THE RELATIONSHIP BETWEEN CONDUCT DISORDER AGE OF ONSET AND COMORBID INTERNALIZING DISORDERS

A THESIS SUBMITTED TO THE GRADUATE DIVISION OF THE UNIVERSITY OF HAWAIʻI AT MĀNOA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN PSYCHOLOGY

MAY 2012

By

Henri-Lee Stalk

Thesis Committee:

Charles W. Mueller, Chairperson,
Brad Nakamura
Yiyuan Xu
Dedication

This work is dedicated to my close friend and colleague Allison Love, who has always modeled kindness and the importance of helping others throughout my graduate career. Without the privilege of her friendship, her continued support and counsel, this thesis would not have been possible.
Acknowledgements

I would like to express my sincere appreciation to all of the parties that have contributed to this research project. The Center for Cognitive Behavioral Therapy has provided direct support with data collection. The Department of Psychology at the University of Hawai‘i at Mānoa has provided financial support for this study. I have been indebted in the preparation of my thesis to my advisor, Dr. Charles W. Mueller who has provided invaluable guidance, support, and training during the thesis process. In addition, I would like to thank my committee members, Dr. Brad Nakamura, who helped me learn the necessary database management skills to complete my thesis and Dr. Yiyuan Xu, who offered statistical guidance. I would also like to thank Dr. Mueller, Dr. Nakamura and Dr. Xu for assisting me with study methodology. I owe appreciation to my former colleagues and fellow graduate students: Dr. Gloria Mathis, Allison Love, Ryan Tolman, Michelle Lopez, Danielle Denenny, Rebecca Wilson, Trina Orimoto, Lisa Teh and Krista Brown who have provided their valuable time to help me with developing my thesis. Data collection for this project would not have been possible without the invaluable support of my undergraduate research assistants: Roy Onomura, Jason Hoe, Allison Powell and Brittney Keith.

I would like to give special recognition to my parents, George and Cynthia Henri Stalk, and my husband Konrad Trapler who have been a constant source of emotional, moral and financial support and I thank them.
Abstract

Conduct Disorder (CD) is associated with high rates of comorbidity, placing children at increased risk for more complex and impairing psychopathology and more negative long-term outcomes. CD is conceptualized to arise from two distinct developmental pathways (Childhood Onset and Adolescent Onset) based on the timing of the earliest CD symptom. The childhood onset subtype is associated with more physical aggression, higher impairment, longer course and poorer outcomes. While this subtype distinction has proven useful, little is known about age of CD onset and the presence of common comorbid disorders (other than AD/HD). The aims of the current study were: (1) to examine the overall rates of internalizing disorder comorbidity, (2) determine if the presence of internalizing comorbidity is predicted by age of CD onset (3) examine whether age of CD onset continues to predict comorbidity after controlling for gender and level of impairment and (4) determine whether gender moderates any relationships between CD age of onset and internalizing comorbidity. The study sample was drawn from archival data of 250 youth who were referred for emotional and behavior assessments at a university-based child and adolescent mental health clinic from 2000 until 2010 and were assigned a CD diagnosis. Results indicated that the overall rate of comorbidity of the final sample ($n=230$) was high, with 177 participants (76.95%), carrying one or more comorbid diagnosis at time of assessment. Eighty-two participants carried one or more internalizing diagnosis (35.65%), of which 34 had a mood disorder without a past or co-occurring anxiety disorder (14.78%) and 32 had an anxiety disorder without a past or co-occurring mood disorder (13.91%). Results consistently indicated that older age of onset predicted the presence of a mood disorder. Generally, younger age
of onset tended to be non-significantly associated with the presence of an anxiety disorder. For example, match sample analyses pairing 52 childhood onset subtype participants with 52 randomly selected adolescent onset subtype participants, showed that a younger age of CD onset marginally predicted the presence of an anxiety disorder. Age of onset, or CD subtype did not significantly predict the co-occurrence of anxiety or mood problems on self-reported or parent-reported dimensional measures. No moderator effect was found for gender on the presence of mood or anxiety disorders. However, a substantively small but statistically significant interaction between gender and age of onset was found indicating that the relationship between age of CD onset and self-reported depression symptoms was greater for girls than for boys. To the author’s knowledge, no other study has examined whether age of onset (measured dimensionally or categorically via subtype) predicted internalizing comorbidity while limiting the age at time of assessment to adolescents only.
# Table of Contents

Acknowledgment .................................................................................................................. ii
Abstract .................................................................................................................................... iii
List of Tables ........................................................................................................................ vi
List of Figures ......................................................................................................................... vii
Introduction ............................................................................................................................ 1
Conduct Disorder ................................................................................................................... 2
Conduct Disorder and Comorbid Internalizing Disorders ...................................................... 3
Comorbidity and Outcomes ................................................................................................... 4
Comorbid Disorder Onset ....................................................................................................... 4
Gender and Comorbidity ........................................................................................................ 5
Possible Causes of CD and Internalizing Disorder Comorbidity ........................................... 6
Conduct Disorder, Comorbidity and Age of Onset ............................................................... 7
Comorbidity and Evidence-Based Treatment ......................................................................... 8
The Current Study .................................................................................................................. 9

**Methods** ............................................................................................................................ 11
  - Sample Characteristics ..................................................................................................... 11
  - Procedure ......................................................................................................................... 12
  - Human Subject Consideration ......................................................................................... 13
  - Measures ......................................................................................................................... 14

**Results** ................................................................................................................................ 20
  - Overall Rates of Comorbidity .......................................................................................... 20
  - The Relationship between Age of CD Onset and Internalizing Disorders and
    Symptoms ........................................................................................................................ 20
  - Match Sample Analysis for the Relationship between Age of CD Onset and
    Internalizing Disorders and Symptoms ......................................................................... 24
  - Other Potential Predictors ............................................................................................... 27
  - Testing Moderators between Age of CD Onset and Internalizing Problems .................. 29

**Discussion** ......................................................................................................................... 31

**Appendices** ....................................................................................................................... 38
  - Appendix A: Age of CD Onset Coding Manual ............................................................... 38

**References** ......................................................................................................................... 41
List of Tables

Table 1: Frequency of Internalizing Disorder Distribution Across CD Subtype ..........................................................................................................................20

Table 2: Internalizing Disorders Regressed on Age of Onset (N=210) ......................21

Table 3: Internalizing Disorders Regressed on CD Subtype (N=230) .........................22

Table 4: Internalizing Symptoms Regressed on Age of Onset...........................................23

Table 5: Internalizing Symptoms Regressed on CD Subtype .............................................23

Table 6: Internalizing Diagnoses Regressed on Age of Onset (N=94) ............................24

Table 7: Internalizing Diagnoses Regressed on CD Subtype (N=104) ............................25

Table 8: Internalizing Symptoms Regressed on Age of Onset...........................................26

Table 9: Internalizing Symptoms Regressed on CD Subtype .............................................26

Table 10: Summary of Forward Wald Logistic Regression Analysis of Age of Onset, Gender and Impairment in Predicting Presence of Mood Disorder ..........................28

Table 11: Summary of Forward Wald Logistic Regression Analysis of CD Subtype, Gender and Impairment in Predicting Presence of Mood Disorder ..........................29
List of Figures

Figure 1: Self-reported Depression Symptoms by Gender and Age of CD Onset ...30
Introduction

Conduct Disorder (CD) is common in childhood, with an estimated lifetime prevalence of 9.5% (12.0% among males and 7.1% among females) and a median age-of-onset of 11.6 years (Nock, 2006). In Hawaii, 46.8% of children enrolled in the state’s Child Adolescent Mental Health Division (CAMHD) have a disruptive behavior diagnosis (i.e., CD, Oppositional Defiant Disorder (ODD) or Disruptive Behavior Disorder, Not Otherwise Specified), making this category the most common in this system of care. Comorbidity rates are high with 69.6% of children diagnosed in the CAMHD system also having at least one other psychiatric diagnosis (CAMHD Performance Report July 2009). CD and the presence of an additional disorder places a child at greater risk for further comorbidities, severe impairment, poor treatment response and negative long-term outcomes (Wolff & Ollendick, 2006).

The current Diagnostic and Statistical Manual of Mental Disorders-IV-TR (DSM-IV-TR; American Psychiatric Association, 2000) distinguishes two subtypes of CD, Childhood and Adolescent Onset, which are thought to arise from different developmental pathways and predict different long-term outcomes (Lahey et al., 1998). There has been little research on differences in temporal ordering of onset of CD and comorbid disorders, patterns of comorbidity among the subtypes and the effect of age at first symptom of CD (which for the purposes of this paper will be referred as “age of onset of CD”), or gender and impairment on comorbid internalizing diagnoses (Loeber, Burke, Lahey, Winters, & Zera, 2000). The current paper will summarize the CD comorbidity literature and describe the current study, which aims to examine any
differences in internalizing comorbidity among CD subtypes and whether age of onset of CD predicts the likelihood of developing comorbid anxiety or depression.

**Conduct Disorder**

CD is a psychological disorder diagnosed in childhood and adolescence that is characterized by rule-breaking and repeated violation of the rights of others. In order to receive a diagnosis of CD, a youth must have exhibited at least three, of a possible 13 symptoms, in the past year. The Childhood Onset subtype of CD is marked by the emergence of the first symptom before the age of 10, while the first symptom occurs at or after the age of 10 for the Adolescent Onset subtype (*DSM-IV-TR*, 2000). This diagnostic distinction in CD is based on extensive research which has indicated that children with early onset of CD symptoms face greater impairment, poorer prognosis and higher likelihood of experiencing a persistent, life-course trajectory of antisocial behavior compared to those who first exhibit CD behavior at or after the onset of puberty (Lahey et al., 1998, Moffitt, Caspi, Harrington, & Milne, 2002). The adolescent onset subtype is associated with less aggressive and less serious antisocial behavior, instability in delinquent behavior and greater likelihood of recovery by adulthood (Hinshaw, Lahey, & Hart, 1993; Moffitt, 1993).

Recent research suggests that there may be a third pathway, or subtype, of CD, one that is “Childhood Limited” and consists of children who share similar risk factors with the early onset group and develop CD at a young age, but go on to experience a remittance of their symptoms prior to adolescence (Barker & Maughan, 2009; Odgers et al., 2007). Though the “Childhood Limited” group may no longer meet criteria for CD as they develop, findings suggest that they are at increased risk for experiencing emotional
difficulties in adulthood (Moffitt, Caspi, Harrington, & Milne, 2002). Of note, the present study focused on adolescents with CD and will not include childhood limited CD.

**Conduct Disorder and Comorbid Internalizing Disorders**

Conduct Disorder has been shown to be associated with an increased risk for having or developing an internalizing disorder, such as depression and anxiety. Comorbidity rates vary greatly depending on gender, age, sample setting and diagnostic criteria used, but research has found that the prevalence rate of comorbid depression in children with either Oppositional Defiant Disorder (ODD) or CD is 15.3% to 25.5% in community samples and 16% to 50% in clinical samples (Feehan, McGee, Nada Raja, & Williams, 1994; Greene et al., 2002; Kovacs, Paulauskas, Gatsonis, & Richards, 1988; McGee, Feehan, Williams, & Anderson, 1992; Zoccolillo & Rogers, 1991). In addition, a longitudinal study of clinic-referred boys found that an increase in CD behaviors predicted an increase in symptoms of depression at later assessments, even after controlling for initial levels of depression (Lahey, Loeber, Burke, Rathouz, & McBurnett, 2002).

In comparison to work on comorbid depression, there has been markedly less research on the prevalence and impact of comorbid anxiety with conduct disorder (Burke, Loeber, Lahey, & Rathouz, 2005). In a small, clinic-referred sample of conduct-disordered boys, Connor, Ford, Albert, and Doerfler (2007) reported that 69% carried an anxiety disorder diagnosis whereas Zoccolillo and Rogers (1991) found that 45% of clinic-referred conduct disordered girls qualified for a comorbid phobic disorder. Community comorbidity rates of children who met criteria for either ODD or CD and anxiety range from 15.3% to 48.1% (Bowen, Offord, & Boyle, 1990; Cohen et al., 1993),
depending on gender. Bittner et al. (2007) found that generalized anxiety disorder significantly predicted a future diagnosis of conduct disorder, while Wolff and Ollendick’s (2006) review of the literature on comorbidity of conduct problems and depression indicated that children with anxious or phobia difficulties have a reduced risk of developing disruptive behavior problems. To the author’s knowledge, an examination of whether age of CD onset predicts the development of comorbid internalizing disorders and symptoms has not yet been conducted.

**Comorbidity and Outcomes**

Studies have shown that children with depression and pre-existing conduct problems are more likely to experience suicidal ideation compared to children with pure conduct disorder (Capaldi, 1992; Loeber & Keenan, 1994). Other research indicates individuals with conduct disorder and depressed mood exhibit more serious and varied kinds of delinquent behavior than those with CD alone (Loeber, Russo, Stouthamer-Loeber, & Lahey, 1994). Overall, findings are mixed on the impact of anxiety on the severity of CD symptoms. Some research has shown that comorbid anxiety may serve a “protective” function against greater impairment, lessening the risk of developing aggressive and antisocial behavior (Loeber et al., 1994; Walker, Lahey, Russo, & Frick, 1999), while it has also been found that anxiety does not improve the course of disruptive behavior problems (Campbell & Ewing, 1990).

**Comorbid Disorder Onset**

The timing of the onset of depression or anxiety and conduct disorder in comorbid youth remains unclear. Most studies indicate that conduct disorder develops prior to depression problems (Biederman, Faraone, Mick, & Lelou, 1995; Nock, Kazdin,
Hiripi, & Kessler, 2006; Zoccolillo & Rogers, 1991). In contrast, in a longitudinal study of a small sample of 8 to 13 year old children, Kovacs and colleagues (1988) found that clinical presentations of depression developed prior to "syndromatic" conduct problems. Using a nationally representative sample, Nock and colleagues (2006) found that the first symptom of CD primarily occurs after specific and social phobia but before all other anxiety disorders. Findings generally indicate that anxiety and conduct are most likely to co-occur in middle childhood, with a decrease in co-occurrence in adolescence (Loeber & Keenan, 1994). The onset of comorbid anxiety has been found to be dependent on the type of disorder and gender.

**Gender and Comorbidity**

The prevalence of CD among girls is lower than among boys (Zoccolillo, 1993). It has been put forth that sex differences in the prevalence of CD, timing of onset of symptoms and comorbid disorders, comorbidity patterns and progression of conduct disorder may be in part due to the failure of DSM-IV-TR criteria to encapsulate CD symptomatology in females (Stahl & Clarizio, 1999; Zoccolillo, 1993).

Gender may also moderate the onset of a comorbid condition. Interestingly, a “paradoxical gender effect” has been found where females with CD experience greater severity and impairment related to CD, and are at higher risk of developing a comorbid disorder than are boys with CD (Loeber & Keenan, 1994). Research has indicated that there are marked sex differences in the development of comorbid depression and conduct disorder (Loeber, Russo, Stouthamer-Loeber & Lahey, 1994). Costello and colleagues (2003) found that after controlling for other comorbidity, depression was comorbid with
CD in girls but not boys. Research also suggests that CD may precede depression in girls (Hipwell et al., 2011).

Zoccolliloo’s (1993) review of child and adult general population studies indicated that the onset of comorbid depression may be more likely to occur in preadolescence in males and mid-adolescence in females. Loeber and Keenan’s (1994) review of child studies on the prevalence of anxiety disorder or, its comorbidity with CD found that girls with conduct disorder are at higher risk than males for developing a comorbid anxiety disorder, especially in adolescence.

**Possible Causes of CD and Internalizing Disorder Comorbidity**

The high rates of comorbidity seen in children and adolescents with conduct disorder might be due to any number of factors. It has been argued that comorbidity is artificially created because the most impaired children (i.e., comorbid) are referred for treatment or due to overlapping definitional criteria (Angold, 1999). However carefully conducted community based prevalence studies and studies that eliminate any shared items (symptoms) find significant comorbidity remains (Angold, 1999; Wolf & Ollendick, 2006). The field is now focused on examining whether comorbidity arises due to shared underlying causes between disorders or because CD is a causal risk factor for the development of subsequent disorders-though no single theory of comorbidity has gained full support (Cunningham & Ollendick, 2010; Kopp & Beauchaine 2007; Wolff & Ollendick, 2006). Several models have been proposed to explain the relationship between CD and other disorders. Glaser (1967) outlined the “masked depression” view, which purports that the aggression and anger seen in CD are actually reflections of depressed mood, which can lead to depression being misdiagnosed as CD. In contrast, Capaldi
(1992) theorized that the negative social consequences (peer rejection, school failure, social isolation) of CD lead to internalizing problems. Incorporating the work of Fergusson et al. (1996) and Weiss et al. (1998), Wolff and Ollendick (2006) proposed that common (i.e., parental depression, negative emotionality) and unique (i.e., parent with Anti-Social Personality Disorder, negative self-concept) risk factors lead to the development of conduct problems and comorbidity over time.

**Conduct Disorder, Comorbidity and Age of Onset**

Significant questions remain regarding the etiology and development of CD, especially the interaction between CD, age and gender and comorbid internalizing disorders. Surprisingly, considering the divergent prognosis of each CD subtype, there has been very little research on age of CD onset and comorbidity patterns (other than specific disorders such as depression, or AD/HD) at time of assessment with mixed gender clinical samples. The author could only locate one such study conducted by Connor et al. (2007) which identified comorbidity patterns of a consecutively referred sample of 53 children, diagnosed with early or adolescent onset CD and ranging in age from 4-17 years old. All the children in the sample met criteria for at least one other psychiatric diagnosis. Results showed that childhood-onset was associated with male gender and high rates of ADHD and anxiety disorders, and that adolescent onset was associated with female gender, high rates of PTSD, alcohol and substance use disorders and six or more diagnoses across lifetime.

While informative, this study relied on a small sample that was predominantly male and Caucasian, limiting the generalizability of their findings. Age of onset was measured categorically; as such, the relationship between age of onset of first CD
symptom and development of comorbid disorders was not examined beyond subtype classification. Additionally, by including subjects as young as 4, Connor and colleagues confounded age and age of CD onset. Specifically, it is not possible to determine if the differences in comorbidity patterns reflect real subtype differences or simple age effects (e.g. higher use of substances by adolescents regardless of diagnostic status). There is a need for additional studies with larger, ethnically diverse samples of adolescents only, to better understand the relationship between CD age of onset and the presence of comorbidity.

**Comorbidity and Evidence-Based Treatment**

The current DSM-IV-TR criteria for CD focuses solely on externalizing symptoms making it difficult for clinicians to recognize patterns of comorbidity and implement effective treatment. The categorical approach of the DSM-IV-TR limits the ability to study disease progression and comorbid difficulties. This is particularly problematic for children with conduct disorder and comorbid internalizing symptoms because evidence-based treatment approaches are generally designed for a specific, single diagnosis and the treatments for CD, depression, and anxiety are markedly different. Specifically, the treatment of CD focuses on caregiver psychoeducation and behavior management, whereas the treatment for affective disorders emphasizes cognitive-restructuring work with the child, and treatment for anxiety utilizes exposure (Blue Menu, Hawaii State Department of Health, 2008). Research examining comorbidity patterns within CD might help illuminate the underlying relationships between CD and other conditions and could lead to improved assessment and treatment. Understanding comorbidity patterns within conduct disorder may be especially helpful as it has been
found that different treatment approaches may be useful for children with CD and comorbid internalizing disorders (Puig-Antich, 1982) and tailoring treatment to CD subtype may be useful in increasing treatment effectiveness (Nock et al., 2006).

**The Current Study**

Data to be used for this study were collected from a child and adolescent mental health clinic, situated in an ethnically diverse locale, which specialized in referrals for anxiety and stress while also assessing many youth with CD. Diagnostic assessments for all referred youth included structured interviews and the routine completion of caregiver and self-report questionnaires of anxiety and depression symptoms. The availability of child and caregiver reports of anxiety, depression and internalizing symptoms and age of onset of first CD symptom (as gathered from the structured interviews) for a mixed gender sample, offers the unique opportunity to assess whether age of onset of CD predicts comorbid internalizing disorders and/or dimensional symptom co-occurrence, and whether this relationship is moderated by gender. This is an especially relevant research focus considering the significant comorbidity rates between CD and internalizing disorders, and that age of CD onset predicts different long-term mental health outcomes for youth. By clarifying whether age of CD onset predicts the co-occurrence or presence of internalizing symptoms, this study will be able to shed light on current developmental models for comorbidity within CD and elucidate whether greater assessment and treatment planning may be needed depending on age of CD onset.

The aim of the current study is to use assessment data on adolescents with CD to determine (1) the overall rates of internalizing disorder comorbidity (2) determine if the presence of internalizing comorbidity (and specifically depressive disorders and anxiety
disorders) or co-occurrence (self-reported dimensional measures of internalizing problems) is predicted by age of CD onset (dimensionally or categorically via sub-types), (3) whether age of CD onset continues to predict comorbidity and co-occurrence of internalizing problems after controlling for other potential predictors (gender and level of impairment), and (4) whether youth gender moderates any relationships between CD age of onset and internalizing comorbidity/co-occurrence among CD subtypes in a clinic-referred sample.
Method

Sample Characteristics

Two hundred fifty (250) adolescents referred for emotional and behavior assessments (EBAs) at a university-based child and adolescent mental health clinic from January 21, 2000 until August 26, 2010 who were then assigned a conduct disorder diagnosis participated in the study. Participants ranged in age from 12 to 19 years old with a mean age of 15.4 (SD = 1.36) and a mean Child Adolescent Functional Assessment Scale (CAFAS) level of 108 (SD = 34.4). The majority of participants were male (68.7%) with adolescent onset subtype of CD (77.4%), and cut across the three levels of CD severity, mild (31.7%), moderate (56.5%) and severe (11.7%). The majority of participants identified as multi-ethnic (48.4%), with the remainder of participants identifying as Caucasian (8.5%), Other (5.6%), Native Hawaiian (5.2%), Filipino (4.7%), Samoan (2.3%), Japanese (1.4%), Chinese (1.4%), Korean (0.9%), Hispanic (0.5%), or chose to not give their ethnicity (8.9%).

Nearly one half of the sample reported their family annual income was less than $20,000 (46%). Fifty-seven participants (24.8%) were living with married parents, 41 participants (17.8%) came from single-family homes, 35 participants (15.2%) had divorced parents, 12 participants had separated parents (5.2%) and 7 participants had lost a parent to death (3%). Participants with any comorbid bipolar (n = 1) or psychosis disorders (n = 6), or who did not have a listed severity level (n = 8), or were in partial remission (n = 5) were excluded from the study, leaving a final sample of 230 participants.
Within the final sample, 20 participants were missing age of CD onset (but were identified as having a subtype in their clinical charts), 5 participants were missing impairment data (as measured by total CAFAS scores), 83 were missing Child Behavior Checklist (CBCL) data, 31 were missing Revised Children’s Anxiety and Depression Scale (RCADS) data and 17 were missing demographic data. Pair-wise deletion of missing cases was used for all analyses.

**Procedure**

Data were collected from a university-based clinic management information system and was extracted using Microsoft Access software, entered into a separate Access database for organization and then imported into SPSS for statistical analysis. Specific information gathered included: a) demographic information (i.e., age at time of assessment, gender, ethnicity, and caregiver income), b) all DSM-IV-TR diagnoses, and d) scores on a battery of measures assessing externalizing and internalizing symptoms and degree of functional impairment.

Data on CD subtype, age of onset of first CD symptom and onset of any comorbid DSM-IV-TR diagnoses were gathered from chart review, specifically collected from each subject’s clinical report. Age of onset was determined by a careful review of all chart material including the formal emotional and behavioral diagnostic assessment and treatment recommendation reports (which were approximately 10 or more pages). A coding manual was created to ensure reliable and valid coding of CD onset age, and age of onset of DSM-IV-TR diagnoses (which are not included in the present study). (See Appendix A for complete coding manual). All age of onset data were double entered by undergraduate research assistants and then validated by different undergraduate research
assistants. The principal investigator resolved any disagreements between coders regarding data assignment. Inter-rater reliability for coding of CD subtype and age of onset was calculated using a two way mixed model using the intra-class correlation coefficient. Good to strong interrater reliability was found for CD subtype, intra-class average measures coefficient (2,1) = .88, and moderate to substantial interrater reliability was found for age of onset, intra-class average measures coefficient (2,1) = .69.

**Human Subjects Consideration**

The study was conducted under a broader University of Hawai‘i at Mānoa Committee on Human Studies Institutional Review Board approval for the use of archival data from this particular clinic. Under this approval, legal guardians provide consent for the use of de-identified data, which includes demographic information (such as age, gender, and ethnicity), diagnostic information, and the standard battery of clinical intake measures for research purposes on childhood behaviors, and youth aged 6 to 17 years provide assent. A de-identified working data set with all pertinent information was created and all linked files were password protected.

**Measures**

**Structured Diagnostic Assessments.** Structured interviews were used to assess each child’s symptoms and to assign all DSM-IV-TR diagnoses. The Children’s Interview for Psychiatric Syndromes (ChIPS) or the Anxiety Disorder Child Interview Schedule (ADIS-IV) was administered to each child, and the Parent’s Children Interview for Psychiatric Syndromes (P-ChIPS) or the Anxiety Disorder Parent Interview Schedule to their primary caregiver (ChIPS/P-ChIPS; Weller & Fristad, 2000; ADIS-C/P; Silverman & Albano, 1996). In the final sample, 95 participants were administered the
ADIS-IV and 135 participants were administered the ChIPS/P-ChIPs. The ADIS-C/P assesses the major anxiety, mood, and externalizing DSM-IV disorders experienced by school-age children and has been found to have strong concurrent validity and excellent test-rest reliability across the syndrome scales (Silverman, Saavedra & Pina, 2001; Wood, Piacentini, Bergman, McCracken, & Barrios, 2002;). The ChIPS and P-ChIPS assess DSM-IV-TR symptoms for 17 syndromes in children and adolescents. Fristad et al. (1998a) found that the ChIPS possesses favorable psychometric properties with sensitivity for each disorder averaging at 70%, and specificity at 84%.

All clinical diagnoses were overseen and approved by two Ph.D. clinical psychologists (consensus). A past or current clinical diagnosis at time of assessment of a mood disorder (Major Depressive Disorder, Mood Disorder Not Otherwise Specified, Dysthymic Disorder) or an anxiety disorder (Generalized Anxiety Disorder, Social Phobia, Separation Anxiety, Obsessive-Compulsive Disorder, Specific Phobia) were used to identify subjects with comorbid internalizing disorders.

Age of CD onset was established retrospectively using caregiver report based on the protocol used in the structured interviews. In this study, the age of first CD symptom as described by informants in each participant’s clinical report was used to mark age of CD. If age of onset could not be determined either dimensionally or categorically via subtype, then the participant was not included in the study.

**Child Behavior Checklist.** The Child Behavior Checklist (CBCL; Achenbach, 1991) is a caregiver report questionnaire that assesses internalizing and externalizing symptoms in children. Across the time span of data collection at the clinic, two versions of the Child Behavior Checklist were administered (CBCL/4-18 and CBCL/6-18).
In the final sample, 39 participants were administered the CBCL/4-18 with the remainder of participants administered the CBCL/6-18. Participants were excluded from pertinent analyses if they were missing (a) more than 11 items from their CBCL or (b) 20% or more of the items necessary to calculate any DSM-Oriented Scale.

For the purposes of this study, the CBCL DSM-IV Affective and DSM-IV Anxiety scales and Internalizing Problems total score were used to measure each participant’s internalizing symptoms from a dimensional perspective. Six new items were added to the CBCL/6-18 (e.g. 2,4,5,28,78 and 99), with item #5 being added to the DSM-IV Affective Problems scale in the CBCL/6-18 version. No new items were added to the DSM-IV Anxiety Problems scale in the CBCL/6-18 version. The Internalizing Problems scale is composed of items from the Anxious/Depressed, Withdrawn/Depressed and Somatic Complaints syndrome scales of the CBCL, item #5 is the only new item included in the calculation of the Internalizing Problems scale (Achenbach, 2001). Following a method used in prior research on handling version differences, a mean substitution missing value item was generated for changed items across the two versions (Nakamura et al., 2008; Ebesutani et al., 2009). Changed items were treated as missing and scale scores were calculated by summing the remaining items and multiplying that score by the total number of items, divided by the total number of items, minus the number of missing items (Nakamura, Ebesutani, Bernstein, & Chorpita, 2008; Ebesutani et al., 2009).

The DSM-IV Anxiety Problems scale reflects DSM-IV Generalized Anxiety Disorder, Separation anxiety disorder, and Specific Phobia, whereas the DSM-IV Affective Problems scale reflects DSM-IV Dysthymia and Major Depressive Disorder.
The Internalizing Problems subscale encompasses items from the Social Withdrawal, Somatic Complaints, and Anxiety/Depression subscales to produce a total score reflecting the overall extent of child’s internalizing symptoms. All CBCL items are coded 0 for “not true,” a 1 for “somewhat or sometimes true,” or a 2 for “very true or often true.” Raw scores can be converted to age-standardized T-scores based on normative samples of children within the same gender and broad age range. Achenbach and Rescorla’s ASEBA (2001) manual recommends using raw CBCL scale scores in order to account for the full range of variation (Achenbach & Rescorla, 2001). As such, raw scores were used in all analyses for this study. The CBCL demonstrates strong test-retest reliability with alpha values ranging from .62 to .92 for boys aged 4 to 11 years old and .66 to .92 for girls aged 4 to 11 years old (Achenbach, 1991). Using a sample of 224 children aged 6 to 18 years, Ferdinand (2008) found that the DSM-IV Affective Problems and Anxiety Problems scales show concurrent validity with the ADIS-C/P and moderate and strong predictive validity, respectively, with corresponding DSM-IV diagnoses. Internal consistency and test-retest reliability for the DSM-IV Affective and Anxiety Problems scales and the Internalizing Problem scale have been reported to be good, with Cronbach Alphas ranging from .72 to .90 and test-retest coefficients ranging from .80 to .91 (Achenbach, 2001).

**Impairment.** The total score on the Child and Adolescent Functional Assessment Scale (CAFAS; Hodges, 1991) was used to measure impairment at time of diagnostic assessment. The CAFAS yields a score ranging between 0 and 240 (with a higher score indicating greater impairment) based on eight scales used to measure the child's
functioning: Role Performance Home, Role Performance School/Work, Role Performance Community (i.e., how effectively the youth fulfills societal roles at home, in school, and in the community), Thinking (i.e., ability of youth to use rational thought processes), Behavior Toward Others/Self (i.e., appropriateness of youth's daily behavior); Moods/Emotions (i.e., modulation of the youth's emotional life), Moods/Self-Harm (i.e., degree of non-accidental self-harm or self-destructive behavior) and Substance Use (i.e., youth's substance use and the extent to which it is inappropriate and disruptive) (Hodges & Wong, 1996). For each scale, the rater determines the level which best describes the youth's most severe level of dysfunction during a specified period (severe impairment = 30, moderate impairment = 20, significant problems or distress = 10, minimal or no impairment = 0). Hodges and Wong (1996) found that the CAFAS demonstrates high inter-rater reliability with lay raters and front-line staff for both total CAFAS scores (0.92 to 0.96) and individual scale scores (0.73 to 0.99), and was a useful indication of impaired functioning at intake. They found that the CAFAS had significant predictive validity across all spheres of functioning; specifically youth with high CAFAS total scores were more likely to have poor social relationships, difficulties in school and involvement with the juvenile justice system. Significant concurrent validity was also demonstrated between the CAFAS and the total score on the CBCL (Hodges & Wong, 1996).

Self-report of Depression and Anxiety Symptoms. The Revised Children’s Anxiety and Depression Scale (RCADS; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000a) was used to assess self-reported level of anxiety and depression symptoms (allowing for another examination of internalizing symptoms from a dimensional
perspective) (Appendix D). The RCADS is a 47-item self-report questionnaire, with scales corresponding to separation anxiety disorder (SAD), social phobia (SP), generalized anxiety disorder (GAD), panic disorder (PD), obsessive-compulsive disorder (OCD), and major depressive disorder (MDD). Respondents were asked to rate whether each item “never,” “sometimes,” “often,” and “always” applies to them, with each item being scored on a scale from 0 (“never”) to 3 (“always”). This study focused on respondent’s raw scores on the total Anxiety plus Depression scale (total internalizing scores), total Anxiety scale and Depression scale as a means of dimensionally assessing participants self-reported internalizing symptoms and anxiety and depression symptoms, respectively. If a participant was missing one item on one of the scale scores a substitution missing value item was generated, by summing the remaining items and multiplying that score by the total number of items minus the number of missing items (Chorpita, Moffitt, & Gray, 2005).

Previous research supports the reliability of the RCADS as a measure for assessing children’s report of symptoms corresponding to selected DSM-IV anxiety and depressive disorders. Chorpita et al. (2000a) found an adequate to strong index of reliability for each dimension measured on the RCADS (range 0.71 to 0.85). Previous analyses of the RCADS also found support for the convergent and discriminant validity of the scales (Chorpita, Moffitt, & Gray, 2006). The RCADS scales correlated positively and significantly with all convergent child and parent interview ratings for their target syndromes and with other self-report measures of anxiety (Revised Children’s Manifest Anxiety Scale; (RCMAS; Reynolds & Richmond, 1978)) and depression (Children’s Depression Inventory; (CDI; Kovacs 1980, 1981)). The RCADS has demonstrated
moderate to high sensitivity (range 0.59 to 0.79) and specificity (range 0.64 to 0.92) for the prediction of a disorder and strong discriminant validity from parent and child rating of oppositional behavior (Chorpita, Moffitt, & Gray, 2006). The RCADS total Anxiety and Depression scales have been reported to have good internal consistency with Cronbach alphas of .84 and .87, respectively (Chorpita et. al, 2005).
Results

Overall Rates of Comorbidity

The overall rate of comorbidity of the sample was high, with 177 participants (76.9%), carrying one or more comorbid diagnosis at time of assessment. Ninety participants carried an ADHD diagnosis (39.1%) and 82 participants carried an internalizing diagnosis (35.6%), of which 34 had a mood disorder without a past or co-occurring anxiety disorder (14.7%) and 32 had an anxiety disorder without a past or co-occurring mood disorder (13.9%). There was uneven distribution of internalizing, mood and anxiety disorders across subtypes in the sample, with a significantly greater number of internalizing disorders (see Table 1). Due to the low sample size of participants with anxiety and mood disorders, all results should be interpreted with caution.

Table 1

*Frequency of Internalizing Disorder Distribution Across CD Subtype*

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>Childhood Onset (n=52)</th>
<th>Adolescent Onset (n=178)</th>
<th>Total n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Internalizing</td>
<td>16</td>
<td>66</td>
<td>82</td>
</tr>
<tr>
<td>Any Anxiety</td>
<td>8</td>
<td>24</td>
<td>32</td>
</tr>
<tr>
<td>Any Mood</td>
<td>3</td>
<td>31</td>
<td>34</td>
</tr>
</tbody>
</table>

*Note.* “Any Anxiety” coded as the presence of an anxiety disorder without a co-occurring mood disorder and “Any Mood” coded as the presence of a mood disorder without co-occurring anxiety disorder.

The Relationship between Age of CD Onset and Internalizing Disorders and Symptoms
First, three logistic regression analyses were conducted to predict the presence of any internalizing, any anxiety or any mood disorder, using age of CD onset (measured dimensionally by age in years of first CD symptom) as the predictor variable. A test of the full model against the model including only the constant, indicated that age of onset measured dimensionally, was not a significant predictor of any internalizing or any anxiety disorder. Age of onset, measured dimensionally, was a marginally statistically significant predictor of the presence of any mood disorder ($\chi^2 [1, N = 210] = 6.72, p = .10$) and showed acceptable fit (Hosmer-Lemeshow $\chi^2 [1, N = 210] = 2.92, p = .81$) (see Table 2). The odds of having a mood disorder are 1.3 times greater with a one-year increase in age of CD onset.

Table 2

*Internalizing Diagnoses Regressed on Age of Onset (N=210)*

<table>
<thead>
<tr>
<th>Criterion Variable</th>
<th>$\beta$</th>
<th>S.E.</th>
<th>Wald’s $\chi^2$</th>
<th>df</th>
<th>p</th>
<th>$e^\beta$</th>
<th>95% CI</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Internalizing</td>
<td>.017</td>
<td>.053</td>
<td>.105</td>
<td>1</td>
<td>.746</td>
<td>1.01</td>
<td>.917</td>
<td>1.12</td>
</tr>
<tr>
<td>Any Anxiety</td>
<td>-.083</td>
<td>.067</td>
<td>1.52</td>
<td>1</td>
<td>.218</td>
<td>.921</td>
<td>.807</td>
<td>1.05</td>
</tr>
<tr>
<td>Any Mood</td>
<td>.262</td>
<td>.101</td>
<td>6.72</td>
<td>1</td>
<td>.010</td>
<td>1.30</td>
<td>1.06</td>
<td>1.58</td>
</tr>
</tbody>
</table>

*Note.* Age of onset coded in years; each comorbidity variable coded with not present = 0, present = 1

Second, three comparable logistic regression analyses were conducted to predict the presence of any internalizing, any anxiety or any mood disorder using *CD subtype* (child vs. adolescent onset) as the predictor. A test of the full model against the model including only the constant indicated that CD subtype was not a significant predictor of
any internalizing or any anxiety disorder (see Table 3). CD subtype significantly predicted the presence of any mood disorder ($\chi^2 [1, N = 230] = 3.89, p = .048$). The odds of youth with adolescent onset subtype having a mood disorder is 3.44 times greater than the odds of youth with childhood onset subtype. However there was insufficient replication within subtype subpopulations for the Hosmer-Lemenshow test to be applied, bringing these findings into question.

Table 3

*Internalizing Diagnoses Regressed on CD Subtype (n=230)*

<table>
<thead>
<tr>
<th>Criterion Variable</th>
<th>$\beta$</th>
<th>S.E.</th>
<th>Wald’s $\chi^2$</th>
<th>df</th>
<th>p</th>
<th>$e^{\beta}$</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Internalizing</td>
<td>.282</td>
<td>.338</td>
<td>.696</td>
<td>1</td>
<td>.404</td>
<td>1.32</td>
<td>.683</td>
<td>2.57</td>
</tr>
<tr>
<td>Any Anxiety</td>
<td>-</td>
<td>.154</td>
<td>.443</td>
<td>.121</td>
<td>1</td>
<td>.728</td>
<td>.360</td>
<td>2.04</td>
</tr>
<tr>
<td>Any Mood</td>
<td>1.23</td>
<td>.627</td>
<td>3.89</td>
<td>1</td>
<td>.048</td>
<td>3.44</td>
<td>1.01</td>
<td>11.7</td>
</tr>
</tbody>
</table>

*Note:* Age of onset coded with child = 0 and adolescent =1; each comorbidity variable coded with not present = 0, present = 1

Third, a series of linear regression analyses were conducted to determine if the co-occurrence of internalizing *symptoms* as reported by the child (RCADS) or the parent (CBCL) (self- and parent-reported dimensional measures of internalizing problems) were predicted by age of CD onset (measured dimensionally or categorically). Due to a positive skew in each of the self-report measures, square root transformations were applied to these variables. Results indicated that age of CD onset (dimensionally or categorically via sub-types) did not significantly predict the co-occurrence of
internalizing, anxiety or mood problems on self-reported measures (i.e., RCADS) or parent-reported measures (i.e., CBCL) (see Table 4 and Table 5).

Table 4

*Internalizing Symptoms Regressed on Age of Onset*

<table>
<thead>
<tr>
<th>Criterion Variable</th>
<th>B</th>
<th>S.E.</th>
<th>β</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCADS Total Anxiety and Depression</td>
<td>.047</td>
<td>.062</td>
<td>.056</td>
<td>.758</td>
<td>.450</td>
</tr>
<tr>
<td>RCADS Total Anxiety</td>
<td>.046</td>
<td>.058</td>
<td>.059</td>
<td>.794</td>
<td>.428</td>
</tr>
<tr>
<td>RCADS Total Depression</td>
<td>.030</td>
<td>.034</td>
<td>.066</td>
<td>.890</td>
<td>.375</td>
</tr>
<tr>
<td>CBCL DSM-IV Adjusted Affective</td>
<td>.142</td>
<td>.153</td>
<td>.080</td>
<td>.930</td>
<td>.354</td>
</tr>
<tr>
<td>CBCL DSM-IV Anxiety</td>
<td>.010</td>
<td>.081</td>
<td>.011</td>
<td>.124</td>
<td>.901</td>
</tr>
<tr>
<td>CBCL Total Internalizing</td>
<td>.198</td>
<td>.309</td>
<td>.055</td>
<td>.641</td>
<td>.522</td>
</tr>
</tbody>
</table>

*Note.* RCADS analyses (*n* = 183) and CBCL analyses (*n* = 136). Age of onset coded in years; each comorbidity variable coded with not present = 0, present = 1

Table 5

*Internalizing Symptoms Regressed on CD Subtype*

<table>
<thead>
<tr>
<th>Criterion Variable</th>
<th>B</th>
<th>S.E.</th>
<th>β</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCADS Total Anxiety and Depression</td>
<td>.314</td>
<td>.389</td>
<td>.057</td>
<td>.806</td>
<td>.421</td>
</tr>
<tr>
<td>RCADS Total Anxiety</td>
<td>.397</td>
<td>.361</td>
<td>.078</td>
<td>1.10</td>
<td>.273</td>
</tr>
<tr>
<td>RCADS Total Depression</td>
<td>-.025</td>
<td>.213</td>
<td>-.008</td>
<td>-.118</td>
<td>.906</td>
</tr>
<tr>
<td>CBCL DSM-IV Adjusted Affective</td>
<td>.089</td>
<td>.971</td>
<td>.008</td>
<td>.091</td>
<td>.927</td>
</tr>
<tr>
<td>CBCL DSM-IV Anxiety</td>
<td>-.233</td>
<td>.509</td>
<td>-.038</td>
<td>-.458</td>
<td>.647</td>
</tr>
</tbody>
</table>
CBCL Total Internalizing  

\[-.594 \quad 1.94 \quad .025 \quad -.305 \quad .761\]

*Note.* RCADS analyses \((n = 199)\) and CBCL analyses \((n = 147)\). Age of onset coded with child = 0 and adolescent = 1; each comorbidity variable coded with not present = 0, present = 1

**Match Sample Analysis for the Relationship between Age of CD Onset and Internalizing Disorders and Symptoms**

Due to unequal distribution of internalizing, mood and anxiety disorders across CD subtype (see Table 1), 52 participants with adolescent onset subtype were randomly selected and matched to the 52 participants with childhood onset subtype. Parallel regression analyses examining whether age of CD onset or CD subtype predicted internalizing, anxiety or mood presence/co-occurrence were conducted on this sample. Using these match sample analyses, age of onset and CD subtype again did not predict presence of any internalizing disorder. However significant effects were found for the presence of any mood disorder (see Table 6). Age of onset measured dimensionally significantly predicted presence of any mood disorder \(\chi^2 [1, N = 104] = 4.54, p = .03\) while also showing acceptable fit (Hosmer-Lemenshow \(\chi^2 [1, N = 104] = 4.93, p = .67\)). The odds of having a mood disorder are 1.35 times greater with a one-year increase in age of CD onset. In addition, age of onset marginally predicted the presence of an anxiety disorder \(\chi^2 [1, N = 104] = 2.97, p = .08\) and showed acceptable fit (Hosmer-Lemenshow \(\chi^2 [1, N = 104] = 2.45, p = .96\)). The odds of having an anxiety disorder decreased by .85 with a one-year increase in age of CD onset.

Table 6

*Internalizing Diagnoses Regressed on Age of Onset (N = 94)*
The matched sample analyses with CD subtype indicated no significant effect for the presence of any internalizing or any anxiety disorders. CD subtype did significantly predict the presence of mood disorders ($\chi^2 [1, N = 104] = 3.86, p = .049$) (see Table 7). The odds of youth with adolescent onset subtype having a mood disorder is 3.88 times greater than the odds of youth with childhood onset subtype. However, even in this match sample there was not sufficient replication within subtype subpopulations for the Hosmer-Lemenshow test to be applied.

Table 7

**Internalizing Diagnoses Regressed on CD Subtype (N = 104)**

<table>
<thead>
<tr>
<th>Criterion Variable</th>
<th>$\beta$</th>
<th>S.E. $\beta$</th>
<th>Wald’s $\chi^2$</th>
<th>df</th>
<th>P</th>
<th>$e^\beta$</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Internalizing</td>
<td>-.015</td>
<td>.070</td>
<td>.047</td>
<td>1</td>
<td>.829</td>
<td>.985</td>
<td>.859</td>
<td>1.13</td>
</tr>
<tr>
<td>Any Anxiety</td>
<td>-.165</td>
<td>.096</td>
<td>2.97</td>
<td>1</td>
<td>.085</td>
<td>.848</td>
<td>.703</td>
<td>1.02</td>
</tr>
<tr>
<td>Any Mood</td>
<td>.307</td>
<td>.144</td>
<td>4.54</td>
<td>1</td>
<td>.033</td>
<td>1.35</td>
<td>1.02</td>
<td>1.80</td>
</tr>
</tbody>
</table>

*Note. Age of onset coded in years; each comorbidity variable coded with not present = 0, present = 1.*
Note. Age of onset coded in years; each comorbidity variable coded with not present = 0, present = 1.

Finally, and consistent with prior results, matched sample analyses indicated that age of CD onset (dimensionally or categorically via sub-types) did not significantly predict the co-occurrence of internalizing, anxiety or mood problems on self reported measures (i.e., RCADS) or parent-reported measures (i.e., CBCL) (see Table 8 and Table 9).

Table 8

<table>
<thead>
<tr>
<th>Criterion Variable</th>
<th>B</th>
<th>S.E. β</th>
<th>β</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCADS Total Anxiety and Depression</td>
<td>.030</td>
<td>.072</td>
<td>.048</td>
<td>.423</td>
<td>.674</td>
</tr>
<tr>
<td>RCADS Total Anxiety</td>
<td>.021</td>
<td>.068</td>
<td>.035</td>
<td>.307</td>
<td>.760</td>
</tr>
<tr>
<td>RCADS Total Depression</td>
<td>.030</td>
<td>.042</td>
<td>.082</td>
<td>.719</td>
<td>.474</td>
</tr>
<tr>
<td>CBCL DSM-IV Adjusted Affective</td>
<td>.092</td>
<td>.212</td>
<td>.057</td>
<td>.435</td>
<td>.665</td>
</tr>
<tr>
<td>CBCL DSM-IV Anxiety</td>
<td>.061</td>
<td>.118</td>
<td>.068</td>
<td>.518</td>
<td>.607</td>
</tr>
<tr>
<td>CBCL Total Internalizing</td>
<td>.332</td>
<td>.471</td>
<td>.092</td>
<td>.705</td>
<td>.483</td>
</tr>
</tbody>
</table>

Note. RCADS analyses (n = 79) and CBCL analyses (n = 60). Age of onset coded in years; each comorbidity variable coded with not present = 0, present = 1.

Table 9

<table>
<thead>
<tr>
<th>Criterion Variable</th>
<th>B</th>
<th>S.E. β</th>
<th>β</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCADS Total Anxiety and Depression</td>
<td>-.053</td>
<td>.418</td>
<td>-.014</td>
<td>-.128</td>
<td>.898</td>
</tr>
<tr>
<td>RCADS Total Anxiety</td>
<td>.019</td>
<td>.393</td>
<td>.005</td>
<td>.049</td>
<td>.961</td>
</tr>
</tbody>
</table>
Other Potential Predictors of Comorbidity

Given the general non-significant findings regarding age of CD onset and anxiety and internalizing problems, no subsequent analyses were done attempting to control for possible confounding variables. Given age of onset measured dimensionally and categorically significantly predicted the presence of any mood disorders (although with statistical limitations), a second logistic regression analyses was conducted examining age of onset and presence of a mood disorder while controlling for the influence of gender, level of impairment and, the interaction of gender and impairment. A forward Wald logistic regression analysis was conducted where gender, level of impairment and the interaction term were entered on step 1 and age of onset was entered on step 2. A test of the full model against the model including only the constant indicated that gender and the gender by impairment interaction term did not significantly predict the presence of a mood disorder. However higher level of impairment was associated with the presence of a mood disorder ($\chi^2 [1, N = 206] = 6.00, p = .014$). Also and to the point of this analysis, age of onset measured dimensionally continued to significantly predict the presence of a mood disorder ($\chi^2 [1, N = 206] = 7.561, p = .006$) (see Table 10). Results showed acceptable fit (Hosmer-Lemeshow $\chi^2 [1, N = 206] = 8.12, p = .42$).

<table>
<thead>
<tr>
<th></th>
<th>RCADS Total Depression</th>
<th>CBCL DSM-IV Adjusted Affective</th>
<th>CBCL DSM-IV Anxiety</th>
<th>CBCL Total Internalizing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-.150</td>
<td>.247</td>
<td>-.066</td>
<td>-.606</td>
</tr>
<tr>
<td></td>
<td>-.057</td>
<td>1.236</td>
<td>-.006</td>
<td>-.046</td>
</tr>
<tr>
<td></td>
<td>.167</td>
<td>.677</td>
<td>.032</td>
<td>.246</td>
</tr>
<tr>
<td></td>
<td>.509</td>
<td>2.706</td>
<td>.024</td>
<td>.188</td>
</tr>
</tbody>
</table>

Note. RCADS analyses ($n = 85$) and CBCL analyses ($n = 63$). Age of onset coded with child = 0 and adolescent = 1; each comorbidity variable coded with not present = 0, present = 1.
Table 10

**Summary of Forward Wald Logistic Regression Analysis of Age of Onset, Gender and Impairment in Predicting Presence of Any Mood Disorder**

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>β</th>
<th>S.E. β</th>
<th>Wald’s $\chi^2$</th>
<th>df</th>
<th>p</th>
<th>e$^\beta$</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Included Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impairment</td>
<td>.016</td>
<td>.006</td>
<td>6.00</td>
<td>1</td>
<td>.014</td>
<td>1.01</td>
<td>1.00</td>
<td>1.02</td>
</tr>
<tr>
<td>Age of Onset</td>
<td>.280</td>
<td>.102</td>
<td>7.56</td>
<td>1</td>
<td>.006</td>
<td>1.32</td>
<td>1.08</td>
<td>1.61</td>
</tr>
<tr>
<td><strong>Excluded Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>1</td>
<td>.697</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>1</td>
<td>.601</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. Predictor Analyses $n=206$. Age of onset coded in years; each comorbidity variable coded with not present = 0, present = 1.*

Parallel analyses with *CD subtype* indicated that impairment ($\chi^2 [1, N = 226] = 6.69, p = .01$) and age of onset continued to significantly predict the presence of any mood disorder ($\chi^2 [1, N = 226] = 4.965, p = .026$) (see Table 11) and showed acceptable fit (Hosmer-Lemeshow $\chi^2 [1, N = 226] = 5.511, p = .70$). Gender and the interaction of gender and impairment were not significant.

Table 11
Summary of Forward Wald Logistic Regression Analysis of CD Subtype, Gender and Impairment in Predicting Presence of Any Mood Disorder

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>β</th>
<th>S.E. β</th>
<th>Wald’s χ²</th>
<th>df</th>
<th>p</th>
<th>e^β (odds ratio)</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Included Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impairment</td>
<td>.015</td>
<td>.006</td>
<td>6.692</td>
<td>1</td>
<td>.010</td>
<td>1.016</td>
<td>1.004</td>
<td>1.027</td>
</tr>
<tr>
<td>Excluded Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>1</td>
<td></td>
<td>.858</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>1</td>
<td></td>
<td>.718</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Predictor Analyses n=226. Age of onset coded with child = 0 and adolescent =1; each comorbidity variable coded with not present = 0, present = 1

Given the generally non-significant findings regarding age of CD onset and CD subtype and self and parent reported symptoms no subsequent analyses were done attempting to control for possible confounding variables.

Testing for Moderators Between Age of CD Onset and Internalizing Problems

Stepwise regression analyses were conducted to examine whether youth gender moderated any relationships between CD age of onset (dimensional) and internalizing comorbidity. Forward regression analyses entering age of onset, gender and the age of onset by gender interaction with the criterion variables of any internalizing disorder.
presence, any anxiety or any mood disorder found no significant effects. When CD subtype, gender and the interaction of CD subtype and gender were entered as predictors with the dependent variables of any internalizing disorder, any anxiety or any mood disorder presence, again no significant effects were found.

Similar analyses were conducted focused on self and parent reported symptoms and generally found no moderator effects, whether using CD subtype or age of CD onset as the predictor. The one exception was a significant interaction term of gender and age of onset ($r^2 = .033$) for the RCADS total depression score, explaining 3.3% of the variance in participants total depression score ($p = .019$). The general pattern of the interaction indicated that older age of onset predicted higher self-reported depression symptoms for girls than for boys (see Figure 1).

Figure 1 Self-reported Depression Symptoms by Gender and Age of CD Onset
Discussion

The current study focused on whether age of CD onset predicted the presence of internalizing symptoms or disorders in a clinic-referred, sample of adolescents diagnosed with CD. Results indicated that older age of CD onset was associated with an increased likelihood of having a past or current mood disorder, although age of onset had no consistent relationship with self- or parent-reported depressive symptoms. The former effect held even after controlling for gender and level of impairment. Further, though not statistically significant, younger age of CD onset tended to predict a past or current presence of an anxiety disorder, but had no consistent relationship with self- or parent-reported anxiety symptoms/problems. Finally, a small moderator effect was found suggesting that older age of CD onset might predict higher self-reported depressive symptoms for girls than for boys.

Despite high rates of comorbidity in our sample (76.95% of participants had at least one other diagnosis), somewhat low overall rates of internalizing disorder comorbidity were found. Rates of mood comorbidity (without co-occurring anxiety comorbidity) were 14.78% for the full sample, with 5.8% of childhood onset subtype participants and 17.4% of adolescent subtype participants carrying a past or current mood diagnosis. Rates of anxiety disorder comorbidity (without co-occurring mood comorbidity) were 13.91% for the full sample, with 15.4% of childhood onset subtype participants and 13.5% of adolescent onset subtype participants carrying a past or current anxiety diagnosis. These rates are significantly less than rates found in other studies using clinical samples, Connor et al. (2007); Greene et al. (2002). While somewhat surprising given the anxiety and stress specialization of the clinic used for this study, these lower
rates might be due to limiting our sample to adolescents, preventing the inclusion of anxiety disorders associated with younger ages of onset (e.g. Separation Anxiety Disorder, Specific Phobia), and limiting our analysis to participants diagnosed with CD (rather than including Oppositional Defiant Disorder also). Further, for the direct comparisons of age of onset and comorbidity, analyses included only those with one but not the other class of internalizing disorders (anxiety or depressive). This relatively low comorbidity rate of anxiety and mood disorders, coupled with some amount of "multi-morbidity" (e.g. 16 youth carried both an anxiety and mood disorder) and uneven age of onset and gender distribution limited the power to answer the core research questions.

In general, the findings point to increase age of onset predicting higher likelihood of a mood disorder. These findings are generally consistent with prior studies, which have shown that that the onset of depression more commonly occurs in adolescence than in childhood (Kashani, Orvaschel, Rosenberg, & Reid, 1989; Kessler, Avenevoli, & Merikangas, 2001; Quay & LaGreca, 1986). The present study goes beyond these findings however, since the sample was restricted to adolescents yet looked at both child and adolescent CD onset, we now have data that suggest mood disorders are not only associated with older youth, but also associated with a later onset of CD. This is somewhat inconsistent with other research that has found comorbid depression generally occurs after other psychiatric comorbidities including CD (Biederman, 1995; Capaldi, 1992; Lahey et al. 2002), which might point to childhood onset being more associated with adolescent depression. Regardless, future studies that compare age of onset across all disorders (or include any lifetime history of each disorder) will help clarify these relationships. Prior research examining CD comorbidity and depressive symptoms
suggest that this effect may be partly moderated by the presence of ADHD (Biederman, Munir, & Knee 1987, Kovacs et al. 1988). Specifically, research has shown a substantial rate of co-occurrence between depression and ADHD (Biederman, Faraone, Mick, & Lelon, 1995, Biederman & Faraone, 1998). This co-occurrence has been contributed to a subpopulation of youth with ADHD who are at higher risk of psychiatric comorbidity than other children or adolescents without ADHD (Biederman et al., 1997). Given this additional comorbidity, a subsequent analysis was conducted after removing all youth with an AD/HD diagnosis. While this restricted the sample size even more, the pattern remained the same, i.e. older age of onset and adolescent onset subtype were found to marginally significantly predict the presence of mood disorder (less than $p = .10$). With larger samples, the effects of AD/HD on age of CD onset and internalizing disorders could be more thoroughly examined.

While the findings were generally non-significant, patterns consistently pointed to lower age of CD onset predicted anxiety comorbidity (including when AD/HD youth were removed from the sample). This trend is generally consistent with other clinic-based studies (Loeber & Keenan, 1994; Conner et al., 2007). Unlike these other studies, this one focused only on adolescents, implying that (if this trend is to be believed) concurrent anxiety disorders in teens are predicted by earlier age of CD onset. This is a different point than "younger kids with CD are more likely to have anxiety disorders compared to older kids" and begins to give clues about the development and maintenance of anxiety disorders.

The current study found no statistically significant relationships between age of CD onset and self- and parent-reported symptoms of anxiety or depression (or
internalizing problems more broadly). The reasons for these non-significant findings are unclear. First, using pairwise deletion of cases dramatically affected sample size, which might have limited effects. Second, the use of raw scores (while recommended by test developers) might mask gender and age normed effects (although the use of an adolescent sample only should have minimized any such age effects). Third, such self- and parent report measures are known to have low agreement across respondents and as such capture a good deal of method variance at the expense of measuring the underlying trait. Structural equation modeling analyses may advance the research in this area. Results also may not have been significant due to the majority of our participants having comorbid diagnoses with other disorders (e.g., ADHD, substance use, Post Traumatic Stress Disorder) whose symptomatology may overlap with self and parent measures of internalizing, anxiety and depression problems. Prior research has shown that the DSM-oriented Affective Problems scale significantly corresponds with oppositional and conduct measures, which may be reflective of youth’s symptoms of depression presenting as irritability (Nakamura et al. 2008). Our sample also had high levels of impairment, which may have lessened any differences across the groups. Furthermore, there was a floor effect on self-report and parent report measures. These findings suggest that using actual diagnoses in contrast to symptomatology is a more accurate estimate of anxiety or depression problems in youth with CD.

Given the generally significant findings regarding age of CD onset and the presence of mood comorbidity, subsequent analyses were conducted to control for the possible confounding variables of gender and level of impairment. As expected higher levels of impairment were associated with higher odds of a mood disorder, likely
reflecting that overall impairment can be affected additively by each disorder, and consistent with prior research (Loeber et al., 1994). Importantly, the relationship between age of onset (measured dimensionally or categorically) significantly predicted the presence of a mood disorder, after controlling for these other effects. These findings suggest that the relationship found between age of CD onset and mood disorders is not an artifact of gender or level of impairment, strengthening these findings. Finally, the current study examined whether youth gender moderated any relationships between age of onset and internalizing comorbidity and co-occurrence. No moderator effect was found for gender on the presence of mood or anxiety disorders. However, a substantively small but statistically significant interaction between gender and age of onset was found indicating that the relationship between age of CD onset and self-reported depression symptoms was greater for girls than for boys. This finding is reminiscent of Keenan and Hipwell’s (1995) meta-analytic review, which indicated that first episodes of depression have been shown to be more severe and longer in duration for girls than boys, and that beginning in adolescence, girls show a disproportionate increase in symptoms and rate of conduct disorder relative to boys.

**Study Limitations**

As with any study, there are some methodological concerns that limit the generalizability of the findings. First the limited sample size and the subsequent small cell sizes for some analyses (e.g. childhood CD onset and mood disorders) adversely affected the power of the study. A larger sample with the same trends in the data might well find more statistically significant effects. One such option would have been to include youth younger than 12 in the sample. While this would have increased sample
size, and very likely have increased the number of youth with comorbid anxiety disorders, it would have added to the confound between age of CD onset and age at time of assessment. Second, the measure of age of onset was somewhat problematic as it was based on caregiver’s retrospective report. Importantly, this recall challenge logically should apply more for those with earlier ages of CD onset and again suggests that looking at younger children (even with the confound mentioned earlier) might prove useful. To limit some of the problems with recall, participants with missing or unclear age of onset data were only included in the analyses when age of onset was measured by CD subtype, and only if diagnosed with a specific subtype, or identified as having an onset associated with a specific development period (for example, caregiver reporting that first CD symptom occurred in “high school”).

**Future Directions**

To the author’s knowledge, no other study has examined whether age of onset (measured dimensionally or categorically via subtype) predicted internalizing comorbidity while limiting age at time of assessment to adolescence. While this study provided greater information regarding the relationship between CD age of onset and comorbid internalizing disorders, there are many avenues for continued research. Longitudinal research examining the development of comorbidities and age of onset could address some of the limitations described above. It is also suggested that future studies incorporate measures of callous-unemotional traits to explore whether these features are associated with age of CD onset and/or moderate the relationship between CD and affective disorders. Finally, more research examining the temporal ordering of
comorbid diagnoses in relation to the onset of CD problems would also contribute to the literature base.
Appendix A: Age of CD Onset Coding Manual

CASE ID: Input child’s case number as found on the chart

INTAKE AGE: Input the child’s age as found at the top of the report: “Age at Assessment”, input both years and months

GENDER: Put a “0” for Male and a”1” for Female
0=Male, 1=Female

ADIS/CHIPS CHILD: Look at the “Sources of Information” section of the report and locate whether the child interview of the ADIS or CHIPS was given, if it was the child interview of the ADIS, input “0”, if it was the child interview of the CHIPS, input “1”. If no ADIS/CHIPS Child given, leave blank.
ADIS Child Interview=0
CHIPS Child Interview=1

ADIS/CHIPS Parent: Look at the “Sources of Information” section of the report and locate whether the parent interview of the ADIS or CHIPS was given, if it was the parent interview of the ADIS, input “0”, if it was the child interview of the CHIPS, input “1” regardless if it was given to a parent, foster care parent, or social worker. If the CHIPS/ADIS parent interview was given as part of the assessment, input the appropriate code, regardless of informant. If no ADIS/CHIPS Parent given, leave blank.
ADIS Parent Interview=0
CHIPS Parent Interview=1

CD SUBTYPE: Look at the “Diagnostic Impressions” section of the report and look to if child was given Conduct Disorder, Childhood Onset, input “0”, if the child was given Conduct Disorder, Adolescent Onset, input “1”
Childhood Onset=0
Adolescent Onset=1

SEVERITY: Look at the “Diagnostic Impressions” section of the report and look to if child was given Conduct Disorder, Partial Remission input “0”, if the child was given Conduct Disorder, Mild, input “1”, Conduct Disorder, Moderate, input “2”, if the child was given Conduct Disorder, Severe, input “3”
Full Remission= leave column blank
Partial Remission= 0
Mild=1
Moderate=2
Severe=3
Not Listed=99

AGE OF ONSET: List age of child’s first CD symptom which is usually found in “Review of Assessment Measures” and if not there, in “Description of Problem Area.” If an age is given, put the age.
If stated from at least the age of (ex: at least the age of 5) put the age listed
If the age is stated as being “around” a certain age, note the age listed (i.e. around age 8, input 8).
If age is stated as “within the past year” put the age listed minus 1 (so if they are 17, put 16).
If age is listed as “from age of” (ex: from age of 5) put the age listed
If age is given as between one age and another (between 5 and 7), input the lowest age.
In the case of multiple ages of onsets listed for different symptoms of CD, use the age of the first CD symptom.
If the first CD symptom started “before age __”, code as the age listed minus 1 (i.e. before age 10 would be coded as 9).
If the age of first CD symptoms is listed as “after age __”, code as the age listed plus 1 (after age 8, would be coded as 9)
If the symptoms for CD have “always” been present, code the age of onset as 0.
If age is listed as “__ or __” code as the younger age listed (e.g., age 13 or 14 should be coded as 13).
If age of first CD symptom is given as a date, leave “Age of Onset” column blank and then put the date in the “DATE OF ONSET” column (i.e. symptoms began Dec. 2006)
If it lists a grade for age of CD onset, look at the table below for the appropriate age. Enter the age and in the Grade column enter 1 (1=yes). Read “Academic Performance” section of the report to check that child has not repeated grades prior to onset of first CD symptom, if child has repeated grades prior to age of onset, calculate grade child would have been in if they had not repeated a grade and input the age for that predicted grade. FLAG in comment section for me. MAKE SURE TO READ ACADEMIC HISTORY TO CHECK FOR GRADE REPETITIONS:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preschool</td>
<td>4</td>
</tr>
<tr>
<td>Kindergarten</td>
<td>5</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Grade</td>
<td>6</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Grade</td>
<td>7</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; Grade</td>
<td>8</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; Grade</td>
<td>9</td>
</tr>
<tr>
<td>5&lt;sup&gt;th&lt;/sup&gt; Grade</td>
<td>10</td>
</tr>
<tr>
<td>6&lt;sup&gt;th&lt;/sup&gt; Grade</td>
<td>11</td>
</tr>
<tr>
<td>7&lt;sup&gt;th&lt;/sup&gt; Grade</td>
<td>12</td>
</tr>
</tbody>
</table>
If grade is listed as “around grade _”, list grade given (ex: around grade 4 would be listed as the age corresponding to grade 4)
If no age is given, put 99
If time period of onset is given as a school period (i.e. elementary school) code as 99 and input “1” in column School

**DATE OF ONSET:** If a date of onset of first CD symptom is given (i.e. Dec. 2006) and no specific age of first CD symptom is listed, input date given (Dec. 2006)

**GRADE:** If a grade level for age of onset of first CD symptom is given (i.e. second grade) and no specific age of first CD symptom is listed, input “1”.

**SCHOOL:** If a school level is given for age of onset of first CD symptom is given (i.e. elementary school) and no specific age of first CD symptom is listed:
   - “1” for Elementary school
   - “2” for middle school
   - “3” for high school
References


