ADHD AND CO-OCCURRING PSYCHOLOGICAL SYMPTOMS: EMOTION REGULATION AND PARENTING AS POTENTIAL MODERATORS

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by
Elizabeth A. Steinberg, M.A.
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Dissertation Committee:

Deborah Drabick, Ph.D., Department of Psychology, Temple University

Laurence Steinberg, Ph.D., Department of Psychology, Temple University

Philip Kendall, Ph.D., Department of Psychology, Temple University

Tania Giovannetti, Ph.D., Department of Psychology, Temple University

Thomas Olino, Ph.D., Department of Psychology, Temple University

Hongling Xie, Ph.D., Department of Psychology, Temple University

ABSTRACT

ADHD and Co-occurring Psychological Symptoms: Emotion Regulation and Parenting as Potential Moderators

Elizabeth Steinberg, M.A.

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Doctoral Advisory Committee Chair: Deborah A.G. Drabick, Ph.D.

A multitude of research demonstrates that ADHD is associated with negative psychological correlates and outcomes among children, such as academic difficulties and peer relationship problems. Youth with ADHD also experience high rates of comorbidity or co-occurring conditions, including mood, anxiety, oppositional defiant, and conduct disorders. However, few studies have investigated the development of co-occurring psychological symptoms among youth with ADHD over time and across different developmental periods. Shared risk factors likely contribute to the development of ODD, CD, anxiety, and depression among youth with ADHD. Emotion regulation and parenting style may confer risk or resilience for the development of co-occurring symptoms, but research is wanting. The current study examined an existing sample of youth who were recruited at age 10-12 and were followed at age 12-14 and 16. Analyses aimed to (a) identify subgroups of youth varying in type and levels of ADHD and co-occurring symptoms at three different time points using latent class analyses, (b) examine stability of membership and transitions to classes that differ in levels of ADHD and co-occurring symptoms using latent transition

analyses, and (c) investigate emotion regulation and parenting style as predictors of stability and transitions among classes. Results revealed different patterns of ADHD and co-occurring symptoms, including a Low Symptoms class at each time point. Classes of youth with ADHD+Externalizing problems and ADHD+Internalizing problems emerged at ages 10-12 and 12-14. At age 16, two classes with qualitatively and quantitatively different externalizing and internalizing symptoms were identified. Latent transition analyses revealed transitions into the Low Symptoms class from each time point, but also stability and transitions to other symptomatic classes. Predictor analyses indicated that emotion regulation and parenting style were associated with transitions among and stability within classes, but findings were dependent on whether classes were defined primarily by co-occurring externalizing or internalizing symptoms. Results of the present study indicate that children with ADHD are likely to exhibit a range of psychological symptoms, but the frequency and quality of co-occurring symptoms may change over time. Emotion regulation and parenting may be potential targets for enhanced interventions among youth with ADHD with and without co-occurring symptoms.

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CHAPTER 1

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) affects an estimated 3%-7% of school-aged children and approximately 9.5% of children aged 4-17 have ever been diagnosed with ADHD, as of 2007 (Centers for Disease Control and Prevention [CDC], 2011). ADHD is conceptualized as a neurodevelopmental disorder, characterized by symptoms falling into three categories: inattention, hyperactivity, and impulsivity. The *Diagnostic and statistical manual of mental disorders* (5th ed.; *DSM-5;* American Psychiatric Association, 2013) groups children into the Predominantly Inattentive presentation (e.g., has difficulty keeping attention during tasks or play, is easily distracted), Predominantly Hyperactive-Impulsive presentation (e.g., runs about, fidgets, talks excessively, interrupts, has difficulty waiting turn), or Combined presentation (both inattentive and hyperactive-impulsive symptoms present). Children must display at least six of nine symptoms of either presentation to meet criteria. Additionally, symptoms must be present before the age of twelve, for at least 6 months, and must cause impairment in two or more settings (i.e., home, school, and in relationships with peers) (American Psychiatric Association, 2013). Research on the etiology of ADHD has suggested that ADHD is a multi-factorial disorder; thus, according to a developmental psychopathology perspective, ADHD likely results from some combination of genetic, neurobiological, psychological, and contextual risk factors (Coghill, Nigg, Rothenberger, Sonuga-Barke, Tannock, 2005; Mick & Faraone, 2008; Nigg, 2006; Thapar, Langley, Asherson, & Gill, 2007). In addition, ADHD is associated with negative psychological correlates and outcomes among youth, such as academic difficulties, peer

relationship problems, and conflicts in the family (Barbearesi et al., 2007; Deault, 2010; Hinshaw & Lee, 2003; Johnston & Mash, 2001; Mrug, Hoza, & Gerdes, 2001). Thus, ADHD is a major public health concern as it may result in decreased quality of life for children and their families.

Research also has demonstrated high rates of co-occurring psychological conditions among youth with ADHD, including mood, anxiety, oppositional, and conduct disorders, with up to 44% of children with ADHD having at least one other disorder and 43% having at least two or more additional disorders in community-based samples, and up to 87% of children having at least one other disorder and 67% having at least two other disorders in clinic-based samples (Angold, Costello, & Erkanli, 1999; Barkley, 2006; Brown et al., 2001; Cantwell, 1996; Costello et al., 2003; Kadesjo & Gillberg, 2001). Given the heterogeneity in symptom presentation, etiology, impairment, and course among youth with ADHD, there are likely different developmental pathways linked to co-occurring externalizing and internalizing symptoms based on child-specific and contextual factors (Frick & Morris, 2004). However, less is known about (a) which children with ADHD are more likely to develop co-occurring conditions, and (b) which co-occurring conditions youth may be likely to develop. Further, little research has investigated mechanisms of developing ADHD and co-occurring symptoms. The proposed study will examine two correlates of ADHD and co-occurring conditions, namely, emotion regulation deficits and parenting styles, which may serve to confer risk for the development of co-occurring symptoms among children with ADHD.

ADHD and Common Co-occurring Symptoms and Disorders

Children who have co-occurring conditions often experience increased symptom severity and are at risk for a more enduring course of the disorder and further negative outcomes than children who do not have co-occurring conditions (Booster, DuPaul, Eiraldi, & Power, 2012; Connor et al., 2003). Thus, understanding the nature and development of co-occurring conditions among youth with ADHD is especially important (Drabick, Gadow, & Sprafkin, 2006; Lilienfeld, 2003). The application of a developmental psychopathology framework is especially relevant and useful for conceptualizing the development of co-occurring conditions among youth with ADHD. Equifinality refers to the idea that diverse pathways may lead to the same outcome, and multifinality suggests that one pathway may result in multiple outcomes depending on other relevant factors (e.g., contextual influences; Cicchetti & Rogosch, 1996). In addition to the development of co-occurring conditions, some children with ADHD evidence desistance of symptoms over time, although the factors that contribute to this desistance are also less understood (Willoughby, 2003).

Researchers have provided various models and explanations to conceptualize co-occurring psychological conditions among children (Angold et al., 1999; Caron & Rutter, 1991; Drabick & Kendall, 2010). At least three potential explanations have received support in the context of ADHD and co-occurring conditions. First, it is possible that ADHD confers risk for additional disorders. ADHD typically develops early in childhood and thus often precedes the age of onset of many psychological disorders experienced by youth. Second, shared risk factors among conditions may account for the co-occurrence of ADHD and additional symptoms (e.g., parenting behaviors, emotion regulation deficits). A third explanation, which has not been examined systematically but warrants further attention,

suggests that correlates or sequelae of ADHD confer risk for additional conditions (Drabick et al., 2006). It is unlikely that one explanation (e.g., ADHD leads to other disorders) accounts for the extent of comorbidity that is observed with ADHD, considering the heterogeneity of symptom presentation, impairment, and range of co-occurring problems among children with ADHD. Thus, a framework that considers differences in symptom profiles among children with ADHD utilizing a person-centered approach and examining factors that might contribute to different patterns of co-occurring conditions would be useful. In particular, a person-centered approach would be useful because it allows for considerations of multiple co-occurring symptoms, changes in symptoms over time, and predictors of changes in symptoms.

Oppositional defiant disorder (ODD) frequently co-occurs with ADHD in childhood, whereas conduct disorder (CD) is more likely to co-occur with ADHD in adolescence (Angold et al., 1999; Costello et al., 2003; Loeber, Burke, Lahey, Winters, & Zera, 2000). ODD typically develops by the age of 8, and no later than early adolescence (American Psychiatric Association, 2013), indicating that the age of onset of ADHD and ODD is similar. Although symptoms of ADHD may be present before ODD symptoms, the similar timing of onset suggests that shared risk factors may contribute to both ADHD and ODD. CD typically has a later age of onset (i.e., after age 10 and during adolescence, though childhood-onset CD requires onset before age 10). Although ADHD and CD may share certain temperamental features, the later onset of CD suggests that correlates of ADHD may predispose children to co-occurring CD (Mannuzza et al., 1991). Thus, in terms of developmental timing, CD typically onsets after ADHD, suggesting that ADHD may predispose children to CD or that the two disorders may share certain risk factors as well.

Though research consistently has shown high associations between ADHD and ODD/CD (e.g., Angold et al., 1999; Costello et al., 2003), internalizing disorders also commonly co-occur with ADHD (for reviews, see Bubier & Drabick, 2009; Jarrett & Ollendick, 2008; Ollendick & Seligman, 2006; Silverman & Ginsburg, 1998). Indeed, it has been estimated that up to one third of children with ADHD have co-occurring anxiety disorders among clinical and epidemiological studies (Biederman et al., 1991; Blackman et al., 2005; MTA Cooperative Group, 1999; Vitiello, 2001). The onset of anxiety disorders varies based on disorder, with separation anxiety disorder typically developing by the age of 7.5 years old and occurring among younger children and social anxiety disorder developing around age 11 (*DSM–IV–TR*, 2000). Therefore, it is likely that each of the comorbidity explanations may apply to the developmental of co-occurring ADHD and anxiety, depending on the anxiety disorder considered.

ADHD also commonly co-occurs with mood disorders (Angold et al., 1999; Costello et al., 2003; Jensen et al., 2001; Spencer, Biederman, & Mick, 2007). Children with ADHD have higher rates of continuous depressive symptoms (as opposed to isolated major depressive episodes) (Bussing et al., 2010; Lahey et al., 2007; Lee et al., 2008) and are more likely to develop depressive disorders later in childhood and adolescence (Biederman et al., 2008; Monuteaux et al., 2007) than children without ADHD. In fact, Seymour et al. (2012) found that children diagnosed with ADHD early in childhood were at a 500% greater risk for major depression or dysthymia before age 18 than children without ADHD. Although there may be familial risk factors that predispose children to both ADHD and depression (Faraone & Biederman, 1997), there is little research regarding factors that might link depression and ADHD (Ostrander & Herman, 2006). Some research suggests that shared risk factors (e.g.,

emotion regulation) contribute to the co-occurrence of ADHD and depression (Seymour et al., 2012).

Although ADHD typically develops earlier in childhood, depression tends to have a later onset, with prevalence rates increasing with age (Kessler & Wang, 2002; Ostrander & Herman, 2006). ADHD typically precedes the developmental onset of major depressive disorder among children and adolescents when these disorders co-occur. Thus, there may be correlates of ADHD that contribute to the development of depression, such as impaired academic functioning, social relationships, and family interactions (Drabick et al., 2006; Herman et al., 2007; Ostrander & Herman, 2006).

Utilizing a developmental psychopathology framework allows the examination of multiple levels of analysis and multiple domains of risk and resilience (Cicchetti & Toth, 2009; Drabick, 2009; Rutter & Sroufe, 2000). In the present study, I propose a conceptual model of the development of co-occurring ADHD and other psychological symptoms among youth followed from childhood into adolescence. There are likely child-specific and contextual factors that promote risk or resilience for the development of co-occurring conditions among youth with ADHD. Specifically, I consider emotion regulation skills and parenting style, which are two potential inter-related candidate processes that may lead children with ADHD symptoms to develop co-occurring psychological symptoms. Before turning to the model of the development of co-occurring psychological symptoms among youth with ADHD, it is necessary to examine the construct of emotion regulation and the interplay between emotion regulation skills and parenting in typical and atypical development.

Emotion Regulation and Temperament

Children with emotion regulation deficits are at risk for externalizing and internalizing symptoms (Cole, Zahn-Waxler, & Smith, 1994; Eisenberg & Morris, 2002). Emotion regulation is an important and useful construct to consider throughout development, though it is complicated to study (for a review, see Cole, Michel, & Teti, 1994). To review the literature and help conceptualize emotion regulation for the present study, the following definition of emotion regulation by Eisenberg and Spinrad (2004) will be adopted:

> The process of initiating, avoiding, inhibiting, maintaining, or modulating the occurrence, form, intensity, or duration of internal feeling states, emotion-related physiological, attentional processes, motivational states, and/or the behavioral concomitants of emotion in the service of accomplishing affect-related biological or social adaptation or achieving individual goals. (p. 338)

Investigating certain markers of emotion regulation, such as temperament, or "biologically rooted individual differences in behavior tendencies that are present early in life and are relatively stable across various kinds of situations and over the course of time" (Bates, 1987, p. 1101), can help further clarify the role of emotion regulation in child outcome, such as the development of co-occurring symptoms among children with ADHD. A developmental psychopathology perspective will be used to demonstrate how temperament contributes to the evolution of emotion regulation over the course of typical and atypical development, highlighting features of risk and resilience, and elucidating the nature of the transactional relations between emotion regulation and parenting. An examination of principles of multifinality and equifinality will illustrate how these various pathways may lead to diverse outcomes, specifically with regard to children with ADHD.

Temperament has demonstrated stability over time—in fact, research shows that temperament at age 3 predicts adult characteristics over 20 years later (Caspi, Roberts, & Shiner, 2005). Additionally, temperament provides the foundation upon which emotional development and emotion regulation are built and interacts with contextual circumstances (Southam-Gerow & Kendall, 2002). Derryberry and Rothbart (1988) separate temperament into the constructs of arousal, emotion (positive/negative affect), and self-regulation (ability to actively control arousal and emotional responses, inhibition/approach, attentional control). Particularly relevant for the present study is the frequency and intensity of positive and negative emotionality, which are associated with social skills, as well as internalizing and externalizing symptoms among youth (Eisenberg, Fabes, Guthrie, & Reiser, 2000). Thus, child-specific temperamental features, such as positive or negative mood, may contribute to the development of emotion regulation, and difficult temperamental styles are predictive of a variety of psychological symptoms (Lengua, West, & Sandler, 1998), suggesting that these features may be useful for models considering the development of co-occurring conditions.

Emotion Regulation Deficits among Children with ADHD

Though much research supports an emotion dysregulation deficit among children with ADHD (Barkley & Murphy, 2010; Braaten & Rosen, 2000; Maegden & Carlson, 2000; Melnick & Hinshaw, 2000; Walcott & Landau, 2004), there is some debate regarding the exact nature of this deficit (Sobanski et al., 2010). Generally, children with ADHD are highly reactive and are characterized by high negative emotionality, high extraversion, and capacity for overly reactive negative/positive emotions (Martel, 2009; Sanson & Prior, 1999). Barkley's (1997) model posits that emotion dysregulation in ADHD is due to an executive inhibition deficit. This deficit includes difficulties with temperamental regulation and

effortful control processes and may involve anterior fronto-striatal attentional networks, resulting in extreme positive approach (Gray, 1991; Posner & Rothbart, 2000). These temperamental profiles and emotion regulation deficits among children with ADHD may play a contributing role in the development of co-occurring psychopathology (De Pauw & Mervielde, 2010). Emotion regulation likely acts as a shared risk factor that may contribute to the development of certain co-occurring disorders among children with ADHD. Specific temperamental styles and emotion regulation deficits associated with each co-occurring condition are discussed later as part of the conceptual model of the proposed study. However, consistent with a developmental psychopathology framework, it is important to consider contextual factors that also interact and impact a child's functioning. Parenting factors also influence children's emotion regulation competencies and may serve as risk factors for negative child correlates, with the potential to exacerbate a child's existing behavioral difficulties or contribute to co-occurring conditions.

Parenting Influences among Children with ADHD

Parenting style also is associated with co-occurring symptoms among children with ADHD. Johnston and Mash's (2001) review supported a transactional model of ADHD and family functioning, such that children with ADHD may influence parenting methods. ADHD is conceptualized as a largely biological disorder, with core symptoms arising from deficiencies in neurobiological functioning. Nevertheless, ADHD symptoms often interfere with interpersonal relationships, and social processes (e.g., parental consistency, family routine) may attenuate the presentation of ADHD symptoms (Lanza & Drabick, 2011). Thus, the types of co-occurring symptoms that develop in addition to ADHD may be especially

influenced by contextual factors (Johnson, Cohen, Kasen, Smailes, & Brook, 2001; Johnston & Mash, 2001; Milberger, 1997; Nigg, 2006; Pfiffner, McBurnett, & Rathouz, 2001).

Longitudinal studies have demonstrated that family difficulties during the school-aged period contribute to the development of conduct problems among children with ADHD symptoms (Johnston & Mash, 2001). Indeed, negative parenting styles are predictive of oppositional and conduct problems beyond prediction from ADHD alone (Deault, 2010; Johnston & Mash, 2001; Kasdan et al., 2004; Pfiffner, McBurnett, Rathouz, & Judice, 2005), and child disruptive behaviors likely influence parenting more than ADHD symptoms alone (Burke, Pardini, & Loeber, 2008). In addition, positive parenting may act as a protective factor against the development of conduct problems among children with ADHD (Chronis et al., 2007).

Thus, children with ADHD may be especially susceptible to harsh or non-supportive parenting styles, leading to the development of co-occurring symptoms. Research has elucidated dimensions of key parenting styles—acceptance versus rejection, psychological autonomy versus psychological control, and firm control versus lax control (Schaefer, 1965) Specifically, research has demonstrated that maternal acceptance (defined by expression of affection, sharing, and positive evaluation) is an important positive parenting style that is linked to lower levels of internalizing problems such as depression (Barber, Stolz, & Olsen, 2005), as well as lower levels of externalizing problems (Muris et al., 2003; Roelofs et al., 2006; Rothbaum & Weisz, 1994). Parental use of psychological control includes intrusive control or covert control through which parents attempt to manipulate children's behavior using strategies such as guilt induction (Barber, 2001). Use of psychological control is linked to elevated levels of internalizing problems (Barber & Harmon, 2001; Silk, Morris, Kanaya,

& Steinberg, 2003). Firm control is defined by Schaefer (1965) as the degree to which parents strictly enforce rules and regulations, set limits, and enforce punishment. Inconsistent, harsh discipline and non-enforcement of rules have been especially linked to increased externalizing behavior disorders, whereas enforcement of rules is associated with decreases in behavioral problems (Gray & Steinberg, 1999; Silk et al., 2003). Thus, given associations with both internalizing and externalizing symptoms concurrently and prospectively, these parenting dimensions are important to consider as predictors of child and adolescent symptoms, as well as changes in symptoms over time. Nevertheless, given heterogeneity among youth with ADHD symptoms, other correlates of ADHD (e.g., child emotion regulation) that might predict the development of co-occurring symptoms should be considered.

Integrated Conceptual Model of ADHD, Co-occurring Symptoms, and Predictors

Emotion regulation and parenting are important to consider in models of the development of externalizing and internalizing symptoms, which can be applied to the development of co-occurring conditions among children with ADHD. Given variability in ADHD symptom presentation, correlates, and course, a developmental psychopathology perspective is necessary to consider multifinality and equifinality in outcomes. There are likely shared risk factors, such as emotion regulation deficits and parenting style, that predispose children with ADHD to other co-occurring conditions. Nevertheless, there is a dearth of literature investigating emotion regulation deficits among children with ADHD and co-occurring conditions and whether parenting style may confer risk or resilience for co-occurring symptoms among youth with ADHD symptoms (Southam-Gerow & Kendall, 2002). To address these gaps, I use a developmental psychopathology framework, including

dimensional approaches, multiple levels of analysis, role of context, and transactional relations between children and their environments, to frame the proposed model (Beauchaine, 2003; Drabick et al., 2006; Rutter & Sroufe, 2000; Steinberg & Avenevoli, 2000).

Children with behavioral disorders typically display negative temperamental styles and have difficulty regulating anger, aggression, and negative emotions; indeed, emotion regulation problems are particularly associated with aggressive symptoms among children with ADHD (Frick & Morris, 2004; Melnick & Hinshaw, 2000; Sobanski et al., 2010). Further, children with ADHD who display negative affect and reactivity (as in Rothbart's model) and ODD symptoms often elicit harsher parenting reactions, further exacerbating child oppositional symptoms (Chamberlain & Patterson, 1995; Patterson, 2002; Patterson, Reid, & Dishion, 1992). Thus, given that ODD is associated with negative emotionality (Martel & Nigg, 2006), one would expect that children who are predisposed to ADHD and exhibit emotion regulation difficulties such as susceptibility to negative, angry, and aggressive emotions might develop symptoms consistent with ODD, especially in the context of harsh, non-supportive parenting strategies.

CD is also characterized by lower levels of emotion regulation, though it has been examined less frequently in terms of emotion regulation dysfunction (Cappadocia, Desrocher, Pepler, & Schroeder, 2009). Children with CD are grouped into childhood-onset and adolescent-onset subtypes. The CD category includes another specifier in *DSM-5* intended to decrease heterogeneity among youth with CD; specifically, youth can be diagnosed based on the presence or absence of callous-unemotional (CU) traits (i.e., “with low prosocial emotions”). Little is known regarding the specific emotion dysregulation

problems within these subtypes, though some research shows that it is likely that children with and without CU traits differ on emotion regulation profiles. Overall, children with CD without CU traits likely evidence marked negative emotion, reactivity, executive functioning deficits, and low agreeableness, which may be manifested as reactive aggression. This subgroup may be more likely to be co-occurring with ADHD, evidencing problems with inhibition and impulsivity (Blair, 2004; Crowe & Blair, 2008; Martel, 2009). Compared to youth with CD without CU traits, children with CD with CU traits may have fewer executive functioning deficits, lower physiological arousal to punishment cues, lower anxiety, and higher levels of proactive aggression (Blair, 2009; Drabick, Bubier, Chen, Price, & Lanza, 2011; Mitchell, Richell, Leonard, & Blair, 2006; Nigg, 2004; Nigg, Goldsmith, & Sachek, 2004; Raine, 2002; Sterzer et al., 2005). Additionally, children with CD and CU typically demonstrate fearlessness, sensation seeking, and disinhibition of aggression (Cappadocia et al., 2009). Thus, there are two hypothesized groups of children with ADHD and CD: (a) children with CD without CU, characterized by under-regulation, negative mood, and high reactive aggression; and (b) children with CD with CU traits, characterized by low agreeableness, decreased fear/empathy, and proactive aggression. For both subgroups, it is expected that children with both ADHD and CD likely demonstrate an even poorer prognosis and deficient emotion regulation abilities relative to youth with ADHD only.

Children with internalizing problems generally exhibit decreased effortful control (Derryberry & Rothbart, 1997). Specifically, children with anxiety tend to avoid events and situations that produce emotional arousal (Mash & Wolfe, 2002), experience emotions more intensely, exhibit dysregulated expressions and less adaptive coping, and evidence decreased ability to improve their mood relative to non-anxious children (Southam-Gerow & Kendall,

2000; Suveg & Zeman, 2004). Researchers hypothesize that ADHD and anxiety might be characterized by poor regulation of both attention and affect, leading to both increased attention to negative stimuli and decreased regulation of accompanying affect (Schatz & Rostain, 2006). However, the pattern of findings likely differs based on ADHD subtype and the type of anxiety disorder experienced by youth, suggesting that further research into the specific emotion regulation deficits occurring in co-occurring ADHD and anxiety is needed.

Emotion regulation deficits among children with depression include increased negative emotionality and intensity of sadness, decreased positive emotions, increased emotional lability, and poor effortful control (Chaplin, Cole, & Zahn-Waxler, 2005; Cole, Teti, & Zahn-Waxler, 2003; Compas et al., 2004; Feng et al., 2009; Rothbart & Posner, 2006; Silk, Steinberg, & Morris, 2003). Thus, children with both ADHD and depression would likely exhibit increased emotional lability, increased negative emotions, and decreased positive emotions. These children are characterized by overregulation of emotional expression and low attentional control, especially in regard to disengaging from negative thoughts. Based on previous research, it is likely that emotion regulation deficits mediate the link between ADHD and depression symptoms among children, even when controlling for ODD/CD (Seymour et al., 2012), such that emotion regulation deficits may be both a correlate of ADHD and depressive symptoms, or shared risk processes that contribute to the symptoms of both conditions during different developmental periods.

Given that ADHD is generally considered a neurodevelopmental disorder with an early onset in childhood, it is important to consider the periods during which ADHD symptoms and these various co-occurring symptoms develop. For ADHD specifically, there may be differences in presentation based on Predominantly Inattentive or Hyperactive-

Impulsive symptoms. Hyperactive-impulsive symptoms typically develop first (around ages 3 to 4), followed several years later by inattentive symptoms (around ages 5 to 7) (Barkley, 2012a, 2012b; Milich, Ballentine, & Lynam, 2001), suggesting that the hyperactive-impulsive subtype may be a developmental precursor to the combined subtype (Applegate et al., 1997). Nevertheless, the subtypes have not been found to be very reliable or stable over development (Valo & Tannock, 2010); thus, *DSM-5* characterizes ADHD as a single disorder varying in severity across two symptom dimensions (predominantly inattentive or predominantly hyperactive-impulsive presentation).

As reviewed earlier, ODD likely develops along with or after ADHD, whereas the onset of CD is typically after ADHD. Anxiety disorders develop across childhood and adolescence depending on the disorder under consideration, and mood disorders typically have an onset during adolescence. Further, although basic emotion regulation skills are often established in the early to middle childhood years, they continue to develop into adolescence. Parenting also plays a larger role earlier in childhood, but may continue to exert influence in later childhood and adolescence. Thus, the current model examines the development of co-occurring conditions over time and through adolescence to capture the range of heterogeneity, multifinality, and equifinality in individual outcomes.

The Current Study

There is a dearth of longitudinal analyses involving co-occurring conditions among children with ADHD. To address this gap, the current study examined co-occurring psychological symptoms among youth with ADHD symptoms in a prospective model. Specifically, I utilized a person-centered approach to identify groups of youth based on (a) ADHD symptoms and (b) co-occurring psychological symptoms. Latent class analysis

(LCA) was used to identify unobserved groups (i.e., classes) of youth based on their symptoms of ADHD, ODD, CD, anxiety, and depression at each time point. Then, longitudinal patterns of ADHD and co-occurring symptom groups from childhood to adolescence were examined. Measures were collected at multiple developmentally relevant time points, including ages 10-12 (Time 1), 12-14 (Time 2), and 16 (Time 3). Emotion regulation and parenting measures were collected at Time 1 and hypothesized to predict stability and transitions among different classes of youth with ADHD and co-occurring symptoms. Specific aims and hypotheses of the current study are outlined below.

Aim 1. To identify subgroups of youth with different profiles of ADHD and co-occurring symptoms.

The first aim of the current project was to identify groups of youth defined by type and levels of (a) ADHD symptoms and (b) co-occurring symptoms, including ODD, CD, separation anxiety, and depression, at three time points.

Hypothesis 1. It was expected that multiple classes would be identified by the LCAs at each time point. It was expected that these classes would differ qualitatively (i.e., different types of symptoms such as externalizing vs. internalizing symptoms) and quantitatively (i.e., different levels or frequencies of symptoms in each class). Hypotheses regarding classes were formed based on prior literature on the development of ADHD and each of the co-occurring symptoms. For instance, research on the developmental course of ADHD symptoms suggests that hyperactive-impulsive symptoms are often present earlier in development and may remit to some degree later in childhood and adolescence, whereas inattentive symptoms evidence more stability during elementary years and decline slightly during adolescence and early adulthood, though typically they do not decline to "normal"

levels (Barkley et al., 2008; Fischer et al., 2002; Hart et al., 1995). Thus, ADHD tends to remit to some degree in adolescence, and it was hypothesized that this pattern would be observed in the present study (cf., Faraone, Biederman, & Mick, 2006).

If ADHD confers risk for other conditions, it was expected that there would be a class of youth with just ADHD symptoms early in development, and there will be groups of youth in later childhood and adolescence with additional co-occurring symptoms. Because of the lack of longitudinal research investigating both the course of ADHD and co-occurring conditions, it was difficult to predict specific classes for each time point. However, it was hypothesized that several patterns would emerge in terms of ADHD and co-occurring symptoms. At each time point, a low ADHD class was expected to emerge. Additionally, ADHD symptoms were expected to decline over the course of development across all groups.

In terms of co-occurring symptoms, a group of children with ADHD and ODD was expected to emerge at Time 1 (ages 10-12). I also expected to identify a group of children with higher levels of ADHD and CD symptoms at Time 1, which would represent the more severe, possibly callous-unemotional group of children with CD and possibly a more severe form of ADHD with a greater genetic loading (Thapar, Harrington, & McGuffin, 2001). In terms of anxiety, I expected that certain anxiety symptoms, such as those characteristic of separation anxiety disorder, would develop earlier (typically by the ages of 5-8), and would be evident by Time 1 (ages 10-12). Similarly, although depression may develop in childhood, rates of depression increase in adolescence (Costello et al., 2003). Thus, at Time 1, five classes were expected to emerge in the LCA, including children with (a) ADHD and ODD symptoms, (b) ADHD and CD symptoms, (c) ADHD and anxiety symptoms, (d) ADHD only symptoms, and (e) low ADHD symptoms. Classes at subsequent time points were expected

to include higher levels of CD and depression, given the typical increases in these co-occurring symptoms in adolescence.

Aim 2. To examine stability of class membership for ADHD and co-occurring symptom groups across late childhood and adolescence and test the explanation that ADHD confers risk for co-occurring symptoms.

Hypothesis 2. In terms of ADHD and co-occurring symptom group membership, certain developmental patterns are likely to be relatively stable, whereas others will likely be characterized by a shift in group membership. As reviewed in Aim 1, ADHD symptoms typically desist over time, but it is likely that some children will evidence more remission than others (Barkley et al., 2008). It was difficult to predict stability of each class because of the lack of literature on ADHD and co-occurring conditions across development. However, research suggests that the group of children evidencing early ADHD and ODD symptoms might also show signs of CD, with increased CD symptoms in the adolescent time points, as CD tends to develop by adolescence among children with ADHD (Barkley, 2006; Waschbusch, 2002). Further, the group of children with ADHD and ODD might change over time, with fewer overall ADHD and ODD symptoms. Similarly, children might transition to classes characterized by higher levels of internalizing symptoms, based on investigations demonstrating increases in some anxiety symptoms and depression symptoms in adolescence. Thus, it was predicted that there would be a degree of stability in some groups and also change over time based on documented developmental trajectories of ADHD and co-occurring symptoms over time.

If ADHD confers risk for other conditions, the LTA would show transitions from an elevated ADHD symptoms group to an ADHD plus other symptoms group. For example, if a

child has ADHD at Time 1 and transitions to an ADHD plus CD class at Time 2, this pattern of findings would be consistent with this explanation.

Aim 3. To test the explanation that shared risk factors account for co-occurring symptoms among youth with ADHD, or that correlates of ADHD confer risk for co-occurring symptoms. Examine emotion regulation and parenting behaviors as predictors of stability and transitions among classes.

Hypothesis 3a. It was hypothesized that children with ADHD symptoms would exhibit emotion regulation deficits relative to children without ADHD symptoms. However, the literature is mixed regarding the types of emotion regulation deficits evidenced among youth with ADHD. Research has suggested that children with ADHD and other disruptive behavior disorders show more negative emotionality and decreased emotional regulation of negative emotions (Martel, 2009; Sanson & Prior, 1999). The dimension of emotion regulation examined in the current study was mood quality, with the hypothesis that children with higher ADHD symptoms would exhibit more negative mood, a construct related to emotion regulation.

Shared risk factors among conditions may account for the co-occurrence of ADHD and co-occurring symptoms (e.g., parenting behaviors, emotion regulation deficits). Though there is research linking emotion regulation deficits to ADHD, ODD, CD, anxiety, and depression, little research evaluates emotion regulation as a predictor of co-occurring symptom groups, stability of these symptom groups, or transitions among these groups. It was hypothesized that emotion regulation deficits would predict transitions to and stability of classes characterized by elevated co-occurring symptoms among children with ADHD symptoms. Specifically, children with ADHD who exhibit a negative temperamental style

and negative mood may be more likely to exhibit co-occurring ODD symptoms. It is hypothesized that children with ADHD symptoms and negative emotionality would exhibit higher CD symptoms, consistent with research related to CD, callous-unemotional traits, and emotion regulation. Children who exhibit high negative emotionality in conjunction with ADHD symptoms may be predisposed to develop anxiety and depression symptoms as well (Seymour et al., 2012; Suveg & Zeman, 2004).

It was hypothesized that classes would differ in mean levels of parenting style and parenting style would predict transitions to classes characterized by co-occurring symptoms for each of the four co-occurring conditions. Specifically, maternal acceptance of youth, use of guilt to control their child, and enforcement of rules were expected to be higher among classes with co-occurring symptoms. As outlined previously, parenting style is especially linked to the development of ODD and CD among youth with ADHD (Burt, Krueger, McGue, & Iacono, 2001; Deault, 2010; Patterson, DeGarmo, & Knutson, 2000), and thus low acceptance and low enforcement of rules were expected to be related to classes with higher levels of externalizing symptoms (e.g., mean levels, transitions to these classes). It was also hypothesized that parenting styles related to guilt and acceptance would predict risk or resilience among children with ADHD and anxiety/depression.

Hypothesis 3b. A third explanation suggests that correlates or sequelae of ADHD confer risk for additional conditions. The mechanisms or correlates of ADHD that predict the development of co-occurring symptoms would be evident by examining what predicts the transitions among classes in the LTA. It was hypothesized that emotion regulation and parenting style would act as the correlates of ADHD that confer risk for subsequent co-occurring symptoms. Thus, children would transition from a pure ADHD group to an ADHD

plus co-occurring symptoms group at a subsequent time point according to the LTA, and emotion regulation and/or parenting would predict these transitions. For example, if parenting style is a correlate of ADHD that confers risk for depression, a participant in a pure ADHD group at Time 1 who also experiences poor parenting style might transition to an ADHD plus co-occurring depression group at Time 3.

CHAPTER 2

METHOD

Participants

The current study used data collected at the Center for Education and Drug Abuse Research (CEDAR) at the University of Pittsburgh as part of a National Institute on Drug Abuse (NIDA)-funded longitudinal study. The CEDAR project has been continuously approved by the University of Pittsburgh's Institutional Review Board (grant number 2 P50 DA05605). The secondary data analyses in this sample were exempt because the analyses involved the study of existing data and the information was recorded by the investigators in such a manner that participants cannot be identified. For these reasons, these analyses met criteria for exemption based on Temple University's Institutional Review Board.

The CEDAR project aimed to elucidate the etiology of substance abuse and substance use disorder using a longitudinal research design. Participants included children who were studied over a 20-year period. Assessments began in 1990 and by 2009, 775 families had been recruited. Recruitment and baseline assessments occurred when index children were 10-12 years (Time 1). Follow-up assessments of interest for the present study were completed when index children were 12-14 years (Time 2) and 16 years (Time 3).

Three groups of male and female children who were at high and low risk for substance use disorders were recruited. Biological fathers (probands) with and without a history of substance use disorders and/or psychiatric diagnoses who had a 10-12 year old child (index child) were recruited through substance use disorders treatment programs, social service agencies, newspaper and radio advertisements, public service announcements, and

random digit telephone calls. Utilizing many recruitment sites decreased the risk of sampling bias (Merikangas et al., 1998). Index children were classified by one of three groups according to their father's lifetime prevalence of mental health disorders: (a) history of substance use disorder, (b) history of other psychiatric diagnosis not including substance use disorder, or (c) no lifetime history of psychiatric diagnosis. Fathers were screened for substance abuse or dependence disorder history using *DSM-III-R* criteria (1987), which was the most recent version of the *DSM* when the study began.

The present study used data from index children who completed assessments at Time 1 (10-12 years old; *N*=775, 72% male) and at least one other assessment: either Time 2 (12-14 years old; *n*=651; 71% male) or Time 3 (16 years old; *n*=618, 73% male). Recruitment of female index children began later than males because of changes in NIH gender equity regulations after the CEDAR project commenced. The sample is predominantly Caucasian (78%; 18% African-American, 4% other ethnicities). Families were excluded from the study on the basis of a history of neurological disorders, schizophrenia, or uncorrectable sensory incapacity in the father; or neurological injury requiring hospitalization, IQ less than 70, chronic physical disability, uncorrectable sensory incapacity, or psychosis in the index child. More extensive recruitment source information and procedures, as well as inclusionary and exclusionary criteria, are described in detail elsewhere (Clark et al., 1997).

Procedure

Procedures were approved by the University of Pittsburgh Institutional Review Board. Adult participants were provided with informed consent, as well as information about the goals, procedures, risks, and benefits of the research protocol. Of the fathers recruited and meeting criteria to participate, 87% consented. Minor children provided assent. A Certificate

of Confidentiality was obtained from NIDA to protect participants. Mothers reported on child ADHD symptoms and co-occurring psychological symptoms at Time 1 and emotion regulation at Time 1. Index children reported on their mothers' parenting behaviors at Time 1 and their own ADHD symptoms at Times 2 and 3.

Measures

ADHD symptoms. At Times 1, 2, and 3, ADHD symptoms were assessed using a modified version of the Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS) (Kaufman et al., 1997, Puig-Antich et al., 1981), which also uses *DSM* criteria to rate children on inattentive and hyperactive-impulsive symptoms of ADHD. At the time of the study, the K-SADS was based on *DSM-III-R* criteria. Parents reported on their children's ADHD symptoms (14 symptoms) at Time 1 using the K-SADS, and index children reported on their own symptoms at Times 2 and 3. The K-SADS was administered to the youth and to one parent or guardian as a collateral informant. Whenever the assessor detected symptoms of a psychiatric disorder, youth and parents were asked to estimate the age of onset for the symptom. Rather than use criteria for the disorder, a summary score of ADHD symptoms (present or absent) was used to capture symptoms that are impairing for youth but do not reach clinical thresholds. Clinical diagnoses were also available using *DSM* cutoffs. All final diagnoses were made in clinical consensus conferences that included the assessor, the assessment coordinator, and a clinically experienced faculty psychiatrist using the best estimate method (Kosten & Rounsaville, 1992; Leckman et al., 1982). If discrepancies occurred between parent and child report on the onset age for psychiatric disorders, then all information was considered and age of onset was based on the judgment of the case conference team. The K-SADS was administered by master's level clinical associates who

were trained to a level of agreement with experienced clinicians of 90%. Inter-rater reliabilities for various disorders were shown to be in the .80 to .90 range.

Co-occurring psychological symptoms. Index children were assessed for anxiety, depression, ODD, and CD using the K-SADS, as described above for ADHD symptoms. Symptoms of major depressive disorder (9 symptoms), separation anxiety disorder (9 symptoms), ODD (9 symptoms), and CD (15 symptoms) were assessed and scored both dimensionally (i.e., symptom counts) and categorically (i.e., according to diagnostic criteria). Generalized anxiety disorder was not measured at Times 1, 2, or 3, and social phobia was assessed with very few questions, leading to extremely skewed data and low variability on the questions. Thus, separation anxiety was the only index of anxiety feasible for use in the present study from the K-SADS. Index children reported on their own symptoms using the K-SADS (Times 1, 2, and 3). Mothers reported on index children's symptoms at Time 1, and index children reported on their own symptoms using the K-SADS at Times 2 and 3. Symptom counts were used for each disorder to capture symptoms that do not reach clinical thresholds for disorders but nonetheless are impairing for youth. Diagnoses were also available based on *DSM* clinical diagnosis criteria and cutoff scores.

Emotion regulation. Mothers reported on youth temperament using the Revised Dimensions of Temperament Survey (DOTS-R; Windle, 1992) at Time 1, which was used as an index of emotion regulation. Fifty-four items were rated from 1 (*usually false)* to 4 (*usually true*). Higher scores indicate higher levels of temperamental emotion dysregulation and lower scores indicate higher levels of negative mood (Tarter et al., 2003). The Mood Quality subscale (7 items, $\alpha = .87$) was used as an index of emotion regulation, consistent with prior research in the present sample (Giancola, 20000; Kirisci & Blackson, 1996).

Several studies have determined that the DOTS-R is reliable and valid (Carson, Council, & Volk, 1989; Windle, 1989, 1991). Mothers rated items on a four-point scale from 1 (*usually false*) to 4 (*usually true*), with higher scores indicating higher levels of temperamental positive mood and lower scores indicating higher levels of negative mood (Tarter et al., 2003). Based on previous research in the proposed sample (Kirisci & Blackson, 1996; Mezzich et al., 2007), emotion regulation was indexed by the sum of endorsed responses on this subscale. The DOTS-R has high reliability and stability, moderate-to-high inter-rater agreement, and predictive validity with internalizing and externalizing problems (Chang et al., 2003; Masi et al., 2003), as well as substance use disorders in the present sample (Giancola & Mezzich, 2003). Further, the mood quality subscale specifically has demonstrated moderate stability, with no statistically significant changes, across a six-year period during adolescence to early adulthood (Windle & Windle, 2006).

Parenting style. Index children reported on their mothers' parenting style at Time 1 using the Children's Report on Parental Behavior Inventory (Schludermann & Schludermann, 1970), an 162-item measure scored on a scale from *Very True (1)* to *Not at All True (3)*. The measure asks children how their parents have acted toward them and yields factors including acceptance/rejection, psychological autonomy/psychological control, and firm control/lax control. Three subscales corresponding to these factors were used: Acceptance ("My mother seems to see my good points more than my faults"), control through guilt ("My mother says if I loved her, I'd do what she wants me to do", and enforcement of rules ("My mother makes sure I obey even if I complain or protest"). Reliability and validity of the CRPBI and its subscales have been well established, demonstrating excellent reliability, concurrent validity, criterion validity, and convergent validity (Locke & Prinz, 2000; Schludermann &

Schuldermann, 1970) and construct validity with other measures of parenting behavior (Safford, Alloy, & Pieracci, 2007; Steele et al., 2005). The CRPBI has significant relations with both internalizing and externalizing disorders, as well as temperament (Bogels, 2004; Lengua, 2006).

Socioeconomic status. Household socioeconomic status (SES) was indexed using Hollingshead ratings (Hollingshead, 1990). SES has demonstrated associations with parenting strategies, given that limited economic resources are associated with family stress and parenting difficulties (Campbell et al., 2000; Hoff, Laursen, & Tardif, 2002). Given the association between SES and several of the study variables, SES was considered as a covariate in analyses.

ADHD treatment status. Youth and parents were asked whether the child was receiving current ADHD treatment (psychotropic and/or psychotherapy) at Time 1, 2, and 3. Additionally, 45 youth had ADHD treatment at Time 1, 19 youth at Time 2, 10 at Time 3.

Statistical Analyses

Consistent with the aims of the current study, analyses examined the relations among ADHD symptoms, emotion regulation, parenting, and various co-occurring symptoms over three time points (ages 10-12, ages 12-14, and age 16). Preliminary analyses included descriptive analyses and correlation matrices conducted in SPSS version 22 to determine whether distributions were appropriate for the proposed analyses, and to identify any potential issues with multicollinearity among variables. Primary analyses were conducted using Mplus 7.11 (Muthén & Muthén, 1998-2014). To address missing data, Mplus uses Full-Information Maximum Likelihood (FIML) estimation, which conducts parameter estimation and estimates standard errors all in one step using all available data (Graham,

2009). FIML does not estimate the missing data, as would be the case with mean- or regression-based imputation techniques; instead, it fits the covariance structure model directly to the observed (and available) raw data for each participant (Enders, 2001). FIML assumes that the missing data are either missing completely at random (MCAR) or missing at random (MAR).

Aim 1. To identify subgroups of youth with different profiles of ADHD and co-occurring symptoms.

Latent class analysis. To address the first goal, latent class analysis (LCA) was conducted. LCA (Muthén & Muthén) empirically derives groups of individuals based on the aggregation of observed items. LCA is a person-centered data reduction method for identifying unmeasured class membership among participants using categorical and/or continuous observed variables, capturing unobserved heterogeneity in outcomes (Heinen, 1996; McCutcheon, 2002). LCA was used to estimate models examining subgroups of children with varying levels of ADHD and co-occurring symptoms at ages 10-12, 12-14, and 16 years. LCA refers to these groups of individuals as latent categorical classes. Each latent class (e.g., high on ADHD and ODD symptoms) describes the relations among observed items (i.e., frequency of ADHD and ODD symptoms). Using a dimensional approach to observed items of empirically derived latent classes is more effective than traditional classification of classes using a cut-off score (Nylund, Bellmore, Nishina, & Graham, 2007b). Cut-off scores and categorical approaches do not account for symptom levels that do not reach clinical threshold or significance, but are nonetheless impairing among youth (Angold et al., 1999; Drabick, 2009; Maser, 2009). This dimensional method also reduces classification errors resulting in false positives or negatives, decreased ability to predict

differences in outcomes, difficulties in identifying and generalizing rates of behavior, and decreased validity for identifying youth who potentially may benefit from prevention and intervention efforts. Thus, LCA is an especially appropriate approach for identifying subgroups of youth with ADHD and co-occurring symptoms, given that symptom levels were expected to vary in frequency and quality across classes and across time.

LCA uses both statistical indices and conceptual or practical implications in selection of the best-fitting model (Nylund et al., 2007b). The 1-class model, which is the independence model based on the observed means in the data, is fit first (Nylund et al., 2007b). Next, the number of classes incrementally increases until the models no longer converge and/or no longer are conceptually sound. Two model parameters are evaluated to assess model fit: item probability parameters and class probability parameters. Item parameters correspond to conditional item probabilities, which are dependent on latent class membership (Nylund et al., 2007b). The item probability parameter describes the probability that an individual in a given latent class has of endorsing that item. The class probability parameters contain information regarding the prevalence of each class in the population (i.e., the relative frequency of this class membership). Conditional item probabilities relay substantive meaning for each class. Values are plotted in an item probability plot, which facilitates interpretation of the latent classes and illustrates each class's profiles of item endorsement (Nylund et al., 2007b). The fit of each model to the data is determined by the conceptual model and model fit parameters (described below), with an emphasis on model parsimony. Each model is compared to the model with one fewer class (Nylund et al., 2007b).

Statistical fit indices are used to assess the model fit and to determine the number of classes at each time point. Given that there is no "gold standard" for determining the model that best fits the data, several statistical indices are used to determine model selection. The Bootstrap Likelihood Ratio Test (BLRT; Nylund, et al., 2007b) estimates the log likelihood differences and compares the fit of the model with *k* classes to the model with *k-1* classes to evaluate if adding an additional class significantly improves model fit. This method of bootstrapping for LCA models has been demonstrated to be an accurate indicator of the true number of classes. The Akaike Information Criterion (AIC; Akaike, 1987); Bayesian Information Criterion (BIC; Schwartz, 1978); and sample-size Adjusted BIC (ABIC; Sclove, 1987) are other frequently used indices and the model that yields the smallest values on these indices indicates the best-fitting model (Nylund et al., 2007b). Although often considered, the AIC is less consistent as an index of model fit for LCAs (Yang, 2006), whereas the BLRT and BIC indices are the most reliable indicators of model fit in LCA (Nylund et al., 2007b). The BIC is the most widely used indicator for determining number of classes in LCA models (Nylund, Asparouhov, & Muthén, 2007a). However, it also is important to consider conceptual information about the model when determining the best fit with the BIC index. For instance, the BIC value may decrease with each additional class, though the decrements with each additional class may become relatively small and the classes may no longer be conceptually meaningful.

Model selection is also based on substantive theory and the conceptual model underpinning the analyses, as well as smallest class size. Very small class sizes (e.g., < 4% of sample) could suggest over-fitting of the data and lower likelihood of replicating the model. In addition, the value and utility of the classes can be assessed using entropy, which

measures the degree to which the latent classes are distinguishable and the precision with which individuals are placed into classes. Entropy ranges from 0 to 1, with higher values indicating clearer class separation, and is based on individual estimated posterior class probabilities (Masyn, Henderson, & Greenbaum, 2010). Last, posterior class probabilities are estimated, which are an index of the individual's probability of belonging to each class of the fitted model, given the individual's observed response pattern for ADHD and co-occurring symptoms. Posterior probabilities are based on the model's estimated item probabilities and estimated prevalence of each latent class.

Auxiliary analyses examined whether classes differed on demographic variables (i.e., age, sex, and SES). Omnibus equality of means tests examined differences in means. For any significant omnibus tests, pairwise comparisons were considered to identify significant differences among the classes.

Hypothesis 1. LCA models were created at all three time points, identifying groups of children with ADHD symptoms and co-occurring symptoms. Although specific groups at Time 1 are hypothesized, given the consideration of multiple sets of co-occurring symptoms, lack of longitudinal research regarding ADHD and co-occurring symptoms, and varying developmental patterns of the symptoms over time, I did not hypothesize specific classes for subsequent time points.

Aim 2. To examine stability of class membership for ADHD and co-occurring symptom groups across late childhood and adolescence and test the explanation that ADHD confers risk for co-occurring symptoms.

Latent transition analysis. Latent transition analysis (LTA; Clogg, 1995) was used to examine developmental patterns of ADHD and co-occurring symptoms across late

childhood to early adulthood. LTA examines changes, or transitions, in latent categorical classes of individuals over time (e.g., Nylund, 2007). LTA uses information from the LCA as a measurement model for identifying unique classes at each time point, and uses autoregressive modeling as a structural model to describe transitions among classes over time. Thus, discontinuous change is modeled through LTA (for example, change from the ADHD and ODD symptoms class to an ADHD, ODD, and CD symptoms class) (see Figure 1). These models use conditional probabilities to describe change among categorical outcomes across time. The relation between two categorical outcomes is specified as a multinomial logistic regression, where the outcome at time *t* is regressed on the variable *t-1*.

To conduct the LTA, the best-fitting LCA model for each time point first was used as a measurement model (Nylund, 2007). Measurement invariance was examined to determine whether parameters for each class are equal across time or vary, and models were constrained or free to vary accordingly. However, depending on the type and number of classes derived at each time point from the LCA, measurement invariance was assessed prior to longitudinal modeling of transition patterns using likelihood ratio tests.

Finally, autoregressive models were conducted using the measurement models from the LCAs at each time point to assess transitions or continuity in class membership over time. After individuals were assigned to a class at each time point (i.e., modal class assignment) based on the LCA, cross-tabulation of stability and transitions among classes was examined as preliminary information. Then autoregressive models identified transitions from each time point (i.e., changes from ages 10-12 to 12-14 and from 12-14 to 16; Figure 1) to examine developmental transitions of individuals based on severity and type of ADHD and co-occurring symptoms over time.

Hypothesis 2. LTA modeling examined developmental patterns of ADHD and co-occurring symptoms over time. As stated, it is likely that children may transition from an ADHD and ODD symptom group to a CD symptom groups, youth with ADHD will exhibit higher levels of CD and depression over time, and ADHD symptoms will likely decrease over development with greater decreases in symptoms in adolescence. In terms of internalizing symptoms, youth were expected to move into classes characterized by higher levels of depressive symptoms in adolescence. If ADHD confers risk for other conditions, the LTA would show transitions from a pure ADHD symptom group to an ADHD plus other co-occurring symptoms class. For example, if a child has ADHD at Time 1 and transitions to an ADHD plus CD class at Time 2, this pattern of findings would be consistent with this explanation.

Aim 3. To test the explanation that shared risk factors account for co-occurring symptoms among youth with ADHD, or that correlates of ADHD confer risk for co-occurring symptoms. Examine emotion regulation and parenting behaviors as predictors of stability and transitions among classes.

Hypothesis 3a. Shared risk factors among ADHD and co-occurring symptoms (e.g., parenting behaviors, emotion regulation deficits) may account for the co-occurrence of ADHD and other symptoms. Levels of emotion regulation were examined within each LCA class. It was hypothesized that groups with higher ADHD symptoms and/or co-occurring symptoms would exhibit lower levels of emotion regulation. Tests of equality of means across latent classes were conducted to determine whether classes differed in levels of emotion regulation. The test of equality of means holds class membership constant and

provides chi-square statistics for omnibus and pairwise comparisons across latent classes. Pairwise comparisons were examined only if the omnibus tests were significant.

Hypothesis 3b. A third explanation suggests that correlates or sequelae of ADHD confer risk for additional co-occurring symptoms. It was hypothesized that emotion regulation and parenting style would act as the correlates of ADHD that confer risk for subsequent co-occurring symptoms. Thus, children would transition from a pure ADHD group to an ADHD plus co-occurring symptoms group at a subsequent time point according to the LTA, and emotion regulation and/or parenting would predict these transitions. For example, if parenting style is a correlate of ADHD that confers risk for depression, a participant in a pure ADHD group at Time 1 who also experiences poor parenting style might transition to an ADHD plus co-occurring depression symptoms group at Time 3.

It was predicted that lower levels of emotion regulation would be associated with higher levels of co-occurring symptoms and more severe symptoms over the course of development. To test this hypothesis, first the overall effect of emotion regulation was tested as a logistic regression on the transition from Time 1 to Time 2 and Time 2 to Time 3 (see Figure 1). The logistic regression test demonstrates whether the effect of emotion regulation is a significant predictor of subsequent group membership. For example, emotion regulation at Time 1 × ADHD/comorbid condition membership class at Time 1 (e.g., ADHD/Co1) was tested as a predictor of subsequent group membership using the LCA models from Aim 1 (e.g., ADHD/Co2).

Next, transition probabilities were examined, allowing comparison of transition probabilities across transition points and across low and high levels of the predictors. Youth were divided into low and high levels of emotion regulation or parenting style predictors

using a median split of these variables because of the (a) range of the variables in the present sample and (b) lack of gold standard cut-offs for these measures that could inform which cut-points to use to determine high and low levels of these predictors. Then, transition probabilities from Time 1 to Time 2 and Time 2 to Time 3 were examined according to whether youth were low or high on predictors and according to class membership. For example, probabilities were examined for youth low on emotion regulation who were in any of the three classes at Time 1 transitioning to Time 2.

It was expected that parenting style also will predict class membership, such that children who exhibit ADHD symptoms and reportedly experience poor parenting (i.e., lower levels of acceptance, higher levels of guilt, and lower levels of rule enforcement) will be more likely to continue to exhibit ADHD symptoms and develop co-occurring symptoms over time. Similar analyses were conducted as those analyses described above evaluating emotion regulation as a predictor of class membership.

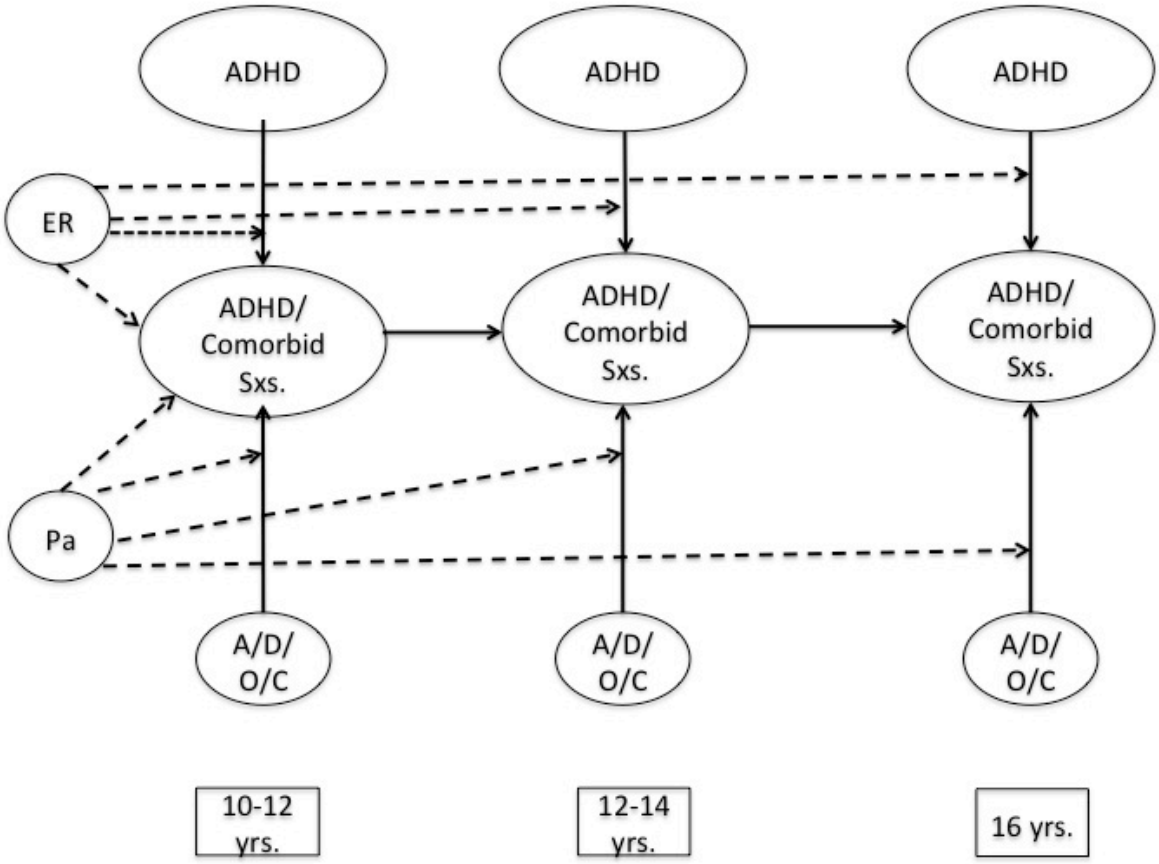

Figure 1. Latent transition model of child ADHD and co-occurring symptoms: Patterns of latent ADHD/co-occurring symptom class membership across Times 1, 2, and 3. *Note.*ADHD/Comorbid Sxs.= latent variable describing type and severity of index child attention-deficit/hyperactivity disorder symptoms and co-occurring symptoms at each time point; A/D/O/C=anxiety, depression, oppositional defiant disorder, and conduct disorder symptoms (measured separately but consolidated for the sake of parsimony in the model); ER=emotion regulation as predictor; Pa=parenting style as predictor (maternal acceptance of child, maternal use of guilt to control child, and maternal enforcement of rules).

CHAPTER 3

RESULTS

Descriptive Statistics

Continuous study variables at Time 1 were significantly correlated in expected directions (see Table 1). For example, lower SES was correlated with higher summed levels of ADHD and co-occurring symptoms. Bivariate correlations indicated continuity in ADHD symptoms (e.g., T1 ADHD with T2 and T3 ADHD) and ODD, CD, MDD, and SAD symptoms. Emotion regulation and parenting were correlated in expected directions with ADHD and co-occurring symptoms across Times 1, 2, and 3 (Table 1). For example, poorer emotion regulation at Time 1 was related to higher levels of ADHD and comorbid conditions.

Table 2 shows the percentages of youth meeting diagnostic criteria based on the K-SADS *DSM-III-R* for ADHD, ODD, CD, MDD, and SAD, as well as ADHD and each comorbid condition, (e.g., ADHD+ODD) at each time point. At Time 1, ADHD had the highest percentage of youth meeting diagnostic criteria for a single disorder. At Times 2 and 3, CD had the highest rate for a single disorder. Decreases in rates of youth meeting diagnostic criteria for ADHD, ODD, and SAD and increases in CD and MDD were evidenced over time. At Time 1, ADHD+ODD had the highest comorbidity rate for youth meeting diagnostic criteria for both disorders. At Times 2 and 3, ADHD+ODD and ADHD+CD had the highest rates for comorbid disorders. No youth (0%) met diagnostic criteria for ADHD and each of the co-occurring conditions considered concurrently (ADHD+ODD+CD+ MDD+SAD) at any of the three time points.

Additionally, an analysis of attrition was conducted. An independent samples *t* test demonstrated that youth who had data at all three time points did not significantly differ on their ADHD symptoms summary score than youth who were missing at a subsequent time point after Time 1 ($t(773)=.337$, $p=.736$).

Table 1.
Bivariate Correlations among Continuous Study Variables

Variable	1	2	3	4	5	6	7
1. V1 Age	-						
2. SES	.06	-					
3. ADHD T1	.04	-.16**	-				
4. ADHD T2	-.04	-.15**	.50**	-			
5. ADHD T3	.04	-.15**	.37**	.59**	-		
6. CD T1	.13**	-.19**	.39**	.32**	.20**	-	
7. CD T2	.16**	-.18**	.24**	.36**	.21**	.37**	-
8. CD T3	.05	-.16**	.23**	.36**	.33**	.35**	.41**

Table 1. (continued)

Variable	8	9	10	11	12	13	14
9. ODD T1	.28**	-					
10. ODD T2	.35**	.40**	-				
11. ODD T3	.47**	.25**	.34**	-			
12. MDD T1	.02	.24**	.13**	.13**	-		
13. MDD T2	.08	.10*	.25**	.11**	.11**	-	
14. MDD T3	.21**	-.00	.10*	.24**	.07	.18**	-
15. SAD T1	.08	.27**	.12**	.09*	.26**	.06	.07

Table 1. (continued)

Variable	15	16	17	18	19	20	21
16. SAD T2	.48*	-					
17. SAD T3	.30*	.33**	-				
18. ER	-.11**	-.11**	-.13**	-			
19. Acceptance	-.08*	-.03	-.00	.10**	-		
20. Guilt	.10**	.06	.12**	-.12**	-.16**	-	
21. Rule Enforcement	.00	-.06	-.04	.06	.31**	-.40**	-
Mean	.89	.51	.14	25.29	21.98	17.51	17.32
SD	1.58	1.30	.53	3.15	5.99	3.97	3.18

Table 2.
Percentage of Individuals Meeting Diagnostic Criteria for Single Disorders and Comorbid ADHD at Times 1-3

	Time 1	Time 2	Time 3
ADHD	13.0	5.7	3.4
ODD	10.2	5.0	2.3
CD	3.1	5.9	7.5
MDD	4.6	4.3	6.2
SAD	7.1	1.3	0.1
ADHD+ODD	3.6	1.3	0.8
ADHD+CD	1.5	1.3	0.9
ADHD+MDD	0.9	0.8	0.6
ADHD+SAD	1.3	0.1	0.0

Note. Diagnostic criteria based on K-SADS *DSM-III-R* criteria. ADHD = attention-deficit/hyperactivity disorder diagnosis; ODD = oppositional defiant disorder diagnosis; CD = conduct disorder diagnosis; MDD = major depressive disorder diagnosis; SAD = separation anxiety disorder diagnosis; ADHD+ODD = ADHD and ODD diagnosis; ADHD+CD = ADHD and CD diagnosis; ADHD+MDD = ADHD and MDD diagnosis; ADHD+SAD= ADHD and SAD diagnosis.

Aim 1: Identification of Classes across Times 1, 2, and 3

At Times 1, 2, and 3, cross-sectional LCA models of ADHD and co-occurring symptoms were run by first testing a one-class model (i.e., the independence model) and then exploring models with more classes. For each of the LCA models at Times 1, 2, and 3, tables describe fit information (i.e., log likelihood ratio, AIC, BIC, ABIC, *p* value for the BLRT, entropy, smallest class size) for LCA models with one through five classes (Tables 3, 4, and 5, respectively). Row 1 contains the fit indices for a one-class model, row 2 for a two-class model, and so on. As previously noted, the BLRT and BIC indices provide the most reliable indicators of true number of classes (Nylund et al., 2007), so these indices primarily were considered in the model building process. In addition, for each LCA model, the means of each indicator for each class are displayed in figures. Finally, relations with demographic covariates are reported to further describe classes for each LCA model.

LCA at Time 1. Examining results for the LCA model at Time 1 (Table 3), the BIC is minimized in the three-class model and thus indicates that the three-class model fits the data best. Other indices continue to indicate a better fitting model with each additional class (i.e., log likelihood, AIC, ABIC, BLRT); however, the four-class model did not reveal substantively distinct or meaningful classes, indicating that youth in the fourth class likely had extreme values on some scores and were placed into their own class. The three-class model had adequate delineation of classes as indicated by the excellent entropy (.935). Posterior class probabilities ranged from .934 to .999, indicating that a very high percentage of youth were placed into a class that reflects their respective levels of severity of ADHD and co-occurring symptoms. The smallest class size (8%, $n = 62$) was both reasonable in size and

conceptually meaningful. In sum, multiple fit indices and parameters indicate that the three-class model best fits the data at Time 1.

Table 3.
Class Model Comparison at Ages 10-12

Classes	Free parameters	Log likelihood	AIC	BIC	ABIC	BLRT	Entropy	Smallest Class Size *n* (%)
1	10	-8147.318	16314.636	16361.164	16329.41	N/A[a]	1	775 (100.0)
2	16	-7539.434	15110.868	15185.314	15134.507	0.000	0.998	62 (8.0)
3	22	-7291.37	14626.74	14729.103	14659.243	0.000	0.935	62 (8.0)
4	28	-7058.413	14172.826	14303.106	14214.193	0.000	0.951	38 (4.9)

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion, ABIC=Adjusted BIC; BLRT = Bootstrap Likelihood Ratio Test.
[a]BLRT is not available for the one-class model.

Given the means of the summary scores for each disorder for each class at Time 1 (see Figure 2), the three classes were distinguished by (1) low levels of all symptoms (ADHD, ODD, CD, MDD, SAD; labeled the Low Symptoms class); (2) ADHD and externalizing behaviors (labeled the ADHD+Ext. class); and (3) ADHD and depression with mild separation anxiety symptoms (labeled the ADHD+Int. class). The Low Symptoms class (79.6%) included youth with lower levels of ADHD symptoms ($M = 2.767$), and very low ODD, CD, MDD, and SAD symptoms.

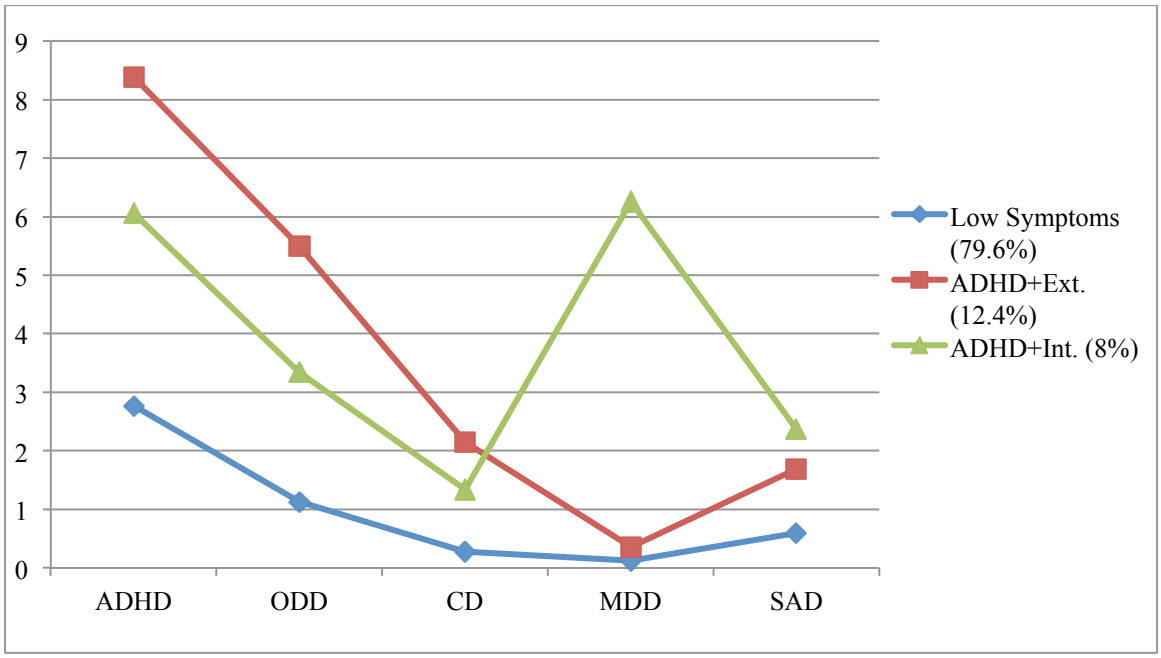

Figure 2. Mean Summary Scores for the Three-Class Model of ADHD and Co-occurring Symptoms at Ages 10-12 (*N*=775). Percentage of sample classified in each latent class provided in legend.

The ADHD+Ext. class (12.4%) exhibited levels of ODD that reach clinical significance (4 symptoms required to meet the criteria threshold according to DSM (versions III through 5) and levels of CD that approached clinical significance (3 symptoms required to meet the DSM criteria threshold). Similarly, levels of depression symptoms for the ADHD+Int. class (8.0%) approached clinical significance, with ADHD levels also close to clinical significance, suggesting that these symptoms may be associated with impairment among members of this class (e.g., Angold et al., 1999).

In terms of demographic differences, follow-up equality of means omnibus tests were conducted and pairwise comparisons were examined if the omnibus tests were significant. The omnibus test was significant for SES ($\chi^2(2) = 18.47$, $p = .000$, $\varphi = .15$). Follow-up pairwise comparisons demonstrated that youth in the ADHD+Ext. ($M = 36.60$; $\chi^2(1) = 9.867$, $p = .002$, $\varphi = .11$) and the ADHD+Int. ($M = 37.08$; $\chi^2(1) = 9.306$, $p = .002$, $\varphi = .11$) classes

had significantly lower SES than children in the Low Symptoms class (M = 42.59). Age did not differ significantly across classes based on the omnibus test ($\chi^2(2) = 4.488$, p =.106, φ = .08). Follow-up logistic regressions demonstrated that there were more males in the ADHD+ Ext. class than in the Low Symptoms class ($t(774) = 3.832$, p = .000, Cohen's d = .28). Youth in the ADHD+Ext. class at Time 1 were significantly more likely to have experienced treatment for ADHD than youth in the Low Sxs. class ($t(774)=3.729$, p=.000, d=.27). Youth in the ADHD+Int. class at Time 1 were significantly more likely to report treatment for ADHD than youth in the Low Sxs. class ($t(774)=2.492$, p=.013, d=.18)

LCA at Time 2. Similar to the LCA findings at Time 1, results for the LCA model at Time 2 (see Table 4) indicated a three-class model best fit the data. Given that the 3-class model already had a class with a small n (4.1% of sample), a 4-class model was not run. The BIC is minimized in the three-class model, and it had good delineation of classes (entropy=.968; posterior class probabilities ranging from .977 to .988). The smallest class size (4.1%, n = 29) represented a small percentage of the sample, though acceptable according to LCA model fit guidelines, and was a substantively meaningful class.

Table 4.
Class Model Comparison at Ages 12-14

Classes	Free parameters	Log likelihood	AIC	BIC	ABIC	BLRT	Entropy	Smallest Class Size *n* (%)
1	10	-6420.349	12860.698	12906.435	12874.683	N/A[a]	1	716 (100.0)
2	16	-5722.791	11477.582	11550.76	11499.956	0.000	.980	35 (4.9)
3	22	-5471.983	10987.965	11088.586	11018.73	0.000	.968	29 (4.1)

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion, ABIC=Adjusted BIC; BLRT = Bootstrap Likelihood Ratio Test.
[a]BLRT is not available for the one-class model.

Examination of patterns of summary score means for each class at Time 2 (see Figure 3) indicates that the three classes at Time 2 were similar to the classes identified at Time 1 (i.e., Low Symptoms, ADHD+Ext., ADHD+Int.). As hypothesized, ADHD symptoms were lower compared to Time 1 across all classes as youth were older at Time 2. At Time 2, the Low Symptoms class (86.2%) was defined by similar patterns of symptoms as the Low Symptoms class at Time 1, with lower levels of symptoms overall. At Time 2, the ADHD+Ext. class (13.4%) also demonstrated similar patterns of symptoms to the ADHD+Ext. class at Time 1. However, although means of ADHD, ODD, and SAD symptoms were lower in this class at Time 2 compared to Time 1, means of CD symptoms increased and Depression symptoms remained fairly consistent. Finally, at Time 2, the ADHD+Int class (4.1%) was characterized by similar patterns of symptoms as the ADHD+Int. class at Time 1. However, means of ADHD, ODD, and SAD symptoms were slightly lower at Time 2 than Time 1, whereas CD and Depression symptoms remained fairly consistent relative to the Time 1 class means for these variables.

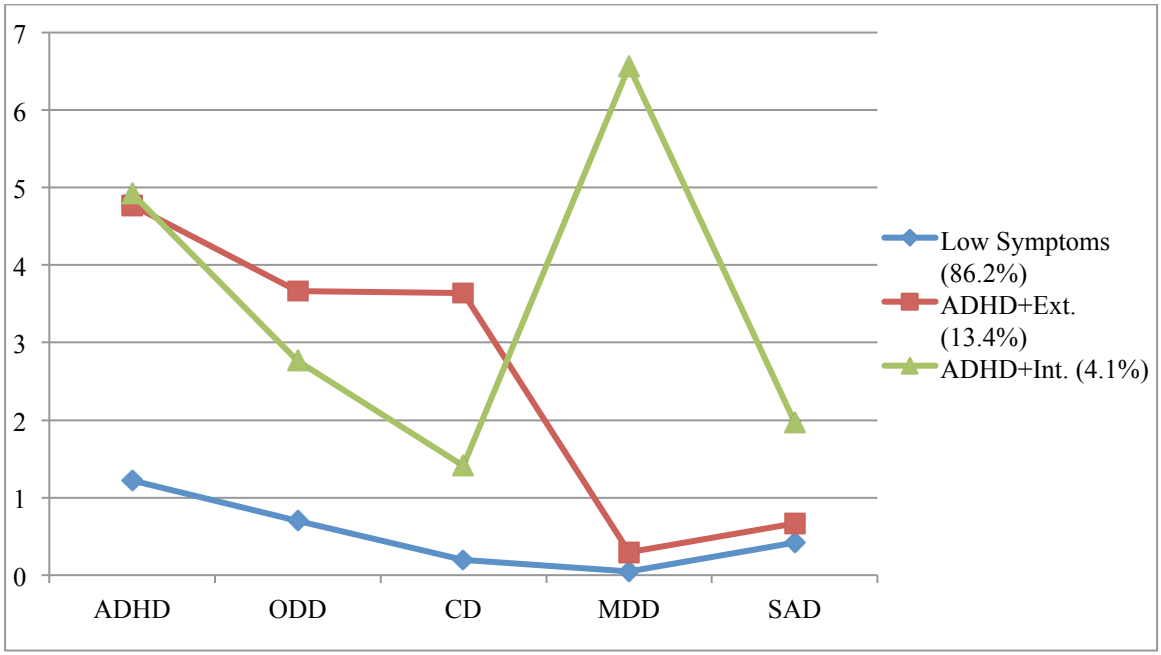

Figure 3. Mean Summary Scores for the Three-Class Model of ADHD and Co-occurring Symptoms at Ages 12-14 (n=716). Percentage of sample classified in each latent class provided in legend.

To examine demographic differences, follow-up equality of means omnibus tests and pairwise comparisons were conducted. The omnibus test was significant for SES ($\chi^2(2) = 15.194$, $p = .001$, $\varphi = .15$). Follow-up pairwise comparisons demonstrated that youth in the ADHD+Ext. ($M = 35.46$; $\chi^2(1) = 12.269$, $p = .000$, $\varphi = .13$) and the ADHD+Int. ($M = 38.28$; $\chi^2(1) = 3.256$, $p = .001$, $\varphi = .07$) classes had significantly lower SES than children in the Low Symptoms class ($M = 43.46$). Additionally, the omnibus test was significant for comparing age across all three classes ($\chi^2(2) = 9.849$ $p = .007$, $\varphi = .12$). Follow-up pairwise comparisons demonstrated that youth in the ADHD+Int. class ($M = 11.76$; $\chi^2(1) = 12.269$, $p = .000$, $\varphi = .13$) were older than children in the Low Symptoms class ($M = 11.37$). Follow-up pairwise comparisons demonstrated that children in the ADHD+Ext. class were more likely to be male than children in the ADHD+Int. class ($t(715) = 2.061$, $p = .04$, $d = .15$) and the Low Symptoms class ($t(715) = 2.105$, $p = .04$, $d = .16$). Compared to youth in the Low Sxs. class,

youth in the ADHD+Ext. and ADHD+Int. classes did not differ in terms of their receipt of treatment for ADHD (*t*'s < -.861, *p*'s > .38)

LCA at Time 3. Results for the LCA model at Time 3 (see Table 5) also indicated a three-class model best fit the data. However, the patterns of symptoms among the classes differed slightly from the patterns identified at Times 1 and 2. The three-class model minimized the BIC, had good separation of classes (entropy = .987), and high association between symptom patterns and class assignment (posterior class probabilities range =.995 to 1.0). The smallest class size (3.9%, *n* = 25) was relatively small but conceptually important and thus retained. Because of this small class in the 3-class model and related concerns regarding overfitting the data and generalizability, a 4-class model was not examined.

Table 5.
Class Model Comparison at Age 16

Classes	Free parameters	Log likelihood	AIC	BIC	ABIC	BLRT	Entropy	Smallest Class Size *n* (%)
1	10	-5212.138	10444.275	10488.843	10457.094	N/A[a]	1	637 (100.0)
2	16	-4737.147	9506.295	9577.603	9526.805	0.000	.984	61 (9.6)
3	22	4523.511	9091.022	9189.071	9119.222	0.000	.987	25 (3.9)

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion, ABIC=Adjusted BIC; BLRT = Bootstrap Likelihood Ratio Test.
[a]BLRT not available for the one-class model.

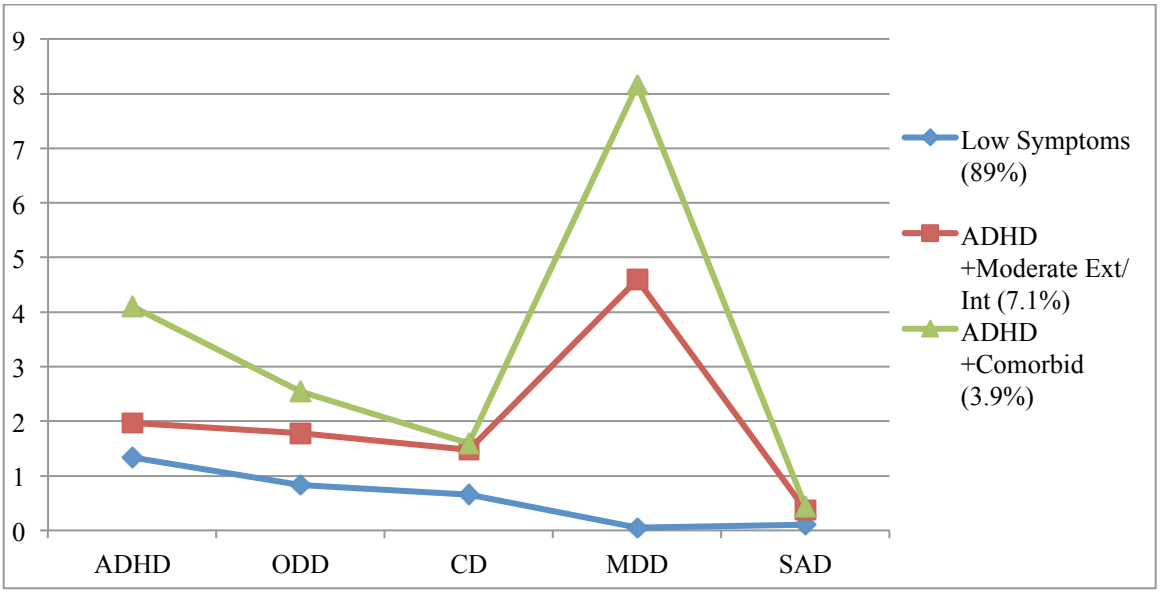

Figure 4. Mean Summary Scores for the Three-Class Model of ADHD and Co-occurring Symptoms at Age 16 *(n*=637). Percentage of sample classified in each latent class provided in legend.

Though three classes emerged at Time 3, they were slightly different in terms of the symptom profiles from the Time 1 and Time 2 classes (see Figure 4). A Low Symptoms Class (89.0%) was similar to the Low Symptoms classes identified at Times 1 and 2, with even further decreased ADHD symptoms at Time 3 than at Time 2. The other two classes were similar in proportional size to the ADHD+Ext. and ADHD+Int. classes from Times 1 and 2, but evidenced both internalizing and externalizing symptoms and differed more in frequency than quality of co-occurring symptoms than the classes identified at Times 1 and 2. For example, a class emerged that was characterized by decreased ADHD and externalizing symptoms (ODD, CD) and increased Depression symptoms. Thus, this class was named the ADHD+Moderate Ext./Int. (externalizing/internalizing) class (7.1%). The third class that emerged was characterized by steady levels of ADHD symptoms and increases in ODD, CD, and Depression symptoms. This class was named the ADHD+Comorbid class (3.9%).

To examine demographic differences across classes, follow-up equality of means omnibus tests and pairwise comparisons were conducted. Omnibus tests revealed that classes did not differ in terms of SES ($\chi^2(2) = 4.204$, $p = .122$, $\varphi = .03$) or age ($\chi^2(2) = 4.885$, $p = .09$, $\varphi = .09$). Follow-up logistic regressions demonstrated that there were more males in the ADHD+Moderate Ext./Int. class than in the Low Symptoms class ($t = 2.502$, $p = .012$, $d = .20$) and fewer males in the ADHD+Comorbid class than in the Low Symptoms class ($t = -3.913$, $p = .000$, $d = -.31$). Compared to youth in the Low Sxs. class, youth in the ADHD+Ext. and ADHD+Int. classes did not differ in terms of their receipt of treatment for ADHD (t's <-1.499, p's > .134)

Aim 2: Stability of Classes across Times 1, 2, and 3

Stability of ADHD and co-occurring symptom class membership was examined using LTA. Parameters for each class were set based on means obtained in the LCA so that classes remained stable in the LTA models. For each class, cross-tabulation of stability and changes in class membership were examined. LTA models utilize FIML to retain the original sample size from each LCA time point; thus, the total sample from the LCA at Time 1 (N=775) was retained for estimating the variance-covariance matrix for the LTA models at Time 2 and Time 3. LTA conditional transition probabilities were explored to evaluate stability and change in class membership. With the addition of latent classes from different time points into the LTA model, slight alterations to class membership were evidenced. However, class interpretations remained consistent across all LTAs (e.g., the Low Symptoms classes continued to be characterized by low levels ADHD and co-occurring symptoms at Times 1, 2, and 3).

Cross tabulation of class membership. Most youth (89%) were in the Low Symptoms class by Time 3 (Table 6). In addition, the ADHD+Ext. class decreased by about 4% from Time 1 to Time 2, and the ADHD+Int. class decreased by about half from Time 1 to Time 3. Two new classes emerged at Time 3—these were characterized by both internalizing and externalizing symptoms, but differed in frequency of co-occurring symptoms.

Table 6.
Percentage of Sample (n) in Classes Across Times 1, 2, and 3

	10-12 years (*N*=775)	12-14 years (*n*=716)	16 years (*n*=637)
Low Sxs.	77.7 (602)	85.4 (662)	89.0 (567)
ADHD+Ext.	14.4 (111)	10.1 (78)	--
ADHD+Int.	8.0 (62)	4.6 (35)	--
ADHD+Mod. Ext/Int.	--	--	7.1 (45)
ADHD+Comorbid	--	--	3.9 (25)

Note. Low Sxs.= low ADHD and low co-occurring (ODD/CD/MDD/SAD) symptom means class; ADHD+Ext. = higher ADHD symptom means and moderate/high ODD and CD symptom means class; ADHD+Int. = higher ADHD symptom means and moderate/high MDD and/or SAD symptoms means class; ADHD+Mod. Ext./Int. = higher ADHD symptom means and moderate externalizing and internalizing symptoms; ADHD+Comorbid = higher ADHD symptom means, moderate/high externalizing, and high internalizing symptoms.

LTA of class membership. Table 7 shows the transition probabilities from ages 10-12 to 12-14 (Time 1 to Time 2). The rows correspond to Time 1 and the columns correspond to Time 2. On the diagonal, the numbers represent stability across time for classes, whereas numbers off the diagonal are the proportion of youth who transition to another class. Consistent with cross-tabulation results of classes across Times 1 and 2, results indicate high levels of stability of the Low Symptoms class (see Table 7). Most youth in the Low Symptoms class remained in that class at Time 2 (93.6%). In contrast, only moderate levels of stability were evidenced among youth in the ADHD+Ext. class from Time 1 to Time 2, with 49.2% transitioning into the Low Symptoms class and 41.2% remaining in the

ADHD+Ext. class. Even less stability was evidenced in the ADHD+Int. class from Time 1, with 70.6% of youth transitioning into the Low Symptoms class, 16.6% transitioning into the ADHD+Ext. class, and 12.8% remaining in the ADHD+Int. class at Time 2.

Table 7.
Transition Probabilities for Association with Latent Classes from Time 1 to Time 2

Time 1 (Ages 10-12)	Time 2 (Ages 12-14)		
	Low Sxs (86.8%)	ADHD+Ext. (8.9%)	ADHD+Int. (4.3%)
Low Sxs. (78.3%)	.936	.037	.028
ADHD+Ext. (13.7%)	.492	.412	.096
ADHD+Int. (8.0%)	.706	.166	.128

Note. Low Sxs. = low ADHD and low co-occurring (ODD/CD/MDD/SAD) symptom means class; ADHD+Ext. = higher ADHD symptom means and moderate/high ODD and CD symptom means class; ADHD+Int. = higher ADHD symptom means and moderate/high MDD and/or SAD symptoms means class.

Table 8 demonstrates the transitions from Time 2 to Time 3. The rows represent the Time 2 classes and the columns represent the Time 3 classes, which are different than at Time 2 (thus, the diagonal does not represent stability in this case). An overall trend of increased symptoms resulted from the LTA examining stability of class membership from Times 2 to 3 (see Table 8). The majority of youth in the Low Symptoms class at Time 2 remained in that class at Time 3 (91.3%). The majority of youth in the ADHD+Ext. class at Time 2 were members of the ADHD+Moderate Ext./Int. class at Time 3 (43.8%). However, movement from the ADHD+Ext. class at Time 2 was evidenced in transitions to the ADHD+Comorbid class (31.2%) at Time 3. Additionally, a large percentage of youth (64.3%) from the Time 2 ADHD+Int. class transitioned into the Low Symptoms class at Time 3, demonstrating reduction in symptoms. A very small percentage of this class transitioned to the ADHD+Mod. Ext./Int. class (4.2%), whereas a larger percentage

transitioned to the ADHD+Comorbid class (31.5%) at Time 3, demonstrating more severe impairment and comorbidity.

Table 8.
Transition Probabilities for Association with Latent Classes from Time 2 to Time 3

Time 2 (Ages 12-14)	Time 3 (Age 16)		
	Low Sxs (85.5%)	ADHD+Mod. Ext./Int.. (6.5%)	ADHD+Comorbid (8.9%)
Low Sxs. (87.7%)	.913	.031	.056
ADHD+Ext. (8.1%)	.249	.438	.312
ADHD+Int. (4.2%)	.643	.042	.315

Note. Low Sxs. = low ADHD and low co-occurring (ODD/CD/MDD/SAD) condition symptom means class; ADHD+Ext. = higher ADHD symptom means and moderate/high ODD and CD symptom means class; ADHD+Int. = higher ADHD symptom means and moderate/high MDD and/or SAD symptoms means class; ADHD+Mod. Ext./Int. = higher ADHD symptom means and moderate externalizing and internalizing symptoms; ADHD+Comorbid = higher ADHD symptom means, moderate/high externalizing, and high internalizing symptoms.

Aim 3: Emotion Regulation and Parenting as Predictors of Transitions among Classes

Aim 3a. Prior to analyzing the roles of emotion regulation and parenting style as potential predictors of transitions across time, I explored whether classes identified at Times 1, 2, and 3 differed in terms of the levels of these predictor variables (all measured at Time 1). Classes differed in terms of Time 1 emotion regulation (see Table 9). Specifically, youth in the Low Symptoms class were rated as exhibiting higher levels of emotion regulation than youth in the ADHD+Ext. and ADHD+Int. classes. In addition, classes differed on maternal acceptance of youth and maternal use of guilt to control youth measured at Time 1. Specifically, mothers in the Low Symptoms class and ADHD+Int. class were reportedly more accepting of their children than mothers in the ADHD+Ext. class. Mothers of youth in the Low Symptoms class reportedly were less likely to use guilt to control their children than mothers of youth in the ADHD+Ext. and ADHD+Int. classes. Maternal enforcement of rules

was not significantly different across the classes at Time 1. At Time 2, maternal use of guilt and enforcement of rules differed across classes such that mothers of youth in the Low Symptoms class used less guilt and enforced rules more than mothers of youth in the ADHD+Ext. class. At Time 2, emotion regulation and maternal acceptance of youth were not significantly different across classes. At Time 3, none of these predictors significantly differed across the classes.

Table 9.
Omnibus Equality of Means Tests and Follow-Up Pairwise Comparisons for Predictors at Times 1-3

Effect	Pairwise Comparison	χ^2	φ
Time 1			
ER			
Omnibus Test	--	27.220***	.19
	Low Sxs>ADHD+Ext.	16.901***	.15
	Low Sxs>ADHD+Int.	10.683***	.12
Acceptance			
Omnibus Test	--	33.614***	.21
	Low Sxs>ADHD+Ext.	28.334***	.19
	ADHD+Int>ADHD+Ext.	6.646**	.09
Guilt		13.174***	.13
Omnibus Test	--		
	Low Sxs<ADHD+Ext.	7.618**	.10
	Low Sxs<ADHD+Int.	5.482*	.08
Rules			
Omnibus Test	--	.416	.02
Time 2			
ER			
Omnibus Test	--	1.856	.05
Acceptance			
Omnibus Test	--	3.084	.07
Guilt			
Omnibus Test	--	6.877*	.10
	Low Sxs<ADHD+Ext.	6.499**	.10
Rules			
Omnibus Test	--	8.170*	.11
	Low Sxs<ADHD+Ext.	5.711*	.09
Time 3			
ER			
Omnibus Test	--	3.572	.07
Acceptance			
Omnibus Test	--	1.107	.04
Guilt			
Omnibus Test	--	3.221	.07
Rules			
Omnibus Test	--	2.668	.06

Note. ER = child emotion regulation at Time 1; Accept = maternal acceptance of child at Time 1; Guilt = maternal use of guilt to control child at Time 1; Rules = maternal enforcement of rules at Time 1. Low Sxs. = low ADHD and low co-occurring (ODD/CD/MDD/SAD) condition symptom means class; ADHD+Ext. = higher ADHD symptom means and moderate/high ODD and CD symptom means class; ADHD+Int. = higher ADHD symptom means and moderate/high MDD and/or SAD symptoms means class.
^ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Aim 3b. Predictors of transitions among classes. Next, I examined whether emotion regulation and parenting predictors were associated with transition probabilities. Covariates were allowed to have time-varying effects, implying that for each time point, the predictor was allowed to affect the class variable differently and thus operate differentially across classes. Median splits were used to divide youth into low and high groups on each predictor to facilitate categorical covariate analyses of the overall effect and effects for youth high vs. low on the predictor on youth's transition probabilities. Median splits were used given the restricted range on some of the predictor variables. Given that there is no "gold" standard metrics for high and low on the ER and parenting measures and several of the predictor variables had restricted ranges, median splits were used to divide the sample and thus to look at whether transitions differ among youth that were high and low on the variable relative to other individuals in the sample. Model estimates are presented in Table 10, where comparisons are made between the Low Symptoms class (the reference class) and the classes listed under the time points (Time 1 to 2 and Time 2 to 3). Each predictor is tested to evaluate whether it is a significant predictor of transitions from the Low Symptoms class to another class (in the "Class" column).

Table 10.
Logistic Regression Coefficients for LTA Model for Transitions from Time 1 to 2 and Time 2 to 3

Class	Effect	Logit	*SE*	*t*
Time 1 to 2				
ADHD+Ext.	ER	.313	.556	.563
	Acceptance	-.750	.297	-2.523**
	Guilt	1.051	.288	3.645***
	Rules	.783	.290	2.698**
ADHD+Int.	ER	-.406	.599	-.677
	Acceptance	-.382	.386	-.990
	Guilt	.328	.376	.872
	Rules	.620	.370	1.674^
Time 2 to 3				
ADHD+Mod.	ER	-.326	.767	-.425
Ext./Int.	Acceptance	-.762	.941	-.810
	Guilt	.334	.489	.682
	Rules	-.093	.482	-.193
	ER	.496	.328	1.513
ADHD+Comorbid.	Acceptance	-.226	.325	-.695
	Guilt	-.003	.328	-.008
	Rules	-.123	.346	-.354

Note. ER = child emotion regulation at Time 1; Accept = maternal acceptance of child at Time 1; Guilt = maternal use of guilt to control child at Time 1; Rules = maternal enforcement of rules at Time 1. Low Sxs. = low ADHD and low co-occurring (ODD/CD/MDD/SAD) condition symptom means class; ADHD+Ext. = higher ADHD symptom means and moderate/high ODD and CD symptom means class; ADHD+Int. = higher ADHD symptom means and moderate/high MDD and/or SAD symptoms means class; ADHD+Mod. Ext./Int. = higher ADHD symptom means and moderate externalizing and internalizing symptoms; ADHD+Comorbid = higher ADHD symptom means, moderate/high externalizing, and high internalizing symptoms.
^ $p < .10$; ** $p < .01$; *** $p < .001$.

Considering transitions from Time 1 to Time 2, children with mothers who reportedly exhibited lower levels of acceptance were more likely to remain in the ADHD+Ext. class compared to the Low Symptoms class (-.750, $p < .05$). In addition, the logistic regression coefficient indicated that youth with mothers who reportedly used more guilt at Time 1 were more likely to transition into the ADHD+Ext. class compared to the Low Symptoms class at Time 2 (1.051, $p < .001$). Moreover, the logistic regression coefficient indicated that youth with a mother who enforced more rules at Time 1 were more likely to transition into the ADHD+Ext. class compared to the Low Symptoms class at Time 2 (.783, $p < .01$). Emotion

regulation did not significantly predict stability or transitions from Time 1 to Time 2, or Time 2 to Time 3. Parenting style did not predict stability or transitions of class membership from Time 2 to Time 3 either.

Next, estimated transition probabilities based on high and low levels of the predictors were examined. Again, median splits were used to divide the sample into low and high levels of each predictor relative to other individuals in the sample. The model does not assume stationary transition probabilities, and therefore different transition probabilities are estimated at each transition point and these transition probabilities can be compared over time and across covariates. For each set of analyses, transition probabilities are presented according to low and high levels of the predictor. Percentages on the diagonals are associated with stability in classes from Time 1 to Time 2. Percentages off the diagonal indicate, for each level of the predictor (low vs. high), the likelihood that an individual would transition to a different class at Time 2.

Table 11.
Estimated Transition Probabilities for Time 1 to Time 2 with Emotion Regulation as a Predictor

	Low ER			High ER		
Time 1	Time 2			Time 2		
	Low Sxs.	ADHD+Ext.	ADHD+Int.	Low Sxs.	ADHD+Ext.	ADHD+Int.
Low Sxs.	93.2%	4.5%	2.3%	93.3%	3.3%	3.4%
ADHD +Ext.	54.2%	32.8%	13.1%	40.9%	59.1%	0.0%
ADHD +Int.	68.7%	19.3%	12.1%	73.3%	12.8%	13.9%

Note. Low Symptoms = low ADHD and co-occurring (ODD/CD/MDD/SAD) symptom means class; ADHD+Ext. = higher ADHD symptom means and moderate/high ODD and CD symptom means class; ADHD+Int. = higher ADHD symptom means and moderate/high MDD and/or SAD symptoms means class; Low ER = youth with emotion regulation at Time 1 below the median of the sample; High ER = youth with emotion regulation at Time 1 above the median of the sample.

As Table 11 demonstrates, there was some stability within classes across time, particularly among the Low Symptoms class. However, certain transitions are notable. There was movement from the Time 1 ADHD+Ext. and ADHD+Int. classes to the Time 2 Low Symptoms class among youth with both high and low emotion regulation. Youth in the ADHD+Int. class at Time 1 were also likely to move into the ADHD+Ext. class when they demonstrated low emotion regulation skills at Time 1 (19.3% for low ER, 12.8% for high ER). Youth in the ADHD+Ext. demonstrated greater stability of class membership when they had high ER (59.1%) versus low ER (32.8%). Additionally, youth in the ADHD+Ext. class at Time 1 were more likely to transition into the ADHD+Int. class at Time 2 when emotion regulation skills were lower than when they were higher. More youth transitioned from the Time 1 ADHD+Int. class into the Time 2 ADHD+Ext. class when they evidenced lower emotion regulation skills (13.1% for low ER, 0% for high ER).

Table 12.
Estimated Transition Probabilities for Time 2 to Time 3 with Emotion Regulation as a Predictor

Time 2	Low ER Time 3			High ER Time 3		
	Low Sxs.	ADHD+Mod. Ext./Int.	ADHD+ Comorbid	Low Sxs.	ADHD+Mod. Ext./Int.	ADHD+ Comorbid
Low Sxs.	85.9%	4.0%	10.1%	88.0%	5.7%	6.3%
ADHD +Ext.	20.4%	68.7%	10.9%	31.9%	61.5%	6.6%
ADHD +Int.	54.2%	5.4%	40.4%	40.7%	23.6%	35.7%

Note. Low Symptoms = low ADHD and co-occurring (ODD/CD/MDD/SAD) symptom means class; ADHD+Ext. = higher ADHD symptom means and moderate/high ODD and CD symptom means class; ADHD+Int. = higher ADHD symptom means and moderate/high MDD and/or SAD symptoms means class; ADHD+Mod. Ext./Int. = higher ADHD symptom means and moderate externalizing and internalizing symptoms; ADHD+Comorbid = higher ADHD symptom means, moderate/high externalizing, and high internalizing symptoms.Low ER = emotion regulation at Time 1 below the median of the sample; High ER = emotion regulation at Time 1 above the median of the sample.

Table 12 demonstrates the transitions from Time 2 to Time 3 with emotion regulation as a predictor. Stability and overall decreases in symptoms were evidenced based on movement from the ADHD+Ext. class to the Low Symptoms class for both low and high ER youth, with a greater proportion of youth transitioning to the Low Symptoms class if they were rated as exhibiting high ER (31.9%) than low ER (20.4%). Interestingly, more youth with higher ER transitioned from the ADHD+Int. class at Time 2 into the ADHD+Mod. Ext./Int. class at Time 3 (23.6%) than youth with lower ER skills (5.4%). More youth with low ER in the ADHD+Int. class transitioned to the ADHD+Comorbid class (40.4%) than youth with high ER (35.7%). Youth with low ER in the ADHD+Ext. class at Time 2 were more likely to transition to the ADHD+Comorbid class at Time 3 (10.9%) than youth with high ER (6.6%).

Table 13.
Estimated Transition Probabilities for Time 1 to Time 2 with Maternal Acceptance as a Predictor

Time 1	Low Acceptance Time 2			High Acceptance Time 2		
	Low Sxs.	ADHD+Ext.	ADHD+Int.	Low Sxs.	ADHD+Ext.	ADHD+Int.
Low Sxs.	94.3%	3.1%	2.5%	92.9%	4.3%	2.8%
ADHD +Ext.	45.9%	42.9%	11.2%	65.2%	29.9%	5.0%
ADHD +Int.	66.8%	20.5%	12.7%	74.9%	12.3%	12.8%

Note. Low Symptoms = low ADHD and co-occurring (ODD/CD/MDD/SAD) symptom means class; ADHD+Ext. = higher ADHD symptom means and moderate/high ODD and CD symptom means class; ADHD+Int. = higher ADHD symptom means and moderate/high MDD and/or SAD symptoms means class; Low Acceptance = levels of acceptance of youth at Time 1 below the median of the sample; High Acceptance = levels of acceptance at Time 1 above the median of the sample.

From Time 1 to Time 2, youth in the Low Sxs. class demonstrated stability for both low and high maternal acceptance (Table 13). Greater resilience was evidenced by transitions to the Time 2 Low Sxs. class from the Time 1 ADHD+Ext. class when maternal acceptance

was high (65.2%) versus low (45.9%). Similar resilience was evident in the ADHD+Int. class moving to the Low Sxs. class, with more symptom attenuation for high maternal acceptance (74.9%) versus low acceptance (66.8%). The ADHD+Ext. class demonstrated more stability when maternal acceptance was low (42.9%) versus when it was high (29.9%). Notable for the Time 1 to Time 2 transition probabilities was the transition from the ADHD+Int. class at Time 1 to the ADHD+Ext. class at Time 2 among youth with low levels of maternal acceptance (20.5%). The ADHD+Int. class demonstrated similarly low stability with both low and high maternal acceptance (12.7% and 12.8%, respectively).

Table 14.
Estimated Transition Probabilities for Time 2 to Time 3 with Maternal Acceptance as a Moderator

Time 2	Low Acceptance Time 3			High Acceptance Time 3		
	Low Sxs.	ADHD+Mod. Ext./Int.	ADHD+ Comorbid	Low Sxs.	ADHD+Mod. Ext./Int.	ADHD+ Comorbid
Low Sxs.	84.8%	6.3%	8.8%	89.4%	3.1%	7.4%
ADHD +Ext.	29.9%	63.7%	6.4%	12.8%	73.2%	14.0%
ADHD +Int.	43.0%	12.1%	44.9%	49.2%	21.9%	28.9%

Note. Low Symptoms = low ADHD and co-occurring (ODD/CD/MDD/SAD) symptom means class; ADHD+Ext. = higher ADHD symptom means and moderate/high ODD and CD symptom means class; ADHD+Int. = higher ADHD symptom means and moderate/high MDD and/or SAD symptoms means class; ADHD+Mod. Ext./Int. = higher ADHD symptom means and moderate externalizing and internalizing symptoms; ADHD+Comorbid = higher ADHD symptom means, moderate/high externalizing, and high internalizing symptoms.Low Acceptance = levels of acceptance of youth at Time 1 below the median of the sample; High Acceptance = levels of acceptance at Time 1 above the median of the sample.

As can be seen in Table 14, stability was evident in the low symptoms class. More youth transitioned to the Low Sxs. class from the ADHD+Ext. class when maternal acceptance was low (29.9%) versus high (12.8%). Transitions to the Low Sxs. class were evident for both low and high acceptance among the ADHD+Int. class. From Time 2 to Time 3, a subset (21.9%) of youth with high maternal acceptance in the Time 2 ADHD+Int. class

transitioned into the Time 3 ADHD+Mod. Ext./Int. class. Increased impairment was evident among youth in the Time 2 ADHD+Int. class transitioning into the Time 3 ADHD+Comorbid class, especially with low maternal acceptance (44.9%) versus high maternal acceptance (28.9%). Conversely, more youth transitioned into the ADHD+Comorbid class at Time 3 from the Time 2 ADHD+Ext. class when acceptance was higher (14.0%) than when acceptance was lower (6.4%). A large percentage of youth transitioned into the ADHD+Mod. Ext./Int. class from the ADHD+Ext. class for both low and high acceptance, with more transitions among youth reporting higher levels of acceptance.

Table 15.
Estimated Transition Probabilities for Time 1 to Time 2 with Maternal Guilt as a Predictor

Time 1	Low Guilt Time 2			High Guilt Time 2		
	Low Sxs.	ADHD+Ext.	ADHD+Int.	Low Sxs.	ADHD+Ext.	ADHD+Int.
Low Sxs.	94.5%	1.4%	3.3%	91.0%	6.8%	2.3%
ADHD +Ext.	46.4%	47.0%	6.6%	52.5%	36.5%	11.0%
ADHD +Int.	76.4%	16.9%	6.7%	64.8%	17.3%	17.9%

Note. Low Symptoms = low ADHD and co-occurring (ODD/CD/MDD/SAD) condition symptom means class; ADHD+Ext. = higher ADHD symptom means and moderate/high ODD and CD symptom means class; ADHD+Int. = higher ADHD symptom means and moderate/high MDD and/or SAD symptoms means class; Low Guilt = levels of maternal guilt to control youth at Time 1 below the median of the sample; High Guilt = levels of maternal guilt to control youth at Time 1 above the median of the sample.

As seen in Table 15, from Time 1 to Time 2, there was stability in the Low Symptoms class for both low and high maternal use of guilt. More youth from the ADHD+Ext. class remained in the ADHD+Ext. class when guilt was low versus high (47.0% vs. 36.5%); conversely, more youth from the ADHD+Ext. class transitioned to the ADHD+Int. class when guilt was high versus low (11.0% vs. 6.6%). However, youth in the

ADHD+Int. class at Time 1 were similarly likely to transition to the ADHD+Ext. class at Time 2 when mothers used both low and high (16.9% and 17.9%, respectively) levels of guilt to control their child. Youth in the Time 1 ADHD+Int. class were more likely to remain in the ADHD+Int. class at Time 2 when guilt was high (17.9%) versus low (6.7%).

Table 16.
Estimated Transition Probabilities for Time 2 to Time 3 with Maternal Guilt as a Predictor

Time 2	Low Guilt Time 3			High Guilt Time 3		
	Low Sxs.	ADHD+Mod. Ext./Int.	ADHD+ Comorbid	Low Sxs.	ADHD+Mod. Ext./Int.	ADHD+ Comorbid
Low Sxs.	87.6%	4.2%	8.2%	86.2%	5.8%	8.0%
ADHD +Ext.	14.4%	85.6%	0.0%	30.8%	55.6%	13.5%
ADHD +Int.	46.3%	22.3%	31.4%	46.4%	6.9%	46.7%

Note. Low Symptoms = low ADHD and co-occurring (ODD/CD/MDD/SAD) condition symptom means class; ADHD+Ext. = higher ADHD symptom means and moderate/high ODD and CD symptom means class; ADHD+Int. = higher ADHD symptom means and moderate/high MDD and/or SAD symptoms means class; ADHD+Mod. Ext./Int. = higher ADHD symptom means and moderate externalizing and internalizing symptoms; ADHD+Comorbid = higher ADHD symptom means, moderate/high externalizing, and high internalizing symptoms. Low Guilt = levels of maternal guilt to control youth at Time 1 below the median of the sample; High Guilt = levels of maternal guilt to control youth at Time 1 above the median of the sample.

Again, stability was evident in the Low Sxs. class. Youth in the ADHD+Ext. class transitioned to the ADHD+Mod. Ext./Int. class more when guilt was low (85.6%) than when guilt was high (55.6%). Youth in the ADHD+Ext. class were more likely to transition to the ADHD+Comorbid group when guilt was high (13.5%) than when guilt was low (0%). From Time 2 to Time 3, the most notable transition was movement of youth from the Time 2 ADHD+Int. class to the Time 3 ADHD+Mod. Ext./Int. class when mothers used low levels of guilt (22.3%), though this transition was not evident among mothers who used high levels of guilt (6.9%). Youth in the Time 2 ADHD+Int. class were more likely to transition to the

ADHD+Comorbid group in the context of high levels of maternal guilt (46.7%) than low levels of guilt (31.4%).

Table 17.
Estimated Transition Probabilities for Time 1 to Time 2 with Maternal Enforcement of Rules as a Predictor

Time 1	Low Enforcement of Rules Time 2			High Enforcement of Rules Time 2		
	Low Sxs.	ADHD+Ext.	ADHD+Int.	Low Sxs.	ADHD+Ext.	ADHD+Int.
Low Sxs.	91.3%	4.2%	4.4%	94.7%	3.4%	1.9%
ADHD +Ext.	38.7%	54.1%	7.2%	57.7%	31.0%	11.3%
ADHD +Int.	67.2%	5.7%	27.0%	71.6%	22.1%	6.3%

Note. Low Symptoms = low ADHD and co-occurring (ODD/CD/MDD/SAD) condition symptom means class; ADHD+Ext. = higher ADHD symptom means and moderate/high ODD and CD symptom means class; ADHD+Int. = higher ADHD symptom means and moderate/high MDD and/or SAD symptoms means class; Low Enforcement of Rules = levels of maternal enforcement of rules at Time 1 below the median of the sample; High Enforcement of Rules = levels of maternal enforcement of rules at Time 1 above the median of the sample.

As can be seen in Table 17, estimated transition probabilities demonstrated that youth in the Time 1 ADHD+Ext. class with mothers who reported lower levels of rule enforcement were more likely to remain in the Time 2 ADHD+Ext. class (54.1%) than youth with mothers who evidenced higher levels of rule enforcement (31.0%). Similarly, youth in the Time 1 ADHD+Int. class were more likely to remain in the ADHD+Int. class at Time 2 when mothers demonstrated low as opposed to high rule enforcement (27.0% vs. 6.3%). Interestingly, a subset of youth in the Time 1 ADHD+Int. class whose mothers demonstrated higher rule enforcement were likely to transition to the ADHD+Ext. class (22.1%).

Table 18.
Estimated Transition Probabilities for Time 2 to Time 3 with Maternal Enforcement of Rules as a Predictor

Time 2	Low Enforcement of Rules Time 3			High Enforcement of Rules Time 3		
	Low Sxs.	ADHD+Mod. Ext./Int.	ADHD+ Comorbid	Low Sxs.	ADHD+Mod. Ext./Int.	ADHD+ Comorbid
Low Sxs.	87.7%	4.7%	7.6%	86.5%	5.1%	8.4%
ADHD +Ext.	13.9%	71.3%	14.8%	40.8%	59.2%	0.0%
ADHD +Int.	49.8%	21.8%	28.4%	39.5%	9.9%	50.6%

Note. Low Symptoms = low ADHD and co-occurring (ODD/CD/MDD/SAD) symptom means class; ADHD+Ext. = higher ADHD symptom means and moderate/high ODD and CD symptom means class; ADHD+Int. = higher ADHD symptom means and moderate/high MDD and/or SAD symptoms means class; ADHD+Mod. Ext./Int. = higher ADHD symptom means and moderate externalizing and internalizing symptoms; ADHD+Comorbid = higher ADHD symptom means, moderate/high externalizing, and high internalizing symptoms. Low Enforcement of Rules = levels of maternal enforcement of rules at Time 1 below the median of the sample; High Enforcement of Rules = levels of maternal enforcement of rules at Time 1 above the median of the sample.

Stability was evident in the Low Symptoms class for both low and high levels of rule enforcement (Table 18). Youth in the ADHD+Ext. class at Time 2 were very likely to transition to the Time 3 ADHD+Mod. Ext./Int. class when enforcement of rules was low (71.3%) as opposed to when it was high (59.2%). Youth in the ADHD+Ext. class at Time 2 were more likely to transition into the Time 3 ADHD+Comorbid class when mothers enforced rules less (14.8%) than when mothers enforced rules more (0%). A relatively small percentage of the ADHD+Ext. class at Time 2 transitioned to the Low Symptoms class at Time 3 when rule enforcement was low (13.9%) versus high (40.8%). Youth in the Time 2 ADHD+Int. class also demonstrated elevated probabilities of transitioning into the ADHD+Mod. Ext./Int. class at Time 3 when mothers enforced rules less (21.8%). However, youth in the ADHD+Int. class at Time 2 were more likely to transition to the Time 3

ADHD+Comorbid class when rule enforcement was high (50.6%) than when it was low (28.4%).

Predictor Analyses Summary. In sum, predictor analyses demonstrated evidence of stability among the Low Sxs. class and stability among youth with symptoms continuing to have symptoms. Some evidence of resilience was found in that some youth transitioned to the Low Symptoms class from symptomatic classes. However, transitions to symptomatic classes were more likely among youth in the symptomatic groups. From Time 1 to Time 2, more stability was evident among the ADHD+Ext. class among youth with high ER, whereas high ER was protective among youth in the ADHD+Int. class. From Time 2 to 3, there were transitions to the ADHD+Mod. Ext./Int. class regardless of ER capabilities. Among ADHD+Int. youth, low ER was associated with symptom desistance and high ER was associated with more movement to the ADHD+Mod. Ext./Int. class. High maternal acceptance predicted transitions to the Low Sxs. class and fewer transitions to high symptoms classes from Time 1 to 2. However, from Time 2 to 3, high maternal acceptance predicted movement to the ADHD+Mod. Ext./Int class from the ADHD+Ext. class and low maternal acceptance predicted transitions to the ADHD+Comorbid class from the ADHD+Int. class. From Time 1 to 2, high levels of guilt were associated with less stability among the ADHD+Ext. class, but more stability among the ADHD+Int. class. From Time 2 to 3, high guilt was associated with more transitions to the ADHD+Comorbid class for both symptomatic classes. For youth in the ADHD+Ext. class, low guilt was associated with movement into the Time 3 ADHD+Mod. Ext./Int. class and for the ADHD+Int. class, low guilt was associated with desistance of symptoms and transitions to both symptomatic classes. From Time 1 to 2, low maternal enforcement of rules predicted more stability among

youth with ADHD+Ext., whereas high enforcement of rules actually predicted more behavior problems among ADHD+Int. youth. From Time 2 to 3, for youth in the ADHD+Ext. class, high enforcement of rules predicted desistance, and low enforcement predicted transitions to the symptomatic classes. For youth in the ADHD+Int. class, high rule enforcement led to transitions to the ADHD+Comorbid class.

CHAPTER 4

DISCUSSION

The presence of co-occurring conditions among youth with ADHD is well-established; however, few researchers have examined patterns of ADHD and co-occurring symptoms prospectively from childhood to adolescence or factors that exacerbate or buffer risk for co-occurring symptoms. The present study addressed these gaps by (a) identifying patterns of ADHD and co-occurring symptoms, (b) examining transitions among classes over time from late childhood to mid-adolescence, and (c) determining whether child-specific (i.e., emotion regulation) and parenting factors buffer or exacerbate risk for co-occurring symptoms.

Although ADHD co-occurs with a variety of psychological symptoms, prior investigations have not examined patterns of ADHD and co-occurring symptoms among youth during different developmental periods, as well as transitions over time among youth who experience different patterns of ADHD and co-occurring symptoms. As expected, a group of youth with low symptoms emerged at each time point. At ages 10-12 and 12-14, there was also a group of youth with higher ADHD symptoms than the low symptoms group and externalizing behavior disorder symptoms, as well as another group with higher ADHD symptoms and internalizing disorder symptoms. At age 16, different classes emerged—one class reflecting moderate ADHD symptoms with moderate externalizing and internalizing symptoms, which may be a more developmentally normative class; and another class with more elevated ADHD and co-occurring symptoms, which may be a more impaired class. Variations of these patterns have been examined in prior LCA studies of ADHD and co-

occurring conditions (e.g., Acosta et al., 2008; Rasmussen et al., 2002; Volk et al., 2005). However, not only does the present study elucidate the patterns of co-occurring symptoms, but it reveals transitions in these patterns—namely, that youth may begin with internalizing symptoms and later develop externalizing symptoms or vice versa. Further, the present study indicated that emotion regulation and parenting style predicted stability and transitions among classes, with low emotion regulation, parental acceptance, parental use of guilt, and enforcement of rules having different implications for different classes of youth.

Aim 1: Identification of Classes of ADHD and Co-occurring Symptoms

Use of a person-centered approach to identify classes of ADHD and co-occurring symptoms allowed for delineation of developmental patterns, as well as identifications of patterns of co-occurring symptoms that differ in terms of quality and frequency of symptoms. Though a growing body of literature examines ADHD and co-occurring symptoms using a person-centered approach (Acosta et al., 2004; Volk et al., 2005), there is a lack of literature examining multiple co-occurring symptoms concurrently across time, a gap that the present study sought to address.

At ages 10-12, three classes emerged that were consistent with findings from prior literature. For instance, the Low Symptoms class was the largest class, representing typically developing youth with low levels of ADHD, ODD, CD, MDD, and anxiety symptoms. Another class of youth with ADHD symptoms and ODD/CD emerged from the LCA at Time 1. This class was the second largest class and is consistent with research on externalizing disorder comorbidity supporting a genetic link and shared environmental influences among children with ADHD, ODD, and CD (Dick, Viken, Kaprio, Pulkkinen, & Rose, 2005). Despite not being a clinical sample, levels of ADHD, ODD, and CD in this class reached

clinical significance. Additionally, a class of youth with elevated ADHD symptoms (though not as high as the externalizing class) and elevated MDD and separation anxiety disorder symptoms was identified, consistent with research on internalizing disorder comorbidity with ADHD in this age group (Acosta et al., 2004; de Nijs et al., 2007). Nevertheless, these findings illuminate patterns of ADHD, MDD, and separation anxiety at ages 10-12. This developmental period is important given that separation anxiety symptoms are usually only evident at this age among youth with pronounced internalizing symptoms and higher co-occurring symptoms with ADHD are associated with more frequent and severe ADHD symptoms (de Nijs et al., 2007; Neuman et al., 2001; Volk et al., 2005, 2006).

At ages 12-14, similar classes emerged from the LCA. The largest class evidenced low symptom levels for all disorders, including desistance of ADHD and ODD symptoms, consistent with developmental patterns of a normative class, as any mild behavioral problems from earlier in childhood typically decrease at this age (Bongers, Koot, Van der Ende, & Verhulst, 2003). At ages 12-14, the ADHD+Ext. class demonstrated decreased ODD symptoms, but increased CD symptoms as compared to Time 1, also consistent with developmental trends of these disorders. Finally, the ADHD+Int. class was very small at Time 2, but meaningful in that depression symptoms were particularly elevated relative to depressive symptom levels at Time 1, consistent with trends of increasing depression as youth approach adolescence. ADHD symptoms in the two symptomatic classes approached clinical thresholds, as did ODD/CD symptoms in the ADHD+Ext. class and MDD symptoms in the ADHD+Int. class.

Results from age 16 revealed some important differences among classes. The low symptoms class was still the largest, as expected. There was no ADHD+Ext. class or

ADHD+Int. class. Instead, a class emerged with some (although decreased when compared to the two symptomatic classis at Time 2) ADHD symptoms, externalizing symptoms, and increased depression symptoms. This class may be considered a class with mild behavior problems and some depression that increases in adolescence, which is considered developmentally normative and may represent a less impaired, albeit symptomatic, class (Bongers et al., 2003; Costello et al., 2003; Volk et al., 2005). Although these findings are consistent with de Nijs, van Lier, Verhulst, and Ferdinand's (2007) research using LCA that has found varying levels of ADHD and co-occurring ODD/CD or aggressive/rule-breaking behavior, those authors did not examine MDD/anxiety within the LCA model, other commonly co-occurring symptoms. Finally, a class emerged at age 16 with the most elevated levels of ADHD and ODD symptoms of the three classes at this time point, somewhat elevated CD symptoms, and a spike in MDD symptoms with clinical levels reached. This group exhibits more severe and frequent co-occurring symptoms relative to previous time points and the other classes identified at Time 3. Elevations in these symptom clusters are consistent with prior work that found similarly elevated ADHD, internalizing, and externalizing symptoms (e.g., Volk et al., 2005). However, the current study builds on this work by identifying classes with different patterns of co-occurring symptoms across childhood and adolescence, important developmental periods for understanding risk and resilience for co-occurring symptoms among youth with ADHD symptoms.

Thus, qualitative and quantitative differences in ADHD and co-occurring symptoms were identified at each time point. For instance, at age 10-12 and age 14, similar classes (ADHD+Int., ADHD+Ext., Low Symptoms) emerged with different types (qualitative) of symptoms (i.e., internalizing in one class and externalizing in another), as well as different

frequency (quantitative) of symptoms. However, at age 16, the ADHD+Mod.Ext./Int. class and the ADHD+Comorbid class have similar symptom profiles (qualitative), though the symptom severity/frequency differs (quantitative) among classes. Using LCA permits recognition of class differences in terms of frequency and type of symptoms, and as such, was well-suited for the primary questions in the current project.

Aim 2: Stability of Class Membership

Both stability and transitions in class membership were evident over the course of the developmental periods examined in the present study. Overall, youth exhibited decreases in ADHD symptoms over the course of development, consistent with hypotheses and previous literature on symptom desistance (Barkley et al., 2008). Additionally, stability was evident in the Low Symptoms class across time and this class size grew proportionally larger by age 16, with youth from each of the other two classes moving into this class. The LTA from ages 10-12 to 12-14 years demonstrated stability in the Low Sxs. class. Moderate stability was evident in the ADHD+Ext. class, but almost half of these youth transitioned to the Low Sxs. class. This pattern might represent youth who "grew out of" their childhood behavioral problems, as research has demonstrated that levels of aggressive and oppositional behavior decrease as youth (especially boys) become older (childhood to adolescence) (Bongers et al., 2003). Transitions were also apparent in the ADHD+Int. class, with a subset of youth moving to the ADHD+Ext. class and relatively small percentage of youth remaining in the ADHD+Int. class. This pattern reflects the overall increases in both internalizing and externalizing symptoms in the early adolescent years, which may be even more apparent among youth with co-occurring ADHD and internalizing symptoms. Though other studies examine LCA models involving ADHD and co-occurring ODD/CD, MDD, and anxiety

cross-sectionally across a broader age range (childhood to adolescence) (e.g., Elia et al., 2009; Volk et al., 2005), the present study elucidates class stability and transitions at each of these developmental periods and thus clarifies how youth's symptoms may change over time.

The LTA model from Time 2 to 3 revealed similar stability of the Low Symptoms class and transitions from the ADHD+Ext. and ADHD+Int. classes to the Low Symptoms class, as expected. The ADHD+Ext. class demonstrated transitions to both the ADHD+Mod.Ext./Int. class and the ADHD+Comorbid class. The most interesting class at Time 2 was the ADHD+Int. class, which evidenced both transitions to the Low Symptoms class, as well as transitions to the ADHD+Comorbid class at Time 3. The ADHD+Comorbid class at age 16 represented the most impaired class and was the smallest, so movements to the Low Symptoms class and ADHD+Mod.Ext./Int. class may represent resilience among some of these youth.

Hypotheses regarding increases in CD and MDD and decreases in ADHD symptoms over time were confirmed. Additionally, ODD and SAD symptoms decreased over time as expected developmentally. Consistent with hypotheses, I found externalizing classes that continued to have externalizing symptoms, and internalizing classes that also showed stability. However, transitions from Time 2 to Time 3 reflected additional co-occurring symptoms in certain groups as noted above, which may represent a more impaired class of youth with ADHD and several co-occurring symptoms.

Aim 3: Emotion Regulation and Parenting as Predictors of ADHD and Co-occurring Symptom Classes

Overall effects of predictors for each LCA revealed that predictors differed the most by class according to auxiliary analyses at Time 1, the point at which these predictors were

assessed. When examining overall effects of predictors on LTA models (e.g., Table 10), predictors were significant for predicting class membership from Time 1 to 2. When examining individual transition probabilities for predictors (e.g., Tables 11-18), patterns emerged that revealed that emotion regulation and parenting style may confer risk or resilience differentially in that these variables predicted transitions and stability of class membership and may be shared risk factors for co-occurring symptoms. Thus, utilizing an LTA model with predictors as covariates allowed for nuanced analyses of overall effects and effects on transitions between time points of these predictors.

In terms of ER, as expected, youth in the Low Symptoms class reportedly evidenced higher emotion regulation than youth in the other two symptomatic classes at ages 10-12 (Time 1). Patterns were especially interesting when examining the Time 1 to Time 2 transitions—more stability was evident among ADHD+Ext. class among youth with high ER, whereas high ER buffered the ADHD+Int. class by predicting transitions to the Low. Sxs. class. Research has demonstrated that there are several developmental pathways to conduct problems that are differentially related to emotion regulation ability (Frick & Morris, 2004). Specifically, youth with poor emotion regulation may have social information processing biases and display reactive aggression and negative emotions, leading to peer rejection (Frick & Morris, 2004). This set of deficits may be evident in the ADHD+Ext. class and thus lead to stability of this class membership and in some cases, the transition to higher levels of internalizing symptoms youth in this class at Time 1 transitioned into the Time 2 ADHD+Int. class).

Youth with higher levels of ER in the ADHD+Ext. class at Time 1 may have represented an overly controlled group of youth with externalizing behaviors, possibly

including youth with callous-unemotional traits who continue to evidence externalizing symptoms at Time 2 despite higher levels of emotion regulation abilities (Frick & Morris, 2004). From Time 2 to 3, youth in the ADHD+Ext. class transitioned to the ADHD+Mod. Ext./Int. class in the context of both low and high ER, demonstrating that these youth have some less impaired, more developmentally normative symptoms at Time 3. High ER did not buffer youth in the ADHD+Int. class at Time 2 to 3 to the extent it did at Time 1 to 2, possibly indicating that these youth were more impaired by mid-adolescence. In summary, although poor emotion regulation is associated with youth ADHD (Martel, 2009; Sobanski et al., 2010), results from the present study do not indicate a uniform pattern of association and instead show that emotion regulation may buffer or exacerbate risk for additional symptoms depending on the pattern of co-occurring symptoms experienced by youth at earlier time points, consistent with developmental changes and multiple pathways for the development of conduct problems.

Parenting factors predicted transitions among classes, with interesting patterns in each parenting style covariate in terms of predicting risk or resilience in transitions. In particular, if mothers were higher on youth acceptance, youth in the ADHD+Ext. and ADHD+Int. classes transitioned to the Low Sxs. class and were less likely to remain in symptomatic classes at Time 2. However, from Time 2 to 3, high acceptance did not predict transitions among the ADHD+Ext. class, indicating that at the 12-14 years old to 16 years old transition point, maternal acceptance may play less of a role for youth who already have behavioral problems. Acceptance has been linked to lower levels of externalizing behaviors in past research (e.g., Rothbaum & Weisz, 1994). Because acceptance was measured at Time 1, it might be that youth who remained in the externalizing class continued to have behavior

problems and over time, elicited harsher, less accepting responses from mothers, consistent with coercive parent-child interaction cycles (Chamberlain & Patterson, 1995; Patterson, 2002; Patterson, Reid, & Dishion, 1992), though prospective assessment of parental acceptance would be necessary to evaluate this possibility. Alternatively, mothers who are very accepting of their children may facilitate further externalizing symptoms, particularly if acceptance is a proxy for lower levels of discipline or requiring youth to take responsibility for the outcomes of their behavioral problems.

Among youth with Time 2 ADHD+Int., low maternal acceptance predicted more transitions to the ADHD+Comorbid class, which is consistent with research that has demonstrated that parental acceptance is associated with lower depression levels among youth (Barber, Stolz, & Olsen, 2005). The findings for maternal acceptance demonstrate that high acceptance may buffer risk among children in the ADHD+Ext. class and ADHD+Int. class earlier in development especially. Thus, youth with ADHD and MDD/anxiety symptoms who have mothers who reportedly exhibit lower levels of acceptance may be more likely to develop additional co-occurring symptoms such as ODD/CD over time in the preadolescent and early adolescent period. Perhaps this transition pattern results from youth's increasing their affiliation with deviant peers, which is particularly possible if youth in the ADHD and internalizing symptoms class experienced problematic peer relationships at an earlier developmental period (e.g., Deater-Deckard, 2001). Future research is necessary to test the influence of these potential contextual influences on these class transitions.

Maternal guilt was linked in particular to transitions among youth in the ADHD+Int. class, with higher levels of parental use of guilt associated with stability in class membership for the ADHD+Int. class. Mixed evidence has shown that psychological control, including

guilt induction, is related to both internalizing and externalizing problems (Hart et al., 1998) and others show that control is more related to internalizing problems, especially among children with negative reactivity (Morris et al., 2002). Findings from the predictor transition probabilities were generally consistent with this literature, but some important distinctions were found. Interestingly, low levels of guilt predicted stability for youth in the ADHD+Ext. class from Time 2 to Time 3, whereas high levels of parental use of guilt predicted more movement to the Low Symptoms class or ADHD+Int. class. Thus, among youth with externalizing behaviors, parental use of guilt may lead to reduced externalizing behaviors, but increased risk for internalizing symptoms.

Results examining maternal enforcement of rules point to the importance of consistency in parenting a child with ADHD symptoms and co-occurring symptoms. Higher enforcement of rules was associated with youth transitions from the ADHD+Ext. class to the Low Symptoms class, whereas low enforcement of rules was associated with stability in the ADHD+Ext. class at Time 1 to 2 and transitions to the ADHD+Mod. Ext./Int. class from Time 2 to 3. Findings were consistent with research reporting an association between firm discipline/rule enforcement and lower levels of externalizing disorder symptoms (e.g., Bates, Pettit, & Dodge, 1995) and in particular, highly inconsistent discipline with ADHD (Martel et al., 2011). However, again, youth in the ADHD+Int. class demonstrated a different pattern, with high enforcement of rules leading to increased transitions to the Time 2 ADHD+Ext. class and increased transitions to the ADHD+Comorbid class from Time 2 to 3. This was consistent with prior research indicating that higher parental control is linked to internalizing problems (Galambos, Barker, & Almeida, 2003; Pettit et al., 2001), but these findings were different in that higher levels of co-occurring internalizing and externalizing symptoms were

evident. It is possible that youth with ADHD symptoms have difficulty when parents attempt to be consistent in enforcing rules, which may lead to further anxious/depressed symptoms among youth resulting from parent-child conflict, as well as coercive parenting cycles that may contribute to and further exacerbate externalizing symptoms.

Strengths, Limitations, and Future Directions

The present study has several methodological strengths. The longitudinal large dataset spanning childhood to mid-adolescence and the repeated measures enabled comparisons of classes and transitions over time. The prospective dataset allowed for examination of differences in ADHD and co-occurring symptoms, different patterns at several developmental periods, and predictors of stability or movement among classes. Analyses included consideration of patterns of co-occurring symptoms, stability of classes, and predictors of class membership and transitions, affording insight into co-occurring symptoms among youth with ADHD symptoms. Predictor analyses permitted examination of factors that may promote risk and resilience. Additionally, prior studies have focused on delineating subtypes of ADHD symptoms in LCA models, which was not a focus of the current study given that research has demonstrated that the hyperactive-impulsive subtype may not be useful to discern (de Nijs, Ferdinand, & Verhulst, 2007) and recent changes to DSM-5 eliminating the ADHD subtype distinctions. The few LCA studies examining ADHD and co-occurring conditions have used a multiple cohort design and conducted LCA among youth that spanned a broader age range (childhood through adolescence) rather than examining several time points in development and prospective relations among classes. In addition, these studies do not always include a range of co-occurring symptoms in their LCA

models, despite evidence of extensive co-occurring conditions among youth with ADHD (e.g., Angold et al., 1999a).

This study is the first to my knowledge to examine stability of latent classes and predictors of stability or transitions in a person-centered approach. Utilization of multiple informants (child and parent report of symptoms, parent report of child emotion regulation, and child report of parenting) adds validity to the analyses and the use of a diagnostic interview has benefits of clinician reliability in assessing symptoms. Using child report of parental behavior has the benefit of giving the child's perspective of parenting style rather than the parent's, which might be influenced by social desirability issues. Finally, the present study is one of the few that investigates relations among ADHD, co-occurring symptoms, and parenting style to understand risk and resilience in a person-centered approach at multiple time points (Deault, 2010), which has important implications for etiological models and prevention and intervention efforts among youth with ADHD symptoms.

Despite these strengths, there are some limitations to the study design. First, the person-centered statistical techniques proposed are the most appropriate to test the research questions, given the developmental nature of the questions. However, there is no "gold standard" indicator for evaluating model fit, a combination of statistical and conceptual considerations were used to interpret findings and select the best-fitting models, which may affect generalizability of the findings. Additionally, because of the developmental periods available in this archival dataset, I could not examine earlier patterns of ADHD symptoms, co-occurring symptoms, parenting, and emotion regulation. Considering ADHD symptoms earlier in development would be especially interesting given the changes in symptoms over time; similarly, considering parenting behaviors and emotion regulation earlier in

development would be useful for understanding the influence of these variables that are evidenced well before age 10 as well. Additionally, generalized anxiety and social anxiety disorder symptoms were unavailable or had very low base rates in the current sample, which limits the generalizability of findings related to co-occurring anxiety disorder symptoms. As separation anxiety disorder typically desists as youth age, future research should examine patterns of additional co-occurring anxiety disorders over time that emerge or are likely to be exacerbated later in development relative to separation anxiety disorder. However, the longitudinal analyses of the participants from age 10-12 to 16 provided a rich source of information about patterns of co-occurring symptoms over time.

Another limitation of the present study is that the measure of emotion regulation was related to mood and temperament and thus a proxy for emotion regulation; indeed, there are additional measures of emotion regulation that may better measure the construct but were not used for the present sample given that ER was not a primary focus of the CEDAR project. Although the use of multiple informants was a strength, the use of parent report on child symptoms and child report on symptoms at different ages may have created some discrepancies in symptom levels; however, research shows that parent report may be more accurate in childhood and youth report more accurate in adolescence (De Los Reyes & Kazdin, 2005), consistent with the present study design. Although the CRPBI is a well-validated measure of parenting and has demonstrated internal consistency and external validity (Safford et al., 2007), it also has been criticized for its length and construct validity. Additionally, child perception of a risk factor may be an important perspective for predicting later outcomes and understanding risk (Cole, Martin, & Powers, 1997; Drabick, Beauchaine,

Gadow, Carlson, & Bromet, 2006). Finally, as the CEDAR sample is mostly male, the results may apply more to male than female children.

Though the present study focuses on co-occurring symptoms dimensionally rather than comorbid disorders, it is worth examining rates of comorbidity in the present sample. As noted in the LCAs at each time point, co-occurring symptoms were elevated in the symptomatic classes and have implications in terms of impairment. However, patterns and rates when examining classes in the latent class analyses at each time point reveal unique patterns of symptoms for each of the conditions when examined all together, which are not apparent when examining rates of comorbidity of ADHD and each single disorder at each time point. As Table 2 demonstrates, rates of youth meeting diagnostic criteria for each single disorder at ages 10-12 were slightly elevated compared to community samples and more consistent with prevalence rates of community samples at ages 12-14 and 16 (Angold et al., 1999; Costello et al., 2003). These elevated rates of single disorders may reflect the fact that a portion of the sample was a high-risk sample of youth with fathers who met diagnostic criteria for substance abuse or another psychiatric condition(e.g., Kendler & Prescott, 1998). Research has documented the high heritability of disorders such as ADHD (Faraone et al., 2005; Nikolas & Burt, 2010; Willcutt et al., 2012). Moreover, youth of substance-abusing fathers are more frequently diagnosed with disruptive behavior disorders than youth whose fathers do not have a history of substance abuse (Clark et al., 1997). However, rates of youth meeting diagnostic criteria for comorbid conditions were similar to some estimates of comorbidity among community samples (Angold et al., 1999). Thus, though single disorder rates reflect a high-risk sample, the percentage of youth meeting diagnostic criteria for comorbid conditions is more consistent with a community-based sample. Further, rates of

ADHD, ODD, and SAD decreased over time while CD and MDD increased over time, as expected developmentally and as confirmed by the symptomatic classes in the LCAs. Thus, LCA allowed for examination of sub-threshold impairment and consideration of patterns of symptoms across all the disorders, despite the generally lower rates of comorbidity observed among youth in the present sample relative to rates of co-occurring symptoms.

Though the LCAs allowed for a dimensional approach and were conducted using symptoms obtained through a diagnostic interview, these analyses did not take into account cross-situational impairment (e.g., at home and at school), age cut-offs, or duration. Though the diagnostic interview did gather this information and it was utilized to examine comorbidity rates (Table 2), the LCA models were not intended to examine whether youth met criteria for the diagnosis of ADHD or a comorbid disorder and thus the findings should be interpreted with this caveat in mind. In addition, the CEDAR project utilized *DSM-III-R* criteria, which have slightly different numbers and wording for symptoms for ADHD and the co-occurring conditions. For instance, there were fourteen symptoms of ADHD in *DSM-III-R*, whereas *DSM-IV* and *DSM-5* have nineteen symptoms, though the core constructs of inattention, hyperactivity, and impulsivity remain the same across *DSM* versions. For ODD, symptoms remained the same, though youth need fewer symptoms to meet diagnostic criteria in *DSM-5* than in *DSM-III-R*. For CD, there are more symptoms in *DSM-5*, so there may have been lower rates of the disorder according to *DSM-III-R*. MDD and SAD remain largely unchanged from *DSM-III-R* to *DSM-5* in terms of symptoms. Differences in number of symptoms required or specific symptoms each disorder may influence the generalizability of the current model and rates of disorders; however, the core constructs of the disorders are the same.

Future research should aim to measure ADHD symptoms earlier in development and into later adolescence and adulthood when further desistance of hyperactive-impulsive symptoms would be expected. Additional measures using multiple levels of analysis of emotion regulation could contribute to the generalizability of the study. Additionally, comparison of parent and child report of symptoms, emotion regulation, and parenting style, additional informants (teachers), and multiple methods of data collection would add to the methodological rigor of the study. Replication of LCA classes at each time point would be important given the slightly smaller classes at certain time points, and future studies should aim to replicate these results in more diverse and representative samples, as well as more similar numbers of males and females. Future research should examine additional predictors of transitions and stability among classes such as peer factors (Hoza, 2007), contextual factors such as neighborhood (Butler et al., 2012), or other child-specific factors such as executive functioning and reward- and punishment-based decision making (Willcutt et al., 2005), given that research has demonstrated that these factors may be important for understanding risk and resilience processes especially among youth with ADHD. Further, parental ADHD and/or additional psychopathology would be an interesting and important correlate to examine, given the high transmission rates of ADHD and psychopathology, as well as evidence that parental ADHD and other psychological conditions influence parenting style (deficits in parental control), family disorganization, monitoring, and discipline approaches and consistency (Johnston, Mash, Miller, & Ninowski, 2012).

Additionally, although not a focus of the present study, sex differences in overall temperamental styles and emotion regulation abilities among boys and girls should be incorporated into etiological and intervention models among youth with ADHD (Martel,

2009). For example, girls who exhibit aggression or anger often do not express these feelings as overtly as boys (Cole et al., 1994), and parenting styles and child × parenting style interactions may differ by child sex (e.g., Lifford, Harold, & Thapar, 2009). Future research should examine how these mechanisms operate among boys and girls, and whether these factors may be associated with different symptom profiles and transitions among classes that differ in terms of ADHD and co-occurring symptoms.

Conclusions and Clinical Implications

Several important findings emerged from the present study. First, youth with ADHD symptoms in childhood evidenced a variety of co-occurring symptoms concurrently and prospectively. Classes of youth elevated on ADHD and internalizing symptoms, ADHD and externalizing symptoms, and low on all symptoms emerged earlier in development, whereas more comorbid groups emerged later in development. Second, youth may evince risk or resilience later in development (e.g., adolescence) with changes in either internalizing or externalizing symptoms, with the most impaired youth exhibiting multiple co-occurring symptoms by mid-adolescence and the least impaired youth demonstrating symptom reductions. Specifically, youth who had low levels of symptoms earlier in development tended to remain in the low symptoms class and a subset of youth from the symptomatic groups also evidenced desistance of symptoms. Although youth in the externalizing classes were more likely to evidence fewer problems over time, youth in the internalizing classes demonstrated increased internalizing and externalizing symptoms. Finally, emotion regulation had a variable influence on youth symptoms over time. High maternal acceptance was a more important predictor of transitions to lower symptoms earlier rather than later in development. Parental use of guilt was associated with reduced externalizing behaviors, but

increased internalizing symptoms. Maternal rule enforcement and consistency are important for youth, but may be especially difficult among parents whose children exhibit ADHD symptoms, which may exacerbate internalizing or externalizing symptoms.

Perhaps most interesting is the potential for a range of outcomes and risk and resilience processes that unfold, evidencing heterotypic and homotypic continuity among conditions that is better realized using a person-centered approach to examining patterns of co-occurring symptoms among youth with ADHD. In fact, certain parenting styles may be more beneficial for youth with certain symptoms; for example, among youth with externalizing symptoms, guilt may be more effective for decreasing child symptoms but may exacerbate symptoms among youth with ADHD and primarily internalizing symptoms. Thus, the present findings indicate that understanding risk and resilience processes related to parenting and youth symptoms requires careful consideration of emotion regulation and parenting predictors.

Given myriad negative outcomes associated with ADHD and co-occurring conditions, clearer understanding of processes through which ADHD confers risk for other symptoms or conditions has important clinical implications. For example, the patterns of symptoms evidenced in the current study can aid in identification of youth at risk for the development of co-occurring conditions, as well as indicate targets and developmental points of prevention and intervention efforts aimed at emotion regulation and parenting practices among youth with ADHD.

A more modular treatment approach may benefit children with ADHD and co-occurring symptoms and emotion regulation deficits, requiring an analysis of specific symptoms and deficits before treatment (Weisz et al., 2012). Indeed, results of the present

study may inform modifications to existing treatments and the development of tailored interventions. Currently, although youth with co-occurring conditions are included in prevention and intervention studies, treatment manuals for childhood disorders typically target single disorders. Among youth with ADHD, assessments should aim to evaluate for a range of co-occurring internalizing and externalizing symptoms and repeated assessments should be conducted over the course of treatment given that youth may transition to classes characterized by lower or higher levels of co-occurring symptoms even without treatment according to the present results. Assessments should also include information regarding the quality and frequency of emotion regulation deficits among children with ADHD and co-occurring conditions so that these processes could be targeted in treatment.

Psychoeducation in emotion regulation skills typically has not been a target of treatments that have been deemed effective among youth with ADHD (Hannesdottir & Ollendick, 2007; Southam-Gerow & Kendall, 2000; Suveg, Southam-Gerow, Goodman, & Kendall, 2007). However, there is promising research on a few preventive interventions for emotion regulation skills (e.g., PATHS—Promoting Alternative Thinking Strategies; Kusche & Greenberg, 1994; and EC—Emotions Course; Izard, Trentacosta, King, & Mostow, 2004), as well as intervention models (ECBT—emotion-focused cognitive-behavioral treatment; Suveg et al., 2006; and CERT—contextual emotion-regulation therapy; Kovacs et al., 2006), each of which requires further evaluation in conjunction with best treatment practices among youth with ADHD.

Similarly, parent involvement in treatment has been deemed important among parents of children with ADHD, with behavior therapy as the only well-established psychosocial treatment for child and adolescent ADHD (e.g., behavioral parent training, behavioral

classroom management, and behavioral peer interventions; Pelham & Fabiano, 2008). Given that parent training is a crucial component of treatment among youth with ADHD, including strategies for improving child emotion regulation, as well as implementing strategies for identifying signs or markers for the development of co-occurring conditions among youth with ADHD would be useful adjuncts to parent training. The present study demonstrates that a warm, accepting, consistent discipline style is likely best, although for some youth, more or less enforcement of rules or control of youth may have differential effects. Parent training should aim to target specific child symptoms accordingly.

Although future research will be necessary to test this possibility, the results of the present study indicate that emotion regulation and parenting may be predictors of treatment outcome and potential targets for enhanced interventions among youth with ADHD with and without co-occurring symptoms. In terms of etiological models, emotion regulation and parenting behaviors could serve as shared risk or protective factors (or correlates of ADHD that increase the likelihood of developing co-occurring conditions), indicating areas to assess and test in terms of prevention and intervention efforts. Future research will be necessary to test the viability of targeting these processes in interventions and whether the addition of these variables to models of the development of co-occurring conditions among youth with ADHD will facilitate improved understanding of multifinality among youth with ADHD and thereby suggest alternative approaches for attenuating symptoms and the development of co-occurring conditions.

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