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A multi-method assessment of emotional processes predicting longitudinal anxiety symptom trajectories in an adolescent clinical sample

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Abstract

Objective: Emotion recognition, reactivity, and regulation are important in the development and maintenance of anxiety disorders. Whether and how these processes differentiate between different trajectories in anxiety remain unclear. The current study examined emotional processes as prospective predictors of anxiety symptom trajectories in psychiatrically hospitalized youth.

Method: Participants were 180 adolescents ($M_{\text{age}} = 14.89$; $SD = 1.35$) from a psychiatric inpatient unit. At index hospitalization, participants completed a behavioral task assessing facial emotion recognition, and self-report measures of emotion dysregulation and reactivity. They completed a self-report measure on anxiety symptoms at baseline and 3, 6, 12, and 18 months post-discharge. Latent growth curve analysis was conducted to identify subgroups of individuals based upon their trajectory of anxiety symptoms across 18-months. ANOVAs were used to examine subgroup differences in emotional processing variables.

Results: Three distinct trajectories were identified, a stable moderate-to-high anxiety group, a group with moderate-to-high anxiety at baseline with symptom improvement over time, and a group characterized by relatively stable low-to-moderate anxiety throughout the study. The two initially moderate-to-high anxiety groups scored higher for emotion dysregulation and emotion reactivity at baseline compared to the low-to-moderate anxiety group. Emotion regulation difficulties relating to emotional non-acceptance were higher for the stable moderate-to-high

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Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Richard T. Liu reports was provided by NIMH. Richard T. Liu reports a relationship with Relmada Therapeutics Inc that includes: consulting or advisory. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

anxiety group than for the moderate-to-high anxiety group that experience symptom improvement over time.

Conclusions: These findings may have clinical implications for discharge planning. Future studies should explore emotion regulation with a focus on non-acceptance of one's emotional experiences as a potential target of intervention in individuals with elevated anxiety.

Keywords

Anxiety; Symptom trajectories; Adolescents; Emotion reactivity; Emotion regulation

1. Introduction

Epidemiological research indicate that anxiety disorders are the most common form of psychopathology among children and adolescents [30]. In fact, some research shows that as many as 30 % of youth will develop an anxiety disorder by age 18 [30]. Prevalence of anxiety disorders are elevated in clinical samples, with a recent study of adolescents in a partial hospitalization program finding that 75 % had at least one anxiety disorder [35]. Longitudinal research suggest that anxiety disorders often precede the developmental onset of mood disorders [9], substance use, and externalizing disorders [45,48]. Thus, understanding risk and maintenance factors of anxiety disorders is critical to prevent these negative mental health outcomes long term.

Most longitudinal studies in the youth anxiety literature tend to focus on characterizing the average symptom course for all participants, which does not reflect the significant heterogeneity in trajectories in anxiety symptoms (e.g., multifinality) that may exist among youth. However, it is important to identify these symptom trajectories and study how they may differ from each other, as doing so may advance the goal of developing tailored interventions [13]. The few previous studies that have examined anxiety symptom trajectories among adolescents consistently identified multiple distinct symptom trajectories [1,11,31, 32]. The number and nature of trajectories varied across studies, with two to three trajectories being most common [1,11,31], and one study finding five trajectories [32]. All studies identified a stable low anxiety symptom trajectory; high-increasing/fluctuating anxiety and moderate-level anxiety trajectories were also reported in almost all studies. The high and changing trajectory showed an increase followed by a decrease that leveled off [31]. Without exception, these studies featured general community samples, leaving unclear what symptom trajectories may be found with adolescent clinical samples, especially after discharge from acute care facilities, where initially elevated symptom presentations may be more common.

1.1. Emotional processes and anxiety

Identifying what may differentiate between anxiety symptom trajectories in clinical populations is important insofar as they may assist clinicians in making disposition determinations and serve as actionable treatment targets. The processing of emotions – including emotion recognition, emotion reactivity, and emotion regulation – are interrelated constructs [18] that play important roles in both the development and maintenance of

anxiety disorders. Given this relationship, emotional processes are promising candidates but have yet to be investigated within this context.

Emotion recognition, defined as the capacity to interpret and understand the emotional state of another person based on sensory stimuli [14], is an important aspect of emotional experiences. Difficulties in emotion recognition represent a transdiagnostic risk factor for various psychiatric disorders in youth [10,46]. Several studies have found that deficits in emotion recognition to be linked to internalizing symptoms over time [7,15,22]. However, to our knowledge, emotion recognition has not been studied longitudinally in relation to anxiety specifically. Furthermore, the three aforementioned studies of internalizing symptoms were limited to two time-points and thus precluded examinations of symptom trajectories. Therefore, how emotion recognition prospectively relates to trajectory of anxiety symptoms remains unclear.

Emotion reactivity is defined as the threshold of stimuli needed to generate an emotional response, including the frequency, intensity, and duration of this response [12,33]. According to an emotion dysregulation model of anxiety [26], anxiety is marked by heightened emotional reactivity, in which one experiences emotions quickly, easily, and intensely. Consistent with this model, prior literature has found that youth with anxiety disorders endorse greater negative affect and reactivity to negative events [21,44] and other negative stimuli [5] compared to non-anxious youth. One study found that heightened emotional reactivity in college students is prospectively associated with anxiety disorders [25]. Nonetheless, the longitudinal relationship between emotion reactivity and anxiety has been understudied, and to our knowledge, no study has examined the former in relation to longitudinal trajectories of the latter.

Emotion reactivity is also related to problems with emotion regulation [33]. This holds true in the context of anxiety; according to an emotion dysregulation model of anxiety [26], the elevated emotion reactivity characteristic of anxiety disorders leads to emotional responses to negative stimuli that are difficult to regulate. Emotion regulation is defined as an effort to influence which, when, and for how long one experiences emotions, as well as the way in which one experiences or expresses them in order to accomplish one's goals [18,19]. This construct has been conceptualized as consisting of multiple facets, including awareness, clarity, and acceptance of emotions, as well as the ability to engage in goal-directed behavior, to control emotional impulses, and to access situationally appropriate regulation strategies when experiencing negative affect [17].

Emotion dysregulation has long been implicated in the development and maintenance of anxiety disorders [2,8,26], and this relationship has been empirically supported across multiple assessments, including self-report, behavioral, and psychophysiological measures [8]. Individuals with anxiety disorders exhibit deficits in the acceptance of emotions, the ability to engage in goal-directed behaviors when distressed, the ability to control impulsive behaviors when distressed, as well as access to effective regulation strategies [40]. Difficulties in emotion regulation have been found in adolescents with anxiety, particularly a greater reliance on maladaptive emotion regulation strategies [6,39]. However, these studies were cross-sectional in nature and therefore do not elucidate the temporal

relationship between emotion regulation and anxiety. Of the few studies that have examined emotion regulation longitudinally in relation to anxiety, one study found that deficits in emotion regulation skills predicted subsequent anxiety symptom severity five years later [47]. Similarly, another study found that specific emotion regulation processes predicted different forms of anxiety across time among children and adolescents [42]. However, neither study evaluated whether uniquely different trajectories in anxiety symptoms exist, and neither study featured a clinical sample, limiting their generalizability with regard to clinically significant symptoms. Additionally, there is a paucity of research in this area on inpatient adolescents, especially during the post-discharge period, a particularly vulnerable period of transition and characterized by symptom acuity that is associated with risk of rehospitalization [4,23].

1.2. Current study

The primary aims of the current study were: (i) to identify 18-month trajectories in anxiety symptoms in a psychiatric sample of adolescents during a period of high clinical risk (i.e., the 18 months post-discharge from inpatient hospitalization); and (ii) to examine emotional processes as prospective predictors of these trajectories. Specifically, the current study aimed to apply a multi-method approach (i.e., using task-based and self-report measures) to examine emotional processes as prospective predictors of 18-month anxiety symptom trajectories. We hypothesized that (i) there would be three distinct anxiety symptom trajectories, and (ii) difficulties with facial emotion recognition, emotion reactivity, and emotion regulation would differentiate among trajectories, with greater difficulties in these emotional processes prospectively differentiating persistently high anxiety from other trajectories.

2. Method

2.1. Participants and procedures

Participants were 180 adolescents ($M_{age} = 14.89$; $SD = 1.35$; range: 13–17) recruited from a pediatric psychiatric inpatient unit. Most participants identified as female (71.7 %) and White (78.9 %). Other racial identities reported include Black (8.9 %), multiracial (8.9 %), and Asian (3.3 %). Additionally, 17.8 % of the sample identified as Hispanic. Moreover, 41.7 % of the sample endorsed a sexual minority orientation.

Participants completed assessments at their index hospitalization, and at 3, 6, 12, and 18 months post-discharge. The baseline assessment included a behavioral task measuring facial emotion recognition, as well as self-report measures of emotion dysregulation and emotion reactivity. At each time point, participants also completed a self-report measure on anxiety symptoms. Assessments were conducted by post-baccalaureate research assistants, postdoctoral fellows, and faculty, and the behavioral task was administered by research staff. Participants received monetary compensation for their time, and transportation costs were covered by the study as needed. This study was approved by the Rhode Island Hospital Institutional Review Board.

2.2. Measures

2.2.1. Anxiety symptoms—The Screen for Child Anxiety Related Disorders (SCARED; [3]) is a 41-item measure of anxiety symptoms over the past three months. Responses for each item are on a Likert scale ranging from 0 (not true or hardly ever true) to 2 (very true or often true) and a total score is derived by summing the individual items such that higher scores reflect greater anxiety. The SCARED demonstrated excellent internal consistency at baseline ($\omega = .96$), 3- ($\omega = .96$), 6- ($\omega = .97$) 12- ($\omega = .97$), and 18-month ($\omega = .97$) assessments.

2.2.2. Emotion recognition—The Diagnostic Analysis of Nonverbal Accuracy (DANVA; [34]) is a computer-based assessment of facial emotion recognition ability with youth and adult facial stimuli. Participants are shown 48 standardized photographs (24 each of youth and adult faces) displaying happy, sad, angry, or fearful expressions, and are asked to indicate which emotion was expressed. Total error rates are calculated for both the child and adult photos, with happy, sad, angry, and fearful scores calculated for both age groups. Higher scores represent more errors or misattributions. Both the youth and adult subtests have demonstrated adequate construct validity, internal reliability, and test-retest reliability [34].

2.2.3. Emotion reactivity—The Emotion Reactivity Scale (ERS; [33]) is a 21-item self-report measure of emotion reactivity and is divided into three subscales: emotional sensitivity, intensity, and persistence. Items are rated on a 5-point Likert scale from 0 (not at all like me) to 4 (completely like me). A total score is derived by summing the item, with higher scores reflecting greater reactivity. In the current sample, the internal consistency of this measure was high (sensitivity $\omega = 0.94$, intensity $\omega = 0.95$, persistence $\omega = 0.88$, and full-scale $\omega = 0.76$).

2.2.4. Emotion regulation—The Difficulties in Emotion Regulation Scale (DERS; [17]) is a 36-item self-report measure of emotion regulation. It consists of six subscales, including non-acceptance of emotional responses, difficulties engaging in goal-directed behavior when experiencing negative emotions, impulse control difficulties when experiencing negative emotions, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity. Each item was rated on a 5-point Likert scale ranging from 1 (almost never, 0–10 %) to 5 (almost always, 91–100 %). Total scores were calculated such that higher scores reflected greater emotion dysregulation. Internal consistency at baseline in the current sample was $\omega = 0.87$ for the full scale, $\omega = 0.92$ for non-acceptance, $\omega = 0.91$ for goals-directed behavior, $\omega = 0.94$ for impulse control difficulties, $\omega = 0.91$ for lack of awareness, $\omega = 0.88$ for lack of clarity, and $\omega = 0.89$ for limited access to emotion regulation strategies).

2.3. Data analytic plan

We conducted analyses in two steps. We first conducted latent class linear mixture models to identify trajectories of anxiety across the 18-month study period. Next, we generated a series of ANOVAs to examine subgroup differences in baseline emotional processing variables. We used the *lcmm* R package [37] to conduct the latent class mixture models.

We estimated models with successive number of classes, ending with a three-class model for the analyses. To determine the optimal model, we compared fit indices across the 1–3 class models. Specifically, we compared fit indices including log likelihood (greater is better) and Bayesian information criterion (BIC; lower is better). Additionally, to assess the probability of an individual being assigned to a single class versus multiple we compared entropy across the 3 classes, where higher is better. We adjusted for sex assigned at birth and age. Next, we used one-way ANCOVAs to evaluate class differences in facial emotion recognition (DANVA), emotion regulation (DERS), and emotion reactivity (ERS), with major depression covaried. We used full-scale and subscales for each measure. For all significant omnibus differences, we conducted Tukey's HSD post-hoc analyses, with family-wise error corrections applied.

3. Results

The most common psychiatric disorders at baseline were major depression (65.6 % of the sample), followed by generalized anxiety disorder (36.7 %), and social anxiety disorder (34.4 %). For more details about the prevalence of major psychiatric disorders in the study sample, see Table 1. At baseline, 68.9 % endorsed a lifetime history of non-suicidal self-injury and 58.3 % endorsed a lifetime history of attempting suicide. Mean duration of hospitalization was 10.96 days (SD = 11.65). Table 2 presents the descriptive statistics of study variables. The retention rate per timepoint are as follows: 95.00 % at 3-month, 88.40% at 6-month, 88.27 % at 12-month, and 87.22 % at 18-month follow up. Results from a paired samples t-test yielded a significant difference between baseline and 18-month follow up anxiety scores ($t[138] = 6.12, p < .001$), with a significant overall symptom decline over time.

3.1. Latent class analyses

Table 3 shows the fit statistics and population share by class. A three-class model had the best fit the data as it had lower log likelihood than all other class models, lower BIC than the one-class model and four-class model, and far better entropy than the four-class model. Fig. 1 illustrates the trajectories of anxiety for the three classes across the 18-month period. In terms of class membership, 31.18 % of the sample fell into a group with persistently moderate-to-high anxiety over the 18-month period; 8.6 % of the sample fell into a declining anxiety group, which initially had moderate-to-high rates of anxiety that declined over time; 60.22 % of the sample fell into a group with persistently low-to-moderate anxiety over the follow-up period.

3.2. ANOVAs comparing analyses²

Table 4 shows the means, omnibus ANOVA tests, and post-hoc comparisons of baseline variables for all three classes. Fig. 2 illustrates these comparisons. ANCOVA analyses with post-hoc comparisons revealed that the two initially moderate-to-high anxiety groups had greater emotional reactivity at baseline compared to the persistently low-to-moderate anxiety group ($ps < .001$). Additionally, at baseline, the persistently moderate-to-high anxiety group

²Of note, there were no differences in terms of trajectory membership based on race ($p = .42$) or family income ($p = .86$).

had greater non-acceptance of their own emotional responses to distress ($p < .001$) than the initially moderate-to-high anxiety group that experience symptom decline over time. The three groups did not differ for facial emotion recognition.

4. Discussion

To our knowledge, this is the first study to examine emotional processes as prospective predictors of anxiety symptom trajectories in youth. Furthermore, this study featured a psychiatrically hospitalized youth sample, heightening the clinical relevance of our findings, and is unique in its multi-method assessment of anxiety risk factors.

Three distinct trajectories were identified: (i) a group characterized by relatively stable low-to-moderate anxiety throughout the study period, (ii) a stable moderate-to-high anxiety group, and (iii) a group with moderate-to-high anxiety at index hospitalization with symptom improvement over time. Important differences of clinical relevance between these distinct subgroups would have been masked if analyses were restricted to the average anxiety symptom course from baseline to 18-month follow up, thus underscoring the importance of identifying and characterizing distinct symptom trajectories rather than looking at whole-sample overall trends.

The number of trajectories identified is consistent with the literature, in that two to three trajectories were most common [1,11,31]. Notably, a stable-low anxiety trajectory was identified in nearly all previous studies, regardless of sample type (e.g., clinical versus community samples; [1,31,32]). However, several previous studies identified a moderate anxiety group at baseline, whereas the current study did not identify a trajectory of this nature. This may be attributed to the fact that previous studies have only examined adolescent anxiety symptom trajectories in general community samples [1,11,31,32], whereas the current study includes a severe clinical sample. It would be reasonable to expect higher representation of moderate-to-high baseline anxiety in psychiatric inpatients, and that a subgroup to these patients to emerge with resolution of these acute symptoms over time after discharge (i.e., regression to the mean). Additionally, the finding of a subgroup with persistently elevated anxiety symptoms after discharge is consistent with prior findings that anxiety disorders follow a chronic course in a substantial subset of individuals [20,41].

As for how emotional processes differentiate between anxiety symptom trajectories identified in this study, after correcting for multiple comparisons, the two initially moderate-to-high anxiety groups generally scored higher on emotion reactivity at baseline compared to the low-to-moderate anxiety group. These results support growing evidence for specific aspects of emotion dysregulation [42,47] and emotion reactivity [25] in relation to anxiety.

Of particular clinical relevance are emotional processes that prospectively differentiate between the two initially moderate-to-high anxiety groups. It is often challenging to predict which youth with severe anxiety will improve over time and which will experience chronic anxiety. Being able to differentiate between these two trajectories in advance is particularly important in clinical settings as it may help inform discharge planning and optimize the match between patient and level of outpatient care. We found that emotion regulation

difficulties relating to non-acceptance of one's own responses when experiencing negative emotions were higher for the stable moderate-to-high anxiety group than for the moderate-to-high anxiety group that experienced symptom improvement over time.

In addition to informing appropriate level of treatment after discharge from inpatient care, these findings suggest that adolescents with different anxiety trajectories may benefit from different treatment strategies. Specifically, Emotion Regulation Therapy [27], a mechanism-targeted intervention that cultivates emotion regulation skills, has demonstrated significant, lasting improvement in symptom reduction in emotional disorders, including anxiety [16,28,29]. Moreover, an adolescent DBT program found that emotion regulation was a significant predictor of change in anxiety symptoms over time [24]. The combination of prior research and these novel findings suggests that adolescents with high anxiety in inpatient care, particularly those with emotion regulation deficits relating to non-acceptance of their own emotional responses, might benefit from interventions addressing these challenges in emotion regulation. Furthermore, these findings suggest that, of all facets of emotion regulation, targeting this tendency towards non-acceptance in particular may yield promise for bending the symptom trajectory of adolescents with otherwise chronically elevated anxiety to be more in line with the trajectory of those who experience significant symptom reduction in the months following discharge from inpatient hospitalization.

The three trajectory groups in the current study did not differ in terms of facial emotion recognition accuracy. These findings differ from those of a prior study that found elevated symptoms of generalized anxiety disorder were associated with more accurate facial emotion recognition, whereas elevated symptoms of separation anxiety disorder were associated with impaired facial emotion recognition [38]. The findings of this past study suggests that accuracy in emotion recognition may differ across anxiety disorders. Therefore, the inconsistency of current findings with those of this prior study may be a function of the current study's focus on anxiety as a global construct, undifferentiated by its subtypes.

The limitations of the current study warrant mention. Although the sample size of this study compares favorably to those of past studies of anxiety trajectories, especially for a clinical sample (i.e., clinical samples are often smaller than general community samples, in part because they are drawn from a smaller population), it is possible that a larger sample would have yielded a larger number of distinct symptom trajectories. However, the current sample size is less of a concern, because the large separation between groups on the primary class indicator gives confidence in the findings. Nonetheless, future studies may benefit from examining larger groups that contain 300 or more participants [43]. Additionally, the current study did not differentiate across anxiety disorders, which previous literature has identified as having differential relationships with emotion regulation deficits [42]. It is possible that trajectories may differ in number and nature across anxiety disorder subtypes. Furthermore, as indicated above [38], trajectories of specific anxiety subtypes may differ in their relation to emotion recognition, reactivity, and regulation. Finally, although the racial and ethnic composition of the sample generally matches census data for the local population [36], the low representation of racial and ethnic minorities as well as the predominantly female sample limits generalizability of the current findings.

Future studies should investigate the predictive relationship between emotional processes and anxiety symptom trajectories with a larger and more racially and ethnically diverse sample. Furthermore, emotion regulation difficulties involving non-acceptance of one's own emotional experiences may be promising for differentiating between clinically elevated symptom presentations in terms of symptom trajectories, and as a potential target of intervention for highly anxious adolescents, with the goal of tailoring them to the distinctive needs of patients prior to discharge.

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References

- [1]. Allan NP, Capron DW, Lejuez CW, Reynolds EK, MacPherson L, Schmidt NB. Developmental trajectories of anxiety symptoms in early adolescence: the influence of anxiety sensitivity. *J Abnorm Child Psychol* 2014;42(4):589–600. 10.1007/s10802-013-9806-0. [PubMed: 24062146]
- [2]. Amstadter A Emotion regulation and anxiety disorders. *J Anxiety Disord* 2008;22(2):211–21. 10.1016/j.janxdis.2007.02.004. [PubMed: 17349775]
- [3]. Birmaher B, Khetarpal S, Brent D, Cully M, Balach L, Balach L, et al. The screen for child anxiety related emotional disorders (SCARED): scale construction and psychometric characteristics. *J Am Acad Child Adolesc Psychiatry* 1997;36(4):545–53. 10.1097/00004583-199704000-00018. [PubMed: 9100430]
- [4]. Brent DA, Perper JA, Moritz G, Baugher M, Roth C, Balach L, et al. Stressful life events, psychopathology, and adolescent suicide: a case control study. *Suicide Life-Threat Behav* 1993;23(3):179–87. [PubMed: 8249030]
- [5]. Carthy T, Horesh N, Apter A, Edge MD, Gross JJ. Emotional reactivity and cognitive regulation in anxious children. *Behav Res Ther* 2010;48(5):384–93. 10.1016/j.brat.2009.12.013. [PubMed: 20089246]
- [6]. Carthy T, Horesh N, Apter A, Gross JJ. Patterns of emotional reactivity and regulation in children with anxiety disorders. *J Psychopathol Behav Assess* 2010;32(1):23–36. 10.1007/s10862-009-9167-8.
- [7]. Castro VL, Cooke AN, Halberstadt AG, Garrett-Peters P. Bidirectional linkages between emotion recognition and problem behaviors in elementary school children. *J Nonverbal Behav* 2018;42(2):155–78. 10.1007/s10919-017-0269-9. [PubMed: 29527080]
- [8]. Cisler JM, Olatunji BO, Feldner MT, Forsyth JP. Emotion regulation and the anxiety disorders: an integrative review. *J Psychopathol Behav Assess* 2010;32(1):68–82. 10.1007/s10862-009-9161-1. [PubMed: 20622981]
- [9]. Cole DA, Peeke LG, Martin JM, Truglio R, Seroczynski AD. A longitudinal look at the relation between depression and anxiety in children and adolescents. *J Consult Clin Psychol* 1998;66(3):451–60. 10.1037/0022-006X.66.3.451. [PubMed: 9642883]
- [10]. Collin L, Bindra J, Raju M, Gillberg C, Minnis H. Facial emotion recognition in child psychiatry: a systematic review. *Res Dev Disabil* 2013;34(5):1505–20. 10.1016/j.ridd.2013.01.008. [PubMed: 23475001]
- [11]. Crocetti E, Klimstra T, Keijsers L, Hale WW, Meeus W. Anxiety trajectories and identity development in adolescence: a five-wave longitudinal study. *J Youth Adolesc* 2009;38(6):839–49. 10.1007/s10964-008-9302-y. [PubMed: 19636785]
- [12]. Davidson RJ. Affective style and affective disorders: perspectives from affective neuroscience. *Cogn Emot* 1998;12(3):307–30. 10.1080/026999398379628.

- [13]. FACT SHEET: President Obama’s Precision Medicine Initiative. [Whitehouse.Gov](https://obamawhitehouse.archives.gov/the-press-office/2015/01/30/factsheet-president-obama-s-precision-medicine-initiative); 2015. (<https://obamawhitehouse.archives.gov/the-press-office/2015/01/30/factsheet-president-obama-s-precision-medicine-initiative>) .
- [14]. Ferretti V, Papaleo F. Understanding others: emotion recognition in humans and other animals. *Genes Brain Behav* 2019;18(1):e12544. 10.1111/gbb.12544. [PubMed: 30549185]
- [15]. Fine SE, Izard CE, Mostow AJ, Trentacosta CJ, Ackerman BP. First grade emotion knowledge as a predictor of fifth grade self-reported internalizing behaviors in children from economically disadvantaged families. *Dev Psychopathol* 2003;15(2):331–42. 10.1017/S095457940300018X. [PubMed: 12931831]
- [16]. Fresco DM, Mennin DS, Heimberg RG, Ritter M. Emotion regulation therapy for generalized anxiety disorder. *Cogn Behav Pract* 2013;20(3):282–300. 10.1016/j.cbpra.2013.02.001. [PubMed: 27499606]
- [17]. Gratz KL, Roemer L. Multidimensional assessment of emotion regulation and dysregulation: development, factor structure, and initial validation of the difficulties in emotion regulation scale. *J Psychopathol Behav Assess* 2004;26(1):41–54. 10.1023/B:JOBA.0000007455.08539.94.
- [18]. Gross JJ. The emerging field of emotion regulation: an integrative review. *Rev Gen Psychol* 1998;2(3):271–99. 10.1037/1089-2680.2.3.271.
- [19]. Gross JJ, Sheppes G, Urry HL. Emotion generation and emotion regulation: a distinction we should make (carefully). *Cogn Emot* 2011;25(5):765–81. 10.1080/02699931.2011.555753. [PubMed: 21824019]
- [20]. Hendriks SM, Spijker J, Licht CMM, Beekman ATF, Penninx BWJH. Two-year course of anxiety disorders: different across disorders or dimensions? *Acta Psychiatr Scand* 2013;128(3):212–21. 10.1111/acps.12024. [PubMed: 23106669]
- [21]. Henker B, Whalen CK, Jamner LD, Delfino RJ. Anxiety, affect, and activity in teenagers: monitoring daily life with electronic diaries. *J Am Acad Child Adolesc Psychiatry* 2002;41(6):660–70. 10.1097/00004583-200206000-00005. [PubMed: 12049440]
- [22]. Izard C, Fine S, Schultz D, Mostow A, Ackerman B, Youngstrom E. Emotion knowledge as a predictor of social behavior and academic competence in children at risk. *Psychol Sci* 2001;12(1):18–23. 10.1111/1467-9280.00304. [PubMed: 11294223]
- [23]. James S, Charlemagne SJ, Gilman AB, Alemi Q, Smith RL, Tharayil PR, et al. Post-discharge services and psychiatric rehospitalization among children and youth. *Adm Policy Ment Health Ment Health Serv Res* 2010;37(5):433–45. 10.1007/s10488-009-0263-6.
- [24]. Lenz AS, Del Conte G, Hollenbaugh KM, Callendar K. Emotional regulation and interpersonal effectiveness as mechanisms of change for treatment outcomes within a DBT program for adolescents. *Couns Outcome Res Eval* 2016;7(2):73–85. 10.1177/2150137816642439.
- [25]. McLaughlin KA, Kubzansky LD, Dunn EC, Waldinger R, Vaillant G, Koenen KC. Childhood social environment, emotional reactivity to stress, and mood and anxiety disorders across the life course. *Depress Anxiety* 2010;27(12):1087–94. 10.1002/da.20762. [PubMed: 21132844]
- [26]. Mennin DS. Emotion regulation therapy for generalized anxiety disorder. *Clin Psychol Psychother* 2004;11(1):17–29. 10.1002/cpp.389.
- [27]. Mennin DS, Fresco DM. Emotion regulation therapy. In: *Handbook of emotion regulation*. 2nd ed. The Guilford Press; 2014. p. 469–90.
- [28]. Mennin DS, Fresco DM, O’Toole MS, Heimberg RG. A randomized controlled trial of emotion regulation therapy for generalized anxiety disorder with and without co-occurring depression. *J Consult Clin Psychol* 2018;86(3):268–81. 10.1037/ccp0000289. [PubMed: 29504794]
- [29]. Mennin DS, Fresco DM, Ritter M, Heimberg RG. An open trial of emotion regulation therapy for generalized anxiety disorder and cooccurring depression. *Depress Anxiety* 2015;32(8):614–23. 10.1002/da.22377. [PubMed: 25945946]
- [30]. Merikangas KR, He J, Burstein M, Swanson SA, Avenevoli S, Cui L, et al. Lifetime prevalence of mental disorders in US adolescents: results from the national comorbidity study-adolescent supplement (NCS-A). *J Am Acad Child Adolesc Psychiatry* 2010;49(10):980–9. 10.1016/j.jaac.2010.05.017. [PubMed: 20855043]

- [31]. Miers AC, Blöte AW, De Rooij M, Bokhorst CL, Westenberg PM. Trajectories of social anxiety during adolescence and relations with cognition, social competence, and temperament. *J Abnorm Child Psychol* 2013;41(1):97–110. 10.1007/s10802-012-9651-6. [PubMed: 22723078]
- [32]. Morin AJS, Mañano C, Nagengast B, Marsh HW, Morizot J, Janosz M. General growth mixture analysis of adolescents' developmental trajectories of anxiety: the impact of untested invariance assumptions on substantive interpretations. *Struct Equ Model* 2011;18(4):613–48. 10.1080/10705511.2011.607714.
- [33]. Nock MK, Wedig MM, Holmberg EB, Hooley JM. The emotion reactivity scale: development, evaluation, and relation to self-injurious thoughts and behaviors. *Behav Ther* 2008;39(2):107–16. 10.1016/j.beth.2007.05.005. [PubMed: 18502244]
- [34]. Nowicki S, Duke MP. Individual differences in the nonverbal communication of affect: the diagnostic analysis of nonverbal accuracy scale. *J Nonverbal Behav* 1994;18(1):9–35. 10.1007/BF02169077.
- [35]. Pelcovitz M, Bennett S, Desai P, Schild J, Beaumont R, Walkup J, et al. High rates of anxiety among adolescents in a partial hospitalization program. *Child Youth Care Forum* 2023;52(1):105. 10.1007/s10566-022-09680-2. [PubMed: 35228789]
- [36]. Poon JA, López R, Marie-Shea L, Liu RT. Longitudinal relations between childhood maltreatment, emotion regulation difficulties, and suicidal ideation and non-suicidal self-injury: an 18-month investigation of psychiatrically hospitalized adolescents. *Res Child Adolesc Psychopathol* 2023. 10.1007/s10802-023-01067-8.
- [37]. Proust-Lima C, Philipps V, Lique B. Estimation of extended mixed models using latent classes and latent processes: the R package lamm. *J Stat Softw* 2017;78:1–56. 10.18637/jss.v078.i02.
- [38]. Rappaport LM, Di Nardo N, Brotman MA, Pine DS, Leibenluft E, Roberson-Nay R, et al. Pediatric anxiety associated with altered facial emotion recognition. *J Anxiety Disord* 2021;82:102432. 10.1016/j.janxdis.2021.102432. [PubMed: 34146888]
- [39]. Sackl-Pammer P, Jahn R, Özlü-Erkilic Z, Pollak E, Ohmann S, Schwarzenberg J, et al. Social anxiety disorder and emotion regulation problems in adolescents. *Child Adolesc Psychiatry Ment Health* 2019;13(1):37. 10.1186/s13034-019-0297-9. [PubMed: 31583014]
- [40]. Salters-Pedneault K, Roemer L, Tull MT, Rucker L, Mennin DS. Evidence of broad deficits in emotion regulation associated with chronic worry and generalized anxiety disorder. *Cogn Ther Res* 2006;30(4):469–80. 10.1007/s10608-006-9055-4.
- [41]. Schopman SM, ten Have M, van Balkom AJ, de Graaf R, Batelaan NM. Course trajectories of anxiety disorders: results from a 6-year follow-up in a general population study. *Aust NZ J Psychiatry* 2021;55(11):1049–57. 10.1177/00048674211009625.
- [42]. Schneider RL, Arch JJ, Landy LN, Hankin BL. The longitudinal effect of emotion regulation strategies on anxiety levels in children and adolescents. *J Clin Child Adolesc Psychol: J Soc Clin Child Adolesc Psychol Am Psychol Assoc Div* 2018;47(6):978–91. 10.1080/15374416.2016.1157757 [53].
- [43]. Sinha P, Calfee CS, Delucchi KL. Practitioner's guide to latent class analysis: methodological considerations and common Pitfalls. *Crit Care Med* 2021;49(1):e63–79. 10.1097/CCM.0000000000004710. [PubMed: 33165028]
- [44]. Tan PZ, Forbes EE, Dahl RE, Ryan ND, Siegle GJ, Ladouceur CD, et al. Emotional reactivity and regulation in anxious and nonanxious youth: a cell-phone ecological momentary assessment study. *J Child Psychol Psychiatry* 2012;53(2):197–206. 10.1111/j.1469-7610.2011.02469.x. [PubMed: 22176136]
- [45]. Verduin TL, Kendall PC. Differential occurrence of comorbidity within childhood anxiety disorders. *J Clin Child Adolesc Psychol* 2003;32(2):290–5. 10.1207/S15374424JCCP3202_15. [PubMed: 12679288]
- [46]. Wells AE, Hunnikin LM, Ash DP, van Goozen SHM. Improving emotion recognition is associated with subsequent mental health and well-being in children with severe behavioural problems. *Eur Child Adolesc Psychiatry* 2021;30(11):1769–77. 10.1007/s00787-020-01652-y. [PubMed: 32997168]

- [47]. Wirtz CM, Hofmann SG, Riper H, Berking M. Emotion regulation predicts anxiety over a five-year interval: a cross-lagged panel analysis. *Depress Anxiety* 2014;31(1):87–95. 10.1002/da.22198. [PubMed: 24151095]
- [48]. Woodward LJ, Fergusson DM. Life course outcomes of young people with anxiety disorders in adolescence. *J Am Acad Child Adolesc Psychiatry* 2001;40(9):1086–93. 10.1097/00004583-200109000-00018. [PubMed: 11556633]

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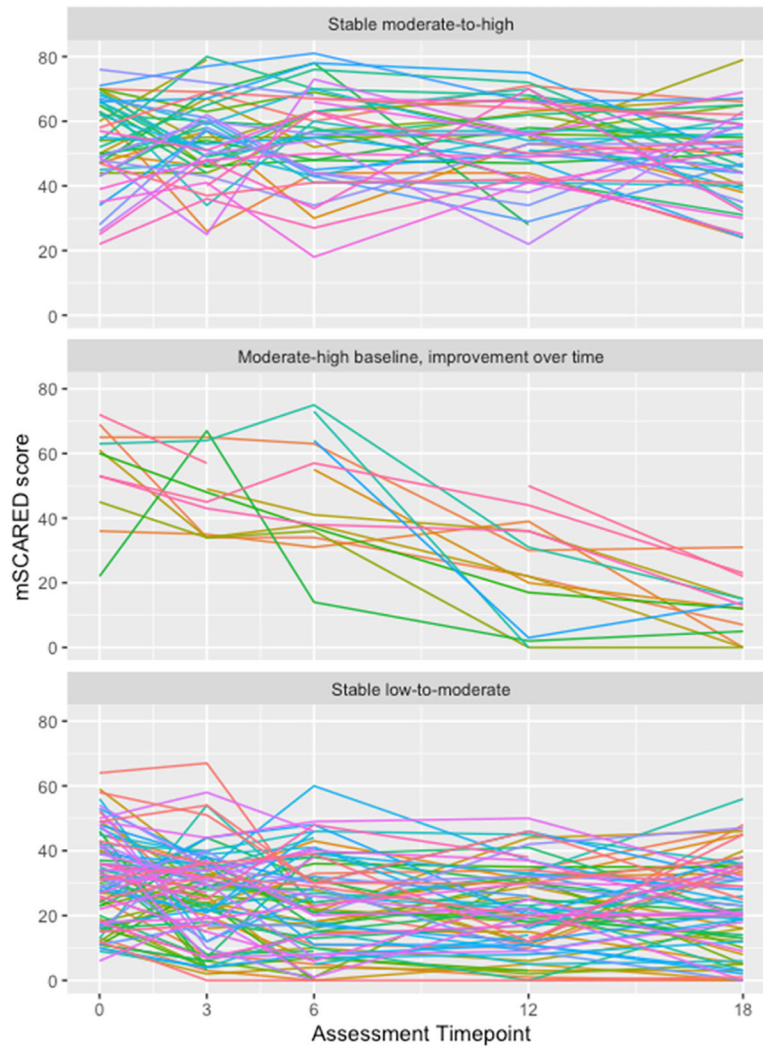
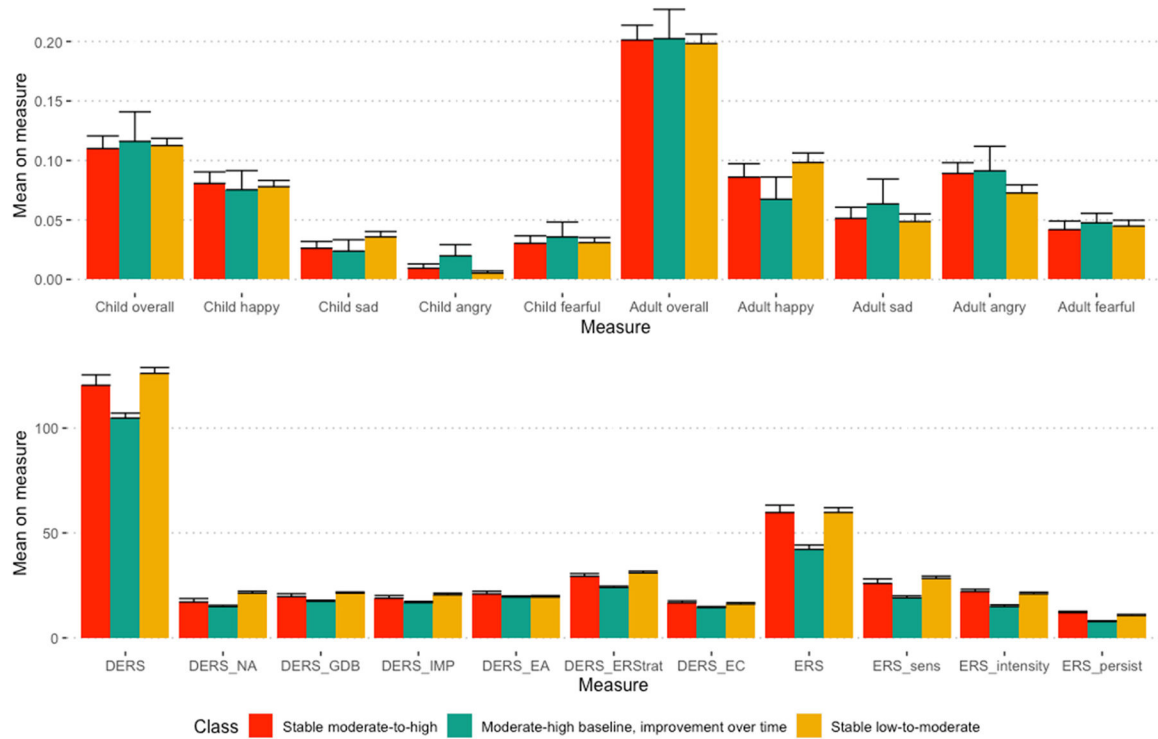


Fig. 1. Trajectories of anxiety symptoms for the three classes across the 18-month period. Note: SCARED = Screen for Child Anxiety Related Disorders.

**Fig. 2.**

Differences in emotional processing variables by anxiety symptom trajectory groups.

Note: Top panel: Diagnostic Analysis of Nonverbal Accuracy measures. Bottom panel:

DERS: Difficulties in Emotion Regulation Scale. DERS_NA: Non-acceptance of emotional

responses. DERS_GDB: Difficulty engaging in goal-directed behavior. DERS_IMP:

Impulse control difficulties. DERS_EA: Lack of emotional awareness. DERS_ERStrat:

Limited access to emotion regulation strategies. DERS_EC: Lack of emotional clarity. ERS:

Emotion Reactivity Scale. ERS_sens: Sensitivity. ERS_intensity: Intensity. ERS_persist:

Persistence.

Table 1

Prevalence of major psychiatric disorders in the study sample.

Current diagnosis	Frequency (<i>n</i>)	% of total sample
Major Depressive Disorder	118	65.6
Bipolar I Disorder	3	1.7
Bipolar II Disorder	3	1.7
Generalized Anxiety Disorder	66	36.7
Social Anxiety Disorder	62	34.4
Panic Disorder	27	15.0
Obsessive-Compulsive Disorder	20	11.1
Post-traumatic Stress Disorder	31	17.2
Attention-Deficit/Hyperactivity Disorder	52	28.9
Oppositional Defiant Disorder	23	12.8
Conduct Disorder	7	3.9
Anorexia Nervosa	5	2.8
Bulimia Nervosa	3	1.7
Psychosis Spectrum Disorders	11	6.1

Note. Diagnoses were based on the Kiddie Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version DSM-5 (K-SADS-PL). Approximately 5 % of the sample ($n = 9$) did not meet diagnostic criteria for any of the disorders in the K-SADS-PL.

Table 2

Descriptive statistics of study variables.

Variable	1	2	3	4	5	6	7	8	9
1. Child Facial Emotion Recognition Error Rate	–								
2. Adult Facial Emotion Recognition Error Rate	.81***	–							
3. Emotion Reactivity	-.10	-.03	–						
4. Emotion Regulation	.06	.13	.63***	–					
5. Baseline Anxiety Symptoms	.01	.01	.64***	.61***	–				
6. 3-Month Follow-up Anxiety Symptoms	-.01	-.03	.41***	.40***	.63***	–			
7. 6-Month Follow-up Anxiety Symptoms	.05	-.06	.49***	.48***	.68***	.73***	–		
8. 12-Month Follow-up Anxiety Symptoms	-.04	-.06	.35***	.40***	.60***	.66***	.68***	–	
9. 18-Month Follow-up Anxiety Symptoms	.00	-.10	.40***	.38***	.51***	.61***	.63***	.67***	–
Mean	3.65	5.56	49.40	116.27	39.30	35.92	35.15	32.65	30.72
Standard Deviation	4.63	4.17	20.55	24.87	18.10	19.08	21.16	20.07	19.12

Note.

* $p < .05$ ** $p < .01$ *** $p < .001$.

Table 3

Fit statistics and population share by profile.

Number of profiles	Fit statistics		Population share				
	loglik	BIC	entropy	Profile 1	Profile 2	Profile 3	Profile 4
1	-3111.47	6264.75	1.00	100 %	-	-	-
2	-3101.33	6260.14	0.71	32.26 %	67.74 %	-	-
3	-3095.08	6263.33	0.71	8.60 %	60.22 %	31.18 %	-
4	-3093.42	6275.68	0.60	26.34 %	37.10 %	22.58 %	13.98 %

Note: Profile numbers in this table may not correspond across models (e.g., profile 2 in the 2-profile model may not be the same as profile 2 in the 3-profile model).

Table 4

Results of ANOVAs for baseline variables predicting anxiety symptom trajectories.

Variable	Mean (SD) by class			ANOVA results		
	Class 1	Class 2	Class 3	f	P	Post-hoc
DANVA child all error rate	0.11 (0.08)	0.12 (0.09)	0.11 (0.06)	0.00	.99	
Child happy	0.08 (0.07)	0.08 (0.06)	0.08 (0.05)	0.00	.97	
Child sad	0.03 (0.04)	0.02 (0.04)	0.04 (0.05)	2.03	.16	
Child angry	0.01 (0.03)	0.02 (0.04)	0.01 (0.02)	5.01	.03	
Child fearful	0.03 (0.05)	0.04 (0.05)	0.03 (0.04)	0.05	.82	
DANVA adult all error rate	0.2 (0.09)	0.2 (0.09)	0.2 (0.08)	0.06	.81	
Adult happy	0.09 (0.08)	0.07 (0.07)	0.10 (0.08)	2.17	.14	
Adult sad	0.05 (0.07)	0.06 (0.08)	0.05 (0.07)	0.48	.49	
Adult angry	0.09 (0.07)	0.09 (0.08)	0.07 (0.07)	2.18	.14	
Adult fearful	0.04 (0.05)	0.05 (0.03)	0.04 (0.05)	0.00	.95	
ERS	59.81 (16.64)	59.73 (13.55)	42.18 (20.36)	1.57	<.05	1 > 3 & 2 > 3
Intensity	21.00 (6.06)	22.06 (4.37)	14.94 (7.47)	1.70	<.05	1 > 3 & 2 > 3
Persistence	10.70 (3.68)	12.00 (2.68)	7.76 (4.1)	2.47	<.01	1 > 3 & 2 > 3
Sensitivity	28.44 (8.15)	25.93 (8.40)	19.07 (9.83)	1.55	<.05	1 > 3 & 2 >
DERS	129.70 (21.42)	123.93 (20.14)	107.56 (23.79)	1.40	.066	
Non-acceptance	21.20 (6.74)	17.06 (6.65)	14.93 (5.79)	1.77	<.05	1 > 2 & 1 > 3
Goal-directed behavior	21.34 (3.82)	19.62 (5.54)	17.41 (5.19)	1.50	.092	N/A
Impulse control	20.56 (6.21)	18.88 (5.23)	16.77 (6.08)	1.21	.24	N/A
Emotional Awareness	19.57 (5.42)	20.93 (4.91)	19.45 (5.24)	0.92	.58	N/A
Limited Access to Strategies	30.86 (5.90)	29.33 (4.91)	24.07 (7.29)	1.47	.07	N/A
Emotional Clarity	16.09 (4.88)	16.69 (3.77)	14.46 (4.60)	.80	.71	N/A

Note. Post-hoc differences with N/A in column had no significant pairwise differences that survived the family-wise error correction in the Tukey's HSD test.

Class 1: Moderate-high baseline, improvement over time

Class 2: Stable moderate-to-high

Class 3: Stable low-to-moderate

DANVA: Diagnostic Analysis of Nonverbal Accuracy.

DERS: Difficulties in Emotion Regulation Scale.

ERS: Emotion Reactivity Scale.