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## Avoidance mediates the relationship between anxiety and depression over a decade later

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### Abstract

Anxiety and depression are often highly correlated with each other. To explain this connection, the present study examined the longitudinal relationship between earlier anxiety and later depression, using avoidance as a mediator and trauma as a moderator. Participants ( $N = 6504$  adolescents) completed baseline measures of anxiety and depression, a measure of avoidance one year later, a measure of trauma six to eight years later, and a measure of depression 12–14 years later. Analyzed with structural equation models, the results showed that anxiety predicted later depression, and this relationship was partially mediated by avoidance. The relationship between avoidance and depression was not moderated by trauma. Together, these findings suggest that anxiety may influence later depression through avoidance, and this relationship remains unaffected by experiencing a traumatic experience.

### Keywords

Anxious; Depressive; Negative affect; Longitudinal; Mediation

## 1. Introduction

Anxiety and depressive disorders are frequently comorbid with one another, yielding lifetime prevalence estimates from 16 to 50% (Angold, Costello, & Erkanli, 1999; Seligman & Ollendick, 1998). Seventy-three percent of persons with major depression have comorbid lifetime anxiety disorders, whereas 27–77% of those with a principal diagnosis of an anxiety disorder develop a lifetime diagnosis of depression (Brown, Campbell, Lehman, Grisham, & Mancill, 2001). In comparison to those with pure diagnoses, individuals with comorbid anxiety and depressive disorders experience greater chronicity and severity of each diagnosis; poorer work and psychosocial functioning; lower perceived quality of life; and a heightened risk of suicide (Brown, Schulberg, Madonia, Shear, & Houck, 1996; Kessler et al., 1998; Olfson et al., 1997; Pfeiffer, Ganoczy, Ilgen, Zivin, & Valenstein, 2009; Sherbourne, Wells, Meredith, Jackson, & Camp, 1996). Hence, a greater understanding of the mechanisms behind this comorbidity is imperative.

Concurrent anxiety and depression are highly correlated with one another ( $r$  ranges .45–.73) when measured on a continuum (Bjelland, Dahl, Haug, & Neckelmann, 2002; Cannon &

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Weems, 2006; Morgan, Wiederman, & Magnus, 1998; Norton, Cosco, Doyle, Done, & Sacker, 2013; Watson, Weber, et al., 1995). Based on this high correlation, anxiety and depression are often conceptualized as slightly variant manifestations of the same underlying phenomena with a shared diathesis (Barlow & Campbell, 2000; Clark & Watson, 1991; Grunhaus, 1988; Kendler, 1996; Kendler, Neale, Kessler, Heath, & Eaves, 1992). The research on the concurrent focus of anxiety and depression has yielded several highly related models including Clark and Watson's (1991) tripartite model, Barlow's (1988) hierarchical model of anxiety and depression, Mineka, Watson, and Clark's (1998) integrative hierarchical model of anxiety and depression, and Watson's (2005) revised hierarchical model of anxiety and depressive disorders. Fundamentally, each of these prominent models suggests that both anxiety and depression are best represented by the same underlying construct, termed negative affect.

Despite the high concurrent relationships between anxiety and depression, these hierarchical models also allow for anxiety and depression to be distinguished from one another. Specifically, across each of the predominant models, arousal is characteristic of anxiety but not depression, and anhedonia (lack of positive affect) is consistent with depression but not anxiety (Barlow, 1988; Clark & Watson, 1991; Mineka et al., 1998; Watson, 2005). The ability to distinguish between anxiety and depression has also gained empirical support as arousal and fear are associated with anxiety, but not depression; and anhedonia is associated with depression but not anxiety (Barlow, Chorpita, & Turovsky, 1996; Bjelland et al., 2002; Brown et al., 2001; Cannon & Weems, 2006; Chorpita, Albano, & Barlow, 1998; Clark & Watson, 1991; Morgan et al., 1998; Tellegen, 1985; Watson, Weber, et al., 1995). Thus, despite these predominant models' higher order structure, anxiety and depression can be reliably distinguished from each other.

The evidence used to support the models of shared symptomatology derives overwhelmingly from concurrent correlations between anxiety and depression using factor analyses (Brown, Chorpita, & Barlow, 1998; Chorpita et al., 1998; Clark, Beck, & Stewart, 1990; Joiner, 1996; Jolly, Dyck, Kramer, & Wherry, 1994; Jolly & Kramer, 1994; Watson, Clark, et al., 1995). However, all research in support of negative affect to date is fundamentally unable to rule out alternative explanations for these findings. Specifically, these methodologies are not able to address the potential relationships between anxiety and depression predicting one another over time (e.g. one way to rule out this alternative explanation is through a longitudinal factor model, which has never before been conducted in this domain).

The limitations of the shared symptomatology models are further highlighted by the literature on the temporal precedence of anxiety and depression. Research on temporal precedence reliably shows that current anxiety significantly predicts later depression (see Jacobson & Newman, 2012a for a meta-analysis). Using continuous measures of anxiety and depression, researchers found that anxiety positively predicted depression with correlations ranging from  $r = .16$  to  $.45$  (without controlling for earlier depression). Further, the hazards ratio range for those with an anxiety disorder to develop a later depressive disorder is 1.49–7.1 (Jacobson & Newman, 2012a). Additionally, anxiety predicts depression across years (Wilson & Hayward, 2005), months (Lockefer & De Vries, 2012), weeks (Wittchen, Becker, Lieb, & Krause, 2002), days (Jacobson & Newman, 2012b; Starr & Davila, 2012a,

2012b; Swendsen, 1997), and hours (Jacobson & Newman, 2012b; Swendsen, 1998). Although third variables still need to be ruled out, this research suggests that anxiety may be a risk factor for depression, and this longitudinal relationship may explain shared symptomatology models (as levels of anxiety predicting depression may appear to occur at the same time point if only measured once across a retrospective period of time).

Despite the vast literature demonstrating that anxiety predicts later depression, only three studies have examined this within a prospective mediational analysis, and hence examined possible mechanisms of how high anxiety leads to increased depression. Firstly, Joiner, Katz, and Lew (1999) examined negative life events and reassurance-seeking as mediators between anxiety and depression; however, these authors did not find that either variable significantly mediated the relationship. Likewise, Ceyhan (2009) studied whether locus of control and problem-solving skills mediated the relationship between earlier anxiety and later depression, but neither variable mediated the relationship. Moitra, Herbert, and Forman (2008) examined behavioral avoidance as a mediator between social anxiety and depressive symptoms over the course of treatment and found that behavioral avoidance partially mediated the relationship. However, the effects of this study may have been due to the order of treatment techniques in the therapies (e.g. anxiety was targeted first, followed by avoidance, followed by depression). Although some mediational variables have been tested, the mechanism through which anxiety might affect later depression is currently unknown in naturalistic settings.

Avoidance is a promising mechanism for explaining the naturalistic longitudinal relationship between anxiety and depression (Moitra et al., 2008). Anxiety is considered an uncomfortable state of physiological activation elicited by a perceived external threat (Nesse & Williams, 1996), and persons who experience anxiety limit their exposure (avoid) to these perceived threats to reduce their levels of discomfort. However, avoiding feared circumstances may also reduce one's exposure to both positive and corrective experiences. For example, if one avoids a social event due to social anxiety, one may not experience social support. Similarly, if someone has agoraphobia and is afraid of leaving his/her house, he or she may not experience the positive physical and psychological health outcomes of nature (Hartig et al., 2011). A lack of such positive life experiences has been shown to coincide with increased depression (Harris & Curtin, 2002; Spinhoven et al., 2011). Thus, depression may develop from increased pessimism and hopelessness about the future due to a skewed sense of reality based on one's exposure to fewer positive events. Although no studies have examined anxiety, depression, and avoidance together longitudinally in a naturalistic setting, research has shown that previous levels of anxiety predict future levels of avoidance (Rinck et al., 2010), and past avoidance predicts later depression (Brewin, Reynolds, & Tata, 1999; Cloninger, Svrakic, & Przybeck, 2006; Plant & Devine, 2003; Wittchen, Kessler, Pfister, Höfler, & Lieb, 2000). Thus, in the current study, avoidance was examined as a possible mediator of anxiety and later depression.

Further, trauma may moderate the relationship between avoidance and depression. Those who regularly cope without avoidance may naturally employ real-life exposure hierarchies (Richard & Lauterbach, 2011). Consequently, the ability to cope with daily stressful events may help one to cope with trauma and enhance one's self-efficacy in dealing with traumas.

However, those who employ avoidance behaviors to cope with life events may not learn to deal with distress (Tryon, 2005). For these persons, experiencing a traumatic event may be similar to the initial distress associated with the beginning of flooding therapy (exposure to individuals' most feared event) without the prolonged exposure to teach them that they can cope with their distress (Sundel & Sundel, 2004). Based on the theory that individuals employing avoidance may be more likely to react to trauma with hopelessness and with the belief that they will never have control over their lives otherwise, we hypothesized that trauma may moderate the relationship between avoidance and depression (Alloy, Kelly, Mineka, & Clements, 1990). Accordingly, we will investigate trauma as a moderator between avoidance and depression.

The current study investigated the relationship between anxiety and depression over time to examine whether avoidance mediated the relationship between anxiety and depression, and whether trauma moderated the relationship between avoidance and depression. This study used a nationally representative longitudinal sample beginning in adolescence and carrying through to early adulthood. We hypothesized that (1) anxiety would predict later depression 12–14 years later; (2) anxiety and depression would be mediated by avoidance, such that anxiety would predict positively avoidance one to two years later and avoidance would predict depression 10–13 years later; and (3) the relationship between avoidance and depression would be moderated by trauma, such that experiencing a trauma five to six years after the avoidance would significantly increase the positive relationship between avoidance and depression.

## 2. Method

### 2.1. Participants

The participants for this study were collected through the National Longitudinal Study of Adolescent Health (Add Health) public use dataset (Harris & Udry, 2013). There were four waves of data collection: the first occurred during 1994–1995; the second occurred during 1995–1996; the third wave occurred during 2001–2002; and the fourth wave occurred during 2007–2008. The data was collected through interviews with participants. The first wave of participants ( $N = 6504$ , 48% male,  $M$  age = 16.04, 66% Caucasian, 25% African American, 1% American Indian, 4% Asian/Pacific Islander, 5% Other) continued with little dropout over the second ( $N = 4834$ , 48% male,  $M$  age = 16.53, 67% Caucasian, 23% African American, 1% American Indian, 4% Asian/Pacific Islander, 5% Other), third ( $N = 4882$ , 46% male,  $M$  age = 22.32, 66% Caucasian, 24% African American, 1% American Indian, 4% Asian/Pacific Islander, 5% Other), and fourth waves ( $N = 5114$ , 46% male,  $M$  age = 28.89, 68% Caucasian, 24% African American, 1% American Indian, 3% Asian/Pacific Islander, 4% Other).

### 2.2. Measures

**Center for Epidemiologic Studies Depression Scale (CES-D)**—The CES-D is a brief self-report questionnaire designed to measure depressive symptoms in the general population (Radloff, 1977). A portion of the CES-D was given to subjects in the Add Health study at waves one and four (see Walsemann, Bell, & Goosby, 2011 for all items included).

To test if the CES-D scale would accurately be reflected as one construct, a confirmatory factor analysis was performed on the 10 CES-D items at wave one. The one factor model resulted in adequate fit ( $\chi^2 = 1125.61$ ,  $p < .01$ , RHO = 0.971, CFI = 0.976, RMSEA = 0.071). Methods used in the confirmatory factor analysis are detailed below. The full scale has been shown to have adequate concurrent validity ( $r = .73-.89$  compared to the Symptom Checklist depression scale) (Weissman, Sholomskas, Pottenger, Prusoff, & Locke, 1977). The retest reliability for the full scale is adequate ( $r = .57$  averaged from 2 to 8 weeks) (Radloff, 1977). There was also good internal consistency ( $\alpha = .979$ ) for these ten items in the current sample. See Table 1 for items. Additionally, a confirmatory factor analysis was performed which included items from the anxiety scale (listed below). This second confirmatory factor analysis yielded identical good model fit with distinct CES-D and anxiety factors ( $\chi^2 = 1650.44$ ,  $p < .01$ , RHO = 0.977, CFI = 0.980, RMSEA = 0.050). This suggests that the reduced CES-D scale is distinct from anxiety.

**Anxiety Scale**—Six items that were given in the Add Health constituted a physiological symptom-based measure of anxiety. Although these items have not been used prior to the Add Health administration, the content represented in these scales is analogous to other measures of anxiety, such as the Beck Anxiety Inventory (Steer & Beck, 1997). To investigate how the items grouped as a factor, a confirmatory factor analysis was performed on this scale. Based on the model fit, the factors held together on a single scale ( $\chi^2 = 143.14$ ,  $p < .01$ , RHO = 0.974, CFI = 0.986, RMSEA = 0.053). Methods used in the confirmatory factor analysis are detailed below. The internal consistency of this scale was adequate ( $\alpha = .62$ ) in this study. See Table 1 for items.

**Avoidance Item**—One item was administered in wave two to assess avoidance. This item was reverse-coded so that a higher level of avoidance represented a higher score on the scale. The avoidance item was: “You usually go out of your way to avoid having to deal with problems in your life.” The scale was rated on a one (anchor: “Strongly Agree”) to five (anchor: “Strongly Disagree”) Likert scale. The item in question appears to be a face valid measure of avoidance and semantically similar to items on previously validated avoidance scales (e.g. “out of my way” is used in the Behavioral Avoidance System scales (Carver & White, 1994), “problems in my life” is a central part of the directions in the Cognitive–Behavioral Avoidance Scale (Ottenbreit & Dobson, 2004)).

**Trauma Grouping Variable**—Add Health inquired about 13 types of trauma including whether a participant had been a victim of assault, rape, knifing, or gunshots; witnessed an assault, knifing, or gunshots; and had a family member or friend commit suicide (see Table 2). This trauma scale was originally formed by Roberts, Fuemmeler, McClernon, and Beckham (2008). These items were summed and dichotomized based on a median split. The median occurred between endorsing none of the items and endorsing one or more on each scale, which is an accepted cutpoint in trauma research (e.g. Scheeringa, Zeanah, Myers, & Putnam, 2003; Tedeschi & Calhoun, 1996). Thus, the trauma group contained 2013 subjects, whereas the no trauma group contained 3765 subjects. This scale was administered in the third and fourth waves of data collection.

**Reported Diagnoses**—In the fourth wave of data collection, persons were asked if they had been diagnosed with an anxiety or depressive disorder by their doctor, nurse, or health care provider. These diagnoses were compared to the anxiety and depression scales to test whether higher scores on the scales were associated with reported clinical diagnoses. As the anxiety questionnaire was only administered in the first and second waves of data collection, anxiety scores were compared with reported diagnoses longitudinally rather than concurrently.

**Planned Analyses**—Prior to the principal analysis, the means of the constructs at each wave were examined (see Table 3). Additionally, the number of psychiatric diagnoses in the fourth wave was examined. Using independent samples *t*-tests, anxiety and depressive diagnoses as the independent variables were analyzed to see if the presence of these diagnoses were associated with higher scores on the anxiety and depression scales, respectively. Area under the receiver operator analyses (ROC) were then examined to determine scale cutpoints and the number of diagnoses at earlier time-points.

Analyses were conducted in LISREL 8.8, using latent variable modeling with anxiety (wave one, hereafter referred to as W1) as a predictor, avoidance as a mediator, and depression (wave four, hereafter referred to as W4) as a dependent variable.<sup>1</sup> Mediation was determined based on the joint significance test, wherein partial mediation was determined by significant regression weights between anxiety and avoidance, and avoidance and depression (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). Full mediation was determined by a lack of significance of the direct relationship between anxiety and depression when avoidance was included in the model.

In the current application, all manifest variables from the anxiety, depression, and avoidance scales are ordinal, and not continuous. As such, all analyses were conducted using the diagonally weighted least squares (WLSMV) estimator with mean and variance adjusted chi-squares, treating all manifest variables as ordinal (Jöreskog & Sörbom, 1996).

Differences between the no trauma group and the trauma group were then examined to test whether the role of avoidance in predicting depression was impacted by the experience of a traumatic event. Note that the trauma measure was dichotomized to facilitate the examination of group differences in model invariance. Differences between the trauma groups were observed by constraining factor loadings and beta weights to be equal across groups and by examining the change in fit statistics. Missing data (approximately 6.6% missingness for the full sample) was handled using full information maximum likelihood (FIML) (the only exception to this was the 726 participants who were missing all of the

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<sup>1</sup>Depression (W1) was also originally included in the model, but it was removed due to substantial multicollinearity issues. Multicollinearity was deemed to be present based on the high correlation between anxiety and depression, and unstable model coefficients. Specifically, the estimate of anxiety (W1) predicting depression (W4) varied widely when depression (W1) was added to the model. Without depression (W1), anxiety (W1) significantly ( $\beta = 0.32$ ,  $SE = 0.02$ ) positively predicted depression (W4). However when depression (W1) was added to the model and predicted depression (W4), the relationship between anxiety (W1) predicting depression (W4) became significantly negative ( $\beta = -0.20$ ,  $SE = 0.04$ ). Unstable estimates, such as those noted in this study, are symptomatic of multicollinearity (Lin, 2008; Wax, 1992). Additionally, there was a moderately high correlation between anxiety (W1) and depression (W1).



trauma variables from wave three and could not be imputed by LISREL's FIML procedure and thus were discarded for the between group analyses).

### 3. Results

#### 3.1. Anxiety and depression measures compared to reported diagnoses

In the fourth wave, 16.2% of the sample reported that they had been diagnosed with major depression by a doctor, nurse, or other healthcare provider. Persons who reported that they had been diagnosed with depression had significantly,  $t(993) = 19.01, p < .001, d = 0.80$ , higher scores on the reduced CES-D depression (W4) scale ( $M = 9.56, SD = 5.82$ ) than those who reported that they had not been diagnosed with depression ( $M = 5.43, SD = 4.14$ ). Receiver operator curve (ROC) analyses were conducted to determine the optimal cut-point. A cutpoint of 7.5 produced the highest Youden's index, with a sensitivity of .74 and a specificity of .58 (Youden, 1950). Using this value yielded an estimated prevalence of 24.4% of the sample with a diagnosis of depression based on participants' self-reported depression scores in wave four. When this criterion was applied to wave one, results showed that 10.1% of the sample would be diagnosed with depression.

In the fourth wave, 12.5% of the sample reported that they had been diagnosed with an anxiety disorder. Participants with an anxiety disorder at time four had a significantly,  $t(762) = 8.35, p < .001, d = 0.40$ , higher score on the anxiety scale at time one ( $M = 4.33, SD = 2.91$ ) than those who did not report having an anxiety disorder at time four ( $M = 3.26, SD = 2.35$ ). Similarly, those who had an anxiety disorder at time four had significantly,  $t(594) = 8.35, p < .001, d = 0.43$ , higher scores on the anxiety scale at time two ( $M = 3.98, SD = 2.43$ ) than those who reported that they did not have an anxiety disorder at time four ( $M = 3.02, SD = 1.96$ ). Because the anxiety diagnosis measure and the anxiety scale were not administered at the same time point the ROC yielded poor predictive validity. Specifically, the approach using the ROC from the anxiety scores at wave two suggested a cutpoint of 2.5 based on the Youden's index, with a sensitivity of .71 and a specificity of .48. When this cutoff was applied to the first wave, the results showed that 55.8% would be diagnosed with an anxiety diagnosis. Thus, the number of anxiety disorders is unknown until wave four; however, the scales at wave one and wave two significantly predicted higher rates of anxiety diagnoses at wave four.

#### 3.2. Testing primary model assumptions

Prior to each analysis, the model's assumptions were tested. Specifically, the model's identification was tested by comparing the model's completely standardized solutions against typically acceptable loadings (Graham, 2005; Jöreskog & Sörbom, 1996). Based on factor loadings in the completely standardized solutions, the identification status of the primary model was considered identified. After testing the identification status, the goodness of fit for the model was examined. To test the goodness of fit, the practical indices of goodness of fit were used: RHO (also titled NNFI) (Bentler & Bonett, 1980; Tucker & Lewis, 1973), CFI (also titled RNI) (Bentler, 1990; McDonald & Marsh, 1990), and RMSEA (Browne & Cudeck, 1993; Steiger, 1990). Practical indices of goodness of fit were

used in place of the chi-square fit statistics as the chi-square values are highly affected by large sample sizes, as in the present dataset.

### 3.3. Anxiety predicting depression

The first hypothesis, that anxiety (W1) would predict later depression (W4), was tested by predicting later depression from earlier anxiety. The goodness of fit indices for this analysis were  $\chi^2 = 7021.51$ ,  $p < .01$ ,  $RHO = 0.953$ ,  $CFI = 0.944$ ,  $RMSEA = 0.10$ , reflected an adequate fit. The results of the model showed that anxiety (W1) significantly ( $\beta = 0.32$ ,  $SE = 0.02$ ,  $Z = 16.36$ ,  $p < .001$ ) predicted later depression (W4) (see Fig. 1).

### 3.4. Anxiety and depression mediated by avoidance

After anxiety was shown significantly and positively to predict depression 12–14 years later, the next model tested if the relationship between anxiety (W1) and depression (W4) was mediated by avoidance. We first examined if anxiety (W1) predicted both avoidance (W2) and depression (W4), and if avoidance (W2) predicted later depression (W4). The goodness of fit indices for this analysis were  $\chi^2 = 662.84$ ,  $p < .01$ ,  $RHO = 0.995$ ,  $CFI = 0.996$ ,  $RMSEA = 0.028$ , suggesting a good fit. In this model, anxiety (W1) significantly ( $\beta = 0.07$ ,  $SE = 0.02$ ,  $Z = 3.22$ ,  $p < .001$ ) predicted avoidance (W2), and avoidance significantly ( $\beta = 0.07$ ,  $SE = 0.01$ ,  $Z = 5.03$ ,  $p < .001$ ) predicted depression (W4) (see Fig. 2). Additionally, the residual direct effect showed that anxiety (W1) significantly ( $\beta = 0.32$ ,  $SE = 0.02$ ,  $Z = 13.00$ ,  $p < .001$ ) directly predicted depression (W4). As such, based on the joint significance test, avoidance partially mediated the relationship between anxiety and depression (MacKinnon et al., 2002). Please note that the magnitude of the mediation explained was 5.1% of the variation between anxiety (W1) predicting depression (W4) (determined by dividing the explained variance of anxiety predicting avoidance by the total degree of variance between anxiety predicting depression).

This model was re-analyzed examining between-group differences between those with and without diagnosed depressive disorders at wave four, and there were no group differences in any loadings. Specifically, when those with depressive disorders were constrained to have equal factor loadings, the difference in fit between the unconstrained group loadings was  $\chi^2_{diff} = -142.11$ ,  $p_{diff} < .01$ ,  $RHO_{diff} = -0.006$ ,  $CFI_{diff} = -0.002$ ,  $RMSEA_{diff} = -0.001$ , which showed that the difference in fit was not practically different. Additionally, when the regression parameters were constrained to be equal, the difference in fit between the chi-square of the partially constrained model and the model with the unconstrained betas was  $\chi^2_{diff} = 6.17$ ,  $p_{diff} > .05$ . Please note that indices of practical fit are not appropriate to test differences in the betas, as chi-squared differences in the betas are not affected by large sample sizes (Graham, 2005). Thus, there were no differences between the structural equation model for those with clinical levels of depression compared to those without clinical depression. Additionally, the model was re-analyzed examining between-group differences in those with anxiety disorders at wave four, and there were also no between-group differences. The difference between the unconstrained model and the model constraining the anxiety disorders group and the non-anxiety disorders group resulted in fit indices of  $\chi^2_{diff} = -25.09$ ,  $p_{diff} < .01$ ,  $RHO_{diff} = -0.002$ ,  $CFI_{diff} = 0.005$ ,  $RMSEA_{diff} =$



-0.001. The fit statistics showed that there were no differences in the practical model fit. Lastly, when the beta-weights were constrained to be equal the difference in fit statistics was  $\chi^2_{\text{diff}}=4.07$ ,  $p_{\text{diff}} > .05$ . This means that results for the groups with and without clinical anxiety were not practically different from one another.

### 3.5. Anxiety and depression mediated by avoidance, moderated by trauma

After showing that avoidance partially mediated the relationship between anxiety and depression within the whole sample, the hypothesis that trauma would moderate the relationship between avoidance and depression was tested. This was done through a series of four two-group models each with greater constraints. The first two-group model examined the fit when all of the factor loadings and beta relationships were unconstrained between the groups. The fit indices for the first model were  $\chi^2 = 541.88$ ,  $p < .01$ , RHO = 0.996, CFI = 0.997, RMSEA = 0.015, suggesting a good fit. When the factor loadings were constrained to be equal, the model fit indices were  $\chi^2 = 542.40$ ,  $p < .01$ , RHO = 0.997, CFI = 0.997, RMSEA = 0.014. By comparison, the latter model fit was not significantly different with the former one ( $\chi^2_{\text{diff}}=0.52$ ,  $p_{\text{diff}} > .05$ ,  $\text{RHO}_{\text{diff}} = 0.000$ ,  $\text{CFI}_{\text{diff}} = 0.000$ ,  $\text{RMSEA}_{\text{diff}} = -0.001$ ), which is note-worthy given the high potential for significance due to the large sample and the constraints on factor loadings. This means that all of the factors can be said to be functioning equivalently in both the high and low trauma groups.

Next, the betas were tested between groups. All of the pathways, except the pathway between avoidance (W2) (as this was the apriori hypothesis) and predicting depression (W4) were constrained to be equal. This model was compared to the previous model, where the factor loadings were constrained. The goodness of fit indices for the partially constrained model was  $\chi^2 = 545.85$ ,  $p < .01$ . The chi-square of the partially constrained model was subtracted by the model with unconstrained betas showing a difference of  $\chi^2_{\text{diff}}=3.45$ ,  $p_{\text{diff}} > .05$ . This means that there were no significant differences in the betas across the two groups, aside from any group difference between the two groups in the beta for avoidance predicting depression (W4).

Subsequently, the apriori hypothesis that high trauma would predict a significantly stronger relationship between avoidance and later depression than the relationship between avoidance and depression in the low trauma group (W4) was tested by constraining all of the pathways to be equal across groups. Then, the model with all the pathways constrained, except avoidance predicting depression (W4), was subtracted from the fully constrained pathway model. The fully constrained pathway model's goodness of fit indices were  $\chi^2 = 547.77$ ,  $p < .01$ . The difference between the partially and fully constrained model was  $\chi^2_{\text{diff}}=1.92$ ,  $p_{\text{diff}} = .08$ . Accordingly, there were no significant differences between the high and low trauma groups for the coefficient of avoidance predicting later depression. As such, trauma did not moderate the relationship between avoidance and depression.

## 4. Discussion

Supporting our first hypothesis, the results of this study showed that anxiety significantly positively predicted later depression over a decade later, with anxiety at wave one explaining

approximately 23% of the variance in depression at wave four. These results are consistent with previous findings suggesting that anxiety predicts later depression (Jacobson & Newman, 2012a).

Moreover, this study also extends previous findings and helps to explain how anxiety and later depression may relate to one another. Supporting our second hypothesis, anxiety and depression were partially mediated by avoidance. This is the first study to find a significant mediational relationship between earlier anxiety and later depression in a naturalistic setting. Consistent with previous research (Moitra et al., 2008; Rinck et al., 2010), these results may support the conceptualization that persons who are anxious employ avoidance as a coping strategy to lessen their negative feelings of anxiety. Also consistent with previous research (Brewin et al., 1999; Cloninger et al., 2006; Moitra et al., 2008; Plant & Devine, 2003; Wittchen et al., 2000), those who employed avoidance had higher levels of later depression. It is possible that avoidance may reduce the likelihood of experiencing positive events and activities. Fewer positive events would then lead to depression as theorized by Lewinsohn (1975) and demonstrated in prior studies (Cohen & Hoberman, 1983; Needles & Abramson, 1990). However, further research is needed to test this theoretical mediational chain.

In contrast to our third hypothesis, there were no significant differences in the relationship between avoidance and depression for those who had experienced a traumatic event versus persons who had not experienced trauma. These results are inconsistent with the conceptualization that those who employ avoidance may not be as prepared to cope with a traumatic event compared to those who do not employ avoidance.

There were no differences in any of the model paths when comparing those with depression diagnoses at the fourth wave against controls. Similarly, there were no group differences between those with anxiety diagnoses at the fourth wave and controls. Thus, anxiety predicting later depression, and avoidance mediating the relationship between anxiety and depression appear to apply both to those in the normal population and those with clinical levels of anxiety and depressive disorders. This makes sense given that both clinical and nonclinical anxiety and depression are considered to be dimensional constructs (Shankman & Klein, 2002; Shear, Bjelland, Beesdo, Gloster, & Wittchen, 2007).

This study has many theoretical and practical implications. By finding the first significant mediational relationship, this study helps to further establish anxiety as a risk factor for later depression and begins to map the potential causal chain between these two constructs (Wu & Zumbo, 2008). In regard to treatment and prevention implications, this study further suggests that interventions targeting heightened subthreshold levels of anxiety in adolescents may prevent high levels of avoidance, and ultimately prevent high levels of depression in early adulthood. Additionally, it suggests that interventions targeting anxiety may also benefit from avoidance and depression as process and outcome variables in later assessments, such that if an intervention is successful there may be reduced levels of avoidance and depression at later times. It also suggests that targeting both subclinical anxiety and tendencies toward avoidance may be helpful. Given the robust effect of anxiety in predicting later depression, treating early subthreshold anxiety in adolescents may be associated with preventing the negative effects of comorbidity between anxiety and

depression in adulthood, such as improving psychosocial and work functioning, heightening perceived quality of life, and reducing rates of suicide (Brown et al., 1996; Kessler et al., 1998; Olfson et al., 1997; Pfeiffer et al., 2009; Sherbourne et al., 1996).

Despite the important theoretical and practical applications, this study has limitations. Although there was a significant mediational relationship between anxiety and depression, the degree to which avoidance explained the relationship between anxiety and later depression was relatively small (5.1% of the total variance between anxiety predicted depression). This small variance could have been due to the use of a single item avoidance measure with no previous psychometric validation. In addition, although this study included some individuals at clinical levels of anxiety and depression, most persons in the sample did not have clinical levels of anxiety and depression. Diagnoses were measured via self-report, rather than a diagnostic interview, which may limit their reliability.

Many studies have shown that anxiety predicts later depression, and not vice versa (Jacobson & Newman, 2012a). As an additional limitation to the current study, the Add Health study did not re-administer the anxiety scale at wave four. Accordingly, we were unable to test whether depression had similar effects in predicting later anxiety for this sample. Thus we could not determine whether anxiety uniquely predicted later depression, or whether depression also predicted later anxiety for this sample. An additional limitation of this study was that we used a measure of general anxiety as opposed to a measure of posttraumatic stress to examine the relationship between anxiety and depression as a function of trauma. As such, it is unknown if the current findings would generalize to posttraumatic stress symptoms in particular.

Additional research needs to be conducted to examine how anxiety and depression relate to each other over time. For example, the following variables should be examined as possible mediators over time: helplessness and hopelessness (anxiety being associated with a state of helplessness, and helplessness gradually developing into a state of hopelessness, hopelessness then is related to the development of depression) (Alloy et al., 1990); attachment/separation (wherein persons respond to separation from an attachment figure first with anxiety and subsequently develop a sense of loss from the relationship coinciding with depression) (Bowlby, 1980); arousal/fatigue (such that anxiety is associated with physiological activation which decreases one's energy levels to produce fatigue, and the low level of energy produces depression) (Akiskal, 1985); and attentional/interpretive biases (such that anxiety is associated with a focus on threat cues, and over time the threat cues lead to a memory bias such that persons can only recall negative events; this recall of only negative events then could lead to the onset of depression) (Butler & Mathews, 1983; MacLeod & Byrne, 1996).

In conclusion, the current study found that anxiety significantly predicted later depression 12–14 years later. Additionally, the relationship between anxiety and depression was jointly positively mediated by avoidance. More research is needed to examine the causal relationship between anxiety and depression, using avoidance and other previously hypothesized causal mechanisms.

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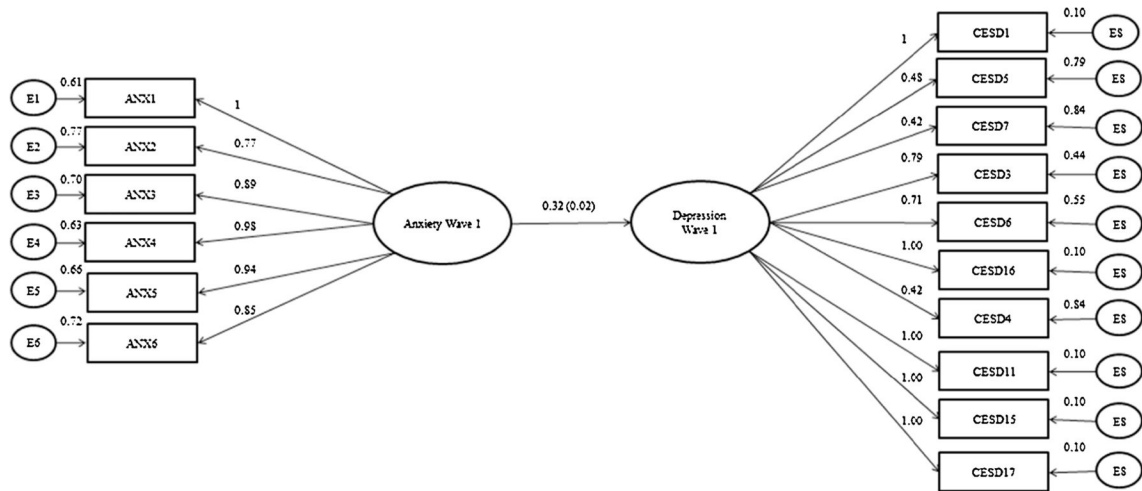
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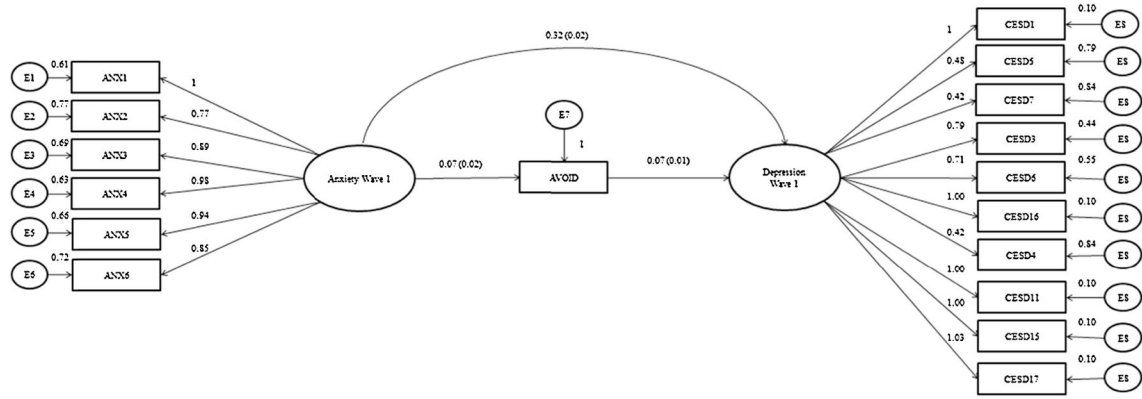


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**Fig. 1.**  $N = 6504$ . In this figure, anxiety at wave one is predicting depression at wave four. Solid lines represent significant connections ( $p < .05$ ).



**Fig. 2.**  $N = 6504$ . In this figure, anxiety at wave one is predicting avoidance at wave two. Additionally, anxiety at wave one and avoidance at wave two are predicting depression at wave four.

**Table 1**

Anxiety, depression, and avoidance scales.

Measure	Item	Waves	Scale
CES-D	You were happy (reverse coded).	1, 2, 4	Never 0–3 most/all of the time
	You could not shake the blues, even with help from your friends and family.	1, 2, 3, 4	Never 0–3 most/all of the time
	You enjoyed life (reverse coded).	1, 2, 3, 4	Never 0–3 most/all of the time
	You felt depressed.	1, 2, 3, 4	Never 0–3 most/all of the time
	You felt that you were just as good as other people (reverse coded).	1, 2, 3, 4	Never 0–3 most/all of the time
	You felt sad.	1, 2, 3, 4	Never 0–3 most/all of the time
	You were bothered by things that usually don't bother you.	1, 2, 3, 4	Never 0–3 most/all of the time
	You didn't feel like eating, your appetite was poor.	1, 2	Never 0–3 most/all of the time
	You had trouble keeping your mind on what you were doing.	1, 2, 3, 4	Never 0–3 most/all of the time
	You felt that you were too tired to do things.	1, 2, 3, 4	Never 0–3 most/all of the time
	You felt hopeful about the future (reverse coded).	1, 2	Never 0–3 most/all of the time
	You thought your life had been a failure.	1, 2	Never 0–3 most/all of the time
	You felt fearful.	1, 2	Never 0–3 most/all of the time
	You were happy (reverse coded).	1, 2, 4	Never 0–3 most/all of the time
	You talked less than usual.	1, 2	Never 0–3 most/all of the time
	You felt lonely.	1, 2	Never 0–3 most/all of the time
	People were unfriendly to you.	1, 2	Never 0–3 most/all of the time
You felt that people disliked you.	1, 2, 3, 4	Never 0–3 most/all of the time	
It was hard to get started doing things.	1, 2	Never 0–3 most/all of the time	
Anxiety	Feeling hot all over suddenly, for no reason.	1, 2	Never 0–4 every day
	Cold sweats.	1, 2	Never 0–4 every day
	Chest pains.	1, 2	Never 0–4 every day
	Fearfulness.	1, 2	Never 0–4 every day
	A stomach ache or an upset stomach.	1, 2	Never 0–4 every day
	Trouble relaxing.	1, 2	Never 0–4 every day
Avoidance	You usually go out of your way to avoid having to deal with problems in your life (reverse coded).	1, 2	Strongly agree 1–5 Strongly disagree

*Note:* This table represents the items from the Center for Epidemiologic Studies Depression Scale (CES-D), the constructed anxiety scale, and the avoidance item. The wave column indicates which wave that the item was administered (not all items were administered at all waves in the Add Health).

**Table 2**

Frequency of traumatic events.

Number	Questions	Percentage of sample experienced
1	Has someone slapped, hit, choked, or kicked you?	9.30%
2	Has [your partner] threatened you with violence, pushed or shoved you, or thrown something at you that could hurt?	7.90%
3	Has [your partner] slapped, hit, or kicked you?	5.80%
4	You saw someone shoot or stab another person	5.40%
5	Someone pulled a gun on you	4.20%
6	Has [your partner] insisted on or made you to have sexual relations with [him/her] when you didn't want to?	3.90%
7	Someone pulled a knife on you	3.60%
8	You were beaten up, but nothing was stolen from you	2.30%
9	Have any of your friends tried to kill themselves and die as a result?	2.30%
10	Someone stabbed you	0.80%
11	Have any of your family members tried to kill themselves and die as a result?	0.80%
12	You were beaten up and something was stolen from you	0.70%
13	Someone shot you	0.50%

*Note:* This table presents the percentage of each of the traumatic events that happened in the sample.



**Table 3**

Descriptive statistics.

Waves	Scale	Sum (SD)	<i>M</i> per item
1	CES-D (18-items)	15.08 (5.10)	0.84
2	CES-D (18-items)	15.16 (4.97)	0.84
3	CES-D (7-items)	7.90 (2.81)	1.13
4	CES-D (10-items)	10.45 (2.69)	1.05
1	Anxiety (7-items)	3.51 (2.67)	0.50
2	Anxiety (7-items)	3.53 (2.47)	0.50
1	Avoidance (1-item)	2.15 (1.06)	2.15
2	Avoidance (1-item)	2.41 (1.12)	2.41

*Note:* This table presents the sum, standard deviation, and item means for the depression, anxiety, and avoidance scales.