



Queensland University of Technology
Brisbane Australia

This may be the author's version of a work that was submitted/accepted for publication in the following source:

Shaw, Therese, [Campbell, Marilyn](#), Runions, Kevin, & Zubrick, Steve (2017)
Properties of the DASS-21 in an Australian community adolescent population.
Journal of Clinical Psychology, 73(7), pp. 879-892.

This file was downloaded from: <https://eprints.qut.edu.au/101806/>

© Consult author(s) regarding copyright matters

This work is covered by copyright. Unless the document is being made available under a Creative Commons Licence, you must assume that re-use is limited to personal use and that permission from the copyright owner must be obtained for all other uses. If the document is available under a Creative Commons License (or other specified license) then refer to the Licence for details of permitted re-use. It is a condition of access that users recognise and abide by the legal requirements associated with these rights. If you believe that this work infringes copyright please provide details by email to qut.copyright@qut.edu.au

Notice: *Please note that this document may not be the Version of Record (i.e. published version) of the work. Author manuscript versions (as Submitted for peer review or as Accepted for publication after peer review) can be identified by an absence of publisher branding and/or typeset appearance. If there is any doubt, please refer to the published source.*

<https://doi.org/10.1002/jclp.22376>

Properties of the DASS-21 in a community adolescent population

Shaw, T.^{1,2}, Campbell, M.A.³, Runions, K.C.^{1,2}, Zubrick, S. R.^{1,4}

¹ Telethon Kids Institute

² Faculty of Medicine, Dentistry and Health Sciences, The University of Western Australia

³ Queensland University of Technology

⁴ Faculty of Education, The University of Western Australia

Corresponding author: Thérèse Shaw

Tel: +61 8 9489 7611 Email: Therese.Shaw@telethonkids.org.au

Address: 100 Roberts Road, Subiaco, Western Australia, 6008

PO Box 855, West Perth, Western Australia, 6872

Acknowledgments

These data were collected under the auspices of the ARC Linkage Grant No. LP 0882087.

Stephen Zubrick is supported by the Australian Research Council (ARC) Centre of Excellence for Children and Families Over the Lifecourse (CE140100027).

Abstract

Although developed for adults, the DASS-21 (Depression Anxiety Stress Scales - short version) has been utilised in many research studies with adolescent samples. Evidence as to the applicability of the DASS subscale scores to represent the distinct states of depression, anxiety and stress as experienced by adolescents is mixed, and the age at which it may be possible to differentiate these three states using the DASS-21 has not yet been determined. This paper evaluated evidence for a multifactor structure in the DASS-21 in adolescents and the specificity of the three subscales for adolescents in general and at different ages. Data were from a large cross-sectional survey of 2,873 school students in Grades 6-12 (ages 12-18 years) in Australia. Confirmatory bifactor analyses testing a quadripartite factor structure were conducted for the whole sample and across gender by age groups. Internal consistency reliability of the DASS total and subscale scores were determined utilising omega coefficients. Results identified most of the variation in the items was explained by a single dominant general factor and the subscales lacked specificity across all age groups. We conclude the DASS-21 can be reliably used to measure general distress in adolescents, but the subscales fail to discriminate between the three states. Our results indicate this lack of discrimination does not reduce with increasing age. These findings caution against the use of adult theoretical models and measures within adolescent populations.

Depression and anxiety are amongst the more burdensome mental health challenges facing young people today (Beesdo, Knappe, & Pine, 2009; Green, McGinnity, Meltzer, Ford, & Goodman, 2005; Lawrence et al., 2015). Progress in addressing this challenge requires research using robust measures. Specifically, valid and reliable measures for depression and anxiety that can be easily completed at the population level are needed for use in this vulnerable population. The shortened version of the Depression Anxiety Stress Scales (DASS-21) has been found to be a robust instrument for adult research, its target population. The scale is also being utilized more commonly in studies of young people, despite mixed evidence as to its applicability to adolescents (Duffy, Cunningham, & Moore, 2005; Mellor et al., 2014; Patrick, Dyck, & Bramston, 2010; Szabó, 2010). This study aimed to examine the extent to which the DASS-21 can differentiate depression, anxiety and stress in pre-adult populations, and assess the developmental period at which the measures on the subscales may be able to differentiate between the separate experiences of depression, anxiety and stress in young people. More broadly, the study aimed to add to the debate on the applicability of measures developed for adults to adolescent samples, as well as whether population measures can discriminate depression from anxiety in pre-adult populations.

Although the prevalence of clinically significant depressive disorders is low in children (0.2%- 1.1%), rates for adolescents (ages 11 – 17 years) are higher, ranging from about 1.1% – 5.0% (Green et al., 2005; Lawrence et al., 2015). Anxiety disorders are more prevalent in adolescents than depressive disorders – for all anxiety disorders combined, the rates are between 4.4% and 7.0% (Green et al., 2005; Lawrence et al., 2015). Furthermore, the types of anxiety disorders differ regarding the age of onset, with separation anxiety disorder (SAD) and certain specific phobias (SP) emerging prior to 12 years of age; social anxiety disorder (SOC) in late childhood and adolescence; and typical onset for panic disorder, agoraphobia

and generalized anxiety disorder (GAD) in late adolescence and even adulthood (Beesdo et al., 2009).

These figures capture only diagnosable cases. Rates of subthreshold and prodromal episodes of both depression and anxiety are substantially higher. Based on a sample of 12,395 adolescents (aged 14–16 years) from 11 European countries, 29.2% of young people were found to have subthreshold depression and 32% subthreshold anxiety (Balazs et al., 2013). Although subthreshold cases are less severe they are still associated with higher levels of psychopathology, suicidal ideation and functional impairment (Balazs et al., 2013; Fergusson, Horwood, Ridder, & Beautrais, 2005).

A challenge to the study of the development of these conditions lies in the difficulty differentiating them due to their comorbidity. A substantial overlap exists between depression, anxiety and symptoms associated with stress response in children (e.g., Lahey et al., 2004). Amongst adolescents, these symptoms are more distinguishable, but remain highly co-morbid (e.g., Axelson & Birmaher, 2001; Brady & Kendall, 1992; Cummings, Caporino, & Kendall, 2014; Garber & Weersing, 2010). Further complicating the picture, different anxiety disorders have different rates of co-morbidity with depression (Cummings et al., 2014; Garber & Weersing, 2010). Co-morbidity is highest between depression and generalized anxiety disorder, partly due to the overlap in symptoms such as sleep disturbance, fatigue and poor concentration (Cummings et al., 2014; Garber & Weersing, 2010). Over thirty percent of socially phobic adolescents experience depressive disorder (Burstein, Ameli-Grillon, & Merikangas, 2011) and panic attacks were associated with a 3.6 fold increase ($OR = 3.6, 95\% CI [1.6, 8.3]$) in the likelihood of depression in a community sample of youth (9-17 years) (Goodwin & Gotlib, 2004).

Explanations for the co-occurrence of depression and anxiety range from measurement-based accounts (including overlap in item pools and symptoms) to accounts that assume the ontological validity of the different disorders. These include overlap in risk factors (e.g., information-processing biases), presence of one disorder increasing the risk of the other (particularly anxiety leading to depression), and presence of a factor common to both depression and anxiety (Cummings et al., 2014; Garber & Weersing, 2010; Seligman & Ollendick, 1998). An influential exemplar of the latter category is the tripartite model of Clark and Watson (1991) for anxiety and depression. The tripartite model proposes a component of negative affect common to both anxiety and depression, comprising non-differentiating shared symptoms, e.g., anger, guilt, fear, and sadness. The model also includes a component specific to depression characterized by anhedonia and one comprising physiological hyperarousal specific to anxiety. Recently, Cummings et al. (2014) proposed a Multiple Pathways Model for three different developmental processes to the co-occurrence of depression and anxiety dependent on whether the young person had a diathesis for anxiety, for depression or for both, as well as the type of relevant anxiety disorder.

Regardless of the reasons for the co-occurrence of the syndromes, a thorough scientific account of these syndromes requires valid and reliable measurement. Furthermore, to ameliorate the negative outcomes of depression and anxiety experienced at syndromal or subsyndromal levels, and prevent progression to more severe symptoms, it is imperative that measures are available which enable early recognition and intervention.

Research and clinical science alike share a need for brief reliable, valid instruments that can assess depression and anxiety. Self-report measures are essential tools for identifying internalizing disorders as these symptoms are deeply personal and not always observable to others. These measures are cost-effective, easy to administer, require no training and can be used both for screening and for research.

Self-report instruments that robustly differentiate between anxiety and depression are available for adult populations. The briefer form of the Depression Anxiety Stress Subscales (DASS-21) has been shown to have good psychometric properties in adult clinical populations (Clara, Cox, & Enns, 2001; Daza, Novy, Stanley, & Averill, 2002) as well as being effective in detecting clinically significant change (Ng et al., 2007). The original DASS-42 (P. F. Lovibond & S. H. Lovibond, 1995) was empirically derived to specifically measure the core symptoms of depression and anxiety in adults while providing maximal discrimination between the two. To this end, in the shortened form, the anxiety subscale comprises an item measuring situational anxiety, and items for anxious affect or panic and physiologic hyperarousal, hence is most akin to symptoms of panic attacks and social anxiety. The depression subscale of the DASS-21 includes items related to dysphoria, anhedonia, hopelessness, devaluation of life, self-deprecation, inertia, lack of interest and excludes symptoms not unique to depression such as those shared with GAD – sleep disturbance, tiredness and poor concentration. During scale development, a further distinct syndrome was identified of stress or tension. This third syndrome was seen not simply as a general distress factor but as a distinct syndrome characterized by agitation, irritability, impatience and difficulty relaxing.

The DASS-21 was hence posited to have a three-factor structure. However, studies applying 3-factor factor analysis (FA) models to data using the DASS with 11-15 year-old participants in Australia and Malaysia have found a simpler structure holds for adolescents, concluding either that the scale did not discriminate between the three states of depression, anxiety and stress, or that the core symptoms were not present in adolescents in the same way as in adults (Duffy et al., 2005; Hashim, Golok, & Ali, 2011; Patrick et al., 2010; Szabó & Lovibond, 2006). In comparison to correlations between .5 and .7 for adults, correlations between the factors in 3-factor models for adolescent data from Australia, Malaysia, China

and Chile typically ranged from .8 to .9 indicating a lack of differentiation between the constructs (Duffy et al., 2005; Hashim et al., 2011; Mellor et al., 2014; Szabó, 2010; Tully, Zajac, & Venning, 2009).

Given the high comorbidity between depression and anxiety disorders and the hypothesized presence of a general factor comprising non-differentiating symptoms as one possible explanation for this co-occurrence (Clark & Watson, 1991; Cummings et al., 2014; Garber & Weersing, 2010), the application of more complex models than 3-factor FA models, which take the communality of factors into account would seem to be appropriate. An example of such models are bifactor models (Chen, West, & Sousa, 2006; Reise, 2012; Rodriguez, Reise, & Haviland, 2016) in which the shared variance between factors is explicitly modelled as a general factor (on to which all items load). Also included in the model are domain-specific or group factors (on to which only the domain-specific items load), orthogonal both to each other and to the general factor. Allowing each item to load on both a general and domain-specific factor allows for determination of the extent to which each item represents unique variance and a domain-specific dimension, for example, depression, rather than a nonspecific general distress dimension. Hence, an added advantage of these models is their ability to assess the specificity of the items in a scale and the ability of subscales to differentiate between related syndromes (Osman et al., 2012). A bifactor model applied to data from the DASS-21 would comprise a general mental health distress factor, and three domain-specific factors for anxiety, depression and stress respectively.

Bifactor models, and variations thereof, have in fact been applied to assess the factor structure of responses to the DASS-21 for adolescents. However, these studies have found either a simpler structure than the posited 'quadripartite' structure with one general and three domain-specific factors or, where the structure was seen to be supported, the separate factors for depression, anxiety and stress lacked specificity. For example, Tully et al. (2009) and

Willemsen, Markey, Declercq, and Vanheule (2011), based on samples of 4,039 Australian adolescents aged 12-18 years and 677 twelve to seventeen year old Belgian students respectively, identified a hierarchical model, but without a domain-specific stress factor. Furthermore, in addition to the shared variance between the depression and anxiety subscale scores represented by the general factor, in both studies the specified model allowed the depression and anxiety factors to correlate and hence the extent to which these domain-specific factors represented unique constructs is difficult to ascertain. Where a 'quadripartite' model with domain-specific factors for each of the three constructs was seen as presenting best fit, a lack of discrimination between the factors was evident (e.g., Hashim et al., 2011; Mellor et al., 2014; Szabó, 2010; Willemsen et al., 2011). For example, in Szabo's Australian study of predominantly 12-15 year old participants (2010), the factor loadings on the domain-specific factors were relatively low, particularly for the stress factor. In the same 'quadripartite' model as Szabó (2010) applied, but with a sample of Malaysian students (mean age = 13 years), only three of the 21 factor loadings on the domain-specific factors differed significantly from zero and were in line with expectations (Hashim et al., 2011). Hence, in studies where bifactor models were appropriately applied with orthogonal factors, the factor loadings were indicative of a dominant shared factor and a lack of specificity in the domain-specific factors for depression, anxiety and stress.

In summary, the findings from these studies indicate the adult version of the DASS-21 used with adolescents does not exhibit a factor structure representing reasonable discrimination between the constructs of anxiety, depression and stress. Were this the case, low inter-factor correlations in 3-factor FA models or robust factor loadings for domain-specific factors in bifactor models would have been observed.

Developmentally it is important to consider when during youth development the 3-factor structure of the DASS-21 emerges. Many previous studies of the DASS factor structure were

limited to younger adolescents and to date only two studies have compared the factor structure of the DASS-21 in different age groups, with disparate findings. Patrick et al. (2010) analysed data from a sample of 425 Australian students aged 11, 12, 15, 17 years and concluded the latent structure comprised only a single factor and that the DASS-21 “does not differentiate depression, anxiety and stress in children and adolescents” (p. 996). In contrast, Tully et al. (2009) found the same ‘tripartite’ structure (excluding a stress factor) held for younger (aged 12-14 years) and older (15-18 years) Australian students, and concluded the depression and anxiety subscales could be “reliably administered individually, with the caveat that each component shares a large portion of the variance” with a general factor of negative affect, seen as “synonymous with stress” (p. 724).

Given the ambiguity in the literature as to the factor structure of the DASS-21 in youth samples and the age at which the scores on the subscales may represent distinct syndromes, we aimed to explore the factor structure and reliability of the DASS-21 across different age groups in a large adolescent community sample. Thus, we aimed to assess the extent to which the general states of depression, anxiety and stress as posited by the DASS-21 were present at different ages. At a practical level, we wished to determine the utility of the DASS total and the depression, anxiety and stress subscale scores for adolescent samples. We hypothesized that over the course of adolescence, we would see increasing differentiation in the three constructs amongst older adolescents, but not in younger adolescents.

Method

Participants

Cross-sectional data on students' bullying experiences were collected in 29 government and non-government schools in three states in Australia in 2009 (Campbell, Spears, Slee, Butler, & Kift, 2012). In total, 45 schools were approached and 29 agreed to participate (64.4% response rate). The students were in Grades 6-12, typically 10 – 18 years of age.

The sample comprised 2,873 students from the 29 schools ($N = 1,461$, 50.9% female,) with a mean age of 13.95 years ($SD = 1.86$). For age comparisons, the students were grouped into three age categories, namely 13 years and younger ($n = 1,193$), 14-15 years ($n = 1,039$), and 16 years and over ($n = 639$). These groupings were chosen as 14 and 16 years have been suggested as two minimum ages at which the DASS may be administered (Lovibond, 2014).

Measures

Depression Anxiety and Stress Scale (S. H. Lovibond & P. F. Lovibond, 1995). This is a 21-item shortened version of the Depression, Anxiety and Stress Scale-42. Participants rate the extent to which certain experiences applied to them over the past week on a four-point scale, ranging from "Did not apply to me at all" to "Applied to me very much, or most of the time". Examples of items are: "I felt that life was meaningless" (depression), "I was aware of the action of my heart, without any physical exertion" (anxiety) and "I found it hard to wind down" (stress). Scores are summed to create a total score (0-126) or for each of the seven-item subscales (0-42). In calculating the mean scores, up to one missing item per subscale was allowed, with the missing item replaced by the mean, as per recommended DASS procedures (Lovibond, 2014).

Procedure

Ethics approval was received from the involved universities, educational systems and schools. Information on the study was provided to parents and, as required, written opt-in parental consent sought. This resulted in survey completion by 30% of the eligible students. Parents and students were assured participation was voluntary and of the anonymity of responses. Student assent was sought prior to survey administration. Hard copy self-complete surveys were administered during class time by a research assistant, with standardized instructions read prior to the administration. Students were provided with a tear-off last page with help seeking suggestions and help-line phone numbers.

Data analyses

Bifactor models are ideally suited to the analysis of multidimensional constructs with overlap between the domains (Chen et al., 2006; Rodriguez et al., 2016). In contrast to second-order factor models where the scale items only relate indirectly through the first-order factors to the second-order or general factor, in bifactor models the factors are not nested and hence the variance in the items can be partitioned into that explained by a broad general factor (general distress in this instance) as well as a domain-specific factor (of depression, anxiety or stress). Hence the component unique to each subscale is identified and quantified, enabling one to determine the specificity of each subscale and the extent to which scores on the subscales discriminate between the inter-related constructs (as opposed to simply being measures of the general distress factor).

The extent to which the aim is met of the DASS scale to measure and differentiate the three constructs, would therefore be demonstrated by good fit of a bifactor model with a common general factor and at least moderate loadings of the relevant items on the domain-specific or group factors i.e., the items would relate strongly to their domain-specific factors. Furthermore, the variance in the item scores would be shared between the general factor and

the domain-specific factors, i.e., the specific factors would explain a substantive share of the total variation in the data.

As the objective was not to identify the ‘best’ model, but test the hypothesized factor structure, confirmatory bifactor models with one general and three domain-specific factors comprising the DASS subscales were applied in Mplus 7.31. All factors in the bifactor models were orthogonal to appropriately partition the variance shared across the items into the general factor and model the unique variance within the set of items specified in the domain-specific factors (Chen et al., 2006; Reise, 2012). Weighted least squares estimation with standard errors and mean- and variance-adjusted chi-square test statistics (WLSMV) was applied due to the skewed categorical item data and school-level clustering was accounted for with the ‘Cluster’ option (Muthén & Muthén, 1998-2012). Missing data were minimal and handled in MPlus through full information maximum likelihood (FIML).

We were also concerned to provide estimates of reliability for the resultant common factor and subscales. Given the multidimensional nature of the constructs and the limitations of the alpha coefficient for complex constructs, we calculated omega-hierarchical and omega-hierarchical subscale coefficients based on the bifactor model (Gignac, 2014; Rodriguez et al., 2016). The coefficient omega-hierarchical represents the degree to which a total unit-weighted composite score is interpretable as a measure of a single common factor, that is, as a measure of internal consistency reliability (Reise, 2012). Omega-hierarchical subscale values indicate the extent to which it is reasonable to report subscale composite scores (unit-weighted) as a measure of the unique components of the construct (the residualized scores after the variance explained by the general factor is removed) rather than an amalgamation of the unique and general factors (Reise, 2012). The analyses were conducted on the data from the whole sample and, to assess developmental differences and in recognition of possible gender effects, within each of the age-gender subgroups.

Results

Female students reported significantly higher total DASS scores ($M_F = 24.7$, $M_M = 18.9$; $t(2866) = -6.40$, $p < .001$) and age differences were significant ($F(2, 2868) = 42.6$, $p < .001$). Although the two younger age groups had similar mean total scores ($M_{13} = 18.6$, $M_{14-15} = 20.8$; $p = .089$), the 16 years and over age group ($M_{16} = 29.5$) differed significantly from each of the other two age groups ($p < .001$).

Factor analyses

A confirmatory bifactor model with a general factor and domain-specific factors for depression, anxiety and stress, was applied (all factors orthogonal). Results for the whole sample are described first, trends across age by gender groups will be dealt with in a later section. The fit of the model was adequate (RMSEA $< .06$ and CFI $> .95$) (**Error! Reference source not found.**). All the items loaded strongly on the general factor (minimum = .595 and almost all above .7), while the loadings on the domain-specific factors were relatively low ($\leq .410$, 66.7% below .3) (**Error! Reference source not found.**). This pattern indicates dominance of a general factor and a lack of specificity in the three domain-specific or group factors. The dominance of the general factor is reinforced by the ECVI (Explained Common Variance Index) value of .89, i.e. 89% of the total variance in the data is explained by the general factor leaving 11% unique to the domain-specific factors.

The item loadings on the general and domain-specific factors may provide some insight into the phenomenology of the constructs in adolescents. The two items which loaded strongest on the general factor were from the anxiety subscale related to panic, namely “felt close to panic” (item 15) and “scared for no good reason” (item 20). Also prominent in the general

factor were the depression indicators of dysphoria (item 13: “down-hearted and blue”), lack of interest (item 16), self-deprecation (item 17) and devaluation of life (item 21), together with the stress indicators of difficulty relaxing (item 12), nervous arousal (item 8) and agitation (item 11). In contrast the factor loadings for the depression indicators of anhedonia (item 3) and inertia (item 5) and for the anxiety indicators related to physiological arousal (items 2, 4, 7 and 19) were slightly lower.

The depression-specific factor was best represented by items measuring devaluation of life (item 21), low self-worth (item 17), hopelessness (item 10), and lack of interest (item 16). For anxiety, the only items with loadings above .3 were “breathing difficulty (item 4) and “aware of heart action” (item 19). For the stress subscale, only item 1 (“I found it hard to wind down”) loaded higher than .30.

As found in other studies (Tully et al., 2009; Willemsen et al., 2011), item 8 “I felt I was using a lot of nervous energy”, did not align well with the stress construct to which it is allocated, with a negative loading of -.047 on this domain-specific factor. Exploratory analyses in MPlus indicated this item was better included in the model as a reflection of anxiety (e.g., a factor loading of .329 ($SE = .024$) on the anxiety specific factor).

Reliability analyses

The coefficient omega-hierarchical was calculated from the bifactor model results as an appropriate measure of reliability for data with a hierarchical factor structure such as these (Gignac, 2014; Reise, 2012). The value of .943 indicates high reliability of a unit-weighted composite score of the 21 items of the DASS and the interpretability of a total score as a measure of a single common factor.

The reliability of the *residualized* subscales, i.e., after the variance explained by the general factor is removed, are given by the omega-hierarchical subscale values in the table below. As reliability coefficients, values above .7 for omega coefficients are preferable. None of the three subscales approached this value. In fact, the highest coefficient was only 0.12 (depression). Given the low values of these reliability coefficients, subscale scores would be unreliable and imprecise indicators of the unique constructs (e.g., the component of depression not shared with anxiety and stress) they are meant to represent. Fundamentally, these values again underline the lack of differentiation between the subscales and the dominance of a general factor.

Supplementary analyses

The conclusion regarding a single dominant factor underlying the DASS items was supported by other analyses, not fully reported here. We ran an exploratory factor analysis as a means of assessing the underlying factor structure and a unidimensional model was indicated (e.g., 1st eigenvalue = 13.148, 2nd eigenvalue = 0.934). We also fitted an oblique three factor CFA in line with the original correlated 3-factor DASS model (**Error! Reference source not found.**). Although the model fit the data well (RMSEA = .030, CFI = .987; factor loadings all above .6), the correlations between the factors were extremely high (depression and anxiety $r = .895$, stress and anxiety $r = .944$, stress and depression $r = .910$) indicating the presence of substantive overlap between the factors.

Comparisons across gender by age groups

The above analyses on the whole sample were repeated for the six groups defined by gender and age. Of interest here is whether the hypothesized model exhibits a closer fit to the data for older versus younger adolescents and hence whether the three states of depression, anxiety and stress as defined by the DASS-21 become more differentiated with age.

The results within each demographic group were largely consistent with those from the whole sample in terms of the dominance of a single factor and the non-specificity of the domain-specific factors. The fit of the bifactor model was adequate within each gender by age group (**Error! Reference source not found.**) and the pattern of factor loadings (not shown) was consistent with that of the whole sample, namely substantive loadings for the general factor with the majority of loadings on the domain-specific factors low (on average 62% of loadings below .3).

As for the total sample, the ECVI values indicated that most of the variability (82.8% or higher) was explained by the general factor (**Error! Reference source not found.**). This percentage would be expected to reduce with increasing age, if the three states become more differentiated with age. However, for both male and female adolescents, the ECVI value remained high across the age groups, with the least overlap in the scale scores present in the middle and not the oldest age group.

The omega-hierarchical and omega-hierarchical subscale scores for each subgroup reflected those of the whole sample, indicating the reliability of the total score as a measure of psychological distress and the lack of specificity of the subscale scores (**Error! Reference source not found.**).

The supplementary analyses conducted for the whole sample, were repeated within each of the gender by age groups. Again the results of exploratory factor analyses (not shown) supported extraction of a single factor (e.g., 1st eigenvalue between 12.1 and 13.4, 2nd eigenvalue between 0.99 and 1.37). The fit of the original DASS 3-factor CFA model was adequate in each group, but the inter-factor correlations were again high (**Error! Reference source not found.**). If the three states of depression, anxiety and stress do become more differentiated with age, one would expect the inter-factor correlations to diminish from the

youngest to the oldest age group. However, the values were similar and if anything, the correlations were lower in the middle age group of 14-15 year olds for both boys and girls.

Discussion

Consistent with the findings of others (Osman et al., 2012; Patrick et al., 2010; Tully et al., 2009) our analyses revealed the dominance of a single factor explaining most of the common variance in the DASS-21 scores for adolescents and young people (almost 90%), with little variation unique to the three domain-specific factors corresponding to the subscales. Results from the reliability analyses indicated the reliability of a composite unit-weighted *total* DASS-21 score as a measure of the single construct of psychological distress, while highlighting the inability of scores on the *subscales* to adequately represent the unique aspects of depression, anxiety and stress. In addition, the overlap or non-differentiation between depression, anxiety and stress did not reduce with increasing age of the adolescents in either the female or male samples.

Whilst these results are counter to the specific aim of the DASS-21 to maximally discriminate between the three states, a lack of specificity in the three subscales for adolescents may be expected. The anxiety subscale is dominated by items related to panic and to a lesser degree social phobia. Non-differentiation between depression and anxiety could be a consequence of their high comorbidity in youth, including panic attacks and social phobia (Burstein et al., 2011; Goodwin & Gotlib, 2004). The overlap between the depression and stress subscales is also not surprising given the fact that depressed mood may be characterized by irritability and anger in adolescents (American Psychiatric Association, 2013). The states are also less differentiable in community than clinical samples (Cummings et al., 2014), such as in this study. However, the extent of the lack of differentiation is

surprising. High correspondence between the anxiety and depression subscales would have resulted had the anxiety subscale represented GAD (and hence symptoms that overlap with depression), but this is not the case. Furthermore, the items that load strongest on the common factor in the bifactor model represent disparate symptoms including panic and dysphoria. The fact that the states do not become more differentiated with age is also notable given that the DASS anxiety subscale comprises items mainly measuring panic-like symptoms and panic disorder typically develops in later adolescence (Beesdo et al., 2009).

The factor loadings in the bifactor model provide some support for the tripartite model of Clark and Watson (1991). For example, the indicators of somatic or physiological arousal associated with anxiety and of the anhedonia aspect of depression were amongst the items with the lowest loadings on the general factor. On the other hand, the physiological symptoms of anxiety loaded strongest on the anxiety-specific factor whilst the two items related to generalized distress had negligible loadings. The uniqueness of these symptoms to anxiety as posited in the tripartite model have also been supported by the findings of others (e.g., Duffy et al., 2005; Osman et al., 2012). The aspect of depression seen as unique under the tripartite model is a lack of positive affect. Again, some support for this is evident from our bifactor models, with items such as feeling life is meaningless, having low self-worth, having nothing to look forward to and lacking enthusiasm loading strongest on the depression specific factor.

There are many reasons why adult measures may not be acceptable in assessing adolescents. First is the reading level required for self-report measures. Using multiple readability measures (the Flesch Reading ease, SMOG and FORCAST formulae) the DASS-21 scales have been shown to have a mean grade level reading age of 8.4 for the instructions and 8.6 for the items meaning that adolescents with a reading age of about 13 years would be able to easily read them (McHugh & Behar, 2009). This is higher than the national norm for reading

newspapers, which is about grade level of 5th or 6th grade. Consequently, we believe it is fair to eliminate this account of the failure to discriminate.

It has also been shown, in addition to readability, that young people's answers to self-report questionnaires about anxiety and depression are determined to some extent by the manner in which the words are understood and interpreted. For example, Campbell, Rapee, and Spence (2001) demonstrated that adults, when asked to indicate their degree of worry about threatening outcomes, interpreted the questions in terms of the frequency with which they thought about the outcomes rather than the degree of aversiveness associated with each outcome. When asked the same questions, young children from 5-9 years old, however, appeared to interpret the questions in terms of the degree of aversiveness of the outcomes should they occur rather than the frequency they thought about them. In contrast, adolescents from 10-16 years old were in a transition stage between equating worry with how bad the outcomes would be if they occurred and equating worry with frequency of thought, similar to adults. Thus adolescents' responses are not only determined by the readability of the words and phrases but also young people's understanding of the adult meaning of these emotion words.

Fowler and Szabó (2013) also considered the failure in identifying stress in particular using the adult DASS in adolescents may be due to differences in comprehension of terms used in the items, e.g., 'intolerant' and 'agitated'. A modified DASS with simplified language and fewer items was developed and tested with adolescents, however further work is required to refine the scale (Fowler & Szabó, 2013). Unfortunately no reading level was reported for this amended scale.

Response set bias may be a contributing factor to the lack of discrimination between depression, anxiety and stress of the DASS in this sample of adolescents – all the items are

phrased negatively and some respondents may simply give the same response to each item due to this consistent phrasing. The collocation of the items assessing the different states within the same scale may also contribute to homogeneity of responses. Furthermore, as adolescence is a time of emotional lability, the time frame of “over the past week” might also be too short a period to accurately assess the differentiation of symptoms at this age.

Of course another possibility is that anxiety, depression and stress are in fact not differentiated symptoms in most adolescents. The DASS-21 is not the only self-report measure that shows high correlations between anxiety and depression scores (e.g., Ollendick, Seligman, Goza, Byrd, & Singh, 2003; Valentiner, Gutierrez, & Blacker, 2002). Similar findings have been reported for the State-Trait Anxiety Inventory for Children (STAIC), the Revised Children's Manifest Anxiety Scale (RCMAS) and the Children's Depression Inventory (CDI) (Cole, Truglio, & Peeke, 1997; Joiner Jr, Catanzaro, & Laurent, 1996), as well as significant correlations between depression and hyperarousal as measured by the Physiological Hyperarousal Scale for Children (PH-C) and PH subscale of the Affect and Arousal Scale (AFARS PH) (Jacques & Mash, 2004). Only a handful of studies such as Boyd and Gullone (1997) maintain, although depression and anxiety are highly correlated, they can be distinguished in adolescents. Adolescence is the time when there is the highest comorbidity of these disorders over the life span (Ollendick, Shortt, & Sander, 2005). Additionally, it has been shown that the phenotypic and genetic structure of internalizing disorder symptoms may differ across the course of development (Waszczuk, Zavos, Gregory, & Eley, 2014). Depression and anxiety may become more associated in adolescence and share most of their genetic etiology with an overarching internalizing genetic found in emerging adults. Perhaps our results are partially due to the fact that the adolescents in this study's community sample experienced only low levels of distress and thus the three

syndromes were not as differentiable as would be the case in clinically depressed and anxious adolescents (Brady & Kendall, 1992; Cummings et al., 2014).

We hypothesized that we would observe an age-related developmental progression of differentiation of the three states of depression, anxiety and stress measured by the DASS-21 in this adolescent population, and yet we did not. This is similar to Tully et al. (2009) where the same factor structure and negligible differences in factor loadings and correlations were found for the DASS-21 between a younger (12-14-years-old) and older (15-18-years-old) group of adolescents. The results of Osman et al. (2012), in a study of emerging adults (university students with a mean age of 19.5 years, $SD = 2.2$) are similar to ours, namely the predominance of a general factor accounting for a large proportion of the common variance in the DASS-21 item scores. Yet the DASS-21 was originally developed in a sample of first year university students with a mean age of 21 years (P. F. Lovibond & S. H. Lovibond, 1995). It is interesting to note that the mean ages for samples of the DASS-21 in non-clinical adult samples which have shown that a 3-factor model fit the data best was 41.0 years ($SD = 15.9$) (Henry & Crawford, 2005) and 44.7 years ($SD = 16.3$) (Sinclair et al., 2012). Perhaps the age where differentiation occurs is much later than has been expected.

Inference from this study must be made in light of its strengths and limitations. Given our community sample, the extent to which the findings are applicable within clinical samples is unknown. The generalizability of the findings beyond the observed sample is also limited by the low participation rate, largely due to low parental consent rates. Based on our experience in Australian school studies, when active parental consent procedures are mandated, consent rates are low and samples biased toward higher socio-economic families and more highly educated parents. Hence the sample was likely skewed toward adolescents with greater reading ability. However, the validity of the findings are strengthened by the large sample

size, particularly the numbers of schools sampled from different school sectors and Australian states.

Conclusions from the literature and our findings are that the DASS-21 can be reliably used to measure general distress in adolescents, but the subscales fail to discriminate between the three states of depression, anxiety and stress in youth. Our results indicate this lack of discrimination does not reduce with increasing age. Hence, we do not recommend the use of the DASS subscale scores as measures of these separate constructs in adolescent community samples, since large components of the three subscale scores would reflect the one common state of generalized psychological distress.

References

- American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*. Arlington, VA: American Psychiatric Association.
- Axelson, D. A., & Birmaher, B. (2001). Relation between anxiety and depressive disorders in childhood and adolescence. *Depression and anxiety, 14*(2), 67-78. doi:10.1002/da.1048
- Balazs, J., Miklósi, M., Keresztesy, A., Hoven, C. W., Carli, V., Wasserman, C., . . . Cosman, D. (2013). Adolescent subthreshold-depression and anxiety: Psychopathology, functional impairment and increased suicide risk. *Journal of child psychology and psychiatry, 54*(6), 670-677. doi:10.1111/jcpp.12016
- Beesdo, K., Knappe, S., & Pine, D. S. (2009). Anxiety and anxiety disorders in children and adolescents: Developmental issues and implications for DSM-V. *Psychiatric Clinics of North America, 32*(3), 483-524. doi:10.1016/j.psc.2009.06.002
- Boyd, C. P., & Gullone, E. (1997). An investigation of negative affectivity in Australian adolescents. *Journal of Clinical Child Psychology, 26*(2), 190-197. doi:10.1207/s15374424jccp2602_7
- Brady, E. U., & Kendall, P. C. (1992). Comorbidity of anxiety and depression in children and adolescents. *Psychological Bulletin, 111*(2), 244-255. doi:10.1037/0033-2909.111.2.244
- Burstein, M., Ameli-Grillon, L., & Merikangas, K. R. (2011). Shyness versus social phobia in US youth. *Pediatrics, 128*(5), 917-925. doi:10.1542/peds.2011-1434
- Campbell, M. A., Rapee, R. M., & Spence, S. H. (2001). Developmental changes in the interpretation of rating format on a questionnaire measure of worry. *Clinical Psychologist, 5*(2), 49-59. doi:10.1080/13284200108521078
- Campbell, M. A., Spears, B., Slee, P., Butler, D., & Kift, S. (2012). Victims' perceptions of traditional and cyberbullying, and the psychosocial correlates of their victimisation. *Emotional and Behavioural Difficulties, 17*(3-4), 389-401. doi:10.1080/13632752.2012.704316
- Chen, F. F., West, S. G., & Sousa, K. H. (2006). A comparison of bifactor and second-order models of quality of life. *Multivariate Behavioral Research, 41*(2), 189-225. doi:10.1207/s15327906mbr4102_5
- Clara, I. P., Cox, B. J., & Enns, M. W. (2001). Confirmatory factor analysis of the Depression–Anxiety–Stress Scales in depressed and anxious patients. *Journal of Psychopathology and Behavioral Assessment, 23*(1), 61-67.
- Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: Psychometric evidence and taxonomic implications. *Journal of abnormal psychology, 100*(3), 316-336.
- Cole, D. A., Truglio, R., & Peeke, L. (1997). Relation between symptoms of anxiety and depression in children: A multitrait-multimethod-multigroup assessment. *Journal of Consulting and Clinical Psychology, 65*(1), 110-119. doi:10.1037/0022-006X.65.1.110
- Cummings, C. M., Caporino, N. E., & Kendall, P. C. (2014). Comorbidity of anxiety and depression in children and adolescents: 20 years after. *Psychological Bulletin, 140*(3), 816. doi:10.1037/a0034733
- Daza, P., Novy, D. M., Stanley, M. A., & Averill, P. (2002). The depression anxiety stress scale-21: Spanish translation and validation with a Hispanic sample. *Journal of Psychopathology and Behavioral Assessment, 24*(3), 195-205.
- Duffy, C. J., Cunningham, E. G., & Moore, S. M. (2005). Brief report: The factor structure of mood states in an early adolescent sample. *Journal of Adolescence, 28*(5), 677-680. doi:10.1016/j.adolescence.2005.08.013
- Fergusson, D. M., Horwood, L. J., Ridder, E. M., & Beautrais, A. L. (2005). Subthreshold depression in adolescence and mental health outcomes in adulthood. *Archives of general psychiatry, 62*(1), 66-72. doi:10.1001/archpsyc.62.1.66
- Fowler, S., & Szabó, M. (2013). The emotional experience associated with worrying in adolescents. *Journal of Psychopathology and Behavioral Assessment, 35*(1), 65-75. doi:10.1007/s10862-012-9316-3

- Garber, J., & Weersing, V. R. (2010). Comorbidity of anxiety and depression in youth: Implications for treatment and prevention. *Clinical Psychology: Science and Practice, 17*(4), 293-306. doi:10.1111/j.1468-2850.2010.01221.x
- Gignac, G. E. (2014). On the inappropriateness of using items to calculate total scale score reliability via coefficient alpha for multidimensional scales. *European Journal of Psychological Assessment, 30*(2), 130-139. doi:10.1027/1015-5759/a000181
- Goodwin, R. D., & Gotlib, I. H. (2004). Panic attacks and psychopathology among youth. *Acta Psychiatrica Scandinavica, 109*(3), 216-221. doi:10.1046/j.1600-0447.2003.00255.x
- Green, H., McGinnity, A., Meltzer, H., Ford, T., & Goodman, R. (2005). *Mental health of children and young people in Great Britain, 2004*. Office of National Statistics, Houndsmills: Palgrave Macmillan Basingstoke.
- Hashim, H. A., Golok, F., & Ali, R. (2011). Factorial validity and internal consistency of Malaysian adapted Depression Anxiety Stress Scale-21 in an adolescent sample. *International Journal of Collaborative Research on Internal Medicine & Public Health, 3*(1), 29-39.
- Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *British Journal of Clinical Psychology, 44*(2), 227-239. doi:10.1348/014466505X29657
- Jacques, H. A. K., & Mash, E. J. (2004). A test of the tripartite model of anxiety and depression in elementary and high school boys and girls. *Journal of abnormal child psychology, 32*(1), 13-25.
- Joiner Jr, T. E., Catanzaro, S. J., & Laurent, J. (1996). Tripartite structure of positive and negative affect, depression, and anxiety in child and adolescent psychiatric inpatients. *Journal of abnormal psychology, 105*(3), 401-409. doi:10.1037/0021-843X.105.3.401
- Lahey, B. B., Applegate, B., Waldman, I. D., Loft, J. D., Hankin, B. L., & Rick, J. (2004). The structure of child and adolescent psychopathology: generating new hypotheses. *Journal of abnormal psychology, 113*(3), 358-385. doi:10.1037/0021-843X.113.3.358
- Lawrence, D., Johnson, S., Hafekost, J., Boerhoorn de Hann, D., Sawyer, M., & Zubrick, S. R. (2015). *The mental health of children and adolescents: Report on the Second Australian Child and Adolescent Survey of Mental Health and Wellbeing*. Retrieved from Canberra, Australia:
- Lovibond, P. F. (2014). Depression Anxiety Stress Scales (DASS). Retrieved from <http://www2.psy.unsw.edu.au/dass/>
- 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. *Behaviour research and therapy, 33*(3), 335-343.
- Lovibond, S. H., & Lovibond, P. F. (1995). *Manual for the Depression Anxiety Stress Scales* (2nd ed.). Sydney: Psychology Foundation of Australia.
- McHugh, R. K., & Behar, E. (2009). Readability of self-report measures of depression and anxiety. *Journal of Consulting and Clinical Psychology, 77*(6), 1100. doi:10.1037/a0017124
- Mellor, D., Vinet, E. V., Xu, X., Mamat, N. H. B., Richardson, B., & Román, F. (2014). Factorial invariance of the DASS-21 among adolescents in four countries. *European Journal of Psychological Assessment, 31*(2), 138-142. doi:10.1027/1015-5759/a000218
- Muthén, L. K., & Muthén, B. O. (1998-2012). *Mplus User's Guide. Seventh Edition*. Los Angeles, CA: Muthén & Muthén.
- Ng, F., Trauer, T., Dodd, S., Callaly, T., Campbell, S., & Berk, M. (2007). The validity of the 21-item version of the Depression Anxiety Stress Scales as a routine clinical outcome measure. *Acta Neuropsychiatrica, 19*(5), 304-310. doi:10.1111/j.1601-5215.2007.00217.x
- Ollendick, T. H., Seligman, L. D., Goza, A. B., Byrd, D. A., & Singh, K. (2003). Anxiety and depression in children and adolescents: A factor-analytic examination of the tripartite model. *Journal of Child and Family Studies, 12*(2), 157-170. doi:10.1023/03/0600-0157/0

- Ollendick, T. H., Shortt, A. L., & Sander, J. B. (2005). Internalizing disorders of childhood and adolescence. In J. E. Maddux & B. A. Winstead (Eds.), *Psychopathology: Foundations for a contemporary understanding* (pp. 353-376). Mahwah, NJ: Lawrence Erlbaum.
- Osman, A., Wong, J. L., Bagge, C. L., Freedenthal, S., Gutierrez, P. M., & Lozano, G. (2012). The Depression Anxiety Stress Scales—21 (DASS-21): Further examination of dimensions, scale reliability, and correlates. *Journal of Clinical Psychology, 68*(12), 1322-1338. doi:10.1002/jclp.21908
- Patrick, J., Dyck, M., & Bramston, P. (2010). Depression Anxiety Stress Scale: Is it valid for children and adolescents? *Journal of Clinical Psychology, 66*(9), 996-1007. doi:10.1002/jclp.20696
- Reise, S. P. (2012). The rediscovery of bifactor measurement models. *Multivariate Behavioral Research, 47*(5), 667-696. doi:10.1080/00273171.2012.715555
- Rodriguez, A., Reise, S. P., & Haviland, M. G. (2016). Evaluating Bifactor Models: Calculating and Interpreting Statistical Indices. *Psychological Methods, 21*(2), 137-150. doi:10.1037/met0000045
- Seligman, L. D., & Ollendick, T. H. (1998). Comorbidity of anxiety and depression in children and adolescents: An integrative review. *Clinical Child and Family Psychology Review, 1*(2), 125-144.
- Sinclair, S. J., Siefert, C. J., Slavin-Mulford, J. M., Stein, M. B., Renna, M., & Blais, M. A. (2012). Psychometric evaluation and normative data for the depression, anxiety, and stress scales-21 (DASS-21) in a nonclinical sample of US adults. *Evaluation & the health professions, 35*(3), 259-279. doi:10.1177/0163278711424282
- Szabó, M. (2010). The short version of the Depression Anxiety Stress Scales (DASS-21): Factor structure in a young adolescent sample. *Journal of Adolescence, 33*(1), 1-8. doi:10.1016/j.adolescence.2009.05.014
- Szabó, M., & Lovibond, P. F. (2006). Anxiety, depression, and tension/stress in children. *Journal of Psychopathology and Behavioral Assessment, 28*(3), 195-205. doi:10.1007/s10862-005-9008-3
- Tully, P. J., Zajac, I. T., & Venning, A. J. (2009). The structure of anxiety and depression in a normative sample of younger and older Australian adolescents. *Journal of abnormal child psychology, 37*(5), 717-726. doi:10.1007/s10802-009-9306-4
- Valentiner, D. P., Gutierrez, P. M., & Blacker, D. (2002). Anxiety measures and their relationship to adolescent suicidal ideation and behavior. *Journal of anxiety disorders, 16*(1), 11-32. doi:10.1016/S0887-6185(01)00086-X
- Waszczuk, M. A., Zavos, H. M. S., Gregory, A. M., & Eley, T. C. (2014). The phenotypic and genetic structure of depression and anxiety disorder symptoms in childhood, adolescence, and young adulthood. *JAMA psychiatry, 71*(8), 905-916. doi:10.1001/jamapsychiatry.2014.655
- Willemsen, J., Markey, S., Declercq, F., & Vanheule, S. (2011). Negative emotionality in a large community sample of adolescents: The factor structure and measurement invariance of the short version of the Depression Anxiety Stress Scales (DASS-21). *Stress and Health, 27*(3), e120-e128. doi:10.1002/smi.1342