RISK-TAKING BEHAVIORS AND IMPULSIVITY IN EMERGING ADULTS BORN PREMATURELY

A Dissertation

by

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ABSTRACT

Recently there has been an increase in research focusing on the role of sleep in psychological disorders in adolescents and young adults due to both increases in risk-taking behaviors and continued brain development during this period. Therefore, the objective of the current study was to extend findings of a master's thesis suggesting a relationship between subjective and objective measures of sleep and externalizing disorders in young adults in a community setting to a vulnerable population (i.e., emerging adults born prematurely). Measures include sleep behavior (Actigraphy, PSQI), birth status, objective measures of impulsivity and risk-taking (CPT-II, BART, Eye-Tracking), and subjective measures of both internalizing and externalizing disorder traits (TriPM, BIS 11, PAI scales, BPS). A total of 227 participants completed the study, including 71 men (premature n = 32) and 156 women (premature n = 103). Participants in the sample showed high average percentages of sleep (M = 91.91%) and few participants reported clinically elevated scores on the measures (≤ 13.45%), as would be expected. Results extend previous findings that both externalizing (i.e., psychopathy as measured by the TriPM) and internalizing (i.e., depression as measured by the PAI) traits decrease subjective sleep quality (i.e., PSQI scores). Results show that on average women born prematurely report increased internalizing traits compared with full term women and men born preterm or full term; while men born prematurely report lower levels of antisocial traits and behaviors (i.e., more female typical) when compared to full term men but still higher levels compared to women born preterm or full term.

Results further suggest that premature birth status is associated with significantly lower rates of antisocial traits, particularly when severity of premature birth increases (i.e., fewer weeks of gestation). The community population and birth status is often not of focus in sleep research with the exception of sleep disordered breathing, and thus findings add to our understanding of this vulnerable population in emerging adults born prematurely who are attending college.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Sleep is an important factor in typical human functioning and development, with typical human sleep continually evolving from infancy to adulthood (Ohayon, Carskadon, Guilleminault, & Vitiello, 2004). Sleep difficulties and disruptions are problematic for individuals across the lifespan and are related to increased psychopathology (Baum et al., 2014; Perfect, Archbold, Goodwin, Levine-Donnerstein, & Quan 2013; Rosen et al., 2004; Ireland & Culpin, 2006). For example, during childhood and adolescence, sleep problems are highly correlated with both internalizing and externalizing disorders such as anxiety, depression, aggression, and hyperactivity (Alfano, Ginsburg, & Kingery 2007; Alfano, Zakem, Costa, Taylor, & Weems 2009; Lavigne et al., 1999; Perfect et al., 2013; Rosen et al., 2004). The current study examined the literature on sleep, psychopathology, and premature birth. As a result of previous mixed findings, the current study sought to examine the relationship between premature birth, sleep, and psychopathology in emerging adulthood.

1.1 Sleep

Normative human sleep is characterized by cycles of both rapid eye movement (REM) and non-REM sleep. During non-REM sleep there are four distinct phases or stages of sleep which are each associated with differing levels of brain activity (Bajaj, & Pachori, 2013; Benca, Obermeyer, Thisted, & Gillin, 1992; Lindberg et al., 2008). The sleep cycle progresses systematically through these stages until REM sleep is reached. Sleep stages cycle approximately five times throughout the night to include both REM and non-REM sleep (i.e., Stages 1-4) (Lindberg et al., 2008; Benca et al., 1992). Stages 3 and 4 are the refreshing or restorative portion of sleep, also known as slow wave sleep (SWS), with time spent in SWS naturally decreasing with age and brain maturation (Feinberg, Higgins, Khaw, & Campbell, 2006; Thomas et al., 2000). In addition to the decrease in SWS, several other normative changes in sleep cycles and phases are common throughout the lifespan (Ohayon et al., 2004). These changes include longer sleep time in childhood compared to adolescence (i.e., an average of 14.2 hours a day for infants versus 8.1 hours for adolescents; Iglowstein, Jenni, Molinari, & Largo, 2003), and shorter sleep time in adulthood (i.e., an average of approximately 7 hours; Steptoe, Peacey, &Wardle, 2006). The decrease in sleep time during adolescence has been explained by environmental demands (e.g., school and other requirements) rather than biological changes (Ohayon et al., 2004), suggesting that adolescence is a critical period for sleep hygiene. Several psychopathologies have been linked to significant deficiencies in sleep and sleep stages (Benca, Obermeyer, Thisted, & Gillin, 1992).

1.2 Sleep and Psychopathology in Childhood and Adolescence

Sleep difficulties have been found to be directly related to increases in impulsive, antisocial, risk taking, and aggressive behaviors in children (Rosen et al., 2004) and adolescents (Clinkinbeard, Simi, Evans, & Anderson, 2011; Ireland, & Culpin, 2006). For example, parents and children (age range of 7- to12-years old) with externalizing disorders (i.e., Conduct Disorder (CD), Oppositional Defiant Disorder (ODD), Attention Deficit/Hyperactivity Disorder (ADHD)) report higher incidences of sleep difficulties compared to children without externalizing disorders (Aronen, Lampenius, Fontell, &

Simola, 2014). Results from actigraphy, a watch-like device that measures sleep using motion or activity-sensing technology (Sadeh, Gruber, & Raviv 2003), suggest that children with more externalizing symptoms (e.g., rule-breaking, social difficulties, aggressive behaviors) also show lower sleep time and lower sleep efficiency (Aronen et al., 2014). Children with internalizing disorders also have sleep problems primarily related to decreased sleep efficiency, longer sleep onset time or insomnia, and higher numbers of nighttime worries (Alfano, Ginsburg, & Kingery, 2007; Alfano, Reynolds, Scott, Dahl, & Mellman, 2013; Aronen et al., 2014; Alfano, Ginsburg, & Kingery, 2007; Alfano, Zakem, Costa, Taylor, & Weems, 2009; Alfano et al., 2013). Furthermore, findings suggest that children with higher incidences of comorbid disorders (i.e., having two or more disorders at once) have significant decreases in sleep time (Aronen et al., 2014).

Adolescence is a time of both decreased sleep due to environmental demands (e.g., increased occupational and academic responsibilities) and natural decreases in SWS, making this age range of increasing interest and significance for sleep research (Feinberg et al., 2006; Ohayon et al., 2004). For example, studies examining a large sample (*N* = 14,382) of adolescent data from the National Longitudinal Study of Adolescent Health have found that adolescents report being significantly more delinquent when they sleep fewer than seven hours a night and become increasingly aggressive when they sleep fewer than five hours a night (Clinkinbeard et al., 2011). Furthermore, studies that have experimentally manipulated sleep during adolescence have found that when sleep is restricted, adolescents become more aggressive, inattentive, impulsive, oppositional, and experience more negative affectivity quickly when sleeping fewer than seven hours (six and a half were used in the studies) a night (Baum et al., 2013; Bebee et al., 2008).

1.3 Sleep and Psychopathology in Adulthood

Adults with sleep difficulties also show increases in both externalizing (Mahajan, Hong, Wigal, Gehricke, 2009) and internalizing (e.g., depression and anxiety) symptoms (Talbot, McGlinchey, Kaplan, Dahl, & Harvey, 2010; Lindberg et al., 2003). Consistent with findings from forensic and non-forensic adult populations, research suggests that poorer subjective sleep quality, as rated by the Pittsburg Sleep Quality Index (PSQI), is related to higher reported aggressive and impulsive behaviors (Kamphuis, Dijk, Spreen, & Lancel, 2014), as well as increased impulsive and hyperactive symptoms (Mahajan, Hong, Wigal, Gehricke, 2009).

1.4 Sleep and the Prefrontal Cortex

The prefrontal cortex is responsible for regulation of impulses and emotional information and is significantly impacted by sleep loss (Choo, Lee, Venkatraman, Sheu, & Chee, 2005; Thomas et al., 2000). For example, research has shown that three days of sleep loss results in decreased emotional intelligence (i.e., interpersonal skills, stress management, and intrapersonal awareness), similar to those observed in individuals with mild prefrontal lobe deficits (Killgore et al., 2008). Other studies that have included only 24 hours of sleep deprivation have shown that the prefrontal cortex and frontal regions show decreased activity and responsiveness as well, suggesting these effects of sleep deprivation develop rather quickly in typically functioning adults (Choo et al., 2005;

Thomas et al., 2000). Thus, sleep researchers are increasingly interested in studying the relationship between sleep difficulties and the behavioral correlates of prefrontal lobe dysfunction (Choo et al., 2005; Killgore et al., 2008; Thomas et al., 2000).

1.5 Sleep and Emerging Adulthood

Emerging adulthood, a period of time from ages 18 to 25 years (Arnett, 2000), is a time of increased sensation seeking, risk taking (e.g., risky sexual or substance use behaviors), and identity development (Arnett, 2000; Miller, & Quick, 2010). It is also a period of research interest due to the continuing development of the frontal cortex (Casey, & Caudle, 2013; Gogtay et al., 2004; Bennett, & Baird, 2006; Romine & Reynolds, 2005) coupled with a lifestyle that is often not conducive to optimal sleep schedules and sleep times (Wolfson, & Carskadon, 1998; Baum et al., 2013; Bebee et al., 2008; Clinkinbeard et al., 2010; Casey, Jones & Hare, 2008; Arnett, 2000; Miller, & Quick, 2010). Furthermore, experimental sleep deprivation during emerging adulthood has been shown to increase the expression of negative mood and general distress as well as symptoms of both depression and anxiety (Babson, Trainor, Feldner, & Blumenthal, 2010; McGlinchey et al., 2011).

Young adults with a history of sleep disturbance are at significantly increased risk of experiencing psychiatric disorders, particularly depression and substance use (Breslau, Roth, Rosenthal, & Andreski, 1996). The risk of developing difficulties in emerging adulthood related to substance use and increased rates of psychopathology can be predicted by sleep problems during childhood and adolescence (Wong, Brower, Nigg, & Zucker, 2010). For example, a longitudinal study of sleep difficulties during childhood and adolescence showed that sleep difficulties in these age ranges predicted adult externalizing problems between the ages of 18 to 20 years (e.g., substance use, risky driving behavior; Wong, Brower, Nigg, & Zucker, 2010). Furthermore, a recent study on emerging adult sleep in a non-forensic, college sample found that increased levels of self-reported impulsivity and depression are predictive of poorer subjective sleep quality (Yaugher & Alexander, 2015).

1.6 Premature Birth: An At-Risk Population

It is estimated that approximately 10 percent of the population is born preterm (i.e., before 37 weeks of gestation; Goldenberg, Culhane, Iams, & Romero, 2008). Rates of mortality increase as weeks of gestation decrease, including those born early term (i.e., 37 to 38 weeks gestation; Mathews & MacDorman, 2011). Due to medical advances, an increasing number of individuals born prematurely or very prematurely (i.e., less than 38 weeks or 22 to 32 weeks of gestation; Battaglia, & Lubchenco, 1967; Smith, Draper, Manktelow, Dorling, & Field, 2007; Mehler, Oberthuer, & Keller et al., 2016) are reaching adulthood (Hack, 2009). Many researchers have focused on this population in childhood and adolescence to the exclusion of emerging adulthood or older adults (Johnson & Marlow, 2014). This gap in the literature is problematic as premature birth increases risk of developing cognitive and behavioral difficulties in adulthood (Johnson & Marlow, 2014) and limited research suggests that these difficulties are consistent throughout their lifetime development (Waxman, Van Lieshout, Saigal, Boyle, & Schmidt, 2013; Paavonen et al., 2007; Johnson, 2007; Johnson & Marlow, 2014; Saigal et al., 2016).

1.7 Premature Birth and Psychopathology

Individuals born prematurely are at an increased risk for experiencing increased psychiatric problems and hospitalizations (Lindstrom, Lindblad, & Hjern, 2009) as well as increases in both internalizing (e.g., depression, anxiety; Allin, Rooney, Cuddy et al., 2006; Hack et al., 2004; Lund et al., 2012; and avoidance in low birth weight populations, Boyle, Miskovic, Van Lieshout, Duncan et al., 2011) and externalizing (e.g., ADHD; Strang-Karlsson, Räikkönen, Pesonen et al., 2008; Lindstrom, Lindblad, & Hjern, 2011) disorders. Studies on early life in children born prematurely, using parental report, have shown that preterm children have more attention difficulties between 1.5 years and 3 years of age (Cosentino-Rocha, Klein, & Linhares, 2014) and decreased adaptive behavioral functioning between 6 months to 5 years of age (Killeen, Shiel, Law, Segurado, & O’Donovan, 2015). Children at age five years also show decreased attentional focus as well as increased ADHD symptomatology when born premature and small for gestational age, respectively (Nygaard, Smith, Torgersen, 2002; Heinonen et al., 2010). Furthermore, some research suggests that children born prematurely are more likely to be impulsive, engage in risk-taking behaviors, and have executive functioning deficits and increased attentional impairments as compared to full-term born controls at age eight years (Anderson & Doyle, 2004; Anderson et al., 2011; Chu, Tsai, Hwang, Hsu, Huang, & Huang, 2012). For example, when using structured interviews and hospital record review, studies involving children (age range 6 to 12 years) born prematurely examining ADHD symptomatology show a significantly higher rate of the disorder in those born preterm or low birth weight (N = 195) compared to matched full-term peers (*N* = 212) (Chu et al., 2012). These results are consistent with meta-analytic results, suggesting that children born preterm have more attention problems, perform poorer on academic tasks, have higher rates of internalizing difficulties, and have poorer executive functioning than their full-term peers (Aarnoudse-Moens, Weisglas-Kuperus, van Goudoever, & Oosterlaan, 2009; Mulder, Pitchford, Hagger, & Marlow, 2009).

Several studies using self-report measures such as the Eysenck Personality Questionnaire-Revised (EPQ-R) and psychiatric or hospital record reviews suggest that those born preterm or small for gestational age are instead more likely to experience internalizing disorders and are more likely to shy away from risk taking, social situations, impulsive acts, and act more cautiously and inattentively in adulthood (Pesonen et al., 2008; Waxman, Van Lieshout, Saigal, Boyle, & Schmidt, 2013; Van Lieshout, Boyle, Saigal, Morrison, & Schmidt, 2015). For example, longitudinal studies examining prematurely born adults between 29 to 36 years of age with self-report measures (Young Adult Social Support Index, Ontario Child Health Study scales) and structured interviews (Mini International Neuropsychiatric Interview) suggest that compared to their full term peers, adults born prematurely report engaging in fewer risk-taking behaviors (e.g., alcohol or substance misuse, past convictions), lower self-esteem, and lower rates of employment and marriage (Saigal, Day, & Van Lieshout et al., 2016). Adding to these mixed findings in other research, adults who were born prematurely did not differ in their personalities when compared to full-term peers (Hertz, Mathiasen, Hansen, Mortensen, & Greisen, 2013). Furthermore, one study found that those born prematurely reported themselves as being warmer in social interactions, experiencing fewer negative emotions, lower rates of impulsivity, and lower hostility compared to full-term matched controls in a large hospital records review of adults between the ages of 18 to 27 years (*N* = 326; 158 preterm adults) (Pesonen et al., 2008). However, this study and similar studies reporting no negative influence of premature birth on behavior and psychopathology are limited by their reliance on self-report measures such as the Eysenck Personality Questionnaire-Revised (EPQ-R) and the NEO Personality Inventory-Revised (Hertz et al., 2013; Ritchie, Bora, & Woodward, 2015, Waxman et al, 2013).

In contrast, studies using multiple methods of assessment suggest that the primary difficulties for those born premature are long-term difficulties with executive functioning (e.g., attention difficulties and externalizing problems; Wilson-Ching et al., 2013). In fact, adolescents born prematurely have shown an increase in ADHD diagnoses (e.g., from structured interview, WASI, and self-report measures) when compared to full-term peers at age 18 years (Burnett et al., 2014). Studies including subjective (e.g., Behavior Rating Inventory of Executive Function, BRIEF) and objective measures (e.g., the Telephone Search task of the Test of Everyday Attention) of adolescent attention difficulties in preterm and full-term youth have demonstrated that preterm adolescents perform worse across several measures of attention (Wilson-Ching et al., 2013). Studies utilizing both parent and self-report in longitudinal studies from adolescence to emerging adulthood suggest that individuals born very premature have lower health related quality of life ratings and as such function more poorly in several facets of life including social relationships and emotional functioning (Baumann, Bartmann, & Wolke, 2016). Furthermore, meta-analytic results suggest that the measures used when assessing the effect of premature birth in children born prematurely differ widely between studies, adding to the mixed findings in this population (Mulder et al., 2009). Meta-analytic findings do support that executive functioning and attentional difficulties remain areas of weakness for those born prematurely, but the effect size of these difficulties decrease as children age (Mulder et al., 2009). Further compounding these inconsistencies are the mixed findings regarding gender differences in this population (Mulder et al., 2009).

1.8 Sleep and Premature Birth

Sleep-disordered breathing (SDB) is highly correlated with externalizing symptoms (Rosen et al., 2004) and collective research suggests that children and adults born prematurely are at an increased risk of experiencing sleep problems in the form of SDB (Paavonen et al., 2007; Rosen et al., 2003; Rosen et al., 2004). For example, in large studies of children (*N* = 850, with 391 preterm participants) it was found that SDB, as measured by cardiorespiratory recordings, is approximately five times more likely in children born prematurely when compared to their full term peers between the ages of eight to 11 years (Rosen et al., 2003). Similarly, in a large cohort of young adults (between 18 to 27 years), premature birth or very low birth weight (VLBW; *N* = 158 preterm, and *N* = 169 full-term) predicted SDB, as measured by self-reported chronic snoring (Paavonen et. al, 2007).

Despite the high incidence of SDB in prematurely born young adults discussed above, studies using actigraphy and sleep diaries to assess general sleep patterns in this age group (ages 16 to 19 years; $N = 517$) suggest that those born prematurely sleep earlier, wake earlier, have fewer nighttime disruptions, and report better subjective-sleep satisfaction (e.g., reported feeling less sleepy in the morning, feeling more rested, etc.) (Hibbs et al., 2013; Björkqvist et al., 2014). Results from actigraphy in both the adolescent and adult samples showed no differences in sleep duration or sleep efficiency between preterm and full term individuals. However, they showed that preterm born individuals are sleep phase advanced (i.e., actigraphy showed the sleep midpoint was sooner compared to full-term controls and bed times were earlier) (Björkqvist et al., 2014; Hibbs et al., 2013). This last finding is consistent with prior studies on sleep-wake times that have suggested earlier sleep and wake times in individuals born prematurely (Strang-Karlsson et al., 2010). These findings are of significance, as there are relatively few studies that use objective measurements of sleep in their findings, however, they only examine general sleep patterns and do not specifically examine the link to psychopathology.

1.9 Purpose of the Current Study

Patterns of decreased sleep efficiency are associated with increased externalizing disorder traits in emerging adulthood (Wong et al. 2010). Findings from the current author's master's thesis further suggest that increased levels of impulsivity and depression are predictive of poorer subjective sleep quality (Yaugher & Alexander, 2015). The current study extended findings of the author's master's thesis by using behavioral tasks and by examining the relationship between sleep difficulties and premature birth status (Paavonen et al., 2007).

Previous findings assessing impulsivity, risk-taking, and sleeping behaviors have relied primarily on self-report measures. Furthermore, few studies have used self-reported birth status in their study design to identify adults born prematurely and have largely relied upon parent-report of their children's status as well as behavior (e.g., externalizing/internalizing behavior, sleep behavior, etc.). The current study, however, explored the relationship of self-reported birth status and emerging adult sleep, risk-taking, and impulsive behaviors and traits among 18- to 27-year-old men and women. Additionally, the current study utilized well validated and reliable behavioral measures of impulsivity (i.e., Continuous Performance Task-II, Antisaccade Task) and risk-taking (i.e., Balloon Analogue Risk Task), and objective measures of sleep (i.e., actigraphy) to examine the gap in the previous literature.

1.10 Hypotheses

Based on current existing literature, study hypotheses were as follows: (1) individuals born prematurely will show lower levels of impulsivity when compared to their full term peers on self-report measures, (2) on behavioral measures of impulsivity and risk-taking, individuals reporting premature birth status will show increased levels of impulsivity according to these "real-time" measures, and (3) individuals born premature will report poorer subjective sleep quality and show decreased sleep efficiency, extending findings of the previous master's thesis in this vulnerable population.

2. METHODS

2.1 Participants

Two hundred and twenty seven undergraduate students (156 women, 71 men) completed the experiment, as partial fulfillment of course requirements. Men and women between the ages of 18 to 27 years (*M* = 18.91, *SD* = 1.33) were recruited. A total of 135 participants reported preterm birth status (i.e., born at least 1-2 weeks early), 84 participants reported full term birth status, and eight participants (3.5%) reported unknown birth status. For the purposes of the current study, those reporting unknown birth status were excluded from analyses examining premature birth status directly, such that the study total for birth status included 219 participants. Of the total 135 participants reporting preterm birth status, 32 were men and 103 were women. The majority of participants identified their ethnicity as Caucasian or Non-Hispanic (*n* = 139, or 61 %); the remaining participants identified as Hispanic (23%), Asian American (7%), African American (4%), and Other (4%). Additionally, participants reported high levels of parent education for both their father (74.5% attained two years of post-secondary education or more) and their mother (71.4% attained two years of post-secondary education or more) indicating high levels of education for over two thirds of the participants parents. Table 1 summarizes the demographic characteristics of the sample. The current study received approval from the Texas A&M Institutional Review Board (IRB2015-0133D).

Desired sample size was determined following power recommendations by Cohen (1992) with alpha set at .05. Effect size estimates were based on meta-analytic findings showing a medium to large effect sizes for the relationship of premature birth status and infant psychomotor development (d = -0.88) (de Kieviet, Piek, Aarnoudse-Moens, & Oosterlaan, 2009), and several meta-analyses with the primary interest of objective and subjective sleep in impulsive children (i.e., children with ADHD) showing a range from both a smaller effect size (d = 0.26) (Sadeh, Pergamin, & Bar-Haim, 2006) to a larger effect size (I^2 = 86.9%) (Cortese, Faraone, Konofal, & Lecendreux, 2009). The current study has a much larger sample size than previous studies examining birth status (e.g., Cooke, 2004; Lund et al., 2012; Tideman et al., 2001, and others), with the exception of hospital based studies and studies relying primarily on self-report measures (e.g., Hack et al., 2004; Hertz et al., 2013; Johnson, 2007; Paavonen et al., 2007; Pesonen et al., 2008, and others).

2.2 Objective Sleep Measurement

A small accelerometer (Actiwatch, AW64, Philips Respironics), worn on the non-dominant wrist was given to all 227 participants to wear for one week to collect objective measures of sleep and wakefulness. Sleep data was not available for 58 participants due to participants wearing the watch fewer than 5 days during the collection period or actiwatch malfunction, resulting in a total of 169 participants with complete actiwatch data. Accelerometers measure activity levels throughout the day and night and have been widely-used in sleep research (Sadeh, Gruber, and Raviv 2003; Tryon, 2004; Tworoger, Davis, Vitiello, Lentz, & McTiernan, 2005). Consistent with previous research methods (Ruiz, Ortega, Martinez-Gomez et al., 2011), in the current study, accelerometers were initialized to capture movement counts within 15 second intervals were given for a period of 7 days (days worn *M* = 6.59, *SD* 0.744) to accurately assess average sleep information (Acebo et al., 1999). Sleep efficiency is defined as the average percent sleep throughout the week that the participant received restful and uninterrupted sleep (Sadeh, Gruber, & Raviv 2003). A percent of sleep above 80.9 percent is considered to be restorative and is described as "good" sleep efficiency in adults (Lauderdale et al., 2006).

2.3 Experimental Tasks

(1) Participants completed the Conners' Continuous Performance Test-II (CPT-II; Conners & Staff, 2000); a task that is commonly used to differentiate individuals with and without ADHD but also provides information about impulsivity (Epstein et al., 2003). The CPT-II is a computer task that provides variables such as mean hit reaction time, measures errors of omission (e.g., inattention) and commission (e.g., impulsivity) which have been found to be highly related to ADHD (Epstein et al., 2003). A total of 218 participants had valid profiles on this measure and were scored for the variables of interest; including errors of omission, errors of commission, and mean hit reaction time, to measure behavioral impulsivity.

(2) The Balloon Analogue Risk Task (BART; Lejuez et al., 2002) was used to assess participant's risk-taking behaviors. The BART is a computer task in which participants virtually inflate a balloon with a pump and earn an amount of money for each pump. Each pump is associated with a higher risk of the balloon exploding, which

results in the participant resetting their earned money amount that is shown to them on the screen. Participants therefore are faced with the challenge of attempting to earn as much money as possible by inflating the balloon to maximum levels without it bursting. As previous research has suggested, the balloons were set to explode on a variable ratio schedule and as such will demonstrate a simulated “real life” behavioral measure of risk-taking (Epstein et al., 2003). A total of 227 participants completed this task and received small prizes based on task performance after completion for incentive. Variables of interest for risk taking assessment on the BART include how frequently the participant “exploded” a balloon and how many pumps they used on average on non-exploded balloons (Lejuez et al., 2002). The BART has good construct validity and is highly correlated with antisocial personality traits (Epstein et al., 2003). The BART has been used in forensic (e.g., Swogger, Walsh, Lejuez, & Kosson, 2010) and non-forensic settings with individuals with psychopathic and impulsive traits, which demonstrated that these constructs are highly related in a community sample and that increased psychopathic traits predicted risk-taking (e.g., Hunt, Hopko, Bare, Lejuez, & Robinson, 2005).

(3) Participants completed an eye-tracking task to examine impulsivity objectively by presenting stimuli on the screen with a signal to either look toward or away from the stimulus (the Look Away Task or Antisaccade Task; Pierce, McCardel, & McDowell, 2014). Whether participants were looking at the appropriate stimulus direction was determined by using the Applied Science Laboratory D6 model eye-tracking system and Results software. Participants with insufficient data were excluded

from analyses (i.e., less than 80% of pupil tracked on average) for a total of 87 participants with eye-tracking data available. However, results did not differ when including available eye-tracking data from all participants, with one exception noted in the results section. The Antisaccade task measures inhibition, cognitive control, and executive control by requiring the participant to inhibit looking towards a stimulus and instead look in the mirror direction (i.e., away) from a stimulus presented on the screen (Munoz & Everling, 2004). The antisaccade task in the current study was modeled after the Pierce, McCardel, and McDowell (2014) 50 percent probability antisaccade task, with half of the trials being prosaccade signals (i.e., look toward represented by a square around the fixation point) and half of the trials being antisaccade signals (i.e., look away represented by a diamond around the fixation point). Antisaccade tasks have been widely used in clinical research on both humans and primates and have been shown to have high clinical utility for distinguishing dysfunction of inhibitory systems and impulsivity, particularly in the prefrontal cortex (Leigh & Kennard, 2004; Munoz & Everling, 2004; Pierce et al., 2014).

2.4 Self-Report Measures

Self-report measures included a short demographics questionnaire and five personality questionnaires. (1) The Barratt Impulsiveness Scale (BIS-11), a 30 item self-report questionnaire that has been previously validated in both impulsive and normal populations (Swann, Anderson, Dougherty, and Moeller 2001; Stanford, Mathias, Dougherty, Lake, Anderson, and Patton 2009), measures motor impulsivity, attentional impulsivity, and non-planning impulsivity was included to assess self-reported levels of impulsive traits. (2) The Triarchic Psychopathy Measure (TriPM; Patrick et al., 2009), a 58-item self-report questionnaire validated with adolescents and adults (age 14 years and older), measures three specific constructs of psychopathy: boldness, meanness, and disinhibition (Patrick et al., 2009). The TriPM was included to assess traits of psychopathy and antisocial traits. (3) Internalizing and externalizing symptoms and affectivity were measured using adapted scales (96 items) of the Personality Assessment Inventory (PAI; Morey 1991), a personality measure validated for use in both college and clinical populations (Kurtz, Morey, & Tomarken 1993; Salekin et al. 2001; Diamond & Magaletta 2006; Jacobo, Blais, Baity & Harley 2007, DeShong & Kurtz 2013), with demonstrated good reliability and validity (Harty et al., 2010). Specifically, the adapted PAI assesses traits including antisocial personality, anxiety, borderline personality, and depression with higher scores indicating more psychopathology. (4) The Pittsburgh Sleep Quality Index (PSQI), a widely-used 19 item self-report questionnaire measures subjective sleep quality and disturbances in the past month (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). (5) The Boredom Proneness Scale, a 28 item scale measures trait boredom proneness and has been widely used in previous research (BPS; Farmer, & Sundberg, 1986). The BPS was included for exploratory analyses to assess whether trait boredom proneness is related to sleep difficulties and premature birth, as it has previously been associated with higher risk-taking and impulsive behaviors (Dahlen, Martin, Ragan, & Kuhlman, 2005) and has never been examined in this group to the author's knowledge.

2.5 Procedure

Participants attended two experimental sessions lasting approximately 60 minutes each. Prior to beginning their first visit participants reviewed and signed the consent form agreeing to participate in the study and to return in one week following completion of the first session to complete part 2 of the study. Study tasks were administered in random order to all participants.

Visit 1. During their initial visit, participants were asked to complete questionnaires related to their impulsive traits (BIS-11; Stanford et al., 2009), sleep behaviors and satisfaction (PSQI; Buysse et al., 1989), psychopathology (select PAI subscales; Morey, 1991), boredom proneness (BP Scale; Farmer, & Sundberg, 1986), and antisocial traits (TriPM; Patrick, 2010) using online survey software (Qualtrics, Survey Software). Participants also completed the Conners' Continuous Performance Test-Second Edition (CPT-II; Conners & Staff, 2000) and Balloon Analogue Risk Task (BART; Lejuez et al., 2002) during this initial visit to examine their behavioral traits of both impulsivity and risk taking behaviors. They were then given an actiwatch (Respironics Actiware 5 ©) to wear for the duration of the week to objectively examine their sleep behaviors and sleep quality. Please see the Appendices for Consent form, Debriefing form, and several task examples (See Figure 1 for the experimental protocol for Visit 1).

Visit 2. Participants returned in exactly one week (seven days) at the same time of day following visit 1 to complete the same questionnaires (BIS-11, PSQI, PAI, BP Scale, and TriPM) a second time to examine the reliability of their psychopathology. The

BART was also completed a second time to examine changes in behavioral impulsivity over time and with practice effects. Participants also completed the eye-tracking task to examine impulsivity (the Look Away task or Antisaccade Task; Pierce et al., 2014). Upon completion of the randomized experimental tasks, participants returned the actiwatch and were given debriefing forms indicating the true purpose of the study along with contact information of local psychological services (See Figure 2 for the experimental protocol for Visit 2).

3. RESULTS

3.1 Data Analysis

SPSS 16.0 was used to conduct all analyses. The proportion of missing data on self-report measures was 1.32% (i.e., PAI, BIS 11, BPS, and TriPM). The proportion of missing objective assessment measures ranged from 0% (i.e., BART) to 39.21% (i.e., objective measures of eye-tracking). The large percentage of missing eye-tracking data was a result of both technical malfunctioning and laboratory relocation issues. Participants with missing data were excluded from analyses examining those variables. Means, standard deviations, and correlations for all variables of interest are presented in Table 2. Self-reported externalizing disorder traits (i.e., TriPM and PAI antisocial *T*-scores) were highly correlated with objective measures of risk taking and impulsivity on the BART (explosions and pumps) and eye-tracking task (only reaction time), but not the CPT-II (measuring attention, Riccio, Reynolds, Lowe, & Moore, 2002). In addition to analyzing the measures correlations with total scores, composite scores were derived for all self-report impulsivity measures (i.e., BIS 11, PAI antisocial *T*-scores, and TriPM scores) and for all objective impulsivity measures (i.e., BART, CPT-II, and eye-tracking scores). Composite scores were calculated by summing all self-report and objective impulsivity scores into *z*-scores by gender (i.e., using the male mean for men, and the female mean for women in computing the *z*-scores) and summed to form a composite self-report impulsivity measure, and a composite objective impulsivity measure. Analyses included in the current study included independent samples *t*-Tests, one way between-subjects analyses of variance (ANOVA), two-way analyses of variance (ANOVA), multivariate analyses of variance (MANOVA), logistic regressions, and ordinary least squares (OLS) regressions. Finally, to analyze gender differences in each regression model, gender was included in the model as a predictor for each regression and the significance of these analyses are noted after each analysis.

3.2 Participant Characteristics

Actigraph measures of sleep quality and efficiency showed the sample had high percentages of sleep efficiency (M = 91.91 %) and slept more than 8 hours on average (M = 8.27 hours). Twenty six participants slept fewer than 6.5 hours or 15.38%, and only 1 or 0.59% of participant slept fewer than 5 hours. In contrast, participants on average reported poor subjective sleep quality on self-report measures (i.e., scores above 5 indicate poor subjective sleep quality; M = 6.09 and 50.67% scored above 5; PSQI). As summarized in Table 2, bivariate Pearson r correlations revealed that actigraphy measures of sleep duration and efficiency were not significantly correlated with subjective report of sleep satisfaction. As expected, composite scores created for sleep duration and efficiency compared to subjective sleep satisfaction (PSQI) z-score were also not significantly related (r = -.06, p > .05).

Similarly, BART measures of risk taking along with impulsivity and inattention were within average range (i.e., fewer than 1.78% had an adjusted average on unexploded balloons over 64; BART; and fewer than 30.28% scored above 60T on the three measures included in analyses; CPT-II). Eye tracking showed that, on average, participants (n = 87) looked in the correct direction on over 79% of the trials. Subjective reports of psychopathic traits showed that the top five percent of overall psychopathy scores (i.e., 71 or above) was well above the sample mean (i.e., $M = 59.20$; TriPM). Subjective report of impulsivity was within normal range for the majority of the sample and only 19.28% scored in the impulsive range (i.e., scores above 72 indicate high impulsivity; $M = 62.15$; BIS-11). The boredom proneness median score was 96, comparable to other studies. Scores on the personality trait measures were within normal limits, with few participants reporting scores in the clinical range (i.e., fewer than 13.45% scored above 70*T* on any of the PAI scales). As expected, the computed composites for objective versus self-report measures of impulsivity did not show a significant relationship ($r = .04$, $p > .05$). These findings further suggest that the self-report and objective measures assessing different dimensions of the constructs of interest are not consistent across measures. Table 2 summarizes the means, *SD*, and correlations for the entire study sample.

3.3 Birth Status Differences

Of the 227 participants that completed the study, eight did not know their birth status, resulting in a total of 71 men and 156 women (i.e., premature men $n = 32$; premature women $n = 103$; premature ≥ 1-2 weeks early) included in birth status analyses (See Table 1 for demographic characteristics of the sample).

Hypothesis 1. Table 3 summarizes the means and standard deviations for the sample split by gender and birth status. We predicted that individuals born prematurely would show lower levels of impulsivity when compared to their full term peers on self-report measures. In order to test if individuals born prematurely (defined as ≥ 1-2 weeks early) show lower levels of impulsivity when compared to their full term peers on self-report measures (i.e., BIS 11, TriPM, and PAI antisocial scale), a one-way between subjects analysis of variance (ANOVA) was performed. Results showed that the main effect of birth status on the BIS 11 was not significant. However, a main effect of birth status was found for TriPM total scores ($F(1, 217) = 7.52$, $p < .05$), such that preterm participants reported significantly lower psychopathy scores ($M = 57.11$, $SD = 15.31$) than full term peers ($M = 63.08$, $SD = 16.25$). Additionally, a main effect of birth status was found for PAI antisocial *T*-Scores ($F(1, 217) = 10.66$, $p < .05$), such that preterm participants reported significantly lower antisocial behavior scores ($M = 51.90$, $SD = 9.20$) than full term peers ($M = 56.40$, $SD = 10.99$). Thus, the hypothesis (1) that individuals born prematurely would show lower levels of impulsivity when compared to their full term peers on self-report measures was confirmed for both antisocial and psychopathic traits. To further analyze the interactive effect of gender and birth status, a two-way analysis of variance was conducted for each variable of interest (BIS 11, TriPM, and PAI antisocial). The main effect of gender remained for both BIS 11 and TriPM scores but the main effect of premature birth was no longer significant. However, results showed that both gender ($F(3, 215) = 20.65$, $p < .05$) and preterm birth status ($F(3, 215) = 4.77$, $p < .05$) remained main effects for PAI antisocial *T*-scores. Suggesting that gender and premature birth status both affect PAI antisocial *T*-scores.

Hypothesis 2. We predicted that on behavioral measures of impulsivity and risk-taking, individuals reporting premature birth status would show increased levels of impulsivity according to these “real-time” measures. In order to test whether individuals reporting premature birth status showed increased levels of impulsivity according to behavioral measures of impulsivity and risk-taking, an additional one-way between subjects analysis of variance (ANOVA) was performed. Results showed that the main effect of birth status on the CPT-II measures of impulsivity and inattention were not significant (i.e., Omission, Commission, and Hit Reaction Time data). Results also showed that the main effect of birth status on the BART pump adjusted averages and explosions were not significant. Finally, results showed that the main effect of birth status on the antisaccade eye-tracking task was not significant for either eye-tracking percent correct, or reaction times. Thus, contrary to the self-report measures indicating decreased impulsivity in those born preterm, individuals reporting premature birth status did not differ significantly from full term individuals on laboratory “real-time” measures of executive functioning and impulsivity. To further analyze the interactive effect of gender and birth status, a two-way analysis of variance (ANOVA) was conducted for each variable of interest (i.e., CPT-II measures, BART measures, and eye-tracking measures). The addition of gender to the models did not change the direction or general significance of these results.

3.4 Other Variables of Interest

A similar analysis of birth status effects on personality measures showed a main effect of birth status on PAI antisocial *T*-scores ($F(1, 217) = 10.66$, $p < .05$) and TriPM total scores ($F(1, 217) = 7.52$, $p < .05$). Compared to full term peers, preterm participants reported significantly fewer antisocial behaviors ($M = 51.90$, $SD = 9.20$; $M = 56.40$, $SD = 10.99$) and scored significantly lower on psychopathy ($M = 57.11$, $SD = 15.31$; $M =$

63.08, *SD* = 16.25). However, in similar analyses, these effects were not seen for our remaining variables of interest (i.e., average sleep efficiency, average sleep time, subjective sleep satisfaction total score, internalizing total scores using the PAI, and boredom proneness total score). To further analyze the interactive effect of gender and birth status, a two-way analysis of variance (ANOVA) was conducted for each variable of interest (i.e., average sleep efficiency, average sleep time, subjective sleep satisfaction total score, internalizing total scores using the PAI, and boredom proneness total score). The addition of gender to the models did not change the direction or general significance of these results.

To assess the effect of birth status and gender (coded 1= premature male, 2=full term male, 3=premature female, 4=full term female) a single one-way MANOVA was conducted with all self-report measures. There was a statistically significant difference in several of our subjective-report variables of interest based on the participants birth status and gender, F (27, 605) = 3.43, $p < .05$; Wilk's $\Lambda = 0.660$, partial $\eta^2 = 0.13$. Birth status and gender have a statistically significant effect on TriPM total (F (3, 215) = 14.58, $p < .05$; partial $\eta^2 = 0.17$), such that men in both groups scored significantly higher than women in both groups on the TriPM but did not differ from their same sex peers. A significant effect for birth status and gender was found with BIS 11 total scores (F (3, 215) = 4.62, $p < .05$; partial $\eta^2 = 0.06$), such that full term men scored significantly higher on the BIS 11 than premature women but not full term women, premature men scored significantly higher than women in both groups on the BIS 11 but not from full term men, and women did not differ by birth status. Finally, gender and birth status had a statistically significant effect on both PAI anxiety *T*-score (F (3, 215) = 4.03, $p < .05$; partial $\eta^2 = 0.05$) and PAI antisocial *T*-score (F (3, 215) = 11.01, $p < .05$; partial $\eta^2 = 0.13$). Post hoc comparisons using the Fisher LSD revealed that full term and premature men scored significantly lower than premature women on anxiety but did not differ significantly from each other or full term women; and full term men scored significantly higher than women in both groups on antisocial traits, premature men scored significantly higher than premature women on antisocial traits, and full term women scored significantly higher than premature women on antisocial traits. In sum, these results show that birth status and gender significantly affected psychopathic traits (men scored higher than women), impulsivity (full term and preterm men scored higher than preterm women but not full term women), anxiety (preterm women scored significantly higher than premature and full term men), and antisocial traits (men scored higher than women, and full term women scored higher than preterm women). Suggesting that preterm women in particular show increased internalizing traits and decreased externalizing traits, even when compared to their full term peers. To further analyze the interactive effect of gender and birth status, a MANOVA was conducted with gender and birth status as factors. The addition of gender to the model showed main effects of gender differences in TriPM score, BIS 11 score, BPS score, and PAI antisocial score such that men scored higher than women; as well as PAI anxiety score such that women scored higher than men, as expected. Additionally, premature birth showed a main effect on antisocial score, such that women born premature continued to have lower scores than men and full term women.

3.5 Birth Status and Gender Differences

Four one-way MANOVAs were conducted to assess the objective measures in the current study split by birth status and gender (i.e., one for objective measures of actigraphy, one for BART measures of risk-taking, one for eye-tracking measures of impulsivity, and one for CPT-II measures of attention and impulsivity). No significant differences were found on actigraphy measures, BART measures, or eye-tracking measures. There was a statistically significant difference in CPT-II impulsivity and inattention measures based on the participants birth status and gender, F (9, 497) = 2.22, $p < .05$; Wilk's $\Lambda = 0.908$, partial $\eta^2 = 0.03$. Specifically, birth status and gender have a statistically significant effect on commission *T*-scores (F (3, 206) = 3.21, $p < .05$; partial $\eta^2 = 0.05$), but not omission *T*-score or hit reaction time *T*-score. Post hoc comparisons using the Fisher LSD revealed that men in both groups had significantly lower *T*-scores than women in both groups, suggesting that both full term and premature women showed significantly more impulsivity on this behavioral measure. The addition of gender to the four models showed main effects of gender differences for only CPT-II commission errors, as expected.

3.6 Birth Status Regressions

Hypothesis 3. We predicted that and individuals born premature would report poorer subjective sleep quality and show decreased sleep efficiency, thus extending findings of the previous master's thesis in this vulnerable population. In order to assess whether individuals reporting premature birth status (IV dummy coded 0 = full term, 1 = premature) predicts poorer subjective sleep quality (DV dummy coded, 0 = good sleep quality, 1 = poor sleep quality) a logistic regression was conducted. The model did not significantly predict PSQI score, *B* = 0.46 (*SE* = 0.28), Wald (1) = 2.73, *p* = .10. The addition of gender to the model did not change the direction or general significance of these results.

To assess the linear relationship of premature birth status predicting subjective sleep quality (PSQI total score) an Ordinary Least Squares (OLS) regression was also conducted. The overall regression used to predict subjective sleep quality was not significant (F (1, 217) = 0.11, p = .74, R^2 = 0.00). The addition of gender to the model did not change the direction or general significance of these results. To assess whether premature birth status predicts decreased sleep efficiency or sleep duration an OLS Regressions were conducted. The overall regression used to predict sleep efficiency was not significant (F (1, 161) = 0.26, p = .61, R^2 = 0.00) and the model predicting sleep duration was also not significant (F (1, 161) = 0.13, p = .72, R^2 = 0.00). The addition of gender to the model did not change the direction or general significance of these results. Thus, we could not confirm hypothesis 3 that individuals born prematurely would report poorer subjective sleep quality and would show decreased sleep efficiency.

To examine whether individuals reporting higher levels of impulsivity and risk-taking behaviors on the objective measures (i.e., CPT-II, eye-tracking, and BART) and similar levels of impulsivity on the self-report questionnaires (i.e., BIS 11, PAI antisocial, TriPM) also report premature or full-term birth status (dummy coded, 0 = full term, 1 = premature), a Logistic Regression was conducted using these measures as independent variables for the dependent variable of birth status. The logistic regression model was not significant, $\chi^2(10) = 6.89$, $p = .74$, and no main effects emerged from the model. The addition of gender to the model did not change the direction or general significance of these results. OLS regressions with birth status as the independent variable and objective measures of impulsivity and risk taking (i.e., CPT-II, eye-tracking, and BART) were also conducted; however, none of the models were significant. OLS regressions with birth status as the independent variable and self-report measures of impulsivity (i.e., TriPM, BIS 11, PAI antisocial, and PAI borderline) were conducted. Significant effects for birth status were found again for self-report measures of psychopathy (TriPM; F (1, 217) = 7.52, $p < .05$, $R^2 = 0.03$) and antisocial (PAI antisocial; F (1, 217) = 10.66, $p < .05$, $R^2 = 0.05$) scores but not for the BIS or PAI borderline scores. Furthermore, TriPM scores ($\beta = -0.18$, t (217) = -2.74, $p < .05$) and PAI antisocial scores ($\beta = -0.22$, t (217) = -3.27, $p < .05$) were significantly predicted by birth status. That is, birth status (dummy coded, 0 = full term, 1 = premature) accounted for 3.35 percent of the variance in TriPM scores, such that a one point increase in birth status (being born premature) resulted in a 5.97 predicted decrease in TriPM scores. Birth status (dummy coded, 0 = full term, 1 = premature) accounted for 4.67 percent of the variance in PAI antisocial scores, such that a one point increase in birth status (being born premature) resulted in a 4.50 predicted decrease in PAI antisocial scores. Thus, premature birth status predicted decreases in both trait psychopathy and trait antisocial behaviors. Table 4 summarizes OLS regressions for birth status as the independent variable predicting both objective and self-report measures.

The addition of gender to the above models showed that gender (β = -0.21, t (207) = 3.09, $p < .05$) was again a significant predictor of Commission *T*-score when controlling for premature birth status (F (2, 207) = 4.79, $p < .05$, $R^2 = 0.04$), but did not change the results of the other models predicting objective impulsivity or risk-taking performance. When gender was entered as a covariate for self-report measures, significance of the results did not change for PAI borderline scores. However, the model was significant for gender and birth status predicting BIS 11 scores, F (2, 216) = 6.26, $p < .05$, $R^2 = 0.06$ and a separate model was significant for gender and birth status predicting TriPM scores, F (2, 216) = 6.26, $p < .05$, $R^2 = 0.17$. Furthermore, within the model, BIS 11 scores (β = -0.23, t (216) = -3.43, $p < .05$) and TriPM scores (β = -0.37, t (216) = -5.87, $p < .05$) were significantly predicted by gender but no longer by birth status. That is, after controlling for birth status (dummy coded, 0 = full term, 1 = premature), gender (coded 1 = male, 2 = female) accounted for 5.15 % of the variance in BIS 11 scores, such that a one point increase in gender (i.e., females) resulted in a 5.18 predicted decrease in BIS 11 scores (i.e., impulsivity). The model for TriPM scores showed that after controlling for birth status (dummy coded, 0 = full term, 1 = premature), gender (coded 1 = male, 2 = female) accounted for 13.32 % of the variance in TriPM scores, such that a one point increase in gender (i.e., females) resulted in a 12.79 predicted decrease in TriPM scores (i.e., psychopathy). Suggesting that the gender differences in these measures are an even stronger predictor than birth status, and the differences psychopathy score seen above were primarily driven by women. However, when gender was entered as a covariate for self-report measures of antisocial traits (PAI antisocial score) the model was significant for gender and birth status predicting antisocial scores, F (2, 216) = 16.46, p < .05, R^2 = 0.13. Furthermore, both premature birth status (β = -0.16, t (216) = -2.48, p < .05) and gender (β = -0.30, t (216) = -4.61, p < .05) were significantly predicting antisocial scores in the model. That is, after controlling gender (coded 1 = male, 2 = female), birth status (dummy coded, 0 = full term, 1 = premature) accounted for 2.46 % of the variance in antisocial scores, such that a one point increase in birth status (i.e., premature) resulted in a 3.33 predicted decrease in antisocial scores. Additionally, after controlling for birth status (dummy coded, 0 = full term, 1 = premature), gender (coded 1 = male, 2 = female) accounted for 8.53 % of the variance in antisocial scores, such that a one point increase in gender (i.e., females) resulted in a 6.53 predicted decrease in antisocial scores. Thus, both gender and birth status predicted decreases in antisocial traits, while gender was primarily driving the results for objective commission *T*-scores, as well as self-reported TriPM and BIS scores.

3.7 Severity of Birth Status Differences

To assess the effects of severity of premature birth additional OLS regressions were conducted with birth status severity (i.e., 0 weeks early, n = 84; 1-2 weeks early, n = 59; 3-6 weeks early, n = 51; 7-9 weeks early, n = 7; 10 + weeks early, n = 3) as the predictor for each dependent variable individually. There were no significant models or main effects for sleep measures (sleep time and percent), BART measures (pumps and explosions), CPT-II measures (omissions, commissions, and reaction time), eye tracking scores (percent correct and reaction time), PSQI scores, BIS 11 scores, BPS scores, PAI anxiety scores, PAI depression scores, or PAI borderline scores. The addition of gender to the model did not change the direction or general significance of these results, however, as expected, gender again predicted BIS 11 scores, BPS scores, PAI anxiety scores, and commission errors when controlling for severity of birth status.

However, further extending hypothesis 1, when assessing whether psychopathy scores as measured by the TriPM and antisocial scores as measured by the PAI were predicted from severity of premature birth, the overall regression used to predict TriPM total score (F (1, 212) = 8.18, $p < .05$, $R^2 = 0.04$) and antisocial *T*-score (F (1, 212) = 12.53, $p < .05$, $R^2 = 0.06$) were significant. Furthermore, the model showed that severity of premature birth (i.e., coded as 0, 1, 2, 3, 4) ($\beta = -0.19$, t (212) = -2.86, $p < .05$) was a significant predictor of psychopathy total score. That is, severity of birth status accounted for 3.72% of the variance in total psychopathy scores, such that a one point increase in birth status severity resulted in a 2.95 predicted decrease a in TriPM score, indicating lower psychopathy score. Thus, as birth status severity increased (i.e., fewer weeks of gestation or more weeks premature) trait psychopathy decreased. Furthermore, the model showed that severity of premature birth (i.e., coded as 0, 1, 2, 3, 4) ($\beta = -0.24$, t (212) = -3.54, $p < .05$) was a significant predictor of antisocial *T*-score. That is, severity of birth status accounted for 5.57% of the variance in antisocial *T*-scores, such that a one point increase in birth status severity resulted in a 2.31 predicted decrease in PAI antisocial *T*-score, indicating lower antisocial traits and behaviors. Thus, as birth status severity increased (i.e., fewer weeks of gestation or more weeks premature) trait antisocial behavior decreased.

The addition of gender to the above models showed that the model predicting TriPM scores from gender and severity of premature birth status (F (2, 211) = 18.83, $p < .05$, $R^2 = 0.15$) was significant. Furthermore, the model for TriPM scores showed that after controlling for birth status severity, gender ($\beta = -0.35$, t (211) = -5.33, $p < .05$) accounted for 11.42 % of the variance in TriPM scores, such that a one point increase in gender (i.e., females) resulted in a 12.17 predicted decrease in TriPM scores (i.e., psychopathy). Suggesting that the gender differences in these measures are an even stronger predictor than birth status severity, and the differences in psychopathy score seen above were primarily driven by women. However, when gender was entered as a covariate for self-report measures of antisocial traits (PAI antisocial score) the model was significant for gender and birth status severity predicting antisocial scores, F (2, 211) = 15.10, $p < .05$, $R^2 = 0.13$. Furthermore, both premature birth severity ($\beta = -0.16$, t (211) = -2.40 $p < .05$) and gender ($\beta = -0.27$, t (211) = -4.09, $p < .05$) were significantly predicting antisocial scores in the model. That is, after controlling gender (coded 1 = male, 2 = female), birth status severity (coded 0-4) accounted for 2.37 % of the variance in antisocial scores, such that a one point increase in birth status severity (i.e., fewer weeks of gestation or more weeks premature) resulted in a 1.57 predicted decrease in antisocial scores. Additionally, after controlling for birth status severity, gender (coded 1 = male, 2 = female) accounted for 6.91 % of the variance in antisocial scores, such that a one point increase in gender (i.e., females) resulted in a 6.06 predicted decrease in antisocial scores. Thus, both gender and birth status severity predicted decreases in antisocial traits, while gender was responsible for the significance of the results for self-reported TriPM scores.

3.8 Sleep Efficiency and Duration Regressions

Next, an Ordinary Least Squares (OLS) regression was conducted to examine whether individuals reporting high levels of both internalizing and externalizing or impulsive traits on the questionnaires will have lower sleep efficiency as measured by actigraphy. The overall regression used to predict sleep efficiency for impulsivity (BIS-11), psychopathy (Tri-PM total), and internalizing and externalizing traits (PAI anxiety, depression, antisocial, and borderline scores) was not significant (F (6, 160) = 1.24, p = .29, R^2 = 0.04). Furthermore, no main effects emerged from the model. A similar analysis with average sleep duration was conducted and the model was not significant (F (6, 160) = 0.51, p = .80, R^2 = 0.02) and no main effects emerged from the model. The addition of gender to the models predicting sleep efficiency and duration from self-report measures of psychopathology did not change the direction or general significance of these results

An OLS regression was conducted to assess whether lower levels of subjective sleep satisfaction as measured by the PSQI were predicted from the self-report variables and objective measures of sleep. The overall regression used to predict subjective sleep quality was significant (F (8, 158) = 19.10, $p < .05$, R^2 = 0.49). Furthermore, TriPM scores (β = 0.29, t (158) = 3.04, $p < .05$) and PAI depression scores (β = 0.55, t (158) = 5.69, $p < .05$) were significant predictors of subjective sleep quality. That is, after controlling for impulsivity scores, anxiety scores, borderline scores, antisocial scores, sleep time, and sleep efficiency TriPM scores accounted for 2.96% and depression scores accounted for 10.43% of the variance in subjective sleep quality, such that a one point increase in TriPM scores resulted in a .06 predicted increase and a one point increase in depression scores resulted in a .14 predicted increase in subjective sleep quality score, indicating poorer subjective sleep quality. Thus, as trait psychopathy and depression increased, subjective sleep quality decreased. The addition of gender to the model did not change the previous results, but additionally showed that after controlling for TriPM scores, impulsivity scores, PAI scores, sleep duration, and sleep efficiency, gender was a significant predictor of subjective sleep quality as well ($\beta = 0.13$, $t\,(157) = 2.09$, $p < .05$).

An OLS regression was conducted to assess percent correct on the eye-tracking task were predicted from the objective measures of sleep. The overall regression used to predict percent correct was not significant. However, percent sleep ($\beta = 0.28$, $t\,(75) = 2.17$, $p < .05$) was a significant predictor of overall eye-tracking percent correct but sleep time was not. That is, after controlling for sleep duration, percent sleep accounted for 5.90% of the variance in eye-tracking percent correct, such that a one point increase in sleep time resulted in a 2.15 predicted increase in eye-tracking percent correct, indicating decreased impulsivity. Thus, when using all available eye-tracking percent correct (including those with lower than 80% tracking), increases in sleep duration predicted increases in executive functioning (i.e., lower impulsivity). However, when percent of eye-tracking was entered as a covariate these results were no longer significant.

Sleep disordered breathing (SDB; self-reported chronic snoring, chronic coughing, and sleep apnea) was reported by 28 participants (9.38% of men and 6.12% of women who reported full term birth status; versus 17.12% of men and 14.56 % of women who reported premature birth status) in the current sample. A chi-squared test of independence was performed to assess whether SDB was reported significantly more in individuals born premature (15.6%) than those born full term (7.1%), a marginally significant difference was found ($\chi^2(1) = 3.39$, $p = 0.066$) and showed that SDB was trending towards being reported more often by those born preterm than their full term peers. Additionally, in order to assess whether individuals reporting premature birth status (IV dummy coded 0 = full term, 1 = premature) predicts SDB (DV dummy coded, 0 = no SDB reported, 1 = any SDB reported) a logistic regression was conducted. The logistic regression model was again marginally significant, suggesting that people born premature show more SDB, $B = 0.87$ ($SE = 0.49$), Wald (1) = 3.23, $p = .07$. Entering gender in the model did not change significance of the results for predicting SDB, but did explain some of the variance, such that premature birth was trending toward significance as a predictor of SDB, $B = 0.94$ ($SE = 0.0.50$), Wald (2) = 3.57, $p = .06$.

3.9 Exploratory Data Analyses

In addition, a Repeated Measures (Paired Samples) *t*-test was conducted with the repeated measures (i.e., the self-report questionnaire measures and tasks; BART, PSQI, TriPM, BIS 11, BPS, PAI scales) to explore these relationships over the duration of the week. As expected, participants showed significantly higher BART explosions at time two (time one $M = 9.16$, $SD = 3.73$ vs. time two $M = 10.47$, $SD = 3.70$), $t(224) = -6.06$, *p*

< .05; and significantly higher BART adjusted pumps at time two (time one $M = 34.08$, $SD = 13.57$ vs. time two $M = 41.29$, $SD = 14.01$), $t(224) = -8.78$, $p < .05$ as a result of practice effects. No significant differences existed between time one measures of subjective sleep quality, psychopathy score, impulsivity score, boredom proneness score, depression score, or antisocial score. However, participants showed significantly higher PAI anxiety *T*-score at time one (time one $M = 57.29$, $SD = 11.46$ vs. time two $M = 56.24$, $SD = 11.64$), $t(222) = 3.28$, $p < .05$; and significantly higher PAI borderline *T*-score at time one (time one $M = 55.83$, $SD = 10.89$ vs. time two $M = 55.22$, $SD = 11.00$), $t(222) = 2.09$, $p < .05$.

Previous studies have found increases in smoking behavior in those that scored higher on BART adjusted average balloon pumps and explosions, as well as higher impulsivity scores on self-report measures (Lejuez et al., 2003). In order to test whether individuals reporting smoking behavior (i.e., those who reported smoking in the last 30 days of any tobacco products, $n = 16$; and those who reported no use of tobacco products in the previous 30 days, $n = 205$) showed increased levels of impulsivity according to behavioral measures of impulsivity and risk-taking (i.e., BART) and self-report measures of impulsivity (i.e., BIS 11), an additional one-way between subjects analysis of variance (ANOVA) was performed. Results showed that the main effect of smoking status on the BART measures of risk taking were not significant (Time one Explosions $F(1, 219) = 1.78$, $p = 0.18$, Adjusted Pumps $F(1, 219) = 0.78$, $p = 0.38$; time two Explosions $F(1, 220) = 0.19$, $p = 0.66$, adjusted pumps $F(1, 220) = 0.20$, $p = 0.89$). Results showed that the main effect of smoking status on the BIS 11 was significant

(Time one BIS 11 $F(1, 220) = 6.16$, $p < .05$; Time two BIS 11 $F(1, 220) = 6.06$, $p < .05$) with smokers scoring higher than nonsmokers on the BIS 11 for each administration. To further assess this relationship in the current sample, Logistic Regression was conducted with time one BART scores and time one BIS 11 scores as predictors of smoking status. The logistic regression model was statistically significant, $\chi^2(3) = 8.46$, $p < .05$. The model explained 9.3% (Nagelkerke R^2) of the variance in smoking status and correctly classified 92.8% of cases. Those scoring higher on the BIS 11 were 0.90 times more likely to engage in any smoking behavior, $B = -0.06$ ($SE = 0.03$), Wald (3) = 5.87, $p = .02$.

4. SUMMARY

4.1 Emerging Adults: Participant Characteristics

The current study examined the relationship between sleep and psychopathology in emerging adults. Collectively, the sample of 227 (135 premature) young adults showed high levels of sleep efficiency and duration and showed a high incidence of poor subjective sleep quality consistent with this age range and population (Kalak, Brand, Beck, Holsboer-Trachsler, & Wollmer, 2015; Yaugher & Alexander, 2015). As expected, few participants reported clinically elevated incidence of internalizing or externalizing psychopathology (as measured by the PAI, TriPM, and BIS 11; Kurtz, Morey, & Tomarken 1993; Salekin et al., 2001; Diamond & Magaletta, 2006; Jacobo et al., 2007, DeShong & Kurtz 2013; Stanford et al., 2009; Drislane, Patrick, & Arsal, 2014). Few participants scored in clinical ranges on well validated measures of risk-taking or impulsivity (as measured by the BART and CPT-II; Epstein et al., 2003; Lejuez et al., 2002) and there was a high percent of correct looks on measures of executive functioning and task-switching (as measured by the eye-tracking or antisaccade task; Liu, Chiau, Tseng et al., 2010).

4.2 Gender Differences

Compared to men, women in the current study exhibited less risky behavior on behavioral measures (i.e., BART pumps and explosions) and scored lower on measures of psychopathy, impulsivity, and antisocial traits (TriPM, BIS 11, PAI antisocial scales) when compared to men. These findings are consistent with well-established gender differences in personality traits such as antisocial personality disorder and risk taking behaviors (Blonigen, Hicks, Krueger, Patrick, & Iacono, 2005; Hicks et al., 2012; Lejuez et al., 2002; Lighthall, Mather, & Gorlick, 2009; Stanford et al., 2009). Similarly, our finding that women compared to men reported more anxiety symptoms and traits replicate well-established gender differences in internalizing disorder prevalence (i.e., PAI anxiety scale) (Feingold, 1994). Results also confirmed gender differences in our measurement of trait boredom in this study and are consistent with previous literature suggesting men scored higher than women (Vodanovich & Kass, 1990). Taken together, these data suggest our sample is a valid representation of a normal distribution of these scores within this population.

4.3 Premature Birth and Psychopathology

The primary aim of this research was to examine the effect of premature birth status on emerging adult psychopathology using both subjective and objective measures. Contrary to our hypotheses, young adults reporting premature birth did not differ from their full term counterparts on measures of impulsivity, anxiety, subjective sleep quality, borderline traits, or boredom proneness. Further, preterm birth did not significantly affect actigraphy measures of sleep efficiency and sleep duration, behavioral measures of impulsivity, risk taking, or executive functioning (as measured by the CPT-II, BART, and eye-tracking). These findings are contrary to previous results suggesting both increased incidence of emotional difficulties and ADHD symptomatology in adolescence (Johnson & Marlow, 2014; Johnson & Wolke, 2013; Lund et al., 2012), as well as decreases in externalizing traits and increases in internalizing traits during emerging adulthood (Pesonen et al., 2008; Waxman et al., 2013) .Yet, consistent with evidence that premature birth may show the strongest effects on females (Hack et al., 2006), women born preterm in this research reported lower levels of impulsivity and antisocial traits. Additionally, there was evidence in the current study that as the severity of premature birth status increased antisocial personality traits decreased, particularly for premature women.

Previous studies have suggested that premature birth effects may be modest in emerging adulthood (Saigal et al., 2016). This conclusion, although consistent with our general results, appears inconsistent with other researchers showing those born preterm compared to their full term peers have reductions in brain volume and delayed maturation of grey matter in both the prefrontal cortex and the hippocampus (Narberhaus et al., 2009; Nosarti et al., 2014). Findings that preterm and full term young adults show no differences in measures of executive function thought to be dependent on these brain structures in the current study and previous research (e.g., CPT-II, Riccio et al., 2002; antisaccade eye-tracking task; Pierce, McCardel, & McDowell, 2014; and BART; Rao, Korczykowski, Pluta, Hoang, & Detre, 2008) suggest the effects of brain function on behavior may be less apparent in this population. It may be that individuals born preterm learn coping strategies that allow them to function on par with their full term peers on these measures during emerging adulthood or it may be that behavioral consequences of preterm birth in emerging adulthood are less apparent due to the freedoms of being away from home and in college but without the demands of adult independence (e.g., career and family demands; Saigal et al., 2006). Prior researchers have also been surprised by the relatively few differences between those born at term and those born preterm during emerging adulthood (Saigal et al., 2006).

A main aim of the current study was to also address the mixed findings on measures of externalizing disorders and traits in emerging adults born preterm (e.g., Hack et al., 2004; Mulder et al., 2009). Meta analytic results suggest that children born prematurely or very low birth weight exhibit higher rates of impulsivity, risk-taking behaviors, and antisocial traits than their full term or average birth weight peers (Mulder et al., 2009) while in adulthood studies suggest that those born preterm exhibit more internalizing disorder traits (Hack et al., 2004). In the current study, men and women born full term as well as men born prematurely reported experiencing more antisocial traits and behaviors than women born prematurely. These results are consistent with well-established gender differences in antisocial traits, and further suggest that premature birth status affects women more than premature men, who show the fewest antisocial and externalizing disorders (Yaugher & Alexander, 2015; Hack et al., 2004; Boyle et al., 2011). These findings may be due to the fact that men consistently score higher than women on antisocial traits throughout childhood to adulthood (Odgers et al., 2008). Furthermore, consistent with our findings, premature birth status appears to increase female-typical traits (e.g., increased neuroticism and anxiety, lower extraversion and sensation seeking; Allin et al., 2006) and affect males more than females (Ritchie, Bora, & Woodward, 2015; Månsson, Fellman, & Stjernqvist, 2015). For example, studies of extremely preterm children at age 2 have demonstrated that girls perform better than boys on cognitive tests, and suggest that female birth is a protective factor (Månsson, Fellman, & Stjernqvist, 2015).

The reasons why women born preterm show even lower levels of impulsivity and antisocial traits are largely unknown. It may be that women born preterm become more agreeable and less extraverted in adulthood and these personality characteristics are a protective factor for individuals born preterm (Hertz et al., 2013). It may also be that female sex is a protective factor and a factor that encourages resilience as well as superior performance on certain measures (Lundequist, Böhm, Lagercrantz, Forssberg, & Smedler, 2015; Månsson, Fellman, & Stjernqvist, 2015). This resilience component in women born preterm, coupled with the fact that women typically report fewer antisocial and risk taking behaviors, suggests that biological sex differences and brain maturation differences may play a crucial role in psychopathology and adaptive functioning (De Bellis et al., 2001; Hill, Threlkeld, & Fitch, 2011).

Others have found that premature birth affected boys more negatively than girls at age 10 years, and proposed that these sex differences in individuals born premature may be a result of disrupted hormonal signals that result from premature birth status (Kuban et al., 2016). This explanation suggests that namely higher rates and circulation of testosterone (e.g., early brain injury studies in rat models; Hill, Threlkeld, & Fitch, 2011) as well as decreased estrogen receptiveness (e.g., postmortem brain studies of ASD; Crider, Thakkar, Ahmed, & Pillai, 2014) can exacerbate difficulties or early injuries to the brain. Additionally, it has been proposed in the literature that increased levels of androgen exposure during prenatal development may be related to inhibited lung development in males (Mage & Donner, 2006). In fact, studies have shown that prenatal levels of androgens increase lung inflammation in males, while estrogen may be a protective factor for females (e.g., mice studies; Card et al., 2006). Furthermore, a large body of research suggests that premature birth is associated with an increase in postnatal testosterone levels, especially in males (Kuiri-Hanninen et al., 2011; Shinkawa, Furuhashi, Fukaya, Suzuki, Kono, & Tachibana, 1983; Tapanainen, Koivisto, Vihko, & Huhtaniemi, 1981). Finally, brain development differs between boys and girls in childhood (De Bellis et al., 2001) and between premature and full term adults (Narberhaus et al., 2009; Nosarti et al., 2014) suggesting the hormone-dependent sexual differentiation of the brain in perinatal life is of importance. Thus, continued brain development coupled with disruption in perinatal testosterone levels may explain the decreases, on average, in externalizing traits seen in men and women born prematurely in the current sample (i.e., they are more female typical). Taken together, findings suggest that premature birth alters sex-linked personality characteristics in emerging adulthood and may pose increased risk for males compared to females. Future studies may benefit from examining hormonal differences (namely testosterone) and neuropsychological differences in men and women born preterm in relation to both their self-reported and objectively measured risk taking and antisocial traits. Additionally, future studies may address why women born preterm differ from full term women and whether the reduced impulsive and antisocial traits afford an advantage or disadvantage to adult development.

It is of interest that our findings showed significant decreases in antisocial and psychopathic personality traits when examining severity of birth status. That is, we found that as severity of premature birth increased (i.e., more premature or fewer weeks total gestation) antisocial and psychopathic traits decreased significantly. Previous longitudinal research has demonstrated a similar effect of birth status severity in cognitive outcomes at age 5 and 18 years (Lundequist et al., 2015). While cognitive outcome variables were not included in the current study, these similar severity differences indicate gestational age is one important determinant of variability in behavioral outcomes.

In this research, self-reported antisocial traits were significantly lower in prematurely born individuals in an emerging adult sample. Thus, our findings replicate previous studies suggesting individuals born prematurely engage in fewer criminal activities and risk-taking behaviors (Hack et al., 2004; Pesonen et al., 2008; Van Lieshout, Boyle, Saigal, Morrison, & Schmidt, 2015; Waxman, Van Lieshout, Saigal, Boyle, & Schmidt, 2013). While gender remained a primary indicator, our findings are also the first to show a similar relationship between birth status and psychopathic personality traits. Previous studies have examined very premature adults between 18 to 19 years using the Eysenck Personality Questionnaire Revised, short form (EPQ-RS) and found no difference between very preterm emerging adults and their full term peers in self-reported psychoticism (e.g., egocentricity, aggression, coldness, and antisocial behavior; Allin et al., 2006). However, psychoticism on the EPQ-RS assesses antisocial behavior proclivity, and it does not tap the three distinct facets of psychopathic personality disorder as the Triarchic Psychopathy Measure does (i.e., TriPM; meanness, boldness, and disinhibition; Patrick, 2010) which does assess the hallmark features of trait psychopathy (Patrick, Fowels, & Krueger, 2009). Additionally, Hack et al. (2004) examined antisocial behaviors in individuals born with very low birth weight (mean gestation of 29.7 weeks) and found that preterm women and men reported lower levels of delinquent behaviors than their full term peers at age 20. However, neither of these studies specifically included psychopathic personality traits in their study design and the differences found in our results may thus be a result of increases in sensitivity to specific traits of psychopathy rather than antisocial traits alone. Future studies may examine this link between psychopathic traits and premature birth status to replicate our novel findings in other samples.

Although breastfeeding rates were not examined in the current study, several other lines of research suggest that decreased breastfeeding during infancy is related to adult neuropsychological difficulties and symptoms of psychopathy (Jackson & Beaver, 2015). These deficits may be partially explained with the importance of breastfeeding for prematurely born infants. Specifically, breastfeeding is particularly important for brain development and cognitive abilities (Tanaka et al. 2008) as well as reduced risk of developing health-related conditions (e.g., necrotizing enterocolitis; Quigley & McGuire, 2014) in those born prematurely. For example, premature children who are given breast milk rather than formula, show increases in intellectual abilities at ages 7 to 8 years (Lucas, Morley, Cole, Lister, & Leeson-Payne, 1992). Furthermore, preterm infants are often supplemented with formula based milk with nutrient fortification to improve growth and often do not exclusively breastfeed with mothers as they may be hospitalized longer and may be fed with gastric tubes rather than direct suckling (Henderson, 2008; McCormick, Henderson, Fahey, & McGuire, 2010; Quigley & McGuire, 2014; Schanler, Shulman, & Lau, 1999). In fact, a "paradox" exists in which breastfeeding preterm infants results in reduced deficits in neurodevelopment at ages 2 and 5 years, but also decreases typical weight gain in infancy (Rozé et al., 2012). Thus, there remains debate as to whether to solely breastfeed infants born prematurely or to supplement the milk which in turn decreases breastfeeding in those born prematurely (Rozé et al., 2012). A recent longitudinal study examining the link between breastfeeding and psychopathology in the form of psychopathy in adulthood (National Longitudinal Study of Adolescent Health; age range 24-32 years) found that those who were not breastfed during infancy were at greater risk for developing psychopathic personality traits (Jackson & Beaver, 2015). Thus, future studies may benefit from continuing this interesting line of research examining the gene-environment interaction with respect to breastfeeding in infants at risk of receiving lower rates of breastfeeding (i.e., those born premature) and adult expression of psychopathic traits with respect to early interventions in infancy.

Our findings showed that on measures assessing risky and antisocial behaviors, both preterm and full term men scored significantly higher than both premature and full term women, suggesting this gender difference is also robust even when splitting the sample. These results are contrary to previous studies suggesting that men also show significantly fewer delinquent behaviors and antisocial traits (Hack et al., 2004).

Additionally, in the current study, impulsivity measures showed that full term and premature men report significantly higher impulsivity than premature women and that premature men report significantly higher impulsivity than full term women. These results are consistent with studies showing women born prematurely are less extraverted, less impulsive, and more conscientious (Pesonen et al., 2008). Thus, our findings suggest that these gender differences do persist in emerging adulthood and warrant further study.

On measures of internalizing behavior and traits, past studies have found that women born prematurely report higher rates of anxiety and depression when compared to full term peers, but these differences are not always observed in men (Hack et al., 2004; Boyle et al., 2011). The current findings suggest that women born prematurely report significantly higher levels of anxiety but not depression when compared to both full term and prematurely born men. However, contrary to previous findings (Lage, Albuquerque, Fuentes, Correa, & Malloy-Diniz, 2013) women showed higher rates of commission errors on behavioral measures of impulsivity (CPT-II), indicating they scored more impulsively than men. Findings from the current study further showed that regardless of birth status, women continued to make more errors of commission than men, suggesting this gender difference persisted even when comparing the birth status. Our findings are also contrary to the self-report measures showing decreased impulsivity in women in the current study. This contradiction may be due to the fact that women born prematurely or very low birth weight often show increased incidence of attentional difficulties compared to men, according to parent report of their children at 20 years of age (Hack et al., 2004). These findings were surprising, but may be a result of attentional deficits rather than impulsivity as suggested by meta-analytic findings regarding CPT measures (Riccio et al., 2002). As attentional deficits have been reported to be a continued difficulty for those born premature in prior studies (Hack et al., 2004), and a large proportion of our sample reported being born prior to term, it may be that the CPT is tapping into different attentional processes and using different brain regions to inhibit responses than risk-taking measures such as the BART (Riccio et al., 2002). Future researchers should continue this line of research and examine the relationship between commission errors using objective measures of brain responses during this task within a premature birth, emerging adult population.

A strength of the current study design was the use of multiple methods to assess impulsivity and risk-taking, and sheds light on the prior mixed research in this population by suggesting that during emerging adulthood these behaviors may be less apparent (Saigal, Day, & Van Lieshout et al., 2016). It may be that as participants age, they compensate for their birth status, and during emerging adulthood they have reached their full term peers in executive functioning (Mulder et al., 2009). Further, recent findings suggest that these traits and behaviors during the emerging adult time period may not be as sensitive as they are in childhood, adolescence, or middle aged adults (ages 29 to 36 years) in this population (Saigal, Day, & Van Lieshout et al., 2016; Saigal, Stoskopf, & Streiner et al., 2006). As noted earlier, the findings of the current study that preterm emerging adults did not differ from their full term peers on measures of executive functioning may be a result of continued frontal lobe maturation in both full term and premature individuals at this age and thus the behavioral differences may not be as noticeable as underlying structural differences in emerging adults (Casey, & Caudle, 2013; Gogtay et al., 2004; Bennett, & Baird, 2006; Romine & Reynolds, 2005). Thus, our findings suggest that premature born emerging adults may be compensating in their behaviors and have learned to act in accordance with their peers. However, internally there may be significant structural and developmental brain differences that we were not able to examine with the current study methodology. In fact, previous neuropsychological research has found that individuals born prematurely show reduced brain volumes and even further delayed maturation of grey matter in the prefrontal cortex, hippocampus, and other areas when compared to full term peers (Narberhaus et al., 2009; Nosarti et al., 2014). These previous findings may be indicative of important structural and developmental differences between full term and premature individuals in emerging adulthood that we are unable to analyze. Our findings may support the possibility that other compensatory or protective factors may be mediating the relationship between premature birth and maladaptive behaviors in this age range, despite continued development of the prefrontal cortex (Narberhaus et al., 2009). As suggested by previous researchers, college samples of emerging adults may also have fewer demands than older adults (Arnett, 2000) and this may also be playing a role in our findings of similar impulsive and sleep behaviors. Future studies may benefit from analyzing impulsive traits, risk-taking behaviors, and sleep differences using brain imaging studies that allow for a more in depth understanding of the internal processes guiding these behaviors rather than strictly using laboratory tasks or self-report measures.

4.4 Premature Birth and Sleep

Studies of premature birth and sleep measurement show mixed results in emerging adults. Some data suggest that those born prematurely sleep longer and report more sleep satisfaction in 16 to 19 year old adolescents (Hibbs et al., 2013). However, other data suggest there is an increased incidence of sleep disordered breathing and associated difficulties in 18 to 27 year old adults (Paavonen et al., 2007), or no differences in sleep efficiency or duration in young adults aged 21 to 29 years old born prematurely (Björkqvist et al., 2014). The current study supports the last findings, and did not show differences in sleep efficiency, duration, or subjective report of sleep in those born premature when compared to their full term peers. It may be that this age range (18-27 years) is not as sensitive as a result of both prematurely born and full term individuals simultaneously experiencing their adaptation to adulthood (Mulder et al., 2009). For example, sleep differences have been seen in children (e.g., ages 16-19 years; Hibbs et al., 2013), but not readily in emerging adults (e.g., ages 21-29 years; Björkqvist et al., 2014), which is further evidence of this narrowing in individual differences during emerging adulthood.

However, as we found in our analyses those born premature were still more likely to show sleep disordered breathing (SDB; snoring, coughing, difficulty breathing, and sleep apnea). These findings are consistent with this age group and premature birth effects on SDB (e.g., ages 18-27; Paavonen et al., 2007). Previous studies have shown great increases in SDB in individuals born prematurely (Paavonen et al., 2007; Rosen et al., 2003; Rosen et al., 2004), and our marginal findings further support that these difficulties persist into emerging adulthood in those born prematurely. Thus, it may be helpful for future studies to take a longitudinal approach beginning in childhood and extending through adulthood to assess the changes in sleep patterns, subjective sleep quality, and sleep efficiency over the lifespan to fully understand the long-term sequela of sleep difficulties as a result of premature birth.

4.5 Exploratory Findings

It is informative that our study findings indicate that both self-reported antisocial and psychopathic traits rather than self-reported impulsivity are highly related to task performance assessing risk-taking (i.e., BART explosions and adjusted pumps) and executive functioning (i.e., eye-tracking task reaction time). Our results further suggest that self-reported impulsivity is highly related to both self-reported psychopathic and antisocial traits. The findings of relatedness between the BART and antisocial and psychopathic traits are not surprising, given that the BART has been shown to be highly correlated with antisocial personality traits in previous studies (Epstein et al., 2003) in both forensic (Swogger et al., 2010) and non-forensic settings (Hunt et al., 2005). However, as expected, in the current study we found few other significant correlations between objective and subjective measures impulsivity and risk taking. Many previous lines of research suggest that there is low to no relationship between laboratory tasks and self-reported impulsivity (Sharma, Markon, & Clark, 2014), and has argued that that these measures may each be tapping additional indicators of these behaviors that do not show overlap on these measures. Our results support this argument and suggest that while self-reported impulsivity is related to antisocial and psychopathic traits, it is not indicative of task performance which may be assessing state risk-taking rather than trait levels of these personality characteristics (Sharma, Markon, & Clark, 2014).

It is also revealing that our study found no relationship between objective (actigraphy percent sleep and duration of sleep) and self-reported (PSQI) levels of sleep satisfaction. These findings replicate previous research in adolescence (Lang et al., 2013) and emerging adulthood (Yaugher & Alexander, 2015). These findings further support that it may be that individuals are not accurate reporters of their own subjective experience of sleep quality. Previous research has found that individuals are poor reporters of sleep duration due to overestimations of actual sleep time (Lauderdale, Knutson, YanLiu, & Rathouz, 2008). Taken together, these findings suggest that continued use of both subjective and objective assessment of sleep is important in sleep research.

Additionally, a large proportion of the current study sample reported poor subjective sleep quality, as has been shown in previous studies (Tworoger et al., 2005). In the present study, higher levels of depression (PAI depression *T*-scores) and increased levels of psychopathic traits (TriPM total scores) predicted poorer subjective sleep quality. These findings are consistent with previous research (Kamphuis et al., 2014; Kenney, LaBrie, Hummer, & Pham, 2012; (Yaugher & Alexander, 2015). In sum, the current findings support the generalizability of our findings to emerging adults in a college setting, and these associations suggest that those with high levels of depression and psychopathic traits report poorer subjective sleep quality.

It is important to note that our repeated measures from visit one and visit two of the study showed increased scores on behavioral tasks (i.e., BART) and consistent scores on several trait measures (i.e., BIS 11, PAI antisocial, PAI depression, PSQI, BPS, and TriPM), as would be expected given previous findings and reliability estimates. Interestingly, PAI anxiety and borderline scores decreased significantly between visit one and visit two in the current study. Both anxiety and depression are related to borderline personality disorder (Distel, Smit, Spinhoven, & Penninx, 2016). It is unlikely that these traits would have changed significantly over the duration of one week; however, it may be that participants became increasingly comfortable in the study setting due to repeated visits and were less anxious or nervous on their second visit, but this is unlikely given the reliability of this measure (Harty et al. 2010; Morrey 1991). Additionally, the adapted PAI scales used in the current study do not allow for validity scale analysis, which may be considered a limitation in interpreting clinical levels of these scores.

In the current study, we found that those scoring higher on the impulsivity measure (BIS 11) were more likely to engage in smoking behaviors. However, we did not find that those who smoke show increased impulsivity on objective measures of risk-taking (BART explosions and adjusted average pumps). Previous studies have found increases in smoking behavior in those that scored higher on BART adjusted average balloon pumps and explosions, as well as higher impulsivity scores on self-report measures (Lejuez et al., 2003).

4.6 Study Strengths and Limitations

The current study has number of strengths, including a large sample size compared to prior studies with similar methods and several results from the current study are consistent with converging evidence in premature populations. Additionally, the current study examines both self-reported and objective measures of sleep, impulsivity, and risk taking which are often lacking in previous studies. Although the current study did not find significant differences between premature birth status and full term participants in eye-tracking measures, our study is the first to use such objective measures of executive functioning in this population. Our findings are also the first to examine psychopathic traits in this population.

However, there are also limitations of the current study. First, a high percentage of the study sample was female (68 %) and a high percentage of the sample reported premature birth status (62 %). A higher incidence of women in the sample may be due to several factors, such as an increased rate of mortality for males born premature (Swamy, Ostbye, & Skjærven, 2008) or as a result of sampling bias (i.e., more women were enrolled in introductory psychology courses during sampling period). Higher incidence of premature birth in study samples is common when examining this population (Allin et al., 2006), and may be due to including those reporting any level of premature birth (born at least one to two weeks early) as well. However, the general results of this research did not change for premature birth analyses when splitting the sample into groups based on weeks born early (e.g., 3 or more weeks early).

Although recent studies have found no difference in education level in participants born prematurely or full term in adulthood (Saigal et al., 2016), further analysis of this is needed in the literature. Thus, additional limitations include using a college or convenience sample to test this vulnerable population, as it may be that individuals who experience the greatest deficits due to premature birth do not attend college or respond to study invitations (Baumann et al., 2016) at the same rate as full term peers. Unsurprisingly, a large proportion of the sample was Caucasian (61 %) and this may have contributed to the results. However, the identified ethnicity in the sample is similar to other studies in college samples (Yaugher & Alexander, 2015) but may limit the generalizability of the findings. As noted above, the current study found few significant correlations between objective and subjective measures of sleep or impulsivity and risk taking. While this is not an uncommon finding when conducting laboratory research (Sharma, Markon, & Clark, 2014), it does suggest that these measures may be tapping additional indicators of these behaviors it is nevertheless indicative that further research should continue to examine these relationships moving forward.

4.7 Conclusions

In sum, our findings support prior research showing decreased antisocial behaviors and traits in those born premature on self-report measures (Pesonen et al., 2008). To our knowledge, the current study is the first to show a relationship between emerging adult psychopathic traits and premature birth status, such that premature birth status and gender was associated with decreased psychopathy scores. Future studies may continue this investigation in emerging adults and throughout development to assess whether this is a stable pattern in individuals born premature. Additionally, our study is among few others using objective measures of risk-taking and impulsivity in a premature birth status, emerging adult sample (Wilson-Ching et al., 2013), and our findings suggest that previous mixed findings concerning internalizing and externalizing traits should continue to be investigated (Mulder et al., 2009). Our results are also hopeful for those born prematurely, as these results suggest that individuals born prematurely function, at least in an academic setting, similarly to their full term peers in sleep patterns, impulsivity and risk taking, and psychologically.

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APPENDIX A

FIGURES

Figure 1. Visit 1 Procedures

Time	**Task**
5 minutes	Participants review and sign consent forms
20 minutes	Questionnaires completed via Qualtrics*
10 minutes	Balloon Analogue Risk Task (BART) *
20 minutes	Conners' Continuous Performance Test-Second Edition (CPT-II) *
5 minutes	Participants receive the pre-programmed Actiwatch

*Note. * Randomized task order*

Figure 2. Visit 2 Procedures

Time	**Task**
5 minutes	Participants return the Actiwatch upon arrival
20 minutes	Questionnaires completed via Qualtrics*
15 minutes	Balloon Analogue Risk Task (BART)*
10 minutes	Antisaccade Task (ASL D6 model eye-tracking system)*
10 minutes	Participants receive Debriefing form and credit for completion

*Note. * Randomized task order*

APPENDIX B

TABLES

Table 1.
Descriptive Statistics of Participants

	Total *N* (Premature *n*)	Total %
Participant Characteristics		
Gender		
Male	71 (32)	31.3 %
Female	156 (103)	68.7 %
Birth Status (weeks preterm)		
Full Term (0 weeks)	84	37.0 %
Late Preterm (1-2 weeks)	59	26.0 %
Moderately Preterm (3-6 weeks)	51	22.5 %
Very Preterm (7-9 weeks)	17	7.5 %
Extremely Preterm (10 + weeks)	3	1.3 %
Don't Know	8	3.5 %
Race/Ethnicity		
Caucasian/Non-Hispanic	139 (90)	61.2 %
Hispanic	52 (30)	22.9 %
Asian American	15 (11)	6.6 %
African American	9 (4)	4.0 %
Other	8	3.5 %
Year in University		
1st Year	143 (94)	63.0 %
2nd Year	46 (29)	20.3 %
3rd Year	22 (7)	9.7 %
4th Year	5 (2)	2.2 %
4 + Years	7 (3)	3.1 %
Parents Education (Father)		
Less Than High School	10 (2)	4.4 %
High School/GED	42 (24)	18.5 %
Two Year/Trade School	27 (16)	11.9 %
Bachelor's Degree	96 (65)	42.3 %
Master's Degree	37 (20)	16.3 %
Doctoral Degree	9 (7)	4.0 %
Parents Education (Mother)		
Less Than High School	14 (6)	6.2 %
High School/GED	47 (27)	20.7 %
Two Year/Trade School	28 (20)	12.3 %
Bachelor's Degree	79 (49)	34.8 %
Master's Degree	34 (19)	15.0 %
Doctoral Degree	21 (14)	9.3 %
Sleep Disordered Breathing (Past Month)		
Yes	28 (21)	12.3 %
No	196 (114)	83.3 %
Exploratory Characteristics		
Smoked Last 30 Days		
Yes	16 (7)	7.0 %
No	206 (127)	90.7 %
Ever Tried Cigarettes/Black & Mild's		
Yes	41 (21)	18.1 %
No	182 (114)	80.2 %

Note. *N* = total sample size, *n* = premature sample size. Total study *N* = 227, some participants did not answer all demographic questions.

Table 2.

Overall Means, Standard Deviations, and Correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Age	–																	
2. Sleep Duration (Minutes)	-0.02	–																
3. Sleep Efficiency (% Sleep)	-0.11	0.35**	–															
4. BART[1] Explosions	0.00	0.07	-0.01	–														
5. BART[1] Pumps (*M*)	0.04	0.05	0.00	0.92**	–													
6. CPT Omission Errors (*T*)	-0.05	0.17**	0.06	-0.05	-0.06	–												
7. CPT Commission Errors (*T*)	-0.10	0.18**	0.10	0.06	0.03	0.32**	–											
8. CPT Reaction Time (*M*)	0.30	-0.00	-0.06	-.002	-0.04	-0.02	-0.46**	_										
9. Eye-Tracking Score (% Correct)	0.00	0.08	0.22	0.14	0.14	0.05	-0.03	-0.05	–									
10. Eye-Tracking RT(*M*)	-0.01	0.09	-0.06	-0.00	-0.05	-0.13	0.12	-0.06	0.07	–								
11. PSQI[1] Score	0.18**	0.05	-0.09	0.03	0.02	0.08	0.04	0.15*	0.02	0.15	–							
12. TriPM[1] Score	0.22**	0.02	-0.14	0.15*	0.14*	0.08	0.00	-0.07	0.00	0.27*	0.17*	–						
13. BIS[1] Score	0.22**	-0.08	-0.06	0.04	0.06	0.05	-0.03	0.10	0.07	0.19	0.27**	0.46**	–					
14. BPS[1] Score	0.23**	0.04	-0.07	0.05	0.05	0.07	-0.04	0.10	0.13	0.11	0.37**	0.26**	0.56**	–				
15. PAI Anxiety[1] (*T*)	0.00	0.03	-0.03	-0.01	-0.00	0.10	0.11	0.07	-0.01	0.18	0.48**	-0.17*	0.18**	0.45**	–			
16. PAI Depression[1] (*T*)	0.16*	0.03	-0.10	0.06	0.06	-0.00	-0.01	0.18**	0.05	0.24*	0.65**	0.03	0.35**	0.60**	0.72**	–		
17. PAI Borderline[1] (*T*)	0.18**	0.04	-0.08	0.09	0.08	0.05	0.01	0.13	-0.01	0.22*	0.55**	0.31**	0.52**	0.58**	0.62**	0.71**	–	
18. PAI Antisocial[1] (*T*)	0.23**	-0.02	-0.18*	0.19**	0.17*	0.06	-0.06	0.03	0.02	0.23*	0.23**	0.79**	0.49**	0.34**	-0.07	0.17*	0.43**	–
Mean	18.91	496.47	91.91	9.16	34.08	50.46	55.20	49.99	79.07	0.79	6.09	59.20	62.15	95.87	57.29	54.29	55.83	53.51
Standard Deviation	1.33	121.64	2.95	3.73	13.57	11.75	10.14	6.20	20.87	1.29	2.91	15.93	10.33	18.00	11.46	11.85	10.89	10.14

Note. **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed). Variable 1 (N = 227), variables 2-3 (N = 169), variables 4-5 (N = 225), variables 6-8 (N = 218), variables 9-10 (N = 87) and variables 11-18 (N = 223) Means and Standards Deviations were derived from non-standardized variables. Means and standard deviations for unstandardized values.

Table 3.

Descriptive Statistics for Variables of Interest by Birth Status and Gender

Variables	Male		Female	
	Premature Male *M* (SD)	Full Term Male *M* (SD)	Premature Female *M* (SD)	Full Term Female *M* (SD)
Age[e]	18.81 (0.90)***	19.91 (1.87)***	18.61 (1.17)***	19.00 (1.17)***
Objective Measures				
Sleep Duration (Minutes)[a]	486.83 (77.45)	473.34 (98.02)	497.90 (135.94)	521.14 (129.70)
Sleep Efficiency (% Sleep)[a]	91.57 (2.45)	90.91 (3.50)	92.03 (2.70)	92.17 (3.27)
BART Total Balloon Explosions[b]	9.44 (3.16)	10.03 (3.35)	8.98 (3.59)	8.55 (4.59)
BART Pumps (Adjusted Average)[b]	35.72 (11.86)	37.07 (11.14)	33.49 (13.35)	31.55 (16.35)
CPT-II Omission Errors (*T*)[c]	48.24 (10.16)	48.67 (8.91)	52.23 (14.30)	49.15 (7.38)
CPT-II Commission Errors (*T*)[c]	52.01 (9.27)*	51.99 (8.10)*	56.36 (10.86)*	57.29 (10.14)*
CPT-II Hit RT (*M*)[c]	49.23 (4.70)	49.36 (5.92)	50.38 (6.07)	49.80 (7.72)
Eye-Tracking Score (% Correct)[d]	84.82 (15.21)	78.84 (20.00)	79.03 (22.26)	73.08 (22.93)
Eye-Tracking RT (Milliseconds)[d]	0.74 (0.43)	1.36 (2.78)	0.79 (0.89)	0.92 (1.09)
Self-Report Measures				
PSQI[e]	5.66 (2.47)	5.69 (2.96)	6.33 (2.80)	6.29 (3.41)
TriPM Total[e]	68.09 (16.25)***	69.43 (13.59) ***	53.70 (13.34) ***	58.55 (16.59) ***
BIS-11 Total[e]	66.88 (11.18)**	64.83 (10.33)**	60.10 (9.91)**	61.55 (9.64)**
BPS Total[e]	101.28 (19.38)	99.66 (16.80)	93.89 (17.82)	93.43 (17.92)
PAI-ANX (*T*)[e]	53.13 (9.63)**	53.91 (8.86)**	59.67 (11.64)**	57.65 (12.98)
PAI-DEP (*T*)[e]	52.41 (12.61)	54.34 (11.01)	54.84 (11.99)	54.57 (12.15)
PAI-BOR (*T*)[e]	56.16 (12.05)	56.86 (12.05)	55.50 (10.64)	56.14 (10.16)
PAI-ANT (*T*)[e]	57.34 (8.38)***	59.80 (11.06)***	50.21 (8.81)***	53.98 (10.38)***

Note. Total $N = 219$ (Male $N = 71$; 32 Premature, 35 Full Term, and Female $N = 156$; 103 Premature, 49 Full Term) overall and varies due to insufficient data or lack of participant response. $N^a = 23, 76, 25, 39$ respectively, $N^b = 32, 102, 35, 49$ respectively, $N^c = 31, 101, 32, 46$ respectively, $N^d = 15, 37, 17, 17$ respectively, $N^e = 32, 103, 35, 49$ respectively. *$p < 0.05$ (two-tailed), **$p < 0.01$ (two-tailed), ***$p <$ 0.00 (two-tailed).

Table 4.
Summary of Ordinary Least Squares Regressions for Birth Status

	B	*SE*	*β*
Age[a]	-0.72	0.18	-0.26**
Objective Measures			
Sleep Duration (min)[b]	-7.14	19.68	-0.03
Sleep Efficiency (%)[c]	0.24	0.47	0.04
BART Total Balloon Explosions[d]	-0.08	0.52	-0.01
BART Pumps (Adjusted Average)[e]	0.18	1.90	0.01
CPT-II Omission Errors[f]	2.34	1.68	0.10
CPT-II Commission Errors[g]	0.22	1.47	0.01
CPT-II Hit RT[h]	0.49	0.89	0.04
Eye-Tracking Percent Correct[i]	4.74	4.60	0.11
Eye-Tracking Reaction Time[j]	-0.36	0.32	-0.12
Self-Report Measures			
PSQI[k]	0.14	0.41	0.02
TriPM[l]	-5.97	2.18	-0.18**
BIS 11[m]	-1.21	1.44	-0.06
BPS[n]	-0.38	2.52	-0.01
PAI ANX[o]	2.02	1.60	0.09
PAI DEP[p]	-0.22	1.66	-0.01
PAI BOR[q]	-0.78	1.52	-0.04
PAI ANT[r]	-4.50	1.38	-0.22**

Note: Birth status (0 = not premature, 1 = premature birth ≥ 1-2 weeks). * p < .05. ** p < .01.

Objective Measures
[a]R^2 = 0.07, F (1, 217) = 15.90, p < .00.
[b]R^2 = 0.00, F (1, 161) = 0.13, p > .05.
[c]R^2 = 0.00, F (1, 161) = 0.26, p > .05.
[d]R^2 = 0.00, F (1, 216) = 0.02, p > .05.
[e]R^2 = 0.00, F (1, 216) = 0.01, p > .05.
[f]R^2 = 0.01, F (1, 208) = 1.94, p > .05.
[g]R^2 = 0.00, F (1, 208) = 0.02, p > .05.
[h]R^2 = 0.00, F (1, 208) = 0.30, p > .05.
[i]R^2 = 0.01, F (1, 84) = 1.06, p > .05.
[j]R^2 = 0.02, F (1, 84) = 1.26, p > .05.

Self-Report Measures
[k]R^2 = 0.00, F (1, 217) = 0.11, p > .05
[l]R^2 = 0.03, F (1, 217) = 7.52, p < .01
[m]R^2 = 0.00, F (1, 217) = 0.71, p > .05
[n]R^2 = 0.00, F (1, 217) = 0.02, p > .05
[o]R^2 = 0.01, F (1, 217) = 1.60, p > .05
[p]R^2 = 0.00, F (1, 217) = 0.02, p > .05
[q]R^2 = 0.00, F (1, 217) = 0.26, p > .05
[r]R^2 = 0.05, F (1, 217) = 10.66, p < .00

Table 5.
Descriptive Statistics for Variables of Interest by Gender

Variables	Male *M* (SD)	Female *M* (SD)	Effect Sex (*d*)
Age	19.34 (1.55)	18.72 (1.17)	0.45**
<u>Objective Measures</u>			
Sleep Duration (Minutes)	482.23 (87.54)	502.62 (133.58)	-0.18
Sleep Efficiency (% Sleep)	91.43 (3.10)	92.12 (2.87)	-0.23
BART Total Balloon Explosions	9.86 (3.22)	8.85 (3.91)	0.28*
BART Pumps (Adjusted Average)	36.81 (11.37)	32.85 (14.31)	0.31*
CPT-II Omission Errors (*T*)	48.54 (9.55)	51.31 (12.54)	-0.25
CPT-II Commission Errors (*T*)	51.91 (8.51)	56.66 (10.48)	-0.50**
CPT-II Hit RT (*M*)	49.39 (5.30)	50.25 (6.56)	-0.14
Eye-Tracking Score (% Correct)	82.20 (17.90)	77.16 (22.43)	0.25
Eye-Tracking RT (Milliseconds)	1.04 (0.83)	2.01 (0.95)	-1.09
<u>Self-Report Measures</u>			
PSQI	5.61 (2.70)	6.31 (2.98)	-0.25
TriPM Total	68.43 (14.95)	55.06 (14.60)	0.90***
BIS-11 Total	65.64 (10.80)	60.59 (9.75)	0.49**
BPS Total	100.26 (17.94)	93.90 (17.73)	0.36*
PAI-ANX (*T*)	53.49 (9.07)	58.99 (12.02)	-0.52***
PAI-DEP (*T*)	53.33 (11.59)	54.72 (11.97)	-0.12
PAI-BOR (*T*)	56.26 (11.95)	55.64 (10.42)	0.06
PAI-ANT (*T*)	58.42 (9.91)	51.31 (9.48)	0.73***

Note. $N = 219$ overall and varies due to insufficient data or lack of participant response (Male $N = 71$, Female $N = 156$).
*$p < 0.05$ (two-tailed), **$p < 0.01$ (two-tailed), ***$p < 0.00$ (two-tailed).

Table 6.
Descriptive Statistics for Variables of Interest by Birth Status

Variables	Premature *M* (SD)	Full Term *M* (SD)	Effect Birth Status (*d*)
Age	18.66 (1.11)	19.38 (1.56)	-0.53***
Objective Measures			
Sleep Duration (Minutes)	495.33 (124.54)	502.47 (119.83)	0.06
Sleep Efficiency (% Sleep)	91.92 (2.64)	91.68 (3.39)	0.08
BART Total Balloon Explosions	9.09 (3.49)	9.17 (4.16)	-0.02
BART Pumps (Adjusted Average)	34.02 (13.00)	33.85 (14.59)	0.01
CPT-II Omission Errors (*T*)	51.29 (13.52)	48.95 (7.99)	0.21
CPT-II Commission Errors (*T*)	55.34 (10.64)	55.12 (9.66)	0.02
CPT-II Hit RT (*M*)	50.11 (5.78)	49.62 (7.00)	0.08
Eye-Tracking Score (% Correct)	80.70 (20.50)	75.96 (21.39)	0.23
Eye-Tracking RT (Milliseconds)	0.78 (0.78)	1.14 (2.09)	-0.23
Self-Report Measures			
PSQI	6.17 (2.73)	6.04 (3.22)	0.04
TriPM Total	57.11 (15.31)	63.08 (16.25)	-0.38**
BIS-11 Total	61.70 (10.58)	62.92 (10.00)	-0.12
BPS Total	95.64 (18.40)	96.02 (17.64)	-0.02
PAI-ANX (*T*)	58.12 (11.51)	56.10 (11.53)	0.18
PAI-DEP (*T*)	54.26 (12.13)	54.48 (11.62)	-0.02
PAI-BOR (*T*)	55.66 (10.95)	56.44 (10.92)	-0.07
PAI-ANT (*T*)	51.90 (9.20)	56.40 (10.99)	-0.44***

Note. $N = 219$ overall and varies due to insufficient data or lack of participant response (Premature $N = 135$, Full Term $N = 84$).
*$p < 0.05$ (two-tailed), **$p < 0.01$ (two-tailed), ***$p < 0.00$ (two-tailed)