M = 24.41) than the low generalised anxiety group ($M = 14.51$; $t(312.65) = -12.72$, $p < .001$, $d = -1.28$, 95% CI [-1.50—1.06]). Scores were also elevated in the moderate/severe panic group ($M = 23.12$) relative to the low panic group ($M = 15.28$; $t(238.47) = -8.88$, $p < .001$, $d =$

-0.99, 95% CI [-1.22 - -0.76]), and in the moderate/severe depression group (M = 22.75) relative to the low depression group (M = 14.45; t(336.89) = -9.93, p < .001, d = -1.04, 95% CI [-1.26 - -0.82).

The ROC curve (see S10) trended towards the top left corner with AUC = .82 (95% CI .78 - .86). A cut-off total score of 16.5 (rounded up to 17) on the WBI was identified as the optimal balance between specificity (.64) and sensitivity (.86).

The WBI did not show measurement invariance across gender; whilst criteria for configural invariance was met, metric invariance was not demonstrated given that neither the RMSEA nor the SRMR fell below their respective cut-offs (albeit by a small margin of 0.002 for SRMR). In contrast, partial invariance for age was demonstrated as across all four stepped models, fit indices met Hu and Bentler's (1999) criterion, and estimated thresholds and loadings were invariant across groups for all items. However, full invariance was not supported as the drop in RMSEA from metric to scalar models exceeded the -0.010 criterion set by Rutkowski and Svetina (2014); see S11. In the test of scalar invariance, both factor loadings and thresholds were constrained, as is recommended for ordinal indicators (Bowen & Masa, 2015).

5. Discussion

This study assessed the psychometric properties of the WBI amongst an adolescent community population. A two-step approach was taken, with state-of-the-art EGA detecting a stable unidimensional structure and CFA confirming substantial loadings on the single factor although fit indices did not fully support the model. Additionally, a planned exploratory analysis (CFA) found that the original two-factor solution proposed by Mahoney et al. (2016) in adults was a good fit to the data, as supported by both factor loadings and fit indices. The total score demonstrated good convergent validity with measures of GAD symptoms and related cognitive processes; however, its strong correlations with panic and depression symptoms indicated poorer divergent validity and specificity was relatively low.

Whilst all items in WBI are statistically valid, at a pragmatic level there appears to be potential for at least one to be removed, which would reduce burden on adolescents and assessors. Specifically, in the EGA, item stability co-efficients exceeded .90 without exception, and the single-factor structure replicated across 92% of bootstrap samples. However, weighted topological overlap values exceeded the threshold for four item pairs, reflecting the similarity in the concepts that they tap – for instance, items 2 and 9, which refer to *"making plans 'just in case'"* and the tendency to *"overplan activities"*. The fit of this unidimensional model was partly supported by CFA with all items loading on the common latent factor; however, fit indices (with the exception of SRMR) failed to meet standard thresholds. This may reflect the hypersensitivity of fit indices to minor model misspecifications – for instance, when factor loadings and correlations are high (Garrido et al., 2016; Sellbom & Tellegen, 2019; Shi et al., 2019). Consequently, it is recommended that they are considered in conjunction with theory rather than as inviolable golden rules (Flores-Kanter et al., 2021; Garrido et al., 2016).

Both unidimensional and correlated two-factor models showed good fit to the WBI, with preference for one over the other dependent on the analysis method (EGA or CFA, respectively); this finding can be accounted for by the different parameters and sensitivities of the two techniques. Although the three items comprising Mahoney and colleagues' 'Avoidance' subscale did not form a distinct cluster in the EGA model, one of its items (8; *"I avoid saying or doing things that worry me"*) was strongly related to both the others in the subscale: items 7 (*"I avoid situations or people that worry me"*) and 4 (*"I delay making decisions…"*). However, no edge was present between items 4 and 7 - perhaps reflecting the fact that delayed decision-making is a less overt form of avoidance. Meanwhile, all three nodes showed conditional relationships with others that captured safety-seeking and overall, EGA found that the optimal data-driven solution was a unidimensional one. Yet CFA indicated that this single-factor structure was inferior in fit to the two-factor structure; this apparently contradictory result may be explained by the fact that unlike EGA, CFA is model-driven, uses covariances, and is more sensitive to subtle item clusterings (Calderón Garrido et al., 2019). In our adolescent sample, avoidance may have represented a small yet coherent subdimension of worry-related actions which was significant enough to be identified by CFA, but comprised too few items and was not sufficiently distinct to be

distinguished by EGA (Golino et al., 2022; Golino & Epskamp, 2017). This is further supported by the strong correlation between the two factors in the CFA (r = .73), which indicates that safety-seeking and avoidance are not empirically identical, but reflect closely-linked aspects of worry-related behaviours. As EGA is a more robust method than traditional factor analytic methods (Golino et al., 2020), and in light of the close relationship between the safety-seeking and avoidance factors in the CFA, we favour EGA's indicated (unidimensional) model but note that the correlated two-factor model also has statistical support.

Whilst the WBI can help build a better understanding of the behavioural profile of GAD, it does not appear to capture a disorder-specific construct, and therefore when taken in isolation, may therefore not be best-suited to identifying high levels of generalised anxiety in adolescents. Analyses indicated that a score of at least 17 may be expected in young people with moderate or severe GAD symptoms; this is the same threshold identified by Mahoney et al. (2016), but with slightly better sensitivity (86% versus 72%). However, the relatively low specificity across both studies (64-66%) indicates high possibility of false positives, and the measure showed poor divergent validity. This was demonstrated in the small mean differences in WBI scores across the moderate/severe generalised anxiety and panic, and moderate/severe generalised anxiety and depression groups (M_{diff} = 1.29 and M_{diff} = 1.35, respectively).

One explanation for these findings is the transdiagnostic nature of worry and associated behaviours. Although worry is the hallmark feature of GAD, it is elevated across all anxiety and mood disorders (Ehring et al., 2024). It is plausible that, for instance, an individual who is worried about having a panic attack may endorse the WBI item referring to 'avoidance of situations that worry me' to the same degree as someone whose main presenting problem is generalised anxiety, albeit with a different reason underlying their response. Equally, the close conceptual links between GAD and depression may be a contributing factor in the strong correlation between worry-related behaviours and depressive symptoms. Both are conceptualised as distress disorders in hierarchical taxonomic models (Kotov et al., 2017), and have been found to share genetic and environmental risk factors (Morneau-Vaillancourt et al., 2020; Waszczuk et al., 2016).

An alternative (but not mutually exclusive) explanation for the relatively poor observed specificity of the WBI involves our measurement of GAD symptoms. We used the GAD-7 as it is a widely-used screening and severity measure for generalised anxiety which has been validated for use in adolescents (Guzick et al., 2024; Löwe et al., 2008; Mossman et al., 2017; Romano et al., 2022; Tiirikainen et al., 2019). However, its items tap largely generic symptoms of anxiety and depression – such as restlessness, nervousness, and irritability – rather than focusing specifically on the cardinal characteristics of GAD (Spitzer et al., 2006). Future research may therefore benefit from employing an alternative self-report measure that aligns more closely with each symptom of GAD as outlined in the diagnostic criterion.

Nevertheless, the limited divergent validity observed in this study does not necessarily detract from the potential clinical use of the WBI, which showed good convergent validity by its associations with GAD-relevant cognitive processes, and stronger correlations with GAD symptom scores than with panic or depression symptom scores. Consequently, the WBI may still be a helpful tool for conceptualising the behavioural patterns associated with GAD.

Average levels of worry-related behaviours were high; this could be due to the sample's elevated anxiety and depression symptoms, but might alternatively be a sign that the WBI's items have less clinical meaning in adolescents compared to adults. Highlighting this, the mean WBI score in the current study was 77% greater than that reported in Mahoney et al.'s (2018b) community adult population - indeed, it was closer to the average score of their treatment-seeking group (M = 19.03). Whilst this could be explained by the large proportion of our respondents who reported at least moderate internalising symptoms (35% and 43% for generalised anxiety and depression, respectively), it may also indicate an issue with the suitability of the measure for this age group. The WBI might be capturing behaviours which are associated with pathological worry in adulthood, but are simply more normative within the psychosocial context of adolescence. As an example, over 40% of adolescents in this study reported delaying or avoiding independent decision-making "most or all of the time" – a much larger proportion that the 26% who endorsed these options in Mahoney et al.'s (2018a) clinical adult population. It is possible that a greater propensity for delayed decision-making is typical of adolescents in general, perhaps driven by lower levels of

autonomy compared to adults or heightened desire to align decisions with their peers (Lashbrook, 2000). Thus, this behaviour might have less explanatory power in relation to pathological worry for adolescents.

Equally misaligned with the specific characteristics of this developmental stage, the WBI assesses reassurance-seeking from inanimate sources (*"personal records*, *internet*, *reviews*, *books")*, but not from interpersonal sources. Thus, in its current form, the WBI may be missing a key social component of worry-related behaviours that could be particularly pertinent during adolescence – a stage of life characterised by greater dependency on peers and parents for emotional support and reassurance (Adams & Berzonsky, 2006; Steinberg, 2001).

The strengths of this study include its advanced analysis and large community sample; however, its limitations must also be considered. We were unable to assess temporal stability, and the over-representation of females in our sample may have biased results. Furthermore, a relatively high proportion of young people failed to pass at least one attention check question and whilst their exclusion from the final sample increases our confidence in the integrity of the data, it also reduces statistical power. Lastly, the elevated levels of mental health difficulties reported by our population may have influenced response patterns. Therefore, future studies should validate the WBI in a larger sample, ideally comparing its performance across both clinical and non-clinical adolescents.

Overall, this study provides initial support for the validity of the WBI for use among adolescents - and by extension, the relevance of worry-related behaviours to generalised anxiety symptoms in this age group. However, results imply that this measure, which was developed with adults in mind, would benefit from adaptation before being used more widely with young people. As such, further work should look to co-develop an adolescent-specific measure of safety-seeking and avoidance behaviours, including the voices of individuals with lived experience of GAD.

6. References

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