Journal of Affective Disorders 357 (2024) 116–125

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research paper

# Alexithymia profiles and depression, anxiety, and stress

David A. Preece [a,b,c,*], Ashish Mehta [b], Kate Petrova [b], Pilleriin Sikka [b,d,e,f], Ethan Pemberton [g], James J. Gross [b]

[a] Curtin University, Curtin enAble Institute & School of Population Health, Australia
[b] Stanford University, Department of Psychology, Stanford, United States of America
[c] The University of Western Australia, School of Psychological Science, Australia
[d] University of Turku, Department of Psychology and Speech-Language Pathology, Finland
[e] University of Turku, Turku Brain and Mind Center, Finland
[f] University of Skövde, Department of Cognitive Neuroscience and Philosophy, Sweden
[g] Edith Cowan University, Psychology Department, Perth, Australia

ARTICLE INFO

*Keywords:*
Alexithymia
Depression
Anxiety
Psychopathology
Perth alexithymia questionnaire
Depression Anxiety Stress Scales-21

ABSTRACT

*Background:* Alexithymia is a multidimensional trait comprised of difficulties identifying feelings, difficulties describing feelings, and externally orientated thinking. It is regarded as an important risk factor for emotional disorders, but there are presently limited data on each specific facet of alexithymia, or the extent to which deficits in processing negative emotions, positive emotions, or both, are important. In this study, we address these gaps by using the Perth Alexithymia Questionnaire (PAQ) to comprehensively examine the relationships between alexithymia and depression, anxiety, and stress symptoms.

*Methods:* University students ($N$ = 1250) completed the PAQ and the Depression Anxiety Stress Scales-21. Pearson correlations, hierarchical regressions, and latent profile analysis were conducted.

*Results:* All facets of alexithymia, across both valence domains, were significantly correlated with depression, anxiety, and stress symptoms ($r$ = 0.27–0.40). Regression analyses indicated that the alexithymia facets, together, could account for a significant 14.6 %–16.4 % of the variance in depression, anxiety, and stress. Difficulties identifying *negative* feelings and difficulties identifying *positive* feelings were the strongest unique predictors across all symptom categories. Our latent profile analysis extracted eight profiles, comprising different combinations of alexithymia facets and psychopathology symptoms, collectively highlighting the transdiagnostic relevance of alexithymia facets.

*Limitations:* Our study involved a student sample, and further work in clinical samples will be beneficial.

*Conclusions:* Our data indicate that all facets of alexithymia, across both valence domains, are relevant for understanding depression, anxiety, and stress. These findings demonstrate the value of facet-level and valence-specific alexithymia assessments, informing more comprehensive understanding and more targeted treatments of emotional disorder symptoms.

## 1. Introduction

*Alexithymia*, meaning "no words for emotions" in Greek, was first coined in the 1970s by American psychiatrists to describe a set of emotion processing deficits they often observed in their patients (Sifneos, 1973). Since this time, a large body of empirical work has supported the status of alexithymia as a multidimensional trait with three core facets[1]: *difficulties identifying one's own feelings* (DIF), *difficulties describing one's own feelings* (DDF), and an *externally orientated thinking style* (EOT) characterized by limited attention to emotions (for a review, see Preece and Sikka, 2024). As formulated within the *attention-appraisal model of alexithymia* (Preece et al., 2017; Preece and Gross, 2023) and *process model of emotion regulation* (Gross, 1998, 2015), emotion processing involves a sequence of stages whereby an emotion becomes the focus of *attention* and then is *appraised* in terms of what it is and what it means, with that appraisal then informing subsequent emotion

* Corresponding author at: Curtin University, Curtin enAble Institute, Kent Street, Bentley 6102 WA, Australia.
*E-mail address:* david.preece@curtin.edu.au (D.A. Preece).

[1] We use the term *facet* here to refer to the different sub-components of the alexithymia construct. This is terminology commonly used in the alexithymia field to refer to the DIF, DDF, and EOT facets of alexithymia (e.g., Luminet et al., 2021; Preece and Sikka, 2024).

https://doi.org/10.1016/j.jad.2024.02.071
Received 11 July 2023; Received in revised form 15 February 2024; Accepted 19 February 2024
Available online 20 February 2024
0165-0327/© 2024 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

regulation decisions. People high in alexithymia have difficulty at the attention (i.e., EOT) and appraisal (i.e., DIF and DDF) stages of emotion processing (Preece and Gross, 2023); they experience their emotions in a more undifferentiated manner, such as being unsure whether a negative emotion is sadness, anger, or fear (Lane and Schwartz, 1987). Such difficulties appear to be due to a combination of *ability deficits* (i.e., poor development in those cognitive structures used to process emotions; Luminet et al., 2021) and *avoidance* (i.e., regular use of experiential avoidance of emotions; Panayiotou et al., 2015; Preece et al., 2023).

Alexithymia is normally distributed in the general population, with around 10 % of people having problematically high levels of alexithymia (Parker et al., 2008). Rates are usually much higher in clinical samples, with around 30–50 % of patients having high alexithymia (e.g., McGillivray et al., 2017). Indeed, alexithymia has been established as an important transdiagnostic risk factor for a variety of emotion-based psychopathologies,[2] including depression, anxiety disorders, eating disorders, psychosomatic disorders, personality disorders, and substance use (e.g., Bankier et al., 2001; Taylor et al., 1999). Much of this relationship between alexithymia and psychopathology risk appears to be explained by emotion regulation deficits associated with alexithymia, whereby alexithymia can impair down-stream emotion regulation, predisposing people to disorders with dysregulated levels of affect (Gross, 2015; Preece et al., 2022).

Over the past few decades, the majority of the alexithymia literature has used the 20-item Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994) to operationalise alexithymia and explore its relationships with psychopathology symptoms. This has produced an important body of literature, consistently finding that overall levels of alexithymia are significantly higher in various psychiatric groups compared to general community samples (e.g., Bankier et al., 2001; McGillivray et al., 2017), and that alexithymia tends to be moderately to strongly associated with levels of depression and anxiety symptoms, with correlations usually around 0.30 to 0.50 (e.g., Li et al., 2015; Müller et al., 2003). For example, a meta-analysis of 19 studies found that overall alexithymia, as assessed by the TAS-20 total score, was moderately associated with self-report or observer-rated psychometric markers of depression, across patient ($r = 0.39$), community ($r = 0.41$), and student ($r = 0.46$) samples (Li et al., 2015). Similar findings have been documented in studies comparing patient and non-patient groups on their alexithymia levels. For instance, Marchesi et al. (2000) found that TAS-20 total scores were significantly higher in patients diagnosed with a depressive disorder ($n = 49$) or an anxiety disorder ($n = 64$), compared to healthy controls ($n = 113$).

A limited number of studies have also extracted DIF, DDF, and EOT subscale scores from the TAS-20, to try to examine relationships between specific alexithymia facets and depression and anxiety. Jakobson and Rigby (2021), for example, used latent profile analysis to derive several alexithymia subtypes or profiles from TAS-20 subscale scores, finding two alexithymic subtypes (a subtype high in all three alexithymia facets, and a subtype high in DIF and DDF but not in EOT), and three non-alexithymic subtypes (one subtype with average levels in all facets, one subtype low in all facets, and one subtype low in DIF and DDF but average for EOT) (see also, Kajanoja et al., 2017). Levels of depression and anxiety symptoms were highest amongst the two alexithymic profiles, with the highest symptoms being present for the profile that had the highest levels of DIF and DDF (but non-elevated EOT) . However, three limitations of the TAS-20 limit the conclusions that can be drawn from this existing work and suggest the need for additional research (Kooiman et al., 2002; Leising et al., 2009; Preece et al., 2024).[3]

First, the TAS-20 was designed only to provide a total scale score, and the developers of the TAS-20 advise against extracting any subscale scores corresponding to the facets of alexithymia (i.e., DIF, DDF, and EOT) (Bagby et al., 2007). If facet scores are extracted, the EOT items have poor reliability (usually around Cronbach's $\alpha = 0.50–0.60$; Kooiman et al., 2002) and thus do not meet established psychometric thresholds for use in research or clinical settings (Groth-Marnat, 2009). Consequently, it remains unclear from the TAS-20 work whether specific facets of alexithymia might be particularly relevant to certain psychopathologies, or how distinct profiles of alexithymia at the facet level might characterize different psychopathology symptom categories. Given that factor analyses consistently support that alexithymia is a multidimensional construct (i.e., comprised of multiple separable facets, rather than just a single general factor; Chan et al., 2023), there is significant statistical value in understanding alexithymia at the facet level. Building on these established factor analytic patterns, a higher resolution view of alexithymia might therefore be usefully harnessed to also better understand links with psychopathology.

Second, in the broader emotion field, it has been widely established that other emotional constructs (e.g., emotion regulation, emotional reactivity, beliefs about emotions) can have differential relationships with psychopathology depending on whether the emotions in question are negatively or positively valenced (e.g., Becerra et al., 2020;

[2] We use the term *psychopathology* throughout this manuscript to refer to mental health disorders and symptoms, such as depression and anxiety, thus aligning with its usage in popular frameworks like the DSM-5-TR (American Psychiatric Association, 2022) and HiTOP (Kotov et al., 2017). We use the term *transdiagnostic* to refer to factors that are relevant to many different categories of mental disorders (Krueger and Eaton, 2015; Dalgleish et al., 2020).

[3] There is also a body of work that has used the Bermond-Vorst Alexithymia Questionnaire (BVAQ) to examine different alexithymia subtypes (e.g., Bermond et al., 2007; Bermond et al., 2006; Moormann et al., 2008). The BVAQ is unique in the alexithymia field in that it is based on an alternative theory of alexithymia that considers both *difficulties fantasizing* and *low emotional reactivity* to be additional facets of alexithymia (Vorst and Bermond, 2001). Bermond et al. (2007) consider DIF, DDF, and EOT to conceptually form a broader construct they call *cognitive alexithymia*, and difficulties fantasizing and low emotional reactivity to conceptually form a separate (uncorrelated) construct they call *affective alexithymia*. They have proposed a set of subtypes based on these conceptual distinctions and have published several studies using cognitive alexithymia and affective alexithymia composite scores from the BVAQ (e.g., Bermond et al., 2007), but to date statistical findings have not aligned with the predictions of their framework (e.g., Bagby et al., 2009). One key issue with the inclusion of low emotional reactivity in the construct is that alexithymia (DIF, DDF, EOT) is typically associated with experiencing significantly higher levels of negative emotion (for a review, see Preece and Gross, 2023), and that the BVAQ subscale assessing emotional reactivity has been found to have poor validity (because it does not separate between emotional reactivity for negative emotions and emotional reactivity for positive emotions, which elsewhere are established as negatively correlated dimensions; for a review, see Preece et al., 2020a). There are also other psychoanalytic theorists that consider difficulties fantasizing (but not low emotional reactivity) part of the alexithymia construct alongside DIF, DDF, and EOT, proposing that these four facets should all correlate positively (Taylor et al., 2023). However, there is now a large body of empirical findings indicating that difficulties fantasizing is, statistically, not part of the alexithymia construct; it does not load on the same latent factor in factor analysis, and is often uncorrelated (or negatively correlated) with DIF and DDF (e.g., Preece et al., 2020a; Watters et al., 2016). Consequently, items on difficulties fantasizing are not included in most psychometric measures of alexithymia (e.g., Bagby et al., 1994). There remains an ongoing conceptual debate in the field between cognitive behavioral (Preece and Gross, 2023) and psychoanalytic (Taylor et al., 2023) theorists about whether difficulties fantasizing is part of the alexithymia construct. In our view, the cognitive behavioral definition of alexithymia (i.e., the attention-appraisal model) presently has the strongest empirical evidence-base, as it conceptualizes alexithymia as a construct exclusively about emotion processing, comprised of DIF, DDF, and EOT (for a review, see Preece and Gross, 2023). As such, this is the theoretical framework we adopt for the current paper, and we do not consider data on difficulties fantasizing or low emotional reactivity to be relevant to our research question. For more information about the cognitive-behavioral perspective on this definitional issue, readers are directed to Preece and Gross (2023), and for the psychoanalytic perspective, readers are directed to Taylor et al. (2023).

Hechtman et al., 2013; Gruber, 2011). The same is likely true for alexithymia, given that brain imaging studies have shown that alexithymia reflects deficits in the processing of both negative and positive emotions (for a meta-analysis see van der Velde et al., 2013). The TAS-20 provides no valence-specific scores and appears to measure alexithymia only for negative emotions (e.g., Chan et al., 2023; Preece et al., 2020b), so it is unclear from research based on the TAS-20 whether (and to what extent) deficits in the processing of positive emotions may also relate to psychopathology.

Finally, recent work with the TAS-20 has highlighted that its DIF items appear to have discriminant validity issues against markers of psychological distress. That is, in factor analysis, much of the variance in the TAS-20 does capture alexithymia, but a significant portion of its variance also captures individuals' current distress levels (e.g., Leising et al., 2009; Marchesi et al., 2014; Preece et al., 2020c, 2024; Veirman et al., 2021). This appears to be attributable to the fact the TAS-20 includes some DIF items like "I have physical sensations that even doctors don't understand", which can conceptually overlap with somatic symptoms of affective disorders. These discriminant validity considerations mean that the TAS-20 may not be the optimal measure to use in determining the extent to which alexithymia, as a distinct construct, is a risk factor for psychopathology.

### 1.1. The present study

The present study aimed to comprehensively examine the relationship between alexithymia and psychopathology symptoms. We sought to do this by utilising the recently developed Perth Alexithymia Questionnaire (PAQ; Preece et al., 2018), which has demonstrated strong validity and reliability across a variety of community, clinical, and student samples (e.g., Chan et al., 2023; Greene et al., 2020; Fynn et al., 2022; Mazidi et al., 2023; Kiskimska and Martínez-Sánchez, 2023; Lashkari et al., 2021; Sethi, 2023; Trimble et al., 2024; Bilge and Bilge, 2020). The PAQ is designed to provide a total scale score as an overall marker of alexithymia, as well as a set of reliable subscale scores that assess the facets of alexithymia across both negative and positive emotions. In addition, discriminant validity analyses have consistently supported the PAQ's capacity to capture alexithymia as a construct that is separable from people's current levels of psychological distress (e.g., Chan et al., 2023; Preece et al., 2020c). The PAQ therefore addresses the abovementioned limitations of the TAS-20 and provides a higher resolution (i.e., facet-level and valence-specific) measure of the alexithymia construct.

We thus used the PAQ in this study to more comprehensively examine the relationships between alexithymia and depression, anxiety, and stress. Of the various categories of psychopathology, we selected depression and anxiety symptoms as our focus here, as they are emotional disorders with high conceptual relevance to alexithymia and are the most common types of psychopathologies, contributing most substantially to global burden of disease (Kessler et al., 2009). We utilised a combination of Pearson correlations, regression analyses, and latent profile analysis, to systematically map the facet-level and valence-specific alexithymia profiles characterizing each symptom category. Given the relative lack of existing data in this space at the facet and valence-specific level, our analyses were exploratory and we did not have specific hypotheses.

## 2. Method

### 2.1. Participants and procedure

Ethics approval for this study was provided by the Curtin University Human Research Ethics Committee. All participants provided informed consent for their data to be used and completed psychometric measures of alexithymia and psychopathology as part of an online survey. Data were collected between October 2019 and June 2023. Our sample consisted of 1250 university students (76.1 % female, 22.7 % male, 1.2 % nonbinary) enrolled in a psychology undergraduate course at an Australian university,[4] with an average age of 22.52 years ($SD$ = 6.59, range = 16–56).[5] Most were employed casually (47.0 %) or part time (25.9 %), with 7.3 % working full time and 19.8 % unemployed. The majority (71.0 %) were born in Australia. Over one third (37.4 %) reported having a history of a formal mental health diagnosis. Of those, the most common diagnostic categories were (non-exclusive): 58.1 % a depressive disorder, 64.5 % an anxiety disorder, 13.9 % attention-deficit hyperactivity disorder, 9.8 % an eating disorder, 9.6 % post-traumatic stress disorder, 5.1 % obsessive compulsive disorder, 3.4 % borderline personality disorder, and 1.1 % a psychotic disorder. Participants received course credit for their participation. An additional 102 participants also completed the survey, but their data were excluded because on a validity check question (worded "Please let us know if you completed the survey in an attentive and serious manner [no consequences or loss of benefits will result from your answer here, as your honesty is very important for the accuracy of our results]") they answered that they did not complete the survey in an attentive manner.

Alexithymia and depression, anxiety, and stress are all dimensional phenomena that exist on a continuum within the community (e.g., Kotov et al., 2017), and the study of these constructs in student samples is common (e.g., Greene et al., 2020; Loas et al., 1996), making this an appropriate population for examining relationships between alexithymia and mental health outcomes.

### 2.2. Materials

#### 2.2.1. Perth Alexithymia Questionnaire (PAQ)

The PAQ (Preece et al., 2018) is a 24-item self-report measure of alexithymia. Five subscale scores can be derived, corresponding to different facets of the construct across negative or positive emotions: *Negative-Difficulty identifying feelings* (N-DIF; e.g., "When I'm feeling bad, I can't tell whether I'm sad, angry, or scared"), *Positive-Difficulty identifying feelings* (P-DIF; e.g., "When I'm feeling good, I can't make sense of those feelings"), *Negative-Difficulty describing feelings* (N-DDF; e.g., "When I'm feeling bad, I can't talk about those feelings in much depth or detail"), *Positive-Difficulty describing feelings* (P-DDF; e.g., "When I'm feeling good, I can't find the right words to describe those feelings"), and *General-Externally orientated thinking* (G-EOT; e.g., "I don't pay attention to my emotions"). All items can also be summed into a total scale score as an overall marker of alexithymia. Items are answered on a 7-point Likert scale, with higher scores indicating higher levels of alexithymia. The PAQ has demonstrated good validity and reliability (e.g., Larionow et al., 2022), and all subscales and the total scale score had good internal consistency in our sample (see Table 1). Factor analysis in this data-set supported the separability of PAQ and Depression Anxiety Stress-21

[4] Psychology university courses typically have more females enrolled than males (Olos and Hoff, 2006), and this is the case at Australian universities, thus explaining why the sample was predominantly female. Participants all received course credit for their participation (as is common in university-based research with students, e.g., Bowen and Kensinger, 2017). Participation was voluntary, with students able to select to participate in this study out of a wide range of other studies at the university.

[5] Age data were unavailable for two participants. There were no other missing data. For those analyses requiring gender and age to be controlled (our regression analyses), participants who indicated their gender as non-binary were not included, as there were not enough participants in that gender category to meet statistical assumptions. Participants reporting their gender as non-binary were included in our Pearson correlations and Latent Profile Analysis. In terms of outliers, there were 44 participants in the dataset with a Mahalanobis distance >25, but none of these had a Cook's distance >1, indicating that none were influential outliers (Field, 2009). There were no indications that any participants were outside of our population of interest, thus all participants were retained in the dataset.

**Table 1**
Descriptive statistics and Cronbach's Alpha and McDonald's Omega Reliability Coefficients for the PAQ and DASS-21.

| | *M* | *SD* | Range | α | ω |
|---|---|---|---|---|---|
| PAQ | | | | | |
| Total score | 74.58 | 30.11 | 24–168 | 0.96 | 0.96 |
| N-DIF | 13.62 | 6.41 | 4–28 | 0.92 | 0.92 |
| P-DIF | 10.99 | 5.57 | 4–28 | 0.91 | 0.91 |
| N-DDF | 14.67 | 6.65 | 4–28 | 0.92 | 0.92 |
| P-DDF | 11.90 | 5.80 | 4–28 | 0.91 | 0.91 |
| G-EOT | 23.41 | 10.89 | 8–56 | 0.93 | 0.93 |
| DASS-21 | | | | | |
| Depression | 6.78 | 5.52 | 0–21 | 0.92 | 0.92 |
| Anxiety | 5.91 | 5.06 | 0–21 | 0.88 | 0.88 |
| Stress | 8.21 | 5.03 | 0–21 | 0.88 | 0.88 |

Note. PAQ = Perth Alexithymia Questionnaire; DASS-21 = Depression Anxiety Stress Scales-21; N-DIF = Negative-Difficulty identifying feelings; P-DIF = Positive-Difficulty identifying feelings; N-DDF = Negative-Difficulty describing feelings; P-DDF = Positive-Difficulty describing feelings; G-EOT = General-Externally orientated thinking.

(DASS-21) scores (see Supplementary Table S1); all PAQ scores loaded on a different underlying factor to the DASS-21 scores, thus demonstrating good discriminant validity (see also, Preece et al., 2020c).

#### 2.2.2. Depression Anxiety Stress Scales-21 (DASS-21)

The DASS-21 (Lovibond and Lovibond, 1995) is a 21-item self-report measure of *depression* (e.g., "I felt down-hearted and blue"), *anxiety* (e.g., "I felt I was close to panic"), and *stress* (e.g., "I found it hard to wind down") symptoms experienced over the past week. Separate subscale scores can be derived for each symptom category. Items are answered on a 4-point Likert scale, with higher scores indicating more severe symptoms. The DASS-21 has demonstrated good validity and reliability (Lovibond and Lovibond, 1995), and had good internal consistency in our sample (see Table 1).

### 2.3. Analytic strategy

Our analytic strategy explored the links between alexithymia (PAQ scores) and depression, anxiety, and stress (DASS-21 scores) through three primary analyses. All analyses were conducted using JASP 0.18.1 software, except for our latent profiles analysis which was conducted in *R* version 4.3.0.

First, we calculated *Pearson correlations* between all PAQ and DASS-21 scale scores, to explore the raw associations between these constructs. Next, we conducted three *hierarchical multiple regression analyses* with 5000 bootstrapped samples, each predicting either (1) depression, (2) anxiety, or (3) stress scores as the criterion variable. In the first step of these regressions, gender and age were entered to control for potential demographic effects (Mazidi et al., 2023). In the second step, we entered all five PAQ subscales; these analyses were designed to determine how much variance alexithymia could account for in these psychopathology symptoms, and which facets of alexithymia might be the strongest unique predictors. Variance Inflation Factor (VIF) values across the predictors ranged from 1.06 to 5.25 (i.e., were under the commonly used VIF threshold of 10; Curto and Pinto, 2011), indicating acceptable levels of multicollinearity.

Lastly, we conducted a *latent profile analysis* to further map profiles of alexithymia that might characterize each symptom category. Latent profile analysis is a modelling technique (i.e., a gaussian finite mixture model) that seeks to identify subtypes or subgroups of participants within a dataset that exhibit similar profiles across a set of variables. It seeks to identify the optimal number of profiles or subgroups, in order to best capture the variance in the data (Hagenaars and McCutcheon, 2009). LPA estimates which profile each participant should be classified into, and classification uncertainty is factored into the model, affording LPA several important statistical advantages over other approaches like cluster analysis (for a discussion, see Bauer, 2022). We ran latent profile analysis using the TidyLPA package in *R* software (Rosenberg et al., 2019). *Z*-scores of all the PAQ and DASS-21 subscales were entered as the variables (i.e., scores standardised so that the average score was 0 and the *SD* was 1).[6] Using the default model parameters of TidyLPA (i.e., Model 1: equal variances and covariances fixed to 0), solutions for 1 to 10 profiles were calculated and compared. The best solution was judged based on six commonly used fit index values (Akogul and Erisoglu, 2017): the Bayesian Information Criterion (BIC), the Sample Size adjusted Bayesian Information Criterion (SABIC), Akaike Information Criterion (AIC), Appropriate Weight of Evidence Criterion (AWE), Classification Likelihood Criterion (CLC), and Kullback Information Criterion (KIC). For each of these, lower values indicate a better fit. BIC was particularly prioritised given past findings that it performs the best of the various fit index values (see Nylund et al., 2007). We also directly compared the solutions using the Bootstrapped Likelihood Ratio Test (BLRT) to determine if an increase in the number of profiles by 1 (e.g., 7-profile solution vs 8-profile solution) significantly improved model fit, with $p < .05$ indicating that the more complex solution was superior. We also considered entropy values (with values $\geq$0.80 considered to indicate acceptable classification certainty for classifying participants into the extracted profiles; Tein et al., 2013) and the theoretical interpretability of the profile solutions (Hagenaars and McCutcheon, 2009). Profile solutions where each profile had at least 5 % of the sample in them were considered acceptable (Kavčič et al., 2022). In interpreting the meaning of scores within each profile, scores around 1 *SD* or more above the sample mean on a variable were considered 'highly elevated' scores, and scores around 0.5 *SD* as 'mildly elevated' scores (Preece et al., 2021).

## 3. Results

### 3.1. Descriptive statistics and Pearson correlations

Descriptive statistics for the sample on the PAQ and DASS-21 are displayed in Table 1. In terms of the standard severity cut-offs for the DASS-21 (Lovibond and Lovibond, 1995): *depression* was in the normal range for 43.6 % of the sample, mild range for 10.5 %, moderate range for 20.7 %, severe range for 11.7 %, and extremely severe range for 13.5 %; *anxiety* was in the normal range for 41.1 %, mild range for 12.7 %, moderate range for 12.1 %, severe range for 10.0 %, and extremely severe range for 24.1 %; and *stress* was in the normal range for 48.5 %, mild range for 13.6 %, moderate range for 17.4 %, severe range for 13.9 %, and extremely severe range for 6.6 %.

Pearson correlations between all PAQ and DASS-21 scores are displayed in Table 2. PAQ total scores were moderately positively associated with levels of depression, anxiety, and stress ($r = 0.37$–$0.42$, $p < .001$). All subscales of the PAQ, assessing the various facets of alexithymia across negative and positive emotions, were also positively associated with depression, anxiety, and stress ($r = 0.27$–$0.40$, $p < .001$).

[6] An alternative approach to the LPA would be to only include the PAQ subscales and then, after extracting those alexithymia profiles, compare the profiles using a set of ANOVAs and post-hoc comparisons to determine if those profiles differ in their DASS-21 depression, anxiety, and stress scores. We preferred to include the DASS-21 scores within the LPA, as we were interested in how patterns of alexithymia and psychopathology can combine to characterize a profile, and this approach minimized the number of statistical tests that needed to be run in order to answer our research question. Thus, we considered it a more parsimonious approach here (see also, Preece et al., 2021).

**Table 2**
Pearson correlations between PAQ scores and DASS-21 scores.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| PAQ | | | | | | | | | |
| 1.Total score | – | | | | | | | | |
| 2.N-DIF | 0.86 | – | | | | | | | |
| 3.P-DIF | 0.84 | 0.62 | – | | | | | | |
| 4.N-DDF | 0.86 | 0.86 | 0.56 | – | | | | | |
| 5.P-DDF | 0.84 | 0.61 | 0.89 | 0.62 | – | | | | |
| 6.G-EOT | 0.86 | 0.61 | 0.62 | 0.64 | 0.60 | – | | | |
| DASS-21 | | | | | | | | | |
| 7.Depression | 0.42 | 0.38 | 0.40 | 0.35 | 0.37 | 0.32 | – | | |
| 8.Anxiety | 0.40 | 0.40 | 0.38 | 0.34 | 0.34 | 0.28 | 0.67 | – | |
| 9.Stress | 0.37 | 0.39 | 0.34 | 0.33 | 0.31 | 0.27 | 0.73 | 0.78 | – |

Note. All correlations $p < .001$. PAQ = Perth Alexithymia Questionnaire; DASS-21 = Depression Anxiety Stress Scales-21; N-DIF = Negative-Difficulty identifying feelings; P-DIF = Positive-Difficulty identifying feelings; N-DDF = Negative-Difficulty describing feelings; P-DDF = Positive-Difficulty describing feelings; G-EOT = General-Externally orientated thinking.

### 3.2. Regression analyses

#### 3.2.1. Depression

Our regression analysis predicting depression symptoms found, at Step 1, that demographic factors accounted for 2.2 % of the variance ($F$ [2,1230] = 13.611, $p < .001$, $R^2 = 0.022$). At Step 2, the addition of the five PAQ subscales into the model accounted for a significant additional 16.4 % of the variance in depression (final model: $F$ [7, 1225] = 40.080, $p < .001$, $R^2 = 0.186$). In terms of significant unique predictors, the N-DIF (β = 0.15) and P-DIF (β = 0.25) subscales and younger age were significant unique predictors of depression (see Table 3).

#### 3.2.2. Anxiety

Our regression analysis predicting anxiety symptoms found, at Step 1, that demographic factors accounted for 3.6 % of the variance ($F$ [2, 1230] = 23.112, $p < .001$, $R^2 = 0.036$). At Step 2, the addition of the five PAQ subscales into the model accounted for a significant additional 15.1 % of the variance in anxiety (final model: $F$ [7, 1225] = 40.143, $p <$ 001, $R^2 = 0.187$). In terms of significant unique predictors, the N-DIF (β = 0.27) and P-DIF (β = 0.23) subscales, and younger age and being female, were significant unique predictors of anxiety (see Table 3).

#### 3.2.3. Stress

Our regression analysis predicting stress found, at Step 1, that demographic factors accounted for 2.0 % of the variance ($F$ [2, 1230] = 12.538, $p < .001$, $R^2 = 0.020$). At Step 2, the addition of the five PAQ subscales into the model accounted for a significant additional 14.6 % of the variance in stress (final model: $F$ [7, 1225] = 34.828, $p < .001$, $R^2 =$ 0.166). In terms of significant unique predictors, the N-DIF (β = 0.30) and P-DIF (β = 0.19) subscales and being female were significant unique predictors of stress (see Table 3).

### 3.3. Latent profile analysis

Our latent profile analysis indicated, in our view, that an eight-profile solution best explained the data. The eight-profile solution was the best fit according to BIC (see Supplementary Table S2 for fit index values for all solutions), whilst still retaining at least 5 % of the sample in each profile. Its entropy value (0.85) indicated good classification certainty, and the eight-profile solution appeared to provide meaningful theoretical differentiation between the extracted profiles. Its fit index values were superior to the one-profile, two-profile, three-profile, four-profile, five-profile, six-profile, and seven-profile solutions, with bootstrapped likelihood ratio tests suggesting superior performance to those simpler solutions ($p = .01$). The more complex ten-profile solution was not viable because it contained a profile with <5 % of the sample. The best alternative to the eight-profile solution seemed to be the nine-profile solution (see Supplementary Fig. S1); it had good performance across the fit index values, with all profiles containing at least 5 % of the sample and an entropy of 0.84, and was therefore viable. The main difference between the eight-profile and nine-profile solutions was an additional profile (containing 6.7 % of the sample) that had low levels of alexithymia across all facets and average levels of depression, anxiety, and stress. However, because most fit index values were generally similar across the eight-profile and nine-profile solutions, and BIC (which elsewhere has been shown to be the best single indicator of

**Table 3**
Standardised (β) and unstandardised (B) beta coefficients from hierarchical regression analyses of PAQ scores predicting depression, anxiety, or stress.

| | Depression | | | | Anxiety | | | | Stress | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Stand. β | Unstand. B | Stand error | $p$ | Stand. β | Unstand. B | Stand Error | $p$ | Stand. β | Unstand. B | Stand Error | $p$ |
| Step 1 | | | | | | | | | | | | |
| Age | **−0.145** | **−0.120** | **0.021** | **<0.001** | **−0.152** | **−0.115** | **0.018** | **<0.001** | **−0.083** | **−0.062** | **0.020** | **0.003** |
| Gender | **–** | 0.269 | 0.359 | 0.466 | **–** | **1.274** | **0.309** | **<0.001** | **–** | **1.305** | **0.326** | **<0.001** |
| Final model | | | | | | | | | | | | |
| Age | **−0.061** | **−0.051** | **0.019** | **0.017** | **−0.073** | **−0.056** | **0.017** | **0.001** | −0.003 | −0.003 | 0.019 | 0.916 |
| Gender | – | 0.125 | 0.336 | 0.781 | **–** | **1.052** | **0.288** | **<0.001** | **–** | **1.052** | **0.312** | **<0.001** |
| N-DIF | **0.145** | **0.125** | **0.050** | **0.014** | **0.272** | **0.213** | **0.043** | **<0.001** | **0.296** | **0.234** | **0.045** | **<0.001** |
| P-DIF | **0.252** | **0.251** | **0.068** | **<0.001** | **0.232** | **0.211** | **0.053** | **<0.001** | **0.185** | **0.169** | **0.058** | **0.003** |
| N-DDF | 0.047 | 0.039 | 0.044 | 0.378 | −0.046 | −0.034 | 0.040 | 0.354 | −0.043 | −0.034 | 0.042 | 0.462 |
| P-DDF | −0.009 | −0.008 | 0.060 | 0.859 | −0.025 | −0.023 | 0.048 | 0.673 | −0.020 | −0.019 | 0.055 | 0.771 |
| G-EOT | 0.037 | 0.019 | 0.021 | 0.390 | −0.002 | −0.000 | 0.018 | 0.943 | 0.010 | 0.005 | 0.018 | 0.811 |

*Note*. Statistically significant unique predictors ($p < .05$) are in boldface. For gender, 0 = male, 1 = female. PAQ = Perth Alexithymia Questionnaire; DASS-21 = Depression Anxiety Stress Scales-21; N-DIF = Negative-Difficulty identifying feelings; P-DIF = Positive-Difficulty identifying feelings; N-DDF = Negative-Difficulty describing feelings; P-DDF = Positive-Difficulty describing feelings; G-EOT = General-Externally orientated thinking.

model fit; Nylund et al., 2007) was better for the eight-profile solution, we ultimately decided that the eight-profile solution represented the best balance of comprehensiveness and brevity. Nonetheless, for completeness, results for the nine-profile solution (and the two-profile, three-profile, four-profile, six-profile, and seven-profile solutions) are also provided in the Supplementary Materials.

For the eight-profile solution that we selected as the best solution, each of the eight profiles are visually displayed in Fig. 1; it includes 95 % Confidence Intervals (CIs) for each variable, and non-overlapping CIs between two profiles can therefore be interpreted as those profiles differing significantly on that variable. Five of the eight profiles had elevated levels of psychopathology symptoms (three *highly elevated* around 1 SD or more from the sample mean, and two *mildly elevated* around 0.5 SD from the sample mean), and three profiles had no elevations in psychopathology symptoms. Of the five profiles with elevated psychopathology symptoms, there was no distinct depression, anxiety, or stress profile; rather, the three symptom categories were relatively even with each other within each profile.

### 3.3.1. Elevated psychopathology profiles

Four of the five profiles with elevated psychopathology also had elevated levels of alexithymia on at least one PAQ subscale (Profiles 1, 4, 6, and 8). *Profile 1* ($n = 119$, 9.5 %) and *Profile 6* ($n = 76$, 6.1 %) had amongst the highest levels of psychopathology, with Profile 1 having the highest levels of alexithymia in the sample on all PAQ subscales (i.e., difficulties in all facets and valence domains), and Profile 6 also having heightened alexithymia across all PAQ subscales. *Profile 4* ($n = 121$, 9.7 %) and *Profile 8* ($n = 137$, 11.0 %) are of particular interest, given their similar levels of psychopathology symptoms (mildly elevated) but contrasting alexithymia profiles across the PAQ subscale scores. Specifically, Profile 4 had heightened difficulties identifying and describing negative emotions (i.e., N-DIF and N-DDF), but average performance for identifying and describing positive emotions (i.e., P-DIF and P-DDF), alongside mild elevations in G-EOT. In contrast, Profile 8 had average performance for appraising negative emotions (i.e., N-DIF and N-DDF), but mildly elevated difficulties appraising positive emotions (i.e., P-DIF and P-DDF). The other profile with heightened psychopathology, *Profile 3* ($n = 104$, 8.3 %), reported low levels of alexithymia across all facets and valence domains.

### 3.3.2. Non-elevated psychopathology profiles

Two of the three profiles with low (or not elevated) psychopathology symptoms also had low levels of alexithymia (Profile 2 and Profile 5). *Profile 2* ($n = 255$, 20.4 %) appeared to be the most adaptive profile, with the lowest levels of psychopathology and alexithymia. *Profile 5* ($n = 253$, 20.2 %) had alexithymia levels closer to the average range for all facets. *Profile 7* ($n = 185$, 14.8 %) had heightened levels of alexithymia across all facets and valence domains, but still had below average levels of

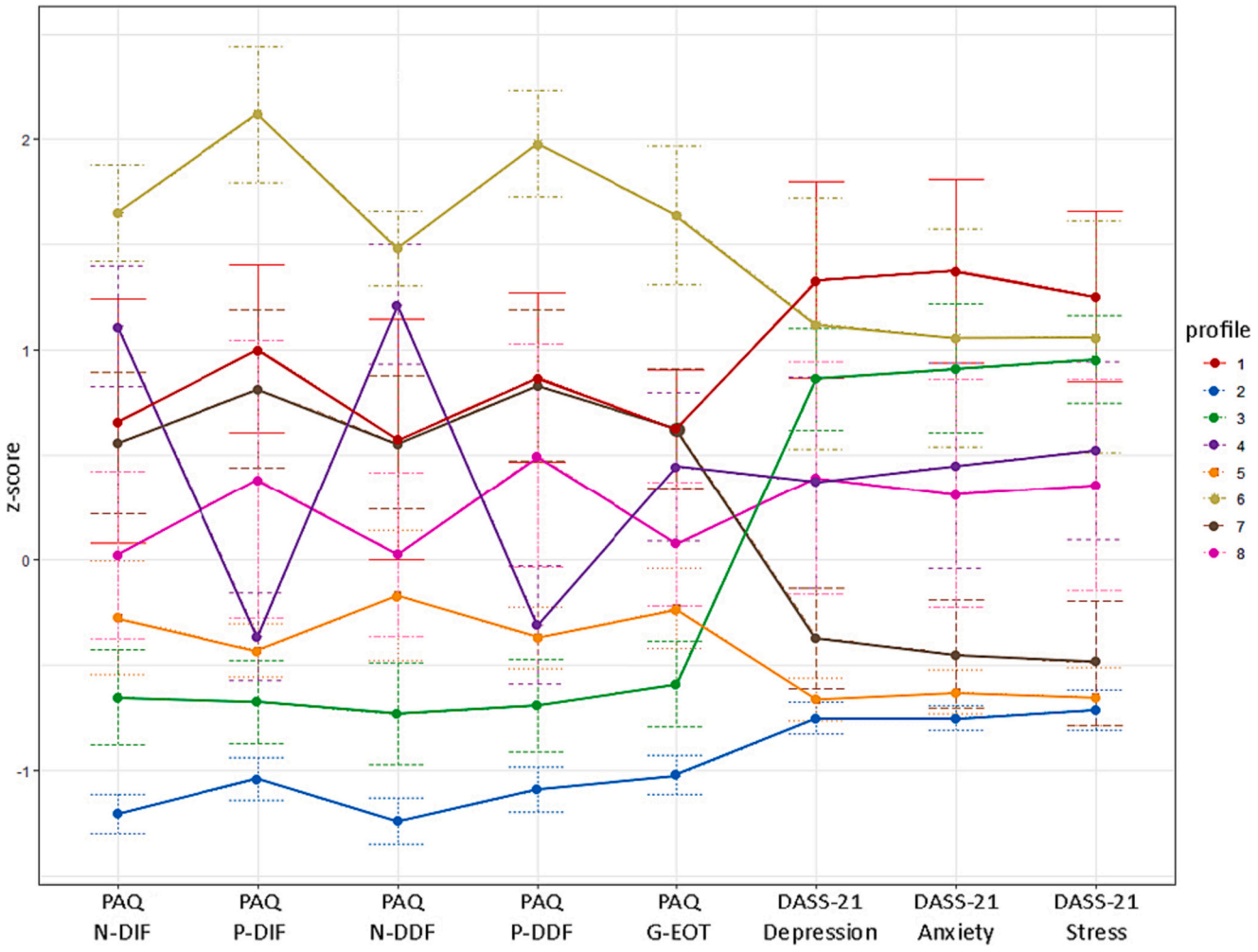



**Fig. 1.** Latent Profile Analysis (8 Profile Solution) of the PAQ and DASS-21 z-scores. Error bars represent 95 % confidence intervals. PAQ = Perth Alexithymia Questionnaire, DASS-21 = Depression Anxiety Stress Scales-21, N-DIF = Negative-Difficulty Identifying Feelings, P-DIF = Positive-Difficulty Identifying Feelings, N-DDF = Negative-Difficulty Describing Feelings, P-DDF = Positive-Difficulty Describing Feelings, G-EOT = General-Externally Oriented Thinking. See Table S3 for a list of each profiles z-scores and 95 % confidence intervals.

psychopathology.

## 4. Discussion

Our aim in this study was to explore the nature of the relationship between alexithymia and depression, anxiety, and stress symptoms, using the PAQ to map detailed facet-level and valence-specific alexithymia profiles. Overall, our findings show that all facets of alexithymia, and both valence domains, are highly relevant to understanding psychopathology symptoms, but that there are also important areas of specificity in understanding the nature of associations for certain alexithymia facets and valence domains.

### 4.1. Linking alexithymia to affective symptoms

Like past TAS-20 work (e.g., Li et al., 2015; Luminet et al., 2001; Müller et al., 2003), we found that total alexithymia scores with the PAQ were significantly associated with higher levels of depression, anxiety, and stress. Importantly though, our study is novel in going beyond the total score level with reliable PAQ subscale scores, with Pearson correlations indicating that all facets of alexithymia, across both negative and positive emotions, are associated with higher levels of depression, anxiety, and stress (with correlations typically in the moderate range). Our regression analyses further highlighted that, in combination, the alexithymia facets could account for a significant 14.6 % to 16.4 % of the variance in these psychopathology symptoms, with the DIF facet being the strongest unique predictor. Such findings are consistent with the central importance placed on the appraisal of emotions within the *attention-appraisal model of alexithymia* (Preece et al., 2017) and the *process model of emotion regulation* (Gross, 2015), whereby the capacity to accurately identify an emotion is hypothesised to be a crucial facilitator and activator of down-stream emotion regulation decisions (e.g., influencing the decisions on whether to regulate and which emotion regulation strategies to use; Preece et al., 2023) and thus long-term emotional outcomes. Importantly, the valence-specific scores of the PAQ in our data indicated that processing deficits in both valence domains played a meaningful role, as the negative and positive subscales of DIF both added significant unique variance to the predictive model. Such findings are consistent with studies of other emotional constructs, such as emotion regulation, showing that both valence domains can play an important role in psychopathology (e.g., Hechtman et al., 2013), as well as the results of brain imaging studies showing that alexithymic deficits do manifest across both negative and positive emotions (e.g., van der Velde et al., 2013). The alexithymia profiles in our data were highly similar across depression, anxiety, and stress, thus supporting the transdiagnostic relevance of the alexithymia construct as a risk factor for emotional disorders.

To the best of our knowledge, this is also the first study to have conducted a latent profile analysis of the PAQ subscale scores, and thus the first to examine valence-specific alexithymia facets in this way. This is significant, because latent profile analysis is uniquely placed to statistically identify different potential valence-specific subtypes of alexithymia, or combinations of alexithymia facet presentations, that may differentially underlie risk of psychopathology (Hagenaars and McCutcheon, 2009). Across the eight profiles (or subtypes) extracted from our latent profile analysis, several important findings emerged.

Our results confirmed that profiles with high psychopathology symptoms (i.e., depression, anxiety, and stress) do often have elevated levels of alexithymia across all facets and valence domains (i.e., Profiles 1 and 6), thus DIF, DDF, and EOT all appear to be relevant to depression, anxiety, and stress. Our findings therefore broadly align with the small amount of existing work that has done subtyping with the TAS-20, which has found various clinically-relevant alexithymia subtypes, including a subtype high on all alexithymia facets and a subtype high specifically in DIF and DDF (e.g., Jakobson and Rigby, 2021), albeit limited by psychometric issues with the TAS-20 subscales (e.g., low reliability for the EOT facet score, and the DIF facet score being confounded by people's current distress levels; Kooiman et al., 2002; Preece et al., 2024). With respect to the EOT facet, some past TAS-20 work had questioned whether EOT is relevant for understanding psychopathology, due to it often being uncorrelated with depression and anxiety levels (e.g., Bamonti et al., 2010; Li et al., 2015). For example, in Jakobson and Rigby's (2021) latent profile analysis findings with the TAS-20, it was an alexithymia profile with elevated DIF and DDF, but non-elevated EOT, that had the highest levels of psychopathology symptoms. Our findings highlight that whilst EOT was not a significant unique predictor in our regressions, it had significant relationships with psychopathology symptoms in bivariate correlations and, in latent profile analysis, high EOT was a feature of most of the profiles with the highest psychopathology levels. Across latent profiles, levels of EOT were generally similar to levels of DIF and DDF, a finding consistent with theorising that attention to emotions (i.e., EOT) is an important foundation for accurate appraisal of emotions (i.e., DIF, DDF) (Gross, 2015; Preece et al., 2017). Thus, by using an EOT marker with higher reliability, such as the PAQ instead of the TAS-20, the clinical relevance of EOT may be more apparent (see also, Preece et al., 2024).

With respect to DIF and DDF, the consideration of emotional valence in our data also appeared highly valuable in distinguishing more nuanced patterns: two of the profiles in our data exhibited pronounced valence-specific patterns, with one profile having deficits only in processing negative emotions (but not positive emotions; Profile 4), and another having heightened deficits in processing positive emotions (but not negative emotions; Profile 8). Both these profiles were associated with similar elevations in depression, anxiety, and stress, reinforcing their clinical relevance. Moreover, whilst rarer, our modelling showed that high psychopathology symptoms can be present in people with low alexithymia (i.e., Profile 3), just as some people can have high alexithymia and not be experiencing elevated psychopathology symptoms (i.e., Profile 7). These latter results are not unexpected, given that alexithymia is conceptually just one of many factors or paths that can increase risk of psychopathology (e.g., childhood maltreatment, emotion dysregulation, neuroticism, adverse and traumatic life events; Brandes et al., 2019; Dohrenwend, 2006; Pielage et al., 2000). Collectively then, our findings highlight the importance of detailed facet-level and valence-specific alexithymia assessments in the context of psychopathology; not everyone with high overall alexithymia, or high psychopathology symptoms, exhibits the same alexithymia patterns at the facet and valence-specific level.

With respect to demographic effects, although not a central focus of our study, our regression analyses also found that being female was a predictor of anxiety and stress, and younger age was a predictor of depression and anxiety symptoms. These findings align with a large body of existing work that has found females often report higher levels of negative affect, distress, and negative emotional reactivity than males (e.g., Bangasser et al., 2010), and that younger age in adults is frequently a risk factor for depression and anxiety symptoms (e.g., Varma et al., 2021). That said, the nature of these demographic effects across the literature can differ depending on what other variables are controlled in the model (see Van Landeghem and Jakobson, 2024).

### 4.2. Broader implications

Taken together, our results have several important theoretical and clinical implications. Firstly, our results further confirm that, in the context of us using an alexithymia measure with stronger discriminant validity against markers of distress (as opposed to the TAS-20, where several different groups have raised discriminant validity concerns; e.g., Leising et al., 2009; Marchesi et al., 2014; Preece et al., 2020c; Veirman et al., 2021), there is a significant relationship between alexithymia and symptoms of common emotional disorders. This supports the specifications of frameworks like the *attention-appraisal model of alexithymia* (Preece et al., 2017, 2023) and the *process model of emotion regulation*

(Gross, 1998, 2015), which specify that alexithymia should be a transdiagnostic risk factor for emotional disorders because alexithymia impairs core emotion regulation processes.

Secondly, as noted above, our findings highlight the utility of facet-level and valence-specific assessments of the alexithymia construct. Recently, the developers of the TAS-20 had speculated that there may be little value for the field in assessing alexithymia at the facet or valence-specific level, arguing that use of an alexithymia total scale score via the TAS-20 should be sufficient, and stating that there is "no need for valence-specific items in evaluating the DIF and DDF facets of the alexithymia construct" (Zahid et al., 2023, p. 8). We think our set of correlation, regression, and latent profile analysis findings with the PAQ provide clear evidence to the contrary in the context of studying psychopathology. Specifically, our data demonstrate that (1) all alexithymia facets and valence domains can be relevant to different emotional disorder symptoms, (2) some alexithymia facets (i.e., DIF) can be stronger predictors than others, (3) both the negative and positive valence domains contribute significant unique variance to the prediction of emotional disorder symptoms, and (4) people with high alexithymia can exhibit different patterns of valence-specific deficits (i.e., either more difficulties processing negative emotions, positive emotions, or both). Thus, moving forward, our results suggest that there will likely be substantial value for the field in using alexithymia measures that allow for facet-level and valence-specific assessments, providing more detailed profiles that can inform targeted and personalised treatment approaches.

With respect to treatment approaches for emotional disorders, our results suggest that in cases of heightened depression, anxiety, and stress, a focus on alexithymia could form an important part of the treatment protocol. Treatment protocols ideally should be prepared to address deficits in both the capacity to focus attention on emotions (i.e., EOT) and the capacity to accurately identify and describe emotions (i.e., DIF and DDF). Our results suggest that a focus on DIF, covering both the negative and positive emotional valence domains, is likely to be particularly fruitful. However, given that not all people with high alexithymia will have the same underlying alexithymia profile at the facet level (at least based on our data), use of detailed alexithymia assessment tools prior to treatment should be beneficial in enabling more precise targeting of specific deficit profiles, thus aligning with the principles of precision psychiatry (Fernandes et al., 2017).

The attention-appraisal model (Preece et al., 2017) specifies that alexithymia issues in DIF, DDF, and EOT are due to the combination of *ability deficits* (i.e., underdeveloped emotion schema systems, or those cognitive structures used to process emotions) and/or *avoidance* (i.e., high usage of emotional avoidance as an emotion regulation strategy; see also, Panayiotou et al., 2015; Luminet et al., 2021). Alexithymia treatment, in the context of emotional disorders, might therefore directly target these mechanisms, via therapeutic approaches that build knowledge of emotions, reduce avoidant coping, and practice the process of noticing, identifying, and describing both negative and positive emotions (e.g., Barlow et al., 2017). Indeed, there is growing evidence that alexithymia levels do reduce significantly following interventions targeting these mechanisms (e.g., Edwards et al., 2018; Norman et al., 2019; Salles et al., 2022). Moreover, in the context of our latent profile analysis results, it is possible that different alexithymia profiles or subtypes might be caused by different proportions or combinations of ability deficits and avoidance. For example, it is possible that people with deficits predominantly in the processing of negative emotions, but not positive emotions, might have alexithymia primarily due to emotional avoidance (i.e., since people generally regard negative emotions to be more undesirable and they are more frequently the focus of avoidance; Becerra et al., 2020). However, emotion schema functioning and avoidance levels were not assessed in our data, and this will be an important direction for future research to determine the mechanisms underlying different profiles.

### 4.3. Limitations and future directions

Whilst we think this study makes a strong contribution, several limitations should be noted that will require future research. Firstly, our sample were all university students from a single Western country, and were mainly female and of a young age. Future research will be important to test the generalisability of our findings across other samples with more diverse demographic distributions, including in other cultural groups. Future work in clinical samples will be particularly important, enabling examination of how alexithymia profiles may be similar or different across non-clinical and clinical samples. Secondly, by design, in terms of psychopathology our study only examined depression, anxiety, and stress. Conceptually, alexithymia is also regarded as a transdiagnostic risk factor for a wide range of other disorder categories characterized by emotion dysregulation, such as eating disorders, psychosomatic disorders, personality disorders, and substance use (Taylor et al., 1999). Future research could include a focus on these other psychopathology categories, thus enabling a more comprehensive understanding of how alexithymia profiles may be similar or different across different types of psychopathology, and how rates of psychiatric diagnosis may differ. The proportion of participants with moderate or severe depression, anxiety, or stress on the DASS-21 was quite high in our sample, which is common in university student samples (Auerbach et al., 2019); our data collection period overlapped with the COVID-19 pandemic, and thus the levels of mental health symptoms we observed are likely to be higher than pre-pandemic data (Copeland et al., 2021; Sun et al., 2023). Thirdly, our data were collected via an online survey, which is a popular methodology in psychology research with many advantages (e.g., Evans and Mathur, 2005), though we did not include any measures of social desirability responding or tools like the Conscientious Responders Scale as data validity checks (Marjanovic et al., 2014). That said, the theoretically congruent and consistent psychometric patterns in our data support good levels of validity. Fourthly, our study was cross-sectional, so future longitudinal studies would be useful to examine the directionality of the relationships between alexithymia and psychopathology.

## 5. Conclusions

Our data show that all facets of alexithymia, across both the negative and positive valence domains, are relevant to the transdiagnostic understanding of depression, anxiety, and stress. People with high overall alexithymia can have different facet-level and valence-specific alexithymia profiles, and many of these profiles are linked to increased levels of emotional disorder symptoms. These findings therefore demonstrate the value of facet-level and valence-specific alexithymia assessments, and inform a more comprehensive understanding of the multidimensional nature and transdiagnostic relevance of the alexithymia construct.

## Funding

This research was supported by part funding of David A. Preece's academic salary by the Raine Medical Research Foundation, Brightspark Foundation, Charter Hall, and the University of Western Australia Cockell Bequest. This research was supported by part funding of Pilleriin Sikka's academic salary by the Finnish Cultural Foundation.

## Role of the funding source

The Raine Medical Research Foundation, Brightspark Foundation, Charter Hall, and the University of Western Australia Cockell Bequest partly funded David A. Preece's academic salary. The Finnish Cultural Foundation funded Pilleriin Sikka's academic salary.

## CRediT authorship contribution statement

**David A. Preece:** Writing – original draft, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Ashish Mehta:** Writing – original draft, Methodology, Conceptualization. **Kate Petrova:** Writing – original draft, Methodology, Conceptualization. **Pilleriin Sikka:** Writing – original draft, Methodology, Conceptualization. **Ethan Pemberton:** Writing – original draft, Methodology, Conceptualization. **James J. Gross:** Writing – original draft, Methodology, Conceptualization.

## Declaration of competing interest

The authors declare that they have no conflicts of interest.

## Acknowledgements

None.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jad.2024.02.071.

## References


Akogul, S., Erisoglu, M., 2017. An approach for determining the number of clusters in a model-based cluster analysis. Entropy 19 (9), 452.

American Psychiatric Association (Ed.), 2022. Diagnostic and Statistical Manual of Mental Disorders: DSM-5-TR (Fifth edition, Text Revision). American Psychiatric Association Publishing.

Auerbach, R.P., Mortier, P., Bruffaerts, R., Alonso, J., Benjet, C., Cuijpers, P., WHO WMH-ICS Collaborators, 2019. Mental disorder comorbidity and suicidal thoughts and behaviors in the world health organization world mental health surveys international college student initiative. Int. J. Methods Psychiatr. Res. 28 (2), e1752.

Bagby, R.M., Parker, J.D., Taylor, G.J., 1994. The twenty-item Toronto Alexithymia Scale—I. Item selection and cross-validation of the factor structure. J. Psychosom. Res. 38 (1), 23–32.

Bagby, R.M., Taylor, G.J., Quilty, L.C., Parker, J.D., 2007. Reexamining the factor structure of the 20-item Toronto alexithymia scale: commentary on Gignac, palmer, and Stough. J. Pers. Assess. 89 (3), 258–264.

Bagby, R.M., Quilty, L.C., Taylor, G.J., Grabe, H.J., Luminet, O., Verissimo, R., Vanheule, S., 2009. Are there subtypes of alexithymia? Pers. Individ. Differ. 47 (5), 413–418.

Bamonti, P.M., Heisel, M.J., Topciu, R.A., Franus, N., Talbot, N.L., Duberstein, P.R., 2010. Association of alexithymia and depression symptom severity in adults aged 50 years and older. Am. J. Geriatr. Psychiatry 18 (1), 51–56.

Bangasser, D.A., Curtis, A., Reyes, B.A., Bethea, T.T., Parastatidis, I., Ischiropoulos, H., Valentino, R.J., 2010. Sex differences in corticotropin-releasing factor receptor signaling and trafficking: potential role in female vulnerability to stress-related psychopathology. Mol. Psychiatry 15 (9), 896–904.

Bankier, B., Aigner, M., Bach, M., 2001. Alexithymia in DSM-IV disorder: comparative evaluation of somatoform disorder, panic disorder, obsessive-compulsive disorder, and depression. Psychosomatics 42 (3), 235–240.

Barlow, D.H., Farchione, T.J., Bullis, J.R., Gallagher, M.W., Murray-Latin, H., Sauer-Zavala, S., Cassiello-Robbins, C., 2017. The unified protocol for transdiagnostic treatment of emotional disorders compared with diagnosis-specific protocols for anxiety disorders: a randomized clinical trial. JAMA Psychiatry 74 (9), 875–884.

Bauer, J., 2022. A primer to latent profile and latent class analysis. In: Methods for Researching Professional Learning and Development: Challenges, Applications and Empirical Illustrations. Springer International Publishing, Cham, pp. 243–268.

Becerra, R., Preece, D.A., Gross, J.J., 2020. Assessing beliefs about emotions: development and validation of the Emotion Beliefs Questionnaire. PLoS one 15 (4), e0231395.

Bermond, B., Vorst, H.C., Moormann, P.P., 2006. Cognitive neuropsychology of alexithymia: implications for personality typology. Cogn. Neuropsychiatry 11 (3), 332–360.

Bermond, B., Clayton, K., Liberova, A., Luminet, O., Maruszewski, T., Ricci Bitti, P.E., Wicherts, J., 2007. A cognitive and an affective dimension of alexithymia in six languages and seven populations. Cognit. Emot. 21 (5), 1125–1136.

Bilge, Y., Bilge, Y., 2020. The measurement of attention-appraisal model of alexithymia: psychometric properties of the Perth alexithymia questionnaire in Turkish. Anatolian J. Psychiatry 21, 71–79.

Bowen, H.J., Kensinger, E.A., 2017. Cash or credit? Compensation in psychology studies: motivation matters. *Collabra:* Psychology 3 (1), 12.

Brandes, C.M., Herzhoff, K., Smack, A.J., Tackett, J.L., 2019. The p factor and the n factor: associations between the general factors of psychopathology and neuroticism in children. Clin. Psychol. Sci. 7 (6), 1266–1284.

Chan, J., Becerra, R., Weinborn, M., Preece, D., 2023. Assessing alexithymia across Asian and western cultures: psychometric properties of the Perth alexithymia questionnaire and Toronto alexithymia scale-20 in Singaporean and Australian samples. J. Pers. Assess. 105 (3), 396–412.

Copeland, W.E., McGinnis, E., Bai, Y., Adams, Z., Nardone, H., Devadanam, V., Hudziak, J.J., 2021. Impact of COVID-19 pandemic on college student mental health and wellness. J. Am. Acad. Child Adolesc. Psychiatry 60 (1), 134–141.

Curto, J.D., Pinto, J.C., 2011. The corrected vif (cvif). J. Appl. Stat. 38 (7), 1499–1507.

Dalgleish, T., Black, M., Johnston, D., Bevan, A., 2020. Transdiagnostic approaches to mental health problems: current status and future directions. J. Consult. Clin. Psychol. 88, 179.

Dohrenwend, B.P., 2006. Inventorying stressful life events as risk factors for psychopathology: toward resolution of the problem of intracategory variability. Psychol. Bull. 132 (3), 477.

Edwards, E., Shivaji, S., Wupperman, P., 2018. The emotion mapping activity: preliminary evaluation of a mindfulness-informed exercise to improve emotion labeling in alexithymic persons. Scand. J. Psychol. 59 (3), 319–327.

Evans, J.R., Mathur, A., 2005. The value of online surveys. Internet Res. 15 (2), 195–219.

Fernandes, B.S., Williams, L.M., Steiner, J., Leboyer, M., Carvalho, A.F., Berk, M., 2017. The new field of 'precision psychiatry'. BMC Med. 15 (1), 1–7.

Field, A., 2009. Discovering Statistics Using SPSS, 3rd ed. SAGE Publications.

Fynn, D.M., Preece, D.A., Gignac, G.E., Pestell, C.F., Allan, A., Vander Kraats, C., Becerra, R., 2022. Assessing alexithymia in adults with acquired brain injury: psychometric properties of the Perth Alexithymia Questionnaire. J. Affect. Disord. 302, 224–233.

Greene, D., Hasking, P., Boyes, M., Preece, D., 2020. Measurement invariance of two measures of alexithymia in students who do and who do not engage in non-suicidal self-injury and risky drinking. J. Psychopathol. Behav. Assess. 42, 808–825.

Gross, J.J., 1998. The emerging field of emotion regulation: an integrative review. Rev. Gen. Psychol. 2 (3), 271–299.

Gross, J.J., 2015. Emotion regulation: current status and future prospects. Psychol. Inq. 26 (1), 1–26.

Groth-Marnat, G., 2009. Handbook of Psychological Assessment. John Wiley & Sons.

Gruber, J., 2011. Can feeling too good be bad? Positive emotion persistence (PEP) in bipolar disorder. Curr. Dir. Psychol. Sci. 20 (4), 217–221.

Hagenaars, J.A., McCutcheon, A.L. (Eds.), 2009. Applied Latent Class Analysis. Cambridge University Press.

Hechtman, L.A., Raila, H., Chiao, J.Y., Gruber, J., 2013. Positive emotion regulation and psychopathology: a transdiagnostic cultural neuroscience approach. J. Exp. Psychopathol. 4 (5), 502–528.

Jakobson, L.S., Rigby, S.N., 2021. Alexithymia and sensory processing sensitivity: areas of overlap and links to sensory processing styles. Front. Psychol. 12, 583786.

Kajanoja, J., Scheinin, N.M., Karlsson, L., Karlsson, H., Karukivi, M., 2017. Illuminating the clinical significance of alexithymia subtypes: a cluster analysis of alexithymic traits and psychiatric symptoms. J. Psychosom. Res. 97, 111–117.

Kavčič, T., Avsec, A., Kocjan, G.Z., 2022. Coping profiles and their association with psychological functioning: a latent profile analysis of coping strategies during the COVID-19 pandemic. Personal. Individ. Differ. 185, 111287.

Kessler, R.C., Aguilar-Gaxiola, S., Alonso, J., Chatterji, S., Lee, S., Ormel, J., Wang, P.S., 2009. The global burden of mental disorders: an update from the WHO world mental health (WMH) surveys. Epidemiol. Psychiatr. Sci. 18 (1), 23–33.

Kiskimska, N.D., Martínez-Sánchez, F., 2023. Spanish adaptation of the Perth alexithymia questionnaire: psychometric properties. Mediterranean J. Clin. Psychol. 11 (2).

Kooiman, C.G., Spinhoven, P., Trijsburg, R.W., 2002. The assessment of alexithymia: a critical review of the literature and a psychometric study of the Toronto alexithymia Scale-20. J. Psychosom. Res. 53 (6), 1083–1090.

Krueger, R.F., Eaton, N.R., 2015. Transdiagnostic factors of mental disorders. World Psychiatry 14 (1), 27.

Kotov, R., Krueger, R.F., Watson, D., Achenbach, T.M., Althoff, R.R., Bagby, R.M., Zimmerman, M., 2017. The hierarchical taxonomy of psychopathology (HiTOP): a dimensional alternative to traditional nosologies. J. Abnorm. Psychol. 126 (4), 454.

Lane, R.D., Schwartz, G.E., 1987. Levels of emotional awareness: a cognitive-developmental theory and its application to psychopathology. Am. J. Psychiatry 144, 133–143.

Larionow, P., Preece, D.A., Mudło-Głagolska, K., 2022. Assessing alexithymia across negative and positive emotions: psychometric properties of the polish version of the Perth alexithymia questionnaire. Front. Psych. 13, 1047191.

Lashkari, A., Dehghani, M., Sadeghi-Firoozabadi, V., Heidari, M., Khatibi, A., 2021. Further support for the psychometric properties of the farsi version of Perth alexithymia questionnaire. Front. Psychol. 12, 657660.

Leising, D., Grande, T., Faber, R., 2009. The Toronto alexithymia scale (TAS-20): a measure of general psychological distress. J. Res. Pers. 43 (4), 707–710.

Li, S., Zhang, B., Guo, Y., Zhang, J., 2015. The association between alexithymia as assessed by the 20-item Toronto alexithymia scale and depression: a meta-analysis. Psychiatry Res. 227, 1–9.

Loas, G., Otmani, O., Verrier, A., Fremaux, D., Marchand, M.P., 1996. Factor analysis of the French version of the 20-ltem Toronto alexithymia scale (TAS-20). Psychopathology 29 (2), 139–144.

Lovibond, P.F., Lovibond, S.H., 1995. The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. Behav. Res. Ther. 33 (3), 335–343.

Luminet, O., Bagby, R.M., Taylor, G.J., 2001. An evaluation of the absolute and relative stability of alexithymia in patients with major depression. Psychother. Psychosom. 70 (5), 254–260.

Luminet, O., Nielson, K.A., Ridout, N., 2021. Cognitive-emotional processing in alexithymia: an integrative review. Cognit. Emot. 35 (3), 449–487.
Marchesi, C., Brusamonti, E., Maggini, C., 2000. Are alexithymia, depression, and anxiety distinct constructs in affective disorders? J. Psychosom. Res. 49 (1), 43–49.
Marchesi, C., Ossola, P., Tonna, M., De Panfilis, C., 2014. The TAS-20 more likely measures negative affects rather than alexithymia itself in patients with major depression, panic disorder, eating disorders and substance use disorders. Compr. Psychiatry 55 (4), 972–978.
Marjanovic, Z., Struthers, C.W., Cribbie, R., Greenglass, E.R., 2014. The Conscientious Responders Scale: a new tool for discriminating between conscientious and random responders. SAGE Open 4 (3), 2158244014545964.
Mazidi, M., Azizi, A., Becerra, R., Gross, J.J., Zarei, M., Mirshafiei, M., Preece, D.A., 2023. Cross-cultural validation and measurement invariance of the Perth alexithymia questionnaire (PAQ): a study in Iran and the USA. Aust. Psychol. 1–16.
McGillivray, L., Becerra, R., Harms, C., 2017. Prevalence and demographic correlates of alexithymia: a comparison between Australian psychiatric and community samples. J. Clin. Psychol. 73 (1), 76–87.
Moormann, P.P., Bermond, B., Vorst, H.C., Bloemendaal, A.F., Teijn, S.M., Rood, L., 2008. New avenues in alexithymia research: the creation of alexithymia types. In: Emotion Regulation: Conceptual and Clinical Issues. Springer US, Boston, MA, pp. 27–42.
Müller, J., Bühner, M., Ellgring, H., 2003. Relationship and differential validity of alexithymia and depression: a comparison of the Toronto alexithymia and self-rating depression scales. Psychopathology 36 (2), 71–77.
Norman, H., Marzano, L., Coulson, M., Oskis, A., 2019. Effects of mindfulness-based interventions on alexithymia: a systematic review. BMJ Ment Health 22 (1), 36–43.
Nylund, K.L., Asparouhov, T., Muthén, B.O., 2007. Deciding on the number of classes in latent class analysis and growth mixture modeling: a Monte Carlo simulation study. Struct. Equ. Model. Multidiscip. J. 14 (4), 535–569.
Olos, L., Hoff, E.H., 2006. Gender ratios in European psychology. Eur. Psychol. 11 (1), 1–11.
Panayiotou, G., Leonidou, C., Constantinou, E., Hart, J., Rinehart, K.L., Sy, J.T., Björgvinsson, T., 2015. Do alexithymic individuals avoid their feelings? Experiential avoidance mediates the association between alexithymia, psychosomatic, and depressive symptoms in a community and a clinical sample. Compr. Psychiatry 56, 206–216.
Parker, J.D., Keefer, K.V., Taylor, G.J., Bagby, R.M., 2008. Latent structure of the alexithymia construct: a taxometric investigation. Psychol. Assess. 20 (4), 385.
Pielage, S., Gerlsma, C., Schaap, C., 2000. Insecure attachment as a risk factor for psychopathology: the role of stressful events. Clin. Psychol. Psychother. 7 (4), 296–302.
Preece, D.A., Gross, J.J., 2023. Conceptualizing alexithymia. Personal. Individ. Differ. 215, 112375.
Preece, D.A., Sikka, P., 2024. Alexithymia. In: Gross, J.J., Ford, B.Q. (Eds.), Handbook of Emotion Regulation. Guilford Press, pp. 233–241.
Preece, D., Becerra, R., Allan, A., Robinson, K., Dandy, J., 2017. Establishing the theoretical components of alexithymia via factor analysis: introduction and validation of the attention-appraisal model of alexithymia. Personal. Individ. Differ. 119, 341–352.
Preece, D., Becerra, R., Robinson, K., Dandy, J., Allan, A., 2018. The psychometric assessment of alexithymia: development and validation of the Perth alexithymia questionnaire. Personal. Individ. Differ. 132, 32–44.
Preece, D.A., Becerra, R., Robinson, K., Allan, A., Boyes, M., Chen, W., Gross, J.J., 2020a. What is alexithymia? Using factor analysis to establish its latent structure and relationship with fantasizing and emotional reactivity. J. Pers. 88 (6), 1162–1176.
Preece, D.A., Becerra, R., Allan, A., Robinson, K., Chen, W., Hasking, P., Gross, J.J., 2020b. Assessing alexithymia: psychometric properties of the Perth alexithymia questionnaire and 20-item Toronto alexithymia scale in United States adults. Personal. Individ. Differ. 166, 110138.
Preece, D.A., Becerra, R., Boyes, M.E., Northcott, C., McGillivray, L., Hasking, P.A., 2020c. Do self-report measures of alexithymia measure alexithymia or general psychological distress? A factor analytic examination across five samples. Personal. Individ. Differ. 155, 109721.
Preece, D.A., Goldenberg, A., Becerra, R., Boyes, M., Hasking, P., Gross, J.J., 2021. Loneliness and emotion regulation. Personal. Individ. Differ. 180, 110974.
Preece, D.A., Mehta, A., Becerra, R., Chen, W., Allan, A., Robinson, K., Gross, J.J., 2022. Why is alexithymia a risk factor for affective disorder symptoms? The role of emotion regulation. J. Affect. Disord. 296, 337–341.
Preece, D.A., Mehta, A., Petrova, K., Sikka, P., Bjureberg, J., Becerra, R., Gross, J.J., 2023. Alexithymia and emotion regulation. J. Affect. Disord. 324, 232–238.
Preece, D.A., Petrova, K., Mehta, A., Sikka, P., Gross, J.J., 2024. Alexithymia or general psychological distress? Discriminant validity of the Toronto alexithymia scale and the Perth alexithymia questionnaire. J. Affect. Disord. 353, 140–145.
Rosenberg, J.M., Beymer, P.N., Anderson, D.J., Van Lissa, C.J., Schmidt, J.A., 2019. tidyLPA: an R package to easily carry out latent profile analysis (LPA) using open-source or commercial software. J. Open Source Software 3 (30), 978.
Salles, B.M., Maturana de Souza, W., Dos Santos, V.A., Mograbi, D.C., 2022. Effects of DBT-based interventions on alexithymia: a systematic review. Cogn. Behav. Ther. 1–22.
Sethi, S., 2023. An empirical study: self-criticism, rumination response style and alexithymia traits in young adults. Curr. Psychol. 1–11.
Sifneos, P.E., 1973. The prevalence of 'alexithymic' characteristics in psychosomatic patients. Psychother. Psychosom. 22, 255–262.
Sun, Y., Wu, Y., Fan, S., Dal Santo, T., Li, L., Jiang, X., Thombs, B.D., 2023. Comparison of mental health symptoms before and during the covid-19 pandemic: evidence from a systematic review and meta-analysis of 134 cohorts. BMJ 380.
Taylor, G.J., Bagby, R.M., Parker, J.D., 1999. Disorders of Affect Regulation: Alexithymia in Medical and Psychiatric Illness. Cambridge University Press.
Taylor, G.J., Bagby, R.M., Porcelli, P., 2023. Revisiting the concept of Pensée Opératoire: some conceptual, empirical, and clinical considerations. Psychodynamic Psychiatry 51, 287–310.
Tein, J.Y., Coxe, S., Cham, H., 2013. Statistical power to detect the correct number of classes in latent profile analysis. Struct. Equ. Model. Multidiscip. J. 20 (4), 640–657.
Trimble, A.C., Robinson, K., Preece, D.A., 2024. Assessing alexithymia in adolescents: psychometric properties of the Perth alexithymia questionnaire in high school students. Aust. Psychol. 1–13.
van der Velde, J., Servaas, M.N., Goerlich, K.S., Bruggeman, R., Horton, P., Costafreda, S. G., Aleman, A., 2013. Neural correlates of alexithymia: a meta-analysis of emotion processing studies. Neurosci. Biobehav. Rev. 37 (8), 1774–1785.
Van Landeghem, C., Jakobson, L.S., 2024. Isolating unique variance in mental health outcomes attributable to personality variables and childhood emotional abuse. Front. Psychol. 15.
Varma, P., Junge, M., Meaklim, H., Jackson, M.L., 2021. Younger people are more vulnerable to stress, anxiety and depression during COVID-19 pandemic: a global cross-sectional survey. Prog. Neuro-Psychopharmacol. Biol. Psychiatry 109, 110236.
Veirman, E., Van Ryckeghem, D.M., Verleysen, G., De Paepe, A.L., Crombez, G., 2021. What do alexithymia items measure? A discriminant content validity study of the Toronto-alexithymia-scale–20. PeerJ 9, e11639.
Vorst, H.C., Bermond, B., 2001. Validity and reliability of the Bermond–Vorst alexithymia questionnaire. Personal. Individ. Differ. 30 (3), 413–434.
Watters, C.A., Taylor, G.J., Bagby, R.M., 2016. Illuminating the theoretical components of alexithymia using bifactor modeling and network analysis. Psychol. Assess. 28 (6), 627.
Zahid, A., Taylor, G.J., Lau, S.C., Stone, S., Bagby, R.M., 2023. Examining the incremental validity of the Perth alexithymia questionnaire (PAQ) relative to the 20-item Toronto alexithymia scale (TAS-20). J. Pers. Assess. 1–12.