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Early Childhood Neurodevelopmental Profiles: Premature and Small for Gestational Age Infants

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Premature and Small for Gestational Age Infants

by

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Abstract

Infants born premature (<37 weeks) and small for gestational age (SGA; <5 lbs, 8ozs, >37 weeks) are at greater risk for neurodevelopmental delays. Delays can be global neurodevelopmental differences, including academic achievement, communication development, and motor skills. Currently, there is not a large enough body of research differentiating the two groups. Neurodevelopmental profile score differences were analyzed between children born premature, children born SGA, children born both premature and SGA, and children born average for gestational age (AGA). Neurodevelopmental domains explored included social, adaptive, communication (expressive and receptive), motor (gross and fine), and cognitive functioning using the Battelle Developmental Inventory (BDI-2 NU), Bayley Scales for Infant and Toddler Development (Bayley-III), and the Preschool Language Scale (PLS-5). Participants ranged in age from 2 months to 2 years 9 months and included European American, Latino, and Asian infants and toddlers.

An ANOVA was used to analyze differences between groups. Across the majority of the developmental areas measured, no significant differences were observed. The gross motor subdomain resulted in significant differences between the control group and the premature and SGA groups, though the effect sizes were small. Overall, results suggest that regardless of a child's birth weight or term development, these factors do not indicate poor performance when compared to AGA children. Future research would benefit from a larger sample size, in addition to utilizing a longitudinal design to produce more generalizable results and provide greater insight into the most effective way to implement early intervention services.

Keywords: early childhood, small for gestational age, premature, developmental, Battelle Developmental Inventory, Bayley Scales of Infant and Toddler Development

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Chapter 1

Introduction

Early childhood neurodevelopmental profiles and milestone achievement have been an area of neurodevelopmental interest for decades. However, research comparing neurodevelopmental profiles for children born small for gestational age (SGA) and premature is insufficient. Research has indicated that children born premature (a birth that takes places before the completion of 37 weeks of gestation) and those born SGA (born full term with a birth weight less than 5 pounds, 8 ounces) are at risk for a variety of medical conditions and neurodevelopmental delays (Bhutta, Cleves, Casey, Cradock, & Anand, 2002). Risk factors for adverse neurodevelopmental outcomes in these populations have included early gestational age, birth weight, structural changes of the brain, infection, male gender, neonatal intensive care unit course, and other complex biological and socioeconomic factors (Dukovska & Juzevski, 2009).

Regarding neurodevelopmental outcomes, prematurity has been associated with global neurodevelopmental differences, Attention Deficit/Hyperactivity Disorder (ADHD), delays in academic achievement, communication development, and motor skills (Tosun et al., 2017). Being SGA has been associated with decreased academic achievement, Attention Deficit/Hyperactivity Disorder (ADHD), and neurodevelopmental delays (Tosun et al., 2017). Regarding course of neurodevelopmental outcomes, early neurodevelopmental delays were found to be predictive of later neurodevelopmental outcomes including motor/neurologic function, visuomotor integrative skills, IQ, academic achievement, communication, executive function, and attention-deficit hyperactivity disorder/behavioral issues, and can include wide-ranging impacts across a child's life (Aylward, 2014). Further, early identification has been identified as a strong predictor of later outcomes, outlining the importance of early childhood neurodevelopmental assessment (Lundqvist-Persson, Lau, Nordin, Bona, & Sabel, 2012).

Early research on assessment of neurodevelopmental outcomes demonstrated mixed findings for children born premature or SGA, with some studies finding no relationship between gestational age, birth weight, and cognitive and communication outcomes (Macias, Saylor, Younginer, & Katikaneni, 2000). However, more recent research has uncovered some neurodevelopmental differences in these groups, to be described here in more detail.

Prematurity

Premature birth occurs in 12–13% of live births in the USA and in 5–9% of live births in other developed countries (Yaari et al., 2018). Premature infants are often divided into categories based on gestational age at birth. Yaari et al. (2018) defined early prematurity groupings using the following terms: extremely premature ($\leq$ 28 weeks of gestation), very premature (29-32 weeks of gestation), and moderately premature (33-34 weeks of gestation). Common causes of prematurity include infections (Group B strep, Herpes, E-coli), poor maternal health or other lifestyle factors (alcohol, tobacco, or other illicit drug use), scheduled deliveries (about 25% of premature births), and a mother who has had a previous premature birth (Waechter, 2014).

Research has demonstrated mixed findings concerning the age of emergence of neurodevelopmental differences. One study found no neurodevelopmental differences before 24 months, but emergence of neurodevelopmental differences by preschool (Shah, Kaciroti, Richards, Oh, & Lumeng, 2016). However, Dukovska and Juzevski (2009) found a significantly lower gross developmental quotient (GDQ) during the first three years of life compared to a control group. Specifically, 20% of the premature infants in their study demonstrated significant neurodevelopmental deficits at 3 years of age (two SD below the mean). The only age at which global developmental scores were commensurate with peers was at 4 months of age (Dukovska & Juzevski, 2009). Overall, research indicates neurodevelopmental differences for children born premature across domains, including; social, adaptive, communication, motor, and cognitive outcomes.

Social Outcomes Premature birth has been shown to impact social functioning in children as they develop. One study explored interactions between very premature (VPT) children and their peers using the Penn Interactive Peer Play Scale (PIPPS), a parent report that assesses play interaction, play disconnection, and play disruption. In this study, parents rated VPT children as being significantly (small effect size) less likely to experience positive play interactions with peers, suggesting early difficulties in establishing and maintaining friendships. No significant difference between groups was found for play disruption or play disconnection, suggesting similar levels of avoidant and aggressive peer play behavior in both groups. Additionally, this same study explored VPT children's interactions with their parents during a structured play procedure in which turn-taking, reciprocity, responsiveness, and shared affect were observed. Findings indicated that VPT children’s interactions were marked by difficulties in these areas (Jones, Champion, & Woodward, 2013). Within the VPT group, predictors of poor social competence included family socioeconomic disadvantage, extreme prematurity, severity of cerebral white matter abnormalities and early childhood exposure to high levels of maternal anxiety and negative parenting (Jones et al., 2013).

In another study in Sweden, children born at 23– 25 weeks who had been evaluated at 36 months corrected age were studied again between 10 and 12 years and compared with controls on social competency. Parents and teachers reported more attention, thinking, and social problems. Teachers rated extremely premature children less well-adjusted than controls. However, a majority (85%) were in mainstream educational placements without adjustment problems (Farooqi et al. 2007). Overall, research on social functioning in children born premature indicate premature children have greater difficulty establishing and maintaining friendships, in addition to greater difficulty engaging with and being attuned to their parents.

Adaptive Functioning Outcomes Closely linked to cognitive ability, adaptive functioning has been associated with other factors such as behavioral/emotional problems and social functioning. In one study, 28 VLBW children without CP, 10 VLBW children with CP, and 31 term-born control children were examined at 10–11 years using the parent-reported Vineland Adaptive Behavior Scales, 2nd ed. Adaptive Behavior Composite scores were significantly lower in the two VLBW groups than in the control group. The difference was still significant after adjustment for sex, socioeconomic status, cognitive scores, and motor scores. Among VLBW children without CP, an abnormal infant motor repertoire at 14 weeks post-term age was significantly associated with a lower Adaptive Behavior Composite score at 10–11 years of age. Further research is needed in VLBW children without major disabilities like CP, as the children in this study had lower adaptive functioning that could not be explained by SES, cognitive, or motor functions (Fjørtoft et al., 2015).

In a study by Galeti, Goulart, and Schwartzman (2018), the frequency of emotional/behavioral problems and adaptive behavior in 4-5 year old children born premature (<1500 g) and full term were compared. Emotional/behavioral and adaptive problems (communication, daily living skills, socialization, motor skills, and fine motor skills) were more frequent in premature than in full term children and were increased by low maternal education and male sex. Overall, research on adaptive functioning indicates children born premature will have greater difficulty compared to their full term peers and because adaptive functioning is so closely linked to skills in the other domains, adaptive functioning impacts will be seen across domains.

Communication Outcomes Developmental differences have been noted for communication in children born premature, though the differences aren't always discriminated using communication sample measures alone (e.g., mean length of utterance in C-units, conjunction analyses, elaborated noun phrases, developmental sentence scoring, conversion of frequency counts to density measures), lending importance to both communication sample measures and standardized measures (e.g. Test of Narrative Language- Oral Narration, Clinical Evaluation of Language Fundamentals, 4th ed. (CELF-4)- Recalling Sentences, CELF-4 Word Classes Expressive, CELF-4 Word Classes Receptive, CELF-4 Understanding Paragraphs). In one study, school-aged children born prematurely were found to achieve communication scores in the low average range on standardized measures (Smith, DeThorne, Logan, Channell, & Petrill, 2014). Findings indicated that school-age children born prematurely were outperformed by peers born at full term. These findings highlighted a difference in outcomes for standardized tests and nonstandardized communication sample measures, describing the importance of standardized assessment in this domain.

A later meta-analysis compiled results from both standardized and nonstandardized comparisons, finding that communication delays for children born before 33 weeks gestation (in receptive communication, expressive communication, phonological awareness, and grammar abilities) continue to early school age and scores suggest children perform significantly lower than their full-term peers (Zimmerman, 2018). However, significant differences between children born prematurely and controls were not found on pragmatic communication outcomes.

Wolfe et al. (2015) matched a VLBW premature cohort with term-born, healthy birth weight infants who spent some time in the NICU (with no major prenatal or perinatal complications), as this is a more appropriate comparison group for isolating the effects of VLBW prematurity from other medical confounds. Findings revealed that the VLBW premature cohort performed slightly better on pragmatic skills than the full term group, but significant differences were not noted on any of the comparisons. The authors noted that this difference could be due to the fact that their term control group all spent some time in the NICU, which may have affected their scores.

Another study that used all five areas of the Bayley- III (social-emotional, adaptive, communication, motor, and cognitive) to assess the neurodevelopmental profile of a cohort of premature infants <32 weeks GA found lower language scores for participants with male gender, but birth weight (BW) and GA were not found to significantly contribute to any of the Bayley-III domains (Velikos et al., 2015). In sum, research on communication outcomes in children born premature indicates that at school-age, children born prematurely are consistently outperformed by peers born at full term, and even greater delays continue to early school age for children born before 33 weeks gestation.

Motor Outcomes Next, research on the motor development of premature infants has outlined risk of developmental motor delays, and differences based on developmental trajectory. Su et al. (2017) used the Alberta Infant Motor Scale (on children 0-18 months) on 2-year olds who were born premature. The assessment emphasized the attainment of gross motor skills, postural alignment, weight bearing of the body, and antigravity movement of the limbs in prone, supine, sitting, and standing positions. Each infant's total raw score was converted to a standardized score (z) according to the Canadian norm. Borderline and significant delays were defined as a z-score < –1 and < –2, respectively. Findings indicated that premature infants identified in the "stably normal" trajectory had better motor performance when compared to premature infants in "deteriorating" and "persistently delayed" categories, yet were still slightly below average in their first year. Infants with a deteriorating trajectory showed initial motor performance in the typical range and then deteriorated to borderline delay (z-score < –1) from 6 months onward. Infants with a persistently delayed trajectory demonstrated borderline motor delay at 4 months and then declined to significant delay from 9 months onward (z-score < –2). Perinatal factors including lower birth weight, male gender, moderate to severe bronchopulmonary dysplasia, stage III to IV retinopathy of prematurity, and major brain damage are associated with a risk of deteriorating and persistently delayed motor trajectories in premature infants. Findings indicated that 20-30% of the children showed borderline or significantly delayed motor outcomes.

Summary of Developmental Outcomes in Prematurity There have been mixed findings regarding a "catch-up effect," which is the concept that premature infants will be most significantly delayed in their first 2 years of life and then "catch up" to full term peers across neurodevelopmental domains. Their delays will have the greatest impact on them early in life and as months progress, the gap between premature infants and full term infants will gradually close. Zimmerman (2018) noted when comparing premature infants to healthy controls within and between studies the peer group chosen needs to be closely considered because it can greatly influence if and to what extent the premature infant "catches up."

Research is varied concerning the age of emergence of neurodevelopmental differences in premature infants. However, neurodevelopmental delays are consistently found across domains in infants born premature. Socially, children born premature have greater difficulty establishing and maintaining friendships, in addition to greater difficulty engaging with and being attuned to their parents. Parents and teachers both report more problems with attention, thinking, and general social problems when comparing premature children to a healthy control group. Communication outcomes have been measured in a variety of ways and research is not consistent in using communication sample measures, compared to parent report or measures administered by non-communication professionals. Overall, school-age children born prematurely are consistently outperformed by peers born at full term, and even greater delays continue to early school age for children born before 33 weeks gestation.

Small for Gestational Age

Small for gestational age (SGA) infants also have been found to experience neurodevelopmental delays compared to their healthy peers, but with differences across domains compared to premature infants. Small for gestational age is a term used to describe a baby who is smaller in weight than the norm for the number of weeks of pregnancy. SGA babies usually have birthweights below the 10th percentile for babies of the same gestational age (Children's Hospital, 2014). Generally, across studies, SGA is consistently defined as a birthweight below the 10^{th} percentile or two SD below the mean for gestational age. However, when studies compared multiple groups of SGA infants, there was variability in definitions by weight to differentiate extent of impact (e.g. Ewing et al., 2017; Løhaugen et al., 2013).

The causes for SGA are multifactorial. An infant may be SGA if the mother is a heavy user of opioids, cocaine, alcohol, and/or tobacco during pregnancy (Cleary et al., 2011). When maternal symptoms of infection arise during pregnancy, TORCH screening (Toxoplasma, Others, Rubella, Cytomegalovirus, Herpes group of viruses) is completed to determine risk of impact to the fetus. Postnatal infant screening for SGA infants includes TORCH, cranial ultrasound (for bleeding, injury, hydrocephalus, infection, masses, and macrocephaly), urine cytomegalovirus polymerase chain reaction (for cytomegalovirus), and karyotype (for genetic differences; Krishnamurthy, Popiel, & Malhotra, 2017). Significant differences that have been identified between full term SGA and non SGA infants include perinatal complications, congenital anomalies, metabolic disorders, neonatal abstinence syndrome (drug withdrawal), respiratory distress and other respiratory conditions (Ewing et al., 2017).

SGA infants show less mature neurobehavioral profiles, particularly in the orientation and motor domains. In addition, cognitive, academic, and behavioral differences have been noted later in development. SGA infants have evidenced significantly lower scores in all neurodevelopmental domains including social, adaptive, communication, motor, and cognitive domains. These differences remained significant after adjusting for parental smoking, socioeconomic class, gestational age at delivery, and gender (Savchev et al., 2013). Specific developmental differences are outlined here by domain.

Social Outcomes It is not clear what factors cause social interaction difficulties in children born who survive very and extremely low birth weight status. In some children, difficulty in making friends and negotiating social relationships may result from ADHD, for which very low birth weight (VLBW) and extremely low birth weight (ELBW) children are at higher risk (Msall & Park, 2008). A second factor contributing to challenges in social competencies may be due to lack of socialization skills. This can reflect a trajectory of difficulties in nonverbal communication and learning skills. This makes it difficult for the child to pick up cues of closeness, distance, and nuance during social encounter (Msall & Park, 2008).

Academic Outcomes Based upon the possible cognitive and communication delays that can be seen in SGA children, it could be anticipated that academic differences might also occur. Paulson (2012) found no differences in reading or math performance for preschool- and kindergarten-aged participants. In another study, SGA infants were defined as those born weighing 1500 grams/3.3 pounds or less, and mean birth weight for the sample was 2.65 pounds (Schraeder, Heverly, O'Brien, & Goodman, 1997). In this study, children born SGA were tested at 7, 9, and 11 years of age, and findings indicated that mathematics was the only domain with a significant main effect for the group (other domains assessed included general information, reading recognition, reading comprehension, total reading, mathematics, and spelling). Tosun (2017) defined SGA as lower than 10th percentile birth weight or two SDs below the mean for gestational age and found delayed academic achievement in 7- to 11-year old children born SGA, using teacher reports (Tosun, 2017). Overall, research on academic outcomes for premature children indicate significant differences in academic achievement, specifically in math and reading scores for both preschool and kindergarten aged children.

Cognitive Outcomes

A study of 120 24-month-olds born SGA indicated that all studied neurodevelopmental domains were poorer in the SGA group, reaching significance for the cognitive (standard score averages of 92.9 vs 100.2), communication (94.7 vs 101), motor (94.2 vs 100) and adaptive (89.2 vs 96.5) scores. Likewise, the SGA group had a higher risk of low scores in communication (odds ratio (OR) = 2.63) and adaptive (OR = 2.72) domains (Savchev et al., 2013). In other research, cognitive performance of SGA newborns has been found to be about 12 percentile points lower than typically developing peers (Paulson, 2012).

Research has demonstrated mixed findings regarding neurodevelopmental trajectory for SGA infants. Lower cognitive outcomes at one and two years of age have been noted (Feldman & Eidelman, 2006). However, Paulson (2012) found that by 2 years of age, no significant cognitive differences were observed between the SGA (lower than third percentile birth weight for gestational age) and non SGA groups (≥ third percentile birth weight for gestational age). Still other evidence suggests that cognitive impacts continue into early adulthood. For instance, research on 19-20 year olds with a history of SGA (defined as lower than tenth percentile birth weight for gestational age and history of intrauterine growth restriction) indicated lower Full-Scale IQ scores on the Wechsler Adult Intelligence Scale – 3rd ed. (WAIS-III; LøHaugen, 2013). The differences in these findings may be due to differing definitions of SGA, with different levels of severity included.

In summary, research has demonstrated mixed findings regarding the age of emergence of neurodevelopmental differences across children born premature and SGA. For premature children, communication delays continue to early school age (Smith et al., 2014; Wolfe, 2015; Zimmerman, 2018). Motor impairment persists throughout childhood for premature children, but research has found no additional deterioration into later childhood. In small for gestational age (SGA) children, infants show less mature neurobehavioral profiles and demonstrate delays in cognitive, academic, motor, and behavioral domains later in development. There are mixed findings on long term cognitive impacts in SGA children, but research suggests cognitive functioning is delayed for newborns up to two years of age (Feldman & Eidelman, 2006; LøHaugen, 2013; Paulson, 2012; Savchev et al., 2013). Research has explored neurodevelopmental differences for children born small for gestational age (SGA) and children born premature, but few studies have done a direct comparison between the two populations.

Building on this research, this study seeks to explore differences between neurodevelopmental groups (premature, SGA, both, and AGA) on neurodevelopmental assessment domains.

Hypotheses

For this study, the independent variable is group membership (whether child was premature, SGA, both, or AGA). The dependent variables are the scores achieved on the neurodevelopmental measures (social, adaptive, communication, motor, and cognitive scores).

1. It is hypothesized that there will be differences between groups (premature, SGA, both, or AGA) on personal/social neurodevelopmental assessment scores.
    a. Children born premature will demonstrate lower social scores than typically developing peers.
    b. Children born SGA will demonstrate lower social scores than typically developing peers.
    c. Children born SGA will demonstrate commensurate scores with children born premature.
    d. Children born both SGA and premature will demonstrate lower social scores than children in the other three groups (premature, SGA, and AGA).
2. It is hypothesized that there will be differences between groups (premature, SGA, both, or AGA) on adaptive neurodevelopmental assessment scores.
    a. Children born premature will demonstrate lower adaptive scores than typically developing peers.
    b. Children born SGA will demonstrate lower adaptive scores than typically developing peers.
    c. Children born SGA will demonstrate commensurate adaptive neurodevelopmental assessment scores with children born premature.

d. Children born both SGA and premature will demonstrate lower adaptive neurodevelopmental assessment scores than children in the other three groups (premature, SGA, and AGA).

3. It is hypothesized that there will be differences between groups (premature, SGA, both, or AGA) on communication scores.
   a. Children born premature will demonstrate lower communication neurodevelopmental assessment scores, in both receptive and expressive subdomains, than typically developing peers.
   b. Children born SGA will demonstrate lower communication neurodevelopmental assessment scores in, both receptive and expressive subdomains, than typically developing peers.
   c. Children born SGA will demonstrate lower communication neurodevelopmental assessment scores, in both receptive and expressive subdomains, than children born premature.
   d. Children born both SGA and premature will demonstrate lower communication neurodevelopmental assessment scores, in both receptive and expressive subdomains, than children in the other three groups (premature, SGA, and AGA).
4. It is hypothesized that there will be differences between groups (premature, SGA, both, or AGA) on motor neurodevelopmental assessment scores.
   a. Children born premature will demonstrate lower motor scores, in both gross motor and fine motor subdomains, than typically developing peers.
   b. Children born SGA will demonstrate lower motor scores, in both gross motor and fine motor subdomains, than typically developing peers.

c. Children born SGA will demonstrate lower motor scores, in both gross motor and fine motor subdomains, than children born premature.

d. Children born both SGA and premature will demonstrate lower motor scores, in both gross motor and fine motor subdomains, than children in the other three groups (premature, SGA, and AGA).

5. It is hypothesized that there will be differences between groups (premature, SGA, both, or AGA) on cognitive neurodevelopmental assessment scores.

    a. Children born premature will demonstrate lower cognitive neurodevelopmental assessment scores than typically developing peers.

    b. Children born SGA will demonstrate lower cognitive neurodevelopmental assessment scores than typically developing peers.

    c. Children born SGA will demonstrate lower cognitive neurodevelopmental assessment scores than children born premature.

    d. Children born both SGA and premature will demonstrate lower cognitive neurodevelopmental assessment scores than children in the other three groups (premature, SGA, and AGA).

Chapter 2

Methods

Participants

Battelle Developmental Inventory Normative Update, 2nd ed. (BDI-2 NU), assessment data were obtained for 87 children (26 children born premature, 8 SGA, 6 combo, 47 controls). Because data were drawn from an assessment clinic database, some participants' communication scores were obtained using the Preschool Language Scale, 5th ed. (PLS-5) and some cognitive and motor scores were obtained using the Bayley Scales of Infant and Toddler Development, 3rd ed. (Bayley III). The premature group ranged in age from 30 to 36.5 months (M=34.7 months, SD=1.38). The SGA group ranged in age from 37 to 40 months (M=38.13 months, SD=1.13). The control group ranged in age from 37 to 41 months (M=39.3 months, SD=1.26). All participants had been referred for eligibility evaluation for early intervention or early childhood special education services through a school district in the state of Oregon. Participants were referred by their pediatrician, teachers, or other care providers.

As a criterion for establishing eligibility for special services, many states use a standard score that is at least 2.0 SDs below the mean in one domain or 1.5 SDs below the mean in two domains. Table 1 depicts the neurodevelopmental scores for this sample, by group and neurodevelopmental domain.

Table 1

Neurodevelopmental Scores by Group and Neurodevelopmental Domain

	Premature Group M(SD)	SGA M(SD)	Controls M(SD)
Adaptive	92.12 (15.37)	84 (16.09)	91.16 (13.22)
Personal-Social	99.09 (14.49)	87.25 (19.29)	96.78 (14.78)
Communication	79.47 (12.17)	75.75 (19.27)	72.08 (14.75)
Motor	92.5 (18.24)	83.13 (17.55)	98.84 (13.82)
Cognitive	84.94 (13.85)	78.88 (14.69)	84.96 (11.76)

Measures

Operational Definitions of Birth Status Groups For the purposes of this study, premature birth is defined as a birth that takes places before the 37th week of gestation. Participants in the prematurity group will not also be small for gestational age. Small for gestational age (SGA) is defined as (1) a birth weight below the 10th percentile for GA, or (2) birth weight below -2.0 SDs for GA. SGA infants were classified based on the definition from The Children's Hospital of Philadelphia (2014). Participants in the SGA group will have completed full-term gestation. Infants who were both premature and SGA were classified in a "Both" group. Infants who were not premature or SGA at birth were classified as appropriate for gestational age (AGA).

Bayley Scales of Infant Development, 3rd ed. The Bayley Scales of Infant Development (3rd ed.; Bayley-III; Bayley, 2005) assesses infant development between the ages of 1 month and 42 months across five domains, including cognitive, communication (receptive and expressive), motor (fine and gross), social-emotional, and adaptive behavior. Index scores on the Bayley-III are calculated including a correction for gestational age. The Bayley-III normative sample included children from special group studies (approximately 10%), including those born prematurely and SGA. The psychometric properties are generally good, but low reliability coefficients (.71) were obtained in the younger age groups (1-5 m) within the Receptive and Expressive Communication subtests (Bayley, 2005). For the other subtests and age groups, the coefficients range between .72 and .98, with an average of 0.89.

Battelle Developmental Inventory Normative Update The Battelle Developmental Inventory Normative Update (2nd ed.; BDI-2 NU; Newborg, 2005) is an assessment commonly used to evaluate children in the areas of personal-social, adaptive, communication, motor, and cognitive domains. Norms are based on English speaking children in the United States and have not been established for premature or low birth weight infants. The BDI-2 NU is comprised of 450 items that measure early neurodevelopmental milestones in the following domains: personal-social, adaptive, communication, motor, and cognitive. The Battelle is normed on 2,500 children ages 0 to 7 years, 11 months. The items in each domain are ordered according to their developmental difficulty level. Proper administration of the BDI-2 NU involves finding the child's basal level (defined as three consecutive items on which the child receives the maximum score) and administering items until the child reaches a ceiling level (defined as three consecutive items on which the child receives a score of 0). Thus, the exact subset of items administered varies by individual child. Index scores on the BDI-2 NU are calculated including a correction for gestational age. The BDI-2 NU uses norms reweighted and calculated based on 2015 census projections. The sensitivity was measured at 0.72-0.93 and specificity was measured at 0.79-0.88. Internal consistency was measured at 0.78-0.96 and inter-scorer reliability was 0.97-0.99. The Battelle faces challenges in construct when used on any special group because there have not been any norms established, specifically with premature and low birth weight children.

Preschool Language Scale The Preschool Language Scale (5th ed.; PLS-5; Zimmerman et al., 2011) is a play-based assessment that measures language skills for children birth through age 7 years and aims to assess language development and identify children who have a language delay or disorder. The standardization sample for the PLS-5 included 1400 children aged birth through 7 years, 11 months and was matched to the 2008 United States Census figures. Clinical studies included a developmental delay study and three language disorder studies (children with receptive language disorder, expressive language disorder, and both receptive and expressive disorder). The PLS-5 reports sensitivity to be 0.83, specificity to be 0.8, and inter-item correlation coefficients ranged between 0.91 and 0.98.

Procedure

This study was approved by the George Fox University Human Subjects Research Committee and data collection was completed using an archival database accessed through the school district. Written permission was obtained from the coordinator of special education. Early intervention and early childhood special education services are provided by a licensed psychologist, speech and language pathologists, and graduate students enrolled in a doctoral program of clinical psychology. The graduate students work under close supervision of the licensed psychologist. Participants were families referred to the school district early child evaluation center to have their child evaluated for Early Intervention (EI) services.

The neurodevelopmental domains of social skills, adaptive skills, communication (expressive and receptive), motor (fine and gross), and cognitive, were assessed depending on the referral concern of the primary care physician, parents, or when other delays were noted by the evaluation team during the assessment.

Because these data were collected in a clinic, the specific measures administered were selected based on the referral concerns, as well as the needs and abilities of the child evaluated. Generally, children were administered the BDI-2 NU. However, if the child was under 12 months of age, the Bayley-III was sometimes selected for cognitive and motor domains. In addition, the PLS-5 was sometimes used in place of the communication index when clinically relevant. The PLS-5 has good concurrent validity with the CELF-2 and the Mullen Scales of Early Learning, but concurrent validity has not been established with the Bayley-III or BDI-2 NU. BDI-2 NU subdomain scores correlated positively with scores on the Bayley-III on similar constructs (between 0.48 and 0.75).

Chapter 3

Results

For this study, the independent variable is group membership (whether child was premature, SGA, both, or AGA). The dependent variables are the scores achieved on the neurodevelopmental measures (personal social, adaptive, communication, motor, and cognitive scores).

Descriptive Statistics

The Statistical Package for the Social Sciences (SPSS, version 26.0) was used for all analyses. Differences found in all analyses were considered significant, and reported, if reaching at least the .05 level of confidence. Skewness and kurtosis of each of the variables were explored using the Shapiro-Wilk Test of Normality (see Table 2).

Table 2

Descriptives for Normal Distributions

	Means	*SD*	Shapiro-Wilk p-value
Personal/Social			
Controls	97.13	15.06	.64
Premature	98.08	14.89	.01
SGA	87.25	19.28	.004
Combo	102.00	14.28	.10

Table 2 continued	Means	*SD*	Shapiro-Wilk p-value
Adaptive			
Controls	91.34	13.25	.82
Premature	90.73	16.32	.74
SGA	84.00	16.09	.78
Combo	96.83	11.43	.77
Communication			
Controls	73.38	14.77	.05
Premature	79.42	13.18	.14
SGA	75.75	19.27	.46
Combo	81.40	6.35	.93
Expressive			
Controls	75.23	15.24	.02
Premature	79.56	16.97	.03
SGA	77.50	16.26	.41
Combo	77.17	6.79	.12
Receptive			
Controls	73.00	16.24	.002
Premature	81.48	14.66	.23
SGA	75.63	19.90	.37
Combo	87.67	8.98	.03
Motor			
Controls	98.26	13.81	.44
Premature	92.77	18.66	.002
SGA	83.13	17.55	.52
Combo	90.60	19.83	.20

Table 2 continued	Means	*SD*	Shapiro-Wilk p-value
Gross			
Controls	99.24	15.70	.01
Premature	90.20	19.28	.002
SGA	84.38	12.37	.59
Combo	89.17	21.08	.25
Fine			
Controls	97.50	16.36	.48
Premature	100.80	15.72	.03
SGA	84.38	20.95	.94
Combo	91.67	12.91	.27
Cognitive			
Controls	84.85	11.78	.43
Premature	86.12	13.63	.12
SGA	78.88	14.69	.37
Combo	80.80	16.45	.22

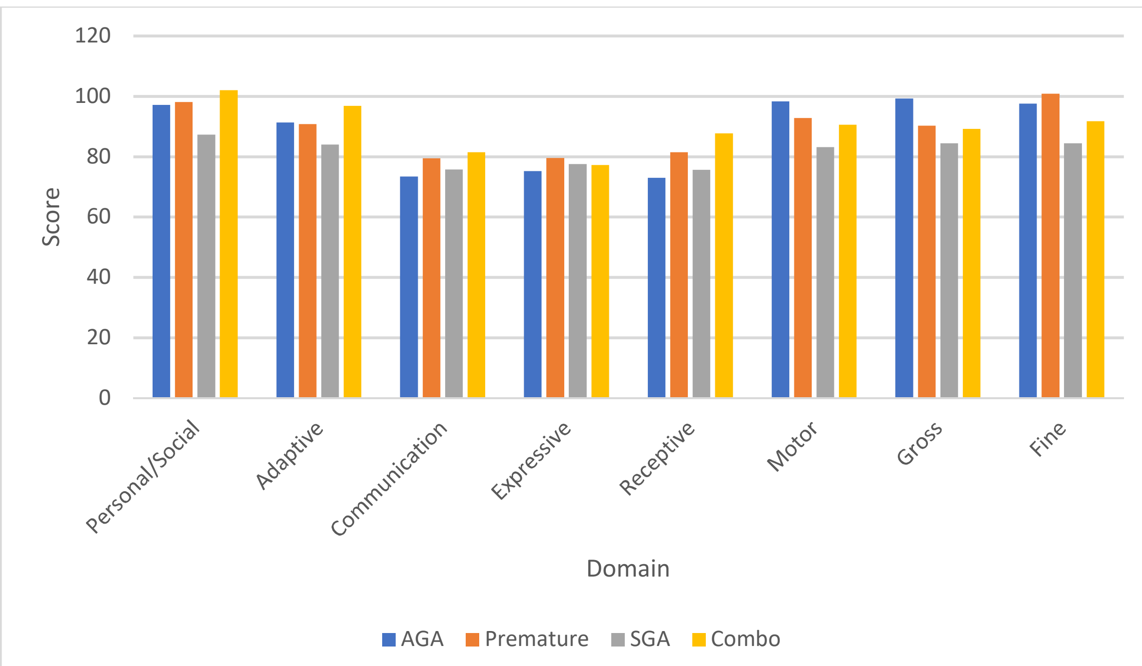
Between Groups Comparisons

Independent Analyses of Variance (ANOVAs) were used to compare the independent variable groups (premature, SGA, both, or AGA) on domain scores (Adaptive, Personal Social, Communication, Motor, Cognitive) and the subdomain scores of Communication (Receptive and Expressive) and Motor (Gross and Fine).

There were no significant differences between groups for Adaptive, Personal Social, Communication, Motor, Cognitive, or the subdomain scores of Communication (Receptive and Expressive) and Fine Motor. The only significant difference found was a significant difference between groups on Gross Motor ($F(3,81) = 2.879$, $p = .041$, $\eta^2 = .096$). Post-hoc tests using Least Significant Differences indicated that the differences between groups on Gross Motor were between the control group compared to the premature group (power = .99) and control group compared to SGA (power = 1.0; see Figure 1). No significant difference was found in Gross Motor scores in infants born both premature and SGA compared to controls.

Figure 1

Group Scores by Domain



Note. This table demonstrates the mean scores of the AGA, premature, SGA, and combination group on each of the developmental domains measured.

To check whether non-significant results were due to a lack of statistical power, post-hoc power analyses were conducted using GPower (Faul & Erdfelder, 1992; for a full description, see Erdfelder, Faul, & Buchner, 1996) with power (1 - β) set at 0.80 (Cohen, 1988) and α = .05, two-tailed. Findings indicated that sample sizes would have to increase up to n = 1,448 in order for group differences on Receptive Language (the score which had the next lowest p-value after Gross Motor) to reach statistical significance at the .05 level, suggesting that results may indeed have been limited by sample size.

Table 3

Between Group Comparisons

		Sum of Squares	*df*	Mean Square	*F*	*p*	*η2*	Power
Adaptive	Between	601.84	3	200.61	.97	.42	.03	.05
	Within	17206.50	83	207.31				
	Total	17808.35	86					
Personal Social	Between	939.17	3	313.06	1.33	.27	.05	.06
	Within	19596.58	83	236.10				
	Total	20535.75	86					
Communication	Between	771.91	3	257.30	1.23	.30	.04	.06
	Within	17140.15	82	209.03				
	Total	17912.06	85					
Expressive	Between	310.30	3	103.43	.43	.73	.02	.05
	Within	19669.42	82	239.87				
	Total	19979.72	85					
Receptive	Between	1945.40	3	648.47	2.60	.06	.09	.09
	Within	20471.45	82	249.65				
	Total	22416.85	85					
Motor	Between	1846.75	3	615.58	2.38	.08	.08	.08
	Within	21213.63	82	258.70				
	Total	23060.37	85					

		Sum of Squares	df	Mean Square	*F*	*p*	*η2*	Power
Gross	Between	2486.10	3	828.70	2.88	.04	.10	.10
	Within	23315.08	81	287.84				
	Total	25801.18	84					
Fine	Between	1815.65	3	605.22	2.23	.09	.08	.08
	Within	21876.71	81	270.08				
	Total	23692.35	84					
Cognitive	Between	394.92	3	131.64	.89	.50	.03	.05
	Within	13626.29	82	166.17				
	Total	14021.21	85					

Chapter 4

Discussion

The current study focuses on the impact of developmental delays in premature, small for gestational age, and premature and SGA infants. Domains that are often impacted in premature and SGA infants include; academic achievement, communication development, and motor skills. SGA children are found to have delays in multiple domains, likely impacted by common causes of a child being born smaller than the usual weight compared to others in their gestational age group (Aylward, 2014; Tosun et al., 2017). Factors causing SGA births include maternal use of opioids, cocaine, alcohol, and/or tobacco during the pregnancy (Cleary et al., 2011). Complications and conditions often associated with SGA infants screened postnatally include TORCH, cranial conditions (bleeding, injury, hydrocephalus, infection, masses, and macrocephaly), urine cytomegalovirus polymerase chain reaction (for cytomegalovirus), and karyotype (genetic differences; Krishnamurthy, Popiel, & Malhotra, 2017). Premature births are also commonly a result of infections (Group B strep, Herpes, E-coli), poor maternal health, or other lifestyle factors, such as drug use as outlined previously (Waechter, 2014). Unlike SGA births, premature infants are often born as a result of a scheduled delivery, oftentimes because the pregnancy is higher risk if carried out to full term (37-40 weeks; Waechter, 2014).

Current research is insufficient in differentiating developmental delays, including short and long term impacts, between premature, SGA, and premature and SGA infants. This study sought to explore neurodevelopmental domain scores and differences in social, adaptive, communication (expressive and receptive), motor (gross and fine), and cognitive functioning in the respective groups. Hypotheses were that premature infants and SGA infants would demonstrate lower social scores, lower adaptive scores, lower communication scores (both receptive and expressive), lower motor scores (both gross and fine), and lower cognitive scores than typically developing peers. It was hypothesized that children born SGA would demonstrate commensurate social scores and adaptive scores compared to children born premature. However, SGA infants would demonstrate lower communication scores (expressive and receptive), lower motor scores (gross and fine), and lower cognitive scores than children born premature. Lastly, children born both premature and SGA were hypothesized to demonstrate lower scores in all domains (adaptive, social, receptive and expressive communication, gross and fine motor, cognitive) than children in the other three groups (premature, SGA, and AGA).

Summary

Across the majority of the developmental areas measured, there were no significant differences observed between groups. In the one subdomain where a significant difference was found (gross motor), the effect size was small. These findings are contrary to prior research and the proposed hypotheses. Discussion of this summative finding is followed by discussion of findings related to specific developmental domains.

Low powerWithin each of the groups, across each domain, low statistical power was observed. Even in the domain that indicated significant differences (gross motor), power was low, reducing the likelihood of a true effect. To increase power, the sample size would need to be significantly larger and based on the current statistical power of each domain.

Clinically-Referred SampleThe participants in the current group were from a clinically-referred sample. Thus, participants in the control group (average for gestational age), were children identified by parents or other care providers to already be exhibiting perceived delays in one or more areas. Scores would likely have had greater discrepancy if non-clinical controls were used.

High Variability Within Groups With groups divided by birth status alone, there was large score variability. Therefore, there are likely a variety of other factors that could be impacting development and need to be considered in predicting developmental outcomes in each domain.

Lack of Sensitivity The BDI-2 NU and Bayley-III may have less sensitivity in use for group comparison. These assessments may be better suited for informing the development of individual treatment plans, rather than utilizing them for comparison between groups.

More Extreme Prematurity Most children in the present sample were born after 33 weeks gestation, whether group membership was premature, small for gestational, or a combination of the two. Many studies focus on more extreme cases of infants born prematurely and small for gestational age, complicating comparison between the results of this study and prior research, as noted for the personal/social domain compared to Jones, et al. (2013), for the adaptive domain as compared to Fjørtoft et al. (2015), for the motor domain compared to Su et al. (2017), and for the cognitive domain compared to Paulson (2012).

Additionally, a study that included what researchers defined as late premature (34-36 weeks), early term (37-38 weeks), and term (39-41 weeks) infants found no neurodevelopmental differences before 24 months, but emergence of neurodevelopmental differences by preschool (Shah, Kaciroti, Richards, Oh, & Lumeng, 2016). Since the majority of the present study's sample is under the age of 3, perhaps developmental differences have yet to emerge. This was noted for the personal/social domain compared to and Farooqi et al. (2007), for the adaptive domain as compared to Galeti, Goulart, and Schwartzman (2018), for the motor domain compared to Su et al. (2017), and for the cognitive domain as compared to Paulson (2012).

Brain Development While, by definition, premature and SGA infants are categorized differently, the causes for early delivery or low birth weight can often be similar and could result in similar impacts on brain development.

Access to Early Intervention Services Premature and SGA infants are also treated similarly in the United States at birth in terms of medical care and early intervention support and services. While infants in this study in the premature, SGA, or combo groups likely received extra care and monitoring post-delivery to ensure normal development of early skills in the explored domains, children in the control group could have had similar delay. However, if delays were minimal or early intervention services were not easily accessible, delays could have been easily missed or not addressed entirely, given their average for gestational age birth status. Specific findings by domain are discussed here.

Personal/Social

It was hypothesized that SGA and premature infants would score similarly in the personal/social domain but would perform worse than the control group and better than the combination group. However, no significant differences were found in personal/social scores between any of the groups (premature, SGA, combination, controls). Studies that focused on premature infants' social functioning explored VPT children, defined as < 32 weeks gestation (Jones, Champion, & Woodward, 2013) and children born 23-25 weeks who had been evaluated at 36 months corrected age and again between the ages of 10 and 12 years (Farooqi et al. 2007). While Farooqi et al.’s (2007) study followed up with the evaluated infants, testing was initially done at 36 months of age for all infants, contrasting from the current study’s sample group. With both studies that evaluated premature infants, both consisted of a sample significantly more impacted in gestational age and weight, in addition to not indicating infants who were both SGA and premature.

Adaptive

No significant differences were found in adaptive scores between any of the groups (premature, SGA, combination, controls), different than the frequency of emotional/behavioral problems and adaptive behavior measured by Galeti, Goulart, and Schwartzman (2018) who found that 4-5 year old children born premature had more frequent incidents than children born full term. This study broadly defined adaptive problems as communication, daily living skills, socialization, and gross and fine motor skills, which differs from the singular adaptive measure used in the Bayley-III and BDI-2 NU inventory used in this study. Little to no research is available on adaptive scores that fit the parameters of the current study and is convoluted by adaptive functioning definitions and the association and overlap between adaptive measure and behavioral, emotional, and social measures.

Communication

Based on prior research, it was hypothesized that the combination group would have the lowest overall communication scores between groups, SGA infants would perform more poorly than premature infants, and each of the groups were expected to score lower than the control group. Zimmerman (2018) conducted a meta-analysis and found delays before school age in both expressive and receptive communication, in addition to phonological awareness and grammar abilities, not differentiating premature, SGA, or combination groups. Similarly, Smith, DeThorne, Logan, Channell, & Petrill (2014) found that premature children (defined as $\leq$ 32 weeks gestation) were outperformed by full term peers on a broad range of communication tests.

Contrary to prior research, this study did not find significant differences in overall communication scores between groups. However, it is important to consider the clinically-referred nature of the control group when forming conclusions based on these findings. In each of the groups, children scored more than 1.5 SD below the mean in overall communication and expressive and receptive communication. It is likely communication skills can be the first indicator to a care provider or pediatrician that a child is experiencing delays, because of the impacts this has on the social interaction with adults and peers.

Motor

It was hypothesized that the combination group would have the lowest overall motor scores between groups, SGA infants would perform more poorly than premature infants, and each of the groups were expected to score lower than the control group. No significant differences were found in overall motor scores between groups. However, when motor scores were divided into gross motor and fine motor subdomains, there were significant differences between birth status groups on gross motor scores, with the SGA group scoring the lowest, followed by the combination group, premature group, and control group. This contradiction to prior research may be due to varying definitions and lack of differentiation between groups. Su et al. (2017) assessed premature infants with very low birth weight, which mirrored the current study's combination group, but did not define groups as small for gestational age based on their weight at birth. More research has been done on gross motor skills compared to fine motor skills, perhaps because developmental milestones in the first 2-3 years of life are more focused on gross motor skill development. Gross motor skill delays are also more easily noticed if a provider is the referral source. While there have been mixed findings regarding a "catch-up effect", Zimmerman (2018) emphasized the importance of carefully considering a control group when comparing premature infants to healthy controls because it can greatly influence "catch up" and other outcomes. Since the healthy controls in this sample are a clinically-referred group, this could have also impacted results.

Cognitive

It was hypothesized that the combination group would have the lowest cognitive scores between groups, SGA infants would perform more poorly than premature infants, and each of the groups were expected to score lower than the control group. No significant differences were found in cognitive scores between groups. This is contradictory to broad conclusions made in prior research. However, Paulson (2012) found no significant cognitive differences in SGA infants by 2 years of age, yet the sample was severe SGA (lower than third percentile birth weight for gestational age) compared to newborns who weighed >3% for GA. Significant differences found in prior research in both premature and SGA infants may be due to differing definitions, with different severity levels.

Implications

In sum, the scores from the current sample indicate children are more likely to be referred when they are exhibiting difficulties with communication skills, both in overall communication and in expressive and receptive communication. Expressive and receptive communication also largely impact social skills and could be the first apparent indication of a delay when children are being referred by a care provider or pediatrician. For each child referred for an evaluation, the results of this study also suggest that individual treatment plans would be the most beneficial in addressing the presenting concerns and any delays that are determined through an assessment, rather than offering early intervention services simply because of a child being born premature or SGA.

Limitations

When looking at the results, it is important to take limitations of the study into account. There were barriers to collecting a detailed patient history regarding the parents and child. The intake forms provided by the evaluation center were brief and included more questions related to the child's major milestones and current developmental performance. This limited the available data points to consider as predictor variables when comparing the groups and their performance across domains. Additionally, the specific sample were children in a single district within the state of Oregon, which may affect the generalizability of results, and may have impacted diversity in the sample group. The size of the sample also impacted the strength of the statistical power, and therefore the significance of the results. Lastly, comparing the groups to a nonclinical control group may have yielded different, perhaps more significant, results than to a clinically referred control group (average for gestational age infants still referred by a parent or care provider).

Future Research

Even with the given limitations, this study provides relevant information about areas that need further exploration. For any future studies, it would be important to collect a detailed family history, perhaps including parent education level, stress levels throughout each trimester of pregnancy and beyond, maternal nutrition, in utero exposure, socioeconomic status, and any interventions already used to assist the child. A larger sample size would be critical for finding any significant differences that are generalizable and reproducible, in addition to utilizing or developing other measures that are more sensitive to between group differences with these specific groups than the measures used in this study. Lastly, a larger sample size, longitudinal design or comparing children tested initially at a later age, could yield different results with valuable insights into providing early intervention services.

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Appendix A

Curriculum Vitae

Alicia M. Gibson

EDUCATION

Doctor of Clinical Psychology (PsyD), George Fox University; Newberg, Oregon
Anticipated May 2022
Dissertation: *Early Childhood Neurodevelopmental Profiles: Premature and Small for Gestational Age Infants*
Emphases: Child and Adolescent, Psychological Assessment
Advisor: Celeste Jones, PsyD

Master of Arts, George Fox University; Newberg, Oregon; May 2019
Concentration: Clinical Psychology
Advisor: Celeste Jones, PsyD

Bachelor of Arts, Northwest Nazarene University; Nampa, Idaho; October 2015
Concentrations: Psychology, Criminal Justice
Advisor: Glena Andrews, PhD

SUPERVISED CLINICAL EXPERIENCE

Practicum Student, Providence Medical Group – Sherwood
July 2020 – Present
Provide therapy, consultation, and evaluations across the lifespan in a primary care setting
Supervisors: Jeri Turgesen, PsyD; Daniel Rodriguez, PsyD

Practicum Student, Dr. Wendy Bourg Private Practice
June 2020 – Present
Conduct clinical interviews and parent-child observations
Administer, score, interpret and co-write child custody evaluation reports
Attend meetings to provide client and attorney feedback
Supervisor: Wendy Bourg, PhD

Practicum Student, George Fox University Health and Counseling Center
November 2019 – May 2020
Provided short-term and long-term individual therapy to traditional and non-traditional students
Supervisor: Luann Foster, PsyD

Assessment Practicum Student, **George Fox University Behavioral Health Clinic**
November 2019 – present

Administer psychodiagnostic and neuropsychological assessments to children and adults in a community clinic setting
Write integrative reports and make recommendations to clients
Supervisors: Kenneth Logan, PsyD; Glena Andrews, PhD

Behavioral Health Crisis Consultant, George Fox University and Yamhill County
January 2019 – present
Respond to crisis calls at Willamette Valley Medical Center and Providence Medical Group – Newberg
Consult in Emergency Department settings with law enforcement, EMS personnel, and physicians
Conduct risk assessments for active suicidality, homicidality, mania, and psychosis
Refer urgent-needs clients to inpatient or outpatient psychiatric care facilities
Supervisors: Mary Peterson, PhD; Bill Buhrow, PsyD; Luann Foster, PsyD

Practicum Student, Oregon City Pediatric Building
July 2019 – November 2019
Administered comprehensive assessments to children and adolescents in a medical setting
Wrote integrative reports and made recommendations to clients
Supervisor: Tim Galuza, PsyD

Practicum Student, North Clackamas Early Childhood Evaluation Center
August 2018 – June 2019
Conducted broadband developmental assessments with ages 0-5
Determined eligibility for developmental delay
Provided feedback and test results to parents
Observed and assisted in Autism Diagnostic Observation Schedules (ADOS-2)
Wrote formal evaluation reports
Provided therapy sessions to elementary school students, 3 hours per week
Supervisor: Fiorella Kassab, PhD

Pre-practicum Therapist, Graduate Department of Clinical Psychology
January 2018 – April 2018
Provided 10 therapy sessions to two undergraduate students as part of the Clinical Foundations graduate course
Conducted intake reports, formulated treatment plans, administered MMSE and SRS, documented progress notes
Reviewed and analyzed video recordings of therapy sessions
Supervisors: Glena Andrews, PhD, MSCP, ABPP, and Daniel Rodriguez, MA

PROFESSIONAL PRESENTATIONS/TRAININGS ATTENDED

Forster, C. (2019, October 16). *Intercultural Communication.* Presentation at George Fox University Grand Rounds, Newberg, OR.

Gil-Kashiwabara, E. (2017, October 11). *Using community based participatory research to promote mental health in American Indian/Alaska Native children, youth and families*. Presentation at George Fox University Grand Rounds, Newberg, OR.

Kuhnhausen, B. (2018, September 15, October 13, November 3). Gender & Sexuality [Certificate Graduate Course]. George Fox University; Newberg, Oregon.

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

McMinn, L., & McMinn, M (2018, September 26). *Spiritual formation and the life of a psychologist: Looking closer to soul-care.* Colloquium Presentation at George Fox University, Newberg, OR.

Pengelly, S. (2018, October 10). *Old pain in new brains.* Presentation at George Fox University Grand Rounds, Newberg, OR.

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

Sordahl, J. (2017, November 8). *Telehealth*. Colloquium Presentation at George Fox University, Newberg, OR.

Taloyo, C. (2018, February 14). *The history and application of interpersonal psychotherapy*. Presentation at George Fox University Grand Rounds, Newberg, OR.

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.

ACADEMIC LEADERSHIP AND VOLUNTEER WORK

Student Editor Coordinator; Graduate School of Clinical Psychology; Newberg, Oregon
August 2020- current

Leader, Child and Adolescent Psychology Student Interest Group; Graduate School of Clinical Psychology; Newberg, Oregon
August 2020 – current

Student Editor, GFU Graduate School of Clinical Psychology; Newberg, Oregon
August 2018 – August 2020

Student Writing Mentor, GFU Graduate School of Clinical Psychology; Newberg, Oregon
September 2018 – December 2018

Serve Day Volunteer, George Fox University; Newberg, Oregon
13 September 2017 and 12 September 2018

Student Wellness Committee, GFU Graduate School of Clinical Psychology; Newberg, Oregon
September 2018 – March 2020

PROFESSIONAL AFFILIATIONS

American Psychological Association (APA); August 2017 – current
Association of Family and Conciliation Courts (AFCC); June 2020 – current

TEACHING EXPERIENCE

Fall 2020

Teaching Assistant
Neuropsychology Assessment Foundations
Graduate School of Clinical Psychology
George Fox University, Newberg, OR
Professor: Glena Andrews, PhD
Duties:

- Aid in the teaching of administration and scoring of child, adolescent, and adult neuropsychological assessments
- Demonstrate fixed, flexible, and process battery approaches in a weekly practice lab
- Test students in competency of administration and scoring
- Assist in preparation and administration of sheep brain clinical exam

Summer 2020

Lead Teaching Assistant
Child and Adolescent Assessment
Graduate School of Clinical Psychology
George Fox University, Newberg, OR
Professor: Elizabeth Hamilton, PhD
Duties:

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

Summer 2020

Teaching Assistant
Geriatric Neuropsychological Assessment
Graduate School of Clinical Psychology
George Fox University, Newberg, OR
Professor: Glena Andrews, PhD
Duties:

- Aid in the teaching of administration and scoring of neuropsychological assessments appropriate for evaluating geriatric patients in inpatient and primary care settings

Spring 2020

Teaching Assistant
PSYD 563 Family Therapy in Diverse Cultures
Graduate School of Clinical Psychology
George Fox University, Newberg, OR
Professor: Mary Peterson, PhD; Amber Nelson, PsyD
Duties:

- Provide feedback on portfolio assignments
- Aid in the organization and structuring of the course
- Participate in meetings with other teaching assistants to address grading criteria for midterms and finals

Fall 2019 *Teaching Assistant*
PSYD 522 Cognitive Assessment
Graduate School of Clinical Psychology
George Fox University, Newberg, OR
Professor: Kenneth A. Logan, PsyD
Duties:

- Aid in the organization and structuring of the course
- Aid in the teaching and practice of individualized assessment of intellectual and other selected cognitive functions (*i.e.* WAIS-IV, WISC-V, WIAT-III, WMS-IV)
- Facilitate weekly lab group meetings with students for administration practice and continued support in course
- Attend weekly meetings with course professor and other teaching assistants to address student concerns and course components
- Participate in meetings with other teaching assistants to address strict grading criteria for APA competency in test administration, test scoring, and testing interpretation and facilitate internal grading consistency

RESEARCH PROJECTS

Andrews, G., Eddy, K., **Gibson**, A. (2019, November 15). *Assessing Global Delays in Corpus Callosum Agenesis: Infants and Toddlers*. National Academy of Neuropsychology, San Diego, CA.

Mara, P., Hoffman, L., **Gibson**, A., Smith, K., Andrews, G., Tsai, A. (2020, February 7). *Limbic System Responses While Viewing Natural Disaster News Clips: Response Differences Between Groups*. International Neuropsychological Society, Denver, CO.

Soden, D., Andrews, G., Chakara, F., Seitz, D., Eddy, K., Rich-Wimmer, N., **Gibson**, A. (In Preparation). Serial Neuropsychological Testing toward a Reliable Concussion Protocol.

PROFESSIONAL REFERENCES

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