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Time Doesn't Change Everything: The Longitudinal Course of Distress Tolerance and its Relationship with Internalizing and Externalizing Symptoms during Early Adolescence

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Abstract

Although distress tolerance is an emerging construct of empirical interest, we know little about its temporal change, developmental trajectory, and prospective relationships with maladaptive behaviors. The current study examined the developmental trajectory (mean- and individual-level change, and rank-order stability) of distress tolerance in an adolescent sample of boys and girls (*N*=277) followed over a four-year period. Next we examined if distress tolerance influenced change in Externalizing (EXT) and Internalizing (INT) symptoms, and if EXT and INT symptoms in turn influenced change in distress tolerance. Finally, we examined if any of these trends differed by gender. Results indicated that distress tolerance is temporally stable, with little mean- or individual-level change. Latent growth models reported that level of distress tolerance is cross-

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sectionally associated with both EXT and INT symptoms, yet longitudinally, only associated with EXT symptoms. These results suggest that distress tolerance should be a focus of research on etiology and intervention.

Keywords

Adolescence; Distress tolerance; Externalizing symptoms; Internalizing symptoms; Longitudinal

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The past two decades have seen the emergence of a new construct: *distress tolerance*, defined as the ability to persist in goal directed activity when experiencing psychological distress (Brown et al. 2002; Lejuez et al. 2003). Multiple cross-sectional studies of community-based and psychiatric adult samples report that distress tolerance is inversely related with substance misuse, antisocial behavior, personality disorders, non-suicidal self-injury, and binging/purging behavior (see Leyro et al. 2010 for a review). Additionally, several studies report that lower distress tolerance negatively impacts drug and alcohol outcomes, such that individuals who demonstrate deficits in this trait are more likely to drop out of drug and alcohol treatment and relapse shortly thereafter (Daughters et al. 2005a, b). As such, a better understanding of the development of distress tolerance has the potential to inform our knowledge of multiple forms of psychopathology.

Current theoretical perspectives propose that distress tolerance is a trait-like, temporally stable mechanism that originates in childhood or adolescence and differentiates into multiple forms of psychiatric illness and maladaptive behavior in adulthood (Linehan 1993; Soenke et al. 2010). However, the work on distress tolerance has almost exclusively been conducted using adult samples, and there are little empirical data regarding its childhood correlates or its developmental course (see Daughters et al. 2009 and MacPherson et al. 2010 for exceptions). In particular, there are two crucial gaps in our knowledge.

First, we know nothing about the longitudinal history of distress tolerance. No data exist on the normative degree and direction of change (generally referred to as *mean-level change*) in distress tolerance. Examining normative developmental trajectories is especially important for identifying potentially high-risk periods in distress tolerance development (e.g., adolescence, puberty). For instance, it is possible that distress tolerance decreases during critical stages of development, such as adolescence, but rebounds to healthier levels in adulthood. Indeed, this pattern of temporary changes in problem behavior from adolescence to adulthood is reported for several traits and psychopathology categories including behavioral disinhibition, negative emotionality, alcohol and drug use, antisocial behavior, and internalizing disorders (Blonigen et al. 2008; Kessler et al. 1994, 2005; McGue et al. 1993; Newman et al. 1996; Olson et al. 1999; Roberts et al. 2001, 2006). A complement to mean-level change is *individual-level change*, which refers to individual variability in reliable and clinically significant (i.e., too large to be attributed to measurement error or regression to the mean) change in the frequency of a given behavior or trait over time. A third developmental index not established for distress tolerance refers to *relative or rank-order stability*. Rank-order stability provides knowledge about whether, for a given individual, poor distress tolerance at a given time point predicts longer-term reductions in distress tolerance or whether the prediction between assessment points is more uncertain. In sum, understanding the natural history of distress tolerance may guard against the potential to overly pathologize temporary (and perhaps even normative) developmental problems as indicators of severe and life-course persistent problem behavior (Edens et al. 2001; Seagrave and Grisso 2002).

A second gap relates to understanding the possible factors that influence stability and change in distress tolerance at an individual and at a group level. In doing so, it is worthwhile to draw upon two well-validated categories of Externalizing (EXT) and Internalizing (INT) symptoms (Kendler et al. 2003; Krueger and Markon 2006, 2011; Krueger 1999; Krueger et al. 2002). EXT, sometimes referred to as behavioral disinhibition, is defined as a predisposition for high novelty seeking, impulsivity, and lack of constraint (Iacono et al. 2008; Sher and Trull 1994). In childhood and adolescence, this is represented by symptoms of psychopathology such as Conduct Disorder (CD), Oppositional-Defiant Disorder (ODD), and Attention-Deficit Hyperactivity Disorder (ADHD; Burt et al. 2006, 2009). Alternatively, INT is the propensity for negative affectivity, which can be further broken down into the factors of fear and distress (Krueger and Markon 2011; Watson 2005). In regards to children and adolescents, this is often represented by the presence of Major Depressive Disorder (MDD) and anxiety disorder symptoms (Burt 2009). It is useful to examine EXT and INT symptoms in the present context for two reasons. First, there is a documented inverse relationship of distress tolerance with both EXT and INT symptoms (Anestis et al. 2007; Bernstein et al. 2009; Daughters et al. 2008, 2009; Ellis et al. 2010; Keough et al. 2010; Nock and Mendes 2008). As an example, Daughters et al. (2009) documented an inverse cross-sectional relationship of distress tolerance with EXT (indexed by a CD-like composite) in adolescents and INT (indexed via MDD and anxiety symptoms) in adolescent females. Second, the patterns of change for EXT and INT have been well-established and repeatedly plotted across studies (Blonigen et al. 2008; Roberts et al. 2001). Both EXT and INT increase in adolescence and stabilize during early adulthood, informing our general understanding of psychopathology and related constructs in this crucial developmental period. Consequently, EXT and INT may provide an explanatory mechanism for the patterns of stability and change in distress tolerance, and distress tolerance may also begin to explain the patterns of change in the development of EXT and INT.

There is significant value in investigating the developmental trajectory of distress tolerance during the transition from childhood to adolescence. Primarily, entry into adolescence is marked by rapid physiological and environmental changes. This period of development is a critical window for neural development that affects emotion regulation and decision-making (Steinberg 2007). Also, there are increased social and cognitive demands on adolescents (e.g., social relationships become more complex, academic tasks more demanding) whereas the capacity needed to complete these tasks might lag well behind. It is not surprising that several studies document steep increases in various forms of psychopathology and problem behavior at puberty and/or transition to middle school (Cicchetti and Rogosch 2002; Galambos et al. 2003; Leadbeater et al. 1999; Pellegrini and Long 2002; Reardon et al. 2009). Nonetheless, there are also individual differences during this period such that many young people navigate through adolescence with relatively little difficulty (Arnett 1999). Given this variability in adjustment, examining the stability, change, and prospective associations of distress tolerance during early adolescence has the potential to increase understanding of the etiological role distress tolerance plays in the development of psychopathology symptoms.

Present Study

In this study, we sought to examine the longitudinal course of distress in a community sample of adolescent boys and girls followed for four years during the transition into adolescence. Our main objectives were (1) to examine the nature and direction of the development in distress tolerance during adolescence and (2) to assess prospective associations among distress tolerance and psychopathology disorder symptoms within EXT and INT categories.

To obtain longitudinal information on the development of distress tolerance during adolescence, we examined three indices of change: *mean-level change, individual-level change*, and *rank-order stability* over four years. Next, to examine prospective associations among distress tolerance and adolescent disorder symptoms within EXT and INT categories, we utilized Latent Growth Modeling (LGM). LGM assesses cross-sectional associations between initial Levels of variables, prospective associations between initial Levels with Change of variables, and relationships between two Change variables. Our focal interest in the LGM analyses was to examine whether the initial Level and Change in distress tolerance would be meaningfully associated with the Level and Change in adolescent adjustment. Finally, we examined gender differences in the longitudinal course and trajectory of distress tolerance as well as in the interrelationships of distress tolerance, EXT, and INT.

Method

Participants

This study sample was comprised of early adolescents (*N*=277), ages 9 to 13 at initial enrollment. Participants were recruited primarily for a larger prospective study of the behavioral, environmental, and genetic mechanisms in youth HIV-related risk behaviors in the greater metropolitan Washington D.C. area. Recruitment methods included media outreach and mailings with area schools, libraries, and boys and girls clubs. Follow-up assessments were conducted at yearly intervals for four consecutive years and are still ongoing with additional assessments planned. The Institutional Review Board approved all protocols. Recruitment was open to all youth in the 5th and 6th grades who were proficient in English; no other exclusion criteria were used. Interested families who met inclusion criteria were invited to come to the University of Maryland campus accessible by public transportation. Upon arrival at the baseline assessment session, a more detailed description of the study procedures was provided and the primary caregiver and youth signed informed consent and assent, respectively. The youth and caregiver were then accompanied to separate rooms to complete the assessments. Standardized instructions were given separately to the caregiver and adolescents at each assessment occasion across time. At each of the four time points parents were compensated with $25 to $35, while children were compensated with $15 to $35 and prizes such as iTunes gift cards, board games, and DVD’s.

At the time of study enrollment, participants were on average 11.0 years of age (*SD*=0.81), 43.7 % female, 47.7 % non-Hispanic White, 36.5 % African-American, 2.5 % Latino, 1.4 % Asian, 0.4 % Native American, and 11.6 % of mixed ethnicity. Although the assessments were planned to minimize age variability, there was still slight variability in age at each assessment [*M* (*SD*) Year 1=11.0 (0.81); Year 2=12.07 (0.89); Year 3 = 13.05 (0.90); Year 4= 14.01 (0.89)]. Since mean-level INT and EXT change throughout adolescence (Bongers et al. 2004; Cicchetti and Rogosch 2002; Hicks et al. 2007), we used a centering procedure to separate (i.e., regress out) the effect of age on distress tolerance, INT, and EXT within each assessment occasion. This approach has successfully been used in previous longitudinal studies (Bornovalova et al. 2009; Hicks et al. 2012; Johnson et al. 2007). Follow-up rates were 89.1 %, 86.9 %, and 83.8 % for Years 2, 3, and 4 respectively. Participants lost to attrition included those who could not be located, or did not respond to phone or letter inquiries. Comparison of participants who were lost to attrition and those who remained on baseline characteristics revealed no significant differences on gender, age, ethnicity, distress tolerance, EXT, or INT (*p*'s>0.10).

Measures

Distress Tolerance—At baseline and each follow-up assessment, participants completed a behavioral measure of distress tolerance: the computerized Behavioral Indicator of Resiliency to Distress (BIRD; Lejuez et al. 2006). In this task, ten numbered boxes (1–10) were presented on a computer screen and participants were instructed to click (using the computer's mouse) a green dot that appeared above a numbered box before the green dot moved to another number. If the youth successfully clicked the numbered box where the green dot was located prior to the dot moving, the bird flew out of its cage, the computer emitted a pleasant chirping sound, and the youth earned a point. In contrast, if the youth clicked the wrong numbered box or did not click prior to the green dot moving, the computer emitted a loud and unpleasant noise, the bird remained in its cage, and the youth did not earn a point.

There were three levels in the BIRD. First, there was a 3 minute level which began with 5-*s* latencies between dot presentations. According to the youth's performance, this latency either increased or decreased by 0.5 *s* (correct answers decreased the latency and incorrect answers or non-responses increased the latency). Second, there was a 5 minute level which began with an average latency from the previous level (this average latency was also calculated to index skill level). This level progressed in difficulty because in the final minute the latency was decreased by half (this was termed as the youth's challenge latency). To finish, the last level included the challenge latency for up to 5 minutes. Right before beginning this last level, the task informed the participant that he or she could end the task by clicking the 'quit game' button on the computer screen at any point in the level. Yet, the youth were told that the magnitude of their prize would be based on their performance; no other specific information about the requirements for each prize was given (Lejuez et al. 2003). For the participants, the total number of points earned was visible at all times during the task on the upper right-hand corner of the screen. Distress tolerance was measured as time (in seconds) to task termination on the final level, and the task was capped at 300 *s*.

Providing evidence for the construct validity of this measure, the BIRD has reliably induced emotional distress in adolescents (Amstadter et al. 2012; Daughters et al. 2009; MacPherson et al. 2010). In these samples distress tolerance on the BIRD related to adolescent alcohol use, delinquent behaviors, and depressive symptomatology demonstrating convergent validity. In addition, emotional distress on the BIRD was unrelated to latency to task termination attesting that latency to termination scores on the BIRD is not simply a measure of distress in response to the task (Daughters et al. 2009; MacPherson et al. 2010).

To assess change in negative affect during the task, participants completed the Positive and Negative Affect Schedule-Children (PANAS-C; Laurent et al. 1999) prior to the first level and after the second level of the task. Participants rated the degree to which they currently felt excited, mad, interested, frustrated, happy, upset, energetic, embarrassed, proud, and nervous on a 10-point scale ranging from ‘not at all’ to ‘extremely’. Distress was indexed based on the composite of mad, frustrated, upset, embarrassed, and nervous. Internal consistency of this distress index ranged from α=0.73 to 0.86 across the PANAS-C assessments.

EXT and INT Symptom Categories—Given previous studies indicating that children and adolescents have problems reporting accurately on EXT symptoms (Costello et al. 1985; Jensen et al. 1999; Rubiostipec et al. 1994; Sibley et al. 2010; Young et al. 2010), we used EXT data provided by the parents. Similar to previous work (Burt et al. 2003, 2005; Elkins et al. 2007; Sherman et al. 1997; Young et al. 2009), our measures of EXT included the parent-reported symptoms of CD, ODD, and ADHD—inattention and hyperactivity symptoms—on the Disruptive Behavior Disorders Rating Scale (DBDRS; Pelham et al. 1992). Internal consistency (Cronbach’s α) for EXT symptoms for Years 1–4 respectively were as follows: for CD 0.61, 0.59, 0.68, and 0.60, for ODD 0.83, 0.80, 0.81, and 0.79, and for ADHD 0.95, 0.95, 0.92, and 0.94.

Previous work indicates that children can provide accurate information regarding their INT symptoms (Costello et al. 1985; Jensen et al. 1999; Lauth et al. 2010). Thus, to measure INT we included self-reported symptoms of DSM-IV-defined MDD and anxiety disorders [composite of Social Phobia, Panic Disorder, Separation Anxiety Disorder, Generalized Anxiety Disorder, and Obsessive–Compulsive Disorder] from the Revised Child Anxiety and Depression Scales (RCADS; Chorpita et al. 2000). Internal consistency (Cronbach’s α) for INT symptoms were as follows: for MDD 0.82, 0.81, 0.84, and 0.86 and for anxiety disorders 0.95, 0.94, 0.94, and 0.95 for Years 1–4 respectively. To ensure reliability of our anxiety composite, we conducted a principal component analysis which confirmed that at all four years anxiety disorders loaded on one component (all loadings>0.77).

All EXT and INT symptoms were worded to reflect behaviors during the previous year. The levels of EXT and INT symptoms were similar to levels in other large, representative community samples (Chorpita et al. 2000; DuPaul et al. 1998; Ebesutani et al. 2010; Pellegrini and Long 2002). Natural log transformations were made where needed. EXT was unacceptably kurtotic at all ages (>3). After log-transforming the EXT variables at all ages, the skew and kurtosis were within acceptable range (<1).

Data Analytic Strategy

We used three indices of developmental change in distress tolerance: *mean-level change*, *individual-level change*, and *rank-order stability*. Mean-level change refers to the magnitude of change in the average scale scores over time for a given population. We evaluated mean-level effects via paired-sample *t*-tests, repeated-measures ANOVAs, and effect sizes (Cohen's d, $M_1 - M_2/SD$) for the change in mean score from Year 1 to Year 2; Year 1 to Year 3; and Year 1 to Year 4. We also examined if mean distress tolerance differed by gender at each age and across time (univariate and repeated-measures ANOVAs). Next, individual-level change refers to the number of individuals who exhibit a clinically significant change in a level of a trait that cannot be accounted for solely by measurement error or regression to the mean (i.e., as a result of chance). Individual-level change is typically assessed with the reliable change index (RCI; Christensen and Mendoza 1986; Jacobson and Truax 1991). The RCI was calculated by adding (or subtracting) the Year 1 standard deviation of a given trait (here, distress tolerance) from the individual Year 1 score. If, at each follow-up assessment, a participant received a score higher (or lower) than the above total, they were considered to have shown reliable change. At each follow-up, participants could fall into one of three categories: improved (has passed RCI in the positive direction), deteriorated (has passed RCI in the negative direction), or unchanged (has passed neither). Assuming a normal distribution in change scores, if individual-level change was solely due to measurement error or regression to the mean, only 5.0 % of the sample would exhibit individual level change (2.5 % improvement and 2.5 % deterioration). Thus, we conducted a chi-square test for individual-level change that tested whether the observed distribution in the sample differed from the distribution expected purely by chance (2.5 % decrease, 95.0 % stable, 2.5 % increase). To examine whether the distribution of participants who changed or remained stable was the same for boys and girls, we used another chi-square test. Last, rank-order stability refers to the consistency of the relative ordering of individuals over time and provides an indicator of the extent to which participants maintain their relative position in a group over time. In the current study, we assessed rank-order stability via the test–retest Pearson correlation coefficients for distress tolerance across four years.

Moreover, we examined the development of distress tolerance and its prospective associations with EXT and INT with LGM (Mplus 5.2; Muthen and Muthen 1998–2007). This modeling technique provides the possibility to examine intra-individual change in each construct (i.e., trajectory) across time, as well as between-subject differences in associations among individual trajectories. To begin, we fit one univariate growth model to the data to evaluate the shape of change, mean, and variance estimates of Level (initial level of scores) and Change (slope) in distress tolerance. We conducted multi-group model comparisons by gender (Jöreskog and Sörbom 1993) to evaluate gender differences in the growth factor means. Second, we used multivariate models to evaluate associations among the growth factors in distress tolerance, MDD, anxiety (composite), CD, ODD, and ADHD. Prior to running the multivariate models, we fit five univariate models to each of our EXT and INT measures to evaluate the shape of change, mean, and variance estimates for Level and Change. Following, the Level and Change of these disorders were regressed onto the Level of distress tolerance, as well as onto the Change of distress tolerance. We again used multi-group comparisons by gender to examine gender differences in these associations.

Model estimation was conducted with Full Information Maximum Likelihood, FIML, estimator (Muthen and Muthen 1998–2007), which enabled us to utilize all available information in the data. That is, participants with missing information in some variables at some assessment occasions were also included in the analyses using model-based missing data imputation. Therefore, we conducted the longitudinal analyses in all 277 participants. Given the large impact of sample size on the Chi-square statistics, we evaluated model fit primarily with the Comparative Fit Index (CFI) and the Root-Mean-Square Error of Approximation (RMSEA). Model fit is considered acceptable when the CFI coefficient is above 0.95 and the RMSEA is below 0.07 (Hu and Bentler 1999; Steiger 2007).

Results

Construct Validity of the Distress Tolerance Tasks

Providing support for the use of latency to task termination on the BIRD as a measure of distress tolerance, results of a series of paired *t*-tests performed on pre- and post-task negative affect ratings revealed an increase in negative affect at the Year 1 assessment [$t(1)=2.57$, $p<0.0l$, $d= 0.15$]; Year 2 assessment [$t(1) =4.97$, $p<0.001$, $d=0.22$]; Year 3 assessment [$t(1)=5.15$,$p<0.001$, $d=0.25$]; and Year 4 assessment [$t(1)=7.24$,$p<0.001$, $d=0.28$]. This indicated that each year, participants regarded the task as stressful. Post-task and change in levels of distress were uncorrelated with latency to task termination at years 1–4 (*r*’s ranging between −0.11 and 0.06, *p*’s>0.26). This suggested that the latency to termination scores on the BIRD was not simply a measure of emotional distress in response to the task.

Mean-Level Change, Individual-Level Change, and Rank-Order Stability of Distress Tolerance

Table 1 provides the means, standard deviations, and effect sizes of change for the distress tolerance scores for our four time points. In order to obtain effect size indices, we compared distress tolerance at Years 2 through 4 to distress tolerance at Year 1. The overall pattern indicated little change and high stability of distress tolerance across the four years. Particularly, there were no significant mean-level changes in any year. There were also no differences between boys and girls in distress tolerance levels in any of the years. Finally, we tested if the slopes of the increases in mean number of symptoms were significantly different for boys and girls using the Gender X Time interaction term in a repeated-measures ANOVA. The interaction term failed to reach significance, indicating that the change in distress tolerance over time does not differ for boys and girls.

Table 2 provides results of analyses examining individual-level change. We detected significant individual-level change in distress tolerance at years 2 through 4. In particular, more individuals exhibited a reliable and clinically significant increase or decrease in their level of distress tolerance than would be expected as a result of chance alone. Participants were no more likely to increase than to decrease in their level of distress tolerance. In addition, the majority of participants remained stable in terms of their distress tolerance levels. A series of chi-square tests for gender differences showed that boys and girls exhibited comparable rates of individual-level change at all follow-up years. Last, Table 3 provides the correlations among distress tolerance levels across the four time points, separately for boys and girls. Distress tolerance evidenced moderate rank-order stability, as indexed by the 4-year test–retest correlation (*r*'s= 0.25–0.51, *p*'s<0.01)[1].

Univariate Growth Model

To evaluate the shape of stability and change of distress tolerance, we fit a univariate growth trajectory to the data. First, the loadings of the four time scores in the trajectory were set to 1 on the Level, which thus represented the Year 1 score of distress tolerance. Second, the time score loadings on the Change factor were set to 0, 1, 2, and 3. Third, if the model with the Change fit the data better than the Level-only model, we compared the linear Change model to a model including this factor as well as a quadratic Change (nested within the linear Change model). Time score loadings on the quadratic Change were set to 1, −1, −1, and 1. With this strategy, our overall goal was to examine whether our measured variable evidenced meaningful changes during adolescence and if so, we evaluated the nature of this change via nested model comparisons.

Mean, variance, and covariance estimates of the Level and Change, along with residual score information for distress tolerance are reported in Table 4. The baseline model for distress tolerance with only the Level fit the data well [$\chi^2_{(8,\ N0277)}$=11.16, CFI=0.98, RMSEA=$0.04_{(0.000|0.086)}$]. A model including both the Level and a linear Change also fit the data well [$\chi^2_{(5,\ N=277)}$=4.45, CFI=1.00, RMSEA= $0.00_{(0.000|0.079)}$] but not significantly better than the Level-only model ($\Delta\chi^2$ (3)=6.71, *ns*). As seen in Table 4, the mean and the variance estimates of the linear Change were non-significant, suggesting that adolescents displayed no mean-level increases or decreases in distress tolerance over time and the individual trajectories were similar rather than different across the participants. Accordingly, a Level-only model best represented distress tolerance in the present sample and all further multivariate analyses included this Level-only model. We examined gender differences in the mean of the Level with a multi-group comparison by gender (the variance of Level was constrained to be equal between the genders as a default; Muthen and Muthen 1998–2007). No differences were observed ($\Delta\ \chi^2$ (1)=0.21, *ns*), suggesting that adolescent boys and girls displayed similar initial levels of distress tolerance.

Multivariate Growth Models

Prior to multivariate analysis, individual univariate growth trajectories were fit to each INT and EXT measure with the same procedure explained above; mean, variance, covariance estimates of the Level and Change, residual score information, model fit, and gender differences for these five models are reported in Table 4. Then, we combined these factors independently into a multivariate LGM with distress tolerance to examine the prospective relationships among these examined constructs. An example of the model is illustrated in

[1]Data on mean-level change, individual-level change, and rank-order stability of all INT and EXT symptoms are reported in Supplemental Materials.

Fig. 1. Specifically, the Level and Change of INT and EXT were regressed onto the Level and Change of distress tolerance (pathways *a, b, c*, and *d* in Fig. 1). As aforementioned, there was no significant slope of distress tolerance, so results are only reported for the Level and Change of INT and EXT symptoms regressed onto the Level of distress tolerance (pathways *a* and *b* in Fig. 1). Autoregressive paths between INT or EXT Level and Change (pathway *e* in Fig. 1) were also included in the model to reduce significance strength (Thompson et al. 2008).

Distress tolerance Level with Level and Change of INT and EXT symptoms, along with multivariate model fit indices and gender differences are reported in Table 5[2]. Overall, the models fit the data fairly well (CFI's>0.96, RMSEA's<0.06). We again examined gender differences with a multi-group comparison by gender, but this time the variance of Level of distress tolerance with Level of INT or EXT was constrained to be equal between the genders as a default (Muthen and Muthen 1998–2007).

With regard to INT symptoms, there was no significant relationship between Level of distress tolerance at Year 1 and Change in MDD or anxiety disorder symptoms across the four years. At Year 1 low distress tolerance did evidence a significant relationship with level of anxiety disorder symptoms, but this effect was driven by females. Multi-group comparison by gender confirmed this as a significant difference ($\Delta \chi^2$ (1)=85.01, p<0.001), suggesting that there was a stronger relationship between distress tolerance and anxiety disorder symptoms in adolescent girls.

For EXT symptoms, there was a positive significant relationship[3] between Level of distress tolerance at Year 1 and Change in ODD and ADHD symptoms across the four years. For ODD high distress tolerance predicted an increase in symptoms, and for ADHD high distress tolerance predicted a decrease in symptoms. Low distress tolerance at Year 1 also evidenced a significant negative relationship with Level of ODD and ADHD symptoms at Year 1. Neither the prospective or cross-sectional relationships were found with CD. Multi-group comparison by gender yielded no significant gender differences ($\Delta \chi^2$ (l)'s <1.06, *p*'s *ns*) in the EXT models.

Discussion

Although distress tolerance is an emerging construct of empirical interest, we know little about its temporal change, developmental trajectory, and prospective relationships with maladaptive traits and behaviors. The current study determined the presence of mean- and individual-level change of distress tolerance, as well as rank order stability using an adolescent sample of boys and girls (mean age ~11 at initial assessment) followed over a 4-year period. Furthermore, we examined if the course of distress tolerance influences change in INT and EXT symptoms, and if INT and EXT symptoms in turn influence change of distress tolerance over time. Although one previous study examined the relationship of distress tolerance with INT and EXT cross-sectionally (Daughters et al. 2009), this study

[2]Data on univariate and multivariate models for each anxiety disorder are provided in Supplemental Materials.
[3]Although the correlation between distress tolerance Level and both ODD and ADHD Change was positive, this reflects the direction of distress tolerance. Refer to Table 4 for direction and significance of ODD and ADHD change.

was the first to examine the development of distress tolerance over time and its prospective associations with INT and EXT. As an additional strength, the current study focused on a crucial developmental window (transition from childhood to adolescence). The study sample was both large and diverse, contributing to the generalizability of the results. Finally, we utilized a stringent operationalization and assessment of developmental pathways and a multi-informant approach to measuring INT and EXT symptoms.

Longitudinal Course of Distress Tolerance

Results indicated that distress tolerance was relatively stable from childhood to adolescence, with no significant mean-level change or high amounts of individual-level change. In addition, results indicated moderate rank-order stability, suggesting that levels of distress tolerance show some fluctuation over time (but not to a level that is clinically meaningful). For example, an individual identified as having the highest level of distress tolerance at baseline may not necessarily show the highest level of distress tolerance in the second or third year. Findings regarding the high degree of mean-level and individual-level stability (but moderate rank-order stability) of distress tolerance during this period of development are consistent with many longitudinal studies of personality change and development. For instance, a recent meta-analysis indicates that the greatest degree of mean- and individual-level change in personality traits occurs during late adolescence and early adulthood. In contrast, the degree of change from childhood to adolescence is small to nonexistent, despite the biological and social upheavals that generally occur during this time (Roberts and DelVecchio 2000; Roberts et al. 2006).

Gender Differences

Surprisingly, there were no gender differences in the stability and change of distress tolerance over time. This is somewhat in contrast to studies documenting that women have lower distress tolerance than men (MacPherson et al. 2008; Simons and Gaher 2005; but see Bornovalova et al. 2008 for contradictory results). The lack of concordance across studies may stem from variability in measurement of distress tolerance (self-report v. behavioral), sampling (community v. clinical samples), and age (children/young adolescents v. individuals well into adulthood). On the other hand, it is possible that distress tolerance is similar for boys and girls throughout childhood and early adolescence. These competing hypotheses should be tested further, and could be tested by following the current group of participants into late adolescence and adulthood.

Cross-Sectional and Prospective Relationships with INT

Cross-sectionally, results indicated that low distress tolerance was significantly related to anxiety disorder symptoms (but not MDD symptoms). The cross-sectional negative association between distress tolerance and anxiety disorder symptoms is consistent with other cross-sectional work in adults (Bernstein et al. 2009; Ellis et al. 2010; Keough et al. 2010) suggesting of distress tolerance’s predictive ability with particular aspects of INT. Longitudinally, however, there was no significant relationship with change in either anxiety disorder or MDD symptoms. This suggests that the associations between distress tolerance and INT symptoms are correlates rather causal antecedents of each other, and that their association is due to broader risk factors for psychopathology such as negative emotionality (Leyro et al. 2010).

Cross-Sectional and Prospective Relationships with EXT

Results indicated several striking findings between distress tolerance and EXT. To begin, distress tolerance was negatively related to ODD and ADHD in Year 1. This cross-sectional finding is exactly what we would expect (see Daughters et al. 2009 and Sargeant et al. 2011). On the other hand, the longitudinal relationships were somewhat unexpected. Higher distress tolerance predicted a decrease in ADHD, but an increase in ODD across the 4 years. There are a couple of points to consider when interpreting these findings. That is, the relationship between distress tolerance and EXT in adolescent development is more nuanced than indicated by previous cross-sectional research. Foremost, adolescence is an opportune time for EXT behaviors to fluctuate; there are documented increases in EXT in late adolescence (Hicks et al. 2007). These types of behaviors changes (e.g., rebelling against parents to be with a partner, being inattentive in class) are consistent with other expected developmental changes like initiating sexual relationships, acting differently to impress peers, or taking risks. Simultaneously, high tolerance of emotions like fear, anxiety, and general negative affect could be necessary to engage in these risky behaviors of EXT nature.

Collectively, this suggests there may be curvilinear effects of distress tolerance; in other words, low and high distress tolerance could be predicting specific outcomes. Depending on the situation or social-behavioral context the effects of high distress tolerance may be adaptive (i.e., high distress tolerance predicting a decrease in ADHD) or maladaptive like with low distress tolerance (i.e., high distress tolerance predicting an increase in ODD). To illustrate, in the context of rebellion against parents, high distress tolerance or persistence may undermine psychological well-being by preventing an individual from disengaging in these behaviors at an appropriate time (Grant and Schwartz 2011). Conversely, high distress tolerance may assist in completing goal-directed tasks (e.g., academic work). Whether distress tolerance evidences curvilinear effects is an empirical question pointed out in literature review on distress tolerance (Leyro et al. 2010). Since nearly all research on distress tolerance focuses on low levels, there may be more to learn about the predictive utility of high distress tolerance. These effects may even be seen particularly in adolescence versus childhood and adulthood because of the normative changes in EXT-related behavior. Unfortunately, the present sample— which is a large, representative community sample comparable to other studies (Chorpita et al. 2000; DuPaul et al. 1998; Pelham et al. 1992)— may have limited our ability to detect more complex, quadratic relationships with distress tolerance. To test whether our speculative interpretation is correct, the presently observed associations should be replicated in samples with higher average levels of EXT symptoms, such as among clinic -referred youth.

It is important to address that this relationship between distress tolerance and EXT was driven by ODD and ADHD, not CD symptoms. One explanation for these findings is that, as previously mentioned, changes in EXT are expected in adolescence, yet these types of EXT are more normative (e.g., rebelling against parents to be with a partner, being inattentive in class). In the case of CD, the child or adolescent is violating the rights of others (sometimes to the point of juvenile delinquency) which is more rare and indicative of severe antisocial psychopathology (Washburn et al. 2007).

Clinical and Theoretical Implications

On the whole, these findings suggest we should pay more attention to distress tolerance earlier in development, particularly since distress tolerance is very stagnant through adolescence. Certainly, early identification could be crucial for healthy psychological functioning because distress tolerance and EXT are longitudinally interrelated (regardless of the directionality of the relationships) and distress tolerance and subcomponents of INT demonstrated relatedness. Of chief importance is identifying the timing and processes involved to better understand when to interrupt the cycle, as this can inform intervention and prevention efforts for more successful and effective treatment (Bornstein 2010). Identifying unique processes that underlie the developmental pathway of distress tolerance can also serve as a treatment target (or when to implement an intervention).

Limitations and Future Directions

The current results should be interpreted in light of the following limitations. First, we collected the data for this project at ages 9 through 13. While this is the first step in longitudinal distress tolerance research, previous research has shown that similar constructs appear even earlier in life (Eisenberg et al. 2007; Zhou et al. 2004, 2008). Moreover, following this sample into the critical period of college transition, and/or extending longitudinal surveillance intervals to include longer periods of time would likely provide meaningful evidence for the development of distress tolerance, INT, and EXT. Also, although we utilized a validated, behavioral index of distress tolerance in the present study, the findings should be replicated using a multi-assessment method, multi-informant measure of this construct (including interview-based methods). Existing research suggests that both self-report and behavioral measures of distress tolerance provide unique and important information about the individuals (Anestis et al. 2012; Bornovalova et al. 2008; McHugh et al. 2011; Schloss and Haaga 2011).

Despite limitations, the current work provides interesting initial results that suggest a number of follow-up studies. Beyond exploring the relationship of distress tolerance with INT/EXT over a more extended period of time, it would be interesting to examine the longitudinal relationship between distress tolerance and highly-overlapping constructs such as Borderline Personality Disorder or substance use, as previous research has shown that these constructs are consistently linked with distress tolerance. Likewise, it would be worthwhile to explore if there are subtypes of developmental trajectories of distress tolerance among adolescents (Weems et al. 2002). For example, there may be a subset of individuals who increase over time, whereas another subset decreases, and a third stays stable. The possibility of trajectory subtypes may explain why there may be some degree of individual change over time, but no *overall* course of change. Furthermore, future research could examine the antecedents and consequences of differential trajectories of distress tolerance such as psychopathology, lifestyle, life stress, and demographics. Work of this kind is likely to contribute substantially to knowledge of the distress tolerance construct, and in turn to methods for preventing and targeting this vulnerability.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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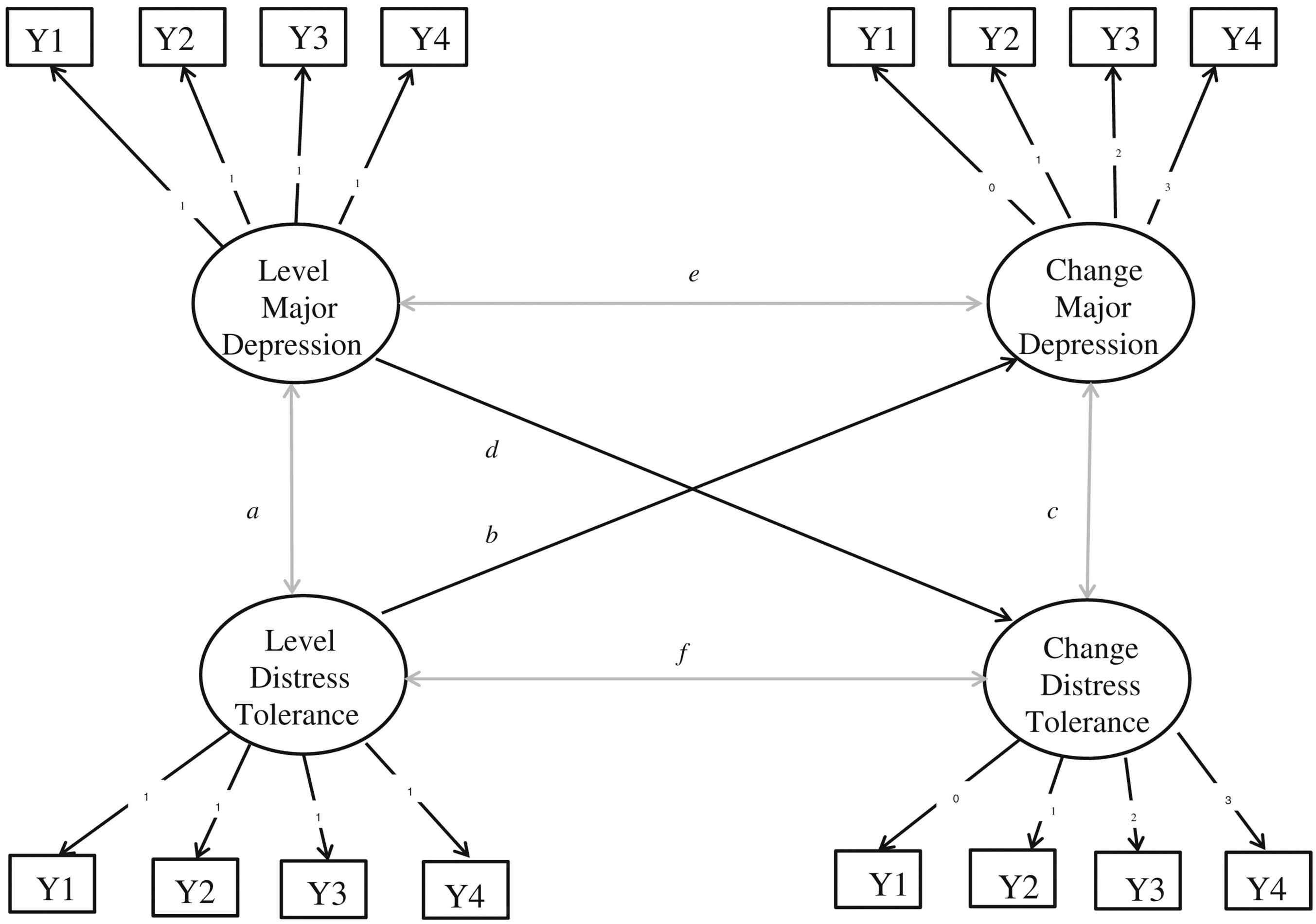

Fig. 1.
A descriptive LGM representing cross-sectional and prospective relationships between Level and Change factors of distress tolerance and EXT. Pathways *a* through *f* were evaluated in our multivariate models

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Table 1

Mean-level change of distress tolerance

	Year 1		Year 2		Year 3		Year 4		Gender	Time	Gender X Time
	Mean	SD	Mean	SD	Mean	SD	Mean	SD			
Distress Tolerance											
Boys	220.10[a]	98.22	219.46[b]	100.75	218.99[c]	99.97	208.43[d]	108.69	$F(1)=0.14, p=0.71$;	$F(3)=0.60$, $p=0.61$;	$F(3)=0.28, p=0.84$;
Girls	208.47	115.19	219.18	104.65	210.79	103.97	214.83	101.90	$d=0.06$	$d=0.04$	$d=0.06$
Combined	215.10	105.79	219.33	102.33	215.32	101.64	211.31	105.50			

[a] $F(1)=076$, $p=0.39$; $d=0.11$

[b] $F(l)=0.00$, $p=0.98; d=0.00$

[c] $F(l)=0.38$, $p=0.54; d=0.08$

[d] $F(l)=0.20$, $p=0.66; d=0.06$

Measured as seconds to termination. *Superscripted letters* indicate a test for gender differences and significance levels for these differences at each year.

*** $p<0.001$;

** $p<0.01$;

* $p<0.05$

Table 2

Percentages of participants who exhibited significant individual-level change in distress tolerance in each year

		%(*N*)			Individual-Level Change		Gender Differences	
	N	**Decrease**	**Stable**	**Increase**	**$\chi^2(2)$ Value**	***P***	**χ^2 (l)Value**	***P***
Individual-Level Change in Distress Tolerance[a]								
Change from year 1 to year 2								
Boys	126	16 %(20)	69 %(87)	15%(19)	178.82***	<0.001		
Girls	99	18 %(18)	61 %(60)	21 %(21)	248.37***	<0.001		
Combined	225	17 %(38)	65 %(147)	18 %(40)	417.25***	<0.001	1.95	0.38
Change from year 1 to year 3								
Boys	123	17 %(21)	67 %(82)	16%(20)	208.04***	<0.001		
Girls	96	13 %(13)	70 %(67)	17%(16)	13.31***	<0.001		
Combined	219	16 %(34)	68 %(149)	16 %(360)	335.56***	<0.001	0.52	0.77
Change from year 1 to year 4								
Boys	113	24 %(27)	59 %(67)	17%(19)	314.66***	<0.001		
Girls	89	16 %(14)	66 %(59)	18%(16)	155.32***	<0.001		
Combined	202	21 %(41)	62 %(126)	17%(35)	456.18***	<0.001	2.07	0.36

[a]Measured as seconds to termination.

*** $p<0.001$,

** $p<0.01$,

* $p<0.05$

RCI reliable change index; *decrease* has passed RCI in the negative direction; *stable* has passed neither criterion; *increase* has passed RCI in the positive direction

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Table 3

Correlations distress tolerance[a] by gender over time

	1.	2.	3.	4.
1. Distress Tolerance Year 1	----	0.25**	0.40***	0.30***
2. Distress Tolerance Year 2	0.42***	----	0.41***	0.51***
3. Distress Tolerance Year 3	0.20*	0.36***	----	0.42***
4. Distress Tolerance Year 4	0.24**	0.43***	0 49***	----

[a]Measured as seconds to termination. Correlations among females are in the shaded area; among males, in the non-shaded area.

*** $p<0.001$;

** $p<0.01$;

* $p<0.05$

Table 4

Growth factor mean, variance, and covariance estimates, along with residual scores

	Level		Change		Level* Change Covariance	Residual Variances[a]				Model Fit		Gender Differences	
	Mean	Variance	Mean	Variance		Y1	Y2	Y3	Y4	CFI	RMSEA	$\chi^2(1)$ Value	*P*
Distress Tolerance[b]													
Boys	221.04***	4116.94***	−3.81	683.74*	−522.88	0.57	0.61	0.56	0.39				
Girls	212 92***	2486.63	−0.72	−268.72	774.89	0.82	0.64	0.58	0.57				
Combined	217.57***	3402.92***	−2.50	303.61	3.35	0.70	0.63	0.57	0.45				
Internalizing Symptoms													
Major Depression													
Boys	6.36***	11 32***	−0.26*	1.02**	−1.44*	0.21	0.42	0.38	0.32				
Girls	6.23***	15.11***	0.11	1.11*	−0.77	0.50	0.30	0.28	0.24				
Combined	6 44***	12.63***	−0.15	1 04***	−0.99	0.39	0.36	0.33	0.28	0.99	0.06	1.15	0.28
Anxiety Disorders(Composite)													
Boys	24 14***	134.33***	−2.23**	11.11**	−26.39**	0.25	0.43	0.40	0.40				
Girls	24 99***	177.65***	−0.86	17.39**	−32.68*	0.44	0.33	0.40	0.33				
Combined	24 76***	152.48***	−1 71**	***	−28.04***	0.36	0.38	0.39	0.35	0.99	0.05	1.18	0.28
Externalizing Symptoms[c]													
Conduct Disorder													
Boys	0.10***	0.06***	0.00	0.00	0.00	0.39	0.62	0.47	0.07				
Girls	0.06***	0.01*	0.00	0.00	0.00	0.65	0.59	0.53	0.49				
Combined	0.08***	0 04***	0.00	0.00	0.00	0.46	0.59	0.48	0.21	0.96	0.10	12.19	<0.001
Oppositional-Defiant Disorder													
Boys	0.34***	0 19***	0.01	0.01	0.00	0.42	0.31	0.46	0.24				
Girls	0 27***	0.15***	0.04*	0.01	−0.01	0.37	0.46	0.41	0.42				
Combined	0.31***	0 17***	0.02*	0.01	0.00	0.42	0.36	0.45	0.31	0.99	0.04	0.61	0.43
Attention-Deficit Hyperactivity Disorder													

	Level		Change		Level* Change Covariance	Residual Variances[a]				Model Fit		Gender Differences	
	Mean	Variance	Mean	Variance		Y1	Y2	Y3	Y4	CFI	RMSEA	$\chi^2(1)$ Value	*P*
Boys	0 90***	0.69***	0.00	0.02*	−0.03	0.22	0.19	0.24	0.13				
Girls	0.80***	0.50***	−0.06*	0.03**	−0.05	0.28	0.30	0.21	0.20				
Combined	0.86***	0.61***	−0.02	0.03***	−0.03*	0.24	0.23	0.23	0.15	0.98	0.09	2.19	0.14

Model estimation conducted with FIML estimator which accounts for missing data.

[a] Standardized values reported.

[b] Measured as seconds to termination.

[C] A11 analyses performed on log-transformed EXT scores.

*** $P<0.001$,

** $P<0.01$,

* $P<0.05$

Table 5

Prospective associations among distress tolerance, INT, and EXT

	Distress Tolerance[a] Level with		Model Fit		Gender Differences	
	Level[b]	Change[b]	CFI	RMSEA	χ^2 (l)Value	*P*
Internalizing Symptoms						
Major Depression						
Boys	−0.07	−0.32				
Girls	−0.28	−0.10				
Combined	−0.18	−0.22	0.98	0.04	75.23***	<0.001
Anxiety Disorders (Composite)						
Boys	−0.15	−0.20				
Girls	−0.42**	0.19				
Combined	−0.29**	−0.01	0.98	0.04	85.01***	<0.001
Externalizing Symptoms[C]						
Conduct Disorder						
Boys	−0.11	−0.20				
Girls	0.09	−0.03				
Combined	−0.02	−0.16	0.97	0.04	1.05	0.31
Oppositional-Defiant Disorder						
Boys	−0.34**	0.35				
Girls	−0 37***	0.52**				
Combined	−0.35***	0.43**	0.99	0.02	0.00	0.95
Attention-Deficit Hyperactivity Disorder						
Boys	−0.18	0.37*				
Girls	−0.34**	0.43**				
Combined	−0.24**	0.38**	0.98	0.05	0.58	0.45

Model estimation conducted with FIML estimator which accounts for missing data.

[a]Measured as seconds to termination.

[b]Standardized values reported.

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[c] All analyses performed on log-transformed EXT scores.

*** $p<0.001$,

** $p<0.01$,

* $p<0.05$