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Trends in the Rate of Inpatient Pediatric Bipolar Disorder Diagnosis between 1996 and 2015

Samantha Sherwood
samanthasherwood7@gmail.com

TRENDS IN THE RATE OF INPATIENT PEDIATRIC BIPOLAR DISORDER DIAGNOSIS BETWEEN 1996 AND 2015

By

Samantha N. Sherwood

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Samantha N. Sherwood

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Andrew Freeman, Ph.D.
Examination Committee Chair

Kathryn Hausbeck Korgan, Ph.D.
Graduate College Interim Dean

Kristen Culbert, Ph.D.
Examination Committee Member

Rachael Robnett, Ph.D.
Examination Committee Member

Jennifer Keene, Ph.D.
Graduate College Faculty Representative

Abstract

Trends in the Rate of Inpatient Pediatric Bipolar Disorder Diagnosis between 1996 and 2015

by

Samantha Sherwood

Dr. Andrew Freeman, Committee Chair
Assistant Professor of Psychology
University of Nevada, Las Vegas

The rate of PBD in the U.S. increased dramatically between the mid-1990s and mid-2000s resulting in concern regarding the potential for misdiagnosis of PBD. However, given that the rate of PBD diagnosis had not been examined in the U.S. since 2004, the longitudinal trajectory of PBD diagnosis subsequent to the mid-2000s was unclear. Therefore, the present study utilized two datasets of administrative billing claims to assess whether longitudinal changes in the rate of inpatient PBD diagnosis continued to occur subsequent to 2004. Study 1 utilized a nationally representative dataset of inpatient psychiatric hospitalizations between 1996 and 2010. De-identified data were obtained from the National Hospital Discharge Survey (NHDS) conducted annually by the National Center for Health Statistics. Study 2 utilized a state-level database of de-identified Medicaid billing claims between 2005 and 2015. Data included youth ages five to 17 hospitalized at one of five psychiatric inpatient hospitals in Nevada during the study period. Results indicated that the proportion of PBD diagnoses to all psychiatric diagnoses increased between 1996 and 2004 among children and adolescents. The proportion of PBD diagnoses then decreased between 2004 and 2010 among children but continued to increase for adolescents. However, the population-adjusted rates of PBD diagnosis per 10,000 individuals in the general population initially increased until the mid-2000s and then decreased until 2010 for all age

groups. State-level data indicated a decline in the rate of PBD diagnosis between 2005 and 2015. Findings provide insight into changing trends in inpatient service utilization for BD in the U.S. Awareness of the current diagnostic trends for BD may assist inpatient administrators and clinicians in preparing for anticipated service utilization and planning allocation of resources. Further research is necessary to evaluate continuously changing diagnostic rates and to determine the exact causes of changing trends in diagnosis across time.

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Chapter 1: Literature Review

Bipolar disorder (BD) is a severe and chronic illness marked by episodic changes in mood. BD is among the leading causes of disability worldwide because it is associated with a high rate of impairment (Lopez & Murray, 1998) and increased mortality due to substantial increase in suicide risk relative to the general population (Schaffer et al., 2015). Most adults with BD retrospectively report initial onset of mood symptoms in childhood or adolescence (e.g., (Chengappa et al., 2003; Goodwin & Jamison, 2007; Perlis et al., 2004) with the typical period of onset between 18 to 22 years (Merikangas et al., 2007; Weissman et al., 1996). However, pediatric bipolar disorder (PBD), or BD that onsets prior to age 18, was considered extremely rare until very recently (Fristad & Algorta, 2013). Opinions regarding the prevalence of PBD began to change when long-term follow-up of children treated for unipolar depression indicated approximately 30% converted from unipolar depression to BD (Geller, Fox, & Clark, 1994) and two larger cohorts of youth with PBD were prospectively identified in the early 1990s (Biederman et al., 1996; Geller, Fox, & Fletcher, 1993). Over the next decade, the rate of clinical diagnosis of PBD increased dramatically (Blader & Carlson, 2007; Moreno et al., 2007). The rate of PBD diagnosis in the U.S. has not been examined since 2004, and it is unknown whether the rate of diagnosis has stabilized, declined, or continued to increase since the mid-2000s. Therefore, the purpose of the current paper is to examine whether the rate of clinical diagnosis of PBD has continued to increase over the past decade.

PBD has been identified in the clinical literature for centuries. In the early 20th century, Kraepelin described bipolar disorder as frequently occurring between ages 15 and 20 (Kraepelin, 1921). Throughout the 1970s and 1980s, case studies and case series identified youth with PBD. The identification of youth in only case studies led many to believe that PBD was exceedingly

rare (Carlson & Glovinsky, 2009). The subsequent increase in the rate of diagnosis in the mid-1990s to mid-2000s caused many to believe that PBD was being over-diagnosed (Hirschfeld, Lewis, & Vornik, 2003; Jenkins, Youngstrom, Washburn, & Youngstrom, 2011). As a result of this worry, the DSM-5 introduced the new diagnosis of disruptive mood dysregulation disorder (American Psychiatric Association, 2013) to potentially decrease the diagnosis of PBD in clinical settings. However, large increases in clinical diagnoses can occur for many reasons. First and foremost, changes in genetic, biological, or environmental risk factors may occur and can result in both increases and decreases in prevalence. Besides true changes in prevalence, the rate of diagnosis can also increase if case-finding improves due to clinician awareness. Prevalence may also increase due to changes in (a) diagnostic definitions and standards; (b) diagnostic substitution; and (c) changes in availability of services (i.e., FDA approved medicine). The precise reason for why a change in prevalence is occurring can be difficult to ascertain unless certain conditions are met.

Change in the Rate of PBD Diagnosis

Outpatient.

Most studies examining the rate of change of PBD diagnosis in the United States examined changes between approximately 1994 and 2004. For example, between 1995 and 2000 the rate of outpatient billing claims for PBD increased from 90 to 150 per 10,000 billing claims in a nationally representative sample of private insurance claims for youth 0 to 18 years (Harpaz-Rotem & Rosenheck, 2004). Analysis of the National Ambulatory Medical Care Survey, a random sampling of U.S. outpatient physicians, assessed rates of PBD diagnosis between 1994 and 2003 and found an increase in diagnosis from 2.5 to 100.3 per 10,000 population among outpatient youth ages 0 to 19 (Moreno et al., 2007). Additionally, the percentage of outpatient

visits with a diagnosis of PBD increased from .01% to .44% out of the total outpatient visits. Analyses based on private insurance data indicate an almost doubling of risk of PBD diagnosis, while the more comprehensive national data suggests risk increased approximately forty-fold. In summary, the rate of outpatient PBD diagnoses increased over a ten-year period.

Inpatient.

An increase in the rate of clinical diagnosis of PBD also occurred in inpatient units during the same time period. In a sample of privately insured youth admitted to inpatient psychiatric facilities, the rate of PBD diagnosis increased from 1,060 to 1,840 per 10,000 youth between 1995 and 2000 (Harpaz-Rotem, Leslie, Martin, & Rosenheck, 2005). Blader and Carlson (2007) examined rates of BD diagnosis among inpatient children, adolescents, and adults between 1996 and 2004, using discharge rates from the National Hospital Discharge Survey. Results indicated that the rate of PBD diagnosis among children ages 5 to 13 increased from 1.3 to 7.3 per 10,000. The rate of PBD diagnosis among adolescents ages 14 to 18 increased from 5.1 to 20.4 per 10,000. The increase in the rate of BD diagnosis was significantly greater among youth than the increase for adults. Furthermore, hospitalization was more prevalent in this sample among male compared to female children (ages 5 to 13), but by adolescence (ages 14 to 18) hospitalization was more prevalent among females compared to males. The rate of diagnosis of PBD also increased by 1.9 times in youth with private insurance (Blader & Carlson, 2007). Similar to outpatient data, the rate of diagnosis of PBD in U.S. inpatient units increased over the same decade but at a higher rate.

Research on changing trends in diagnostic rates using samples from the U.S. ended at the peak of the PBD diagnostic phenotype debate. Many European scholars have argued that PBD was an American concern (James et al., 2014; Parry & Richards, 2014). However, two analyses

using data from the nationwide German inpatient healthcare system examined continued change in rates of PBD diagnosis between 2000 and 2013 (Holtmann et al., 2010; Rao et al., 2016). Holtmann and colleagues (2010) identified an increase from 0.113 to 0.191 per 10,000 in PBD diagnosis between 2000 and 2007 among hospitalized youth under age 19 years. Change in the PBD diagnostic rate varied by age with younger youth (< 15 years) displaying no change in the rate of PBD diagnoses but older adolescents (15-19 years) displaying a large increase in the rate of PBD diagnoses. Rao and colleagues (2016) subsequently compared these findings with data from the same nationwide inpatient database to determine continued change between 2008 and 2013. The rate of diagnosis of PBD in children (< 15 years) did not significantly increase (0.2 to 0.3 per 100,000), while the rate of diagnosis among older adolescents (15 – 19 years) increased from 6.56 to 8.14 per 100,000 adolescents. Proportionally, the rate of PBD diagnosis increased from 0.26 to 0.27 of all psychiatric diagnosis in the German inpatient healthcare system between 2008 and 2013 (Rao et al., 2016). These findings suggest either: (a) risk factors for PBD are changing in Germany as well as the U.S., or (b) if one assumes that earlier U.S. increases also apply to Germany then the rate of PBD diagnosis has also increased. Of note, the German healthcare system is markedly different from the U.S. health care system, and provider incentives for diagnosis are likely to differ dramatically (Stringaris & Youngstrom, 2014). Therefore, it is possible that trends in the rate of PBD diagnosis may have differed between the U.S. and Germany over the past decade.

Implications.

Findings regarding the increase in PBD diagnosis were presented in terms of relative risk at the time of publication. For example, Moreno and colleagues (2007) indicated a 40-fold increase in the proportion of office visits for PBD (i.e., 0.01 to 0.44%) as a proportion of all

outpatient office visits. The presentation of this finding as a 40-fold increase in the proportion of office visits for PBD led to concerns about the potential over-diagnosis of PBD. However, when considered in terms of absolute risk, a 40-fold increase from 0.01% is quite small. Furthermore, this increase was not considered within the context of broader epidemiological findings. In particular, the epidemiological base rate for the spectrum of pediatric bipolar disorders has been estimated at 1.8%, with the prevalence rate rising to 2.7% when considering only youth age 12 or older (Van Meter, Moreira, & Youngstrom, 2011). While the rate of PBD diagnosis per 10,000 youth increased dramatically between the mid-1990s to mid-2000s, this rate still remained below the estimated epidemiological base rate of PBD. Changes in the rate of inpatient PBD diagnosis identified by Blader and Carlson (2007) also remained below the estimated epidemiologic base rate of PBD. While PBD diagnosis increased between 1996 and 2004, the risk of PBD diagnosis associated with an outpatient visit remained well below what would be expected given epidemiological base rates. Therefore, a portion of youth with PBD identified in epidemiological samples may still not have received services during this time.

Changes in Diagnostic Rates of Other Disorders

Much of the concern regarding the increase in PBD diagnosis views the increase in relative isolation. However, other pediatric psychiatric disorders have seen changes in diagnostic rates similar to or greater than PBD. For example, between 2000 and 2007, an increase in depressive disorder diagnosis from 1.3 to 4 per 10,000 admissions was identified for youth ages 0 to 19 using data from the German inpatient healthcare system (Holtmann et al., 2010). A follow up to this study compared data collected between 2008 and 2013 with the original data collected between 2000 and 2007 and identified a total increase from 1.3 to 10.4 per 10,000 admissions in the rate of depressive disorder diagnosis between 2000 and 2013 (Rao et al.,

2016). During this time period, the rate of diagnosis of depression in youth increased approximately eightfold, relative to twofold for PBD. Therefore, clinicians working in inpatient psychiatric units might be diagnosing all mood disorders in youth more frequently.

While it is possible that clinicians are simply more willing to diagnose mood disorders, it is also possible that the stigma associated with the use of more severe diagnoses has decreased and clinicians have become more willing to use diagnoses indicating more severe psychopathology. For example, in the same dataset used to identify change in the rate of PBD diagnosis, Blader and Carlson (2007) also identified a significant increase in the rate of diagnosis of conduct-related disorders between 1996 and 2004. In particular, the rate of diagnosis of conduct-related disorders increased by 6.2% among children and 12% among adolescents nationally during this time period (Blader & Carlson, 2007). Therefore, the increase in PBD diagnosis may simply reflect an increase in clinicians' willingness to diagnose more severe psychopathology in inpatient units.

Reasons for Changes in Prevalence Rates

The increased prevalence of PBD in clinical settings has stirred substantial debate regarding the appropriate diagnosis of BD in children and adolescents. For example, the DSM-5 included disruptive mood dysregulation disorder with the hopes of decreasing PBD diagnosis in children and adolescents (American Psychiatric Association, 2013). However, the changes in the rate of PBD diagnosis should be considered in the greater context of the identification of disorders and diseases. Cancer and autism spectrum disorders (ASD) provide two worthwhile comparators because the epidemiological surveillance of the clinical prevalence of both illnesses has greater longevity than PBD. The clinical diagnosis of some subtypes of cancer have increased while others have decreased in the prior two decades. For example, the clinical

prevalence of prostate cancer diagnosis increased dramatically from a relatively undiagnosed, unrecognized disease to a more easily identified illness with the introduction of PSA screening. Similarly, the rate of ASD diagnosis increased between 7.5 and 15 fold between 1966 and the early 2000s (4 per 10,000 to 30 – 60 per 10,000; Fombonne, 2003; Rutter, 2005). Therefore, the changes in the clinical prevalence of PBD diagnosis may not be due to over-diagnosis, but reflective of broader changes related to clinical service provision, such as increased availability of effective screening tools.

In both cancer and ASD surveillance, the reasons for changes in the clinical prevalence of the illnesses have been given substantially greater thought than in PBD. In particular, changes in the rate of screening, classification, and risk exposure are likely causes of changes in the prevalence of cancer (Ward, Thun, Hannan, & Jemal, 2006). For example, improved classification of esophageal cancers by cell type instead of bodily region indicated that while the overall prevalence of esophageal cancers has increased slightly, some types (e.g., squamous cell carcinoma) decreased while other types increased (e.g., adenocarcinoma; Vizcaino, Moreno, Lambert, & Parkin, 2002). Exposure to risk factors also affects the true rate of illness. For example, as the prevalence of smoking has decreased, so too has the prevalence of lung cancers (Govindan et al., 2006). However, for illnesses not clearly marked by definable biological tests such as ASD and PBD, additional factors might also play a role in the rate of change of diagnosis. In addition to changes in the screening, classification, and risk factors, mental health diagnoses are also likely subject to changes in the availability of services, pattern of referrals, increased public awareness, and changes in diagnostic definitions (Fombonne, 2003). For example, many ASD observers believe that the increase in the rate of autism diagnosis is most likely due to external factors related to service provision, awareness, and changes in diagnostic

definitions and not directly due to a large increase in the actual incidence of autism from changes in risk factors (Hansen, Schendel, & Parner, 2015; Rutter, 2005). Therefore, if PBD experienced a period of a broader diagnostic definition, increased awareness, and an increase in the availability of assessment tools and interventions, then an increase in the clinical diagnosis of PBD should be expected. At the same time that the clinical prevalence of PBD increased from the mid-1990s to the mid-2000s, all of these external risk factors occurred making it more difficult to link the change in PBD diagnostic rates to any specific reason for such a change.

Changes in the Diagnostic Standard.

BD in adults is defined as an illness of distinct episodes with changes in mood and energy (American Psychiatric Association, 2013; World Health Organization, 1992). Despite diagnostic manuals and many textbooks implying that adults with BD present with distinct mood episodes separated by periods without mood symptoms, approximately half of adults with BD have subthreshold symptoms between mood episodes (Perlis et al., 2006). Similarly, most youth with PBD present with subthreshold symptoms between episodes (Birmaher, Axelson, Goldstein, et al., 2009; Birmaher et al., 2006; DelBello, Hanseman, Adler, Fleck, & Strakowski, 2007; Geller, Tillman, Bolhofner, & Zimerman, 2008). Early work examining the phenotype of PBD emphasized its chronic course (Birmaher et al., 2006). One such instantiation is the 'broad' phenotype of PBD. The 'broad' phenotype emphasized chronic presentation marked by the presence of severe, chronic irritability (Biederman et al., 2004). While the broad phenotype garnered clinical support because it represents a set of severely dysregulated and impaired youth, the lack of distinct episodes concerned many. The broad phenotype represented a non-episodic presentation in contrast to the historical description of BD as an episodic syndrome. Additionally, the broad phenotype focused on the presence of severe irritability as the principal

symptom of mania and youth did not need to present with more specific symptoms of mania such as grandiosity, elated mood, or decreased need for sleep (Leibenluft, Charney, Towbin, Bhangoo, & Pine, 2003; Youngstrom, Birmaher, & Findling, 2008). The potential symptoms of mania that were also symptoms of other disorders (e.g., irritability, increased energy) led to concerns about misdiagnosis of PBD. Therefore, a 'narrow' phenotype was proposed as a more restricted alternative to the broad phenotype.

The narrow phenotype of PBD focuses on the presence of specific symptoms of mania. The narrow phenotype requires elated mood or grandiosity *and* typically also requires the presence of a clear episode which lasts for a period of at least one week (Geller et al., 2002; Leibenluft et al., 2003). Under this phenotype, irritable mood is insufficient on its own to meet criteria for mood disturbance in the narrow phenotype because irritability could arise due to many different presenting concerns. The use of an "and" rule and the exclusion of irritability as a symptom of mania creates a more restrictive definition that may ignore a subset of cases (Sharma et al., 2016; Washburn, West, & Heil, 2011). Therefore, an 'intermediate' phenotype attempted to compromise between the narrow and broad definitions of pediatric mania.

The intermediate phenotype is consistent with DSM and International Classification of Diseases (ICD; World Health Organization, 1992) diagnostic criteria. The intermediate phenotype also includes the entire spectrum of BD (i.e., bipolar I, bipolar II, cyclothymia, and OSBARD) by accounting for even brief duration episodes of manic symptoms such as 1-3 days. The intermediate phenotype also includes irritable mood as a cardinal symptom of mania even if no elevated mood is present, as long as duration and other diagnostic criteria are met (Leibenluft et al., 2003; Pavuluri, Birmaher, & Naylor, 2005). Research using the intermediate phenotype indicates that characteristics of PBD are generally consistent with adult presentations of BD

except that youth with PBD tend to have longer duration episodes and more irritable mood (Youngstrom, Birmaher, & Findling, 2008). Additionally, youth with PBD often exhibit high levels of functional impairment (Freeman et al., 2009) and have a family history of mood disorders (Birmaher et al., 2006).

While some differences between PBD and adult BD exist, substantial overlap between the two diagnoses has been identified. A meta-analysis of 20 studies of PBD phenomenology indicated that approximately 79% of youth with PBD presented with increased energy, 57% had grandiosity, and other symptoms of mania ranged from being present in 54% to 77% of youth with PBD (Van Meter, Burke, Kowatch, Findling, & Youngstrom, 2016). This continuity between child and adult phenotypes of BD suggests that the clinical presentation of PBD may be similar to adult BD for many youths. As a result, a consensus around a DSM-oriented model of PBD using the intermediate phenotype has recently developed (Carlson & Glovinsky, 2009; Robert A. Kowatch, Youngstrom, Danielyan, & Findling, 2005; Van Meter et al., 2016). Prior to this consensus, the debate surrounding the PBD phenotype may have influenced the criteria used to diagnose PBD in clinical practice. Clinicians may have based diagnoses on either the broad, narrow, or intermediate phenotypes. In particular, if clinicians used the broad phenotype during this time, the rate of diagnosis of PBD would be expected to increase because the broad phenotype substantially expanded diagnostic criteria. Given these concerns, questions arose about the extent to which the rate of clinical PBD diagnosis had changed prior to the resolution of the phenotype debate.

Changes in Awareness.

From the mid-1990s to the mid-2000s, there was a dramatic increase in public awareness related to the PBD diagnosis (Lofthouse & Fristad, 2004). One metric of public awareness is

how often a term is searched on the internet. Google trends suggests bipolar disorder is being searched less often since the mid-2000s than prior to the mid-2000s (Fond, Gaman, Brunel, Haffen, & Llorca, 2015), suggesting that heightened public awareness of PBD prior to the mid-2000s likely occurred simultaneously with the increase in the rate of diagnosis of PBD. Similar increases in awareness have been observed for other psychiatric disorders. For example, the rate of ASD diagnosis has continued to increase concurrently with the increase in public awareness about the disorder. While public searching for BD has decreased since the mid-2000s, Google trends indicates that public searching for ASD has remained relatively stable and the rate of diagnosis of ASD has continued to increase. It is possible that the rate of diagnosis of PBD has not continued to increase in the same manner given the decline in public awareness of BD since the mid-2000s. Therefore, it is important to assess the rate at which PBD has been diagnosed over the past decade to determine whether there is need for concern regarding continued increase of PBD diagnosis.

Changes in Assessment Methods.

Development of effective screening tools can have a substantial impact on the rate at which an illness is diagnosed (e.g., as in cancer and ASD diagnosis). Prior to the mid-1990s, evidence-based assessment tools for diagnosing PBD were limited. As part of the increased scientific awareness of PBD, researchers focused on improving methods for assessing PBD. These advances included structured and semi-structured clinical interviews, self-report measures and informant-report measures with questions specifically designed to assess mania symptoms. For example, the Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS; Puig-Antich & Chambers, 1978), a semi-structured interview initially developed in the 1970s to assess for a variety of psychiatric symptoms using DSM-III criteria, was revised repeatedly to improve

the bipolar disorders diagnostic section (Ambrosini, 2000; Geller et al., 2001). Structured and semi-structured clinical interviews adapted for the assessment of mania in youth aided researchers and clinicians in consistently identifying cases of PBD.

Previously adult-focused self-report measures of mania were also adapted to facilitate youth and caregiver self-report. For example, a parent-report version of the Young Mania Rating Scale (P-YMRS) was developed and showed good discriminative validity in identifying cases of PBD compared to unipolar depression, disruptive behavior disorders, and other clinical diagnoses (Gracious, Youngstrom, Findling, & Calabrese, 2002). In addition to clinical interviews and rating scales, the importance of using setting-specific base rates and family history of BD as factors in evidence-based decision-making was instituted during this time period (Youngstrom, Findling, Kogos Youngstrom, & Calabrese, 2005). The introduction of effective screening tools and evidence-based assessment techniques may have led to more accurate identification of PBD cases, thereby impacting the rate at which PBD was diagnosed.

Another potential outcome of evolving assessment methods is diagnostic substitution, which occurs when an individual diagnosed with 'disorder A' is later re-diagnosed with 'disorder B,' which takes the place of the original diagnosis. Diagnostic substitution is common among patients who receive an eventual BD diagnosis. Individuals with BD often experience long durations between receiving an initial psychiatric diagnosis (e.g., major depressive disorder) and receiving a diagnosis of BD (Hirschfeld et al., 2003; Lish, Dime-Meenan, Whybrow, Price, & Hirschfeld, 1994). With the advent of more effective screening measures between the mid-1990s to mid-2000s, many youths initially diagnosed with another psychiatric disorder may have experienced diagnostic substitution for a bipolar spectrum disorder upon re-evaluation, causing the rate of diagnosis of PBD to increase. However, mania typically onsets after depression

(Birmaher, Axelson, Strober, et al., 2009). Therefore, diagnostic substitution might also reflect the "typical" developmental onset of the disorder in which youth are initially diagnosed with depression but then later display symptoms of mania. During the period of diagnostic increase from the mid-1990s to mid-2000s, increased awareness and methods for detecting subthreshold mania symptoms may have increased the diagnostic transition from unipolar to bipolar depression. Since then, screening tools for PBD have been continuously refined. It is possible that with the development of more effective screening tools, cases of PBD may have been captured earlier in childhood or adolescence, potentially leading to a decrease in diagnostic switching over the past decade.

Changes in Interventions.

The availability of pharmacological interventions for PBD also increased between the mid-1990s and mid-2000s. Findings from open-label trials and retrospective chart reviews suggested that mood stabilizing medications and second-generation antipsychotics may be effective in treating symptoms of PBD (Biederman et al., 2005; Frazier et al., 1999; Kowatch, Sethuraman, Hume, Kromelis, & Weinberg, 2003; Schreier, 1998). Placebo-controlled trials of pharmacological intervention for youth with PBD were also completed during this time with promising results (Kowatch et al., 2005). These interventions represented promising treatment options for youth with PBD receiving services in both inpatient and outpatient settings. Furthermore, compared to other countries, U.S.-based mental health providers may be incentivized to assign diagnoses if effective treatment options are available in order to receive reimbursement for services (Stringaris & Youngstrom, 2014). As the availability of pharmacological interventions for PBD increased, the rate at which clinicians were willing to provide a diagnosis of PBD may have increased between the mid-1990s to mid-2000s. However,

given evolving reimbursement practices and a potential decrease in public awareness of PBD, it is unknown whether youth continued to be referred for treatment at an increased rate over the past decade.

Although the rate of change of PBD diagnosis has been assessed in Europe through 2013, potential changes in the rate of PBD diagnosis in the U.S. post-2004 have not been examined. Given the continued concern about overdiagnosis of PBD in the U.S., it is important to identify whether the rate of diagnosis of PBD has continued to change over the past decade. Therefore, the purpose of the current study was to examine the trajectory of PBD diagnosis after 2004 using national- and state-level inpatient data.

Chapter 2: Method

Study 1. National Sample

Data Source.

Data for Study 1 included health information collected via the National Hospital Discharge Survey (NHDS) conducted annually by the National Center for Health Statistics (https://www.cdc.gov/nchs/data/series/sr_01/sr01_039.pdf). NHDS data is nationally representative based on a national probability sample of discharges from short-stay hospitals (i.e., average length of hospitalization less than 30 days for all patients) or general hospitals or children's hospitals regardless of length of stay. Psychiatric hospitals are typically included under the short-stay hospital criteria. Hospitals were selected via three stages that are described in detail by Dennison and Pokras (2000). In the third stage, discharges were selected from each hospital using stratified random sampling for coding. The number of cases was between one and five percent of discharges with a minimum of 250 discharges annually.

Data collected between 1996 and 2010 are de-identified and publicly available for download and analysis at the individual patient level. NHDS data includes patient diagnoses, age, gender, race, discharge year, geographic region, and type of insurance coverage. Each observation includes a weight that allows one to estimate the prevalence in the population (e.g., number per 10,000 persons).

Statistical Analyses.

All data analysis was conducted in R (R Core Team, 2013). Cases were limited to those with a primary diagnosis of a psychiatric disorder. This approach was used to exclude individuals hospitalized for physical health reasons who also have a psychiatric illness (e.g., a person hospitalized for an appendectomy who also had a diagnosis of major depressive disorder).

PBD was the focal diagnosis of all analyses. However, to better place the PBD findings in context, analyses were also repeated for youth with a primary diagnosis of a unipolar depressive disorder (DD) and for overall hospitalizations. Summing the weights of all cases in which a psychiatric disorder appeared as the primary diagnosis yielded an estimate of the total number of discharges from acute care facilities during the survey year. Dividing this estimated total number of discharges by the corresponding year's U.S. population estimate for each age group permitted computation of annual hospitalization rates for children, adolescents, and adults.

For PBD and DD, two indices were calculated from the NHDS data to represent rates of psychiatric diagnoses. Each index was computed for PBD and DD. The indices were: (a) proportion of psychiatric discharges with a primary diagnosis of PBD, and (b) the rate of PBD-related discharges per 10,000 persons in the general population for the respective age group. For overall hospitalization trends, the following two indices were examined: (a) the proportion of all psychiatric hospitalizations relative to physical health hospitalizations and (b) the rate of psychiatric hospitalizations per 10,000 persons. Consistent with recommended practices, data were initially be screened for out-of-range values, plausible means and standard deviations, and univariate outliers (Tabachnick & Fidell, 2007).

To examine the change in the proportion of youth being diagnosed with PBD, a series of chi-squared tests were conducted. To examine the overall trend in PBD diagnoses, the proportion from 1996 was compared to the proportion from 2010. To replicate Blader and Carlson (2007), the proportion of PBD cases from 1996 was compared to the proportion of PBD cases from 2004. To test whether a change in proportion occurred, the proportion of cases from 2004 was compared to the proportion of cases in 2010. The analyses were repeated for proportions for DD and overall psychiatric hospitalization.

To test whether the population-adjusted rate of PBD diagnosis changed over time, a series of linear regression analyses with multiple predictors were conducted. Models were fit hierarchically to predict the rate of PBD diagnosis from survey year and age group. Age group was examined by using adolescents as the reference group in comparison with children and adults. The assumptions of regression (i.e., linear relationship, homogeneity of variance, and normality of residuals) were examined via a series of plots. Analyses were repeated for DD and overall psychiatric hospitalization.

A series of logistic regressions were conducted that examine the ratio of PBD to other psychiatric hospitalization diagnoses. Models were fit hierarchically to predict PBD diagnosis from survey year, age, gender, race, U.S. region of the reporting facility, and type of health insurance coverage. Age group was examined by using adolescents as the reference group in comparison with children and adults. To examine gender, women were coded as 0 and men were coded as 1. Patients who identified as White were coded 0 and patients who identified as African-American were coded as 1. Government-funded insurance (e.g., Medicaid) was coded as 0 and private insurance was coded as 1. Deviation coding was used to assess each geographic region (i.e., South, West, Midwest, and Northeast) compared to the mean of all geographic regions. This set of analyses was repeated for DD as well.

Study 2. State-Level Sample

Data Source.

Data for Study 2 included Medicaid billing claims from five psychiatric inpatient hospitals in Nevada. De-identified billing claims were obtained from the Center for Health Information Analysis (https://chia.unlv.edu) and included claims for 48,108 unique inpatient admissions between 2005 and 2015 for youth ages five to 17. Diagnoses were reported for each

claim using ICD-9 codes. Mood disorder diagnoses were classified into two groups: 1) PBD or 2) DD. PBD was classified using codes 296.00 - 296.06; 296.40 - 296.46; 296.50 - 296.56; 296.60 - 296.66; 296.70; 296.80; 296.81; 296.89; and 301.13. DD was classified using codes 296.20 - 296.26; 296.30 - 296.36; 300.4; 311.00; and 625.4. Additional variables in this dataset included gender, year, and hospital of admission.

Statistical Analyses.

Data were analyzed using the R statistical software. As in Study 1, PBD was the focal diagnosis of all analyses. To place the PBD findings in context for Study 2, analyses were again repeated for youth with primary diagnoses of DD. Admissions rates for each diagnostic group were converted to rate per 1,000 admissions per hospital per year. Linear regression was used to assess whether the rate of PBD diagnosis changed over time. Gender was subsequently added to the model to evaluate whether gender impacted the change in the rate of diagnoses over time, given that there are gender differences in the prevalence of mood disorders, particularly depression (Angst et al., 2002; Kuehner, 2003). A three-stage hierarchical multiple linear regression analysis was conducted to predict the rate of PBD diagnosis from year, gender, and the interaction between year and gender. An identical three-stage hierarchical regression model was conducted to evaluate the rate of diagnosis of DD. To ease the interpretation of the models, year was centered on 2005 so that data from 2005 had a year equal to 0, 2006 had a year equal to 1, and so on. Gender was dummy coded as '0' for males and '1' for females.

To account for clustering of diagnostic rates within hospitals over time, the cluster-adjusted variance-covariance matrix was used to obtain estimates of the standard error, *t*-value, and significance value for each level of the regression models. The cluster-adjusted variance-covariance matrix was also used to obtain the 95% confidence interval for the estimates of each

predictor. The *F*-statistic for each level of the models was obtained using the Wald test. R^2 and the change in R^2 were obtained from each of the original models, as R^2 does not change even if the errors are clustered. R^2 is calculated using the sums of squares, which become irrelevant once the variance-covariance matrix is used to account for clustering. However, R^2 is still useful as a measure of goodness-of-fit even after using the corrected variance-covariance matrix to obtain new standard error and *t*-value estimates.

The assumptions of regression (i.e., linear relationship, homogeneity of variance, and normality of residuals) were examined via a series of plots. Following visual examination of the data, the trend in diagnostic rates for the PBD and DD groups appeared nonlinear. As such, a second three-stage hierarchical multiple linear regression model was conducted to determine whether adding polynomial regression coefficients was meaningful. An identical model was conducted for the DD group. The cluster-adjusted variance-covariance matrix was again used to obtain estimates of the standard error, *t*-value, and significance value for each level of the regression models. R^2 and the change in R^2 were obtained for each level of the models to determine the overall variance accounted for after adding each polynomial regression coefficient. The *F*-statistic for each level of the model was obtained using the Wald test.

Chapter 3: Results

Study 1. National Sample

Changes in Proportions of Diagnoses.

Between 1996 and 2010, 6.97% of all inpatient hospitalizations for individuals ages five and older were associated with a primary psychiatric diagnosis. The proportion of psychiatric hospitalizations initially increased from 6.76% in 1996 to 7.09% in 2004 ($\chi^2(1) = 23.36$, $p = .003$) and decreased to 6.35% in 2010, $\chi^2(1) = 96.98$, $p < .001$ resulting in a decline in the proportion of psychiatric diagnoses to overall hospitalizations between 1996 (6.76%) and 2010 (6.35%), $\chi^2(1) = 24.41$, $p = .002$. However, the overall proportion of psychiatric hospitalizations to all inpatient hospitalizations masks age-specific differences. Adults (> 18 years old) were most similar to the overall trajectory. For adults, psychiatric hospitalizations represented 6.50% of all adult hospitalizations in 1996 and this remained stable in 2004 at 6.64% ($\chi^2(1) = 3.96$, $p = .22$) before declining to 5.72% in 2010, $\chi^2(1) = 149.07$, $p < .001$. In contrast, both children (5-13 years old) and adolescent (14-18 years old) proportions increased during the same time period. For adolescents, the proportion of psychiatric hospitalizations to all hospitalizations increased from 13.19% in 1996 to 18.97% in 2004 ($\chi^2(1) = 109.09$, $p < .001$) and increased again to 22.04% in 2010, $\chi^2(1) = 18.00$, $p = .009$. The proportion of psychiatric hospitalizations for children grew from 7.55% of all child hospitalizations in 1996 to 9.72% in 2004 ($\chi^2(1) = 25.10$, $p < .001$) and continued to increase to 16.12% in 2010, $\chi^2(1) = 106.09$, $p < .001$. In summary, the overall decrease in the proportion of psychiatric diagnoses relative to all inpatient diagnoses was driven by a decrease in the adult psychiatric hospitalizations, while psychiatric hospitalizations increased for children and adolescents during the same time period.

Bipolar Disorder.

Fourteen percent of all psychiatric hospitalizations were associated with a primary diagnosis of BD between 1996 and 2010. BD-related admissions increased from 9% of all psychiatric hospitalizations in 1996 to 15% in 2004 ($\chi^2(1) = 326.62$, $p < .001$) and continued to increase to 17% in 2010, $\chi^2(1) = 11.65$, $p = .03$. Figure 1 compares the proportions of all psychiatric hospitalizations with a diagnosis of BD, DD, or other non-mood disorder diagnoses by age group. Adults were again similar to the overall trajectory in BD diagnosis. The proportion of adult BD diagnosis increased from 9.21% of all adult psychiatric hospitalizations in 1996 to 13.94% in 2004 ($\chi^2(1) = 181.85$, $p < .001$), and continued to increase to 15.34% in 2010, $\chi^2(1) = 11.30$, $p = .04$. Adolescents were most similar to adults. The proportion of adolescent BD diagnosis increased from 8.56% of all adolescent psychiatric hospitalizations in 1996 to 22.46% in 2004 ($\chi^2(1) = 91.18$, $p < .001$), and continued to increase to 27.93% in 2010, $\chi^2(1) = 9.36$, $p = .03$. In contrast to the continued increase in BD diagnosis for adults and adolescents, the proportion of child BD diagnosis decreased between 2004 and 2010. The proportion of BD-related hospitalizations increased from 8.31% of all child psychiatric hospitalizations in 1996 to 32.23% in 2004 ($\chi^2(1) = 105.19$, $p < .001$), then decreased to 19.54% in 2010, $\chi^2(1) = 24.29$, $p < .001$. In summary, the continued increase in the proportion of BD diagnoses to all psychiatric diagnoses between 2004 and 2010 was largely driven by adults and adolescents, while the proportion of child BD diagnoses decreased during the same period.

Depressive Disorders.

The proportion of DD-related hospitalizations to all psychiatric hospitalizations between 1996 and 2010 was 23%, which was not significantly different from the proportion of BD-related admissions during the same period, $\chi^2(1) = .04$, $p = .82$. DD-related psychiatric admissions

increased significantly from 22% to 24% between 1996 and 2010, $\chi^2(1) = 12.80$, $p = .02$. In contrast to BD, DD-related psychiatric hospitalizations initially remained relatively stable at 22% in both 1996 and 2004 ($\chi^2(1) = 1.96$, $p = .39$), and then increased to 24% in 2010, $\chi^2(1) = 27.86$, $p = .001$. Adults did not follow the overall trend in DD-related hospitalizations. The proportion of adult DD diagnosis relative to all adult psychiatric diagnoses remained stable over time at 21.28% in 1996, 20.41% in 2004 ($\chi^2(1) = 3.06$, $p = .28$), and 21.76% in 2010, $\chi^2(1) = 7.85$, $p = .10$. The proportion of adolescent DD-related hospitalizations relative to all adolescent psychiatric hospitalizations followed a similar pattern. The proportion of adolescent DD remained stable at 29.42% in 1996, 33.42% in 2004 ($\chi^2(1) = 4.85$, $p = .13$), and 38.39% in 2010, $\chi^2(1) = 6.34$, $p = .08$. In contrast to adults and adolescents, the proportion of child DD diagnoses compared to all child psychiatric diagnoses decreased from 32.48% of all child psychiatric hospitalizations in 1996 to 20.32% in 2004 ($\chi^2(1) = 25.46$, $p < .001$), followed by an increase to 35.32% in 2010, $\chi^2(1) = 31.33$, $p < .001$. The trend in the proportion of child DD diagnoses appears to have followed the opposite trend compared to child BD diagnoses. In summary, the mild increase in the overall proportion of DD diagnoses between 1996 and 2010 occurred despite relatively stable diagnostic practices in adults and adolescents. The diagnosis of DD in children was variable during this time period.

Changes in Population-Adjusted Rates of Diagnoses.

Table 1 displays population-adjusted rates of diagnoses by age between 1996 and 2010. Visual inspection of the longitudinal trajectory of population-adjusted rates of psychiatric diagnoses suggested a trend that could be nonlinear. Therefore, a series of regression models were fit hierarchically to test whether the change in the population adjusted rate of psychiatric hospitalization per 10,000 persons was nonlinear. Table 2 displays the hierarchical regression

results. Age group accounted for 77% of the variance in the population-adjusted rate of psychiatric hospitalizations, $p < .001$. Therefore, age group was controlled for in all analyses.

After controlling for age group, year did not significantly predict the population-adjusted rate of psychiatric hospitalizations between 1996 and 2010, $\Delta R^2 = .01$, $p = .27$. Despite a significant improvement in model fit ($\Delta R^2 = .02$, $p = .03$), there was not a significant interaction between age and year. A significant quadratic effect for year indicated that the population-adjusted rate of psychiatric hospitalizations increased between 1996 and 2006, followed by a slight decrease between 2006 and 2010, $\Delta R^2 = .12$, $p < .001$. However, the quadratic effect was moderated by age group, $\Delta R^2 = .01$, $p < .001$. As seen in Figure 2, the rate of psychiatric hospitalizations for children increased between 1996 and 2002 but remained relatively stable until 2010. The rate of psychiatric hospitalizations for adults increased mildly between 1996 and 2006, but then declined below 1996 levels by 2010. The rate of psychiatric hospitalizations for adolescents increased rapidly between 1996 and 2006 before starting a decline through 2010. In summary, the adult and adolescent age groups experienced a period of initial increase in psychiatric hospitalizations followed by a decrease, while children experienced a period of initial increase followed by stabilization in psychiatric hospitalization rates.

Bipolar Disorder.

Hierarchical regression models empirically tested whether the change in the population adjusted rate of BD-related hospitalizations per 10,000 persons was nonlinear. Table 3 displays the hierarchical regression results. Age group accounted for 59% of the variance in the population-adjusted rate of BD diagnosis, $p < .001$. Therefore, age group was controlled for in all analyses.

After controlling for age group, the population-adjusted rate of inpatient BD diagnosis increased mildly each year by .38 [.14, .61] diagnoses per 10,000 persons, $\Delta R^2 = .08$, $p = .003$. After controlling for the main effects of age group and year, there was not a significant interaction between age and year, $\Delta R^2 = .02$, $p = .41$. Adding a quadratic coefficient to year significantly improved overall model fit, $\Delta R^2 = .11$, $p < .001$. As seen in Figure 3, when controlling for age group, the population-adjusted rate of BD diagnosis increased between 1996 and 2006, followed by a decrease between 2006 and 2010. After controlling for the main effects of age group, year, and year^2, there was a trend toward a moderating effect of age group on the quadratic effect of year, $\Delta R^2 = .03$, $p = .07$. In summary, the rate of BD diagnosis per 10,000 initially increased until the mid-2000s and then decreased through 2010 for all three age groups.

Depressive Disorders.

Hierarchical regression models empirically tested whether the change in the population adjusted rate of DD-related hospitalization per 10,000 persons was nonlinear. Table 4 displays the hierarchical regression results. Age group accounted for 79% of the variance in the population-adjusted rate of inpatient DD diagnosis ($p < .001$) and was controlled for in all future analyses.

After controlling for age group, year did not significantly predict the population-adjusted rate of inpatient DD diagnosis, $\Delta R^2 = .00$, $p = .18$. However, after controlling for main effects of age group and year, there was a significant interaction between year and the adult age group ($\Delta R^2 = .04$, $p < .001$), indicating that the change in the rate of diagnosis for adults was significantly different from the change in the rate of diagnosis for adolescents. The change in the rate of diagnosis for children over time did not significantly differ from adolescents. Adding a quadratic coefficient to year significantly improved overall model fit, $\Delta R^2 = .15$, $p < .001$. The

quadratic effect of year was moderated by age group, $\Delta R^2 = .01$, $p = .003$. As seen in Figure 4, the population-adjusted rate of inpatient DD diagnosis for children remained relatively stable between 1996 and 2002 and then increased until 2010. In contrast, the population-adjusted rate for adolescents increased between 1996 and 2003, then decreased until 2010. The rate of DD diagnosis among adults displayed a slight decrease across the study period. In summary, the population-adjusted rates of DD diagnosis were variable between age groups across the study period.

Impact of Demographic Variables on Risk for Diagnoses.

Bipolar Disorder.

A series of logistic regression models examined the effect of demographic variables on BD diagnosis. The demographic variables considered included age group, gender, race, insurance type, and geographic region. Table 5 displays the results of the logistic regressions. Age group was examined by using adolescents as the reference group in comparison with children and adults. To examine gender, women were coded as 0 and men were coded as 1. Patients who identified as White were coded 0 and patients who identified as African-American were coded as 1. Government-funded insurance (e.g., Medicaid) was coded as 0 and private insurance was coded as 1. Deviation coding was used to assess each geographic region (i.e., South, West, Midwest, and Northeast) compared to the mean of all geographic regions.

The first model examined the main effects of all demographic variables. After controlling for other demographic characteristics, adults were 43% less likely to receive a BD diagnosis than adolescents while children were not significantly different from adolescents in their risk for receiving a BD diagnosis. Compared to women, men were 34% less likely to be assigned a BD diagnosis. African-American individuals were 35% less likely to receive a BD diagnosis

compared to White individuals. Risk for BD diagnosis also varied by geographic region. Individuals living in the South and Midwest were 30% and 10% times more likely to receive a BD diagnosis compared to the average, respectively. In contrast, individuals living in the West were 20% less likely to receive a BD diagnosis compared to average. There was no difference in the odds of receiving a BD diagnosis by insurance type. In summary, race, gender, and geographic region altered an individual's risk for BD, while insurance status did not affect risk.

After controlling for main effects of all demographic variables, interactions between the demographic variables and time were examined. First, interactions between year and age group were assessed. The odds of receiving a BD diagnosis initially increased and then decreased at a more rapid rate for children compared to adolescents. In contrast, the odds of receiving a BD diagnosis increased and then decreased more slowly for adults relative to adolescents. Second, interactions between gender with year and age group were examined. Gender significantly interacted with the quadratic effect of year, such that the likelihood of receiving a BD diagnosis increased for both men and women until 2004, at which time it remained stable for women but decreased for men by 2010. There was no significant difference in the odds of BD diagnosis between boys and girls in the child age group, and this was not significantly different from the adolescent age group. However, adult men carried lower odds of receiving a BD diagnosis compared to adult women during the study period (Figure 5). In summary, the odds of receiving a BD diagnosis varied by age group throughout the study period. The odds of BD diagnosis by gender were significantly different between men and women in the adult age group.

A third model evaluated interactions between year, race, and age group. The odds of receiving a BD diagnosis increased at a greater rate for African-American individuals across the study period compared to White individuals. There was also a significant interaction between

race and age group during the study period, such that African-American adults carried lower odds of BD diagnosis compared to African-American adolescents (Figure 6). In summary, race significantly interacted with both year and age group to impact the odds of BD diagnosis.

A fourth model examined interactions between year, insurance type, and age group. There was a significant interaction between insurance type and year, such that such that the likelihood of receiving a BD diagnosis increased between 1996 and 2008 but remained stable between 2008 and 2010 for individuals insured through a government program. In contrast, the odds of BD diagnosis among privately insured individuals increased between 1996 and 2005, then decreased through 2010. Insurance type also interacted with age group (Figure 7), such that privately insured children were more likely to receive a BD diagnosis than their publicly insured counterparts, which differed from adolescents. In summary, the odds of receiving a BD diagnosis across the study period was impacted by significant interactions between insurance type, year, and age group.

A final model assessed the interaction between year and geographic region. Geographic region significantly interacted with year, such that individuals in the South were 1.12 times more likely to be given a BD diagnosis compared to the average across the study period. In contrast, individuals in the West and Midwest were 13% and 3% less likely to receive a BD diagnosis, respectively. Geographic region also significantly interacted with the quadratic effect of year. The likelihood of BD diagnosis for those residing in the South significantly increased until 2006 and then decreased through 2010. In contrast, the odds of BD diagnosis for those living in the West remained relatively stable until 2002 and then increased through 2010. Risk of BD diagnosis for individuals in the Midwest increased across the study period (Figure 8). In

summary, the odds of receiving a BD diagnosis significantly varied by geographic region throughout the study period.

Depressive Disorders.

Logistic regression models were repeated to examine the effect of demographic variables on DD diagnosis. Table 6 displays the results of the logistic regressions. Trends in the main effects of demographic variables on DD diagnosis were similar to the trends identified for BD. In particular, individuals in the adult age group were 34% less likely to receive a DD diagnosis compared to adolescents, while children did not significantly differ from adolescents in their risk for receiving a DD diagnosis. Compared to women, men were 41% less likely to be given a DD diagnosis. African-American individuals were 29% less likely to receive a DD diagnosis compared to White individuals. Individuals living in the South and Midwest were 1.2 and 1.4 times more likely to receive a DD diagnosis compared to the average, respectively. In contrast, individuals living in the West were 33% less likely to be assigned a DD diagnosis compared to the average. In contrast with BD, privately insured individuals were 40% more likely to receive a DD diagnosis compared to their publicly insured counterparts. In summary, race, gender, geographic region, and insurance type altered an individual's risk for DD.

After controlling for main effects of all demographic variables, interactions between the demographic variables and year were examined. There were no significant interactions between year with gender, race, and age group. However, race significantly interacted with age, such that African-American adults carried a lower risk of receiving a DD diagnosis compared to African-American adolescents (Figure 9). There was not a significant interaction between geographic region and year. Potential interactions between insurance type with year and age group were also examined. Insurance type interacted with year such that privately insured individuals carried

increased odds of DD diagnosis compared to publicly insured individuals. However, the odds of a privately insured person receiving a DD diagnosis decreased across the study period. Insurance type also interacted with age group such that privately insured adults were more likely to receive a DD diagnosis compared to privately insured adolescents (Figure 10). In summary, an individual's risk for DD was significantly altered by the interaction between race and age group, as well as interactions between insurance type with year and age group.

Study 2. State Sample

There were 48,108 unique inpatient admissions for youth ages five to 17 between 2005 and 2015. Table 7 displays admissions counts and characteristics of the sample. The total number of pediatric inpatient hospitalizations for any psychiatric diagnosis increased from 3,140 to 7,728 admissions between 2005 and 2015. Data from three hospitals were not available during all years between 2005 and 2009. However, data from all hospitals were available between 2010 and 2015, during which time the overall number of pediatric hospitalizations increased from 4,659 to 7,728.

Bipolar Disorder.

We initially hypothesized that the rate of PBD diagnosis significantly decreased between 2005 and 2015. The rate of PBD diagnosis decreased from 207 to 111 per 1,000 admissions between 2005 and 2015. Visual inspection of the longitudinal trajectory of PBD diagnostic rates suggested a decrease between 2005 and 2015 that could be nonlinear. Therefore, three polynomial regressions were fit hierarchically to empirically test whether the change in PBD diagnostic rates was nonlinear. Table 8 displays the hierarchical regression results. Hospital of admission accounted for 17% of the variance in the rate of PBD diagnosis, $F(4, 44) = 1.86$, $p = .14$. Although not significant, hospital of admission was controlled for in all future analyses.

After controlling for hospital of admission, the rate of PBD diagnosis significantly decreased each year. Adding a quadratic or cubic coefficient did not significantly improve overall model fit. Both the quadratic and cubic effects trended toward a rapid decrease in PBD diagnosis with the cubic effect trending toward a slight increase in the final three years. Overall, the rate of PBD diagnosis declined between 2005 and 2015 (Figure 9).

A second hierarchical regression analysis examined the interaction between year and gender on the rate of PBD diagnosis over time. Table 9 displays the hierarchical regression results. When including gender in the dataset, hospital of admission significantly accounted for 14% of the variance in the rate of PBD diagnosis. After controlling for hospital of admission, the rate of PBD diagnosis significantly decreased each year. After controlling for hospital of admission and year, gender was not associated with PBD diagnostic rates and there was not a significant interaction between year and gender. Therefore, the rate of diagnosis of PBD decreased between 2005 and 2015 for both boys and girls.

Depressive Disorders.

The rate of pediatric DD diagnosis increased from 284 to 429 per 1,000 admissions between 2005 and 2015. Visual inspection of the longitudinal trajectory of DD diagnostic rates suggested an increase between 2005 and 2015 that could be nonlinear. Therefore, three polynomial regressions were fit hierarchically to empirically test whether the change in DD diagnostic rates was nonlinear. Table 10 displays the hierarchical regression results. Hospital of admission significantly accounted for 44% if the variance in the rate of DD diagnosis. Therefore, hospital of admission was controlled for in all future analyses.

After controlling for hospital of admission, the rate of DD diagnosis significantly increased each year. Adding a quadratic coefficient to the model indicated that the rate of DD

diagnosis significantly increased quadratically over time. Specifically, DD diagnostic rates decreased slightly between 2005 and 2008 and then increased dramatically between 2008 and 2015. Adding a cubic coefficient did not significantly improve overall model fit.

A second hierarchical regression analysis examined the interaction between year and gender on the rate of DD diagnosis over time. Table 11 displays the hierarchical regression results. When including gender in the data set, hospital of admission significantly accounted for 26% of the variance in the rate of DD diagnosis. After controlling for hospital of admission, year, and gender, there was a significant interaction between year and gender. Simple slopes analysis indicated that the slope of the rate of diagnosis for women ($b = 13.03$, $p < .001$) significantly increased while the slope of the rate of diagnosis for men ($b = -.40$, $p = .87$) remained stable over time. A final model examined the interaction between gender and the quadratic trend of year. Adding a quadratic coefficient significantly improved overall model fit, such that the rate of DD diagnosis for girls initially decreased between 2005 and 2008 followed by a dramatic increase between 2008 and 2015. Figure 10 displays the interaction between gender and the quadratic trend of year.

Chapter 4: Discussion

The rate of PBD in the U.S. increased dramatically between the mid-1990s and mid-2000s (Blader & Carlson, 2007; Harpaz-Rotem et al., 2005; Harpaz-Rotem & Rosenheck, 2004; Moreno et al., 2007), resulting in concern regarding the potential for overdiagnosis of PBD (Hirschfeld et al., 2003). However, given that the rate of PBD diagnosis had not been examined in the U.S. since 2004, the continued longitudinal trajectory of the rate of PBD diagnosis was unknown. Therefore, this study aimed to assess whether longitudinal changes in the rate of inpatient PBD diagnosis continued to occur subsequent to 2004.

Blader and Carlson (2007) examined the rate of PBD diagnosis between 1996 and 2004 using a nationally representative dataset of inpatient hospital admissions. Study 1 extended Blader and Carlson's (2007) findings another 6 years to 2010 in order to assess whether the rate of national inpatient PBD diagnosis increased, decreased, or remained stable between 1996 and 2010 with a particular focus on the period between 2004 to 2010. Study 2 utilized state-level data to lengthen the period under analysis to 2015. These extensions were important because in the mid-2000s scientific consensus developed around the intermediate diagnostic phenotype for PBD (Carlson & Glovinsky, 2009; Kowatch et al., 2005; Van Meter et al., 2016) which may have reduced the use of the broad PBD diagnostic phenotype in clinical practice. In addition, public awareness of PBD may have decreased after the mid-2000s (Fond et al., 2015). Therefore, we hypothesized that the rate of PBD diagnosis would decrease after 2004.

As a proportion of all national psychiatric hospitalizations, BD diagnosis increased across the child, adolescent, and adult age groups until 2004. The proportion of BD diagnosis decreased among children from 2004 to 2010, while the proportion of BD diagnoses to all psychiatric hospitalizations increased among adolescents and adults during this period. In contrast to the

proportion of BD diagnosis to psychiatric hospitalizations, the population-adjusted rate of national BD-related hospitalizations significantly decreased from the mid-2000s until 2010 for all age groups. This trend was particularly notable for children, given that the population-adjusted rate of overall psychiatric hospitalizations remained stable for children while the population-adjusted rate of PBD diagnosis declined. In summary, while BD diagnoses came to represent a greater proportion of inpatient psychiatric diagnoses among adolescents and adults across the study period, the rate of BD-related hospitalizations in the general population decreased from the mid-2000s to 2010 for all age groups.

The availability of the national data ended in 2010. State-level inpatient data examined 2005 to 2015 to provide a more recent window into inpatient psychiatric hospitalization diagnostic trends. State-level data indicated that the rate of PBD diagnosis significantly decreased among youth ages five to 17 between 2005 and 2015. However, youth ages five to 17 were grouped together into a single age category to facilitate the de-identified nature of the data. It is therefore possible that trends in PBD diagnosis may be different between children and adolescents in the state-level data, and that one age group may be driving the decline in PBD diagnosis identified in our analyses.

Our findings contrast with recent international estimates of trends in PBD diagnosis. For example, population-adjusted rates of PBD diagnosis among Danish youth increased between 1995 and 2003 (similar to the trend in the U.S.). However, the Danish rate of PBD diagnosis continued to increase between 2004 and 2012 (Kessing, Vradi, & Andersen, 2014) in contrast to the apparent decrease in PBD diagnosis over a similar time period in the U.S. Results from German psychiatric inpatient units also contrasted with findings from the present study. In particular, the population-adjusted rate of inpatient diagnosis of PBD in Germany remained

stable among youth under age 15 from 2000 to 2013, but continuously increased for youth ages 15 to 19 and adults across the study period (Holtmann et al., 2010; Rao et al., 2016). This contrasted with our data in which we observed significant initial increases followed by decreases in the population-adjusted rate of BD diagnosis for children, adolescents, and adults. These differences in diagnostic trends between countries also conflict with epidemiological data suggesting that there is no significant difference in the actual prevalence of PBD internationally. However, rates of clinical diagnosis of PBD appear to vary based on the diagnostic phenotype (e.g., broad vs. narrow) used to classify cases of PBD (Van Meter et al., 2011). Therefore, it is possible that discrepancies in rates of PBD diagnosis between the U.S. and other countries may be due to differences in diagnostic definitions used to classify PBD rather than a true difference in prevalence.

In addition to identifying the longitudinal trajectory of PBD, the present study also aimed to compare it with the longitudinal trajectory of inpatient DD diagnosis. Results of Study 1 indicated that the population-adjusted rate of DD diagnosis among adolescents in the U.S. initially increased until the mid-2000s and then decreased until 2010. However, DD diagnosis in U.S. children increased between the mid-2000s and 2010, while the rate of DD diagnosis in adults decreased across the study period. At the state level, the rate of DD diagnosis for boys remained stable between 2005 and 2015 but increased exponentially for girls between 2008 and 2015. Internationally, increases in the inpatient diagnosis of depressive disorders have been identified among youth in the German national healthcare system. In particular, DD diagnosis increased by 832% among youth ages 0 to 19 (Holtmann et al., 2010; Rao et al., 2016). These findings suggest that longitudinal changes in diagnostic trends are not unique to PBD, and that

the rate of diagnosis of pediatric depressive disorders significantly increased over the same time period.

A number of factors could have led to changes in the rate of inpatient PBD diagnosis. Significant concern about misdiagnosis of PBD (Hirschfeld et al., 2003) may have dissuaded clinicians from assigning the PBD diagnosis in the U.S. subsequent to the mid-2000s. Concern about overdiagnosis in particular may have resulted in diagnostic substitution, in which individuals initially diagnosed with PBD were later assigned a different psychiatric diagnosis. In the case of psychiatric conditions such as autism, diagnostic substitution has been implicated as one potential driver of change in rates of clinical diagnosis (Bishop, Whitehouse, Watt, & Line, 2008). As rates of autism diagnosis have increased, rates of other developmental disorders, such as language disorders, have decreased (Bishop et al., 2008; Jick & Kaye, 2003). Vedel Kessing and colleagues (2015) examined the stability of PBD diagnosis among Danish youth between 1994 and 2012 via a national register which allowed for the tracking of repeated psychiatric service contact for each patient. Some youth who did not receive a diagnosis of PBD at their initial contact with psychiatric services were later assigned a PBD diagnosis at subsequent points of contact. However, the opposite was also observed. In particular, of the youth who did receive a diagnosis of PBD at the initial point of contact, 21% experienced diagnostic substitution to other psychiatric disorders, such as major depression or schizophrenia, by the second point of contact (Vedel Kessing et al., 2015). It is possible that diagnostic substitution may have occurred similarly in the U.S. between PBD and other psychiatric diagnoses not included in the present study, which may have contributed to declining rates of PBD diagnosis.

Another factor that may have resulted in declining rates of PBD diagnosis in the U.S. over the past decade relates to changes in public awareness about PBD. The initial increase in

PBD diagnosis from the mid-1990s to mid-2000s coincided with greater media and scientific coverage related to PBD (Lofthouse & Fristad, 2004). However, BD has been searched less often on the internet since the mid-2000s (Fond et al., 2015), it is possible that PBD is no longer at the forefront of public awareness. A decline in public awareness of PBD could have resulted in individuals being less likely to seek services related to PBD, leading to a decrease in clinical diagnosis.

Although diagnostic substitution and decreased awareness of PBD since the mid-2000s may have played a role in changing diagnostic rates, inpatient prevalence of PBD may have also been influenced by an increase in the availability of outpatient psychiatric services. By the mid-2000s, the prevalence of outpatient office visits for BD had increased significantly in the U.S., with the majority of these youth and adults receiving pharmacological interventions at the outpatient level (Moreno et al., 2007). Interventions via outpatient care could have resulted in a decreased need for repeated hospitalizations for PBD over the past decade. However, one outpatient clinic in the U.S. identified a significant decrease in outpatient PBD diagnosis between 2008 and 2013 (Wesemann, 2016). Additional nationwide research is needed to determine whether there was a general trend toward increasing or decreasing outpatient service utilization, and whether this may have impacted the rate of inpatient PBD diagnosis.

In addition to examining overall trends in diagnosis, exploratory aims of both Study 1 and 2 included evaluating whether changes in the rate of PBD diagnosis significantly varied by demographic variables. Among youth, there was not a significant difference in the rate of PBD diagnosis by gender at the national or state levels suggesting that diagnostic rates of PBD were similar for boys and girls across the study period. However, in the national data, gender significantly interacted with year and the adult age group which suggested that adult men carried

lower odds of receiving a BD diagnosis compared to adult women across the study period. Findings from the present study contrast with earlier analyses that did identify gender differences in the rate of PBD diagnosis among youth specifically (Blader & Carlson, 2007; Moreno et al., 2007). However, epidemiological findings disagree as to whether some symptoms of PBD may be more prevalent by gender. Some results indicate no gender differences in the actual prevalence of BD (Diflorio & Jones, 2010; Wozniak et al., 2013). Others suggest that some specific symptoms of PBD (i.e., increased energy, pressured speech, hyperactivity, grandiosity, and people-seeking) may be more common among boys than girls (Van Meter et al., 2016), which could contribute to differing diagnostic rates by gender in clinical practice if these symptoms were more noticeable to clinicians.

While rates of BD diagnosis did not vary by gender among youth in our samples, other variables such as race, insurance type, and geographic region significantly interacted with year to predict BD diagnosis. In the U.S., previous analyses of clinical BD diagnosis have also observed such variations in diagnosis (e.g., Blader & Carlson, 2007). In the present study, differences in diagnostic rates by demographic variables were also observed in the DD group in both the state and national samples. These patterns persisted despite no identified differences in prevalence by most demographic variables in epidemiological research (Rowland & Marwaha, 2018; Weissman et al., 1996). Rather than a true difference in prevalence, this variability in diagnosis may be a result of disparities in access to mental health services across various demographic groups. For example, African-American and Hispanic individuals were less likely to receive treatment for mental health difficulties compared to white individuals between 1990 and 2003 (Kessler et al., 2005). Furthermore, Hispanic and African-American individuals appear to have a greater likelihood of receiving clinical diagnoses of psychotic disorders compared to White

individuals. African-American individuals may be less likely to be diagnosed with a mood disorder compared to White individuals in clinical settings (Delphin-Rittmon et al., 2015). Mental health disparities among adults and youth may result from a number of factors that disproportionately affect minority groups, such as provider bias, discrepancies in access to care (Alegria, Vallas, & Pumariega, 2010; McGuire & Miranda, 2008), norms regarding treatment seeking behavior (Delphin-Rittmon et al., 2015), and socioeconomic status (Chow, Jaffee, & Snowden, 2003). Therefore, it is possible that the impact of demographics on the diagnosis of pediatric mood disorders may reflect broader trends in mental health disparities.

Limitations

While the present study provided evidence to suggest that the rate of PBD has decreased since the mid-2000s, the current data cannot be used to identify the precise reasons for why changes in inpatient diagnostic rates have occurred. Although there are a number of possible causes, the precise reason for why changes in the prevalence of clinical diagnoses occur can be difficult to ascertain. Further research is needed to determine the specific causes of changing trends in pediatric mood disorder diagnosis. Additionally, this study utilized de-identified billing data in which each data point represented a unique admission. Some individuals may have been repeatedly hospitalized throughout the study period and may contribute more than one unique admission to the data. Furthermore, the accuracy of administrative billing data for use in medical research has been questioned (Johnson & Nelson, 2013). Administrative billing data from medicine has sometimes indicated high agreement when compared to medical records or laboratory reference standards. For example, a systematic review of the utility of billing data to identify ventricular arrhythmias determined that the use of ICD-9 codes produced high positive predictive values when compared to patient medical records (Tamariz, Harkins, & Nair, 2012).

Administrative definitions of diabetes have also demonstrated high sensitivity and positive predictive values when compared to laboratory reference standards, though these values were dependent upon which administrative definition of diabetes was used (Southern et al., 2010). However, other findings have indicated that administrative billing databases may be prone to significant errors, such as data being incorrectly entered by hospital staff (Khwaja, Syed, & Cranston, 2002). Additionally, one administrative claims database of intracranial aneurysms demonstrated low specificity, sensitivity, and positive predictive value in identifying cases when compared to the neurosurgical departmental database (Woodworth, Baird, Garces-Ambrossi, Tonascia, & Tamargo, 2009). Although billing data is associated with limitations, it may still represent an effective means to obtain large samples in order to estimate trends in apparent service utilization (Johnson & Nelson, 2013). A further limitation of the present study is that findings from the state-level database are limited to a sample of Medicaid-insured youth. It is therefore unknown whether inpatient diagnosis of pediatric mood disorders have followed the same trends among privately insured youth at the state level. National data suggested that diagnostic rates for both PBD and DD may vary by type of insurance coverage (i.e., government-funded vs. private insurance). Finally, only primary diagnoses were included in this study. It is therefore possible that rates of inpatient PBD diagnosis may be higher when ancillary diagnoses are considered to account for potential comorbidity.

While results of the present study should be interpreted in light of limitations, they may provide valuable insight into changing trends in inpatient service utilization for BD in the U.S. Costs associated with the clinical management of BD are high among adults (Dean, Gerner, & Gerner, 2004; Stensland, Jacobson, & Nyhuis, 2007) and youth (Peele, Axelson, Xu, & Malley, 2004). Individuals with BD are estimated to utilize significantly more resources on average when

compared to individuals with other psychiatric disorders (Peele et al., 2004; Stensland et al., 2007). Therefore, awareness of the current diagnostic trends for BD may assist inpatient administrators and clinicians in preparing for anticipated service utilization and planning allocation of resources. Further research is necessary to evaluate continuously changing diagnostic rates and to determine the exact causes of changing trends in diagnosis across time.

Appendix A: Tables

Table 1

Population-Adjusted Rates per 10,000 of Overall Psychiatric, BD, and DD Hospitalizations by Age and Year

	Psychiatric Hospitalization			BD-related Hospitalization			DD-related Hospitalization		
Year	Child	Adolescent	Adult	Child	Adolescent	Adult	Child	Adolescent	Adult
1996	15.56	69.92	90.45	1.29	5.98	8.34	5.05	20.57	19.16
1997	16.55	71.20	89.88	1.56	6.04	8.57	3.91	21.80	20.25
1998	21.47	79.98	87.58	2.70	8.39	9.07	5.24	28.16	19.26
1999	20.25	82.85	88.63	1.52	11.74	10.22	5.54	25.40	19.80
2000	17.67	91.90	93.58	3.15	17.48	13.20	4.58	24.20	18.90
2001	22.80	114.83	98.09	5.61	30.53	13.02	6.01	38.75	22.70
2002	28.53	103.59	101.58	8.73	25.04	14.36	7.75	33.11	22.84
2003	23.61	95.69	94.05	6.20	15.96	12.08	6.90	36.15	20.85
2004	22.78	89.86	94.59	7.34	20.18	13.18	4.63	30.03	19.31
2005	22.96	100.58	96.49	8.05	28.73	15.45	5.55	30.93	19.91
2006	25.15	105.43	95.45	8.78	34.57	15.72	6.58	30.68	19.55
2007	28.56	104.06	92.72	7.18	25.91	15.17	7.66	30.59	18.49
2008	21.94	70.90	80.53	4.76	19.63	13.93	6.58	23.02	16.71
2009	21.88	88.42	81.86	5.01	19.13	12.43	7.37	31.55	17.11
2010	28.16	90.84	79.07	5.50	25.37	12.13	9.95	34.87	17.20

Table 2

Hierarchical Regression of Model Fit for Population-Adjusted Psychiatric Hospitalization Predicted by Year

Predictors	Control b [95% CI]	Linear b [95% CI]	Year x Age Group b [95% CI]	Quadratic b [95% CI]	$Year^2$ x Age Group b [95% CI]
Constant	92.83* [86.26, 99.39]	95.6712* [86.93, 104.41]	86.42* [72.99, 99.84]	75.63* [66.33, 84.92]	67.67* [61.78, 73.55]
Age Group					
Child	-69.61* [-76.45, -62.76]	-69.54* [-76.76, -62.32]	-67.59* [-81.31, -53.87]	-67.84* [-78.32, -57.37]	-51.35* [-57.66, -45.03]
Adult	-1.51 [-8.82, 5.81]	-1.59 [-9.05, 5.87]	8.78 [-5.70, 23.26]	9.80 [.05, 19.54]	18.11* [10.34, 25.89]
Year		-.39 [-1.07, .29]	.87 [-.66, 2.41]	5.32* [3.74, 6.89]	8.60* [5.65, 11.55]
Year x Child			-.29 [-1.86, 1.28]	-.23 [-1.51, 1.06]	-6.99* [-10.13, -3.85]
Year x Adult			-1.42 [-3.12, .28]	-1.52* [-2.65, -.39]	-4.96* [-8.24, -1.67]
$Year^2$				-.31* [-.39, -.22]	-.54* [-.77, -.30]
$Year^2$ x Child					.47* [.22, .72]
$Year^2$ x Adult					.24 [-.01, .49]
R^2	.77	.78	.80	.92	.92
F	734.60*	452.78*	385.00*	395.87*	594.39*
ΔR^2		.01	.02	.12	.00
ΔF		**281.82**	**67.78***	**10.87***	**198.52***

Note. 95% CI = 95% confidence interval.
* $p < .05$.

Table 3

Hierarchical Regression of Model Fit for Population-Adjusted Rate of BD Predicted by Year

Predictors	Control b [95% CI]	Linear b [95% CI]	Year x Age Group b [95% CI]	Quadratic b [95% CI]	$Year^2$ x Age Group b [95% CI]
Constant	23.52* [19.70, 27.35]	20.37* [16.06, 24.68]	16.4480* [7.90, 25.00]	11.08* [3.76, 18.40]	2.74 [-4.27, 9.76]
Age Group					
Child	-17.12* [-14.51, -6.58]	-17.12* [-14.19, -6.46]	-11.75* [-20.71, -2.78]	-11.87* [-19.36, -4.38]	-3.54 [-10.80, 3.71]
Adult	-10.54* [-21.09, -13.16]	-10.33* [-21.03, -13.21]	-6.01 [-14.76, 2.74]	-4.78 [-12.13, 2.57]	4.37 [-2.77, 11.51]
Year		.38* [.14, .61]	.85 [-.06, 1.75]	2.60* [1.66, 3.54]	5.32* [2.90, 7.74]
Year x Child			-.64 [-1.60, .31]	-.65 [-1.41, .12]	-3.37* [-5.84, -.89]
Year x Adult			-.52 [-1.46, .42]	-.64 [-1.40, .12]	-3.68* [-6.14, -1.22]
$Year^2$				-.11* [-.15, -.07]	-0.28* [-.45, -.12]
$Year^2$ x Child					.17* [.01, .34]
$Year^2$ x Adult					.19* [.03, .36]
R^2	.59	.67	.69	.80	.83
F	62.90*	42.11*	27.90*	65.80*	63.07*
ΔR^2		.08	.02	.11	.03
ΔF		**20.79***	**14.21**	**37.90***	**2.73**

Note. 95% CI = 95% confidence interval.
* $p < .05$.

Table 4

Hierarchical Regression of Model Fit for Population-Adjusted Rate of DD Predicted by Year

Predictors	Control b [95% CI]	Linear b [95% CI]	Year x Age Group b [95% CI]	Quadratic b [95% CI]	$Year^2$ x Age Group b [95% CI]
Constant	30.31* [27.77, 32.85]	31.14* [28.05, 34.24]	26.90* [21.73, 32.08]	24.39* [20.03, 28.74]	22.05* [18.65, 25.45]
Age Group					
Child	-23.72* [-26.41, -21.02]	-23.68* [-26.51, -20.86]	-22.46* [-27.72, -17.21]	-22.44* [-27.30, -17.59]	-16.99* [-20.51, -13.47]
Adult	-10.73* [-13.44, -8.03]	-10.78* [-13.54, -8.02]	-5.82* [-11.22, -.42]	-5.48* [-10.05, -.91]	-3.01 [-6.50, .49]
Year		-.11 [-.27, .05]	.46 [-.05, .96]	1.46* [.87, 2.05]	2.39872* [.90, 3.90]
Year x Child			-.18 [-.70, .34]	-.17 [-.72, .39]	-2.38* [-3.95, -.80]
Year x Adult			-.67* [-1.20, -.14]	-.71* [-1.20, -.23]	-1.70636* [-3.26, -.15]
$Year^2$				-.07* [-.10, -.04]	-0.13* [-.26, -.01]
$Year^2$ x Child					.14966* [.02, .28]
$Year^2$ x Adult					.06813 [-.06, .19]
R^2	.79	.79	.83	.88	.89
F	279.73*	155.40*	231.35*	145.67*	222.67*
ΔR^2		.00	.04	.05	.01
ΔF		**124.33**	**75.95***	**85.68***	**77.00***

Note. 95% CI = 95% confidence interval.
* $p < .05$.

Table 5

Logistic Regression Predicting Odds of BD Diagnosis by Demographic Variables

		Interaction of Demographic Variables with Year and Age Group				
	Main Effects	Age Group	Gender	Race	Insurance Type	Geographic Region
Predictor	*OR* [95% CI]	*OR* [95% CI]	*OR* [95% CI]	*OR* [95% CI]	*OR* [95% CI]	*OR* [95% CI]
Constant	.20 [.18, .22] *	.12 [.10, .15] *	.17 [.15, .19] *	.19 [.17, .21] *	.22 [.19, .26] *	.23 [.20, .26] *
Year	1.13 [1.11, 1.15] *	1.26 [1.19, 1.34] *	1.11 [1.08, 1.14] *	1.12 [1.10, 1.15] *	1.08 [1.06, 1.11] *	1.08 [1.05, 1.11] *
Year^2	.995 [.994, .996] *	.99 [.99, .99] *	.996 [.994, .998] *	.995 [.994, .997] *	.998 [.996, 1.00]	.998 [.996, .999] *
Age Group						
Child	1.11 [.98, 1.27]	.70 [.48, 1.02]	1.13 [.92, 1.39]	1.17 [1.01, 1.35] *	.95 [.79, 1.13]	1.12 [.98, 1.27]
Adult	.57 [.53, .62] *	.98 [.80 1.21]	.69 [.62, .77] *	.62 [.56, .68] *	.54 [.48, .61] *	.57 [.53, .62] *
Gender	.66 [.63, .70] *	.66 [.63, .70] *	.92 [.77, 1.11]	.66 [.63, .70] *	.66 [.63, .70] *	.66 [.63, .70] *
Race	.65 [.61, .69] *	.65 [.61, .69] *	.65 [.61, .69] *	.68 [.53, .86] *	.65 [.61, .69] *	.65 [.61, .69] *
Insurance Type	1.01 [.97, 1.06]	1.02 [.97, 1.07]	1.02 [.97, 1.07]	1.02 [.97, 1.07]	.78 [.64, .94] *	1.02 [.97, 1.07]
Geographic Region						
South	1.30 [1.25, 1.35] *	1.29 [1.24, 1.34] *	1.30 [1.25, 1.35] *	1.30 [1.25, 1.35] *	1.30 [1.25, 1.35] *	.84 [.75, .94] *
West	.80 [.75, .86] *	.80 [.75, .86] *	.80 [.75, .86] *	.80 [.75, .86] *	.80 [.75, .86] *	1.29 [1.06, 1.58] *
Midwest	1.11 [1.05, 1.17] *	1.11 [1.06, 1.17] *	1.11 [1.05, 1.16] *	1.11 [1.05, 1.17] *	1.11 [1.05, 1.17] *	1.05 [.92, 1.20]
Interaction with Age						
Child x Year		1.22 [1.09, 1.36] *				
Adult x Year		.87 [.82, .93] *				
Child x Year^2		.99 [.98, .99] *				
Adult x Year^2		1.01 [1.00, 1.01] *				
Interaction with Gender						

Gender x Year			1.04 [1.00, 1.08]			
Gender x Year^2			.997 [.994, .999] *			
Gender x Child			.88 [.68, 1.15]			
Gender x Adult			.64 [.54, .75] *			
Interaction with Race						
Race x Year				1.07 [1.01, 1.13] *		
Race x Year^2				.99 [.99, 1.00]		
Race x Child				.75 [.56, 1.01]		
Race x Adult				.65 [.54, .78] *		
Interaction with Insurance Type						
Insurance x Year					1.10 [1.06, 1.15] *	
Insurance x Year^2					.992 [.990, .995] *	
Insurance x Child					1.36 [1.05, 1.76] *	
Insurance x Adult					1.10 [.94, 1.30]	
Interaction with Geographic Region						
South x Year						1.12 [1.09 1.16] *
West x Year						.87 [.82, .93] *
Midwest x Year						.97 [.93, 1.02]
South x Year^2						.994 [.992, .996] *
West x Year^2						1.01 [1.00, 1.01] *
Midwest x Year^2						1.00 [1.00, 1.01] *
Nagelkerke R^2	.025	.026	.026	.026	.026	.027
ΔR^2		.001	.001	.001	.001	.002

Note. BD = Bipolar Disorder. *OR* = Odds Ratio. 95% CI = 95% confidence interval. ΔR^2 = Change in Nagelkerke's R^2 between the main effects model and interaction effects models.
* $p < .05$.

Table 6

Logistic Regression Predicting Odds of DD Diagnosis by Demographic Variables

		Interaction of Demographic Variables with Year and Age Group				
	Main Effects	Age Group	Gender	Race	Insurance Type	Geographic Region
Predictor	*OR* [95% CI]	*OR* [95% CI]	*OR* [95% CI]	*OR* [95% CI]	*OR* [95% CI]	*OR* [95% CI]
Constant	.49 [.45, .53] *	.45 [.38, .52] *	.51 [.46, .57] *	.47 [.43, .52] *	.56 [.49, .63] *	.47 [.43, .52] *
Year	.98 [.96, .99] *	.96 [.91, 1.02]	.97 [.95, .99] *	.98 [.961, .997] *	.96 [.94, .98] *	.98 [.96, 1.01]
Year^2	1.00 [1.00, 1.00] *	1.00 [.999 1.01]	1.00 [.999, 1.002]	1.00 [1.00, 1.00]	1.003 [1.001, 1.004] *	1.00 [.999, 1.002]
Age Group						
Child	.89 [.79, 1.01]	1.05 [.81, 1.37]	.89 [.74, 1.07]	.83 [.73, .96] *	.90 [.76, 1.07]	.89 [.79, 1.01]
Adult	.66 [.62, .71] *	.72 [.61, .85] *	.67 [.61, .74] *	.83 [.73, .96] *	.60 [.53, .67] *	.67 [.62, .71] *
Gender	.59 [.57, .61] *	.59 [.56, .61] *	.51 [.44, .60] *	.59 [.57, .61] *	.59 [.56, .61] *	.59 [.57, .61] *
Race	.71 [.68, .75] *	.71 [.67, .75] *	.71 [.68, .75] *	.83 [.68, 1.01]	.71 [.67, .75] *	.71 [.68, .75] *
Insurance Type	1.39 [1.33, 1.44] *	1.39 [1.34, 1.45] *	1.39 [1.33, 1.44] *	1.39 [1.34, 1.45] *	1.10 [.93, 1.29]	1.39 [1.33, 1.45] *
Geographic Region						
South	1.23 [1.19, 1.27] *	1.23 [1.20, 1.28] *	1.23 [1.19, 1.27] *	1.23 [1.19, 1.27] *	1.23 [1.19, 1.27] *	1.24 [1.14, 1.35] *
West	.67 [.63, .71] *	.67 [.63, .71] *	.67 [.63, .71] *	.67 [.63, .71] *	.67 [.63, .71] *	.60 [.51, .70] *
Midwest	1.36 [1.31, 1.42] *	1.36 [1.30, 1.42] *	1.37 [1.31, 1.43] *	1.37 [1.31, 1.43] *	1.36 [1.30, 1.42] *	1.37 [1.23, 1.52] *
Interaction with Age						
Child x Year		.91 [.83, 1.01]				
Adult x Year		1.02 [.96, 1.08]				
Child x Year^2		1.01 [1.00, 1.01]				
Adult x Year^2		1.00 [.99, 1.00]				
Interaction with Gender						

Gender x Year			1.01 [.98, 1.05]			
Gender x Year^2			1.00 [.999, 1.003]			
Gender x Child			.99 [.78, 1.27]			
Gender x Adult			.98 [.85, 1.13]			
Interaction with Race						
Race x Year				.99 [.95, 1.04]		
Race x Year^2				1.00 [.998, 1.005]		
Race x Child				1.26 [.96, 1.65]		
Race x Adult				.78 [.66, .93] *		
Interaction with Insurance Type						
Insurance x Year					1.05 [1.01, 1.08] *	
Insurance x Year^2					.996 [.994, .999] *	
Insurance x Child					.93 [.73, 1.19]	
Insurance x Adult					1.20 [1.04, 1.39] *	
Interaction with Geographic Region						
South x Year						1.00 [.97, 1.03]
West x Year						1.04 [.99, 1.09]
Midwest x Year						.99 [.95, 1.02]
South x Year^2						1.00 [.998, 1.002]
West x Year^2						1.00 [.994, 1.001]
Midwest x Year^2						1.00 [.999, 1.004]
Nagelkerke R^2	.033	.033	.033	.033	.033	.033
ΔR^2						

Note. DD = Depressive Disorders. *OR* = Odds Ratio. 95% CI = 95% confidence interval. ΔR^2 = Change in Nagelkerke's R^2 between the main effects model and interaction effects models.
* $p < .05$.

Table 7

Nevada Hospital Admissions Counts and Sample Characteristics

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Inpatient Admissions	3,140	2,551	2,256	2,302	3,356	4,659	4,784	4,865	5,871	6,596	7,728
Gender											
Men	1,686	1,349	1,617	1,276	1,730	2,513	2,423	2,440	2,763	3,216	3,294
n (%)	(54)	(53)	(72)	(55)	(52)	(54)	(51)	(50)	(47)	(49)	(43)
Women	1,454	1,202	639	1,026	1,626	2,146	2,361	2,425	3,108	3,380	4,434
n (%)	(46)	(47)	(28)	(45)	(49)	(46)	(49)	(50)	(53)	(51)	(57)
Diagnosis											
PBD	650	493	447	375	487	620	451	403	439	509	856
n (%)	(21)	(19)	(20)	(16)	(15)	(13)	(9)	(8)	(7)	(8)	(11)
DD	892	690	473	491	790	1,091	1,304	1,377	1,629	2,181	3,316
n (%)	(28)	(27)	(21)	(21)	(24)	(23)	(27)	(28)	(28)	(33)	(43)

Table 8

Hierarchical Regression Analysis of Model Fit for PBD Diagnosis Predicted by Hospital and Year

Predictors	Control Model b [95% CI]	Linear Model b [95% CI]	Quadratic Model b [95% CI]	Cubic Model b [95% CI]
Constant	130.97* [109.91, 152.02]	221.62* [175.09, 268.15]	252.66* [181.15, 324.17]	232.09* [150.00, 314.18]
Hospital				
1	-25.81* [-49.46, -2.16]	-39.39* [-68.95, -9.82]	-40.34* [-70.05, -10.63]	-43.66* [-73.76, -13.56]
2	54.11 [-7.33, 115.54]	40.53 [-1.23, 82.29]	39.57* [1.32, 77.82]	36.25 [-.01, 72.52]
3	-16.23 [-55.09, 22.62]	-17.82 [-38.18, 2.54]	-17.33 [-40.13, 5.48]	-17.41 [-39.14, 4.31]
4	3.48 [-27.02, 33.99]	7.25 [-24.96, 39.47]	6.70 [-20.86, 34.26]	9.80 [-17.63, 37.24]
Year		-15.42* [-22.55, -8.29]	-34.16* [-59.69, -8.62]	7.46 [-52.23, 67.16]
$Year^2$			1.82 [-.31, 3.95]	-9.07 [-21.86, 3.71]
$Year^3$				.72 [-.07, 1.50]
R^2	.17	.52	.57	.62
F	1.86	5.43*	5.50*	7.86*
ΔR^2		.35	.05	.05
ΔF		3.57*	.07	2.36

Note. 95% CI = 95% confidence interval.
* $p < .05$.

Table 9

Hierarchical Regression Analysis of PBD Diagnosis Predicted by Hospital, Year, Gender, and Year x Gender Interaction

Predictors	Control Model b [95% CI]	Year b [95% CI]	Main Effects of Year and Gender b [95% CI]	Year x Gender Interaction b [95% CI]
Constant	66.36* [57.64, 75.09]	114.72* [92.86, 136.57]	115.52* [89.17, 141.87]	129.79* [92.03, 167.55]
Hospital				
1	-13.79* [-23.57, -4.00]	-21.23* [-33.42, -9.03]	-21.22* [-33.47, -8.97]	-21.09* [-33.17, -9.01]
2	30.58* [3.07, 58.08]	24.31* [3.63, 44.98]	24.28* [3.67, 44.89]	23.95* [3.99, 43.90]
3	-9.00 [-23.84, 5.85]	-10.07* [-19.64, -.51]	-10.06* [-19.69, -.44]	-9.97 [-20.24, .30]
4	.86 [-12.44, 14.16]	2.63 [-11.12, 16.37]	2.63 [-11.32, 16.59]	2.72 [-11.13, 16.56]
Year		-8.18* [-11.31, -5.06]	-8.18* [-11.31, -5.05]	-10.69* [-15.83, -5.54]
Gender			-1.67 [-16.83, 13.50]	-30.85 [-73.25, 11.55]
Year * Gender				5.09 [-.90, 11.08]
R^2	.14	.41	.41	.44
F	2.57*	6.84*	7.47*	6.30*
ΔR^2		.27	.00	.03
ΔF		4.27*	.63	1.17

Note. 95% CI = 95% confidence interval.
* $p < .05$.

Table 10

Hierarchical Regression Analysis of Model Fit for DD Diagnosis Predicted by Hospital and Year

Predictors	Control Model b [95% CI]	Linear Model b [95% CI]	Quadratic Model b [95% CI]	Cubic Model b [95% CI]
Constant	313.41* [283.31, 343.52]	225.42* [166.02, 284.82]	306.34* [243.00, 369.69]	300.17* [228.57, 371.77]
Hospital				
1	-112.18* [-147.23, -77.14]	-99.01* [-140.55, -57.46]	-101.50* [-146.43, -56.57]	-102.49* [-148.94, -56.04]
2	18.43 [-30.79, 67.65]	31.61 [-13.97, 77.19]	29.12 [-6.63, 64.86]	28.12 [-8.35, 64.59]
3	34.00 [-42.70, 110.70]	35.54 [-23.59, 94.66]	36.82 [-12.56, 86.20]	36.79 [-13.13, 86.72]
4	-69.24 [-145.37, 6.89]	-72.90* [-131.53, -14.27]	-74.33* [-118.49, -30.18]	-73.40* [-117.52, -29.29]
Year		14.96* [4.74, 25.18]	-33.90* [-59.84, -7.95]	-21.41 [-85.37, 42.55]
$Year^2$			4.74* [2.10, 7.38]	1.47 [-13.97, 16.91]
$Year^3$				.21 [-0.81, 1.24]
R^2	.44	.57	.70	.70
F	20.34*	13.37*	20.52*	17.33*
ΔR^2		.13	.13	.00
ΔF		6.97*	7.15*	3.19

Note. 95% CI = 95% confidence interval.
* $p < .05$.

Table 11

Hierarchical Regression Analysis of DD Diagnosis Predicted by Hospital, Year, Gender, and Year x Gender Interaction

Predictors	Control Model b [95% CI]	Year b [95% CI]	Main Effects of Year and Gender b [95% CI]	Linear Year x Gender Interaction b [95% CI]	Quadratic Year x Gender Interaction b [95% CI]
Constant	160.33* [143.33, 177.33]	122.93* [92.79, 153.08]	-76.01* [45.42, 106.60]	114.49* [86.21,142.78	131.81* [92.72, 170.91]
Hospital					
1	-59.72* [-80.18, -39.25]	-53.79* [-74.26, -33.31]	-53.69* [-70.21, -37.18]	-53.64* [-70.66, -36.62]	-54.78* [-73.29, -36.28]
2	13.49 [-18.75, 45.73]	18.52 [-14.06, 51.10]	20.85 [-2.34, 44.04]	19.69 [-1.345, 40.74]	18.56* [.49, 36.62]
3	23.59 [-11.02, 58.20]	23.60 [-7.84, 55.03]	20.94 [-2.06, 43.95]	22.06* [.56, 43.55]	22.49* [5.15, 39.82]
4	-38.25* [-75.96, -.54]	-39.40* [-73.78, -5.01]	-39.29* [-66.96, -11.62]	-39.27* [-64.03, -14.52]	-39.92* [-58.96, -20.88]
Year		6.29* [.60, 11.98]	6.28* [1.95, 10.61]	-.40 [-4.40, 3.60]	-10.76 [-23.70, 2.18]
Gender			93.78* [71.24, 116.32]	16.38 [-31.62, 64.39]	59.61* [8.75, 110.47]
Year * Gender				13.43* [5.36, 21.49]	-13.00 [-33.66, 7.66]
$Year^2$					1.00 [-.09, 2.10]
$Year^2$ * Gender					2.57* [.48, 4.66]
R^2	.26	.30	.62	.68	.76
F	10.76*	8.00*	28.17*	33.16*	38.32*
ΔR^2		.04	.32	.06	.08
ΔF		2.76*	20.17*	4.99*	5.16*

Note. 95% CI = 95% confidence interval.
* $p < .05$.

Appendix B: Figures

Figure 1

Proportions of Mood Disorders Compared to All Adult Psychiatric Hospitalizations by Age

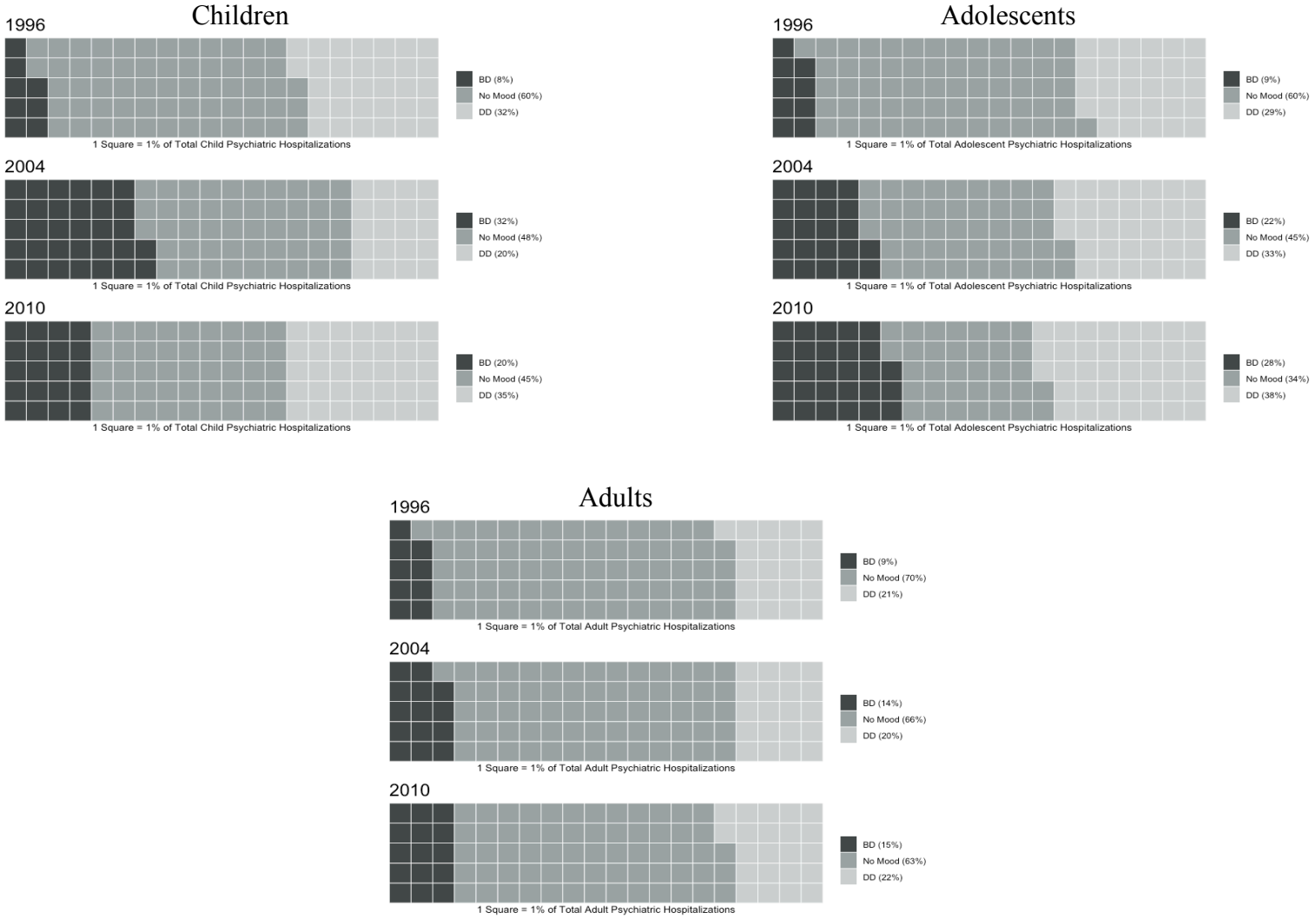


Figure 2

Population-Adjusted Rate of Psychiatric Hospitalization by Age between 1996 and 2010

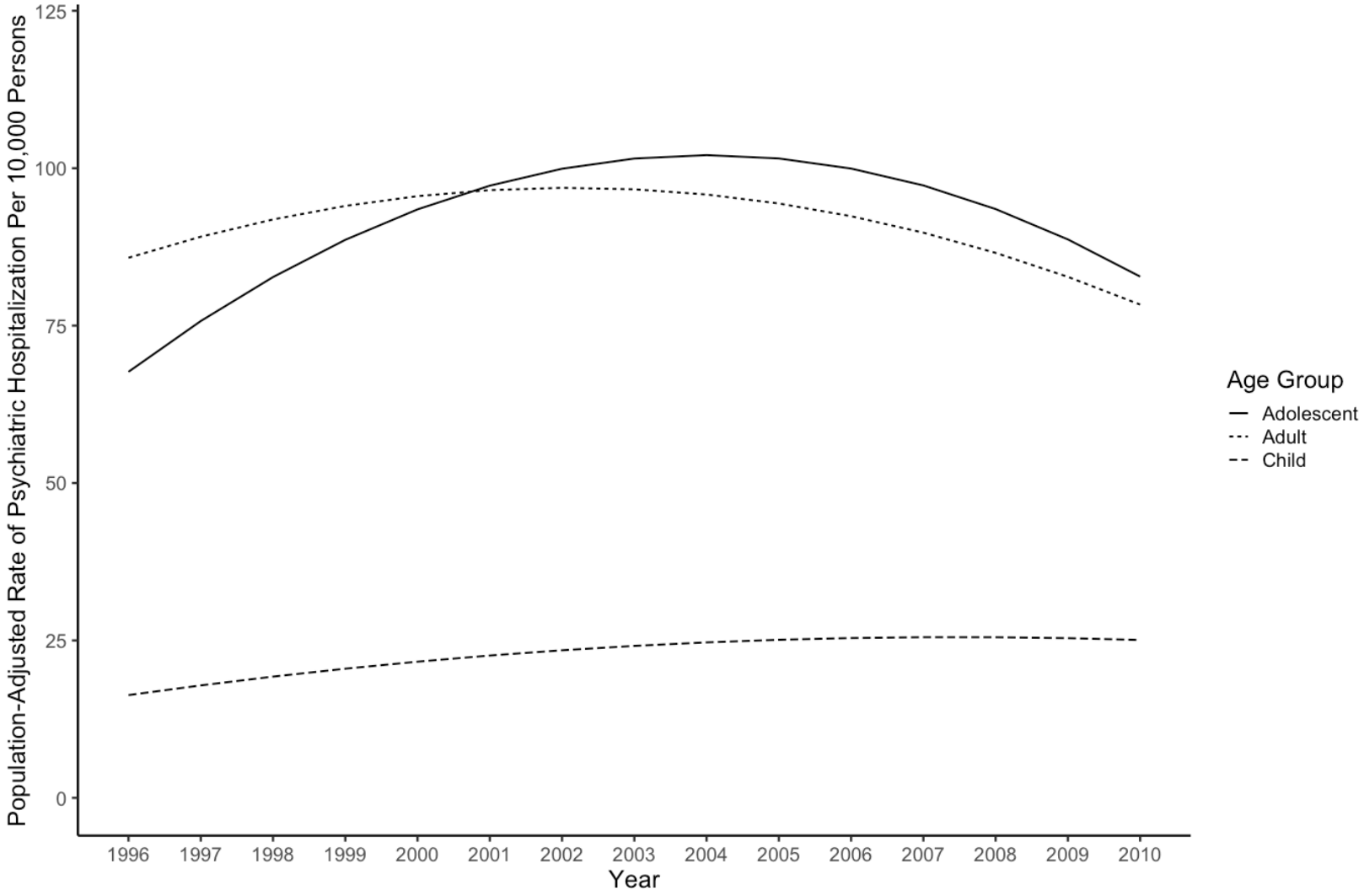


Figure 3

Population-Adjusted Rate of BD-related Hospitalization by Age between 1996 and 2010

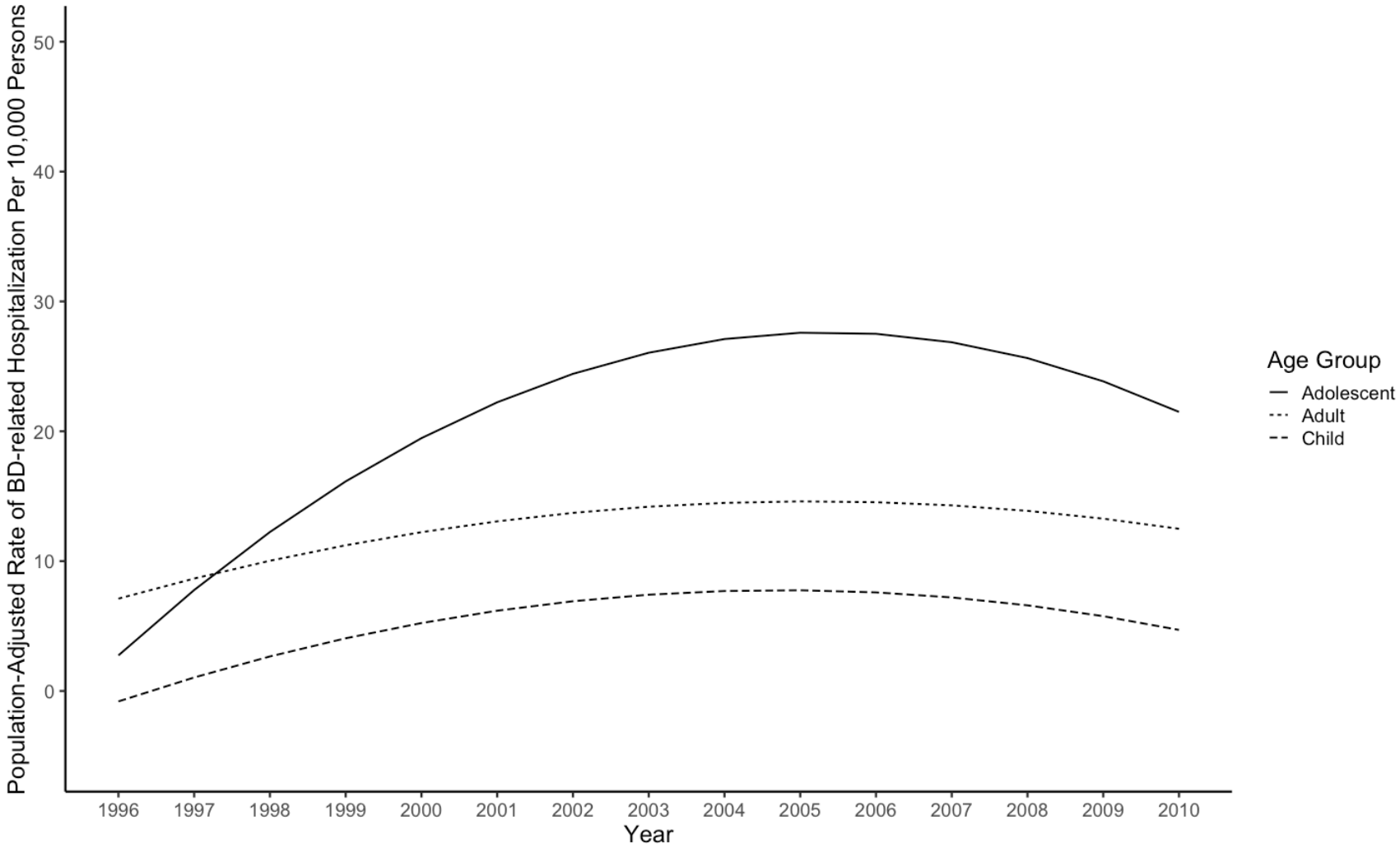


Figure 4

Population-Adjusted Rate of DD-related Hospitalization by Age between 1996 and 2010

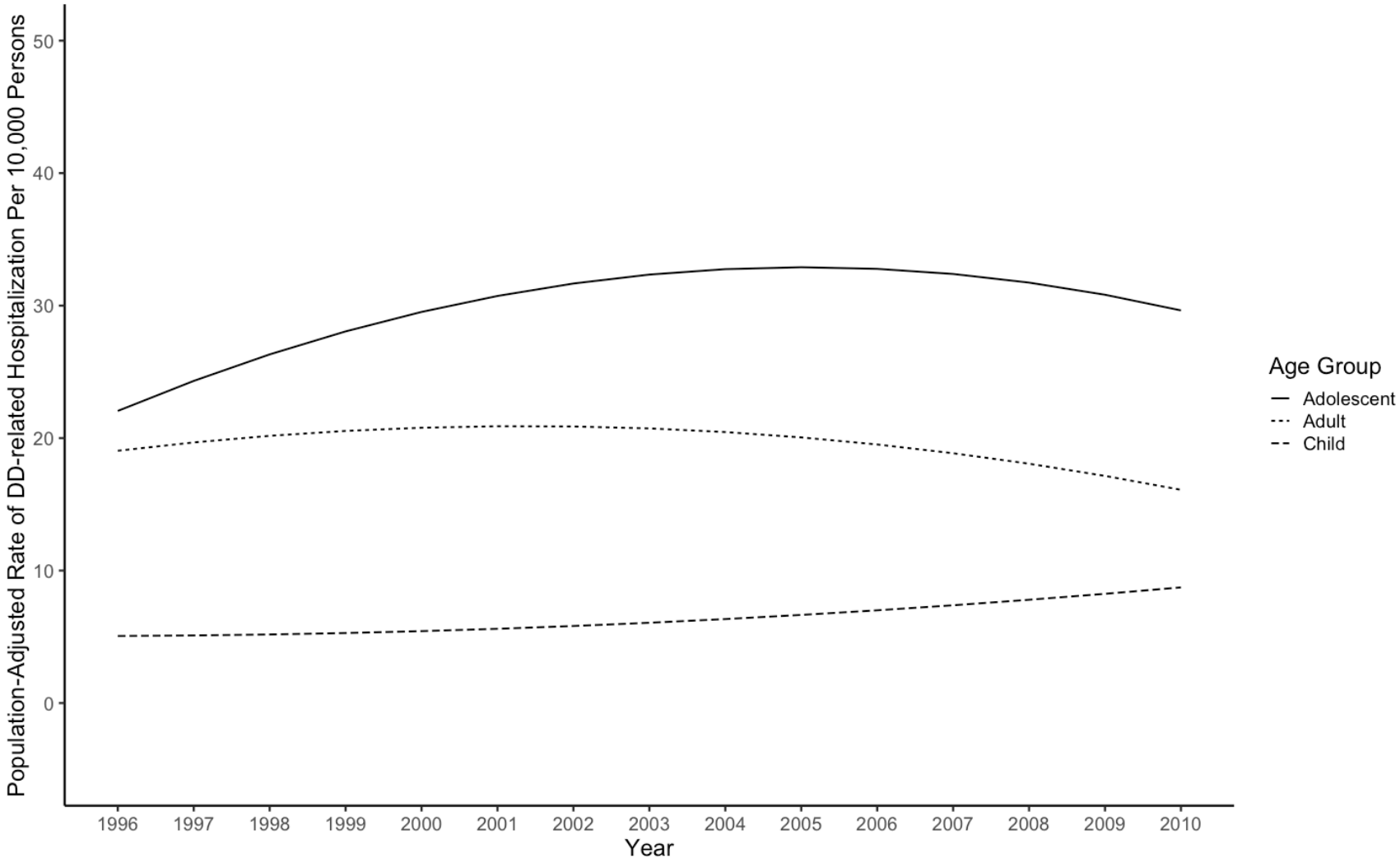


Figure 5

Interaction between Gender and Age Group Predicting Odds of BD Diagnosis between 1996 and 2010

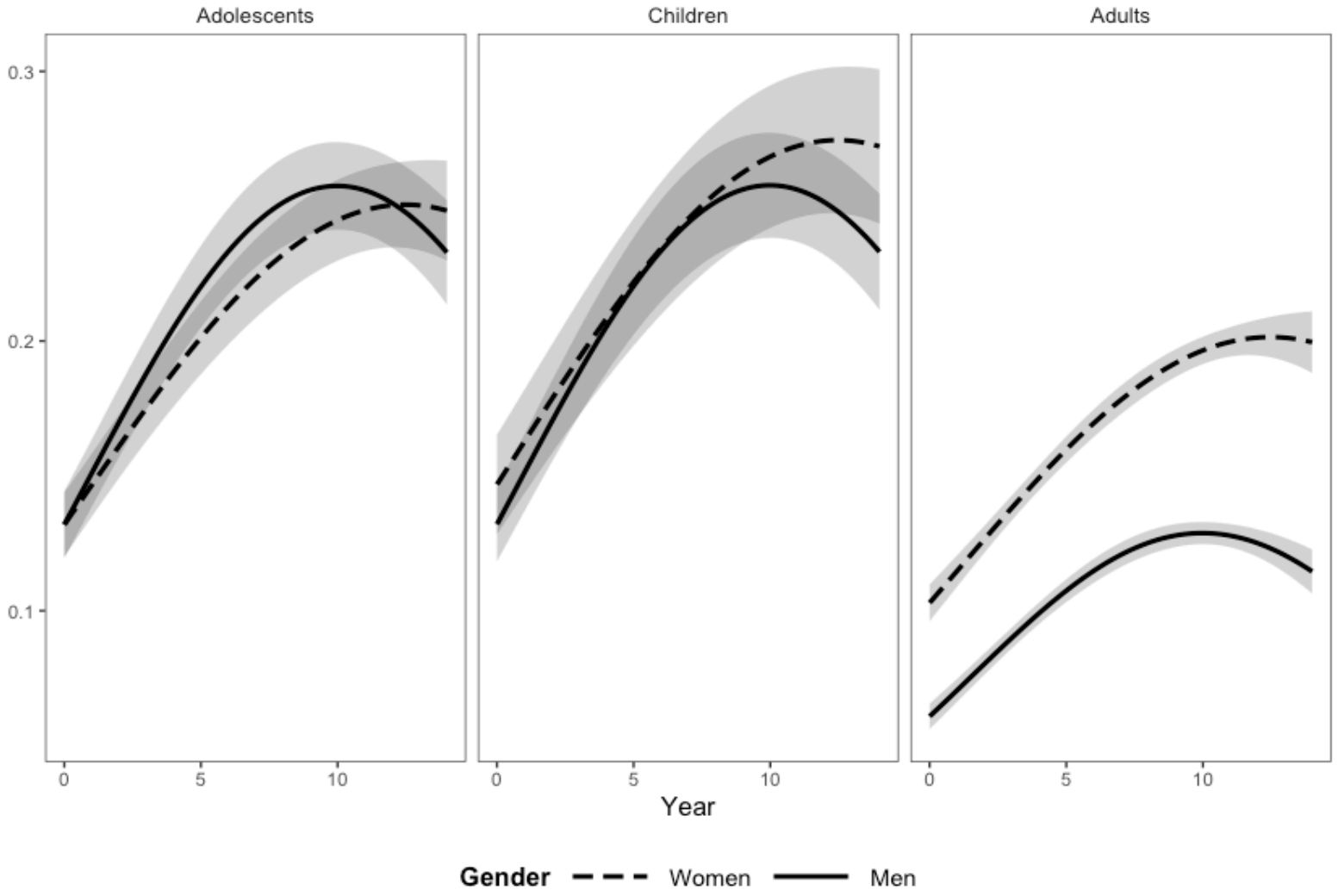


Figure 6

Interaction between Race and Age Group Predicting Odds of BD Diagnosis between 1996 and 2010

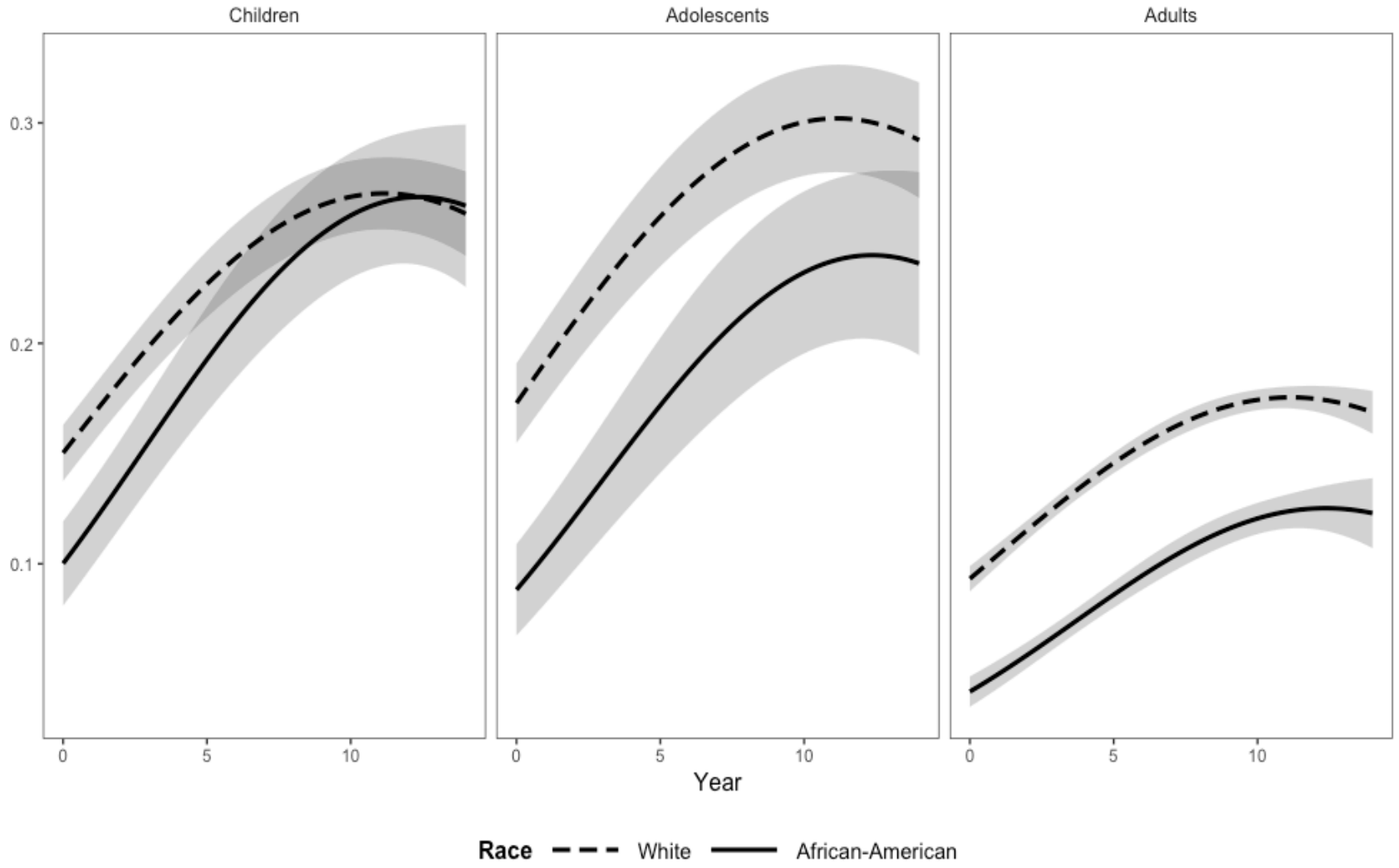


Figure 7

Interaction between Insurance Type and Age Group Predicting Odds of BD Diagnosis between 1996 and 2010

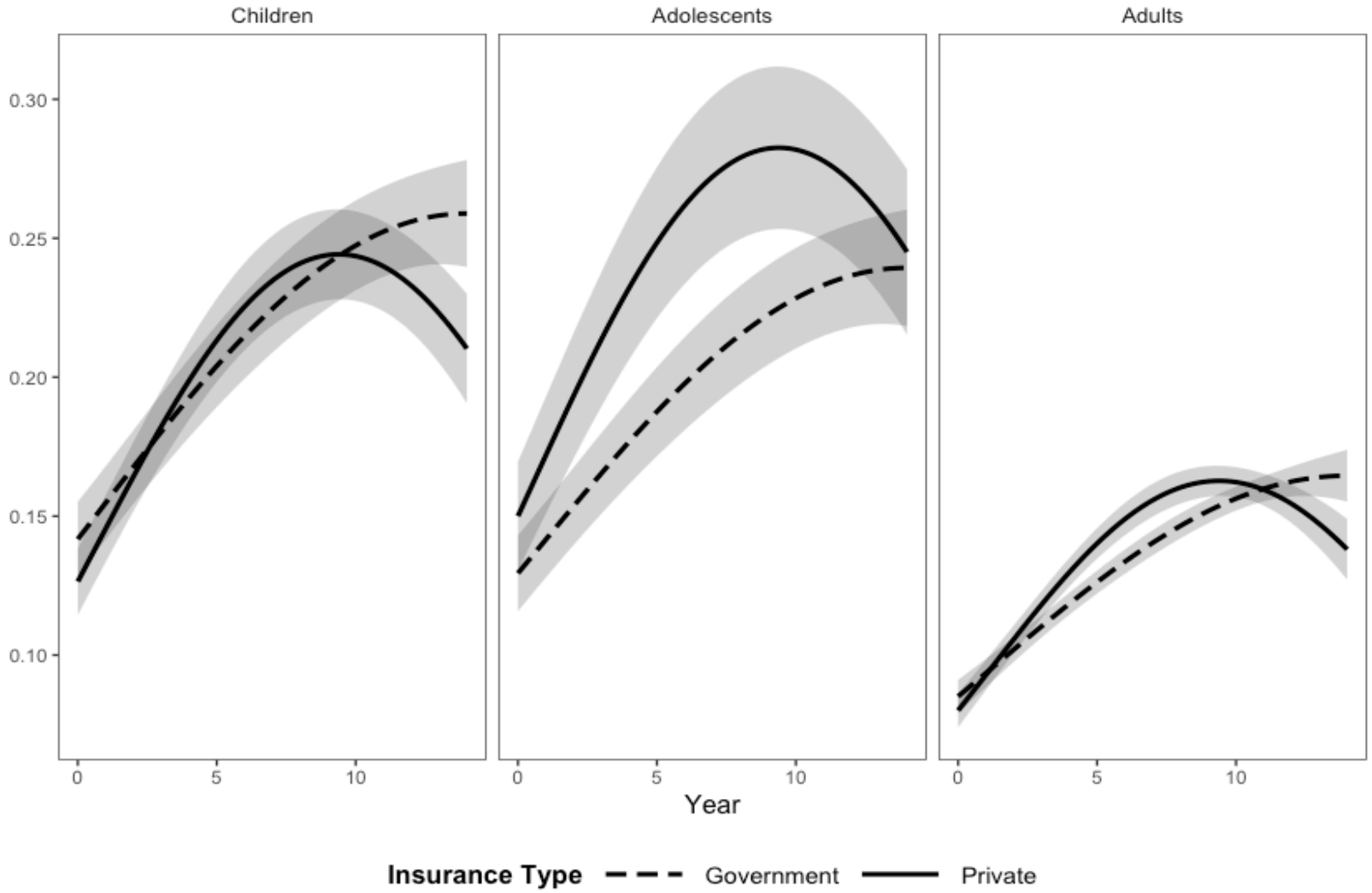


Figure 8

Interaction between Geographic Region and Year Predicting Odds of BD Diagnosis between 1996 and 2010

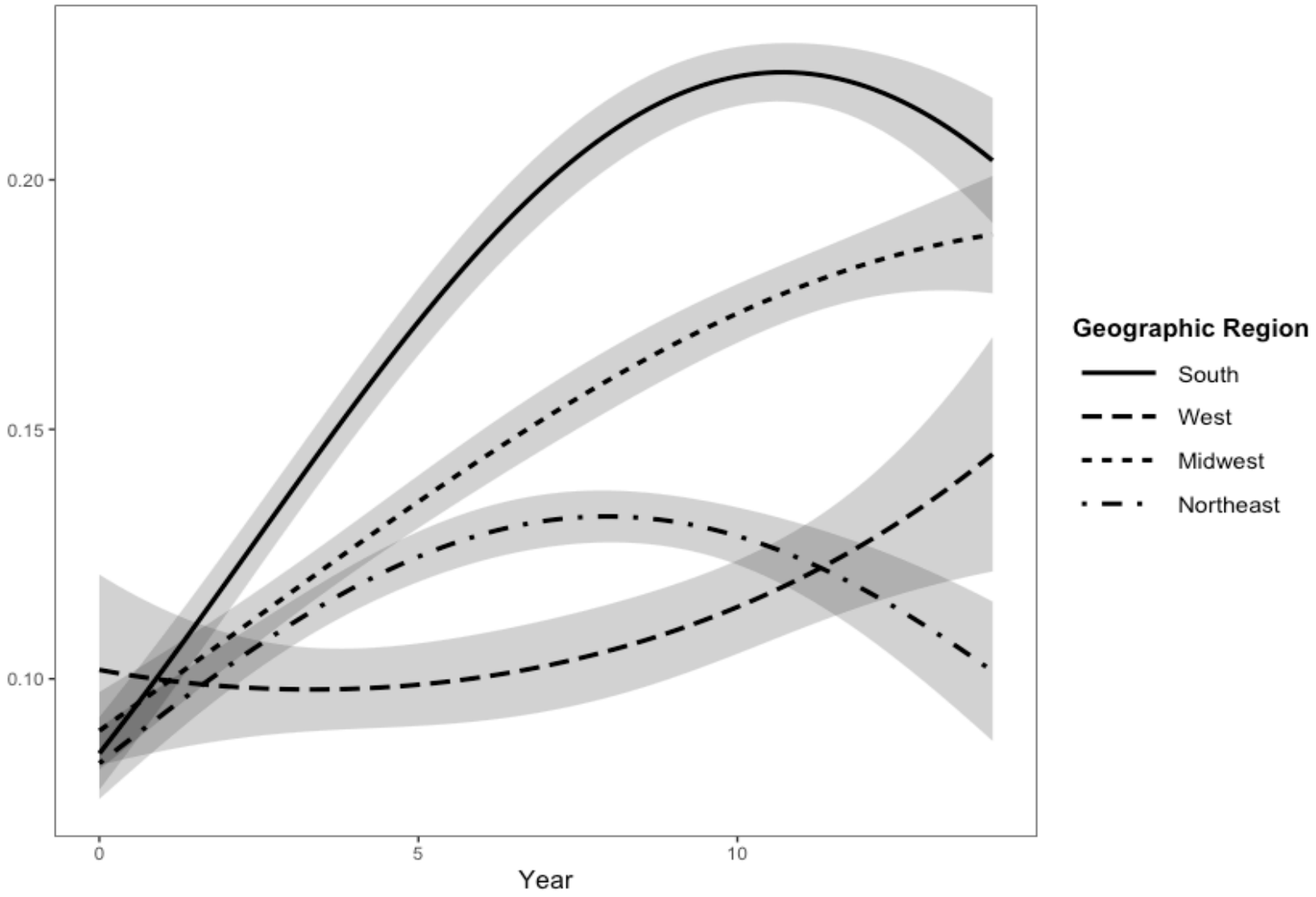


Figure 9

Interaction between Race and Age Group Predicting Odds of DD Diagnosis between 1996 and 2010

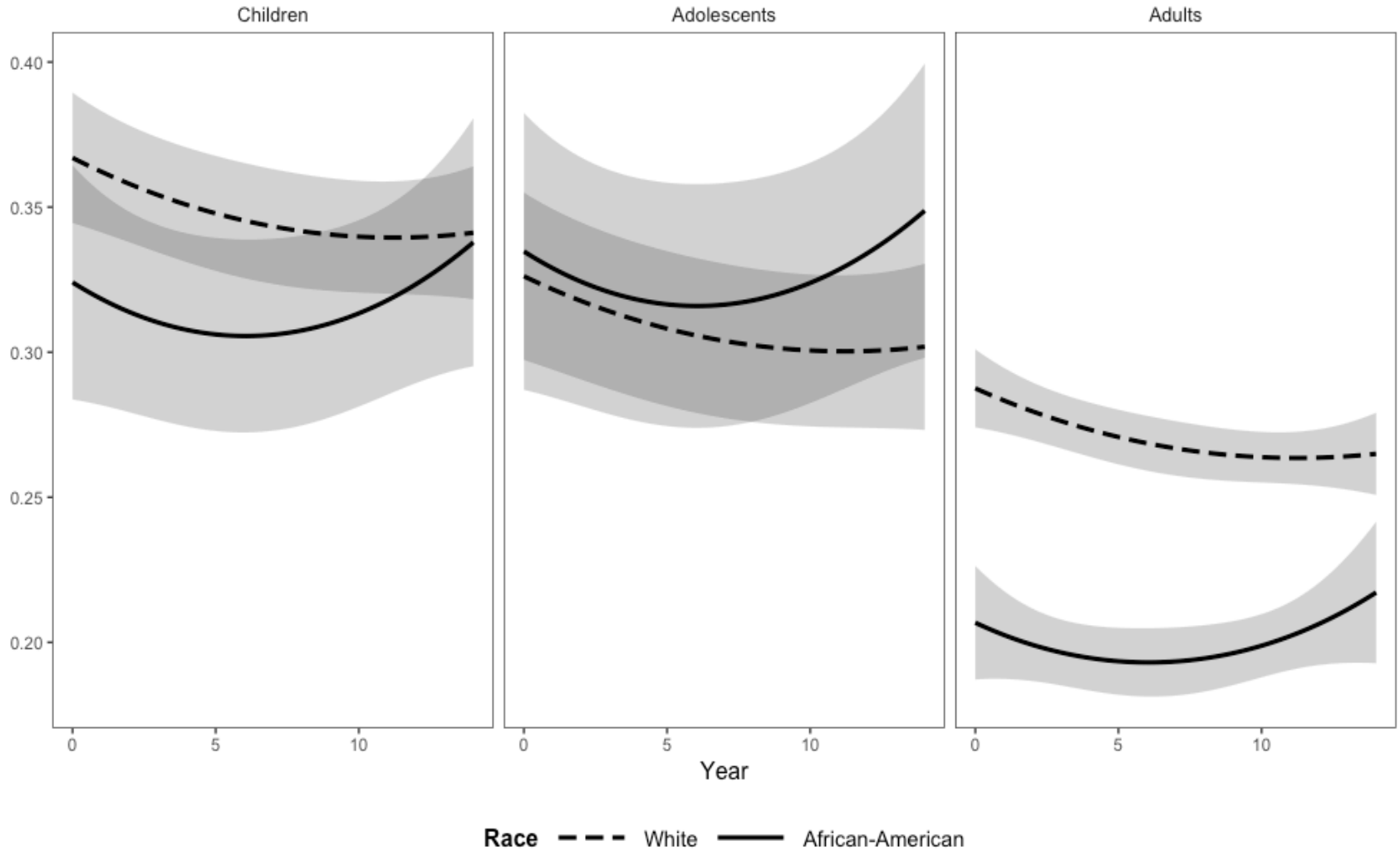


Figure 10

Interaction between Insurance Type and Age Group Predicting Odds of DD Diagnosis between 1996 and 2010

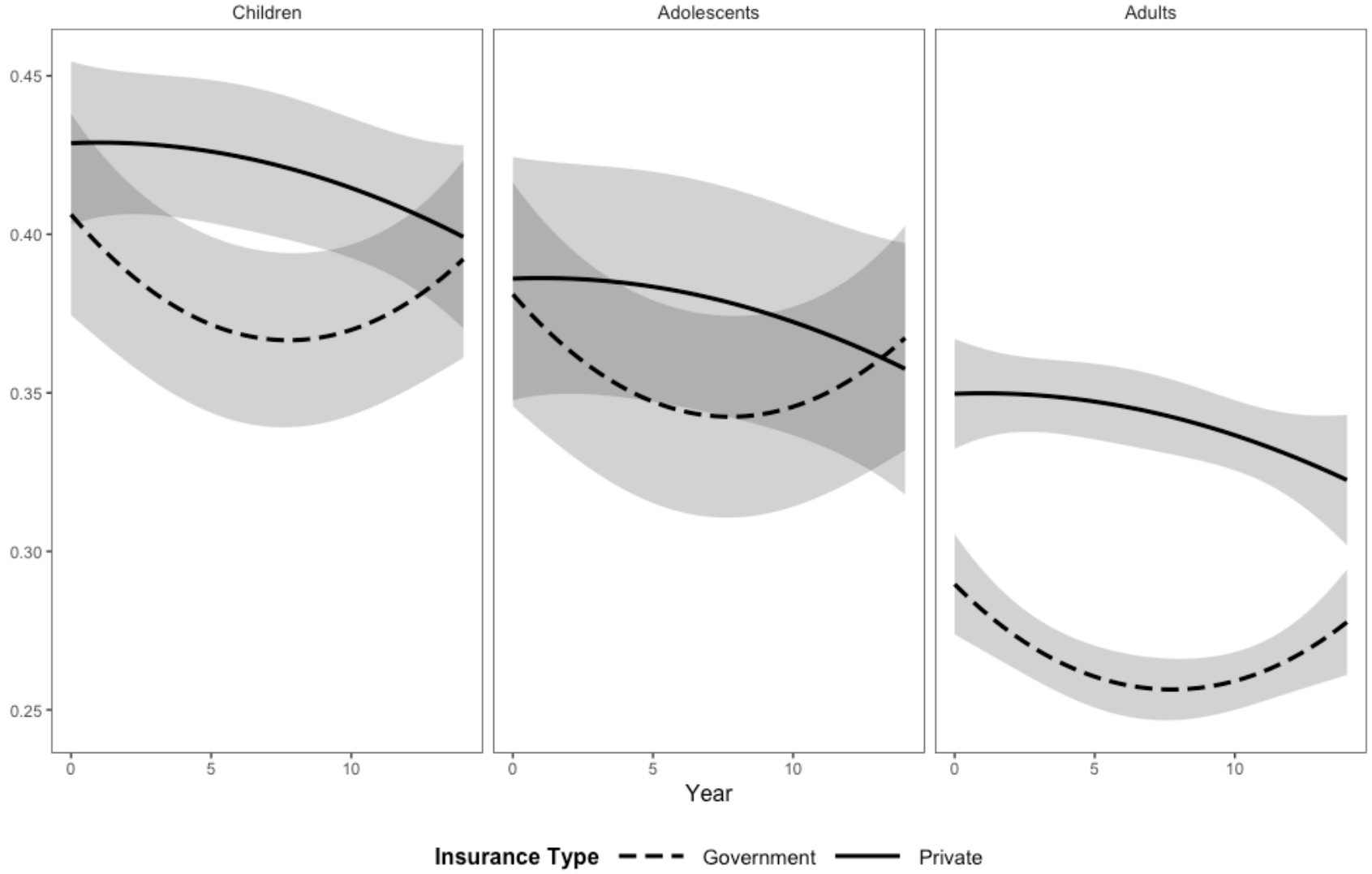


Figure 11

Diagnostic Rate of PBD per 1,000 Admissions between 2005 and 2015 by Hospital

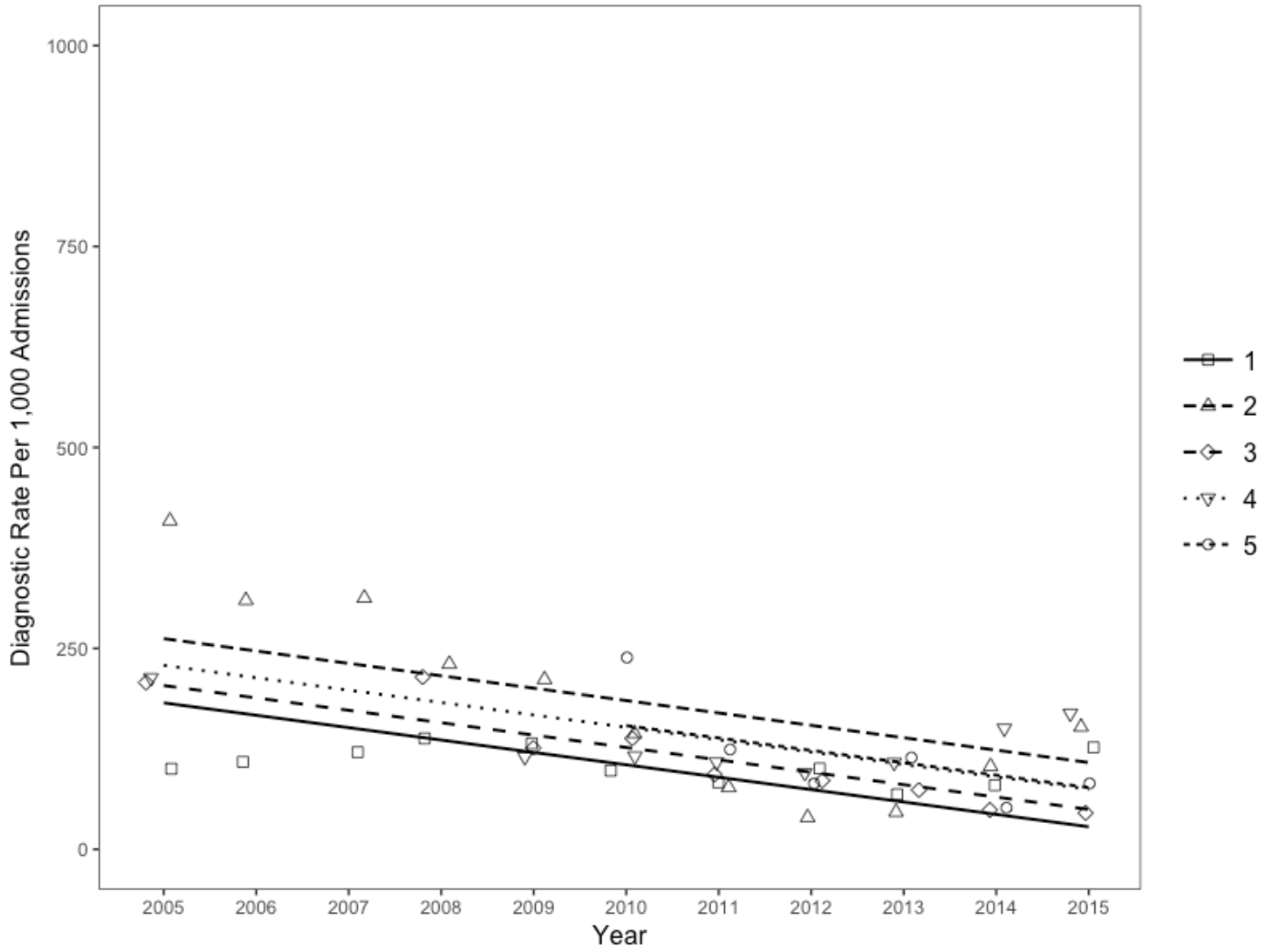
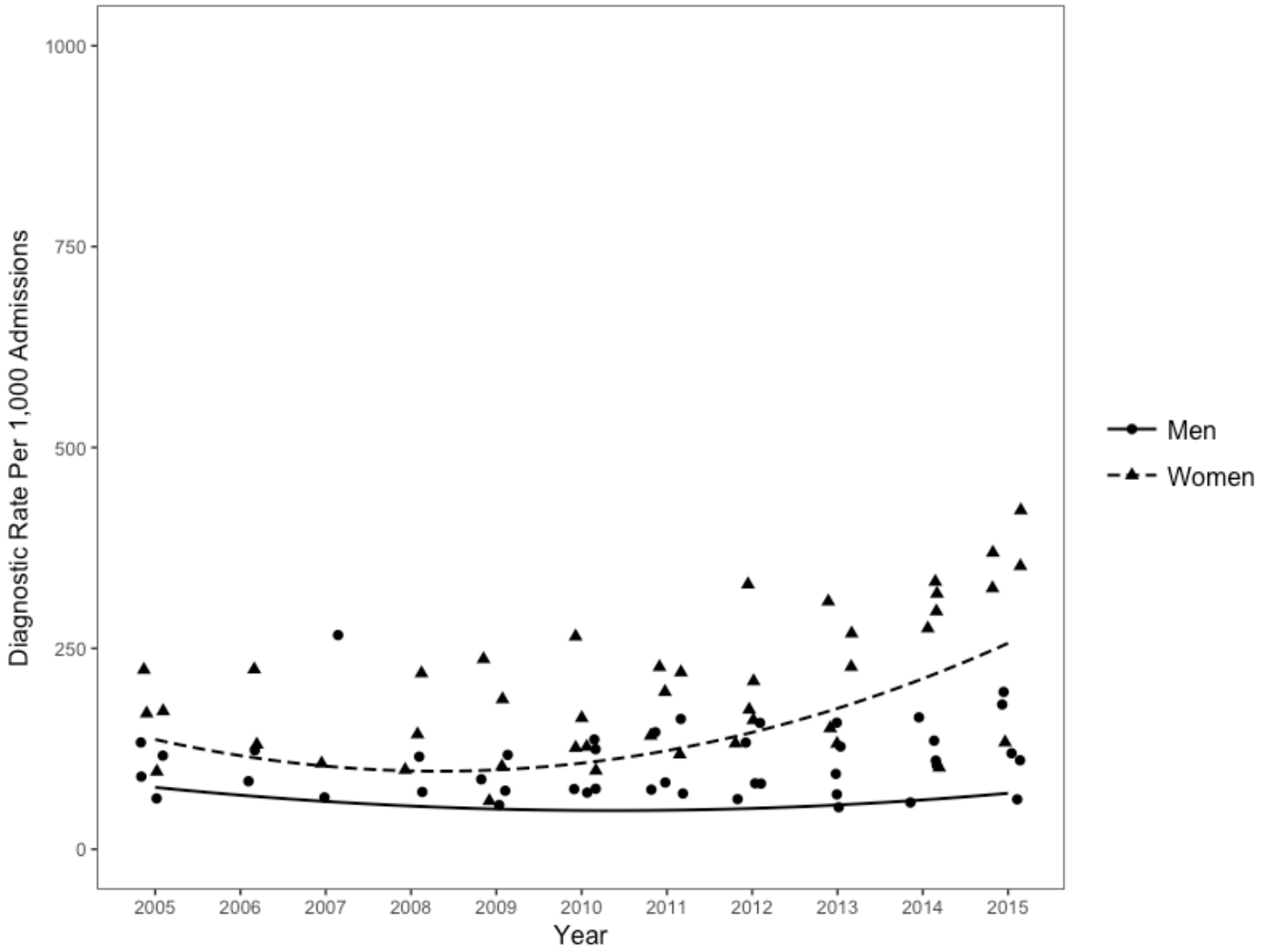


Figure 12

Interaction between Gender and Quadratic Effect of Year on the Rate of DD Diagnosis per 1,000 Admissions between 2005 and 2015



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Curriculum Vitae

Samantha N. Sherwood
University of Nevada, Las Vegas
4505 S. Maryland Parkway
Las Vegas, NV 89154
sherws1@unlv.nevada.edu

EDUCATION

Ph.D., Clinical Psychology **Expected 2022**
University of Nevada, Las Vegas

M.A., Clinical Psychology **Expected May 2019**
University of Nevada, Las Vegas

B.S., Psychology; Sociology
University of Utah **May 2014**

SCHOLARSHIPS AND AWARDS

2019-2020 **UNLV Graduate Access Grant**
2018 **Johnson Youngstrom Prize for Outstanding Student Poster** – Association for Behavioral and Cognitive Therapies 52nd Annual Convention, Washington, D.C.
2018-2019 **Patricia Sastaunik Scholarship** – UNLV
2018-2019 **UNLV Graduate Access Grant**
2018 **Competitive Travel Award** (Fall Session) - UNLV
2018 **College of Liberal Arts Summer Research Stipend Award** – UNLV
2018 **Graduate College Summer Session Scholarship** – UNLV
2018 **Competitive Travel Award** (Summer Session) – UNLV
2018 **1st Place Poster Presentation** – UNLV Graduate Research Forum
2017 **Honorable Mention Poster Presentation** – 2017 International Summit on Suicide Research, Henderson, NV
2017 **Competitive Travel Award** (Fall Session) – UNLV
2017 **Competitive Travel Award** (Summer Session) – UNLV
2014 **Psi Chi International Honor Society** – University of Utah
2012-2014 **Dean's List** – University of Utah

RESEARCH EXPERIENCE

Graduate Research Assistant and Project Manager **August 2016 – Present**
Development of Irritability, Mood and Emotions Lab
University of Nevada, Las Vegas
Primary Advisor: Dr. Andrew J. Freeman, Ph.D.

Project 1: Trends in the Rate of Inpatient Pediatric Bipolar Disorder Diagnosis Between 1996 and 2015 (Master's thesis project)
Project 2: Irritability, Distress, and Internalizing Symptoms
Project 3: Virtual Darkness for Young Adult Sleep Difficulties

Responsibilities: 1) Project management; 2) Participant recruitment, consent, and evaluation; 3) Development of new study protocols; 4) Preparation of manuscripts and conference submissions; 5) Development of IRB submission materials; 6) Supervision and training of study personnel; 7) Data management and analysis; 8) Literature reviews

Clinical Research Coordinator **May 2014 – August 2016**
The Brain Institute, Department of Diagnostic Neuroimaging
University of Utah
Primary Advisors: Dr. Perry F. Renshaw, M.D., Ph.D., M.B.A.
Dr. Douglas G. Kondo, M.D.

Project 1: Placebo-Controlled Trial of Creatine Augmentation for Adolescent Females with Treatment-Resistant Major Depressive Disorder: A Magnetic Resonance Spectroscopy Study
Project 2: Detecting Depression and Bipolar Disorder in Adolescents Using a Biomarker Panel
Project 3: Placebo Controlled Study of Uridine for Adolescent Bipolar Depression: A Magnetic Resonance Spectroscopy Study

Responsibilities: 1) Participant recruitment and consent; 2) Administered the Structured Clinical Interview for DSM-IV and weekly mood rating scales; 3) Dispensed study medication; 4) Data management; 5) Prepared manuscripts, grant applications, regulatory materials, and annual reports to the FDA, IRB, NIMH, and Data Safety and Monitoring Board; 6) Supervised and trained study personnel

Research Assistant **August 2014 – May 2014**
Risk to Resilience Lab, Department of Psychology, University of Utah
Salt Lake County Juvenile Detention Center, West Valley City, Utah
Primary Advisor: Dr. Patricia Kerig, Ph.D.

Project: Investigating the Mechanisms Linking Trauma and Youth Antisocial Behavior
Responsibilities: 1) Obtained informed consent; 2) Ran participants through study protocol using questionnaires and physiological equipment

Field Research Assistant **May 2013 – May 2014**
Department of Family and Consumer Studies, University of Utah
Department of Psychology, University of Utah
Primary Advisor: Dr. Carroll Werner, Ph.D.

Project: Moving Across Places Study
Responsibilities: 1) Worked independently to complete field ratings; 2) Participated in frequent trainings to ensure interrater reliability with other study staff members

Research Assistant **May 2012 – May 2014**
Applied Cognition Lab, Department of Psychology, University of Utah
Primary Advisor: Dr. David Strayer, Ph.D.

Project: Measuring Cognitive Distraction in the Automobile
Responsibilities: 1) Obtained informed consent; 2) Conducted participant visits; 3) Trained new research assistants; 4) Set up and maintained EEG equipment 5) Data collection, entry, and coding; 6) Participant recruitment

PEER-REVIEWED PUBLICATIONS

Huber, R. S., Kim, T. S., Kim, N., Kuykendall, M. D., **Sherwood, S. N.**, Renshaw, P. F., & Kondo, D. G. (2015). Association Between Altitude and Regional Variation of ADHD in Youth. *Journal of Attention Disorders*. Advance online publication. doi: 10.1177/1087054715577137

BOOK CHAPTERS

Freeman, A. J. & **Sherwood, S. N.** (In press). Pediatric Bipolar Disorders. In Jewell (Ed.), *The Encyclopedia of Child and Adolescent Development.*

PAPER PRESENTATIONS AND SYMPOSIA

2. **Sherwood, S. N.** & Freeman, A. J. (2018, November). *Virtual Darkness as an Intervention for Insomnia.* In J. C. Levenson (Chair), *Innovations in Behavioral Interventions for Disturbed Sleep.* Symposium presented at the 2018 Association of Behavioral and Cognitive Therapies Annual Convention, Washington, D.C.

1. Kondo, D. G., Forrest, L. N., Shi, X., Sung, Y. H., Huber, R. S., **Sherwood, S. N.**, & Renshaw, P. F. (2016, October). *Target Engagement with Brain Energy Metabolism: Studies of Creatine for Adolescent Females with Treatment-Resistant Depression.* Paper presented during the Treatment-Resistant Depression in Adolescents: Neurobiology and Novel Approaches for Treatment symposium at the 2016 American Academy of Child and Adolescent Psychiatry Conference, New York, NY

POSTER PRESENTATIONS

Sherwood, S. N. & Freeman, A. J. (Accepted for presentation). *Factor Structure of the Pittsburgh Sleep Quality Index.* Abstract accepted for presentation at the 2019 American Psychological Association Annual Convention, Chicago, IL

Sherwood, S. N. & Freeman, A. J. (Accepted for presentation). *Impact of Demographic Variables on Longitudinal Trajectories of Pediatric Bipolar Disorder Diagnosis*. Abstract accepted for presentation at the 2019 International Society for Bipolar Disorders Annual Convention, Sydney, Australia

Sherwood, S. N. & Freeman, A. J. (2018, November). *Trends in the National Rate of Inpatient Pediatric Bipolar Disorder Diagnosis between 1996 and 2010.* Poster presented at the 2018 Association of Behavioral and Cognitive Therapies Annual Convention, Washington, D.C. **(Johnson Youngstrom Prize for Outstanding Student Poster)**

Garcia, B. A., **Sherwood, S. N.**, Freeman, A. J. (2018, November). *From Mood Symptoms to Aggression: Irritability as a Mediating Variable.* Poster presented at the 2018 Association of Behavioral and Cognitive Therapies Annual Convention, Washington, D.C.

Sherwood, S. N., Garcia, B. A., Cachero, A., & Freeman, A. J. (2018, November). *Sleep Chronotype, Mood, and Irritability.* Poster presented at the 2018 Association of Behavioral and Cognitive Therapies Annual Convention, Washington, D.C.

Sherwood, S. N. & Freeman, A. J. (2018, June). *Virtual Darkness as an Intervention for Insomnia: Preliminary Findings from a Randomized Controlled Trial.* Poster presented at the Journal of Clinical Child and Adolescent Psychology (JCCAP) Future Directions Forum, Washington, D.C.

Sherwood, S. N., Greenway, J., Freeman, A. J. (2018, February). *Trends in Pediatric Mood Disorder Diagnosis in a Nevada Medicaid Population between 2005 and 2015.* Poster presented at the 2018 Graduate and Professional Student Research Forum, University of Nevada, Las Vegas **(1st Place Poster Presentation)**

Kondo, D. G., Huber, R., Shi, X., Sung, Y. H., Prescot, A., Fiedler, K., Hellem, T., **Sherwood, S. N.**, Forrest, L., Boxer, D., & Renshaw, P. F. (2017, November). *Clinical and Imaging Studies of Uridine: A Rapid Treatment for Suicidal Ideation via Shared Mechanisms with Ketamine and Lithium*. Poster presented at the 2017 IASR/AFSP International Summit on Suicide Research, Henderson, NV **(Honorable Mention)**

Sherwood, S. N., Greenway, J., Freeman, A. J. (2017, November). *Trends in Pediatric Mood Disorder Diagnosis in a Nevada Medicaid Population between 2005 and 2015.* Poster presented at the 2017 Association of Behavioral and Cognitive Therapies Annual Convention, San Diego, CA

Ibarra, M., Rogers, E., Santarsierri, B., **Sherwood, S. N.,** Chen, Y. L., & Freeman, A. J. (2017, November). *Gender, Chronotype, and Affective Symptoms.* Poster presented at the 2017 Association of Behavioral and Cognitive Therapies Annual Convention, San Diego, CA

Sherwood, S. N., Chen, Y., & Freeman, A. J. (2017, August). *Chronotype Does Not Predict Non-Suicidal Self-Injury*. Poster presented at the 2017 American Psychological Association Annual Convention, Washington, D.C.

Chen, Y., **Sherwood, S. N.**, & Freeman, A. J. (2017, August). *Cultural Differences in Mania: Gender but not Ethnicity Matters*. Poster presented at the 2017 American Psychological Association Annual Convention, Washington, D.C.

Diaz, V., Chen, Y., Saucedo, M., **Sherwood, S. N.**, & Freeman, A. J. (2017, August). *The Relationship between Irritability, Mood and Anxiety in College Students*. Poster presented at the 2017 American Psychological Association Annual Convention, Washington, D.C.

Sherwood, S. N., Forrest, L. N., Huber, R. S., Renshaw, P. F., & Kondo, D. G. (2016, April). *Perfectionism in Adolescents with Treatment-Resistant Depression and Healthy Comparison Subjects*. Poster presented at the 2016 Western Psychological Association Conference, Long Beach, CA

Scholl, L. S., Bakian, A. V., Huber, R. S., **Sherwood, S. N.**, Kondo, D. G., & Renshaw, P. F. (2016, May). *Frequency of Anxious Feelings Linked with Altitude of Residence.* Poster presented at the 2016 Association for Psychological Science Convention, Chicago, IL

Sherwood, S. N., Forrest, L. N., Scholl, L. S., Huber, R. S., Renshaw, P. F., & Kondo, D. G. (2015, September). *Perfectionism and Treatment Response in Adolescent Females with Treatment-Resistant Major Depressive Disorder.* Poster presented at the 2015 Utah Science Technology and Research initiative (USTAR) Confluence, Salt Lake City, UT

Kuykendall, D., **Sherwood, S.,** Kondo, D. G., Scholl, L., & Renshaw, P. F. (2014, November). *Major depressive disorder's association with altitude of residence by county in the United States for 2012.* Poster presented at the 2014 American Public Health Association's Annual Meeting and Exposition, New Orleans, LA

PRE-DOCTORAL PRACTICUM TRAINING

Doctoral Practicum Student **February 2019 – Present**
UNLV Child School Refusal and Anxiety Disorders Clinic 2 to 5 hours per week
Las Vegas, NV
Supervisor: Christopher Kearney, Ph.D.

Responsibilities: Co-facilitate a weekly family-based group for youth with selective mutism and their caregivers, with a focus on evidence-supported interventions such as exposure, problem-solving, and school-based intervention.

Doctoral Practicum Student **August 2018 – Present**
Desert Willow Treatment Center 10 to 15 hours per week
Las Vegas, NV

Supervisors: Caron Evans, Ph.D.; Robert Kutner, Psy.D.

Responsibilities: Provide evidence-based assessment and intervention services for adolescents on acute and residential psychiatric inpatient units. Conduct weekly individual and family therapy to address a range of behavioral and emotional concerns (e.g., depression, bipolar disorder, suicidal ideation, oppositional behavior, etc.). Complete comprehensive integrated assessment reports and feedback sessions with adolescents and caregivers. Participate in weekly treatment team meetings with a multidisciplinary team including psychiatrists, psychologists, social workers, nurses, psychiatric case workers, and caregivers.

Doctoral Practicum Student **August 2017 – June 2018**
The PRACTICE Community Mental Health Clinic 15 to 20 hours per week
Department of Psychology, UNLV
Supervisors: Rachele Diliberto, Ph.D.; Michelle Paul, Ph.D.

Responsibilities: Provided evidence-based therapeutic services to children and adolescents with a range of behavioral and emotional concerns (e.g., ADHD, Tourette's disorder, trichotillomania, perfectionism, anxiety, depression, oppositional behavior, etc.) at a campus-based community mental health clinic. Provided psychological assessment services for a variety of concerns, including learning difficulties, academic achievement and cognitive ability, and psychodiagnostic clarification. Completed comprehensive integrated assessment reports and provided feedback and direction to clients and families. Conducted bi-weekly new client intakes, case presentations at treatment team meetings, and follow-up intakes.

MENTORSHIP AND SERVICE

Cohort Representative **May 2018 – Present**
Clinical Student Committee
University of Nevada, Las Vegas

Invited Panelist **September 2016**
Graduate School in Psychology Informational Session
Nevada State College

Graduate Mentor **August 2016 – May 2017**
Outreach for Undergraduates Mentorship Program
University of Nevada, Las Vegas

TEACHING EXPERIENCE

Instructor of Record **Fall 2018 – Present**
University of Nevada, Las Vegas
Supervisor: Wayne Weiten, Ph.D.
Courses: PSY 101 – General Psychology, 2 sections per semester

Developed a 16-week curriculum for introductory topics in physiological psychology, research methods, learning, personality, development, social behavior, history, and psychological disorders. Delivered bi-weekly lectures and utilized the MindTap learning platform to enhance student engagement. Developed syllabi, assignments, activities, and exams designed to assess and facilitate critical thinking skills. Concurrently enrolled in Teaching of Psychology with a supervisory component for the initial semester of teaching.

Graduate Teaching Assistant **Fall 2017 – Spring 2018**
University of Nevada, Las Vegas
Instructor: Diane Villa, Ph.D.
Courses: PSY 316 – Cognitive Psychology, 4 sections
PSY 341 – Abnormal Psychology, 2 sections
PSY 438 – Child Behavior Disorders, 1 section
COLA 100LA – First Year Seminar, 1 section

Graduate Teaching Assistant **Spring 2017**
University of Nevada, Las Vegas
Instructor: Andrew J. Freeman, Ph.D.
Course: PSY 341 – Abnormal Psychology

PROFESSIONAL TRAINING

Acceptance and Commitment Therapy (ACT) Workshop **Fall 2018**
Instructor: Steven Hayes, Ph.D.
Two-day live workshop with instruction in the use of ACT to treat a variety of psychological problems. Areas of training included theory and proposed mechanisms of change, instruction on specific ACT skills, and guided role-playing of ACT delivery.

Interprofessional Education Program **Spring 2018 & 2019**
Supervisor: Michelle Paul, Ph.D.
Annual eight-hour workshops aimed at increasing awareness of interprofessional education, practice concepts, roles, and responsibilities for the participating healthcare professions with the goal of understanding how integrated health teams should function to better serve patients.

Integrated Behavioral Health in Primary Care Course **Fall 2017**
Instructor: Sara Hunt, Ph.D.
Sixteen-week course developed based on recommendations from the Interprofessional Education Collaborative for clinical professions who plan on delivering integrated behavioral health services. Areas of training included assessment, intervention, consultation, and working within an interdisciplinary team. Emphasis areas of the course included populations with complex needs in both physical and mental health (e.g., pediatric chronic pain patients).

Regression Workshop **May 2017**
Instructor: Andrew J. Freeman, Ph.D.

Comprehensive 6-day workshop on regression and use of R statistical programming for data analysis.

Clinical Research Certificate **May 2015**
Research Administration and Training Series, University of Utah

Certificate in Criminology and Corrections **May 2014**
College of Social and Behavioral Sciences, University of Utah

PROFESSIONAL AFFILIATIONS

Association for Psychological Science (APS), Student Affiliate	2017 – Present
Association for Behavioral and Cognitive Therapies (ABCT), Student Member	2017 – Present
American Psychological Association (APA), Student Member	2016 – Present
American Psychological Association of Graduate Students (APAGS)	2016 – Present
APA Division 53, Society of Clinical Child & Adolescent Psychology (SCCAP)	2015 – Present