

The Developmental Outcome of Very Low Birth Weight Infants at 18 Months

by

Lauren Foran, M.S., M.S.Ed.

A Doctoral Project Submitted in Partial Fulfillment of the
Requirements of the Degree of Doctor of Psychology in the
Department of Psychology at Pace University, New York City

2014

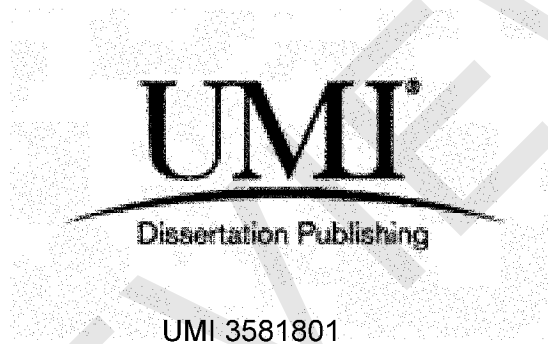
UMI Number: 3581801

All rights reserved

INFORMATION TO ALL USERS

The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.

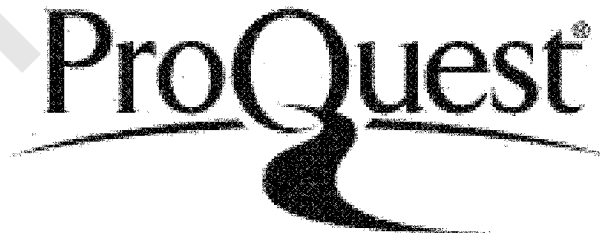


UMI 3581801

Published by ProQuest LLC 2014. Copyright in the Dissertation held by the Author.

Microform Edition © ProQuest LLC.

All rights reserved. This work is protected against unauthorized copying under Title 17, United States Code.



ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

PSY.D PROJECT FINAL APPROVAL FORM

NAME: Lauren Foran

TITLE OF PROJECT: The Developmental Outcome of Very Low Birth Weight Infants
at 18 Months

DOCTORAL PROJECT COMMITTEE:

PROJECT ADVISOR: K. Mark Sossin, Ph.D.
Name

Professor Pace University
Title Affiliation

PROJECT CONSULTANT: Baptiste Barbot, Ph.D.
Name

Professor Pace University
Title Affiliation

PROJECT CONSULTANT: Gail Ross, Ph.D.
Name

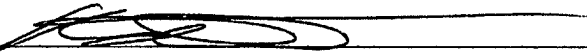
Associate Professor Weill Cornell Medical College
Title Affiliation

FINAL APPROVAL OF COMPLETED PROJECT:


I have read the final version of the doctoral project and certify that it meets the relevant requirements for the Psy.D. degree in School-Clinical Child Psychology.


Project Advisor's Signature

9/26/14
Date


Project Consultant's Signature

9/26/14
Date


Project Consultant's Signature

9/25/14
Date

PREVIEW

©2014
Lauren Foran, M.S.Ed.
ALL RIGHTS RESERVED

ACKNOWLEDGEMENTS

I would like to express my deep appreciation and gratitude to my advisor, Dr. K. Mark Sossin, for his guidance, expertise, and encouragement, while introducing me to the world of infant mental health assessment. Thank you to Dr. Gail Ross who generously shared her data, knowledge, and time to help me grow as a psychologist and as a professional. I would also like to recognize Dr. Baptiste Barbot for his essential assistance, recommendations, and support. I feel truly fortunate to have had the opportunity to work with these individuals.

I would like to thank my parents for supporting me in pursuing higher education, as well as my other family members, professors, mentors, and supervisors, whose guidance and support has brought me to this point in my academic career. A special thank you to Sherri Foran and Marion Schwartz for their time and editorial feedback. Finally, I am very grateful for the unwavering support and encouragement from David Strober, without whom I would never have completed this project or graduate program.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	iv
LIST OF FIGURES	vii
LIST OF TABLES	viii
ABSTRACT	ix
CHAPTER	
I INTRODUCTION	1
II LITERATURE REVIEW	5
Research Overview	6
Cognitive Development	7
Demographics and Perinatal Variables	10
Language Development	15
Behavior and Psychological Development	18
Statement of Purpose.	23
Research Questions.....	25
III METHOD	27
Participants.....	27
Materials	30
Child Behavior Checklist 1.5-5.....	31

	Bayley Scales of Infant and Toddler Development-Third Edition	32
	Procedure	33
IV	RESULTS	35
	Hypothesis I	35
	Hypothesis II	35
	Hypothesis III	36
	Results of Cluster Analysis	37
V	DISCUSSION	52
	Overview of Findings	52
	General Implications	61
	Limitations	63
	Future Directions	65
	REFERENCES	69
	FOOTNOTES	84
	APPENDICES	85

LIST OF FIGURES

Figure 1. Tree Diagram.....	39
Figure 2. Cluster Solution Variances.....	40
Figure 3. Bayley-III Cluster Means.....	42

LIST OF TABLES

Table 1. Demographic Variables	28
Table 2. Frequencies for Primary Variables.....	30
Table 3. Descriptive Statistics of Empirically Based CBCL (1.5-5) Scales.....	32
Table 4. Descriptive Statistics of Primary Bayley-III Variables.....	32
Table 5. Cluster Descriptive Statistics.....	43

ABSTRACT

The objective of this study was to identify perinatal variables and demographic characteristics that influence cognitive, language, and behavioral development in very/extremely preterm and low birth weight infants at the corrected age of 18 months. An additional study goal was to explore the interaction of language specifically with cognitive functioning, attention, and perinatal and behavioral characteristic for this population. The study consisted of a total of 117 participants, born weighing less than 1250g and at less than 28 weeks gestation. Outcome measures included cognitive functioning and expressive and receptive language as measured by the Bayley-III. Behavioral functioning was assessed based on parent report using the Child Behavior Checklist (CBCL/1.5-5). Correlational, multivariate analysis of variance, a hierarchical cluster analysis, and cross tabulations were completed to examine relationships and membership associations based on performance and demographic and perinatal variables. The demographic variables were gender, socioeconomic status and minority status. The cognitive and language functioning, with significant differences in reported behavior problems, and demographic and perinatal characteristics among the groups. The following were identified as demographic and perinatal variables significantly associated with group membership; SES, the presence of IVH severe grades, chorioamnionitis, and BPD. The effect size of these variables were all measured as moderate. Many behavioral differences were identified on the CBCL (1.5-5) significantly associated with group

cognitive and language functioning, with significant differences in reported behavior problems, and demographic and perinatal characteristics among the groups. The following were identified as demographic and perinatal variables significantly associated with group membership; SES, the presence of IVH severe grades, chorioamnionitis, and BPD. The effect size of these variables were all measured as moderate. Many behavioral differences were identified on the CBCL (1.5-5) significantly associated with group membership including; anxiety problems, pervasive developmental disability (PDD), total problems, anxiety/depression, somatic complaints, emotional reaction, withdrawn, attention, internalizing behaviors, and externalizing behaviors. Children with low cognitive and language scores were more likely to have had a serious health condition, low SES, and more reported behavioral problems on the CBCL (1.5-5). Identifying children with these particular perinatal and demographic profiles may benefit intervention timing, focus, design, and improve later outcome.

CHAPTER I

INTRODUCTION

Overview

Advances in neonatal care have increased survival rates for infants born at low birth weights and very preterm. With these advances in care, the amount of severe developmental and neurological deficits have also declined. However, the number of subtle deficits evident over time has grown as these individuals age. Individuals born at extremely low birth weights have shown deficits in one or more of the following: cognitive impairment, academic difficulties, learning disabilities, psychological disorders, attention-deficit/hyperactivity disorder, specific neuropsychological deficits, increased behavioral problems, and/or social problems (Aarnoudes-Moens, Weisglas-Kuperus, van Goudoever, & Oosterlann, 2009; Allen, 2002; Houtzager, Gorter-Overdiek, Van Sonderen, Tamminga, & Van Wassenauer, 2010).

While some of these deficits may be evident in early childhood, many are not identified until school-age or even adolescence. Past research has shown that the deficits identified in childhood can continue to have an effect on these individuals even as they become adults. Research has shown a variety of deficits seen in preterm and low birth weight children. However, less is known about the differences that occur among children born low birth weight and/or preterm that do not develop delays or recover from early deficits and achieve functioning within normal limits, and children who continue to

struggle at school age and beyond. Identifying some of the characteristics that influence these differences could help the understanding of which children are particularly at risk and inform risk assessment.

Numerous factors have been identified as influencing future development for this population. Some of these factors are gender, gestational age, birth weight, family socioeconomic status, and medical complications and treatments. Less is known about how these specific factors affect different aspects of neurodevelopmental functioning at the preschool age and later in life.

One goal of this study is to identify associations between both receptive and expressive language development and cognitive functioning and various perinatal and demographic variables in a single cohort study of very/extremely low birth weight children ($\leq 1250\text{g}$; V/ELBW) at 18 months (corrected age). The corrected age of 18 months was chosen for this study as it is common practice for an evaluation to occur at this age as part of follow-up care for high-risk infants and is frequently used in research (Suppeiey et al., 2009; Vohr, Wright, Hack, Aylward, & Hirtz, 2004). Throughout this document, 18 months will refer to the child's corrected age unless otherwise noted. Secondary goals are to evaluate associations between cognitive development, receptive and expressive language development, and attention issues at the corrected age of 18 months in very/extremely low birth weight children.

Advances in neonatology and prenatal treatments and assessments in the last fifty years have been particularly important in decreasing morbidity and mortality rates of preterm and low birth weight infants. Considering the multiple sequelae of health and developmental delays, the field of neonatology has made tremendous improvements in

multiple areas of care (Philip, 2005). Since then advances in infant temperature control, nutrition, respiratory support and assisted ventilation, the use of surfactant, and prenatal corticosteroids all contributed to improved survival rates and later outcome (Philip, 2005).

In addition to advances in treatment and understanding of preterm infant development and common health concerns, the field simultaneously advanced in assessing infant functioning. Early diagnosis and identification of risk factors, as well as the availability of technologies contributed to the development of the field (Philip, 2005). There are many important health consequences and risk factors associated with very and extremely preterm births. While all of these can have a significant impact on subsequent development, particular perinatal health and demographic characteristics will be the focus of this study.

As will be discussed in more detail later, there are several medical conditions common in children born at low birth weights and preterm that significantly impact functioning. Many of these conditions are serious and prior to improvements in diagnosis and treatment typically resulted in the infant's death. As a result the survival of these infants is relatively new and we do not yet fully understand how these conditions influence development.

While perinatal factors influence prematurity and development, various demographic and environmental variables have also been identified as influential. These include socioeconomic status, race and ethnicity, gender, maternal age at birth, geographic location, and access to care. Individuals in economically disadvantaged environments, of African American and Hispanic background, and those without access

to advanced medical care are more at-risk of developmental delays and subsequent deficits (Duncan et al., 2012; Erickson, Montague, MacLean, Bancroft, & Lowe, 2012; Hintz, Kendrick, Vohr, Kenneth Poole, & Higgins, 2006). Additionally, infants born to mothers of advanced maternal age have a higher risk for preterm and/or low birth weight (Xiong, Gonzalez, & De-Zhi, 2012).

Language and attention have often been identified as consistent areas of deficit for this population. Researchers have only just begun to examine biological, demographic, and comorbid factors that may influence language and attention development for these at risks children. Identifying the other factors that influence language and attention may enhance our understanding of how these areas of functioning relate to cognitive and behavioral functioning which may lead to the development of more effective early intervention (Wolke, Smara, Bracewell, & Marlow, 2008).

PREVIEW

CHAPTER II

LITERATURE REVIEW

Due to medical and technological advances, survival rates of preterm and low birth weight infants have improved significantly over the past several decades. Available statistics for the United States report a 90% survival rate for infants born between 1,000g to 1,500g; 60% for those weighing 750g to 1,000g; and 33% for infants born between 500g to 750g (Rossetti, 2001). Improved survival rates at lower birth weights results in substantially more medical complications for this group, which could impede later functioning and development in a multitude of areas, including, but not limited to, communication (Leversen et al., 2011; Rossetti, 2001). Holms and Crosbie (2010) reported that the degree of prematurity affects later outcome, with children born before 32 weeks gestation being six times more likely than full-term peers to receive special education services by the time they are school age. Other studies have reported that as many as 40-50% of VLBW infants have significant academic or behavior problems (Allen, 2002).

According to the Center for Disease Control, the rate of low birth weight in the United States was 8.10% in 2011 (Martin, Hamilton, Ventura, Osterman, & Mathews 2013). The rate of preterm births has been influenced by an increase in multiple births, the use of in vitro fertilization and other conception aides, and advances in obstetric clinical practice (McGuire, Henderson, & Fowlie, 2004).

Infants born preterm and at low birth weights are not as developed physically and neurologically at the time of their birth. There has been a substantial amount of research on the influence of this birth status on later development (Johnson & Marlow, 2011; Johnson, Wolke, Hennessy, & Marlow, 2011; Mu, Lin, Chen, Chang, & Tsou, 2008; Stephens & Vohr, 2009; Vohr et al., 2000; Vohr et al., 2012; Wolke et al., 2008; Xiong et al., 2012). Studies have shown lower academic achievement and a higher classification in special education from school age to adolescence and even lower earning potential in adulthood. Many individuals born at extremely or very low birth weights are also premature births; much of the past research does not distinguish between the two groups (Vohr et al., 2000; Vohr et al., 2012).

Historically, research has found a consistent disadvantage in numerous areas of functioning for this population, which include; academic functioning, psychological functioning, income levels in adulthood, and social functioning. As neonatal and postnatal care, technology, and availability have improved over time, they have resulted in changes in the long-term outcomes for the preterm and low birth weight population (Pooharst et al., 2013; Stephens & Vohr, 2009). Though mortality rates and severe disability rates have decreased, the number of mild to moderate disabilities have increased. This has resulted in more children receiving special education services (Holms & Crosbie, 2010; Vohr et al., 2000).

Research Overview

A review of past research for low birth and preterm infants and cognitive development, language, and behavioral problems will follow. There are three different generally accepted classifications of preterm: extremely preterm (EPT; <26weeks), very

preterm (VPT; 26-33 weeks) and late preterm (LPT; 34-36 weeks). Similarly, there are classifications based on birth weight: extremely low birth weight (ELBW; <1000g), very low birth weight (<1500g) and low birth weight (LBW; <2500g) (Johnson & Marlow, 2011; Wolke et al., 2008; Xiong et al., 2012). Outcomes are frequently compared to term-born and normal birth weight children (NBW, \geq 37 weeks and \geq 2500g).

Reviewing past research will help to inform on common risk factors for infants in the V/ELBW population. It is however, important to note that continuously advancing treatment and follow-up services for this population significantly affect later outcome. The specifics of each study should be considered as the participant's degree of prematurity and/or birth weight, location, decade and type of treatment available are all critical and crucial factors that significantly impact later outcome and study findings.

Cognitive Development

Later cognitive functioning is one area that has been found to be affected by V/ELBW and/or V/EPT birth. The findings of past research on the long-term cognitive outcome of very or extremely low birth weight infants is evolving as advances occur in medical care and early intervention services. Studies have consistently shown that overall IQ for premature children decreases at approximately 1.3 to 1.7 points per week born early, and that IQ is directly correlated with gestational age (Allen, Cristofalo, & Kim, 2011).

The presence of psychological, behavioral, and social difficulties impacts learning, these issues are often co-occurring and have been found to be negatively correlated with school performance (Aarnoudes-Moens, Weisglas-Kuperus, Duivenvoorden, van Goudoever, & Oosterlann, 2013; Aarnoudes-Moens et al., 2009;

Allen, 2002; Ambalavanan et al., 2012; Clark, Woodward, Horwood, & Moor, 2008; Delobel-Ayoub et al., 2009; Hille et al., 2001). Understanding more about when cognitive abilities remain stable and identifying any potentially influencing factors could help in the early identification of particularly vulnerable preterm and low birth weight children. Recent research indicates that ELBW individuals continue to have a greater probability of having deficits and disabilities despite improvements in care (Potharst et al., 2013; Stephens & Vohr et al., 2000; Vohr et al., 2009). The presence of psychological, behavioral, and social issues complicate the knowledge base for this area as research details and design can make cross comparisons and generalizability difficult. This complication applies to this study as well as both a limitation to be discussed in more detail later and as a fact that supports the need for more research in this area and necessitates the need for this study.

One important change in the field and care for the particularly vulnerable infants, those born at less than 28 weeks and weighing less than 1250g at birth, was the development of individualized developmental care. Als and colleagues (2003) investigated the effectiveness of individualized care programs. These programs included multiple components of intervention to improve infant and family functioning. The interventions used were defined in the Newborn Individualized Developmental Care and Assessment Program (NIDCAP), which attempts to highlight individuality and reduce stress. These interventions included; detailed observation to minimize family stress, caregivers receiving education on implementing recommendations and collaborating with the infant and infant's family. The changes in care, as a result, were thought to lead to

better outcomes in infant medical health and neurobehavioral and parental functioning (Als et al., 2003).

In addition to the changes in prenatal, neonatal, and postnatal care, there have also been differences in research methodology and assessment measures. These differentials have made international or even national comparisons difficult. While many facilities now offer follow-up care for infants born very preterm or V/ELBW, program specifics differ considerably; hence, comparing data between care centers remains difficult. The analysis of multiple studies contributes to the variability in outcomes and limitations in cross study comparisons. These study limitations and differences include small and nonrepresentative samples, differing methodology and study designs, poor selection criteria of control groups, high attrition rates, and inadequate demographic data (Bhutta, Cleves, Casey, Cradock, & Anand 2002).

The changes made to assessment measure designs and standardization have also complicated the matter. The changes from the second to third editions of the Bayley Scales of Infant and Toddler Development have resulted in higher scores for both preterm children and other high-risk children. Further examination of this issue indicates that the increases in Bayley scores are related to the changes in measure design and are not related to actual improvement in abilities in these populations (Vohr et al., 2012). This is problematic, as these results tend to exclude more children from qualifying and benefiting from special services than the Bayley-II would have identified. Additionally, the difference between Bayley-II and Bayley-III scores makes comparison of consecutive cohorts difficult. However, the updated measure may indeed provide a more accurate presentation of the child's true abilities (Vohr et al., 2012).