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Appraisals of dependent stressor controllability and severity are associated with depression and anxiety symptoms in youth

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Abstract

Background and Objectives: Stress is well established as a strong risk factor for internalizing psychopathology. Learned helplessness research demonstrates that perceived controllability of stressors affects internalizing symptoms. Furthermore, subjective perceived stress is associated with psychopathology. However, most recent research has focused on measuring the frequency and expert-rated severity of stressful life events despite evidence for the importance of stress perceptions. The present study brings together past and current literatures to investigate the importance of perceived severity and controllability of recent life events in the association between stressors and internalizing symptoms.

Design and Methods: We used a revised version of the Adolescent Life Events Questionnaire (ALEQ) that asked participants (ages 13–22, N = 328) to rate the frequency of 65 stressful events typical to youth, as well as the perceived stressfulness and control they felt over each event. Events were categorized prior to analysis as dependent (self-generated), independent (fateful) or neither.

Results: Controllability and severity appraisals were associated with depression and anxiety symptoms, controlling for stressor frequency (which also predicted symptoms), for dependent but not independent stressors.

Conclusions: These results highlight the importance of controllability and severity appraisals as potential risk factors for internalizing disorders, exposing a potential target for therapy.

Keywords

stress controllability; stress severity; depression; anxiety; stress appraisal; ALEQ

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Data Availability

The data that support the findings of this study are openly available in Open Science Framework at https://osf.io/amjh9/?view_only=6c4d7cff3bd643ecbf4b2453fe435453

Disclosure of Interest

The authors report no conflicts of interest.

Introduction

The association between stress and internalizing psychopathologies has been strongly established; stressful life events predict depression episodes (Kendler, Karkowski, & Prescott, 1999; Kendler, Thornton, & Gardner, 2001; Mazure, 1998) and are associated with anxiety disorders (Mineka & Oehlberg, 2008). Adolescence and emerging adulthood is marked by heightened stress experience (e.g., Grant et al., 2014) and is a critical developmental period for internalizing psychopathology risk (e.g., Merikangas et al., 2010). Specifically, latent risk factors such as cognitive vulnerabilities (e.g. negative inferential style, tendency to ruminate), poor executive function, and negative emotionality are thought to interact with heightened peer and academic stress during this period to produce internalizing symptoms (Hankin et al., 2016). Because persistence and recurrence (estimated at 53% for MDD) of internalizing disorders is high (Rohde, Lewinsohn, Klein, Seeley, & Gau, 2013), it is important to study this critical onset period and develop methods to reduce risk.

Consequently, researchers have sought to measure stress exposure as a risk factor for psychopathology, including quantifying the frequency and researcher-rated severity of negative life events (Hammen, 2015; Harkness & Monroe, 2016; Kessler, 1997; Mazure, 1998). However, studies show that factors such as stressor controllability and subjective stress appraisals impact stress outcomes (Koolhaas et al., 2011; Maier & Seligman, 1976; 2016; Maier & Watkins, 2005; Pryce et al., 2011). Appraisals were previously widely studied in relation to stress and coping (e.g., Compas, 1987; Folkman, 1984; Lazarus, 1990), yet a push for more objective measures of stressors (Brown & Harris, 1978; Dohrenwend & Shrout, 1985) moved the field away from this research. Thus, human clinical research today focuses on stressor frequency and expert ratings of severity. Animal research, however, has continued to investigate other factors that affect stress outcomes, including controllability (for review, see Maier & Seligman, 2016).

To bring these literatures together, we revised the Adolescent Life Events Questionnaire (ALEQ; Hankin & Abramson, 2002), a commonly used measure of frequency of stressful life events in youth, to add participant ratings of perceived controllability and severity of each stressor. The current study examines whether controllability and severity appraisals are associated with depression and anxiety symptoms in adolescents and emerging adults. Given, evidence that the relationship between stress and internalizing psychopathology is stronger for dependent stressors (i.e., events in part caused by the behavior of the individual) than independent stressors (i.e., fateful events; e.g., Liu & Alloy, 2010) we also test whether the associations between stress appraisals and internalizing symptoms differ for these stressor types.

Stressor Controllability

The effects of the controllability of stressors on stress responses have been examined in the context of learned helplessness theory, which posited that the experience of uncontrollable events leads to helplessness, the learned belief that one’s behaviors do not change outcomes (Maier & Seligman, 1976; Seligman, 1975). Supporting this theory, rats with control over a stressor, such as an electric shock, do not experience the battery of negative outcomes

suffered by animals without control over the same stimulus, including prolonged stress responses, fear conditioning, anxious behavior, and learned helplessness (Amat, Aleksejev, Paul, Watkins, & Maier, 2010; Amat et al., 2005; Baratta et al., 2007; Maier & Seligman, 1976; Chorpita & Barlow, 1998). Human studies report similar behavioral results to uncontrollable stressors including increased emotional arousal, enhanced conditioned fear expression (Hartley, Gorun, Reddan, Ramirez, & Phelps, 2014), altered cognitive functioning (Henderson, Snyder, Gupta, & Banich, 2012) and sensitization of the stress system, (Chorpita & Barlow, 1998), yet for humans *perception* of control[1], rather than actual control, is critical to determining stress response (Geer, Davison, & Gatchel, 1970; Glass, Singer, & Friedman, 1969; Maier & Seligman, 1976; Seligman, 1975). Importantly, depressed individuals exhibit helplessness behaviors (e.g. passivity, quickness to give up) to controllable stressors, which healthy individuals only exhibit for uncontrollable stressors (Klein & Seligman, 1976; Klein, Fencil-Morse, & Seligman, 1976), and there is some evidence that depression is associated with controllability ratings of daily hassles (e.g., Cheng, 2001) and stressful life events (Gan, Zhang, Wang, Wang, & Shen, 2006; Zong et al., 2010). The learned helplessness theory of depression thus proposes that negative events lead to depression when an individual learns that they lack control (Maier & Seligman, 1976; Seligman, 1975), and hopelessness theory builds on this to assert that individuals' *appraisals* about stressors, including their controllability, are important factors for depression risk (Abramson, Metalsky, & Alloy, 1989). These theories have been extended to anxiety (Alloy, Kelly, Mineka, & Clements, 1990), and indeed, learned helplessness has been associated with GAD, PTSD, and panic disorder (Mineka & Oehlberg, 2008). Together, this evidence highlights the importance of perceived controllability in the relationship between negative life events and internalizing symptoms.

Stressor Severity

While recent research employs expert ratings of life events to study the association between stressor severity and internalizing disorders, earlier research investigated individuals' perceptions of stressors using constructs similar to perceived stressor severity (for a brief review, see Lazarus, 1990). These studies found that decreased desirability of events, increased perceived stress burden in one's life, and perceived severity of daily hassles were more strongly associated with depression symptoms than stress frequency measures (Cohen et al., 1983; Compas et al., 1987; Rowlison & Felner, 1988). These measures differ somewhat from the current operationalization of perceived stress severity but highlight the importance of subjective experience of stress severity in relation to internalizing symptoms.

A few more recent studies also demonstrate that perceived stress severity is associated with internalizing symptoms. One study using a self-rated measure of life event stress severity found that perceived threat-related stress was associated with anxiety disorders, and perceived loss-related stress was associated with depression (Sandin, Chorot, Santed, &

[1]Appraisals of stressor controllability are somewhat related to, but importantly distinct from, the construct of locus of control–general beliefs about whether events, good or bad, are caused by external (e.g. luck, powerful others) or internal (one's own behavior) forces (Rotter, 1966). External locus of control is associated with depression (Benassi, Sweeney, & Dufour, 1988; Cheng, Cheung, Chio, & Chan, 2013; Prociuk, Breen, & Lussier, 1976) but it is unknown how it relates to controllability appraisals of specific stressors. The current study thus focuses on appraisals of the controllability of specific stressors, not general beliefs of one's role in bringing about events.

Valiente, 2004), as has been found using expert-rated measures (Asselmann, Wittchen, Lieb, Höfler, & Beesdo-Baum, 2015; Brown & Harris, 1978; Kendler & Gardner, 2010). A different study found that self-ratings of daily stressor severity were somewhat more strongly associated with changes in mood than expert-ratings (r = .32 vs .20) (Almeida, Wethington, & Kessler, 2002). This could result from the participants' moods affecting their ratings, but it also could be due to the importance of subjective experience of stress. Indeed, discrepancies between expert and participant ratings of stressor severity have long been noted as potentially important for understanding links between stress and psychopathology (e.g., Brown & Harris, 1978).

In sum, there is evidence that perceptions of stressor controllability and severity are important in understanding the impacts of stress, yet stress frequency and expert-rated severity measures have become the standard in the field as appraisals were thought to be confounded by the individual's emotional reaction to events (for reviews, see Hammen, 2005; Harkness & Monroe, 2016; Kessler, 1997; Mazure, 1998). This has greatly influenced current stress measures, including the original version of the Adolescent Life Events Questionnaire (ALEQ).

Adolescent Life Events Questionnaire (ALEQ)

The ALEQ (Hankin & Abramson, 2002) measures the frequency of experienced negative life events over a specified period of time (typically three or six months), in domains including family, peer, romantic/relationship, and school/achievement and neighborhood stressors. Studies using the ALEQ show stressor frequency to be associated with psychopathology in youth, including anxious arousal (Barrocas & Hankin, 2011; Hankin, 2008; Snyder & Hankin, 2016), depression symptoms (Barrocas & Hankin, 2011; Calvete, Orue, & Sampedro, 2017; Hankin, 2008; Snyder & Hankin, 2016; Young, LaMontagne, Dietrich, & Wells, 2012), general internalizing symptoms (Hankin, 2008) and externalizing behavior (Calvete et al., 2017; Hankin, 2008). The ALEQ has thus been demonstrated to be a valid measure of stress exposure in youth, which reliably predicts psychopathology. Although reporter bias is always a concern when using self-report methods and there is evidence that internalizing psychopathology can lead to negative memory biases (Dillon & Pizzagalli, 2018), stress frequency measures, including the ALEQ, have been invaluable to the study of stress and psychopathology. We posit, however, that understanding individuals' perceptions of stressors in addition to frequency will provide a more complete picture of the relationship between stress and mental health. The current study addresses this using a revised version of the ALEQ that gathers frequency and appraisal information for recent stressors.

Current Study

In sum, helplessness/hopelessness theory, animal research, and past human research suggest that appraisals of stressor controllability and severity play an important role in determining stressor outcomes (Abramson, Metalsky, & Alloy, 1989; Abramson, Seligman, & Teasdale, 1978; Breier et al., 1987; Geer et al., 1970; Glass et al., 1969; Koolhaas et al., 2011; Maier & Seligman, 1976). However, little human research has tested the association between psychopathology and perceived controllability and severity of life event stressors. We test

this in the current study by revising the ALEQ (ALEQ-R) to include participant ratings of perceived controllability and severity for each endorsed life event. The hypotheses and the data analysis plan were pre-registered prior to data analysis on the Open Science Framework website[2]. We predicted that lower controllability and higher severity ratings would each be associated with higher depression and anxiety symptoms in youth, controlling for stress frequency ratings.

This study also explored whether controllability and severity appraisals are differentially associated with depression and anxiety for dependent (partially caused by the individual, e.g. relationship problems) versus independent (fateful, e.g. illness of a family member) stressors. Depression and anxiety are more closely tied to dependent stressors (e.g., Connolly, Eberhart, Hammen, & Brennan, 2010). This may be explained by the stress generation hypothesis (Conway, Hammen, & Brennan, 2012; Hammen, 1991; 2006) which posits that vulnerability to internalizing psychopathology, as well as depression and anxiety themselves, promote maladaptive behaviors that lead to dependent stressors, further increasing internalizing symptoms (Hammen, 1991; 2006). This theory has been supported across multiple studies (Connolly et al., 2010; Hammen, 2018; Liu, 2013; Liu & Alloy, 2010; Shapero, Hankin, & Barrocas, 2013; Snyder & Hankin, 2016). Thus, as a more exploratory analysis, we hypothesized that appraisals of dependent stressors would be particularly associated with depression and anxiety. Specifically, if individuals perceive stressors that they helped cause to be uncontrollable, it could lead to increased feelings of guilt, lower self-esteem and hopelessness (e.g. “It’s my fault but there is nothing I can do to fix it.”), as well as impair the ability to understand how to fix or prevent these problems in the future, increasing stress generation and internalizing symptoms.

Because age and gender are both known to affect the prevalence and course of internalizing psychopathology (e.g., Hankin et al., 2016; Merikangas et al., 2010), we tested for age and gender moderation of relationships between stress appraisals and symptoms. Lastly, as a follow-up analysis to understand the importance of stress frequency on the effects of appraisals, we tested whether frequency moderates the relationship between stress appraisals and symptoms.

Method

Participants

Participants were recruited from the greater metro Denver area through direct mail, as well as from an ongoing longitudinal study. ZIP codes were selected by researchers based on US Census data to maximize racial and economic diversity and recruitment letters sent to addresses identified has having one or more residents in the target age range. Interested families contacted the lab and were screened for eligibility: individuals had to be in the 13–22 year age range, be able to complete a series of cognitive tasks and questionnaires (corrected-to-normal vision, use of both hands, and absence of any serious neurological or cognitive impairments which would preclude completing the tasks or questionnaires), be fluent in English, and have a parent who was fluent in English and could provide informed

[2]https://osf.io/amjh9/?view_only=6c4d7cff3bd643ecbf4b2453fe435453

consent if they were under 18. There were no other exclusion criteria, and no participants were excluded after enrolment. A total of 328 youth (Mean age = 16.45, SD = 2.42) were included in the study. The racial identity of the sample was 68.6% white, 8.2% Black or African American, 3.7% American Indian/Native Alaskan, 3.0% Asian, 10.7% more than one race, 2.1% other, and 3.7% N/A. Ethnicity was 18% Hispanic/Latino, 78% non-Hispanic/Latino and 4% N/A. The sample size provides a power above 0.8 for all analyses for f^2 effect sizes of 0.027 or greater, considered a small effect size (J. Cohen, 1988).

Procedure

Data were collected as part of a larger study protocol. Participants gave written informed consent (if age = 18–22) or assent (if age = 13–17) before the start of the study. Parents provided informed consent for minors. Questionnaires were completed online, either before arrival to the lab or at the end of the lab visit. Participants were compensated for their time. All study procedures were approved by the University of Denver Institutional Review Board.

Measures

Adolescent Life Events Questionnaire Revised (ALEQ-R)—The ALEQ (Hankin & Abramson, 2002) self-report instrument assesses a broad range of negative life events typically experienced by youth, occurring in the past 6 months. The original ALEQ was revised for the current study as detailed below, and the full revised questionnaire (ALEQ-R) with item-level descriptive statistics is provided in Supplemental Materials Table 1. Items include dependent stressors (e.g. getting bad grades) and independent stressors (e.g. crime in the neighborhood). The ALEQ-R was designed to include a broader coverage of stressors, expanding from 37 to 65 items, and additional items were also intended to correct the balance between the number and endorsement rate of independent and dependent items[3]. Two researchers (BLH and HRS) independently coded each item in the ALEQ-R as independent, dependent, or neither (ambiguous or mixed). Inter-rater agreement was high (kappa = 0.83); for each of the 7 items where the two raters disagreed, one researcher labelled it as neither while the other classified it as dependent or independent. In these cases, the more conservative label of neither was used, resulting in a total of 26 independent, 23 dependent, and 16 neither items.

For all items, participants rated how often the event occurred in the past 6 months. Most items were rated from 0 (*never*) to 4 (*always*). 12 items were unlikely to have occurred more than once in the previous 6 months (e.g., parents getting divorced) and were rated as no (0) or yes (1). Item ratings were summed to calculate frequency of all stressors, dependent stressors, and independent stressors. In addition to rating frequency, participants responded to two additional questions for each endorsed item (i.e., frequency > 0 *never*): (1) “How stressful was it for you?” from 1 (*Not very stressful*) to 5 (*Very stressful*), and (2) “How much control did you feel like you had during that time? (e.g., How much did you feel like you could make things better or less stressful?)” from 1 (*No control/Completely out of my control*) to 5 (*Completely in my control*).

[3]In the previous version of the ALEQ, there were fewer independent stressor items and these items were endorsed infrequently (e.g., death of a family member).

Prior to analysis, controllability ratings were reverse scored such that higher ratings indicated higher uncontrollability. Because participants only rated the severity and uncontrollability of events that had occurred, mean ratings were calculated across endorsed events (i.e., frequency > 0). This ensured that severity and uncontrollability ratings were mathematically independent of frequency, allowing effects of stressor frequency and appraisals to be disentangled[4]. Mean severity and uncontrollability ratings were calculated for all stressors as well as independent and dependent stressors separately.

Children's Depressive Inventory (CDI)—The CDI is the most commonly used self-report measure of depression symptoms for children and adolescents (W. E. Craighead, Smucker, Craighead, & Ilardi, 1998). It consists of 27 items that assess symptoms of depression within the past two weeks. Each item contains three statements, and the participant chooses which most accurately describes how they have been feeling (e.g., "I do not feel alone," (0) "I feel alone many times," (1) and "I feel alone all the time" (2)). A total sum score is calculated. Studies have shown the CDI to be valid and reliable for rating depression symptoms in youth (Saylor, Finch, Spirito, & Bennett, 1984; Timbremont, Braet, & Dreessen, 2004). Internal consistency in the current study was good (α = .895).

Center for Epidemiological Studies Depression Scale for Children (CES-DC)—The CES-DC is a 20-item self-report measure of depression symptoms in youth (e.g., "I felt down and unhappy," "I did not feel like eating, I wasn't very hungry"). Participants rate how often they experienced these symptoms within the past two weeks from "Not at all" (1) to "A lot." (4). A total sum score is calculated. This scale has been previously shown to be both valid and reliable in youth (Faulstich, Carey, Ruggiero, Enyart, & Gresham, 1986; Fendrich, Weissman, & Warner, 1990). Internal consistency in the current study was good (α = .913).

Penn State Worry Questionnaire for Children (PSWQ-C)—The PSWQ-C (Chorpita, Tracey, Brown, & Collica, 1997) is a commonly used self-report measure of worry (e.g., "Many things make me worry," "Once I start worrying I can't stop"), with 14 items rated from "*Never true*" (1) to "*Always true*" (4). A total sum score is calculated. This questionnaire has been shown to have strong reliability and validity for youth (Chorpita et al., 1997). Internal consistency in the current study was good (α = .937).

Multidimensional Anxiety Scale for Children (MASC)—The MASC (March, Parker, Sullivan, Stallings, & Conners, 1997) is a widely used self-report measure of anxiety symptoms in children and adolescents. It includes 39 items that fall under the following subscales: (1) Physical Symptoms of Anxiety, (2) Harm Avoidance, (3) Social Anxiety, and (4) Separation Anxiety/Panic. We omitted the Harm Avoidance subscale due to evidence suggesting that it assesses risk aversion rather than anxiety (Snyder et al., 2015). Participants rate items (e.g., "I get shaky or jittery," "I feel shy") from "Never true" (0) to "Often true" (3). A total sum score is calculated. The questionnaire has good reliability and validity for

[4]We originally planned to analyze severity and controllability as raw sums and frequency weighted measures. However, because these measures were highly dependent on the number of stressors endorsed, we found extremely high correlation between controllability, severity, and frequency, preventing separate analyses for these measures. To address this, we instead took the mean controllability and severity ratings across stressors endorsed for each participant, eliminating the dependency on frequency. To understand the importance of frequency in these analyses we both controlled for frequency and tested interactions between frequency and appraisals.

youth (March et al., 1997; Muris, Merckelbach, Ollendick, King, & Bogie, 2002). Internal consistency in the current study was good (α = .922).

Analyses

The two depression measures (CDI and CESD-C, r = .79) and two anxiety measures (PSWQ-C and MASC, r = .67) were highly correlated and thus combined to form z-score composite measures of depression and anxiety for more robust measurement, as composite scores provide more robust and reliable measurements (Rushton, Brainerd, & Pressley, 1983). In cases of missing data from one questionnaire, the z-score from the available questionnaire was used as their composite score (three participants were missing CES-DC and eleven were missing PSWQ-C). We performed stepwise multiple linear regressions to test the hypotheses that ratings of controllability and severity were associated with depression and anxiety symptoms while controlling for frequency of stressors. In each regression, stressor frequency, age and gender were entered at the first step, followed by either mean severity or uncontrollability ratings (in separate regressions) in the second step, and finally both severity and uncontrollability ratings in the third step. Separate regressions were run for depression and anxiety using each of the following stressor criteria: all stressors combined, independent stressors, dependent stressors, and both stressor types simultaneously. We included age and gender as covariates in all regressions due to established age and gender differences in the trajectories of stress, depression, and anxiety, and additionally tested whether age and gender moderated the relationships between stressor frequency, appraisals, and depression and anxiety symptoms. Due to research suggesting severe events may be particularly predictive of depression (e.g., Brown & Harris, 1978), we additionally performed the same analyses using the number of high-severity stressors (i.e., rated by the participant as a 4 or 5) experienced rather than mean severity. Lastly, to determine whether stress frequency affected the relationship between appraisals and symptoms, we tested for interactions between frequency and appraisals in relation to depression and anxiety symptoms.

Results

Descriptive statistics, bivariate correlations and demographic comparisons

Table 1 shows descriptive statistics and bivariate correlations. As expected, stress frequency, perceived severity and perceived uncontrollability were significantly correlated with depression and anxiety symptoms (ps<.001). This was true for dependent stressors specifically (ps<.001), as well as independent stressor frequency (ps<0.001) and severity (ps<0.05), but not independent stressor uncontrollability (ps>0.05). In addition, paired samples t-tests showed that mean severity ratings for independent (M = 2.90, SD = 1.76) and dependent (M = 2.85, SD = .92) stressors did not differ (t(290) = .513, p = .608), but independent stressors (M = 3.63, SD = 1.19) were rated as significantly more uncontrollable than dependent stressors (M = 2.65, SD = 0.70; t(290) = 13.63, p<.001). A series of t-tests investigating gender differences in stress and internalizing variables found that in general, female participants reported more stress and higher depression and anxiety symptoms (ps<.05, see Supplemental Materials Table 2). One-way ANOVAS were also performed to

determine whether stress and internalizing variables differed by race and ethnicity; no significant differences were found (*ps*>.05, Supplemental Materials Tables 3 & 4).

Depression Regressions (Table 2)

All ALEQ-R stressors combined—When tested in separate regressions, both uncontrollability (β=.190, p<.001) and severity (β=.184, p<.001) appraisals of stressors were significantly associated with depression symptoms while controlling for stressor frequency. When the appraisals were tested together, only severity (β=.152, p=.005) and frequency (β=.528, p<.001) remained significant.

Dependent and independent stressors—When tested in separate regressions, uncontrollability (β=.172, p<.001) and severity (β=.187, p<.001) appraisals of dependent stressors were each associated with depression symptoms while controlling for stressor frequency. When the appraisals were tested together, uncontrollability (β=.141, p=.010), severity (β=.127, p=.014) and frequency (β=.471, p<.001) of dependent stressors all remained significant. Independent stressor frequency was significantly associated with depression symptoms (β=.447, p<.001), but neither uncontrollability nor severity appraisals of independent stressors were significant. When dependent and independent stressors were analyzed together, dependent stressor uncontrollability (β =.146, p=009) and severity (β =.130, p=029) appraisals remained significant, along with both dependent (β =.353, p<.001) and independent (β =.154, p=.017) stressor frequency (Table 2).

Anxiety Regressions (Table 3)

All ALEQ-R stressors combined—Uncontrollability (β=.099, p=.036) and severity (β=.266, p<.001) appraisals were both separately associated with anxiety symptoms accounting for stressor frequency. When included together in the same regression, only stressor severity (β=.271, p<.001) and frequency (β=.456, p<.001) remained significant.

Dependent and independent stressors—For dependent stressors, uncontrollability (β=.145, p=.003) and severity (β=.310, p<.001) appraisals were significantly associated with anxiety symptoms when tested in separate regressions, but when tested together only severity (β=.291, p<.001) and frequency (β=.374, p<.001) were significant. Appraisals of independent stressors tested in separate regressions were not significantly associated with anxiety symptoms, but frequency was significant in all regressions. These patterns hold when dependent and independent stressors were included together in regressions (Table 3).

Secondary Analyses

High-Severity Analyses (Supplementary Materials Tables 5 & 6)—Results were largely the same as the mean severity regressions for depression and anxiety.

Frequency-Appraisal Interactions (Supplementary Materials Tables 7 & 8)—In the depression analyses, there were significant interactions between frequency and appraisals for all stressors together (Frequency x Severity: β=.148, p=.003; Frequency x Uncontrollability: β=.110, p=.029) and dependent stressors (Frequency x Severity: β=.133, p=.006; Frequency x Uncontrollability: β=.142, p=.005), such that at higher stress

frequencies, appraisals were more strongly associated with depression symptoms. There were no significant frequency-appraisal interactions for independent stressors (*ps*>.05) In the anxiety analyses, the interaction between independent stressor frequency and independent mean severity was significant (*β*=.217, *p*=.01) such that severity was more strongly related to anxiety symptoms at higher stress frequencies. No other appraisal-frequency interactions were significant in relation to anxiety (*ps*>.05).

Age and Gender Moderation (Supplemental Materials Tables 9–12)—There was no age moderation. Gender moderated the relationship between total stressor frequency and both depression and anxiety symptoms such that effects were larger for female participants. For depression, this moderation was significant for dependent stressors only, while for anxiety, gender moderated this relationship for independent stressors only.

Discussion

Stressful life events are strongly linked to anxiety and depression. Although clinical psychology research focused in recent decades on measures of stressor frequency and expert-rated severity, evidence shows that perceived life stress is associated with depression and anxiety symptoms (Sandin et al., 2004) and negative mood and distress, potentially more so than expert ratings (Almeida et al., 2002). Furthermore, in-lab research suggests that uncontrollability plays a critical role in determining the effects of stressors, causing altered emotionality and sensitization of the stress system which can lead to depression (Maier & Seligman, 1976) and anxiety (Chorpita & Barlow, 1998; Maier & Watkins, 1998).

We thus hypothesized that severity and uncontrollability appraisals of recent stressful life events would be associated with depression and anxiety symptoms in youth, a period marked by heightened stress (Grant et al., 2014) and internalizing disorder risk (Hankin et al., 2016; Merikangas et al., 2010). This study evaluated these hypotheses using the ALEQ-R, a newly revised stress questionnaire, to assess perceived uncontrollability and severity of recently experienced negative life events. Our results confirmed these hypotheses, along with exploratory hypothesis that appraisals of dependent, and not independent, stressors would be associated with depression and anxiety symptoms. The association between depression symptoms and uncontrollability appraisals in the current study is consistent with hopelessness theory (Abramson et al., 1989), and our results suggest that this model may also extend to anxiety.

We further found that stress frequency significantly interacted with appraisals such that appraisals were especially associated with symptoms at higher stress frequencies. This is not unexpected, as maladaptive appraisals during a period of low-stress would not be expected to lead to strong internalizing symptoms. The relationships between appraisals and symptoms were not moderated by age or gender, suggesting that these relations are fairly stable across adolescence and emerging adulthood, and are similar for both genders. However, there was some gender moderation of the effect of stressor frequency on depression and anxiety symptoms, such that stressful life events more strongly predicted symptoms in female participants, consistent with prior research (e.g., Hankin et al., 2015; Shih, Eberhart, Hammen, & Brennan, 2006). Future research is needed to determine if

appraisal effects are consistent across the lifespan, or if stressor appraisals are particularly important in adolescence and emerging adulthood. The latter seems possible given that this period is characterized by heightened stress experience (e.g., Grant et al., 2014) and appraisals appear to have greater effect at higher stress frequencies.

Overall, dependent stressors were more strongly associated with depression and anxiety than independent stressors, consistent with previous research (e.g., Liu & Alloy, 2010). Importantly, the current study shows that only appraisals of dependent, and not independent, stressors predicted internalizing symptoms. This result is particularly interesting as independent stressors were rated by participants as significantly more uncontrollable on average than dependent stressors. Thus, whereas independent stressors are most likely more objectively uncontrollable than dependent stressors, dependent stressors that are perceived as relatively more uncontrollable are particularly associated with internalizing symptoms.

It is possible that situations where individuals understand their role in bringing about dependent stressors but feel a lack of control to make things better are particularly likely to lead to internalizing psychopathology, consistent with extensive evidence that attributing negative events to internal causes is associated with increased internalizing symptoms (Huang, 2015). In particular, this combination of feeling responsible yet helpless to change outcomes could lead to specific symptoms of depression such as guilt, low self-esteem, and worthlessness which could contribute to increased helplessness or hopelessness by decreasing future motivation to try to prevent stressors, in turn leading to stress generation. To directly test this possibility, future research is needed that measures individuals' *perceived* dependency of each event (i.e. perceived contribution to the cause of each event) to determine whether there is an interaction between perceived self-cause and uncontrollability appraisals in producing symptoms, rather than relying on expert-ratings of dependency.

Similar to controllability, severity appraisals of dependent, but not independent, stressors were significantly associated with depression and anxiety symptoms while controlling for stress frequency. We speculate that the knowledge that one contributed to a stressful event could especially lead to symptoms such as guilt and anxiety when the event is perceived as more severe. Importantly, uncontrollability and severity appraisals may not be fully independent of one another. The correlation between the two ratings for dependent stressors was $r = .42$ ($p < .001$). It is likely that when stressors feel uncontrollable they feel more severe, and that severe events seem more difficult to overcome and are thus perceived as more uncontrollable.

While thus far we have discussed the possibility that stressor appraisals lead to symptoms, another possible interpretation of our results is that internalizing symptoms affect how people appraise stressors. Feelings of hopelessness associated with depression may lead to a perceived lack of control and an amplified stress response when presented with a stressor, causing it to feel more severe. Given the relative stability of depression and anxiety symptoms over time, it is quite possible that symptoms we measured were present when the stressors were experienced. Finally, given that internalizing psychopathology can lead to negative memory biases (Dillon & Pizzagalli, 2018), it is possible that participants with

higher depression and anxiety symptoms recall past stressors as more severe and uncontrollable.

Considering these interpretations of our results, that appraisals impact symptoms or that symptoms impact appraisals, the most likely explanation is that the effects are bidirectional; uncontrollability and severity appraisals increase depression and anxiety symptoms, and these symptoms in turn affect future appraisals, creating a positive feedback loop that could precipitate worsening symptoms over time. One limitation of this study is its cross-sectional nature, making the direction of effects impossible to determine. A future multi time-point longitudinal study is needed to investigate these transactions over time. In addition, while this study gathered frequency information for each endorsed stressor, it lacks information relating to the timing of the stressors within the past six months. It is possible that more recently experienced stressors have a stronger effect on current symptoms, and this should be explored in the future. A daily diary paradigm could be especially useful as it would allow for a fine-grained temporal analysis of how stressor appraisals affect and are affected by internalizing symptoms. Future research assessing lifetime history of psychopathology would also be valuable to determine if past anxiety or depressive disorders affect stress appraisals (e.g., stress sensitization).

Future research would also benefit from collecting additional measures that may further clarify these relations. First, there are many ways that an individual could feel/exert control over a situation which our current controllability measure does not gather. An important future direction is to determine exactly how individuals act to control stress, and whether certain strategies are more or less effective in increasing perceived controllability and mitigating negative outcomes. In addition, including specific measures of hopelessness and helplessness in future studies could elucidate whether they meditate relationships between appraisals and symptoms. Lastly, this study relied on self-report instruments, and while the questionnaires we employed have been shown to have good reliability and validity, reporting biases are always a concern. Additional measures of factors that can affect self-report, such as negativity bias and state mood, can help to address this possibility.

By demonstrating the importance of severity and uncontrollability appraisals as potential risk factors for internalizing disorders, especially during high-stress periods, our results highlight new potential avenues for treatment. Approaches such as cognitive behavioral therapy (CBT) already target cognitions and appraisals, including attempting to reduce severity appraisals (i.e., catastrophizing). Employing similar techniques to change appraisals of stressor controllability could supplement current depression and anxiety treatments. One possible method for this is to increase individuals' experiences with controllable stressors, as helplessness research has found that the experience of controllable stress has a protective effect against the learned helplessness consequences of future uncontrollable stressors, both behaviorally and neurally (Amat et al., 2005; Amat, Paul, Watkins, & Maier, 2008; Maier & Seligman, 1976). Other methods of altering maladaptive controllability appraisals could also be explored, such as thought restructuring and reappraisal techniques currently employed in CBT.

In sum, the current study shows that severity and uncontrollability appraisals are associated with depression and anxiety symptoms. Perceptions of stress controllability in particular have been greatly under-studied in recent decades, and going forward, it will be critical to explore the directionality and mechanisms of these relations, the symptom-level links between appraisals and internalizing, and how stress appraisals can best be incorporated into clinical interventions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Correlations and descriptive statistics of main measures.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Age	**M**=16.45 **SD**=2.42															
2. CDI	−.032	8.06 7.45														
3. CES-DC	−.019	.788**	32.98 10.36													
4. MASC	−.109*	.682**	.613**	27.82 14.93												
5. PSWQ-C	.116*	.551**	.549**	.607**	30.73 9.47											
6. Depression composite z-score	−.030	.946**	.946**	.686**	.584**	-										
7. Anxiety composite z-score	−.006	.688**	.651**	.900**	.897**	.710**	-									
8. All-stressor frequency	−.032	.625**	.528**	.569**	.459**	.609**	.572**	28.70 20.35								
9. Dependent stressor frequency	−.079	.583**	.512**	.539**	.421**	.579**	.534**	.933**	13.31 10.29							
10. Independent stressor frequency	.030	.519**	.409**	.468**	.402**	.489**	.484**	.862**	.692**	7.36 6.24						
11. All-stressor mean severity	.168*	.310**	.356**	.349**	.446**	.357**	.445**	.323**	.320**	.283**	2.80 .93					
12. All-stressor mean uncontrollability	−.005	.307**	.275**	.263**	.236**	.314**	.280**	.303**	.276**	.305**	.481**	2.99 .69				
13. Dependent mean severity	.203**	.340**	.363**	.386**	.475**	.376**	.482**	.362**	.370**	.298**	.868**	.382**	2.79 .94			
14. Independent mean severity	.038	.083	.148*	.083	.165**	.127*	.143*	.055	.081	.050	.779**	.364**	.446**	2.89 1.77		
15. Dependent mean uncontrollability	−.029	.351**	.307**	.297**	.267**	.351**	.315**	.318**	.335**	.216**	.353**	.712**	.418**	.146*	2.63 .72	
I16. Independent mean uncontrollability	.015	.067	.076	.039	.067	.082	.063	.071	.077	.084	.387**	.704**	.226**	.502**	.231**	3.63 1.18

* = p<0.05,

** = p<0.001.

Mean and standard deviation provided in the shaded diagonal. Z-score mean and standard deviation does not apply.

Table 2.

Regression analyses of stressor frequency and appraisals predicting depression symptoms

Stressors Included	Model		b	SE	β	t	p	R^2	Adjusted R^2
All Stressors	1	Age	−.006	.018	−.016	−.348	.728	.369	.363
		Gender	−.050	.043	−.053	−1.155	.249		
		Stressor Frequency **	.028	.002	.597	13.059	<.001		
	2	Age	−.019	.018	−.047	−1.053	.293	.397	.390
		Gender	−.021	.043	−.022	−.490	.624		
		Stressor Frequency **	.025	.002	.540	11.467	<.001		
		Severity **	.188	.049	.184	3.806	<.001		
	3	Age	−.006	.018	−.017	−.370	.712	.387	.379
		Gender	−.039	.043	−.042	−.924	.356		
		Stressor Frequency **	.026	.002	.556	11.782	<.001		
		Uncontrollability *	.190	.064	.140	2.980	.003		
	4	Age	−.016	.018	−.042	−.928	.354	.402	.392
		Gender	−.021	.043	−.022	−.483	.629		
		Stressor Frequency **	.024	.002	.528	11.066	<.001		
		Severity *	.152	.054	.149	2.799	.005		
		Uncontrollability	.107	.070	.079	1.536	.126		
Dependent stressors only	1	Age	.003	.018	.008	.165	.869	.337	.330
		Gender	−.075	.044	−.079	−1.689	.092		
		Dependent stressor frequency **	.052	.004	.567	12.073	<.001		
	2	Age	−.014	.019	−.035	−.743	.458	.364	.356
		Gender	−.048	.044	−.051	−1.101	.272		
		Dependent stressor frequency **	.046	.005	.496	9.926	<.001		
		Dependent stressor severity **	.189	.052	.187	3.637	<.001		
	3	Age	.003	.018	.007	.160	.873	.363	.355
		Gender	−.070	.043	−.074	−1.611	.108		
		Dependent stressor frequency **	.047	.004	.509	10.407	<.001		

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Stressors Included		Model	b	SE	β	t	p	R^2	Adjusted R^2
		Dependent stressor uncontrollability **	.226	.064	.172	3.552	<.001		
	4	Age	−.010	.018	−.025	−.528	.598	.377	.366
		Gender	−.051	.044	−.054	−1.179	.239		
		Dependent stressor frequency **	.043	.005	.471	9.304	<.001		
		Dependent stressor severity *	.142	.055	.141	2.597	.010		
		Dependent stressor uncontrollability *	.166	.067	.127	2.481	.014		
Independent stressors only	1	Age	−.025	.021	−.063	−1.191	.235	.213	.204
		Gender	−.064	.051	−.067	−1.263	.208		
		Independent stressor frequency **	.069	.008	.447	8.452	<.001		
	2	Age	−.026	.021	−.066	−1.262	.208	.223	.212
		Gender	−.055	.050	−.058	−1.093	.275		
		Independent stressor frequency **	.069	.008	.443	8.409	<.001		
		Independent stressor severity	.054	.028	.101	1.917	.056		
	3	Age	−.025	.021	−.063	−1.204	.230	.215	.204
		Gender	−.062	.051	−.065	−1.232	.219		
		Independent stressor frequency **	.069	.008	.443	8.349	<.001		
		Independent stressor uncontrollability	.035	.042	.044	.835	.404		
	4	Age	−.026	.021	−.066	−1.260	.209	.223	.209
		Gender	−.055	.051	−.058	−1.090	.277		
		Independent stressor frequency **	.069	.008	.443	8.382	<.001		
		Independent stressor severity	.056	.033	.105	1.727	.085		
		Independent stressor uncontrollability	−.007	.049	−.009	−.140	.888		
Independent and dependent stressors	1	Age	−.005	.020	−.012	−.238	.812	.325	.316
		Gender	−.067	.047	−.070	−1.435	.152		
		Dependent stressor frequency **	.042	.006	.454	6.923	<.001		
		Independent stressor frequency *	.022	.010	.144	2.191	.029		
	2	Age	−.022	.020	−.056	−1.113	.267	.354	.340
		Gender	−.040	.047	−.042	−.854	.394		

Stressors Included		Model	b	SE	β	t	p	R^2	Adjusted R^2
		Dependent stressor frequency **	.036	.006	.387	5.747	<.001		
		Independent stressor frequency *	.023	.010	.146	2.263	.024		
		Dependent stressor severity *	.195	.062	.187	3.139	.002		
		Independent stressor severity	.000	.029	.000	.000	>.999		
	3	Age	−.004	.019	−.010	−.214	.830	.355	.342
		Gender	−.064	.046	−.067	−1.386	.167		
		Dependent stressor frequency **	.036	.006	.386	5.757	<.001		
		Independent stressor frequency *	.024	.010	.152	2.353	.019		
		Dependent stressor uncontrollability **	.250	.070	.186	3.556	<.001		
		Independent stressor uncontrollability	−.005	.039	−.007	−.136	.892		
	4	Age	−.017	.020	−.042	−.836	.404	.369	.351
		Gender	−.044	.046	−.046	−.958	.339		
		Dependent stressor frequency **	.033	.006	.353	5.192	<.001		
		Independent stressor frequency *	.024	.010	.154	2.400	.017		
		Dependent stressor severity *	.136	.065	.130	2.078	.039		
		Independent stressor severity	.013	.033	.024	.398	.691		
		Dependent stressor uncontrollability *	.196	.074	.146	2.643	.009		
		Independent stressor uncontrollability	−.029	.045	−.036	−.648	.518		

* = p<0.05,

** = p<0.001.

Gender coded −1 = female, 1 = male

Table 3.

Regression analyses of stressor frequency and appraisals predicting anxiety symptoms.

Stressors Included	Model		b	SE	β	t	p	R^2	Adjusted R^2
All stressors	1	Age	.004	.017	.012	.256	.798	.378	.372
		Gender**	−.211	.041	−.235	−5.187	<.001		
		Stressor frequency**	.024	.002	.536	11.805	<.001		
	2	Age	−.013	.016	−.034	−.787	.432	.437	.430
		Gender**	−.172	.039	−.191	−4.356	<.001		
		Stressor frequency**	.020	.002	.454	9.972	<.001		
		Severity**	.258	.045	.266	5.690	<.001		
	3	Age	.004	.017	.011	.246	.806	.387	.379
		Gender**	−.204	.041	−.228	−5.029	<.001		
		Stressor frequency**	.022	.002	.507	10.743	<.001		
		Uncontrollability*	.127	.061	.099	2.101	.036		
	4	Age	−.013	.016	−.035	−.803	.422	.437	.428
		Gender**	−.172	.039	−.191	−4.351	<.001		
		Stressor frequency**	.020	.002	.456	9.856	<.001		
		Severity**	.263	.050	.271	5.249	<.001		
		Uncontrollability	−.016	.064	−.012	−.251	.802		
Dependent stressors only	1	Age	.010	.017	.028	.609	.543	.346	.340
		Gender**	−.234	.041	−.263	−5.650	<.001		
		Dependent stressor frequency**	.043	.004	.501	10.739	<.001		
	2	Age	−.016	.017	−.043	−.946	.345	.421	.414
		Gender**	−.193	.040	−.217	−4.880	<.001		
		Dependent stressor frequency**	.033	.004	.384	8.044	<.001		
		Dependent stressor severity**	.295	.047	.310	6.310	<.001		
	3	Age	.010	.017	.028	.611	.542	.365	.356

Stressors Included		Model	b	SE	β	t	p	R^2	Adjusted R^2
		Gender**	−.230	.041	−.258	−5.629	<.001		
		Dependent stressor frequency**	.039	.004	.452	9.255	<.001		
		Dependent stressor uncontrollability*	.179	.060	.145	2.987	.003		
	4	Age	−.014	.017	−.039	−.851	.395	.423	.414
		Gender**	−.194	.040	−.218	−4.907	<.001		
		Dependent stressor frequency**	.032	.004	.374	7.671	<.001		
		Dependent stressor severity**	.277	.050	.291	5.577	<.001		
		Dependent stressor uncontrollability	.063	.061	.051	1.034	.302		
Independent stressors only	1	Age	−.003	.019	−.009	−.171	.865	.249	.242
		Gender**	−.228	.046	−.254	−4.929	<.001		
		Independent stressor frequency**	.058	.008	.402	7.787	<.001		
	2	Age	−.005	.019	−.012	−.238	.812	.259	.249
		Gender**	−.220	.046	−.245	−4.762	<.001		
		Independent stressor frequency**	.058	.007	.398	7.741	<.001		
		Independent stressor severity	.050	.026	.099	1.924	.055		
	3	Age	−.003	.019	−.009	−.175	.861	.250	.239
		Gender**	−.227	.046	−.254	−4.908	<.001		
		Independent stressor frequency**	.058	.008	.401	7.724	<.001		
		Independent stressor uncontrollability	.011	.039	.015	.287	.774		
	4	Age	−.005	.019	−.012	−.239	.811	.261	.248
		Gender**	−.220	.046	−.245	−4.750	<.001		
		Independent stressor frequency**	.058	.008	.401	7.772	<.001		
		Independent stressor severity*	.061	.030	.122	2.055	.041		
		Independent stressor uncontrollability	−.035	.044	−.046	−.780	.436		
Independent and dependent stressors	1	Age	.011	.018	.029	.587	.558	.329	.319
		Gender**	−.234	.044	−.263	−5.372	<.001		
		Dependent stressor frequency**	.032	.006	.376	5.748	<.001		

Stressors Included		Model	b	SE	β	t	p	R^2	Adjusted R^2
		Independent stressor frequency*	.021	.009	.148	2.267	.024		
	2	Age	−.017	.018	−.046	−.945	.345	.403	.390
		Gender**	−.195	.042	−.218	−4.646	<.001		
		Dependent stressor frequency**	.023	.006	.265	4.088	<.001		
		Independent stressor frequency*	.022	.009	.151	2.431	.016		
		Dependent stressor severity**	.316	.056	.326	5.689	<.001		
		Independent stressor severity	−.029	.026	−.058	−1.112	.267		
	3	Age	.011	.018	.031	.631	.529	.352	.338
		Gender**	−.232	.043	−.261	−5.396	<.001		
		Dependent stressor frequency**	.027	.006	.316	4.706	<.001		
		Independent stressor frequency*	.023	.009	.157	2.426	.016		
		Dependent stressor uncontrollability*	.208	.066	.166	3.165	.002		
		Independent stressor uncontrollability	−.024	.037	−.032	−.642	.522		
	4	Age	−.014	.018	−.038	−.791	.430	.408	.391
		Gender**	−.197	.042	−.221	−4.692	<.001		
		Dependent stressor frequency**	.021	.006	.247	3.749	<.001		
		Independent stressor frequency*	.023	.009	.157	2.537	.012		
		Dependent stressor severity**	.288	.059	.296	4.870	<.001		
		Independent stressor severity	−.012	.029	−.025	−.417	.677		
		Dependent stressor uncontrollability	.096	.067	.076	1.422	.156		
		Independent stressor uncontrollability	−.045	.041	−.060	−1.099	.273		

* = p<0.05,

** = p<0.001.

Gender coded −1 = female, 1 = male