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Developmental Trajectories of Anxiety Symptoms in Early Adolescence: The Influence of Anxiety Sensitivity

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Abstract

Children and adolescents seem to suffer from anxiety disorders at rates similar to adults. Interestingly, anxiety symptoms appear to generally decline over time within children as evidenced by lower rates in early and middle adolescence. There is some evidence that there may be heterogeneous subpopulations of adolescent children with different trajectories of anxiety symptoms, including a class of adolescents with elevated levels of anxiety that do not dissipate over time. Anxiety sensitivity has been identified as an important risk factor in the development of anxiety psychopathology. This study prospectively examined the development of anxiety symptoms in a sample of 277 adolescents (M_{age}=11.52; 44 % female, 56 % male) over a 3 year period including the influence of anxiety sensitivity on this development. Further, this study investigated whether there were distinct classes of adolescents based on their anxiety symptom trajectories and including anxiety sensitivity as a predictor. Consistent with other reports, findings indicated an overall decline in anxiety symptoms over time in the sample. However, three classes of adolescents were found with distinct anxiety symptom trajectories and anxiety sensitivity was

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an important predictor of class membership. Adolescents with elevated anxiety sensitivity scores were more likely to be classified as having high and increasing anxiety symptoms over time versus having moderate to low and decreasing anxiety symptoms over time. There are important implications for identification of adolescents and children who are at risk for the development of an anxiety disorder.

Keywords

Anxiety; Anxiety sensitivity; Growth mixture modeling; Adolescents

The development of anxiety symptoms in childhood and adolescence is associated with and predictive of multiple negative outcomes. Epidemiological studies have estimated that the prevalence of anxiety disorders in early adolescence ranges from 10 to 20 % (Achenbach et al. 1998; Costello et al. 2003; Shaffer et al. 1996). In community adolescent populations, prior anxiety symptoms are strong and consistent predictors of later anxiety symptoms. Further, an anxiety disorder diagnosis in adolescence is a strong predictor of later diagnosis for the same or another anxiety disorder (Copeland et al. 2009; Ferdinand et al. 2007) and untreated anxiety symptoms in childhood and adolescence often persist into adulthood (Ferdinand and Velhurst 1995; Lewinsohn et al. 2008).

In spite of the prevalence and pernicious nature of anxiety disorders in adolescent children, studies examining growth in anxiety symptoms from early to middle adolescence generally report declines in these symptoms over time. For example, Olatunji and Cole (2009) found a general decline in anxiety symptoms across 4 years in 787 early adolescent children (ages 9–10). As part of the CONAMORE project, a 5-year study of Dutch early and late adolescents, Hale et al. (2008) examined growth in specific anxiety disorder symptoms (e.g., generalized anxiety disorder [GAD], panic disorder [PD], separation anxiety disorder [SAD], social phobia [SP]) in 939 early to middle adolescents (M=12.0 years, SD=0.57). Once again, anxiety symptoms generally decreased over time in both boys and girls, although GAD symptoms increased over time in girls, and SP symptoms remained stable in both boys and girls. Other reports have also found declines in anxiety symptoms across similar ages (e.g., Costello et al. 2003; Crocetti et al. 2009; Van Oort et al. 2009).

The general declining trend in anxiety symptoms from childhood to adolescence is likely not specific to all children. Further, it is also not likely a function of the different age-of-onset and prevalence rates for different anxiety disorders across the developmental spectrum as prevalence rates for any anxiety disorder remain relatively consistent across childhood and adolescence (Costello et al. 2011), most likely due to a high degree of heterotypic continuity (i.e., an individual's anxiety symptom presentation may vary across development while his level of anxiety generally remains stable; e.g., Copeland et al. 2009). Instead, there may be multiple anxiety symptom trajectories, for which the additive effects equate to this general declining trend (Olatunji and Cole 2009; Weems 2008). Weems (2008) has suggested a theoretical model in children and adolescents for which children can have one of several different anxiety trajectories, based on the interaction between biological, behavioral, general levels of predisposition to anxious emotion, and social risk and protective factors. In

this model, most children display generally low and stable levels of anxiety symptoms, with modest declines at times, which are attributable to normative decreases in anxiety over time. Some children display stable and high levels of anxiety. Finally, other children show different patterns of decline or escalation over time, most likely due to environmental influences.

Recent advances in methodology have provided researchers with opportunities to explore whether there are groups of individuals with different hypothesized anxiety symptom trajectories. Growth mixture modeling (GMM; Muthén 2004; Muthén and Asparouhov 2009) can reveal latent classes of individuals based on levels of anxiety symptoms at a single time as well as the growth of these symptoms over time. To our knowledge, only two studies have examined the trajectory of anxiety symptoms in adolescent children. Crocetti et al. (2009) uncovered 2 latent anxiety classes in a combined sample of 923 early- (*M*=12.42 years, *SD*=0.59) and 390 middle- (*M*=16.68 years, *SD*=0.80) adolescents across five time points, each approximately 1 year apart. The first class represented the overwhelming majority of the sample (91.3 %), and featured adolescents characterized by a low initial level of anxiety that decreased over time. The second class represented 8.7 % of the sample, and featured adolescents characterized by a high initial level of anxiety that increased over time. Morin et al. (2011) explored the trajectory of anxiety symptoms in 1,011 adolescents (*M*=12.66 years, *SD*=0.69) across six time points spaced across 4 years. They found five classes with distinct trajectories; no anxiety (19.9 %), low-stable (39.7 %), high-stable (30.0 %), and two classes with quadratic trajectories, one with high initial rates that decrease in the middle time periods and increase at the end time period (4.9 %), and one with moderate initial rates that increase during the middle time periods and decrease at the end time period (5.4 %). Although both of these studies include early adolescent children, one limitation is that they also included older adolescent and adults in their samples.

Several other studies have also used GMM to examine anxiety-related symptoms in younger children with these reports typically uncovering three- and four-class models (Côté et al. 2002; Côté et al. 2009; Feng et al. 2008; Sterba et al. 2007). However, most of these studies either conflate anxiety and depression symptoms to create a single internalizing measure (e.g., Côté et al. 2009; Sterba et al. 2007) or only consider a trait associated with anxiety (i.e., fearfulness; Sterba et al. 2007). One exception is Feng et al.'s (2008) use of maternal reports of anxiety symptoms in 290 boys between the ages of 2 and 10. This study found four classes with distinct trajectories; low-stable (50.8 %), low-increasing (8.8 %), high-declining (32.5 %), and high-increasing (7.9 %), a pattern which maps on to the suggested theoretical model of anxiety as proposed by Weems (2008).

In sum, there is some variability in the number of anxiety trajectories that have emerged in GMM studies using children. At least two classes tend to emerge across most studies; one of these classes consists of children/adolescents who demonstrate few anxiety problems across time, and a much smaller class consists of children/adolescents who exhibit high and increasing levels of anxiety (e.g., Crocetti et al. 2009; Feng et al. 2008). The classes that do emerge tend to reflect all (Feng et al. 2008; Morin et al. 2011) or some of the trajectories hypothesized to emerge in the theoretical model of anxiety trajectories proposed by Weems (2008).

An important feature of GMM is its ability to examine the influence of external risk factors on growth. One of the best studied risk-factors for the development and persistence of anxiety disorders, anxiety sensitivity (AS), refers to a fear of anxiety related sensations and the belief that these sensations will have harmful physical, cognitive, and social consequences (Reiss et al. 1986; Zinbarg et al. 1997). Anxiety disorders are believed to develop more readily in those with high AS because of fearful responding to and avoidance of uncomfortable, but common, bodily sensations (Rabian et al. 1999). Therefore, a person with high AS holds a belief that puts them at risk for fearing any situation that could cause anxious arousal (e.g., snakes, social situations, perceived contamination). Unlike anxiety symptoms generally, which can fluctuate within the individual, AS is considered a relatively stable personality trait, unique from, and providing incremental validity beyond trait anxiety and negative affectivity in predicting anxiety symptoms and disorders (Noël and Francis 2011; Reiss and McNally 1985).

AS is associated with a variety of negative mental health outcomes (Rapee and Medoro 1994). Research on adolescent samples has found an association between elevated AS and general anxiety symptoms as well as specificity in predicting anxiety over depression (Lambert et al. 2004; Hayward et al. 2000; Joiner et al. 2002). In addition, among adolescents with high AS, elevated panic symptomology, increased rates of PD, and a greater fear of laboratory induced physiological sensations have all been found (Calamari et al. 2001; Rabian et al. 1999; Weems et al. 2002). A recent meta-analysis of anxiety symptoms in children and adolescents reported significantly higher levels of AS in children diagnosed with an anxiety disorder compared to children not meeting clinically diagnostic levels of anxiety (Noël and Francis 2011). In this analysis, Noël and Francis also found that although AS showed stronger relations with some anxiety disorders than with others (i.e., higher in PD versus obsessive compulsive disorder [OCD], SP, and specific phobia), it still appeared to operate as a general risk factor for anxiety disorders in children and adolescents.

There are few studies examining the prospective relation between AS and anxiety symptoms in early adolescent children. In a sample of 2,365 adolescents (*M*=15.4 years, *SD*=0.9), Hayward et al. (2000) reported that AS significantly predicted the first onset of 4-symptom PD, controlling for negative affectivity and childhood SAD (the predictive influence was marginal when past or current depression was included as a covariate). In a sample of 145 early adolescent children, Weems et al. (2007) examined the influence of baseline AS on anxiety symptoms 1 year later in a subsample of 52 adolescents (*M*=11.15 years, *SD*=3.2). They found that AS predicted anxiety symptoms over time, although these results should be interpreted with caution because baseline anxiety symptoms were not controlled for. As part of a larger study including 302 adolescent children, Hensley and Varela (2008) examined the influence of AS and hurricane exposure on 110 adolescents (*M*=12.41 years, *SD*=0.94) on panic symptoms. In this report, AS only predicted panic symptoms one year later when baseline anxiety was not controlled for. In a sample of 277 early adolescents (*M*=11.0 years, *SD*=0.8), Schmidt et al. (2010) found that AS significantly predicted future development of anxiety symptoms one year later, controlling for baseline anxiety.[1] Although these studies

[1]This study was conducted using Baseline and Time 1 data from the current study.

ostensibly establish the role of AS in predicting changes in anxiety symptoms, most are regression-based and therefore limited to examining the effect of AS on changes in group mean anxiety symptoms over time, not on anxiety symptom trajectories. Examining the effect of AS on anxiety symptom trajectories can expand knowledge of this risk factor in that it allows for an examination of the role AS plays in group- and individual-level anxiety symptom growth.

The Current Study

The objectives of the current study were to examine the influence of AS on the trajectory of anxiety symptoms in adolescents generally, and on distinct classes of adolescents with similar anxiety symptom trajectory profiles. Currently, there is no extant work examining the influence of AS on anxiety symptom trajectories in adolescents. There are a few studies that find initial AS levels are associated with later anxiety symptoms (e.g., Schmidt et al. 2010; Weems et al. 2007). Based on these findings, we hypothesized that AS would predict, positively, initial levels and growth of anxiety symptoms in adolescents. Further, based on the extant work on AS and depression, we hypothesized that the effect of AS would be specific to anxiety and not predict initial levels or growth of depression symptoms (e.g., Hayward et al. 2000; Joiner et al. 2002). In addition, there is little research on whether there are classes of adolescents with similar anxiety symptom trajectories and, despite the importance of AS as a risk factor for the development of an anxiety disorder (e.g., Noël and Francis 2011), no research on the influence of AS on these classes. In studies including early- and late-adolescents or children, at least two classes have consistently emerged (e.g., Crocetti et al. 2009; Feng et al. 2008). Based on these studies, we hypothesized that two classes of adolescents would emerge, one characterized by low and stable rates of anxiety symptoms, representing the vast majority of children, and another characterized by high and increasing levels of anxiety symptoms, representing only a small percentage of children. Although no previous research has examined the role of AS in predicting anxiety symptom classes in adolescents, there is ample support that AS predicts the presence or absence of anxiety disorders in children and adolescents (e.g., Noël & Francis). Therefore, it was hypothesized that AS would also predict class membership such that higher rates of AS would predict membership in the class of children with high and increasing levels of anxiety symptoms.

Method

Participants

A community sample of 277 early adolescents (*M* age=11.0 years, ages ranged from 9.0 to 13.0 at baseline) and their primary caregivers (80.5 % mothers) were recruited to participate in a longitudinal prospective study exploring HIV-related risk factors and mechanisms in youth. The study was advertised as investigating youth health-related behaviors and received institutional review board (IRB) approval at the University of Maryland. Participants were a sample of adolescents and their parents recruited in a large northeast metropolitan area, recruited through media outreach and mailings to local schools, libraries, and Boys and Girls Clubs. Of the sample of 277 children, one subject was not included in the analysis because all data were missing at each time for the outcome measures of interest. Of the remaining

participants, 229 were not missing any data for the outcome variables and 47 participants were missing data at one or more time points. All 276 children were included in the analyses because Full Information Maximum Likelihood (FIML), which was used as the estimator in analyses, has been shown to increase power to detect effects (when missing data are present) as well as decrease potential attrition bias (Schafer and Graham 2002). The sample consisted of 121 females and 155 males, and was 48.9 % Caucasian, 35.5 % African American, 2.9 % Hispanic, 1.4 % Asian, 0.4 % Native American, 10.9 % biracial or other, and 0.4 % failing to report.

Demographics

Guardians completed a demographic form for personal information as well as information about the child. These forms included age, gender, race, status of biological father's presence in the home, and family outcome. For family income, skewness divided by standard error was significantly positively skewed (s =4.81, SE=0.15). However, because the Yuan-Bentler Scaled Chi-Square (Y-B $\chi 2$) was used as the estimator and this is robust to non-normality and provides adjustments to correct standard errors, no corrections were undertaken for family income. Analyses in which family income was adjusted for skew using a square root transformation did not reveal substantial differences in the results.

Measures

The Revised Child Anxiety and Depression Scales (RCADS; Chorpita and Daleiden 2000)—The RCADS was designed to assess symptoms of DSM-IV anxiety disorders as well as major depressive disorder. Ten items measure major depressive disorder (e.g., "I feel sad or empty"). Nine items measure SP (e.g., "I am afraid of looking foolish in front of people") and PD (e.g., "My heart suddenly beats too quickly for no reason"). Seven items measure SAD (e.g., "I fear being away from my parents") and six items measure GAD (e.g., "I worry that bad things will happen to myself") and OCD (e.g., "I have to do things just right to stop bad things"). Items are measured on a 4-point Likert-like scale (*never*, *sometimes*, *often*, and *always*). A total anxiety score was obtained by summing across all anxiety symptoms and a total major depressive disorder score was obtained by summing those items. Convergent validity with similar measures of anxiety and anxiety disorders has been demonstrated (Chorpita and Daleiden 2000).

The Childhood Anxiety Sensitivity Index (CASI; Silverman et al. 1991—The Childhood Anxiety Sensitivity Index (CASI; Silverman et al. 1991) is an 18-item measure of AS in children adapted from the 16-item adult version (Reiss et al. 1986). Example items include "it scares me when I feel nervous," and "it scares me when my heart beats fast." Items are rated on a 3-point Likert-like scale (none, some, and a lot). CASI scores range from 18 to 54 with higher scores indicating higher levels of AS. The scale was adapted for and validated with a child and adolescent population and has demonstrated adequate reliability and validity in these populations (Silverman et al. 1991; Weems et al. 1998). There is some debate about the lower order factors measured by the CASI (e.g., Lambert et al. 2004; Silverman et al. 2003); however, it is agreed that the lower order factors are subsumed hierarchically under an AS factor. Therefore, in the current study, the total CASI score was used.

Procedure

Parents of children who participated provided informed consent and children provided assent and then completed a series of self-report questionnaires as part of a larger battery of assessments (see Daughters et al. 2009) in a private room. All questionnaires pertinent to this study were collected across all three time points. To limit systematic order effects, measures were randomly ordered. Baseline assessments lasted approximately 1 h. Follow-up, assessments lasted approximately 1.5 h. Follow-up assessments were completed after roughly 12 months (+/− 2 months; M_{age} at Year 1 follow-up = 12.07, M_{age} at Year 2 follow-up = 13.05). Participants and guardians were compensated $25 at each visit.

Data Analytic Procedure

Descriptive statistics were computed and examined using SPSS version 18. Latent growth curve modeling was used to examine the degree to which CASI scores were predictive of initial RCADS anxiety symptoms and growth of these symptoms over a 3 year time span, controlling for socioeconomic status (SES), gender, and baseline RCADS depression symptoms. To establish divergent validity, latent growth curve modeling was also used to examine the degree to which CASI scores were predictive of initial RCADS depression symptoms and growth controlling for SES, gender, and baseline RCADS anxiety symptoms. Although not a focus of the study, gender and income were included because prior research has implicated gender and income as significant predictors of both anxiety and depression (e.g., Hale et al. 2008; Miech et al. 1999). In this study, conditional models, including predictor variables, for RCADS anxiety and RCADS depression were fit to the data. All models were fit using Mplus version 6 (Muthén and Muthén 2011) using FIML to account for missing data and the Y-B χ^2 to provide corrected standard errors to account for nonnormality and nonindependence of observations due to the longitudinal design (i.e., Yuan and Bentler 2000). The Y-B χ^2 and several fit indices were used to assess overall model fit. A nonsignificant Y-B χ^2 indicates that the overall test of model fit was acceptable. A comparative fit index (CFI) greater than or equal to 0.95, square root mean residual (SRMR) below 0.08, and root mean square error of approximation (RMSEA) below 0.06 also indicate acceptable overall model fit (e.g., Hu and Bentler 1999).

Growth Mixture Modeling

Because we hypothesized that there would be distinct classes of children with anxiety symptoms in the data, and that CASI scores would significantly predict class membership, GMM (Muthén 2004; Muthén and Asparouhov 2009) was used. GMM relaxes the assumption that all children are members of a single class and instead models the data under the assumption that there is a mixture of unknown but inferred subclasses. Individuals within the sample are assigned to these classes based on their posterior probabilities using multinomial logistic regression (Muthén 2004). To ensure that models did not terminate early due to local maxima (Jung and Wickrama 2008) models with 1000 to 2000 random sets of starting values and the 100 best retained for final optimization were used. Repeated −2loglikelihood (−2LL) values in the analysis provided evidence that local maxima were not occurring.

Models with increasing classes were compared while including significant growth curve modeling predictors. Inclusion of important predictors in GMM results in better classification of model effects and class membership (e.g., Bolck et al. 2004). According to Muthén (2004) leaving out an important predictor will distort the slope of the other predictor (in this analysis, class membership). Further, if covariates that are expected to distinguish between individuals do not distinguish between classes, model support is weakened. Only the predictors that significantly affected the growth curve model were included in this analysis. As per convention, residual variances and covariances were constrained to equality across classes.

Several criteria were used to guide the decision regarding class enumeration. Extracted classes should be theoretically justifiable (Jung and Wickrama 2008). Based on previous findings (e.g., Crocetti et al. 2009; Feng et al. 2008), between two and five classes were expected, with at least one class containing a large percentage of adolescents low in anxiety and another class containing a small percentage of children high in anxiety. Classes should also be distinct. If two classes emerged that were only slight variations of a single class in a model with one less class, these classes were not considered distinct (Muthén and Muthén 2000). Several fit statistics also provide guidance regarding class enumeration. The Bayesian Information Criterion (BIC) and Akaike's Information Criterion (AIC) were used. Smaller BIC and AIC values were used to provide support for one model over another. The Lo-Mendell-Rubin test (LMR-LRT; Lo et al. 2001) provides an analytic approximation of the likelihood ratio test comparing a model with k classes to a model with $k - 1$ classes differing only in mean structure. Significant LMR-LRT indicates that the number of classes in the current model is favored over the model with one less class than the current model by this criterion. Finally, entropy was provided. Higher values indicate that there is better separation between classes (Petras and Masyn 2010).

Results

Means and standard deviations or percentages as appropriate for variables assessed at Baseline and Year 1 and Year 2 follow-up are presented in Table 1. A correlation matrix for all variables is also presented for participants with all outcome data available (N=229). Examining frequencies in SPSS 18, outliers were detected that were +/− 3 standard deviations from the interquartile range. These outliers were corrected by setting this +/−3 standard deviations as a boundary. Several of the variables also demonstrated levels of skewness and kurtosis. Because the estimation method used in the growth curve analysis is robust to nonnormality, these values were not corrected. Data indicated strong correlations for RCADS anxiety (rs=0.47–0.60) and RCADS depression (rs=0.52–0.67) suggesting strong stability from Baseline to Years 1 and 2 and that there was at least moderate rank order stability from Baseline to Year 2 follow-up.

Conditional latent growth models of RCADS anxiety and RCADS depression were examined, with time centered on initial status, to determine the fit of these models to the data Unconditional models were omitted to save space, although similar results were found for the overlapping unconditional and conditional parameters.[2] Model results are available upon request. The conditional model for RCADS anxiety was examined, including RCADS

Baseline depression score, CASI total score, and gender and income as covariates.[3] Age and ethnicity were not included because they were not significantly correlated with any predictor or outcome variables. All fit indices revealed that the model fit the data adequately (Y-B χ^2=10.62, p >0.05, CFI=0.99, SRMR=0.03, RMSEA=0.06). Estimates of model parameters are provided in Table 2. RCADS depression and CASI scores significantly predicted the intercept. The mean slope was significant and negative. Gender significantly and negatively predicted the slope indicating that there was a greater decline in RCADS anxiety symptoms in males as compared to RCADS anxiety symptom decline in females. RCADS depression also significantly predicted negative growth in the slope. A greater level of RCADS depression symptoms at Baseline predicted a decline in RCADS anxiety from Baseline to Year 2. Baseline CASI scores also significantly predicted RCADS anxiety symptoms decline indicating that a greater level of CASI scores at Baseline predicted a decline in RCADS anxiety from Baseline to Year 2.

To examine the discriminant validity of CASI in predicting anxiety, the conditional model for RCADS depression was examined. Predictors included RCADS Baseline anxiety, CASI total score, and gender and income. Fit indices were equivocal regarding model fit, with the Y-B χ^2 (14.51, p = 0.01) and RMSEA (0.08) indicating poor fit, and the CFI (0.98) and SRMR (0.03) indicating acceptable fit. Model parameter estimates are provided in Table 2. Only RCADS anxiety predicted variability in the intercept. The slope was negative and significant, indicating that RCADS depression scores decreased from Baseline to Year 2. Only RCADS anxiety significantly predicted the slope and the relation was negative, indicating that initial RCAD anxiety scores predicted negative growth in RCADS depression scores from Baseline to Year 2.

Growth Mixture Modeling

RCADS anxiety symptoms were examined to determine whether there were unique classes of trajectories of children's anxiety symptoms and the extent to which baseline RCADS depression and CASI scores predicted these classes.[4] Time was again centered on initial status. Model fit indices for two-through five-class models are presented in Table 3. Model comparisons revealed that there was no support for models with more than three classes. Although the AIC decreased from the three- to the four-class model, the BIC increased and the LMR-LRT was nonsignificant in the four-class model. Comparing the two- and three-class models indicated that the BIC and AIC decreased from the two-class model to the three-class model, and the LMR-LRT was significant in the three-class model. Further, entropy was higher in the three-class model than in the two-class model. Therefore, the three-class model was considered the best fitting model.[5]

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[2]Multiple group growth curve analysis was conducted using age instead of time to determine whether age effects could produce biased parameter estimates (e.g., Mehta and West 2000). Across the three age-groups comprising 98 % of the sample (i.e., 10, 11, and 12 year-olds), invariance testing revealed no differences for the anxiety model ($\Delta \chi 2$=8.07, Δ df=16, p=0.95) or the depression model ($\Delta \chi 2$=13.58, Δ df=16, p=0.63). Therefore, age was pooled in this study.

[3]Conditional models were also examined by RCADS anxiety disorders, independently. There were few substantive differences. Nonsignificant slope values were found for GAD, PD, and SP, and CASI scores only marginally predicted the slopes for GAD and PD. Therefore, we examined aggregated anxiety disorder symptoms.

[4]Because there was one child with information missing on one of the predictor variables, and MPLUS does not include cases with missing information on the predictor variables in GMM, 275 children were used in this analysis.

There were 29 children (17 girls, 12 boys) classified in the high-increasing class with a posterior probability of 0.90. There were 140 children (75 girls, 65 boys) classified in the moderate-declining class with a posterior probability of 0.97. Finally, there were 106 children (29 girls, 77 boys) classified in the low-declining class with a posterior probability of 1.00. Table 4 provides results from the final conditional model, and indicates that there were substantive differences in the trajectories of the three classes. Multinomial logistic regression was used to provide odds ratios, and odds ratios and predictor means are provided in Table 5. Odds ratios could not be calculated comparing the low-declining class to the other classes when all three predictors were in the model because of the occurrence of quasi-complete separation (Albert and Anderson 1984). The problem only occurred when all three predictors were included in the model together, and was specific to the low-stable class. Therefore, when comparing odds ratios between the low-declining class and the other classes, odds ratios were calculated for the predictors independently. As CASI scores increased, the odds of moving from the low-declining to the moderate-declining and then the high-increasing class increased. Depression only predicted status in the low-declining class as compared to status in the other classes. Again, as depression scores increased, the odds of being in the other classes increased. The odds of being in the high-increasing or in the moderate-declining class was higher for girls as compared to the odds for being in these classes for boys.

For comparison, RCADS depression symptoms were also examined to determine whether there were unique classes of trajectories of children's depression symptoms and the extent to which baseline RCADS anxiety and CASI scores predicted these classes. Model comparisons revealed only limited support for the two-class model. Whereas the two-class model fit better than the one-class model, there were only 10 adolescents (3.7 %) in one of the classes. Further, odds ratios revealed no significant predictors of class membership.

Discussion

The present study adds to a growing body of research on the trajectory of anxiety symptoms in children and adolescents. Consistent with other work, anxiety symptoms generally declined across three years from early to middle adolescence; however, GMM revealed the presence of three classes of individuals with distinct anxiety symptom trajectories. Classes included a small class of adolescents with high initial levels of anxiety that increased over time, and two similarly sized classes of adolescents characterized by moderate- and low-declining trajectories. This study also provided evidence that AS was an important predictor for inclusion in the high-increasing anxiety trajectory group. Altogether, this suggests that whereas most adolescents are not at risk for an anxiety disorder, there is an important subpopulation of children who are at risk and that AS serves as an important risk factor for these children.

This study demonstrates the importance of considering heterogeneity in adolescent anxiety symptoms. We found that adolescent anxiety symptoms generally declined across 3 years in

[5]Although the four-class model did not fit better than the three-class model, the classes that emerged in this model were consistent with the theoretical model of anxiety symptom trajectories proposed by Weems (2008), with the high-increasing class ostensibly dividing into a moderate-increasing class and a high-stable class.

this study. Studies that have explored the trajectory of anxiety symptoms over time without considering heterogeneity have also found that anxiety symptoms generally declined in late childhood and adolescence (e.g., Hale et al. 2008; Olatunji and Cole 2009). This approach may be masking important differences in adolescents' growth in anxiety symptoms. Examination of heterogeneity of anxiety symptom trajectories in this study revealed that there was a subset of children whose anxiety symptoms did not fit this pattern of declining anxiety symptoms. Studies that have considered the heterogeneity of adolescents' anxiety symptoms have also uncovered multiple classes of children with different anxiety symptom trajectories (e.g., Crocetti et al. 2009; Morin et al. 2011; Feng et al. 2008). This suggests that studies that only consider anxiety symptoms homogeneously may be missing important differences between individuals regarding growth of anxiety symptoms over time.

In the present study, three classes of adolescents based on initial levels and trajectories of anxiety symptoms were found. Most children were classified as having either low-declining (38.5 %) or moderate-declining (50.9 %) anxiety symptom trajectories. A smaller group of children were classified as having high-increasing anxiety symptom trajectories (10.5 %). Other studies have found similar class structures. Crocetti et al. (2009) found 2 classes of anxiety symptom trajectories in a sample of adolescents, categorized as low and decreasing (91.3 %) and high and increasing (8.7 %). They did not report on a three-class solution, stating that an additional class was just a variation of one of the two classes they found. We also found that our two- and three-class models were similar. In our study, a low- to moderate-declining trajectory in the two class model produced the moderate- and low-declining classes in the three-class model. Whereas Feng et al. (2008) found 4 classes in a sample of children, our three classes mapped onto three of their classes reasonably well. They found high-increasing, high-declining, and low-stable classes with similar proportions (7.9 %, 32.5 %, and 50.8 % respectively) to our high-increasing, moderate-declining, and low-declining classes.

In contrast, Morin et al. (2011) reported 5 classes of adolescents based on their anxiety symptom trajectories, none of which matched this high and increasing anxiety symptom trajectory class. Measurement differences between our study and the Morin et al. study could account for these discrepant findings. Morin et al. used the French adaptation (Freeston et al. 1994) of the Beck Anxiety Inventory (BAI; Beck and Steer 1993). The BAI focuses heavily on the physiological aspects of anxiety and as such has been found to best perform as a measure of PD symptoms (Leyfer et al. 2006). In contrast, the measures used in this (i.e., RCADS) and other studies that found similar trajectories (e.g., Crocetti et al. 2009; Feng et al. 2008) captured a broad range of anxiety symptoms across disorders. Given that anxiety disorders demonstrate a high degree of heterotypic continuity (Copeland et al. 2009; Ferdinand et al. 2007), Morin and colleagues' results may be more specific to PD. Our findings indicate that there appear to be important differences in children's anxiety symptom trajectories.

These findings provide partial support for the developmental model of anxiety symptoms proposed by Weems (2008). In this model, children are classified by four anxiety symptom trajectories as stable-elevated, decreasers, increasers, and stable-low. Whereas Feng et al. (2008) found support for these four classes, we did not find a class that could be labeled

increasers. Developmental differences as well as biological or social moderator influences may account for this difference. The sample in our study comprised adolescent boys and girls. In contrast, the sample in the study by Feng et al., comprised 2- to 10-year old boys only. It is also possible that the proposed increasers and stable-elevated classes represent relatively small proportions of the population, and therefore were grouped together in this study as the high-increasing class.

The presence of a class of adolescents with high and increasing levels of anxiety has important implications. The prevalence rates of anxiety disorders in early adolescence range from 10 to 20 % (Achenbach et al. 1998; Shaffer et al. 1996; Costello et al. 2003). In a study examining the clinical utility of the RCADS, Chorpita et al. (2005) reported a mean score of 33.02 on this measure in children and adolescents diagnosed with an anxiety disorder. Given that the mean RCADS scores for the high-increasing class were around or above this threshold across all three time points (Baseline M=41.86, Time 1M=40.35, Time 2M=46.08), it is likely that many of these adolescents are similar to adolescents who are clinically diagnosed with an anxiety disorder. Feng et al. (2008) provided evidence of this in their study of children. They found that children classified as having high and declining anxiety symptoms (32.5 %) were twice as likely to be diagnosed with an anxiety disorder compared to children who were classified as having low and stable anxiety symptoms (50.8 %). Children who were classified as having high and increasing anxiety symptoms across their childhood (7.9 %) were five times more likely to be diagnosed with an anxiety disorder than the low-stable class of children. Therefore, it appears likely that children with profiles similar to the high-increasing class in our study are at an increased risk for an anxiety disorder.

In this study, AS was an important and specific predictor of anxiety symptoms in children with elevated levels of anxiety. Consistent with past studies, elevated AS levels predicted elevated baseline anxiety symptoms controlling for baseline depression and did not predict baseline depression symptoms controlling for baseline anxiety symptoms (Joiner et al. 2002; Schmidt et al. 2010). However, AS negatively predicted anxiety symptom growth over time when heterogeneity of the sample was not considered. This would appear contrary to findings of regression-based approaches that have identified AS as an important prospective predictor of anxiety symptoms in adolescents (e.g., Hensley and Varela 2008; Schmidt et al. 2010; Weems et al. 2007). The impact of AS as a risk factor only emerged when AS was allowed to predict the heterogeneous anxiety classes. Elevated AS significantly increased the odds of adolescents being classified in the high-increasing and moderate-declining anxiety classes versus the low-declining class and in the high-increasing class versus the moderate-declining class. Although no other studies have considered the impact of AS as a risk factor in predicting class membership, researchers have found that children and adolescents clinically diagnosed with anxiety disorders have significantly higher AS scores compared to control children and adolescents (Noël and Francis 2011). Therefore, it appears that the confluence of high AS along with high anxiety symptoms is particularly pernicious among children and adolescents. AS is generally considered to be an amplification factor that exacerbates anxiety. This type of purported vicious cycle, however, seems far more

likely to emerge among adolescents already experiencing higher levels of anxiety symptoms.

The results of this investigation implicate AS as a mechanism that may account for increased anxiety among older children. This is encouraging because among adults, very brief interventions consisting of psychoeducation and interoceptive exposure exercises have consistently reduced total AS and AS subfactors (Schmidt et al. 2007; Feldner et al. 2008). Currently, there is limited empirical work evaluating the efficacy of targeting AS among children and adolescents. A brief (six session) school based group intervention targeting AS in youths (aged 11–17) reduced anxiety symptoms post-intervention (Balle and Tortella-Feliu 2009). However, these differences were not significantly different than a wait-list control group until a 6 month follow-up. More work on comparable programs is needed because targeted programs show larger effects than universal prevention programs (Lau and Rapee 2011).

There are several limitations to consider in this study. Techniques such as GMM require replication. Although other studies in children and adolescents found similar classes (e.g., Crocetti et al. 2009; Feng et al. 2008), neither study included AS as a predictor. Because only three time points were available in the current study, only linear growth could be modeled. Although models of linear growth fit the data well, there may be additional classes of adolescents with rising and declining levels of anxiety. The present study was conducted in a community sample and no clinical diagnoses were made. A strong test of the emergence of important trajectories would be the inclusion of a diagnostic interview, especially at later time points to determine if these adolescents with elevated anxiety symptoms met diagnostic criteria for an anxiety disorder.

Conclusions

This study highlights the importance of examining heterogeneity of anxiety symptoms in children and adolescents. Studies that do not investigate heterogeneity could conclude that anxiety problems are transient and therefore not of concern in adolescents. It has already been demonstrated in children that membership in a class with high and increasing levels of anxiety increases the odds of being diagnosed with an anxiety disorder. Further, if heterogeneity is not considered, AS does not appear to be an important risk factor. In this study, we demonstrated that the odds of having a profile of high and increasing anxiety symptoms increases with elevated levels of AS. Future studies should explore the overlap between anxiety trajectories and the development of anxiety disorders. Future interventions should focus on the impact of intervening on AS in these anxiety symptom trajectories.

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Table 1

Bivariate correlations and descriptive statistics for primary study variables

	M (*SD*)	1	2	3	4	5	6	7	8	9	10	11
1. CASI BA	11.64 (6.20)	–	0.63*	0.47*	0.48*	0.37*	0.35*	0.23*	−0.10	−0.12	−0.01	−0.16*
2. Anxiety BA	25.36 (15.36)		–	0.78*	0.59*	0.52*	0.47*	0.41*	−0.10	−0.11	−0.07	−0.05
3. Depression BA	6.60 (4.57)			–	0.50*	0.60*	0.39*	0.52*	−0.11	−0.16	−0.12	−0.05
4. Anxiety Y1	22.41 (13.38)				–	0.77*	0.60*	0.51*	−0.4	−0.09	0.09	0.03
5. Depression Y1	6.12 (4.27)					–	0.51*	0.67*	0.02	−0.04	−0.03	0.01
6. Anxiety Y2	20.60 (13.01)						–	0.74*	−0.19*	−0.08	0.07	0.04
7. Depression Y2	5.95 (4.55)							–	−0.08	−0.07	−0.01	−0.02
8. Gender	44 % female								–	0.06	−0.02	0.06
9. Age	11.0 (0.8)									–	0.06	0.03
10. Ethnicity	49 % Caucasian										–	−0.12
11. Income	94 K (74 K)											–

N=244–263 formeans. *N*=229 for correlations. CASI BAindicates Total Score on the Child Anxiety Sensitivity Index at baseline. Anxiety BA, Y1, and Y2 indicates anxiety scores on the Revised Child Anxiety and Depression Scale at baseline, year 1, and year 2 assessments. Depression BA, Y1, and Y2 indicates depression scores on the Revised Child Anxiety and Depression Scale at baseline, year 1, and year 2 assessments. Gender coded as Female = 0 and Male = 1

* $p \leq 0.05$

Table 2

Model parameter estimates for the conditional models of anxiety and depression

Conditional models	Anxiety			Depression		
	Unstandardized parameters	β	SE	Unstandardized parameters	β	SE
Intercept	25.15***		0.47	6.58***		0.16
Intercept variance	21.96		11.65	3.12**		1.13
Slope	−2.26***		0.38	−0.34**		0.13
Slope variance	18.49*		8.82	1.97*		0.86
Covariance	1.70		7.72	0.28		0.79
Intercept predictors						
Gender		0.02	0.04		0.01	0.04
Income		0.02	0.03		0.00	0.04
RCADS depression		0.66***	0.05			
RCADS anxiety					0.91***	0.05
CASI baseline		0.42***	0.06		−0.04	0.06
Slope predictors						
Gender		−0.15*	0.07		0.003	0.08
Income		0.05	0.07		−0.04	0.08
RCADS depression		−0.44***	0.11			
RCADS anxiety					−0.48**	0.15
CASI baseline		−0.26*	0.09		−0.01	0.13

RCADS Anxiety indicates anxiety symptoms on the Revised Child Anxiety and Depression Scale. RCADS Depression indicates depression symptoms on the Revised Child Anxiety and Depression Scale. CASI Baseline indicates anxiety sensitivity score on the Childhood Anxiety Sensitivity Index

* $p \leq 0.05$,

** $p \leq 0.01$,

*** $p \leq 0.001$

Table 3

Fit indices for alternative growth mixture models

GMM	−2Loglikelihood	*df*	AIC	BIC	Entropy	LMR-LRT (*p value*)
1 Class	−2782	14	5593	5643		
2 Classes	−2760	20	5560	5633	0.88	0.04
3 Classes	*−2742*	*26*	*5536*	*5630*	*0.94*	*0.01*
4 Classes	−2731	32	5527	5642	0.94	0.39
5 Classes	−2718	38	5511	5649	0.94	0.35

AIC Akaike's Information Criterion. *BIC* Bayesian Information Criterion. *LMR-LRT* Lo-Mendell-Rubin Likelihood Ratio Test. The best-fitting model in italics

Table 4

Results from the final conditional three-class GMM with RCADS depression and CASI baseline scores as predictors

Conditional models	High-increasing		Moderate-declining		Low-declining	
	Parameters	SE	Parameters	SE	Parameters	SE
Intercept	33.84***	2.22	26.11***	0.69	21.43***	0.97
Intercept variance	18.50	10.54	18.50	10.54	18.50	10.54
Slope	6.29***	1.98	−2.85***	0.56	−4.05***	0.80
Slope variance	16.99*	6.67	16.99*	6.67	16.99*	6.67
Covariance	−8.09	6.60	−8.09	6.60	−8.09	6.60
Model predictors	β	SE	β	SE	β	SE
Intercept predictors						
Gender	0.07*	0.04	0.08*	0.04	0.09*	0.04
RCADS depression	0.83***	0.05	0.81***	0.05	0.80***	0.06
CASI baseline	0.22***	0.06	0.21***	0.06	0.13***	0.04
Slope predictors						
Gender	−0.08	0.07	−0.09	0.07	−0.09	0.07
RCADS depression	−0.44***	0.11	−0.41***	0.10	−0.38***	0.10
CASI baseline	−0.43***	0.10	−0.39***	0.09	−0.23***	0.06

RCADS Anxiety indicates anxiety symptoms on the Revised Child Anxiety and Depression Scale. RCADS Depression indicates depression symptoms on the Revised Child Anxiety and Depression Scale. CASI Baseline indicates anxiety sensitivity score on the Childhood Anxiety Sensitivity Index

* $p \leq 0.05$,

** $p \leq 0.01$,

*** $p \leq 0.001$

Table 5

Predictor means by class membership and class multinomial regression results for three-class model

Predictors			**Odds ratio (High-increasing as reference)**		
High-increasing	**Mean**	***SD***	**Estimate**	**SE**	**Est. OR**
RCADS depression	9.39	5.10			
CASI baseline	17.98	6.08			
Moderate-declining					
Gender			0.27	0.44	1.32
RCADS depression	6.94	4.64	−0.05	0.05	0.95
CASI baseline	14.46	4.93	-0.10^{*}	0.04	0.91
Low-declining					
Gender			1.33^{**}	0.44	3.76
RCADS depression	5.36	3.76	-0.19^{***}	0.05	0.82
CASI baseline	6.15	2.53	-1.08^{***}	0.14	0.34
Low-declining			(Moderate-declining as reference class)		
Gender			1.12^{***}	0.28	3.06
RCADS Depression			-0.09^{**}	0.03	0.91
CASI baseline			-0.97^{***}	0.14	0.38

SE Standard error. *OR* Odds ratio. Odds ratios including the low-declining class were conducted with each predictor independently because of estimation problems when all three predictors were in the model

$^{*}p \leq 0.05$,

$^{**}p \leq 0.01$,

$^{***}p \leq 0.001$