Co-occurring Trajectories of Symptoms of Anxiety, Depression, and Oppositional Defiance From Adolescence to Young Adulthood

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Abstract

This study uses a cohort-sequential longitudinal design to examine the patterns of change and codevelopment of anxiety, depression, and oppositional defiant symptoms (ODS) from late adolescence to young adulthood. Four waves of data were collected biennially by individual interview with a random, community-based sample of 662 youth ages 12 to 18 years at Time 1 (18–26 years at Time 4). Using latent growth curve modeling, we examined co-occurring changes in the levels, rates of change, and variability in symptoms of anxiety, depression, and oppositional defiance. Sex differences were also assessed. Levels of anxiety, depression, and ODS were correlated at each time point. Moreover, adolescents with high initial levels in one domain tended to have high initial levels in the other domains. In addition, increases in depressive symptoms were significantly correlated with increases in anxiety and in ODS, but adolescent levels of symptoms did not predict increases over time. Symptoms of anxiety (for female and male individuals) and depression (for male individuals) continue to increase in young adulthood, whereas ODS stabilize or decline. Adolescent levels of these problems have a significant impact on later levels, suggesting that preventive interventions may be needed in adolescence to defer negative consequences of mental health problems in young adults.

Studies show that 15% to 20% of adolescents experience psychiatric disorders at any given time (Costello, Copeland, & Angold, 2011). Moreover, in both community-based and clinical samples of adolescents, rates of co-occurrence between a variety of internalizing and externalizing symptoms approximate 50% to 60% (Boylan, Vaillancourt, Boyle, & Szatmari, 2007; Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Sterba et al., 2010). In an effort to explain these high rates of comorbid symptoms, recent research with children and adolescents has begun to examine the bivariate influences of different types of symptoms on each other over time (e.g., Burke & Loeber, 2010; Drabick, Ollendick, & Bubier, 2010; Oland & Shaw, 2005). Anxious, depressive, and oppositional symptoms are among the most common mental health concerns in adolescence and young adulthood (Costello et al., 2003; Garber, Keiley, & Martin, 2002; Sterba et al., 2010). However, longitudinal research on the continuities, co-occurrence, and mutual influences of these symptoms in the transition to young adulthood is limited, and the influence of adolescent levels of symptoms on mental health in young adulthood is not well understood. This is a particularly important time of life

when mental health and behavioral problems can disrupt stage-salient transitions in education, employment, and romantic relationships (Arnett, 2011).

Epidemiological research reviewed by Costello et al. (2011) on changes in prevalence of psychiatric disorders in the transition from adolescence to adulthood evidences declines in disruptive behavior disorders and increases in some anxiety disorders (panic and agoraphobia); however, findings concerning the direction of changes in depression are inconsistent. Moreover, many of the available epidemiological studies focus on short-term, within-person changes or cross-sectional age differences. Past research also suggests that specific disorders are more likely to predict themselves over time (homotypic continuity) than to predict other types of disorders (heterotypic continuity; Costello et al., 2011). However, heterotypic patterns have been reported for different diagnoses within domains of internalizing problems (e.g., anxiety and depression cross-predict each other; e.g., Kessler et al., 2008) and childhood behavioral problems precede adult anxiety and depression, or externalizing problems (oppositional defiant disorders typically precede conduct disorders; Lahey, Loeber, Burke, Rathouz, & McBurnett, 2002; Rowe, Costello, Angold, Copeland, & Maughan, 2010). Longitudinal studies assessing the dynamics of comorbidity of disorders that cross over internalizing and externalizing dimensions also show significant relationships over time (e.g., oppositional defiant disorder was reciprocally related to anxiety in a study by Rowe et al., 2010).

Symptom checklists, rather than diagnostic interviews, are commonly used to assess or screen for psycho-pathology in large-scale studies of community-based samples. Longitudinal studies of univariate trajectories of symptoms of anxiety and depression are adding to our understanding of changes in symptoms over time. Studies show linear increases in mean levels of depressive symptoms and in new cases of depressive disorders from mid- to late adolescence (Hale, Raaijmakers, Muris, van Hoof, & Meeus, 2008; Van Oort, Greaves-Lord, Verhulst, Ormel, & Huizink, 2009), followed by declines or leveling off of symptoms in young adulthood (Galambos, Leadbeater, & Barker, 2004; Hankin et al., 1998). Similarly, increases are found for some specific types of anxiety such as social anxiety (Ranta et al., 2007) or generalized anxiety disorders (Van Oort et al., 2009). However, Hale et al. (2008) found a slight decrease in panic disorder, school anxiety, and separation anxiety disorder symptoms in adolescents, whereas symptoms of social phobia remained fairly stable over time.

There is some indication that the prevalence of both oppositional defiant disorders and conduct disorders decline across the adolescent to young adult transition (Costello et al., 2011), but studies of changes in oppositional defiant symptoms (ODS) levels are not available for the age group. For community samples of adolescents transitioning to young adulthood, symptoms of ODS (argumentative, irritable, angry, resentful, etc.) may disrupt the formation of key relationships with employers, romantic partners, and friends. Moreover, recent research suggests that there may be a need to disentangle affective (irritable, headstrong) and behavioral (headstrong, hurtful) components of oppositional defiant disorders (Stringaris & Goodman, 2009). Reviewing this literature, Burke and Loeber (2010) found that oppositional defiant disorder typically precedes depression rather than the reverse, but they also suggested that affective (easily annoyed, touchy, spiteful) and

behavioral (argumentative, defiant) dimensions of oppositional defiant disorder may differentially predict either depression or conduct problems. The comorbidity and coinfluence of either oppositional defiant disorders or *symptoms* of oppositional defiance (ODS), anxiety, and depression from adolescence to young adulthood is not known.

Similar to studies of psychiatric disorders, past research also shows that subclinical symptoms of mental health problems in adolescence predict homotypic clinical disorders in adulthood (Shankman et al., 2009). For example, severity of symptoms of depression and a history of anxiety disorder increased the likelihood of full-syndrome depressive disorders from midadolescence to 30 years of age in a community sample (Klein, Shankman, Lewinsohn, & Seeley, 2009). Little research has investigated the cross-domain influences of common mental health symptoms or the influence of adolescent levels of these symptoms on mental health in young adulthood. In this study, we examine the patterns of change and codevelopment of anxiety, depression, and ODS from late adolescence to young adulthood.

CO-OCCURRING TRAJECTORIES OF SYMPTOMS OF DEPRESSION, ANXIETY, AND OPPOSITIONAL DEFIANCE

Longitudinal research on symptom trajectories across the transition from adolescence to young adulthood has examined temporal relations among bivariate symptom combinations. In a two-wave study of youth 15 to 24 years, anxiety disorders predicted the onset and persistence of depression, and depression predicted the onset (but not persistence) of anxiety (Kessler et al., 2008). Hale, Raaijmakers, Muris, van Hoof, and Meeus (2009) assessed symptom severity growth annually for 5 years in two Dutch adolescent cohorts ages 10 to 15 years and 16 to 20 years and found that initial symptom severity for either anxiety or depression was predictive of the development of the other. Following diagnoses of mental health problems among New Zealand participants from ages 11 to 32 years, Moffitt et al. (2007) found that a pattern in which the onset of anxiety was concomitant with, or preceded the onset of depression, was almost as likely as a pattern with the reverse ordering of comorbid disorders. Kim-Cohen et al. (2003), following diagnoses in a birth cohort to age 26 years, found that adult disorders were generally preceded by the same type of childhood disorders (e.g., adult anxiety was preceded by juvenile anxiety); however, 25% to 60% of adults with disorders also had a history of conduct disorder or oppositional defiant disorder.

In summary, the research to date suggests that patterns of common mental health symptoms and their covariations may differ across symptom types in the transition from adolescence to young adulthood. On average, depressive symptoms typically increase across adolescence and stabilize in young adulthood, with higher levels for female individuals at each age. We expect that these trajectories will be replicated in this study. Based on past research, patterns of change and coinfluences of anxiety and ODS for male and female individuals across this transition are unclear. Moreover, although bivariate relations among anxious, depressed, and ODS symptoms have begun to be examined, their multivariate influences have not been assessed. Given past research showing that anxiety and depression are both related to ODS, and to each other, it is expected that symptoms of anxiety or depression fuel the covariation of each with ODS. We are not aware of any study that has examined the codevelopment of

these symptom domains and their influences on each other from late adolescence to young adulthood.

In this study, we use an accelerated four-wave longitudinal design spanning participant ages 12 to 18 years at Time 1 (18–26 at Time 4) to investigate the shape and correlations among adolescent (Time 1) levels and trajectories of symptoms of anxiety, depression, and ODS. We begin by verifying the distinctiveness and invariance across time and sex of the symptom constructs as measured by a screening tool: the Brief Child and Family Phone Interview (BCFPI). Next we examine the shape of univariate trajectories of each symptom domain and then use multivariate models to examine the covariations in levels, rates of within-person changes, and variability among symptom domains. Sex differences are also tested.

METHOD

Participants

Data from the Victoria Healthy Youth Survey (HYS) were collected, biennially, four times, between 2003 and 2010 in a medium-sized Canadian city (population 300,000). In 2003, a random sample of 9,500 private telephone listings yielded an eligible sample of 1,036 households with youth aged 12 to 18 years ($M = 15.52$, $SD = 1.93$). Of eligible households, 185 (18%) parents or guardians refused permission, 187 (18%) adolescents refused to participate, and 2 (0.0001%) participants were older than 18 years at the time of interview, leaving a Time 1 (T1) sample of 662 adolescents (342 female). The total participation rate for eligible adolescents was 64%. Distribution by age cohort on entry to the study was as follows: age 12 years, $n = 83$ (39 female); age 13, $n = 90$ (54 female); age 14, $n = 104$ (47 female); age 15, $n = 98$ (57 female); age 16, $n = 104$ (42 female); age 17, $n = 112$ (58 female); age 18, $n = 71$ (45 female). At Time 1, 85% of the sample was Caucasian, 4% were Asian, 4% were mixed/biracial, and 3% were Aboriginal. The remaining 4% belonged to other ethnic groups (e.g., Black, Hispanic, or other). The living situation, parental education, and ethnicity reported by participating youth were almost identical to that of the population from which the sample was drawn (Albrecht, Galambos, & Jansson, 2007). Response rates were 87% ($n = 578$) at Time 2 (T2), 81% ($n = 539$) at Time 3 (T3), and 69% ($n = 459$) at Time 4 (T4). Analyses of differences in initial status for participating and nonparticipating youth comparing T1 and T4 showed that nonparticipants were more likely to be male (36%) than female (25%) and have lower socioeconomic status (SES; $M = 4.07$, $SD = 1.30$ compared to $M = 3.59$, $SD = 1.49$). Nonparticipants also reported slightly lower anxiety symptoms ($M = 5.48$, $SD = 2.58$) compared to those retained ($M = 5.95$, $SD = 2.58$; Cohen's $d = .01$). Differences for symptoms of depression and ODS were not significant. Differential attrition from T1 to T4 was also unrelated to cohort age, Pearson $\chi^2(6) = 0.99$, *ns*.

Procedure

The HYS was administered to youth by trained interviewers in their homes or an alternate location that provided privacy (e.g., at the university). Informed consent was obtained from parents or guardians, and from the youth. The HYS included multiple items on sociodemographics; family, peer, and school environments; mental health; and substance use in a two-part questionnaire read to all youth. In Part 1, the interviewer recorded responses;

Part 2 responses were recorded by the youth to enhance confidentiality for potentially sensitive issues such as use of illegal substances and sexual behavior. Interviews took 2 hr, on average. Respondents received a \$35 honorarium at each interview.

Measures

Symptoms of anxiety, depression, and oppositional defiance were assessed with the BCFPI (Cunningham, Boyle, Hong, Pettingill, & Bohaychuk, 2009); an abbreviated version of the revised Ontario Child Health Study scales (Boyle, Offord, Racine, Fleming, Szatmary, & Sanford, 1993). The BCFPI was developed for standardized intake screening and outcome evaluation for children 6 to 18 years of age and is not intended to yield diagnoses. Items on the BCFPI specifically tap current levels of symptoms delineated in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; American Psychiatric Association, 1994) for different psychiatric disorders. A comparison of the BCFPI and the Diagnostic Interview Schedule for Children, Version 4 showed Pearson correlations between Diagnostic Interview Schedule for Children, Version 4 symptom counts and BCFPI scale scores exceeded 0.65 and kappa scores were 0.49 for ODS, 0.34 for Anxiety, and 0.28 for Depression (Boyle et al., 2009). This is comparable to the screening potential of other problem checklists such as the CBCL for classifying *Diagnostic and Statistical Manual of Mental Disorders* child psychopathology (i.e., Rishel, Greeno, Marcus, Shear, & Anderson, 2005). Investigating the comparability of assessments of externalizing symptoms (for attention deficit/hyperactivity disorder, oppositional defiant disorder, and conduct disorder) in diagnostic interviews with mothers and the Ontario Child Health Study scales in a community sample, Dirks and Boyle (2010) reported that the quantification of externalizing symptoms were similar in the interviews and checklists.

Eighteen items are rated on a 3-point scale, ranging 0 (*never*), 1 (*sometimes*), and 2 (*often*), reflecting current experiences of symptoms. Youth are asked, "Do you notice that you [. . . item]." The items for anxiety are as follows: Worry about your past behavior? Worry about doing the wrong thing? Worry about doing better at things? Are overly anxious to please people? Are afraid of making mistakes? Worry about things in the future? Items for the Depression subscale are as follows: Feel hopeless? Get no pleasure from your usual activities? Have trouble enjoying yourself? Are unhappy, sad, or depressed? Have no interest in your usual activities? Are not as happy as people your age? Items for the ODS subscale are as follows: Are defiant, or that you talk back to people? Are easily annoyed by others?; are cranky? Argue a lot with others? Are angry and resentful? Blame others for your own mistakes? Cronbach's alpha for each symptom across the four waves ranged from .75 to .78 for anxiety; .80 to .84 for depression, and .72 to .76 for ODS. Total scores are used for each symptom domain with higher scores reflecting more severe symptom levels (range = 0–12; i.e., a score of 12 indicates currently experiencing all six symptoms often).

Planned Analyses

Prior to evaluating patterns of symptoms and their co-variations, confirmatory factor analysis was used to test the expected differentiated structural organization and invariance across time and sex for symptoms of anxiety, depression, and ODS (Brown, 2006). A robust weighted least squares estimator was used because it was the best option for modeling

categorical nonnormal data (Brown, 2006; as this is a community sample of adolescents, responses were positively skewed.). An acceptable model was defined as root mean square error of approximation (RMSEA) = 0.06, comparative fit index (CFI) = 0.95, and Tucker–Lewis index (TLI) = 0.95 (Hu & Bentler, 1999). Chi-square difference tests were used to establish measurement invariance by comparing an unconstrained model to models that had equal factor loadings and equal intercepts. For invariant models, $\chi^2 < 0.05$.

A three-factor confirmatory factor analysis model at each time of assessment fit the data well (RMSEA = .06–.07; CFI = .93–.96, TLI = .92–.95). Factor loadings ranged from 0.47 to 0.85. Moreover, estimates indicated moderate correlations between factors of anxiety and depression (0.48–0.63), anxiety and oppositional symptoms (0.38–0.52), and depression and oppositional symptoms (0.61–0.68). Factor correlations above 0.85 are often used as the cutoff for problematic discriminant validity (Brown, 2006); as such, these results maintain the hypothesis that three distinct but related constructs at each wave are being measured. In addition, both configural (i.e., equality of number of salient factor loadings) and metric (weak) factorial invariance (i.e., equality of magnitude of factor loadings; Meredith 1993) were established across time and sex for this specific age range (12–26 years; see Table 1). Accordingly, sex differences in this study are not a function of measurement error and observed change in mental health symptoms over time is a function of true change and not changes in measurement over time. In light of these findings, and to facilitate interpretability of the multivariate models, subscale scores (composites of subsets of items) measuring the number and severity of symptoms in each domain were used in all subsequent analyses, rather than latent construct scores (Brown, 2006).

Multiple-group latent growth curve models were used to empirically test for sex differences in the association between symptom levels of anxiety, depression, and oppositional defiance over four time points. In the first step, univariate latent growth curve models summarize the values of each symptom domain over time in terms of (a) an initial mean level or intercept, (b) a rate of change or slope, and (c) residual variance (Duncan, Duncan, & Strycker, 2006). The latent growth factors (intercept and slope) have both a mean and variance parameter and the residual variance is a combination of random error and systematic, statelike short-term fluctuation around the mean trajectory. Once the function form of the growth models (linear or quadratic growth) was established for male and female individuals, the significance of sex differences was evaluated by comparing changes in model fit resulting from imposing and releasing cross-group equality constraints on the specified paths between men and women following a bottom-up stepwise procedure recommended by Bollen and Curran (2006). Models were estimated with the loadings of the growth factors at each time point constrained to be equal, leaving all other parameters free to vary across sex (unconstrained model). Then constraints were placed on model parameters in the following order: (a) regression coefficients, (b) means of the growth parameters (intercept and slope), (c) variances and covariances, and (d) residual variance. Each model is a more restrictive version than the one preceding it. The differences in chi-square values and the degrees of freedom between comparisons of sequentially nested models provided a test of the null hypothesis that the more restricted model fits as well as the less restrictive model.

Associations among symptom growth parameters over time were assessed using multivariate growth curve modeling (Duncan et al., 2006; McArdle, 1998). These models provide estimates of the covariation among individual differences in initial levels of each variable, covariation in rates of linear change, associations in time-specific episodic expressions of two variables, and the predictive relationships between initial levels in one variable and subsequent change in another (Curran & Willoughby, 2003; Hofer et al., 2009). Because standardized estimates are not provided by Mplus when using time scores, correlations for each parameter of interest (i.e., intercept–intercept covariance) were derived using parameter variances and covariances (Hofer et al., 2009).

All models were fit using Mplus 6.1 (Muthén & Muthén, 1998–2010). The latent growth metric used was time in study. The time between interviews varied for each individual with a mean of 2.07 years ($SD = 0.10$) between Time 1 and Time 2, 1.97 years ($SD = 0.14$) between Time 2 and Time 3, and 2.78 years ($SD = 0.25$) between Time 3 and Time 4. The intercept was specified to be at the first occasion of measurement for each individual with the slope and intercept means conditional on age at baseline to account for initial age heterogeneity (Hofer et al., 2009) and SES (i.e., mothers education) to adjust for potential effects of economic stress. To facilitate interpretation of the data, the participant's age was centered at 12 years permitting the growth factors to reflect the age of the youngest participant at Time 1 and each unit change as 1 year advance. Finally, freely estimated residual variances did not result in better fitting models (χ^2 range = 0.49–3.04, $df = 3$, $p > .05$), hence for parsimony, the residual variances for each symptom domain were constrained to be equal across time in all models (Wolfinger, 1996). Maximum likelihood estimation was used to accommodate incomplete data (missing values and attrition). This technique uses all available data to identify highly probable parameter estimates for a particular data set and reduces sample bias related to attrition (Baraldi & Enders, 2010). It provides unbiased population estimates under the assumption that data are “missing at random” and data are accounted for by covariates and prior values (R. J. A. Little & Rubin, 1987).

RESULTS

Preliminary Analyses

Means and standard deviations for symptom levels by sex at each assessment are presented in Table 2. Sex differences were small and significant for mean levels of depressive symptoms at Time 1 only. Mean changes at each of the four assessments were small to moderate for anxiety (Cohen's $d = 0.09, 0.04$, for males and females, respectively), depression (Cohen's $d = 0.30, -0.04$, respectively), and ODS (Cohen's $d = -0.18, -0.31$, respectively).

Intercorrelations among symptom domains were significant at each time point. Higher anxiety symptoms were associated with higher levels of depressive symptoms (range in $r_{\text{males}} = .35-.55$; range in $r_{\text{females}} = .37-.50$) and higher levels of ODS (range in $r_{\text{males}} = .26-.42$; range in $r_{\text{females}} = .31-.41$). Depressive symptoms and ODS were also positively correlated (range in $r_{\text{males}} = .40-.55$; range in $r_{\text{females}} = .50-.57$).

Univariate Symptom Trajectories

Linear trajectories provided the best fit to the data for all three symptom domains for male adolescents, and for levels of anxiety and depression for female adolescents. The quadratic fixed-effect of time was significant for levels of ODS for female adolescents, indicating a significant improvement in model fit. Additional fit indices are not provided by the Mplus software when using individually varying time intervals. Table 3 provides the coefficients and standard errors for each of three symptoms domains, with the intercept and slope conditional on baseline age, and SES. In addition, Figure 1 depicts the trajectories of each symptom domain over time by age cohort.

Initial symptom levels for male and female adolescents reflect moderate levels of anxiety, mild to moderate levels of ODS, and mild levels of depression at age 12 years. Multiple-group latent growth model estimates indicate that female adolescents had significantly higher levels of depressive symptoms than male adolescents. Between-person differences in age at baseline predicted initial levels of depression and anxiety for both male and female adolescents, with older individuals showing greater initial levels of mental health problems. For example, for every 1-year increase in age, the initial level of anxiety symptoms increased by 0.15 ($p < .05$) for male adolescents and 0.27 ($p < .001$) for female adolescents.

As shown in Table 3, the linear slopes were significant and positive for anxiety ($p = .06$) and depression for male adolescents, and for anxiety (but not depression) for female adolescents, reflecting increases in these mental health problems across the transition to adulthood. For female adolescents, the trajectory of ODS levels were quadratic, first increasing and then decreasing during the transition to adulthood (see Figure 1). ODS levels were stable for male adolescents over time. The slopes for anxiety and ODS levels were also conditional on age (see Table 3).

There was significant variance in initial levels of anxiety, depression, and ODS for both sexes, as well as variance in the slopes of all symptom domains for male adolescents, and ODS for female adolescents, indicating systematic between-person differences in trajectories of mental health. Significant residual variance estimates indicate within-person variation in mental health trajectories over time as well. Multiple-group models revealed few sex differences in parameter estimates. Only the mean levels and slopes of depression were significantly different, $\chi^2(2) = .88$, $p < .01$. There was no evidence to support sex differences in the means of anxiety levels, or the regression coefficients, variances, covariances, and residual variances of the growth parameters for anxiety and depression. Sex differences in the univariate trajectories of ODS could not be statistically compared in multiple group models because of the different functional forms of the trajectories (i.e., linear for male, quadratic for female; Duncan et al., 2006). Finally, significant negative factor correlations between intercepts and slopes for anxiety and ODS for male adolescents, shown in the last line of Table 3, indicate that male adolescents reporting higher initial levels of symptoms decreased at faster rates than male adolescents reporting lower initial levels. However, intercept-slope correlations are affected by changes in the centering of the intercept so caution is needed in interpreting this finding.

Co-occurrence of Symptoms of Anxiety, Depression, and ODS Across Time

Multiple-group multivariate models were used to assess whether the associations among mental health symptom domains differed by sex. Only linear slopes can be simultaneously compared in multivariate LGM analyses—hence, the small but significant quadratic effect on the pattern of change for ODS for female adolescents could not be taken into account. Sex differences were examined using a model-building procedure similar to that used for univariate models (Bollen & Curran, 2006). In addition, the covariances across domains (e.g., intercept–intercept covariances) were tested for equality for male and female participants. Chi-square difference tests at each stage of the model-nesting procedure were not significant. Moreover, the fully constrained model fit as well as the model in which the constraints on all the parameters were released, $\chi^2 = 23.31$, $df = 43$, $p > .05$, reflecting the fact that the associations between mental health symptom domains did not differ significantly for male and female adolescents. Hence, for parsimony, parameter estimates for the multivariate model are presented for the total sample.

Parameter estimates for the multivariate model showed that anxiety, depression, and ODS levels co-occur at each time point and, with the exception of anxiety and ODS, also codevelop over time (see Table 4). Correlations among the intercepts were moderate (range = .40–.62) and indicate that adolescents with high initial levels in one domain tended to have high initial levels in other symptom domains. Significant positive slope–slope correlations were found between anxiety and depression ($r = .59$) and for depression with ODS ($r = .63$): Individuals who tended to show increases in depression also tended to show increases in anxiety and ODS across the transition to adulthood. However, the slope–slope correlation between anxiety and ODS was not significant. The small but positive and significant residual–residual correlations for all symptom combinations (range = .23–.33) indicated that on occasions when within-person scores in one domain deviated from the trend or trajectory, then scores in another domain changed in a similar way. Finally, to test the unique predictive effects of each symptom domain at baseline, each slope factor was regressed on all three intercepts. All coefficients were small and not significant (see Table 4), indicating that levels at Time 1 did not predict changes over time for any combination of symptoms.

DISCUSSION

This study expands our understanding of the patterns of change in, and interrelations among, levels of anxious, depressive, and ODS in a community sample followed from adolescence to young adulthood. It is among the few studies that model sex differences in univariate patterns of changes in common mental health symptoms across this important developmental phase. To our knowledge, this is the first study to investigate sex differences in the effects of adolescent levels of symptoms on levels in young adulthood as well as the patterns of co-occurring symptoms in this age transition.

Univariate Patterns of Change

Consistent with past research using diagnostic categories in a community sample (Costello et al., 2011), univariate patterns of change were best represented by increases for anxiety—for female and male adolescents ($p = .06$). For depressive symptoms, past findings of

changes across the transition to young adulthood are inconsistent. Sex differences in linear changes in depressive symptoms that were found here may help to explain this inconsistency: Increases in depressive symptoms were significant for male but not female adolescents. Female participants had higher levels of depressive symptoms initially, but symptoms leveled off over time. Sex differences were also found for changes in ODS. A significant quadratic pattern of change in ODS for female adolescents indicated a decline symptom levels over time. For male adolescents, the nonsignificant linear pattern of change indicates a leveling of ODS levels across this transition. This suggests that ODS may remain a concern for some male adolescents. Oppositional behaviors (argumentative, irritable, angry, etc.) are likely to be perceived as a sign of immaturity in this age group and interfere with demands for positive relationships with employers, parents, and new friends and romantic relationships, compromising healthy young adult transitions.

The increase in anxiety symptoms in male and female adolescents may reflect a response to the increased demands for coping with stresses resulting from the multiple transitions during young adulthood. However, the functional effects of these symptoms on stage salient tasks need to be better understood. For youth already experiencing high levels of symptoms, coping with the stresses of young adulthood may be difficult. The linear increase in depressive symptoms for male adolescents is consistent with recent evidence showing that male adolescents may be having more overall difficulties coping with the minor hassles and major events that characterize the transition to adulthood compared to female adolescents (Pettit, Lewinsohn, Seeley, Roberts, & Yaroslavsky, 2010) and that male adolescents may be more likely to engage in behaviors that can aggravate or be aggravated by their depressive symptoms such as substance use (Needham, 2007), or school dropout (Ewert, 2010; Needham, 2009). Clearly, more research on the risks for and consequences of increasing symptoms of anxiety for female adolescents and depression for male adolescents is also needed.

Patterns of Co-occurring Symptoms of Anxiety, Depression, and ODS Over Time

Correlations among initial levels of symptom domains were significant in adolescence at Time 1. Consistent with past research, these adolescent symptom levels were not predictive of cross-domain (heterotypic) changes in symptoms. Sex differences in these correlations were also not significant. Further research is needed to investigate the temporal sequencing of the coinfluences of anxiety, depression, and ODS; however, past research suggests that these symptom types are already dynamically related in younger samples (Lahey et al., 2002). Given the older age of the sample and stability of symptom levels across time, their effects on sustaining each other may be reciprocal rather than directional. In the current study, increases in depression and anxiety were also significantly correlated, as were increases in depression and ODS.

Prior cross-sectional and short-term longitudinal studies have shown links between mean levels and developmental trajectories for bivariate combinations of anxiety, depression, and oppositional defiant disorders in community samples of children and early adolescents. Here, a multivariate model examining all three symptom domains simultaneously also showed moderate correlations among adolescent levels for all symptom combinations (range

= .40–.62): Adolescents who started high in one domain were also consistently high in the others at each assessment point. Consistent with research suggesting that comorbidity reflects more severe pathology or the combined effects of multiple risk factors (see review by Oland & Shaw, 2005), stable correlations between symptom levels across domains suggest that there is considerable consolidation of psychopathology and that this persists across the transition to young adulthood. Common risk factors or underlying processes of psychopathology (e.g., negative causal attributions) may also fuel co-occurring symptoms. It is possible that anxiety and depression can be colinked by self-deprecation or withdrawal from social interactions. Similarly, the cycling of depression, anxiety, and ODS may be simultaneously enhanced by common interpersonal stress and conflicts.

In this study, increases in levels of depressive symptoms were associated with increases in symptom levels of both anxiety and ODS in young adulthood. Past research with children suggests mechanisms that link depression to hopelessness are related to prolonged anxiety (Snyder et al., 2009) or to criticism from others elicited by oppositional defiance (Boylan et al., 2007; Gilliom & Shaw, 2004). Comorbid ODS and depression may reciprocally fuel increases in each other when affected youth are marginalized or alienated from relationships with parents and conventional peers (Beyers & Loeber, 2003; Stringaris & Goodman, 2009). It may also be that depressive symptoms of fatigue, negative affect, somatic symptoms, and self-criticism have a particularly salient role in sustaining increasing psychopathology in the young adult transition. For example, the cycling of negative affect and irritability that, respectively, accompany depression and oppositional defiance may be self-sustaining over time (as each plays a role in eliciting criticism from others and enhancing self-criticism). Alternatively, negative affect and irritability may fuel stressful life events (e.g., losing jobs or romantic partners) and enhance depressive ruminating on the inevitability of ongoing failures or inability to cope with the multiple demands of this developmental phase (e.g., to work, succeed academically, or start or maintain romantic relationships.)

Given past research indicating that ODS is predictive of emotional disorders in early adulthood (Rowe et al., 2010) and the significant associations between levels of anxiety and ODS in adolescence, it is surprising that changes over time in these symptom types are not correlated. This lack of covariation may also be the result of individual differences in responses to anxiety: Highly anxious youth may avoid unpleasant or anxiety-provoking activities by consistently withdrawing from interactions with others and activities, limiting opportunities for oppositional defiant behaviors. Alternatively, anxiety may fuel symptoms of ODS (e.g., arguments and fights with parents) as they resist increased demands for independent actions that are expected in this period of development. Recent research (Beyers & Loeber, 2003; Stringaris & Goodman, 2009) has also begun to distinguish among dimensions of ODS (irritable, headstrong, and hurtful) in youth that are differentially related to emotional problems and conduct disorders, and the findings of Stringaris and Goodman (2009) suggest that only the irritable dimension is associated with emotional problems. The symptoms of ODS assessed in this study combine headstrong (defiant, talk back to people, argue a lot with adults) and irritable (easily annoyed by others) dimensions, possibly obscuring the relations between increasing anxiety and irritability related to ODS.

The significant variance in intercepts and slopes found for each symptom domain (except for the slopes of anxiety and depression for female adolescents) also suggests that there are important individual differences in these patterns of change across all three symptom domains (range = .23–.33) that need to be explained. Consistent with this variability, researchers using Latent Class Growth Analyses to follow children ages 2 to 12 years (Fanti & Henrich, 2010) and 16 to 30 years (Olino, Klein, Lewinsohn, Rohde, & Seeley, 2010) have described as many as eleven trajectories to represent patterns of change in pure and co-occurring internalizing and externalizing symptoms over time. However, Latent Class Growth Analyses methods are sensitive to sample size and non-normal distributions, and trajectories identified in past exploratory research require replication and links to theory (T. D. Little, Card, Preacher, & McConnell, 2009).

Overall, findings from the current study suggest that, across adolescence and early adulthood, expressions of anxiety, depression, and oppositional symptoms are distinctive within domains and invariant across time. By young adulthood, increases in symptoms are still apparent for female adolescents (in anxiety) and male adolescents (in depression), whereas average trajectories of oppositional symptoms are declining or stabilizing. Research on theoretical models of predictors, of risk and protective factors, and of individual differences in the trajectories is needed to better understand stability, recovery from, or exacerbation of these concerns. We also need to know more about the consequences of mental health problems for the developmentally salient tasks of young adults. Accomplishing these tasks sets the foundations for adulthood and can have lifelong and cross-generational effects, particularly for vulnerable populations (e.g., Leadbeater & Way, 2001).

Study Limitations

Findings of this study are limited by our relatively small Canadian sample of primarily Caucasian youth. However, the random recruitment of this community-based sample and use of maximum likelihood estimation to manage missing data increase our confidence in the generalizability of the findings to similar samples. In addition, although youth retained in the longitudinal sample had significantly higher levels of anxiety at the initial assessment, these differences were small and were not likely to be meaningful. Interrelations among levels and trajectories of symptoms for high-risk or clinic-referred youth may be underestimated by our findings.

The study is based on self-reported symptoms. Although this approach might be strengthened with a measure of symptoms observed by others (parents, romantic partners, or peers), the participant's own experiences and self-identification of these problems may be particularly important to their coping, help seeking, and recovery. Moreover, in the transition to young adulthood, youth often move into independent housing and parents may become less aware of ongoing problems. Peer support networks and dating partners also tend to fluctuate over this period, and new friends may not be aware of the youth's experiences of anxiety and depression. Finally, the consistency in the rank ordering of symptom levels (intercepts) in repeated assessments across 6 years also offers considerable confidence in the reliability and validity of these self-reports.

In addition, our cohort-sequential design may only approximate a “true” picture of the patterns of change that might be found by following a single age group over time. However, research suggests that comparisons of cohort-sequential and true longitudinal designs yield similar results (Duncan et al., 2006), and longitudinal research comparing trajectories of, and covariation in, mental health symptoms over the transition from adolescence to young adulthood is extremely limited. Hence, this study makes an early contribution by describing within individual patterns of change in mental health symptoms over 6 years spanning the transition to young adulthood. Nevertheless, given that we found significant differences in individuals’ fluctuations in symptoms, it may be that measurement across shorter time intervals is needed to tease out the timing of relationships among symptom levels.

Because of the multiple changes that characterize transitions from adolescence to young adulthood, we might expect significant occasion-specific variability and interdependencies (covariability) across symptom domains. In late adolescence and young adulthood, increases in independence, autonomy, and competence—along with enhanced emotional regulation, self-confidence, and coping skills—and release from chronic stresses of adolescence (e.g., academic failure, family discord, peer victimization) may reduce the likelihood of depression, anxiety, and oppositional defiance for some youth (Pettit et al., 2010). It is also possible that the intermittent challenges of young adulthood create new stressors that contribute to pathology for some youth. For example, work expectations, financial strain, moves, disrupted friendship networks, or romantic relationships can sustain preexisting problems in vulnerable individuals or engender variability in occasion-specific symptoms (Arnett, 2011). Further research is needed to understand the etiological basis and functional significance of the dynamic relations among the common mental health symptoms observed in this study.

Our findings of stable levels of symptoms and their interrelations over time underscore the importance of early identification of, and intervention in, these problems in adolescence. Prevention or public health approaches may be needed to reduce adolescent levels as well as their continuity in young adulthood when developmental tasks calling for increases in autonomy, persistence, and relatedness can be severely compromised. Screening and intervention of subclinical levels of symptoms may be needed to stem the continuation of mental health problems in young adulthood. Programmatic extensions of successful treatments (such as relaxation therapy, interpersonal and cognitive behavioral therapy, and mindfulness training) to public health approaches that reach out to community samples of youth with mental health problems may also be needed.

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FIGURE 1.

Univariate symptom trajectories for anxiety, oppositional defiant symptoms (ODS), and depression illustrating three cohorts for female (above) and male (below) adolescents. *Note:* Separate lines within each symptom domain represent cohorts who entered the study at a Time 1 age of 12 years, 15 years, or 18 years.

TABLE 1

Measurement Invariance Over Time and Sex

Invariance	Model Description	χ^2	df	χ^2	df	RMSEA	CFI	TLI
Time (T1–T4)								
	1. Baseline model ^a	1009.42***	561	—	—	0.04	0.95	0.95
	2. Equal factor loadings ^b	997.75***	576	24.12	15	0.03	0.95	0.95
	3. Equal intercepts ^c	1147.38***	612	196.94***	36	0.04	0.94	0.94
Gender								
Time 1	1. Baseline model	552.08***	264	—	—	0.06	0.95	0.94
	2. Equal factor loadings	535.09***	279	18.27	15	0.05	0.95	0.95
	3. Equal intercepts	596.48***	294	45.84***	15	0.06	0.94	0.94
Time 2	1. Baseline model	614.99***	264	—	—	0.07	0.94	0.93
	2. Equal factor loadings	580.13***	279	17.76	15	0.06	0.95	0.94
	3. Equal intercepts	658.78***	294	48.80***	15	0.07	0.93	0.93
Time 3	1. Baseline model	495.82***	264	—	—	0.06	0.96	0.95
	2. Equal factor loadings	477.94***	279	16.07	15	0.05	0.96	0.96
	3. Equal intercepts	538.41***	294	33.69***	15	0.06	0.96	0.96
Time 4	1. Baseline model	444.63***	264	—	—	0.06	0.96	0.96
	2. Equal factor loadings	430.40***	279	16.10	15	0.05	0.97	0.97
	3. Equal intercepts	489.27***	294	36.59***	15	0.05	0.96	0.96

Note: χ^2 = differences in chi-square values between models; df = difference in degrees of freedom between models.

^aBaseline model is an unconstrained model with parameters freely estimated.

^bIn this model path loadings for each indicator were constrained to equality across time and sex; Model 2 is compared to Model 1.

^cIn this model the intercepts for each indicator were constrained to equality across time and sex; Model 3 is compared to Model 2.

TABLE 2

Sex Differences in Means and Standard Errors for Each Symptom Domain

	n	Anxiety		Depression		ODS	
		M	SE	M	SE	M	SE
Time 1							
Male	320	5.67	0.14	2.42	0.13	4.30	0.13
Female	342	5.94	0.14	3.13***	0.15	4.26	0.13
Time 2							
Male	272	6.16	0.16	2.98	0.15	4.26	0.14
Female	306	6.31	0.15	3.38 [†]	0.15	4.23	0.14
Time 3							
Male	245	6.17	0.16	3.50	0.17	4.18	0.15
Female	294	6.33	0.15	3.69	0.16	4.06	0.14
Time 4							
Male	204	5.93	0.19	3.12	0.18	3.88	0.16
Female	255	6.02	0.16	3.03	0.17	3.57	0.13

Note: Male adolescents are the reference group. ODS = oppositional defiant symptoms.

 $p < .001$.[†]
 $p = .06$.

TABLE 3
Univariate Latent Growth Curve Model Parameter Estimates (Est.) and Standard Errors for Each Symptom Domain

Parameters	Anxiety				Depression				ODS			
	Male		Female		Male		Female		Male		Female	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Fixed effects												
Intercept	5.44	0.51***	5.13	0.46***	2.21	0.49***	3.24	0.50***	4.36	0.43***	4.58	0.51***
Age ^a	0.15	0.07*	0.27	0.07***	0.21	0.07**	0.17	0.08*	0.02	0.07	0.03	0.07
SES	-0.01	0.10	-0.003	0.10	-0.09	0.10	-0.15	0.10	-0.01	0.09	-0.11	0.10
Rate of change												
Slope (Lin.)	0.21	0.11 [†]	0.26	0.08**	0.34	0.11**	0.06	0.10	0.09	0.09	0.38	0.24
Age	-0.02	0.02	-0.06	0.01***	-0.02	0.02	-0.01	0.01	0.001	0.01	-0.11	0.03**
SES	-0.03	0.02	-0.01	0.02	-0.04	0.02	-0.004	0.02	-0.04	0.02*	0.01	0.05
Slope (Quad.)											-0.07	(0.03)*
Age											0.02	(0.004)***
SES											-0.001	(0.01)
Variance												
Intercept	3.47	0.49***	3.21	0.47***	2.94	0.42***	3.80	0.55***	3.28	0.41***	3.63	0.48***
Slope (Lin.)	0.07	0.02**	0.01	0.02	0.06	0.02**	0.03	0.02	0.04	0.01**	0.39	0.17*
Slope (Quad.)											0.01	(0.003)
Residual	3.00	0.22***	3.46	0.25***	2.80	0.22***	3.27	0.25***	2.15	0.15***	1.88	0.18***
Factor correlation												
Intercept with Lin.	-0.16	0.08*	-0.01	0.07	-0.09	0.08	-0.05	0.08	-0.14	0.05**	-0.23	0.21

Note: ODS = Oppositional Defiant Symptoms; SES = social economic status defined as level of mother's education at Time 1; Lin. = Linear; Quad. = Quadratic.

^a Age at Time 1, centered at 12 years.

[†] $p = .06$.

* $p < .05$.

** $p < .01$.

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TABLE 4

Multivariate Latent Growth Curve Model Random Effects Correlation and Regression Estimates for Each Symptom Domain With Age at Baseline and SES as Covariates

Parameter	Covariance (SE)	Standardized Correlation	Regression Coefficient
Between Domain Relationships			
Intercept			
Anx WITH Dep	1.91 (0.27) ***	0.52	
Anx WITH ODS	1.37 (0.25) ***	0.41	
Dep WITH ODS	2.08 (0.27) ***	0.57	
Slope			
Anx WITH Dep	0.02 (0.01) *	0.57	
Anx WITH ODS	0.02 (0.01)	0.47	
Dep WITH ODS	0.02 (0.01) *	0.62	
Residual Variance			
Anx WITH Dep	0.89 (0.12) ***	0.28	
Anx WITH ODS	0.60 (0.10) ***	0.23	
Dep WITH ODS	0.86 (0.11) ***	0.33	
Between Domain Predictions			
Intercept of Anx Predicting			
Slope of Dep			−0.01 (0.02)
Slope of ODS			−0.01 (0.02)
Intercept of Dep Predicting			
Slope of Anx			0.002 (0.02)
Slope of ODS			−0.01 (0.02)
Intercept of ODS Predicting			
Slope of Anx			0.01 (0.02)
Slope of Dep			−0.004 (0.02)

Note: SES =social economic status defined as mother's education at Time 1; SE =standard error; Anx =anxiety symptoms; Dep = depression symptoms; ODS = oppositional defiant symptoms.

*
 $p < .05$.

**
 $p < .01$.

 $p < .001$.