6-2021

Prenatal Polysubstance Exposure (PPE) and ADHD: Comparison of Behavior Profiles in Children and Adolescents

Rana Tanios

Prenatal Polysubstance Exposure (PPE) and ADHD:

Comparison of Behavior Profiles in Children and Adolescents

by

Rana Tanios

Presented to the Faculty of the

Graduate School of Clinical Psychology

George Fox University

in partial fulfillment

of the requirements for the degree of

Doctor of Psychology

in Clinical Psychology

Newberg, Oregon

June 2021

Prenatal Polysubstance Exposure (PPE) and ADHD: Comparison of Behavior Profiles in Children and Adolescents

by

Rana W. Tanios

has been approved

at the

Graduate School of Clinical Psychology

George Fox University

as a Dissertation for the PsyD degree

Signatures:

Kathleen Gathercoal, Ph.D., Chair

Elizabeth B. Hamilton, Ph.D., Member

Glena L. Andrews, Ph.D., Member

Date: June 16, 2021

Prenatal Polysubstance Exposure (PPE) and ADHD: Comparison of Behavior Profiles in Children and Adolescents

Rana W. Tanios

Graduate School of Clinical Psychology

George Fox University

Newberg, Oregon

Abstract

Previous research reveals pervasive polysubstance use during pregnancy, with widespread neurological, cognitive, and behavioral deficits that have lasting implications for both adults and children with prenatal polysubstance exposure (PPE; Behnke et al., 2013; Forray, 2016). Early PPE identification leads to improved long-term outcomes. However, identifying PPE is difficult due to underreported use, absent dysmorphic features, and behaviorally similar profiles to other psychiatric conditions, with ADHD identified as the most common referral and most prevalent diagnosis assigned for children with PPE (Chasnoff et al., 2010). Despite similar behavioral symptoms, emerging data reveal a specific neurological profile for PPE distinct from ADHD, illustrating the need for targeted interventions. Consequently, it becomes imperative to build a more extensive neurobehavioral profile to identify children with PPE and better distinguish them from other diagnoses. The current study sought diagnostic clarity by exploring behavioral differences between children with PPE and non-exposed ADHD using clinical scales and composites from the BASC-3 parent and teacher rating forms. Participants were derived

from an archived database from rural school districts. Results found parents yielded higher predictability than teachers, with parents accurately differentiating PPE from ADHD individuals 100% of the time. However, no independent scales predicted PPE group. Significant differences were observed by parents for Externalizing Problems, Adaptive Skills, Depression, and Withdrawal scales, with higher clinical scores detected for the PPE group. Findings underline the BASC-3 as a potential and effective tool in differentiating PPE from ADHD groups and continue to aid in constructing a comprehensive behavioral profile for those prenatally exposed.

Keywords: ADHD, prenatal, polysubstance, exposure, behavioral, deficits, BASC

Table of Contents

List of Tables

Chapter 1

Introduction

Relevance

Prenatal substance exposure negatively impacts children's development, generating cognitive, behavioral, and physical side effects that generate long-term repercussions (Easey, 2019; Khoury et al., 2018; Reitan, 2017). National surveys found 5.9% of women in America reported illicit drug use, 10% alcohol use, and approximately 15% tobacco use while pregnant (England et al., 2020; Forray, 2016). Despite extensive studies on the harmful effects of prenatal drug use, long-term implications, and increased efforts towards prevention programs, in utero opioid use quadrupled from 1999-2014 (Haight et al., 2018), while cannabis use more than doubled between 2002-2017 (NIDA, 2020) by women during pregnancy.

Due to the stigma and shame that typically accompanies substance use during pregnancy, exact use is presumably underreported, and yet, indicates an emerging concern regarding in-utero exposure ramifications that persist into adulthood. For example, prenatal alcohol-exposed adolescents and adults diagnosed under the fetal alcohol spectrum disorders (FASD) displayed increased risk for adverse life outcomes, including alcohol use, inappropriate sexual behaviors, involvement within the justice system, increased self-injurious behavior (SI), and psychiatric hospitalizations (Lynch et al., 2017; Streissguth, 2004). A study found in utero marijuana exposure negatively impacted adaptive functioning across child development into adulthood (Forman et al., 2017). In-utero cocaine exposure is associated with emotional dysregulation in young adults, increased likelihood of cocaine use in teens, and overall increased likelihood of

arrests (Richardson et al., 2019; Yip et al., 2015). Additionally, cocaine, methamphetamines, and alcohol in utero exposure all were found to alter inhibitory control in adults (Richardson et al., 2019).

In Utero Polysubstance Exposure

Understanding the impact of in-utero substance exposure is further complicated by data indicating polysubstance abuse is fairly common. Women who use during pregnancy are found to have used more than one drug, displaying a strong relationship between stimulant use and multiple drug use (Degenhart, et al., 2010; Forray, 2016). For instance, of women who reported alcohol use, approximately 40% also reported the use of one or more other substances, including tobacco, marijuana, opioids, and other substances (England et al., 2018). Only 11% of pregnant women who used nonmedical opiates reported solely using opiates during pregnancy (Jarlenski, 2017), and opioid use during pregnancy was linked to greater overall polysubstance use (Harder & Murphy, 2019). Accordingly, prenatal polysubstance exposure (PPE) introduces new concerns and questions surrounding drug interaction and respective outcomes. However, in efforts to identify PPE, it can become difficult to isolate symptoms considering approximately more than 16% of pregnant mothers who use illicit or legal drugs typically use more than one drug, making it challenging to isolate individual drug reactions (Oei, 2018). Among pregnant women in a compulsory program for substance abuse, the average number of drugs used was 2.65 (Reiten, 2017).

Importance of Early Diagnosis

The pervasive long-term effects of prenatal drug exposure highlight the importance of early detection and prevention. There are correlations between fewer adverse life outcomes and earlier diagnosis of fetal alcohol syndrome (FAS; Streissguth et al., 2004). Increased risk for

future substance abuse varied significantly whether individuals were diagnosed during early childhood (Dirks et al., 2019; Rangmar et al., 2015). Earlier diagnoses led to decreased criminal justice contacts in prenatally alcohol-exposed individuals (Currie et al., 2016). Furthermore, Alex and Feldmann (2012) found earlier detection of FASD to be one of the most protective factors against social and behavioral deficits, as well as potential relief from tension and fear of failure for caregivers or parents.

Implications of Prenatal Drug Exposure

Internalized Behaviors. Accordingly, in efforts to better construct a profile for PPE, it becomes necessary to first examine the behavioral and cognitive implications of individual drug exposures. Internalized behaviors are indicative of an individual's emotional and psychological state, and are primarily characterized by maladaptive processes of the self. For instance, prenatal cocaine exposure (PCE) alters arousal systems in the brain, resulting in increased internalized behaviors, particularly significant withdrawal, emotional dysregulation, less sociability, and anxious and depressive symptoms compared to non-exposed samples (Richardson et al., 2019). Prenatal opiate, nicotine, and alcohol exposure are all significantly associated with internalized emotional dysregulation, anxiety, depression, and decreased interest in activities (Konijnenberg et al., 2016; Patel et al., 2019; Terrel et al., 2019).

Externalized Behaviors. Additionally, externalized behaviors, or maladaptive behaviors in the external world, are also prevalent within in utero exposed individuals. Prenatal cocaine exposure is also associated with elevated rates of aggression, delinquent behavior, and increased adolescent substance abuse (Minnes et al., 2014). Marijuana use during pregnancy increased the risk of aggressive behavior only in females as early as 18 months. Overall prenatal substance exposure was positively correlated with violence and other behavioral consequences (Terrel et

al., 2019), but data suggests males exhibit greater violence than females. Nevertheless, it was found that violent behaviors in prenatal cocaine-exposed children increased from ages 12 to 14 years for both males and females (Minnes et al., 2014). Additionally, alcohol exposure was found to increase externalized problems, including symptoms usually associated with conduct disorder (Easey et al., 2019; Oei, 2020). Prenatal methamphetamine exposure is positively correlated with increased behavioral problems and greater stress response during the neonatal period; reduction in early adversity and development in responsive home environments demonstrated lower risks for both internalizing and externalizing behaviors (Eze et al., 2016; Ross et al., 2015). Increased risk-taking behaviors are common in prenatal drug exposure children and adolescents due to the substances effects and impact on reward processing centers in the brain (Morie, Crowley, Mayes, & Potenza, 2019).

Executive Functioning. Executive functioning is often impacted and revolves around altered cognitive processes including planning, impulsivity, decision making, and problem solving. Poor inhibitory control is observed in both cocaine and methamphetamine-exposed children, further increasing the risk for impaired executive functioning (Richardson et al., 2019; Eze et al., 2016). Inhibitory control deficits in drug-exposed children suggest individuals experience low arousal levels because of decreased stimulation sensitivity levels, thereupon increasing risky behavior and sensation-seeking found present in children with PPE (Smith et al., 2015; Terrel et al., 2019). A broad range of regulatory problems, particularly high levels of attention difficulties, have been identified in children prenatally exposed to marijuana, methamphetamines, and opiates (El Marooun et al., 2011; Nygaard et al., 2016; Ross et al., 2015). Prenatal drug exposure negatively impacts general executive functioning domains in adolescents; however, Fisher et al. (2011) discovered executive functioning deficits were

predicted and dependent on evidence of behavioral dysregulation and early adversity. According to Lynch et al. (2015), executive functioning difficulties may not emerge until adolescence, emphasizing the need for evaluation based on specific profiles, rather than current symptomology.

Male participants exposed to cocaine in utero exhibited relatively worsened attention than their female counterparts, whereas prenatal marijuana exposure was associated with increased attention deficits in females. Females exposed to cocaine in utero exhibited greater deficits in working memory, organization, and self-motivation than non-exposed females (Carmody et al., 2011; Minnes et al., 2014). Children born to mothers who used either opioids or multiple substances exhibited greater regulatory and externalized behaviors than non-exposed children (Nygaard et al., 2016). However, Nygaard and colleagues (2016) did not find significant differences in regulatory problems between children born to mothers who solely used opiates and children whose mothers used multiple drugs. This is important to consider when attempting to build a neurobehavioral profile for PPE in which it may be difficult to identify and distinguish symptoms from their respective drug exposures.

Adaptive Functioning. Adaptive functioning revolves around an individual's necessary skills for everyday living. A disproportionate amount of literature focuses on adverse outcomes concerning cognitive and behavioral consequences of prenatal substance exposure. Limited studies exist on the effects of in-utero drug exposure on an individual's adaptive functioning. Studies that do, focused primarily on prenatal alcohol exposure (PAE). Existing research revealed adaptive deficits for both in utero alcohol and tobacco exposure in both children and adults. One study found no significant associations between prenatal cocaine, opiate, or marijuana exposure around adaptive functioning in young adults and only low to moderate effect

for alcohol exposure. (Forman et al., 2017; Ware et al., 2012). Ase et al. (2012), used the Vineland Adaptive Behavior Scales (VABS) and found adaptive functioning, with particular deficits in communication, daily living, and socialization, to be significantly worse in prenatal alcohol exposed children when compared to IQ-matched, typically developed peers. Prenatal cocaine exposure led to specific language impairments, which persisted into adolescence (Bandstra et al., 2010). Language deficits in these children were linked to deficits in overall adaptive social skills due to the children's increased difficulties in developing and fostering quality friendships and relational skills.

Fetal Alcohol Spectrum Disorders

Alcohol is the second most used drug in pregnancy, after tobacco, and the most extensively studied on its short-term and long-term cognitive and neurobehavioral effects (Forman, 2017). Alcohol effects vary widely depending on exposure quantity, gestational period, and genetics; however, the most common diagnosis for prenatal alcohol exposure is fetal alcohol syndrome (FAS). FAS is the most common and severe diagnosis under fetal alcohol spectrum disorder (FASD) due to its extensive diagnostic criteria, including growth retardations, central nervous system impairments, and facial dysmorphia (Chasnoff et al., 2015). Effects range from impacted intellectual ability and executive functioning to learning, behavioral, and adaptive deficits (Ase et al., 2012; Nash et al., 2011). Assuming children do not meet the criteria for a full FAS diagnosis, prenatal alcohol syndrome (pFAS) has still been found to lower social functioning and perspective-taking, heightened internalized and externalizing behaviors, and impact social cues processing (Khoury et al, 2018; Stevens et al., 2017). Those with PAE experience more adverse effects, including a higher correlation for low SES and limited access to health services. PAE individuals, without physical identifiers, were particularly at risk because

they were less likely to be diagnosed early and receive appropriate services (Lynch et al., 2015). Of note, most studies used participants referred to official FASD diagnostic clinics highlighting difficulties for many individuals to access diagnostic services, especially without physical identifiers or behaviors that present as other diagnosis. Accordingly, it becomes imperative to begin to shift to more behavioral and adaptive dysfunction in youth to better identify and treat PPE groups.

Attention Deficit Hyperactivity Disorder

Nonetheless, detecting in utero polysubstance exposure, let alone a single drug effect, may be difficult due to varying symptoms, especially when dysmorphic features are absent, substance history unknown, and existing research on drug interactions limited. One sample found approximately 80% of its children, eventually diagnosed with FASD, had a missed diagnosis and roughly 8% had a misdiagnosis (Chasnoff, et al., 2015). Attention deficit hyperactivity disorder (ADHD) was the most common referral diagnosis, which supports ongoing studies that reported 40-75% of children with FASD were also diagnosed with ADHD. (Rasmussen et al., 2010; Chasnoff et al., 2010). In addition, prenatal exposure to tobacco produces neural changes, including reduced the agenesis of the corpus callosum activity, comparable to changes found in those diagnosed with ADHD (Holz et al., 2014).

ADHD is the most commonly diagnosed comorbid condition in America, with a prevalence rate of 5% globally in school-age children (Parker et al., 2013). ADHD is a neurodevelopmental disorder characterized by varying symptoms of inattention, impulsivity, and hyperactivity beyond typical child development (Parekh, 2017). Symptoms are comparable to the distractibility, attention, and executive functioning deficits found in various PPE samples. ADHD is frequently diagnosed during early childhood due to atypical behavioral features and

executive functioning that become most prominent during early development. The American Academy of Pediatrics recommends parent training in behavior management as the first line of treatment before medication (Wolraich et al., 2019). Behavioral interventions include skills training, parent training, group therapy, psychoeducational programs, CBT, and classroom management. Yet, the most common line of treatment for social problems and other ADHD symptoms is combination of psychostimulants and behavioral therapy (Felt et al., 2014). Methylphenidate (MPH) and dexamphetamine (DEX) are the two most frequently administered stimulant medications, both of which have been proven effective in treating core ADHD symptoms, with MPH demonstrating a slight advantage over DEX (Efron et al., 1997). Amphetamines, including Adderall, are also often prescribed (O'Malley & Storoz, 2003).

ADHD Treatments Outcomes on In Utero Substance Exposure

On the other hand, psychostimulants have negative consequences on PPE groups, including desensitization and behavioral responsivity that increase the risk for substance addiction (Migliorini et al., 2015; Uban et al., 2015). There is also conflicting data on the effects of common psychostimulant ADHD medications on children with FASD. Less than 50% of an FASD sample responded negatively to methylphenidate, suggesting dextroamphetamine as a better first-line psychostimulant treatment for ADHD symptoms in FASD samples (O'Malley & Storoz, 2003). Yet, while Adderall was also found to be effective in children with FASD who displayed ADHD symptoms, other studies did not find preferential stimulant treatment between either, and instead found inattention in FASD to be less responsive to overall ADHD medication (Doig et al., 2008). One study found ADHD medication was able to improve hyperactive symptoms for children exposed to alcohol, in utero (PAE), but not attention and inhibitory deficits (Hagan et al., 2016). Conversely, other findings suggested overall stimulant interventions

were less effective in targeting social skills and other deficits in FASD children than neuroleptics (Koren, 2015; Mela et al., 2018). Methylphenidate and other psychostimulants often prescribed for ADHD are less effective or produce poorer outcomes in FASD samples (Hoffman, 2017; Kodituwakku & Kodituwakku, 2011; Koren, 2015).

ADHD versus Prenatal Polysubstance Exposure

Discrepancy in responses to psychotropic medication signifies inherent symptomology differences, indicating neurochemistry distinctions between non-exposed ADHD and PPE children groups. Furthermore, while particular ADHD interventions may treat specific or similar symptoms in prenatal drug exposure, many underlying symptoms are, in turn, missed (Ozsarfati & Koren, 2015). For example, though an estimated 73% of children with FASD also met criteria for ADHD (Doig, et al., 2008), there are fundamental differences and varied symptoms that are often overlooked and suggest a distinct, neurobehavioral profile for PPE groups. Recent follow-up studies found an association between PPE groups and deficits in language, attention, cognitive performance, and delinquent behavior in adolescence (Ase et al., 2012).

Exposed individuals yielded greater deficits in fluid reasoning than non-exposed ADHD individuals (Seitz, 2019). PAE children and non-exposed ADHD samples both exhibited greater externalizing and behavioral problems related to non-exposed ADHD children (Sandtory et al., 2018; Raldiris et al., 2018). Additionally, the PAE group exhibited greater aggressive behaviors and atypicality than ADHD children, while the comorbid ADHD and PAE group displayed significantly more hyperactivity and withdrawal (Raldiris et al., 2018). Though both ADHD and PAE populations exhibited cognitive impairments, deficits in verbal comprehension and perceptual reasoning were greater for the alcohol-exposed samples (Glass et al., 2013). These discrepancies indicate distinct consequences of FASD that, while possibly exacerbated by a

comorbid ADHD diagnosis, are behaviorally independent. Established executive and adaptive functioning impairments found in FASD samples may account for behavioral difficulties exhibited through social problem solving, decreased response inhibition, and difficulty identifying mental states and facial expressions of others (Mattson et al., 2019). Increased aggression associated with PPE can be distinctively explained by increased cortisol levels, which inhibit emotional and impulse control needed to appropriately regulate behaviors (Buckingham-Howes et al., 2016). Children with FASD have higher rates of social and behavioral problems and deal with overstimulation in comparison to ADHD children, while non-exposed ADHD individuals were more likely to struggle with focus and sustained attention (Hagan et al., 2016).

Furthermore, evidence indicates the substantial advantage of specialized interventions for youth with in utero polysubstance exposure. A targeted self-regulation intervention focusing on emotional sensitization and recognition, behavioral regulation, and social problem-solving skills for children with FASD yielded a positive change in critical brain regions involving the targeted deficits (Nash et al., 2017). Interventions that specifically target deficits in quantity systems for PAE children produced greater results than general math accommodations ordinarily provided in schools (Jacobson et al., 2011). Due to risk factors and long-term implications associated with PPE, it is imperative to focus on identifying and providing access to appropriate social, education, and medical services (Lambert et al., 2013; Oei et al., 2018; Paley & O'Connor, 2011). In utero drug exposure including tobacco, alcohol, and opiates produce language deficits unique to prenatal drug exposures can be treated by language and literacy training (Paley & O'Connor, 2011). Individualized treatments that target specific PAE repercussions include Family Moving Forward (FMF), Cognitive Control Therapy (CCT), and Animal Assisted Therapy (AAT), all of which focus on specific alcohol exposure features including parental self-

efficacy, positive parent-child relationships, and processing information (Paley & O'Connor, 2011). Further, while stimulant medication may improve the functioning of youth with ADHD, youth with PPE often respond to stimulants with increased levels of emotional and behavioral dysregulation, irritability, and decreased inhibition control (Hoffman, 2017). Unlike non-exposed ADHD samples, children who are exposed often experience additional environmental risk factors that can be mitigated by specific interventions and resources.

Neuropsychological-based studies suggest similar behavioral deficits between PPE and ADHD groups may be based on separate cognitive events. Previous studies conducted on verbal learning and memory tasks found children with prenatal alcohol exposure performed worse on encoding new information, whereas children with ADHD had difficulty retrieving information (Crocker et al., 2011). Both groups displayed similar deficits in verbal and memory tasks; however, brain imaging analyses found similar behaviors in spatial working memory tasks required different cognitive effort between ADHD and alcohol exposed children (Malisza et al., 2012). Though both groups demonstrate significant executive functioning deficits, with prominent abnormalities found in both the frontal lobes and caudate nucleus, studies have found those with prenatal alcohol exposure groups demonstrated additional impairments in temporal, parietal, and corpus callosum regions (Vaurio et al., 2008). Findings regarding patterns of adaptive deficits in PPE groups indicated arrested development while non-exposed ADHD samples demonstrated delayed adaptive functioning (Forman, 2017; Mattson et al., 2019; Ware et al., 2012), only increasing support for a specific developmental neurotoxicity profile for PPE (Brinker et al., 2019; Terrel et al., 2019).

Purpose of this Study

Considering the likelihood to be treated for ADHD symptoms and the importance of specifically cultivated interventions, it becomes imperative to continue to build a more extensive neurobehavioral profile to not only identify children with PPE, but to better distinguish them from children with similar behavioral symptoms like ADHD. In utero exposed children may be genetically predisposed to ADHD (Sandtorv et al., 2018) and demonstrate higher scores associated with ADHD symptoms including core deficits in inattention, hyperactivity, and impaired adaptive functioning (Santorv et al., 2018; Infante et al., 2015). However, there is evidence of unique variations and vulnerability in fetal brain structures and neurobehavioral disinhibitions (Holz et al., 2014).

Given underlying disparities in behavioral deficits, the current study aims to seek diagnostic clarity by exploring behavioral differences between children with PPE and those with non-exposed ADHD diagnoses. This study will concentrate on ADHD and PPE as the two main dependent variables. Independent predictors will include clinical and composite scales from the Behavioral Assessment System for Children- Third Edition (BASC-3), including adaptive measures. There are currently confounding findings on what is the most appropriate measure for prenatal alcohol exposure, let alone general PPE groups, with psychologists, teachers, and pediatricians all demonstrating significant positive identifiers in early identification. However, data indicate that although maternal self-report is the most common method to identify prenatal drug exposure in clinical settings, pediatricians do not routinely screen patients for PAE (Bax et al., 2015). Child Behavior Checklist parent forms and California Verbal Learning Test-Children's Version (CVLT-C) were previously used to identify differences between the two groups, but the studies did not focus on improving identification. Goh and colleagues (2016)

developed a decision tree model and established approximately an 80% accuracy in distinguishing non-exposed samples from prenatal alcohol exposure based on Vineland Adaptive Behavior Scales-Second Edition (VAB-II), Child Behavior Checklist (CBCL), and IQ testing. However, given difficulty in accessing care, this study hopes to predict group diagnoses based on a single behavioral measure to improve access to services and identification. My hypotheses for this study are as follows:

H1: Adaptive functioning composite scales will best predict group affiliation, and the PPE group will exhibit lower adaptive functioning scores in comparison to the ADHD group.

H2: Both in utero polysubstance exposure and ADHD profiles will correlate significantly with increased externalizing behaviors, but PPE children will also exhibit significant internalizing behaviors.

H3: Parent/Guardian will yield higher predictability for the PPE group than teacher reports

Chapter 2

Methods

Participants

Data from 27 participants were gathered from an archived database from a psychological service group for rural schools. Informed consent was previously obtained from participants and their guardians to conduct comprehensive psychological assessments for IEP eligibility and other school-based accommodations for which the participants were initially referred for. Guardians were informed data gathered may be used for research purposes, with all identifiable data remaining confidential. Demographic information included age, gender, and ethnicity, all which were gathered from participant files (See Table 1).

Materials

Behavioral Assessment System for Children, Third Edition (BASC-3)

The BASC (Reynolds & Kamphaus, 2015) is a norm-referenced measure for youth ages 2-21 years that utilizes multiple respondents to test for clinically significant emotional and behavioral concerns which include externalizing, internalizing, and adaptive functioning measures (Reynolds & Kamphaus, 2015). This study utilized both the Parent Rating Scales (PRS) and the Teacher Rating Scales (TRS) which each take 10-20 minutes to administer. Scores are derived from comparing the individual's scores to those of age-matched peers. Both the PRS and TRS include questions with a 4 point Likert scale by responding to answers with N for *Never,* S for *Sometimes,* O for *Often, or* A for *Almost always*. The use of multiple respondents in

the BASC allows for the comparison of a child's behavior across domains and perspectives and reduces the risk of misclassification (Stone et al., 2013).

Table 1

Demographics

Item	Category	Frequency	Percentage (%)
Ethnicity	European American	19	70.4
	Latino/Latina	4	14.8
	Biracial/ Multiple Ethnicities	4	14.8
Gender	Male	23	85.2
	Female	4	14.8
Age	3-6	1	3.7
	7-9	6	22.2
	10-12	10	37.0
	13-15	6	22.2
	16-18	4	14.8

The BASC contains five composite scales: Externalizing Problems, Internalizing Problems, Behavioral Symptoms Index, School Problems, and Adaptive Skills. Additional clinical and adaptive scales are scaled and expressed through T-scores and percentiles. Parent-report measurement reports indicate good interrater reliability between .89-97 on composite scores and .76-.93 on clinical and adaptive scales. Teacher-report scales composite scores also

show good interrater reliability ranging from .89-.98 and clinical and adaptive scale interrater reliability between .77-.96. For the purpose of this study, the data were analyzed on the individual clinical scales and the four composite scales: Externalizing Problems, Internalizing Problems, Behavioral Symptoms Index, and Adaptive Skills. The Externalizing Problems Composite score include aggression, hyperactivity, and conduct problems. The composite for Internalizing Problems includes somatization, anxiety, and depression. The Behavioral Symptoms Index includes ratings for hyperactivity, aggression, depression, attention problems, atypicality, and withdrawals. Finally, the Adaptive Skills Composite measures positive overall adjustment and pro-social behaviors, including adaptability, social skills, leadership skills, study skills, functional communication skills, and activities of daily living.

Procedure

Using the archived database, participant files were screened and assigned to one of the two diagnostic groups: prenatal polysubstance exposure (PPE) and ADHD based on report diagnoses. Diagnostic evaluations were previously completed through comprehensive batteries which consisted of a combination of developmental questionnaires, cognitive and achievement tests, the Behavioral Assessment System for Children-Third Edition (Parent, Teacher, and Self-Reports), and other screeners to help inform diagnoses. All diagnoses/diagnostic impressions were verified and signed off by the supervising licensed psychologist. Those who met criteria for ADHD (through cognitive and behavioral evaluations) and did not have reported PPE were put into the ADHD group. The PPE group was determined by parent/guardian reports of in utero substance exposure (included alcohol, tobacco, methamphetamines, and cocaine), and excluded any participants with a co-occurring ADHD diagnosis. Both groups included participants with other additional psychiatric comorbidity disorders, including mood and anxiety disorders, in

order for the participant pool to reflect real world prevalence of both ADHD and PPE psychiatric comorbidity rates (Pehlivanidis et al., 2020).

Chapter 3

Results

An independent sample *t*-test was conducted to compare mean subscale and composite scores between PPE and ADHD groups, as not all composite scores were included in the logistic regression. Parent rater score means differed across the scales between groups, with notable significance found in overall Adaptive Skills $t(24) = -3.49$, $p < .01$, Behavioral Symptoms Index $t(24)$ 2.10, $p = .05$, and Externalizing Problems $t(24)$ 1.94, $p = .07$. The PPE group scored significantly higher than the ADHD group in multiple scales (see Tables 2 and 3), particularly in all adaptive and behavioral symptom composite scores. Although, no significant difference was found for the overall internalized problem composite score $t(24)$ .87, $p = .40$, the depression clinical scale was significantly different $t(24)$ 2.19, $p = .04$, with the PPE group displaying higher depression scores($M = 62.31$, $SD = 7.97$) than the ADHD group ($M = 53.69$, $SD = 11.75$). It should be noted that parent report scores for the PPE group displayed higher clinical scores than the ADHD group in all scales, except in attention problems (PPE: $M = 66.15$, $SD = 11.43$; ADHD: $M = 67.38$, SD 7.87) $t(24$ -.32, $p = .75$; see Table 1.) No significant difference was found between any clinical and composite scores for teacher reports (see Table 3).

A logistic regression analysis was performed to determine if any independent predictors (BASC-3 composite and clinical scales) can statistically predict the two diagnostic groups: (a) AHDH) and (b) Prenatal Polysubstance Exposed. Two logistic regressions were conducted independently for the parent (PRS) and teacher (TRS) raters using constant predictor variables

Table 2

BASC-3 Scale Descriptive Data and Comparisons for PPE and ADHD in Parent Reports

	PPE			ADHD			Independent *t*-test		
BASC-3 Composite & Clinical Scales	*N*	*M*	*SD*	*N*	*M*	*SD*	*t*	df	Sig. (*p*)
Hyperactivity	13	68.62	20.42	13	64.69	15.69	0.55	24	0.59
Aggression	13	70.31	19.21	13	53.69	9.84	2.78	17.9	0.01
Conduct Problems	13	70.77	17.58	12	55.17	15.4	2.35	23	0.03
Externalizing Problems	*13*	72.23	*20.71*	*13*	*59.00*	*13.34*	*1.94*	*24*	*0.07*
Anxiety	13	55.54	11.24	13	55.15	12.16	0.08	24	0.93
Depression	13	62.31	7.97	13	53.69	11.75	2.19	24	0.04
Somatization	13	49.08	9.62	13	48.15	10.19	0.24	24	0.81
Internalizing Problems	*13*	56.38	*8.76*	*13*	*52.85*	*11.88*	*0.87*	*24*	*0.40*
Attention Problems	13	66.15	11.43	13	67.38	7.87	-0.32	24	0.75
Atypicality	13	61.85	17.66	13	52.38	11.33	1.63	24	0.12
Withdrawal	13	62.77	14.25	13	49.92	8.51	2.79	24	0.01
Behavioral Symptoms Index	*13*	69.31	*13.58*	*13*	*59.00*	*11.35*	*2.10*	*24*	*0.05*
Adaptability	13	38.69	9.02	12	46.23	8.47	-2.20	24	0.04
Social Skills	13	37.85	9.85	13	49.69	8.42	-3.30	24	0.00
Leadership	12	36.54	8.34	13	43.25	9.63	-1.86	23	0.08
Functional Communication	13	34.31	8.03	13	43.92	9.38	-2.81	24	0.01
Activities of Daily Living	13	35.17	7.96	13	44.15	6.84	-3.03	23	0.01
Adaptive Skills	*13*	34.77	*8.26*	*13*	*44.92*	*6.47*	*-3.49*	*24*	*0.00*

Note. Standard scores are presented with a mean of 100 and a standard deviation of 10. *Italics indicate composite scales.*

which include: (a) Hyperactivity, (b) Aggression, (c) Conduct Problems, (d) Anxiety, (e) Depression, (f) Somatization, (g) Attention, (h) Atypicality, (i) Withdrawal, and (j) Adaptive Skills. Research indicates a distinct adaptive deficit for PPE children not equally found in

Table 3

BASC-3 Scale Descriptive Data and Comparisons for PPE and ADHD in Teacher Reports

	PPE			ADHD			Independent *t*-test		
BASC-3 Composite & Clinical Scales	*N*	*M*	*SD*	*N*	*M*	*SD*	*t*	df	Sig. (*p*)
Hyperactivity	11	65.27	17.80	14	61.29	15.41	0.60	23	0.55
Aggression	11	63.18	17.20	14	61.21	13.91	0.32	23	0.75
Conduct Problems	11	63.27	17.90	13	65.31	16.51	-0.29	22	0.78
Externalizing Problems	*11*	*65.00*	*18.20*	*14*	*64.14*	*15.95*	*0.13*	*23*	*0.90*
Anxiety	11	56.82	16.20	14	59.43	15.72	-0.41	23	0.69
Depression	11	65.73	15.90	14	62.93	16.36	0.43	23	0.67
Somatization	11	56.09	18.90	14	51.93	12.67	0.66	23	0.52
Internalizing Problems	*11*	*62.91*	*18.14*	*14*	*60.86*	*15.45*	*0.31*	*23*	*0.76*
Attention Problems	11	66.45	9.17	14	64.57	9.87	0.49	23	0.63
Learning Problems	11	68.73	12.20	14	68.43	13.30	0.06	23	0.95
School Problems	*11*	*68.82*	*10.74*	*13*	*67.92*	*11.92*	*0.19*	*22*	*0.85*
Atypicality	11	64.91	15.70	14	65.29	15.88	-0.10	23	0.95
Withdrawal	11	61.18	11.15	14	64.57	15.11	-0.62	23	0.54
Behavioral Symptom Index	*11*	*68.55*	*14.71*	*14*	*67.71*	*13.13*	*0.15*	*23*	*0.88*
Adaptability	11	34.64	12.63	14	35.43	10.80	-.17	23	0.87
Social Skills	11	37.73	5.04	14	40.21	10.56	-.78	19.5	0.45
Leadership	11	37.27	4.61	13	35.38	5.12	0.94	22	0.36
Study Skills	11	35.36	8.24	13	34.46	8.19	0.27	22	0.79
Functional Communication	11	36.55	7.71	14	34.50	10.70	.53	23	0.60
Adaptive Skills	*11*	*34.73*	*6.83*	*14*	*34.36*	*8.20*	*.12*	*23*	*0.91*

Note. Standard scores are presented with a mean of 100 and a standard deviation of 10. *Italics indicate composite scales.*

children with ADHD; consequently, the adaptive skills composite was additionally included as a separate predictor variable because it yielded the greatest significant predictor results. All appropriate assumptions were met.

Parent Rating Scale

A binary logistic regression analysis was conducted to determine if BASC-3 clinical scales and composite scores can predict the diagnosis between ADHD and PPE children samples. As seen in Table 3, overall accuracy rates across ability to identify the PPE sample between the two groups was greater than chance (Chi2 (10) = 34.62, $p < .001$) for parent reports. This prediction was also supported by the magnitude of sensitivity (100%) and its specificity (100%), indicating parents were able to not only accurately classify the PPE group, but also correctly discriminate them from the ADHD sample. Chiefly, the model explained 100% (Nagelkerke R2) of the variance, and parent raters were able to predict the PPE group from the ADHD group every time (100%). Each predictor variable went into the logistic equation and collectively yielded a significant predictor value. However, no independent predictor variable was found to significantly predict group membership (P = .100, see Tables 4 and 5).

Due to the small sample size, the Wald test was deemed not an appropriate predictor analysis because of the standard error's (SE) sensitivity to sample size. Consequently, the odds ratio (OR) was used instead because of its nonparametric standardized metric, resulting in decreased sensitivity to sample size and more appropriate analysis of independent statistical significance. According to parent raters, the PPE group were 6.40 times more likely to score significantly higher in the Hyperactivity scale, 5.44 times more likely to exhibit higher anxiety scores, and 4.53 times more likely to exhibit higher somatization scores than the ADHD group.

Table 4

Predicted Accuracy Measures for PPE Group Membership

Accuracy Measures (%)	*Parent Reports*	*Teacher Report*
Overall Accuracy	100.0	75.0
Sensitivity	100.0	63.4
Specificity	100.0	84.6

Note. The cutoff set at .500.

Though no independent scale was predictive of PPE, results suggest higher clinical adaptive skills increased the likelihood of PPE diagnosis 14.58, respectively (see Table 5). Due to limited sample size odds ratio statistics should be interpreted with caution.

Teacher Rating Scale

The teacher rating model was not statistically significantly, with accuracy rates no more significant than chance alone $X^2(11) = 10.45$, $p = .49$ for teacher reports. Teachers were only able to correctly identify 64% of the PPE cases, with better ability to recognize ADHD from PPE (85%). The model explained only 42% of the variance (Nagelkerke R^2) with BASC-3 teacher reports overall predictive value at 75% of PPE cases (Table 4). Teacher raters' independent predictive variables did not yield any significance in predicting group diagnosis nor demonstrated significant in identifying one group over the other (See Table 6).

Table 5

Logistic Regression Analysis: Parent Rating Scale

	B	SE	Exp(β)	Wald	Sig. (*p*)
(Constant)	-101.666	92892.73	0.00	0.00	1.00
Hyperactivity	1.86	.865.31	6.40	0.00	1.00
Aggression	-2.04	1127.14	.13	0.00	1.00
Conduct Problems	-4.31	567.60	.01	0.00	1.00
Anxiety	1.70	551.37	5.44	0.00	1.00
Depression	-4.14	836.62	.02	0.00	1.00
Somatization	1.51	422.80	4.53	0.00	1.00
Attention Problems	8.62	1249.22	5556.15	0.00	1.00
Atypicality	-2.01	364.70	.13	0.00	1.00
Withdrawal	-1.60	389.83	.20	0.00	1.00
Adaptive Skills	2.69	1028.68	14.58	0.00	1.00

Note. SE = Standard Error. Adaptive Skills composite factors in the following clinical scales: Adaptability Social Skills, Leadership, Functional Communication, and Activities of Daily Living. Exp (β) represents odds ratio. Confidence Interval = (CI-95%)

Table 6

Logistic Regression Analysis: Teacher Rating Scale

	B	SE	Exp(β)	Wald	Sig. (*p*)
(Constant)	11.493	14.10	98026.037	.67	.42
Hyperactivity	-.13	.11	.88	1.34	.24
Aggression	-.14	.13	.87	1.13	.29
Conduct Problems	.24	.16	1.27	2.21	.14
Anxiety	.13	.11	1.14	1.31	.25
Depression	-.04	.10	.96	.14	.71
Somatization	-10	.08	.90	1.53	.22
Attention Problems	-.13	.17	.88	.55	.49
Learning Problems	.04	.08	1.05	.31	.58
Atypicality	.02	.055	1.02	.13	.72
Withdrawal	-.04	.09	.96	.20	.65
Adaptive Skills	-.10	14.10	.91	.33	.57

Note. SE = Standard Error. TRS Adaptive Skills composite factors in the following clinical scales: Adaptability Social Skills, Leadership, Functional Communication, and Study Skills. Exp (β) represents odds ratio. Confidence Interval = (CI-95%).

Chapter 4

Discussion

Previous research has revealed pervasive polysubstance use during pregnancy (Centers for Disease Control and Prevention, 2020; Forray & Foster, 2015), with data revealing extensive and widespread neurological, cognitive, and behavioral deficits found in both adults and children with a history of in utero drug exposure (Behnke et al., 2013; England et al., 2020; Forray, 2016). Despite similar behavioral symptoms observed between ADHD and PPE groups, emerging data reveals a specific neurological profile for prenatal drug exposure that is cognitively and neurologically distinct, signaling different mechanisms and the need for specialized interventions (Ware et al., 2014; Greenbaum et al., 2009). To date, no previous studies had examined the behavioral differences between ADHD and prenatal polysubstance exposure.

Discussion of Hypotheses

Hypothesis 1

We hypothesized PPE children would exhibit greater adaptive functioning deficits than non-exposed ADHD children. Results only partially confirmed this hypothesis. Parents found children with PPE exhibited significantly worse adaptive functioning scores than those with ADHD in all adaptive scales, including social skills, adaptability, leadership, functional communication, and activities of daily living. However, no independent variable predicted group diagnosis. Though the Adaptive Skills composite score was unable to distinguish between the two groups in either parent or teacher reports, it boasted a large effect size, indicating those

exposed to substances in utero are more likely to exhibit greater adaptive deficits than children with ADHD.

Previous studies reveal mixed outcomes concerning diagnosis effects on adaptive functioning, with some studies detecting similar adaptive deficits between prenatal alcohol exposure and ADHD (Taylor & Enns, 2019; Ware et al., 2012), while others reveal FASD individuals demonstrate significantly lower adaptive scores than non-exposed ADHD samples (Peadon & Elliot, 2010). Interestingly, multiple studies support adaptive deficits findings in ADHD samples but indicate a developmental delay in ADHD samples vs. arrested development in FAS samples. These findings suggest existing adaptive deficits may worsen as PPE children age, while children with ADHD who exhibit adaptive deficits may transition out these deficits as they grow (Crocker et al., 2009; Whaley et al., 2001). Teachers reported similar adaptive deficits in both groups, suggesting it may be more difficult to differentiate adaptive deficits between groups in the classroom, whereas adaptive deficits may be more obvious to detect and differentiate at home, in the absence of comparison groups. Parent rating scale findings on differences between group memberships differed from a previous study where BASC-2 parent measures were used to compare ADHD and FASD groups and found no significance in Adaptive Skills; these discrepant scores may be due to natural variations in subjective measures, as well as possible group differences in PPE vs. FASD diagnosis. Moreover, the BASC-3 parent rating scale's 100% accuracy suggests overall predictive measures are equally important in improving identification as single significant differences that may be more sensitive to various factors (Raldiris et al., 2018).

Hypothesis 2

Results partially confirmed this hypothesis. According to both parents and teachers, the PPE group displayed significant externalizing problems, notably increased aggression and conduct problems, with parents finding that the PPE group demonstrated more substantial externalizing problems than the ADHD group. While parents did not find any externalizing behaviors in the ADHD sample, teachers found similar moderate externalizing problems among both groups. Of note, teachers could not differentiate between the two groups in any domains, suggesting teachers may recognize behavioral deficits in comparison to non-exposed, typically developed children, but will have overall greater difficulty distinguishing externalizing behavioral differences, in the classroom, between groups who exhibit general externalized behavior deficits. Results support existing data regarding in-utero substance exposure and its effects on externalizing behaviors (Easey et al., 2019). Children with in utero drug exposures specifically display increased aggression and conduct disorders (Nygaard et al., 2016) which corroborates our findings; however, there are conflicting data on rater reports, with some studies finding teachers are better able to identify externalizing problems than mothers (Raldiris et al., 2018; Stone et al., 2013). Discrepancies around rater efficacy may be due to the reason for referral and awareness of diagnosis, which affects the perception of presenting behaviors. Parents may be better able to focus on specific aspects of externalized behaviors versus teachers who may not have the capacity to filter, and as a result, may make more generalized observations.

Neither parent nor teacher reports indicated significant differences in internalized behaviors between PPE and ADHD group. Teachers reported similar at-risk behaviors for both groups, and parents did not report any significant internalizing problems, except elevated depression in the PPE group. Present findings are consistent with previous research that find

teachers may be better at identifying internalizing problems than parents (Raldiris et al., 2018). Depression and higher odds of having anxiety for PPE group suggest it may not necessarily be that these children do not display internalizing problems, but rather, they may be more difficult to identify and distinguish by teachers and parents alike. However, it is important to note that the parents found increased withdrawal in PPE children, not ADHD, which is not filtered into the Internalizing Problems composite score. Detected withdrawal deficits align with previous research which suggests PPE can lead to withdrawal symptoms, and for which, parents may be better able to identify at home than generalized internalized behaviors when compared to teachers (Richardson et al., 2019).

Hypothesis 3

Results confirmed this hypothesis: Parents did yield higher predictability for PPE diagnosis than teacher reports, with parents accurately identifying and differentiating children with prenatal polysubstance exposure from children with ADHD every time. Teacher raters were able to correctly identify the PPE group from the ADHD group with 75% accuracy. However, results indicated teacher reports were not better in identifying group membership than chance. These results are inconsistent with findings that identify teachers are better at identifying externalized behaviors in children than parents, in addition to being able to contribute to better identification compared to parent reports (Greenbaum et al., 2009; Taylor & Enns, 2019).

Implications

The majority of existing studies have analyzed the differences between ADHD and FASD groups to improve differential identification and early interventions. There is a lack of literature on the impacts of prenatal polysubstance exposure, despite evidence of significant abnormalities from multiple drug interactions when compared to single drug exposure and

similar overreaching behavioral ramifications found across various drug exposures (Lynch, 2015). Subsequently, this study not only shifted focus from prenatal single drug effects to PPE groups in response to the prevalence of prenatal polysubstance use but was also the first to evaluate a single behavioral screener to improve accessibility and identification. The BASC-3 parent reports identified particular deficits for externalizing problems, increased withdrawal, and significantly higher adaptive skills deficits in the PPE sample than for kids with ADHD. Though no single BASC-3 scale predicted group membership in either parent or teacher reports, children with clinically elevated adaptive skills scores on the parent report are more likely to be diagnosed with PPE, which aligns with previous studies and helps differentiate the two groups. The BASC-3 includes both behavioral and adaptive functioning domains, which may allow for a more extensive evaluation within one behavioral measure.

Teachers reported increased internalized behaviors in both groups. However, unlike parent reports, teachers were unable to differentiate between the two groups when behaviors began to dissociate from the typically developing peers. Considering mixed findings on the benefits of using teachers to better identify deficits in group membership, the importance of differentiating diagnoses, not just identifying symptoms, should be taken into account when pursuing improved identification. The BASC-3 parent forms exhibited 100% accuracy in predicting PPE. Given the evidence of a distinct neurobehavioral profile for drug-exposed populations, these results may help evaluators appropriately diagnose and seek suitable interventions that targeted the reported deficits.

Goh et al. (2016) built an expansive decision tree based on multiple cognitive, behavioral, and adaptive measures that accurately predicted FAS from prenatal alcohol exposure and non-exposed samples approximately 80% of the time. Other studies comparing ADHD vs. prenatal

drug exposure gathered their clinical samples from clinics specializing in FASD diagnoses. In contrast, this study only applied one behavioral health screener, allowing for more convenient and accessible evaluation with equally high accuracy rates that may be implemented in school settings and non-specialized clinics. The BASC-3 should never be used as a sole diagnostic tool; however, if there is suspected ADHD, behavioral and executing functioning deficits, with possible in utero polysubstance exposure, the BASC-3 parent reports can be used in schools and clinics alike to assist in identifying group membership. The BASC-3 includes both behavioral and adaptive functioning domains. Furthermore, results add to the expanding body of literature on PPE profiles.

Limitations and Future Studies

In light of the small sample size, current results should be interpreted with caution. Gender differences were not analyzed within and between groups due to the limited sample pool. The small sample size was partially due to the archived database, which collected its participants from a rural, lower SES environment. Research demonstrates varying impacts on aggression, executive, and adaptive functioning based on gender, with additional studies indicating the potential effects of lower SES on increased risky behaviors in males (Lynch et al., 2015). In addition, neither a control group nor non-exposed samples were included in the analysis. As such, our sample and respective results may not be representative of more urban settings and would benefit from a more diverse pool in future replication studies. A larger population and control group would reduce standard error size and may reveal individualized predictor scales. The parent rating attention scale generated an unreliable odds ratio statistic, and as a result, should be interpreted with caution, a larger sample size may reduce standard error.

Future studies should look into the effects diagnoses may have on presentation and identification. Given mixed reports on teacher and parent abilities to identify significant differences between PPE and ADHD groups, future studies may want to continue exploring differences between PPE and ADHD groups using larger samples, given the fact parents' perspectives can differ depending on SES, adopted status, and understanding of current symptoms. In addition, the majority of previous studies have agreed to the idea of co-occurring ADHD diagnosis in children with prenatal drug exposure. However, given the repeated distinction and data found between ADHD and PPE samples, research should inquire around the question if PPE samples can receive a diagnosis of ADHD, even if they behaviorally meet criteria. This study revealed the BASC-3 parent measure as a viable assessment in differentiating ADHD from the PPE group to improve diagnoses and treatment. Although no single predictor was identified, the odds of being diagnosed with PPE increases with greater adaptive deficits, indicating the need for more studies on adaptive functioning and specialized interventions that can be rolled out on clinical and school-based levels. Prenatal polysubstance exposure increases the risk for behavioral deficits; hopefully more studies focus on general in utero drug exposures to decrease the risk of missing only more children to significant effects and misdiagnoses.

References

Alex, K., & Feldmann, R. (2012). Children and adolescents with fetal alcohol syndrome (FAS): better social and emotional integration after early diagnosis. *Klinische Padiatrie, 224*(2), 66–71. https://doi.org/10.1055/s-0031-1299682

Åse, F., Ilona, A., Mirjam, K., Pekka, S., Eugene, H. H., Sarah, M. N., & Marit, K. (2012). Adaptive behaviour in children and adolescents with fetal alcohol spectrum disorders: A comparison with specific learning disability and typical development. *European Child & Adolescent Psychiatry, 21*(4), 221-31. doi:http://dx.doi.org.georgefox.idm.oclc.org/10.1007/s00787-012-0256-y

Bandstra, E. S, Morrow, C. E, Accornero, V. H, Mansoor, E., Xue, L., & Anthony, J. C. (2010). Estimated effects of in utero cocaine exposure on language development through early adolescence. *Neurotoxicology and Teratology*, *33*(1), 25–35. https://doi.org/10.1016/j.ntt.2010.07.001

Bax, A. C., Geurts, C. D., & Balachova, T. N. (2015). Improving recognition of children affected by prenatal alcohol exposure: Detection of exposure in pediatric care. *Current Developmental Disorders Reports, 2*(3), 165–174. https://doi.org/10.1007/s40474-015-0057-3

Behnke, M., Smith, V. C., Committee on Substance Abuse, & Committee on Fetus and Newborn (2013). Prenatal substance abuse: Short- and long-term effects on the exposed fetus. *Pediatrics*, *131*(3), e1009–e1024. https://doi.org/10.1542/peds.2012-3931

Brinker, M. J., Cohen, J. G., Sharrette, J. A., & Hall, T. A. (2019). Neurocognitive and neurodevelopmental impact of prenatal methamphetamine exposure: A comparison study

of prenatally exposed children with nonexposed ADHD peers. *Applied Neuropsychology. Child, 8*(2), 132–139. https://doi.org/10.1080/21622965.2017.1401479

Buckingham-Howes, S., Mazza, D., Wang, Y., Granger, D. A, & Black, M. M. (2016). Prenatal drug exposure and adolescent cortisol reactivity: Association with behavioral concerns. *Journal of Developmental and Behavioral Pediatrics, 37*(7), 565-572.

Carmody D. P., Bennett, D. S., Lewis, M. (2011). The effects of prenatal cocaine exposure and gender on inhibitory control and attention. *Neurotoxicol Teratol, 33*, 61–68

Centers for Disease Control and Prevention (2020). Pregnancy: Polysubstance use in pregnancy. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. https://www.cdc.gov/pregnancy/polysubstance-use-in-pregnancy.html

Chasnoff, I. J., Wells, A. M., & King, L. (2015). Misdiagnosis and missed diagnoses in foster and adopted children with prenatal alcohol exposure. *Pediatrics*, *135*(2), 264–270. https://doi.org/10.1542/peds.2014-2171

Chasnoff, I. J., Wells, A. M., Telford, E., Schmidt, C., & Messer, G. (2010). Neurodevelopmental functioning in children with FAS, pFAS, and ARND. *Journal of Developmental and Behavioral Pediatrics JDBP*, *31*(3), 192–201. https://doi.org/10.1097/DBP.0b013e3181d5a4e2

Connor, S., Tan, K. Y., Pestell, C. F., & Fitzpatrick, J. P. (2020). The demographic and neurocognitive profile of clients diagnosed with fetal alcohol spectrum disorder in PATCHES Pediatrics Clinics across Western Australia and the Northern Territory. *Alcoholism, Clinical and Experimental Research, 44*(6), 1284–1291. https://doi.org/10.1111/acer.14345

Crocker, N., Vaurio, L., Riley, E. P., & Mattson, S. N. (2011). Comparison of verbal learning and memory in children with heavy prenatal alcohol exposure or attention-deficit/hyperactivity disorder. *Alcoholism, Clinical and Experimental Research*, *35*(6), 1114–1121. https://doi.org/10.1111/j.1530-0277.2011.01444.x

Crocker, N., Vaurio, L., Riley, E. P., & Mattson, S. N. (2009). Comparison of adaptive behavior in children with heavy prenatal alcohol exposure or attention-deficit/hyperactivity disorder. *Alcoholism, Clinical and Experimental Research, 33*(11), 2015–2023. https://doi.org/10.1111/j.1530-0277.2009.01040.x

Currie, B. A., Hoy, J., Legge, L., Temple, V. K., & Tahir, M. (2016). Adults with fetal alcohol spectrum disorder: Factors associated with positive outcomes and contact with the criminal justice system. *Journal of Population Therapeutics and Clinical Pharmacology = Journal de la Therapeutique des Populations et de la Pharmacologie Clinique, 23*(1), e37–e52.

Degenhardt, L., Dierker, L., Chiu, W. T., Medina-Mora, M. E., Neumark, Y., Sampson, N., Alonso, J., Angermeyer, M., Anthony, J. C., Bruffaerts, R., de Girolamo, G., de Graaf, R., Gureje, O., Karam, A. N., Kostyuchenko, S., Lee, S., Lépine, J. P., Levinson, D., Nakamura, Y., Posada-Villa, J., … Kessler, R. C. (2010). Evaluating the drug use "gateway" theory using cross-national data: consistency and associations of the order of initiation of drug use among participants in the WHO World Mental Health Surveys. *Drug and Alcohol Dependence*, *108*(1-2), 84–97. https://doi.org/10.1016/j.drugalcdep.2009.12.001

Doig, J., McLennan, J. D., & Gibbard, W. B. (2008). Medication effects on symptoms of attention-deficit/hyperactivity disorder in children with fetal alcohol spectrum disorder.

Journal of Child and Adolescent Psychopharmacology, 18(4), 365–371. https://doi.org/10.1089/cap.2007.0121

Easey, K. E., Dyer, M. L., Timpson, N. J., & Munafò, M. R. (2019). Prenatal alcohol exposure and offspring mental health: A systematic review. *Drug and Alcohol Dependence, 197,* 344–353. https://doi.org/10.1016/j.drugalcdep.2019.01.007

Efron, D., Jarman, F., & Barker, M. (1997). Side effects of methylphenidate and dexamphetamine in children with attention deficit hyperactivity disorder: A double-blind, crossover trial. *Pediatrics, 100*(4), 662–666. https://doi.org/10.1542/peds.100.4.662

El Marroun, H., Hudziak, J. J., Tiemeier, H., Creemers, H., Steegers, E. A., Jaddoe, V. W., Hofman, A., Verhulst, F. C., van den Brink, W., & Huizink, A. C. (2011). Intrauterine cannabis exposure leads to more aggressive behavior and attention problems in 18-month-old girls. Drug and alcohol dependence, 118(2-3), 470–474. https://doi.org/10.1016/j.drugalcdep.2011.03.004

England, L. J., Bennett, C., Denny, C. H., Honein, M. A., Gilboa, S. M., Kim, S. Y., Guy, G. P., Jr, Tran, E. L., Rose, C. E., Bohm, M. K., & Boyle, C. A. (2020). Alcohol use and co-use of other substances among pregnant females aged 12-44 years - United States, 2015-2018. MMWR. *Morbidity and Mortality Weekly Report, 69*(31), 1009–1014. https://doi.org/10.15585/mmwr.mm6931a1

Eze, N., Smith, L. M., LaGasse, L. L., Derauf, C., Newman, E., Arria, A., Huestis, M. A., Della Grotta, S. A., Dansereau, L. M., Neal, C., & Lester, B. M. (2016). School-aged outcomes following prenatal methamphetamine exposure: 7.5-Year follow-up from the infant development, environment, and lifestyle study. *The Journal of pediatrics, 170*, 34–8.e1. https://doi.org/10.1016/j.jpeds.2015.11.070

Felt, B. T., Biermann, B., Christner, J. G., Kochhar, P., & Harrison, R. V. (2014). Diagnosis and management of ADHD in children. *American Family Physician, 90*(7), 456–464.

Fisher, P. A., Lester, B. M., DeGarmo, D. S., Lagasse, L. L., Lin, H., Shankaran, S., Bada, H. S., Bauer, C. R., Hammond, J., Whitaker, T., & Higgins, R. (2011). The combined effects of prenatal drug exposure and early adversity on neurobehavioral disinhibition in childhood and adolescence. *Development and psychopathology*, *23*(3), 777–788. https://doi.org/10.1017/S0954579411000290

Forman, L. S., Liebschutz, J. M., Rose-Jacobs, R., Richardson, M. A., Cabral, H. J., Heeren, T. C., & Frank, D. A. (2017). Urban young adults' adaptive functioning: Is there an association with history of prenatal exposure to cocaine and other substances? *Journal of Drug Issues, 47*(2), 261–276. https://doi.org/10.1177/0022042616684679

Forray, A. (2016). Substance use during pregnancy. F1000Research, 5. https://doi.org/10.12688/f1000research.7645.1

Forray, A., & Foster, D. (2015). Substance use in the perinatal period. *Current Psychiatry Reports, 17*(11), 91. https://doi.org/10.1007/s11920-015-0626-5

Glass, L., Ware, A. L., Crocker, N., Deweese, B. N., Coles, C. D., Kable, J. A., May, P. A., Kalberg, W. O., Sowell, E. R., Jones, K. L., Riley, E. P., & Mattson, S. N. (2013). Neuropsychological deficits associated with heavy prenatal alcohol exposure are not exacerbated by ADHD. *Neuropsychology*, *27*(6), 713–724. https://doi.org/10.1037/a0033994

Goh, P. K., Doyle, L. R., Glass, L., Jones, K. L., Riley, E. P., Coles, C. D., Hoyme, H. E., Kable, J. A., May, P. A., Kalberg, W. O., Sowell, E. R., Wozniak, J. R., & Mattson, S. N.

(2016). A decision tree to identify children affected by prenatal alcohol exposure. *The Journal of Pediatrics*, *177*, 121–127.e1. https://doi.org/10.1016/j.jpeds.2016.06.047

Greenbaum, R. L., Stevens, S. A., Nash, K., Koren, G., & Rovet, J. (2009). Social cognitive and emotion processing abilities of children with fetal alcohol spectrum disorders: a comparison with attention deficit hyperactivity disorder. *Alcoholism, Clinical and Experimental Research, 33*(10), 1656–1670. https://doi.org/10.1111/j.1530-0277.2009.01003.x

Hagan, J. F., Jr., Balachova, T., Bertrand, J., Chasnoff, I., Dang, E., Fernandez-Baca, D., Kable, J., Kosofsky, B., Senturias, Y. N., Singh, N., Sloane, M., Weitzman, C., & Zubler, J. (2016). Neurobehavioral disorder associated with prenatal alcohol exposure workgroup, & American Academy of Pediatrics. *Neurobehavioral Disorder Associated With Prenatal Alcohol Exposure. Pediatrics, 138*(4), e20151553. https://doi.org/10.1542/peds.2015-1553

Haight, S. C., Ko, J. Y., Tong, V. T., Bohm, M. K., Callaghan, W. M. (2018). Opioid use disorder documented at delivery hospitalization — United States, 1999–2014. MMWR *Morb Mortal Wkly Rep, 67,* 845–849.
DOI: http://dx.doi.org/10.15585/mmwr.mm6731a1external icon.

Harder, H. J., & Murphy, A. Z. (2019). Early life opioid exposure and potential long-term effects. *Neurobiology of Stress, 10,* 100156. https://doi.org/10.1016/j.ynstr.2019.100156

Hoffman, M. (2017). ADHD related to fetal alcohol syndrome. http://www.medscape.org/viewarticle/546475

Holz, N. E., Boecker, R., Baumeister, S., Hohm, E., Zohsel, K., Buchmann, A. F., Blomeyer, D., Jennen-Steinmetz, C., Hohmann, S., Wolf, I., Plichta, M. M., Meyer-Lindenberg, A.,

Banaschewski, T., Brandeis, D., & Laucht, M. (2014). Effect of prenatal exposure to tobacco smoke on inhibitory control: neuroimaging results from a 25-year prospective study. *JAMA Psychiatry*, *71*(7), 786–796. https://doi.org/10.1001/jamapsychiatry.2014.343

Infante, M. A., Moore, E. M., Nguyen, T. T., Fourligas, N., Mattson, S. N., & Riley, E. P. (2015). Objective assessment of ADHD core symptoms in children with heavy prenatal alcohol exposure. Physiology & behavior, 148, 45–50. https://doi.org/10.1016/j.physbeh.2014.10.014

Jacobson, J. L., Dodge, N. C., Burden, M. J., Klorman, R., & Jacobson, S. W. (2011). Number processing in adolescents with prenatal alcohol exposure and ADHD: Differences in the neurobehavioral phenotype. *Alcoholism: Clinical and Experimental Research, 35*(3), 431–442. https://doi.org/10.1111/j.1530-0277.2010.01360.x

Jarlenski, M., Barry, C. L., Gollust, S., Graves, A., Kennedy-Hendricks, A., & Kozhimannil, K. (2017). Polysubstance use among US women of reproductive age who use opioids for nonmedical reasons. *American Journal of Public Health, 107*(8), 1308-1310. doi:http://dx.doi.org/10.2105/AJPH.2017.303825

Khoury, J. E., Jamieson, B., & Milligan, K. (2018), Risk for childhood internalizing and externalizing behavior problems in the context of prenatal alcohol exposure: A meta-analysis and comprehensive examination of moderators. *Alcohol Clin Exp Res, 42*, 1358-1377. doi:10.1111/acer.13805

Kodituwakku, P. W., & Kodituwakku, E. L. (2011). From research to practice: an integrative framework for the development of interventions for children with fetal alcohol spectrum

disorders. *Neuropsychology Review, 21*(2), 204–223. https://doi.org/10.1007/s11065-011-9170-1

Konijnenberg, C., Sarfi, M., & Melinder, A. (2016). Mother-child interaction and cognitive development in children prenatally exposed to methadone or buprenorphine. *Early Human Development*, *101*, 91–97. https://doi.org/10.1016/j.earlhumdev.2016.08.013

Koren, G. (2015). Pharmacological treatment of disruptive behavior in children with fetal alcohol spectrum disorder. *Pediatric Drugs 17,* 179–184. https://doi-org.georgefox.idm.oclc.org/10.1007/s40272-015-0118-4

Lambert, B. L., Bann, C. M., Bauer, C. R., Shankaran, S., Bada, H. S., Lester, B. M., Whitaker, T. M., LaGasse, L. L., Hammond, J., & Higgins, R. D. (2013). Risk-taking behavior among adolescents with prenatal drug exposure and extrauterine environmental adversity. *Journal of Developmental and Behavioral Pediatrics, 34*(9), 669–679. https://doi.org/10.1097/01.dbp.0000437726.16588.e2

Lynch, M. E., Kable, J. A., & Coles, C. D. (2015). Prenatal alcohol exposure, adaptive function, and entry into adult roles in a prospective study of young adults. *Neurotoxicology and Teratology*, *51*, 52–60. https://doi.org/10.1016/j.ntt.2015.07.008

Lynch, M. E., Kable, J. A., & Coles, C. D. (2017). Effects of prenatal alcohol exposure in a prospective sample of young adults: Mental health, substance use, and difficulties with the legal system. *Neurotoxicology and Teratology, 64,* 50–62. https://doi.org/10.1016/j.ntt.2017.10.001

Malisza, K. L., Buss, J. L., Bolster, R. B., de Gervai, P. D., Woods-Frohlich, L., Summers, R., Clancy, C. A., Chudley, A. E., & Longstaffe, S. (2012). Comparison of spatial working memory in children with prenatal alcohol exposure and those diagnosed with ADHD; A

functional magnetic resonance imaging study. *Journal of Neurodevelopmental Disorders, 4*(1), 12. https://doi.org/10.1186/1866-1955-4-12

Mattson, S. N., Bernes, G. A., & Doyle, L. R. (2019), Fetal alcohol spectrum disorders: A review of the neurobehavioral deficits associated with prenatal alcohol exposure. *Alcohol Clin Exp Re, 43*, 1046-1062. doi:10.1111/acer.14040

Melà, M., Okpalauwaekwe, U., Anderson, T. J., Eng, J., Nomani, S., Ahmed, A.G., & Barr, A. M. (2018). The utility of psychotropic drugs on patients with Fetal Alcohol Spectrum Disorder (FASD): A systematic review. *Psychiatry and Clinical Psychopharmacology, 28*, 436 - 445.

Migliorini, R., Moore, E. M., Glass, L., Infante, M. A., Tapert, S. F., Jones, K. L., Mattson, S. N., & Riley, E. P. (2015). Anterior cingulate cortex surface area relates to behavioral inhibition in adolescents with and without heavy prenatal alcohol exposure. Behavioral brain research, 292, 26–35. https://doi.org/10.1016/j.bbr.2015.05.037

Minnes, S., Singer, L. T., Min, M. O., Lang, A. M., Ben-Harush, A., Short, E., & Wu, M. (2014). Comparison of 12-year-old children with prenatal exposure to cocaine and non-exposed controls on caregiver ratings of executive function. Journal of youth and adolescence, 43(1), 53–69. https://doi.org/10.1007/s10964-013-9927-3

Morie, K. P., Crowley, M. J., Mayes, L. C., & Potenza, M. N. (2019). Prenatal drug exposure from infancy through emerging adulthood: Results from neuroimaging. *Drug and Alcohol Dependence, 198*, 39–53. https://doi.org/10.1016/j.drugalcdep.2019.01.032

Nash, K., Koren, G., Rovet, J. A. (2011). Differential approach for examining the behavioural phenotype of fetal alcohol spectrum disorders. *J. Popul. Ther. Clin. Pharmacol. 18*, 440–453.

Nash, K., Stevens, S., Clairman, H., Rovet, J. (2017, December 28). Preliminary findings that a targeted intervention leads to altered brain function in children with fetal alcohol spectrum disorder. *Brain Sci. 8*(1):7. doi: 10.3390/brainsci8010007. PMID: 29283403; PMCID: PMC5789338.

NIDA. 2020 (June 3). Study finds increased cannabis use during pregnancy. https://www.drugabuse.gov/news-events/news-releases/2019/06/study-finds-increased-cannabis-use-during-pregnancy on 2020, August 18

Nygaard, E., Slinning, K., Moe, V., & Walhovd, K. B. (2016). Behavior and attention problems in eight-year-old children with prenatal opiate and poly-substance exposure: A longitudinal study. *PloS One, 11*(6), e0158054. https://doi.org/10.1371/journal.pone.0158054

Oei, J. L. (2018), Adult consequences of prenatal drug exposure. *Intern Med J, 48,* 25-31. doi:10.1111/imj.13658

Oei, J. L. (2020). Alcohol use in pregnancy and its impact on the mother and child. *Addiction (Abingdon, England)*. https://doi.org/10.1111/add.15036

O Malley, K. D., & Storoz, L. (2003). Fetal alcohol spectrum disorder and ADHD: Diagnostic implications and therapeutic consequences. *Expert Review of Neurotherapeutics, 3*(4), 477–489. https://doi.org/10.1586/14737175.3.4.477

Ozsarfati, J., & Koren, G. (2015). Medications used in the treatment of disruptive behavior in children with FASD--a guide. *Journal of Population Therapeutics and Clinical Pharmacology*, *22*(1), e59.

Paley, B., & O'Connor, M. J. (2011). Behavioral interventions for children and adolescents with fetal alcohol spectrum disorders. Alcohol Research & Health: *The Journal of the National Institute on Alcohol Abuse and Alcoholism, 34*(1), 64–75.

Parekh, R., MD. (2017). *What Is ADHD?* Washington, DC: American Psychological Association. https://www.psychiatry.org/patients-families/adhd /what-is-adhd.

Parker, J., Wales, G., Chalhoub, N., & Harpin, V. (2013). The long-term outcomes of interventions for the management of attention-deficit hyperactivity disorder in children and adolescents: A systematic review of randomized controlled trials. *Psychology Research and Behavior Management, 6,* 87+. https://link-gale-com.georgefox.idm.oclc .org/apps/doc/A375581094/AONE?u=newb64238&sid=AONE&xid=1be0a012

Patel, N. B., Xu, Y., McCandless, L. C., Chen, A., Yolton, K., Braun, J., Jones, R. L., Dietrich, K. N., & Lanphear, B. P. (2019). Very low-level prenatal mercury exposure and behaviors in children: The HOME Study. *Environmental Health: A Global Access Science Source, 18*(1), 4. https://doi.org/10.1186/s12940-018-0443-5

Peadon, E., & Elliott, E. J. (2010). Distinguishing between attention-deficit hyperactivity and fetal alcohol spectrum disorders in children: clinical guidelines. *Neuropsychiatric Disease and Treatment, 6*, 509–515. https://doi.org/10.2147/ndt.s7256

Pehlivanidis, A., Papanikolaou, K., Mantas, V., Kalantzi, E., Korobili, K., Xenaki, L., Vassiliou, G., & Papageorgiou, C.C. (2020). Lifetime co-occurring psychiatric disorders in newly diagnosed adults with attention deficit hyperactivity disorder (ADHD) or/and autism spectrum disorder (ASD). *BMC Psychiatry, 20*, 423 (2020). https://doi.org/10.1186/s12888-020-02828-1

Raldiris, T. L., Bowers, T. G., & Towsey, C. (2018). Comparisons of intelligence and behavior in children with fetal alcohol spectrum disorder and ADHD. *Journal of Attention Disorders*, *22*(10), 959–970. https://doi.org/10.1177/1087054714563792

Rangmar, J., Hjern, A., Vinnerljung, B., Strömland, K., Aronson, M., & Fahlke, C. (2015). Psychosocial outcomes of fetal alcohol syndrome in adulthood. *Pediatrics, 135*(1), e52–e58. https://doi.org/10.1542/peds.2014-1915Reitan, T. (2017). Patterns of polydrug use among pregnant substance abusers. *Nordic Studies on Alcohol and Drugs, 34*(2), 145.

Reynolds, C. R., & Kamphaus, R. W. (2004). Behavior assessment system for children (2nd ed.). Circle Pines, MN: American Guidance Service.

Richardson, G. A., De Genna, N. M., Goldschmidt, L., Larkby, C., & Donovan, J. E. (2019). Prenatal cocaine exposure: Direct and indirect associations with 21-year-old offspring substance use and behavior problems. *Drug and Alcohol Dependence, 195,* 121–131. https://doi.org/10.1016/j.drugalcdep.2018.10.033

Ross, E. J., Graham, D. L., Money, K. M., & Stanwood, G. D. (2015). Developmental consequences of fetal exposure to drugs: what we know and what we still must learn. Neuropsychopharmacology : official publication of the American College of Neuropsychopharmacology, 40(1), 61–87. https://doi.org/10.1038/npp.2014.147

Sandtorv, L. B., Fevang, S. K. E., Nilsen, S. A., Bøe, T., Gjestad, R., Haugland, S., & Elgen, I. B. (2018). Symptoms associated with attention deficit/hyperactivity disorder and autism spectrum disorders in school-aged children prenatally exposed to substances. *Substance Abuse : Research and Treatment, 12,* 1178221818765773. https://doi.org/10 .1177/1178221818765773

Seitz, Dylan J., (2019). Differentiating cognitive deficits between ADHD and in utero polysubstance exposure. *Doctor of Psychology (PsyD). 296*. https://digitalcommons.georgefox.edu/psyd/296

Smith, L. M., Diaz, S., LaGasse, L. L., Wouldes, T., Derauf, C., Newman, E., Arria, A., Huestis, M. A., Haning, W., Strauss, A., Della Grotta, S., Dansereau, L. M., Neal, C., & Lester, B. M. (2015). Developmental and behavioral consequences of prenatal methamphetamine exposure: A review of the Infant Development, Environment, and Lifestyle (IDEAL) study. Neurotoxicology and teratology, 51, 35–44. https://doi.org/10.1016/j.ntt.2015.07.006

Stevens, S. A., Clairman, H., Nash, K., & Rovet, J. (2017). [Formula: see text] Social perception in children with fetal alcohol spectrum disorder. *Child Neuropsychology: A Journal on Normal and Abnormal Development in Childhood and Adolescence, 23*(8), 980–993. https://doi.org/10.1080/09297049.2016.1246657

Stone, L. S., Speltz, M. L., Collett, B., & Werler, M. M. (2013). Socioeconomic factors in relation to discrepancy in parent versus teacher ratings of child behavior. *Journal of Psychopathology and Behavioral Assessment, 35*(3), 314–320. https://doi.org/10.1007/s10862-013-9348-3

Stone, R. (2015). Pregnant women and substance use: Fear, stigma, and barriers to care. *Health & Justice, 3,* 2. https://doi.org/10.1186/s40352-015-0015-5

Streissguth, A. P., Bookstein, F. L., Barr, H. M., Sampson, P. D., O'Malley, K., Young, J. K. (2004). Risk factors for adverse life outcomes in fetal alcohol syndrome and fetal alcohol effects. *Journal of Developmental and Behavioral Pediatrics, 25*(4):228–238. [PubMed: 15308923]

Taylor, N. M., & Enns, L. N. (2019) Factors predictive of a fetal alcohol spectrum disorder diagnosis: Parent and teacher ratings, *Child Neuropsychology, 25*(4), 507-527, DOI: 10.1080/09297049.2018.1495187

Terrell, S, Conradt, E., Dansereau, L., Lagasse, L., & Lester, B. (2019). A developmental origins perspective on the emergence of violent behavior in males with prenatal substance exposure. *Infant Ment Health J., 40,* 54– 66. https://doi-org.georgefox.idm.oclc.org/10.1002/imhj.21758

Uban, K., Comeau, W., Bodnar, T., Yu, W., Weinberg, J., & Galea, L. (2015). Amphetamine sensitization and cross-sensitization with acute restraint stress: Impact of prenatal alcohol exposure in male and female rats. *Psychopharmacology, 232*(10), 1705–1716. https://doi.org/10.1007/s00213-014-3804-y

Vaurio, L., Riley, E., & Mattson, S. (3008). Differences in executive functioning in children with heavy prenatal alcohol exposure or attention-deficit/hyperactivity disorder. *Journal of the International Neuropsychological Society, 14*(1), *119-129. doi:10.1017/S1355617708080144*

Ware, A. L., Crocker, N., O'Brien, J. W., Deweese, B. N., Roesch, S. C., Coles, C. D., Kable, J. A., May, P. A., Kalberg, W. O., Sowell, E. R., Jones, K. L., Riley, E. P., Mattson, S. N., & CIFASD (2012). Executive function predicts adaptive behavior in children with histories of heavy prenatal alcohol exposure and attention-deficit/hyperactivity disorder. Alcoholism, clinical and experimental research, 36(8), 1431–1441. https://doi.org/10.1111/j.1530-0277.2011.01718.x

Whaley, S. E., O'Connor, M. J., & Gunderson, B. (2001). Comparison of the adaptive functioning of children prenatally exposed to alcohol to a nonexposed clinical sample. *Alcoholism, Clinical and Experimental Research, 25*(7), 1018–1024.

Wolraich, M. L., Hagan, J. F., Jr, Allan, C., Chan, E., Davison, D., Earls, M., Evans, S. W., Flinn, S. K., Froehlich, T., Frost, J., Holbrook, J. R., Lehmann, C. U., Lessin, H. R., Okechukwu, K., Pierce, K. L., Winner, J. D., Zurhellen, W., & Subcommittee On Children And Adolescents With Attention-Deficit/Hyperactive Disorder (2019). Clinical practice guideline for the diagnosis, evaluation, and treatment of attention-deficit/ hyperactivity disorder in children and adolescents. *Pediatrics, 144*(4), e20192528. https://doi.org/10.1542/peds.2019-2528

Yip, S. W., Lacadie, C. M., Sinha, R., Mayes, L. C., & Potenza, M. N. (2015). Prenatal cocaine exposure, illicit-substance use and stress and craving processes during adolescence. *Drug and Alcohol Dependence*, *158*, 76–85. https://doi.org/10.1016/j.drugalcdep.2015.11.012

Appendix A

Curriculum Vitae

EDUCATION

2017- Present **George Fox University , Newberg, Oregon**
Graduate Department of Clinical Psychology: APA Accredited
M.A. Clinical Psychology (Spring 2019)
Psy.D. Clinical Psychology (*Anticipated Graduation,* Spring 2022*)*

2012- 2016 **University of California, Irvine**
B.A. Psychology
B.A. Criminology, Law, & Society

SUPERVISED DOCTORAL-LEVEL CLINICAL EXPERIENCE

June 2019- June 2021 **Providence Medical Group- Southwest Pediatrics**
Portland, OR

Title: *Behavioral Health Practicum II & Pre-Intern Clinician*
Treatment Setting: *Pediatric Primary Care; Pediatric Specialty Care*
Three Clinical Rotations (24 months)*: SW Pediatrics Clinic, Scholls Pediatric Clinic, Providence Pediatric Specialty Care Clinic- St. Vincent (Includes: Endocrinology, Gastroenterology, Neurology, Ortho, Ears, Nose, Throat (ENT), Urology, Surgical, and Infectious Disease)*
Supervisors: *Tyson Payne, Psy,D., Jeri Turgesen, ABPP, MSCP*

- Provide consultation and brief solution-based interventions in a primary care setting for two separate primary care clinics and pediatric specialty care for children and adolescent ranging from 2—20 year old.
- Utilized behavioral health techniques including warm handoffs, consultation, and collaboration with providers in primary and specialty care
- Partnered and consulted with physicians regarding direction of patient care
- Employed brief behavioral-health, evidence-based interventions including cognitive behavioral therapy, acceptance and commitment therapy, and brief solution focused therapy for children, adolescents, and families
- Co-led groups & assisted in developing curriculum for parent training group (Was scheduled to begin prior to COVID-19)
- Mental Health Speaker on Mental Health Professional panel-- Work2BeWell Virtual Mental Health Summit

Dec. 2018- **Behavioral Health Crisis Consultation Team**

Present Yamhill County, OR

Title: *Behavioral Health Crisis Consultant, QMHP*
Treatment Setting: *Providence Newberg Medical Center; Willamette Valley Medical Center*
Supervisors: *Luann Foster, PsyD; Mary Peterson, PhD, ABPP; William Buhrow,PsyD*

- Conduct evidence-based suicide and homicide risk assessments, cognitive evaluations, and other assessment of patient's mental health concerns and risk factors in order to determine level of risk for the Emergency Department, Intensive Care Unit, and Medical/Surgical Unit
- Consult with physicians, supervisors, and other medical staff to provide recommendations regarding patient risk, hospitalization, and discharge plan.
- Document evaluations in electronic medical charts and coordinate resources with county mental health professionals
- Case management experience: collaborating with county mental health and local agencies, arranging inpatient psychiatric hospitalizations, and contacting and arranging respite care facilities and availabilities.

Aug. 2019- May 2020 **West Hills Healthcare Clinic**
McMinnville, OR

Title: *Supplemental Practicum Intern*
Treatment Setting: *Primary Care Clinic*
Supervisor: *Joy Mauldin, PsyD*

- Developed and administered comprehensive assessment batteries including cognitive, academic, neuropsychological, behavioral and personality assessments for patients referred by primary care physician and behavioral health provider(s) across lifespan. Reason for referrals include: attention, concentration, and cognitive concerns
- Interpreted, wrote, and provided feedback for comprehensive reports in collaboration and direct supervision of Dr. Mauldin
- Testing was impacted by COVID-19. Was unable continue in-person or virtual assessment administration

Aug. 2018- June 2019 **Rural Child and Adolescent Services**
Yamhill Carlton, OR

Title: *Practicum I Clinician*
Treatment Setting: *Behavioral Health Service Group- Public K-12th Grade*
Supervisor: *Elizabeth Hamilton, PhD*

- Provide short-term, long-term individual, group, and milieu therapy from a solution-focused orientation for children and adolescents, primarily in an elementary school setting.
- Issues addressed include trauma, family and school stressors, emotional disturbance and emotional and behavioral dysregulation
- Implement weekly behavioral health and social/emotional curriculums

for middle school students
- Conduct and interpret psychological assessment for Individualized Education Plans (IEPs) and write comprehensive reports on batteries including intellectual, academic, behavioral and psychological assessment utilized for IEPs and 504 plans for children K-12th grade.
- Consult and collaborate within a multidisciplinary system as part of a team of teachers and learning specialists for client and assessments cases

Aug. 2017- May 2018 **George Fox University, Pre-Practicum Therapy**
Newberg, OR

Title: *Pre-Practicum Therapist*
Treatment Setting: *University Counseling*
Supervisor: *Glena Andrews, PhD, ABPP; Mark Thomas, MA*

- Provided outpatient, individual, client-centered psychotherapy services to volunteer undergraduate students
- Conducted intake interviews, engage in treatment planning, write professional reports, and make case presentations
- Facilitated and co-led depression, processing group
- Consult with supervisors and members of clinical team
- All sessions video-taped, reviewed extensively, and discussed in weekly individual and group supervision

OTHER RELEVANT EXPERIENCE

Oct. 2015- June 2016 **Los Angeles County Sheriff's Department- Carson Station**
Carson, CA

Title/Program: *UC Irvine Advanced Field Study Program Intern*
Treatment Setting: *Gang Diversion Program*
On Site Supervisor: *Deputy Noya*

- Case manager for client cases ranging in ages (6-18 year old) referred for various behavioral and emotional concerns including probation hours, etc.
- Mentored and helped facilitated weekly didactic group meetings
- Logged case notes for cases
- Conducted school and home visits [with supervisory deputy] to further assess and follow up with the clients
- Tutored clients in subjects ranging from math to English.
- Conducted data analysis and co-authored 2014-2015 *Gang Diversion Program Statistics Book*

RESEARCH EXPERIENCE

Oct. 2015- **Doctoral Dissertation**

June 2016 ***Title:*** *Prenatal Polysubstance Exposure (PPE) and ADHD: Comparison of Behavior Profiles in Children and Adolescents*
Committee Chair*: Kathleen Gathercoal, PhD*
Committee Members: *Elizabeth Hamilton, Ph.D, & Glena Andrews, Ph.D*
Defense Date: June 2021

Oct. 2019- March 2020 **Co-Consultant, Program Evaluation of Youth Fitness Program: Edwards Elementary School**
Faculty Supervisor: *Marie-Christine Goodworth, PsyD;*

- Engage in a consultant role for Edwards Elementary to help develop assessment battery to evaluate new fitness program targeting Cardiovascular Health for at-risk youth and its effects on effects on mental health
- Consultation Services include: providing evidence-based measures and structure for ethical and statistical significance.
- Was scheduled to analyze data gathered before COVID-19 lockdown disrupted evaluation and measures.

Jan. 2019- June 2019 **Research Assistant, Providence Health & Services- Healthier Kids, Together Initiative**
Faculty Advisor: *Elizabeth Hamilton, PhD; Mary Peterson, PhD, ABPP*

- Funded by Oregon's Providence Health & Services Grant, *The Healthy Kids: Healthy Community Program* aims to serve local rural communities to support physical activity, nutritious eating, and overall health-related quality of life in youth and adolescents to target childhood obesity.
- As a research assistant, I led and finalized modules for Healthy Lifestyle Choices (HLC) curriculum to 4th graders weekly for approx. 6 weeks
- Curriculum Modules included: nutrition, fitness, life skills, stress management, and safety
- Gathered data on curriculum's effect on elementary and middle-school students' health-related quality of life (HRQOL), physical activity, and emotional well-being
- Administered Evidence-Based Questionnaires pre and post include: *Physical Activity Questionnaire (PAQ) (Elementary School), Kid-KINDL Children's Questionnaire, & Social-Emotional Assets and Resilience Scales (SEARS) Teacher and Child Forms*

March. 2018- Present **Member, Research Vertical Team**
Faculty Advisor: *Kathleen Gathercoal, PhD*

- Bi-monthly group for developing research competencies that consists of dissertation development, participation in collaborative supplemental research projects, and overall development of follow colleagues areas of research interests

- Various areas of team interest and focus: Trauma, FASD, Integration, Program Evaluations, and Diversity/Multiculturalism

Oct. 2014-April 2015 **Lead Consultant/Researcher, Gang Diversion Program**
Research Setting: *UC Irvine Advanced Field Study Program*

- Lead author in the *Gang Diversion Team's 2014-2015 Statistical Report Book Report*
- Gathered and analyzed client cases and termination levels of program to determine effectiveness and success rates of police-implemented prevention programs for at-risk youth

Oct. 2014-April 2015 **Parenting Stress & Daily Affective Experience Lab**
Research Setting: *UCI Consortium For Integrative Health Studies*

- Interacted and trained participants for the study to assess increased stress levels for parents
- Managed heart rate monitors and activity monitors for participants
- Interpolated and assessed ECG data

PUBLICATIONS & PRESENTATIONS

Publication(s)

Rich-Wimmer N, **Tanios R,** Qu Y, Andrews G, A-059 Gender-Related Behavioral Differences in Children with Partial or Complete Agenesis of the Corpus Callosum: Exploring Attention, Rule Breaking, and Aggressive Behaviors, *Archives of Clinical Neuropsychology*, Volume 35, Issue 6, September 2020, Page 849, https://doi.org/10.1093/arclin/acaa068.059

Presentations (National)

Richer-Wimmer, N, **Tanios, R**., Yuan, Q, & Andrews, A (2020*). Gender-Related Behavioral Differences in Children with Partial or Complete Agenesis of the Corpus Callosum: Exploring Attention, Rule Breaking, and Aggressive Behaviors*. Presented at National Academy of Neuropsychology, Virtual Conference, October 2020. Abstract Published In *Archives of Clinical Neuropsychology*

Tanios, R., Shattuck, M. & Gathercoal, K. (2019). *Gender Differences in Relationship Between Health-Related Quality of Life and Faith in Young Adults.* Presented at American Psychological Association, Chicago, Il, August 2019.

SUPERVISION & TEACHING EXPERIENCE

Aug.2020-Present ***Peer Supervisor*, Clinical Conceptualization & Application Team**
Title: Fourth Year Supervisor
Treatment Setting: George Fox University Doctoral Program
Supervisor: Kristie Knows His Gun, PsyD

- Provided clinical oversight to a second year PsyD student
- Helped develop student's clinical and assessment skills
- Observed clinical skills
- Collaborated in development of theoretical orientation and personal style of therapy
- Evaluated student's development of clinical and professional skills
- Provided feedback on clinical work

Dec 2019- June 2020 ***Clinical Trainer,*** **Behavioral Health Crisis Consultation Team**
George Fox University, Yamhill County Mental Health
Faculty: Luann Foster, PsyD; Mary Peterson PhD ABPP; Bill Buhrow, PsyD

- Provided live training and consultation in suicide and homicide risk, psychosis, and cognitive problems and documentation procedures for new recruits.

Jan 2020- April 2020 ***Graduate Teaching Assistant,*** **Multicultural Therapy**
George Fox Graduate School of Clinical Psychology, Newberg, OR
Faculty: Winston Seegobin, PsyD

- Provided Guest lecture and Q&A on topic of Middle-Eastern clients
- Scored and provided clinical feedback on assignments and reflections on material

Jan 2020- April 2020 ***Graduate Teaching Assistant,*** **Cognitive and Behavioral Therapy**
George Fox Graduate School of Clinical Psychology, Newberg, OR
Faculty: Joel Gregor, PsyD

- Provide Guest lecture, demonstrate role-plays, and provide student feedback on in-vivo training exercises
- Course provides framework in conceptualization and treatment from first-third wave cognitive therapies including Rational Emotive Behavior Therapy, Cognitive Behavioral Therapy, Acceptance and Commitment Therapy, and Dialectical Behavioral Therapy
- Grade students' papers and tests, and provide feedback
- Lead review sessions for midterm and final examinations as well as facilitate group discussion

Aug.. 2019 Dec. 2019 ***Teaching Assistant*****, Undergraduate Advanced Counseling Class**
George Fox University, Newberg, Oregon
Title: Fourth Year Supervisor
Faculty: Laura Geczy-Haskins, PsyD

- Facilitated clinical skills development with a group of 3-4 undergraduate students.
- Other assignments involve supporting the students' personal insight, role modeling, mentoring and providing feedback to mock-therapy recordings, and role playing

June 2019 ***Graduate Teaching Assistant,* Child and Adolescent Assessment**
George Fox Graduate School of Clinical Psychology, Newberg, OR
Faculty: Elizabeth Hamilton, PhD

- Aid in teaching of administration and scoring of child and adolescent assessments, including adaptive functioning assessments, diagnostic-specific instruments, social competence measures, and projective techniques
- Aid students in demonstrating understanding of evidence-based approaches to integration of assessment data and treatment planning
- Present a de-identified case example and facilitate class discussion

Sept. 2018- Dec. 2018 **Depression Group Peer Supervisor**
Treatment Setting: Community Mental Health
Supervisor: Glena Andrews, PhD

- Facilitated, trained, organize, and held weekly group supervision for 5 graduate students who were group facilitators for a depression support group program run in Newberg, OR

SPECIALIZED TRAININGS & CERTIFICATIONS

Amy Stoeber, PhD. *Child Adverse Events to Adults with Substance Use Problems.* Colloquium, Graduate School of Clinical Psychology, George Fox University, Newberg, OR. February 12, 2020

CAMS: Collaborative Assessment and Management of Suicidality Training—CAMS Certified Clinician, *George Fox University (2018)*

Certification in Trauma Work in Clinical Practice. *Will Finish Training and Receive Certification (April 2021)*

Forster, C. (2019, March) *Intercultural Empathy & Cultural Intelligence (CQ) Workshop.* Presentation given at Multnomah Friends Meeting, Portland, OR. C.E. credit.

Gil-Kashiwabara, Eleanor (Psy.D.) *Using Community Based Participatory Research (CBPR) to Promote Mental Health in American Indian/Alaska Native (AI/AN) Children, Youth and Families.* George Fox University, October 2017

Marlow, D. (2019, March 20). *Foundations of Relationship Therapy – The Gottman Model.* Presentation at George Fox University Grand Rounds.

McMinn, L., McMinn, M. *Spiritual Formation and the Life of a Psychologist: Looking Closer at Soul-Care.* George Fox University, Graduate School of Clinical Psychology Fall Colloquia, Newberg, OR. Sept. 2018

Pengally, S. *Old Pain in New Brains.* George Fox University, Graduate School of Clinical Psychology Fall Grand Rounds, Newberg, OR, October 2018

Safi, D., & Millkey, A. (2019, February 13). *Opportunities in Forensic Psychology*. Colloquium Presentation at George Fox University, Newberg, OR.

Sordahl, Jeffrey (Psy.D.) *Telehealth Psychotherapy.* George Fox University, November 2017.

Strohsal, K. (2019). Focused Acceptance and Commitment Therapy. Newberg, OR

Taloyo, Carlos. PhD. *The History and Application of Interpersonal Psychotherapy*. George Fox University, February 2018.

Vogel, M. (2018, March 14). *Integration and Ekklesia.* George Fox University Colloquium Presentation, Newberg, OR.

Worthington, L (2019, September 25). *Promoting Forgiveness.* Presentation at George Fox University Grand Rounds, Newberg, OR.

INVITED SPEAKER ENGAGEMENT & PRESENTATIONS

Oct 2020 ***Mental Health Speaker*, Mental Health Professional Panel—** Work2BeWell-Virtual Teen Mental Health Summit. *Sponsored by Providence.*

Nov 2020 ***Co-facilitator/Speaker*, Immigrant, Refugee, & International Student Processing Group.** Multicultural Committee, *George Fox University*. *Scheduled for Nov. 2020*

Dec 2020 **Presenter**, **Assessing Risk & Safety with Minority Populations**. Behavioral Health Consultation Team., *George Fox University. Scheduled for Dec. 2020.*

UNIVERSITY AND PROFESSIONAL SERVICE

2019-2020 **Leadership Board, Multicultural Committee Board Member**
Communications Chair; Public Relations Manager
Graduate School of Clinical Psychology
George Fox University, Newberg, OR

2017-Present **Member, Child and Adolescent Special Interest Group**
George Fox University Graduate School of Clinical Psychology

PROFESSIONAL MEMBERSHIPS AND AFFILIATIONS

American Psychological Association---Student Affiliate
Division 54 Society of Pediatric Psychology Member

HONORS AND AWARDS

- Multicultural Scholarship, 2017-Present; *George Fox University*
- Dean's Honor List -- 2013-2016; *University of California, Irvine*
- UC Irvine Social Ecology Award for Excellence & Achievements in Advanced Field Study Program—2016

REFERENCES

**References available upon request*