

The Association between Early Care and Education and Midlife Outcomes:

The Abecedarian 5th Decade Follow-up

Mary Elizabeth Sonnier-Netto

Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State University in
partial fulfillment of the requirements for the degree of

Doctor of Philosophy
in
Human Development

Sharon Landesman Ramey (Chair)

Craig T. Ramey

Martha Ann Bell

Carolyn M. Shivers

Anisa Zvonkovic

March 22, 2018
Blacksburg, Virginia

Keywords: poverty, early care and education, early education, midlife, successful aging, locus of control, health, economics

The Association between Early Care and Education and Midlife Outcomes:
The Abecedarian 5th Decade Follow-up

ABSTRACT

This dissertation focuses on the midlife adjustment of individuals from a longitudinal study in its 5th decade of follow-up. The Abecedarian Project, a prospective randomized control trial (RCT), began in 1972 with the primary goal of preventing cognitive impairments and school failure in children born into impoverished families with multiple risk factors by randomly assigning 111 infants to either an early education (n = 57) or control group (n = 54). This dissertation reports midlife outcomes at ages 39 – 45 for 42 individuals who received the early education treatment and 36 who were controls. This dissertation focuses on two primary hypotheses within a two-journal manuscript format. The first primary hypothesis of this dissertation is that the Abecedarian early education intervention will increase the number of successful outcomes over the lifespan, showing the cumulative effect of positive experiences (Sameroff, 2009) and a sense of personal efficacy (Dweck, 2008; Seeman, 1959). The second primary hypothesis of this dissertation is that response contingent learning and being an active agent in early cognitive and social settings during the first five years of life will provide a strong foundation for future perceptions of control over important areas in one's life (Furnham & Steele, 1993; Walden & Ramey, 1983; Wallston, Wallston, & DeVellis, 1978). The analysis of midlife indices of strength and risk reveal results favoring the treatment group compared to the controls on both the Midlife Strengths Index ($F(1,76) = 15.85, p = .000$) and the Midlife Risk Index ($F(1,76) = 8.88, p = .004$). Additionally, a significant interaction exists between group assignment and IQ at age 48 months for the Midlife Strengths Index ($\beta = -.215, p < .05$). Analyses of Locus of Control scales reveal that the control group reports "powerful others" have more influence on both their health behaviors ($F(1, 76) = 3.962, p = .05$) on the Multidimensional Health Locus of Control Scale

and their economic behaviors ($F(1, 76) = 5.146, p = .026$) within the Economic Locus of Control Scale. Additionally, the control group reported more external economic locus of control than the treatment group with a marginal statistical significance ($F(1, 76) = 3.359, p = .071$). Results are consistent with the conclusion for children born into multi-risk, economically impoverished families there are lifelong benefits of receiving high-quality early care and education that extend into the midlife years.

The Association between Early Care and Education and Midlife Outcomes:
The Abecedarian 5th Decade Follow-up

GENERAL ABSTRACT

This dissertation focuses on the midlife adjustment of individuals from a longitudinal study in its 5th decade of follow-up. The Abecedarian Project, a randomized control trial (RCT), began in 1972 with the primary goal of preventing school failure in children born into impoverished families with multiple risk factors by randomly assigning 111 infants to either an early education (n = 57) or control group (n = 54). This dissertation reports midlife outcomes at ages 39 – 45 for 42 individuals who received the early education intervention treatment and 36 who were controls not receiving the early education intervention treatment. This dissertation focuses on two primary hypotheses within a two-journal manuscript format. The first primary hypothesis of this dissertation is that the Abecedarian early education intervention will increase the number of successful outcomes over a person's life, showing the effect of positive life experiences and a sense of personal efficacy. The second primary hypothesis of this dissertation is that response-contingent learning and being active in early learning and social settings during the first five years of life will provide a strong foundation for future views of control over important areas in one's life. The results found in this dissertation are consistent with the conclusion for children born into multi-risk, economically impoverished families there are lifelong benefits of receiving high-quality early care and education that extend into the midlife years.

DEDICATION

This dissertation is dedicated to my grandfather, Daniel Sonnier, who did not have the opportunity to attend school, but knew the value of an education. He instilled in me that no one could take my education away, no matter life's circumstances. Thank you, PawPaw, for making way the path for generations after you.

&

I also dedicate this dissertation to my nephew, Zane Wakefield Blalock, whose short life was filled with love, joy, and spunk. Zane, I am forever grateful for your presence in my life and will never tire in my pursuit to make this world a better place for little people like you and their families.

ACKNOWLEDGMENTS

“For I know the plans I have for you,” declares the Lord, “plans to prosper you and not to harm you, plans to give you a hope and a future.” Jeremiah 29:11

There have many times in the process of earning my Ph.D. when I have doubted “the plan” and every time I did there was a constant wave of support from many people who helped get me here.

To my husband, Brett Netto, for being willing to chase my dream and finding yours along the way. We certainly did not see this plan in our future, but we have done this together and I am eternally grateful you are my partner.

To my parents, Nancy and James Sonnier, your expectation of me was always to do my best. You taught me through your actions what hard work and determination can do. You raised me into independence with a spirit of service that will forever be your legacy.

To the great mentors of my life who saw qualities in me I did not know I possessed, especially to Judy Hearne, Danita Munday, Janet Nelson, Alice Thomas, and countless others. Thank you is not enough for who and what you are to me. I can only hope to give back to others at least a fraction of what each of you has given to me by way of your faith, support, tenacity, and love.

To my tribe of friends I consider my family, each of you has supported and loved me through different periods of my life and this journey. I cannot thank you enough for believing in me when I was not able to do so for myself, especially to Jenniffer Fields LeDoux and LiVen Lam. The two of you are ever present in my day to day life even though miles and life’s activities separate us.

To my mentor and chair, Sharon Landesman Ramey, you are the reason I am here. Little did we know the way our lives would intertwine for me to be in this place and time, but I am grateful for all the battles, the tears, and your unwavering support. Your generosity of spirit and time is astonishing. You are the reason that I will do better because I know better.

To the other half of the dynamic duo and my mentor, Craig Ramey, for allowing me to work on the Abecedarian Project alongside you. You have taught me many things, but most of all in all situations to be kind. Your stewardship and care for the Abecedarian Project is something extraordinary. I am forever in your debt.

To Martha Ann Bell for being a bright spot my first year at Virginia Tech and a cheerleader throughout this whole process. Your care and deep passion for children is a light for all to see.

To Carolyn Shivers, I am immensely grateful for your time and talent. Your enthusiastic support of my work and ideas is something I will forever treasure. Your encouragement when I was more lost than an Easter egg at Christmas is what pushed me through when I wanted to quit.

To Anisa Zvonkovic, who allowed me to join the Department of Human Development family, I am immensely grateful. I will walk into the world with a different understanding of contextual factors and theory than I entered with because of the stewardship of our department.

To the “Boyz” for endless hours of love, entertainment, and support.

Last, but certainly not least, I would like to acknowledge the participants in the Abecedarian Project. You have been a part of the fabric of my entire career and having the opportunity to spend time with you is one of the great highlights of my life.

Table of Contents

ABSTRACT.....	ii
GENERAL ABSTRACT.....	iv
DEDICATION	v
ACKNOWLEDGMENTS	vi
TABLE OF CONTENTS	viii
LIST OF TABLES.....	ix
LIST OF FIGURES.....	x
CHAPTER I. Introduction	1
Background.....	1
Purpose of Study.....	6
CHAPTER II. Title: Indicators of successful aging: An experimental study of long-term effects of early care and education on midlife outcomes	8
Abstract	8
Introduction	10
Methods	14
Results	22
Discussion	23
References	28
Tables and Figures	33
CHAPTER III. Title: Economic and health locus of control in midlife linked to early care and education intervention	41
Abstract	41
Introduction	43
Methods	49
Results	55
Discussion	59
References	63
Tables and Figures	69
CHAPTER IV. Conclusion.....	77
REFERENCES.....	81
APPENDICES	
Appendix A.....	91

List of Tables

Table 1. Demographics of original and 5 th decade study samples	33
Table 2. Midlife strength indicators by group and percentage	34
Table 3. Midlife risks indicators by group and percentage	35
Table 4. Midlife indices: Bivariate correlation matrix	36
Table 5. Standardized beta weights for multiple regression models predicting Midlife Indices.....	37
Table 6. Eligibility High Risk Index for Mothers in original Abecedarian study.....	69
Table 7. Demographics of Original and 5 th decade study samples.....	70
Table 8. Midlife outcomes for early education and control groups	71
Table 9. Multidimensional Health Locus of Control Scales: Bivariate correlation matrix.....	72
Table 10. Economic Locus of Control Scales: Bivariate correlation matrix	73

List of Figures

Figure 1. Abecedarian 5 th Decade Study participant retention	38
Figure 2. Midlife indices means by treatment group	39
Figure 3. Mean number of midlife strength indicators by group and IQ at 48 months	40
Figure 4. Abecedarian 5 th Decade Study participant retention	74
Figure 5. Multidimensional Health Locus of Control means by scales and treatment group	75
Figure 6. Economic Locus of Control means by sub-scales and treatment group	76

CHAPTER I: INTRODUCTION

Background

Being born into poverty is the single greatest threat to a child's well-being in the United States (Heckman, 2013) with approximately 21 percent of children living in families below the federal poverty threshold (Kids Count Data Book, 2017). Family poverty is linked to low academic achievement, placement in special education, high school dropout, and adult reliance on government assistance (Heckman, 2013; Duncan & Murnane, 2015). For children born into economically impoverished families, a variety of risk factors such as low parental education, teen parents, untreated mental health and substance abuse problems, and lack of stable positive social support often are elevated (Ramey, et al., 1976; Sameroff, 2009; Haskins & Sawhill, 2009). In fact, the number of risk factors a family exhibits is known to negatively affect child outcomes (Sameroff, 2009). A key question is whether providing high-quality early care and education during the first five years of life aid in mitigating the effects of being born into poverty with multiple risk factors? This is a compelling social question, particularly because the rates of children under the age of six living in poverty have remained high from approximately 16 percent in the 1970s to more than 20 percent in 2017 (Kids Count Data Book, 2017)?

In 1972, recruitment began for the Abecedarian Project, an in-depth randomized control trial of children born into poverty to examine the effects of providing intensive high quality early care and education, from infancy to school entry, on reducing developmental and cognitive delays associated with school failure. Inclusion criteria for the Abecedarian Project was based on 13 socio-demographic factors that were weighted and combined into a high-risk index (Appendix B). Criterion for inclusion in the Abecedarian Project was a score of 11 or more on the high-risk index (Ramey & Smith, 1977) as well as infants needed to appear free of biological conditions

with known links to mental, motor, or sensory disabilities (Ramey et al., 1976). Scores on the high-risk index at entry ranged between 11 and 37 with mean a score of 20.70 (5.52) for families who enrolled in the Abecedarian Project. Local social service agencies and prenatal clinics within the catchment area of the project assisted in identifying potential study participants (Ramey et al., 1976).

Four cohorts of families enrolled in the Abecedarian Project between the years of 1972 and 1977. A total of 109 families with 111 infants (1 set of identical twins, 1 sibling pair), accepted their random assignment to participate in the Abecedarian Project; 57 infants (28 girls and 29 boys) were randomly assigned to the education group and 54 infants (31 girls and 23 boys) were randomly assigned to the control group. Of the 109 original families, 107 were African American, and two were White. At entry of the project, 76 percent of children lived in female-headed households with 66 percent of mothers not having high school diplomas (Ramey & Campbell, 1984).

The Abecedarian Project took place in a small, relatively affluent, university town with a median income of \$19,200 in 1970 and a high proportion of the population with advanced degrees (U.S. Department of Commerce, 1971), due the university being the major employer. A wide range of human service agencies were available to economically poor families living in the area as well as programs providing housing, fuel subsidies, food supplements, and job training to those in need. In addition to the wide-range of services available to families, a large teaching hospital and two publically funded clinics for patients of low income were accessible. All of the Abecedarian Project families, thus, had potentially easy access to a high degree of material, fiscal, and social supports in the locale (Campbell & Ramey, 1994).

The primary goal of the Abecedarian Project was to test whether providing a high quality early care and education intervention from birth to school entry could exert a strong effect on preventing cognitive impairments and later poor school achievement. The intervention was designed to provide children from extremely low resource (financial, social, and educational) families with a highly responsive and intellectually stimulating full day, year round program beginning in infancy (Ramey, et al., 2012). A particular concentration of the Abecedarian Project's curriculum was on the infant and young child as being an active learner and contributor to daily experiences. Also included was an emphasis on the child being skilled in communicating their feelings, interests, and ideas in their interactions with adults, peers, and the environment. The trained teachers and caregivers offered a rich set of learning experiences (in a detailed curriculum known as *Leaningames*, c.f. Sparling and Lewis, 1984) and provided stability in positive social-emotional relationships with the children. The active and individually-paced learning experiences were accompanied by adult expressions of warmth, acceptance, and positive regard. Additionally, adults were taught to allow children as much autonomy and independence as reasonable to support curiosity and creativity while maintaining children's safety (McGinness & Ramey, 1981). Through repeated exposure to well-timed and specific feedback in daily routines and activities caregivers in the early care and education setting were able to support children's ability to see themselves as co-creators influencing and responding to the environment around them. This intervention program therefore laid the foundation for acquiring a sense of self-efficacy, internal Locus of Control (LOC), and a self-agency. The systematic child-centered intervention provided by the Abecedarian Project occurred six to eight hours per day, five days per week, 50 weeks per year starting as early as six weeks of age until

school entry into kindergarten (McGinness & Ramey, 1981; Ramey & Campbell, 1984; Ramey et al., 2012).

To control effects that could confound the focus of the primary study hypothesis (i.e. that education early in life makes a lasting and large difference), the Abecedarian Project offered to the families and children in both the early education group and the control group a set of services relating to free infant nutritional support, free or no cost medical/health care in accordance with American Academy of Pediatrics, and extensive free social supports to families. This allowed for concluding that early care and education intervention was the likely casual factor in different outcomes, rather than simply offering lots' of early care and good nutrition and family supports that inherently would be associated with an early education program.

Published findings from the Abecedarian Project over the first four decades of life have consistently shown significant positive outcomes favoring individuals in the early education group compared to the control group in the areas of increased tested IQ, school performance, reading and math achievement, educational attainment in adulthood, employment, and health outcomes (e.g., Ramey & Campbell, 1984; Ramey & Campbell, 1992; Campbell, et al., 2001; Campbell, et al., 2002; Campbell, et al., 2012; Campbell, et al., 2014). One study reported differences in children's academic LOC in elementary school (Walden & Ramey, 1983) as a function of receiving the Abecedarian early care and education intervention. Combined, the reported benefits of the Abecedarian Project intervention create a life history for those in the early care group that provided a significantly distinct set of life experiences that promoted optimal outcomes such as an individuals maintaining full-time employment, having personal assets without relying on government assistance, and belief that others do not have power over them in critical areas in their life (Heaven, 1989; Jacobs-Lawson, et al, 2011; Rowe & Kahn,

2015; Wallston, Wallston, & DeVellis, 1978). Therefore, this dissertation has two primary hypotheses: 1) the Abecedarian early education intervention would increase the number of successful outcomes over the lifespan, showing the cumulative effect of positive experiences (Sameroff, 2009) and a sense of personal efficacy (Dweck, 2008; Seeman, 1959) and 2) response contingent learning and being an active agent in early cognitive and social settings during the first five years of life provided a strong foundation for future perceptions of control over important areas in one's life (Furnham & Steele, 1993; Walden & Ramey, 1983; Wallston, Wallston, & DeVellis, 1978).

For the Abecedarian 5th Decade Study, individuals were contacted by letter or telephone inviting them to enroll by the original family coordinator of the Abecedarian Project from 1972. Data collection took place between 2016 and 2017 via in-person face-to-face sessions. Project funds compensated participants for their time and travel. All aspects of the study protocol had Institutional Review Board approval.

Five participants died (1 education; 4 control) between the age 30 follow-up study (n = 103) and the 5th Decade Study (ages 39 to 45) reducing the number of potential participant recruitment to 98 individuals (Appendix B). Of the potential 98 participants still living, one participant from the education group withdrew from the study and two participants (1 education; 1 control) were in prison making them ineligible to participate in the study further reducing the potential population to 95 for the 5th Decade Study. Seventy-eight individuals out of the 95 potential participants (82%) agreed to take part in the current study. Of the 78 participants who agreed to participate in the 5th Decade Study, 98 percent were African American, 42 adults (20 female and 22 male) were in the education group and 36 in the control group (21 female and 15 male).

Data collection occurred in individualized sessions lasting three to four hours beginning with informed consent followed by an interview and functional magnetic resonance imaging (fMRI) brain scan. The interview portion of the individualized session consisted of two portions. The first portion of the interview involved an open-ended narrative interview conducted by the original Principal Investigator of the project typically lasting five to fifteen minutes with participants being asked to share about their current lives, aspirations for the future, and what being a part of the research project has meant to them. The second portion of the interview was a semi-structured interview conducted by interviewers blinded to participants' group assignment lasting approximately 45 to 60 minutes. The semi-structured interview consisted of questions relating to education, household composition and residence history, relationships with parents or parent figures, employment and benefits, health and health care, multidimensional health locus of control, economic locus of control, and community involvement. The final component of the 5th Decade Study was a separate session of fMRI scanning and neuroeconomic games lasting approximately 60 to 70 minutes. The fMRI scans were carried out by a MRI research technologist, blinded to participant group assignment, who screened participants to ensure their safety. For the purpose of this dissertation, data from the fMRI and neuroeconomic games are not included.

Purpose of Study

The purpose of this study is to continue longitudinal investigation of the possible association between early life experiences (i.e., the Abecedarian intervention) and midlife (ages 39 – 45 years) adjustment with a strong interest in Locus of Control and decision-making within a two journal manuscript format.

The first manuscript titled *Indicators of Successful Aging: An Experimental Study of Long-term Effects of Early Care and Education on Midlife Outcomes* examines if involvement in the Abecedarian early education intervention is associated with increases the number of successful outcomes and decreases risk factors, showing a cumulative pathway of more positive experiences (Sameroff, 2009) and a sense of greater personal efficacy (Dweck, 2008; Seeman, 1959) as assessed by newly created indices of strength and risk in midlife. The Abecedarian Project's enduring positive effects of providing high-quality early care and education to children born into poverty with multiple risk factors supports the investigation of midlife adjustment as framed in Rowe and Kahn's (1997; 2015) three component definition of successful aging -- is that low probability of disease and disease-related disability, high cognitive and physical function, and actively engaging in life.

The second manuscript titled *Health and Economic Locus of Control in Midlife Linked to Early Care and Education Intervention* examines whether response contingent learning and being an active agent in early cognitive and social settings during the first five years of life provide a strong foundation for future perceptions of control over important areas in one's life (Furnham & Steele, 1993; Walden & Ramey, 1983; Wallston, Wallston, & DeVellis, 1978). The important Locus of Control domains in midlife include health and personal economics.

Title: Indicators of successful aging: An experimental study of long-term effects of early care and education on midlife outcomes

Abstract

Background and Objectives: The Abecedarian Project began in 1972 with the primary goal of preventing cognitive impairments and school failure in children born into impoverished families with multiple risk factors. In its 5th decade of follow-up, the current study examines long-term outcomes for those who did and did not receive a five year high-quality early care and education intervention on successful aging in midlife.

Research Design and Methods: The Abecedarian Project is a prospective randomized control trial that randomly assigned 111 infants to either an early education (n = 57) or control group (n = 54). The current study reports outcomes at ages 39 – 45 years for 42 who received the early education treatment and 36 controls. Informed by Rowe and Kahn's (1987) definition of successful aging, we generated 10-item composite indices for midlife strength and risk. Analyses investigated whether the treatment group differed in their indices of midlife adjustment, as well as whether or not their midlife outcomes related significantly to their intelligence scores just prior to school entry. Experienced interviewers blinded to participant group assignment conducted interviews.

Results: Significant group differences favoring the early education group compared to the control group occurred for both the Midlife Strengths Index ($F(1, 76) = 15.85, p = .000$) and the Midlife Risk Index ($F(1, 76) = 8.88, p = .004$). Moreover, a significant interaction exists between group assignment and IQ at age 4 for the Midlife Strengths Index ($\beta = -.215, p < .05$), supporting the hypothesis that cognitive competence early in life provides a strong foundation for later positive educational, health, social, and economic outcomes.

Discussion and Implications: Providing high-quality early care and education to children born into multi-risk, economically impoverished families shows a significant association with benefits that extend far beyond the already well-documented one in childhood and early adulthood. Plausible mechanisms for this developmental chain of positive outcomes are considered.

Introduction

Are there benefits of providing intensive high quality early care and early education to children born into impoverished and multi-risk families that can be detected in midlife? This is the question being addressed in the Abecedarian 5th Decade Follow-up (ages 39 – 45 years). The Abecedarian Project began in 1972 as a randomized control trial (RCT) with the primary goal of preventing cognitive impairments and subsequent school failure in children at risk (Ramey, et al., 1976; McGinness & Ramey, 1981; Ramey & Campbell, 1984). Children who participated in the Abecedarian Project were randomly assigned to either an early education group receiving high quality early care and education from infancy to kindergarten entry or a control group (Ramey, et al., 1976). Previous findings from the Abecedarian Project affirm significant differences in educational attainment, type of employment, and health between groups at all ages starting from 18 months of age into participants' mid-30s (Ramey, Sparling, & Ramey, 2012). As participants become older, multiple life experiences and biological aging contribute to their adjustment. Will there be evidence of outcomes in midlife that are strongly linked to early life experiences – particularly early care and education in the first five years of life - that in turn may set the stage for transition into even later stages of successful aging?

Rowe and Kahn (1987) coined the term “successful aging” defining it as a “low probability of disease and disease-related disability, high cognitive and physical function capacity, and active engagement with life” (Rowe & Kahn, 1997, p. 433). In essence, successful aging is more than potential: “it involves activity” (Rowe & Kahn, 1997, p. 433). For the activity of aging to be successful, precursors of activity (i.e., antecedents) must occur (Rowe & Kahn, 2015). Longitudinal research creates an opportunity to investigate antecedents of successful aging over time (Herzog & Morgan, 1992; Kern & Friedman, 2009). Few well-

controlled experimental studies exist, such as the Abecedarian Project, to test for plausible causal pathways to successful midlife outcomes. For children born into severe economic poverty with multiple risk factors, the Abecedarian Project tested the effects of providing continuous high-quality early care and early education from early infancy through school entry, providing a strong basis for investigating the long-term influences of early life experiences on successful aging and quality of life throughout adulthood (Campbell, et al., 2012). Other landmark longitudinal studies of early childhood developmental processes also contribute to framing our understanding of the early correlates and predictors of positive adult outcomes.

We now know more than ever about the meaningful ways that development and learning occur beginning at birth and continue throughout the lifespan (Ramey, 2017). “The development of the child is a product of the continuous dynamic interactions of the child and the experience provided” through contexts such as family and school (Sameroff & MacKenzie, 2003, p. 614). This is particularly poignant when thinking about intelligence not being a fixed trait at birth (Bayley & Schaefer, 1964), but instead being “a product of the continuous dynamic interactions of the child and the experience provided by his or her social settings” (Sameroff, 2009 p.6). Key longitudinal studies, notably the Berkeley Growth Study, the Terman Life Cycle Study, and the Perry Preschool Study provide relevant findings from earlier cohorts in the United States about the influence of early life experiences on individuals as they age (Bayley & Schaefer, 1964; Kern & Friedman, 2008; Ramey et al., 2012; Schweinhart, 2005). Due to Bayley’s work on The Berkeley Growth Study, she concluded a child’s intelligence is impacted by environmental and social factors such as poverty (Jones & Bayley, 1941). The Berkeley Growth Study traced typical cognitive, motor, and physical development in the first year of life to later correlations of adult size which aided in the development of the Bayley Scale of Infant Development with a sample of

61 healthy, full-term infants born in one of two Berkeley, CA hospitals between 1928 and 1929 to White, English-speaking parents (Bayley & Schaefer, 1964).

Findings from the Terman Life Cycle Study show that both intelligence scores and school performance from an early age predict significant adult outcomes such as educational attainment and maintaining full-time employment (Campbell et. al., 2012; Kern & Friedman, 2009). The Terman Life Cycle Study, initiated in 1922 by Lewis M. Terman, a 20th century psychologist, compared a group of children with high IQs at the age of 11 years old to groups of typical children in the general population investigating outcome similarities and differences (Terman, 1925). Recent findings from the Terman Life Cycle Study suggests early education success in reading is related to positive characteristics of higher IQ and income levels in midlife (Kern & Friedman, 2009).

The most comparable study to the Abecedarian Project is the Perry Preschool Study. The Perry Preschool Study in which African American children born into poverty in Ypsilanti, MI (an area outside Detroit) assigned children to a one or two year preschool program (Schweinhart, 2005). Eligibility required the children to already show a significant cognitive delay as indexed by IQ scores of 85 or lower at age 3. The preschool program emphasized active learning 2.5 hours each weekday morning during a typical 9-month school year with families having weekly home visits in the afternoon (Weikart, Bond, & McNeil, 1978). In the most recent follow-up study of Perry Preschool Study at age 40, individuals who attended the preschool program intervention were more likely to have graduated from high school, hold a job, and have higher income earnings than individuals in the control group who did not receive the preschool program (Schweinhart, 2005). Similar findings to the Perry Preschool Study are from the Chicago Longitudinal Study (CLS) in the Child-Parent Center Program. The CLS program provided

children from preschool to third grade (ages 3 – 9 years) an enrichment school-based educational program along with comprehensive family services (Reynolds, 2000). Results from CLS indicate children who received the early enrichment have greater education attainment, better socioeconomic status, and higher annual income compared to the comparison group lasting into midlife (Reynolds, Ou, & Temple, 2018).

The Abecedarian Project similarly has demonstrated enduring positive effects of high-quality early care and education on outcomes as individuals in the early education group age into their 30s (Ramey et al, 2012). Previous published findings of the Abecedarian Project coincide with the Rowe & Kahn's (1987) definition of successful aging. Such as the individuals in the early education group being less likely to be placed in special education (Ramey, Campbell, Burchinal, Skinner, Gardner, & Ramey, 2000), having lower rates of teenage smoking, drug use, and depression (Campbell, et al., 2002) along with having better cardiometabolic health as measured around age 37 years (Campbell, et al., 2014) can fall within Rowe & Kahn's (1987; 2015) low probability of disease and disease-related disability. Previous Abecedarian findings also link to the successful aging definition component of high cognitive and physical function by the early education group having higher IQ scores (Ramey & Campbell, 1984), better reading and math skills (Ramey, Campbell, & Ramey, 1999), higher education attainment (Campbell, Ramey, Pungello, Sparling, Miller-Johnson, 2002; Campbell, et al., 2012), and lower body mass index ratios compared to the control group (Campbell, et al., 2014). Lastly, the successful aging definition component of being actively engaged in life ties to the previous Abecedarian findings in the early education group of increased social competency (Ramey et al., 2012), higher rates of full-time employment (Campbell, et al., 2012), and lower rates of public assistance (Campbell, et al., 2012) compared to individuals in the control group.

With such promising findings and implications from landmark studies and earlier follow-ups of the Abecedarian Project sample, we hypothesized that individuals who received the early care and education intervention would have more successful midlife adjustment as measured by a newly created Midlife Strength Index. Conversely, we hypothesized that those who received the early education treatment would have fewer indicators of difficulty in midlife, as captured in a newly created Midlife Risk Index.

Methods

Study Sample

In 1972, recruitment began for the Abecedarian Project, an in-depth study of children from families with multiple risk factors due to disadvantaged backgrounds. Local social service agencies and prenatal clinics in the catchment area of the project assisted in identifying potential participants. Selection criteria for inclusion in the Abecedarian Project was based on 13 socio-demographic factors that were weighted and combined into a high-risk index that can be found in previous publications (e.g. Campbell & Ramey, 1994; Ramey & Campbell, 1984; Ramey et al., 1976). Criterion for inclusion in the Abecedarian Project was a score of 11 or more on the High-risk Index (Ramey & Smith, 1977). Scores on the High-risk Index at entry ranged between 11 and 37 with mean a score of 20.70 ($SD = 5.52$) for families who enrolled in the Abecedarian Project. For inclusion in the research project, infants also needed to appear free of biological conditions linked to mental, motor, or sensory disabilities (Ramey et al., 1976).

Between 1972 and 1977, four cohorts of families were enrolled in the Abecedarian Project. A total of 109 eligible families, 111 infants (1 set of identical twins, 1 sibling pair), accepted random assignment to participate in the Abecedarian Project; 57 infants (28 girls and

29 boys) were randomly assigned to the early education group, and 54 infants (31 girls and 23 boys) were randomly assigned to the control group. Of the 109 original families, 107 were African American, and two were White. At entry into the Abecedarian Project, 76 percent of children lived in female-headed households with 66 percent of mothers not having high school diplomas (Ramey & Campbell, 1984). Baseline characteristics of participants in the 5th Decade Follow-up are summarized in Table 1 and indicate no group differences. This is important, supporting the view that there has not been differential attrition associated with treatment group. Most of the attrition is due to death, some to loss of contact information, and a very few due to incarceration.

INSERT TABLE 1

Families who participated in the Abecedarian Project were from a small, relatively affluent university town, with a median household income of \$19,200 in 1970, with most parents being well educated (U.S. Department of Commerce, 1971). A wide range of human service agencies were available in the area providing assistance with housing, fuel subsidies, food supplements, job training, and social services to families challenged by economic poverty. Additionally, there was a large teaching hospital and two publically funded clinics for patients of low income. Therefore, a relatively high degree of material, fiscal, and social supports were available to families (Campbell & Ramey, 1994).

Abecedarian early education treatment. The Abecedarian Project delivered a basic level of intervention to families in both the early education and control groups from birth to age 8 years in the form of infant nutritional support, free or no cost health care in accordance with the American Academy of Pediatrics, and unlimited social supports individualized to each family's needs. In addition to these supplemental supports to both groups, the early education

group received a free, high-quality early care and education program in a university-based childcare center for 6 to 8 hours per day, 5 days per week, 50 weeks per year starting as early as six weeks of age until the child entered kindergarten. The early care and education staff consisted of a director, 12 teachers and teacher's aides, and an administrative staff. Teacher-child ratios ranged from 1:3 in the nursery to 1:6 as children entered their last year of preschool. The early educational staff varied in their backgrounds from having graduate degrees in early childhood education to community paraprofessionals; all early education staff received active and ongoing, onsite professional development and extensive training related to implementing the early childhood curriculum developed for the Abecedarian program. Staff consistently received support for and demonstrated high levels of competence in supporting children's developmental progress at each age (McGinness & Ramey, 1981; Ramey et al., 2012).

Informed by emerging scientific literature of how children learn, the Abecedarian early educational intervention was strongly grounded in the importance of providing children rich learning opportunities through stable supportive caregiving. The curriculum known as Learninggames focused on children's development in the domains of language, motor, social-emotional development, and cognition (Sparling and Lewis, 1984). Curriculum items were presented to each infant within a dyadic (adult: infant) context. As children matured, items were presented in small groups and the curriculum content focused on more conceptual and skill-based activities (e.g. math, pre-phonics, and communication skills) (Ramey & Campbell, 1984). While language development and conversational reading were strong priorities throughout the 5 years of the early educational intervention, children were given many opportunities to choose their own activities on a daily basis. By providing children with consistently varied and interesting learning opportunities, children learned they could be co-creators in their everyday

world of social and learning experiences. These repeated and consistent learning opportunities that provided well-timed and specific feedback to each child, based on his or her demonstrated behavior, comprise what is termed response-contingent learning. The theory guiding the curriculum is that young children learn and remember best when they are active (rather than passive) in being able to influence and respond to the environment around them, thus providing children motivation to explore and learn with increasingly sophisticated skills to be competent in many dimensions of their lives (Ramey, et al., 2012).

Current Sample and Attrition

The original family coordinator of the Abecedarian Project since 1972 assisted in locating participants for the Abecedarian 5th Decade Study. Individuals were contacted by letter, telephone, or in person to invite them to enroll in the follow-up study. Data collection occurred during individual face-to-face sessions between 2016 and 2017. Project funds remunerated participants for their time and travel. All aspects of the study protocol had Institutional Review Board approval.

Between the age 30 follow-up study (N = 103) that took place between the years 2003 – 2009 and the 5th decade follow-up study (ages 39 to 45), five study participants died (1 in early education and 4 control), reducing the possible total number of participants to 98 (Figure 1). One participant from the early education group withdrew from the study and two participants (1 in early education and 1 in control) were in prison and ineligible to participate, further reducing the potential sample to 95 individuals. Of these, 78 participants (82%) agreed to participate and provided data. The demographic composition of the follow-up sample was highly comparable to the original study sample as shown in Table 1. 98 percent African Americans; 42 adults (20

female and 22 male) were in the early education group and 36 in the control group (21 female and 15 male).

INSERT FIGURE 1

We collected data in individualized sessions lasting three to four hours beginning with informed consent followed by an interview and a functional magnetic resonance imaging (fMRI) brain scan. The interview consisted of two portions. The first portion of the interview consisted of an open-ended narrative interview videotaped in full, conducted by the original Principal Investigator of the project typically lasting 5 to 15 minutes with participants being asked to share about their current lives, aspirations for the future, and what being a part of the research project has meant to them. The second portion of the interview was a semi-structured interview lasting 45 to 60 minutes. The semi-structured interview included questions in the following areas: education, household composition and residence history, relationship or involvement with significant other, children and grandchildren, relationships with parents or parent figures, employment and benefits, health and health care, multidimensional health locus of control, economic locus of control, and community involvement. Experienced interviewers, blinded to group assignment, conducted the semi-structured interviews.

The final component of the Abecedarian 5th Decade Study session was the inclusion of functional magnetic resonance imaging (fMRI) and neuroeconomic games which took 40 to 60 minutes. The fMRI scans were carried out by a MRI research technologist, blinded to participant group assignment, who screened participants to ensure their safety. For the purposes of this article, we are focusing on data collected from the semi-structured blinded interview portion of the individualized sessions.

Midlife indicators. Midlife indicators identified from the semi-structured interview correspond with Rowe & Kahn's (1987; 2015) three-component definition of successful aging. In order to investigate the ability to avoid disease and disease-related disability (Rowe & Kahn, 1987), individual items were selected to be a part of the midlife indicators related to education, health, public assistance, and pregnancy. Additionally, items relating to education, employment, and public assistance were selected to support the high cognitive and physical component of successful aging (Rowe & Kahn, 1987). Lastly, items relating to personal resources, relationships, and civic engagement were selected to investigate the engagement in life activities component from Rowe & Kahn (1987).

Midlife indicators were placed into the two indices of midlife strength and risk. Each index includes 10 items treated as a dichotomous item (yes = 1; no = 0) then tallied into a composite score from 0 to 10. The rationale for combining singular indicators of aging into the two indices of midlife strength and risk is based on the work of Sameroff, Seifer, Barocas, Zax, and Greenspan (1987). In their work, Sameroff, Seifer, Barocas, Zax, and Greenspan (1987) proposed "the study of multiple risk factor exposures in children given that the analysis of singular risk factor exposure might underestimate the capability of risk factors to interfere with healthy child development (p. 1342). In order not to underestimate the capability of indicators to either promote or hinder successful aging, a composite index of strength and risk were created by combining indicators into a summary score for each indices (Evans, Li, & Whipple, 2013).

Midlife Strength Index. Derived from participant responses to semi-structured interview questions during the Abecedarian 5th Decade Follow-up, a continuous measure of midlife strength was created into an index of 10 items in five general areas. The five general areas included within the Midlife Strength Index are education, health, employment, personal

resources, and parental relationships. Each of the 10 items were treated as a binary variable (yes = 1, no = 0). The first of the five areas in the Midlife Strength Index is education. Within the area of education, the three items include completion of a high school diploma, completion of a four-year college degree, and completion of a graduate degree. The second of the five areas is health with the one item of participants rating their overall health favorably. The third area within the Midlife Strength Index is employment with an item of if the participant is engaged in full-time employment. The fourth area of personal resources consists of home and car ownership and having a checking and savings account. The final area within the index is parental relationships with participants reporting if the relationship with their parents or parental figures is “very close.” The total possible score on the Midlife Strength Index is 10.

Midlife Risk Index. Derived from participant responses to semi-structured interview questions during the Abecedarian 5th Decade Follow-up, a continuous measure of midlife risk was combined to create an index with 10 items in six general areas. The six general areas include education, health, employment, public assistance, civic engagement, and pregnancy. Each of the ten items were treated as a binary variable (yes = 1, no = 0). The first of the six areas within the Midlife Risk Index is education with participants reporting whether he or she did not complete a high school diploma. The second area of health includes two items of participants rating their overall health unfavorably and indicating if they do not have health insurance. The third area of employment includes a participant reporting if he or she is unemployed. The fourth area of public assistance within the midlife risk indicators includes five items. The five items under public assistance are if participants currently receive disability/SSI, housing assistance, food stamps, and/or Medicaid. The fifth area of civic engagement includes participants reporting if they voted in the last presidential election or not.

The final area within the Midlife Risk Index includes teen parent with an item indicating if a participant had their first child less than age 20. The total possible score on the Midlife Risk Index is 10.

Measure of intelligence. Children in both the early education and control groups were assessed frequently with measures of cognition (developmental quotients or IQ depending on the tool), reading and math performance, social/emotional development, and school progress. Blinded assessments occurred every three months until age 18 months, every six months until age 5, and then during their school years at ages 8, 12, and 15, and in adulthood at ages 21, 30, and 35 – 37. Intelligence was assessed with standardized, age-appropriate measures. For the purposes of this paper, we selected the Stanford-Binet Intelligence Scale: Form L-M (Ramey & Campbell, 1984; Terman & Merrill, 1972) score at the age 48 months. The rationale is this is the last age when IQ scores were measured for all study participants prior to entering kindergarten.

Data analysis

For individuals who participated in the Abecedarian 5th Decade Study, an intent-to-treat analysis plan was used to estimate the association between early life experiences and midlife adjustment. Analyses of variance (ANOVA) examined associations between treatment group and midlife outcomes. Additionally, chi square analyses explored group differences between individual items on the Midlife Strength Index and Midlife Risk Index. A Pearson's correlation measured the strength and direction of association between IQ at 48 months, midlife strength indicators, and midlife risk indicators. Because gender and random group are dichotomous, a point-biserial correlation measured the strength and direction of association for these variables as well as presence or absence of items on the indices. A point-biserial correlation is a special case of the Pearson's correlation applied when variables used are dichotomous.

We used multiple regression as the primary method to predict midlife total scores for strength and risk as a function of treatment group and IQ at 48 months of age. An interaction term between group assignment and IQ was added to the second model. All independent variables were centered before creating interactions.

Results

Tables 2 and 3 summarize items within the midlife strength and risk indices indicating whether significant proportional differences were present or not using chi square analyses. A multivariate analysis of variance did not reveal group differences by gender for the Midlife Strength Index ($F(1, 78) = .106, p = .75$) or the Midlife Risk Index ($F(1, 78) = .044, p = .83$). A one-way analysis of variance reveals for participants who received the early educational treatment report significantly more midlife strength indicators ($F(1, 76) = 15.85, p = .000$) with a $M = 6.71$ ($SD = 1.57$) than did the control group that did not receive the early educational intervention with a $M = 5.08$ ($SD = 2.05$). Additionally, participants who received the early educational intervention report significantly fewer midlife risk indicators ($F(1, 76) = 8.88, p = .004$) with a $M = 1.29$ ($SD = 1.45$) in contrast to the control group with a $M = 2.56$ ($SD = 2.27$). Figure 2 illustrates both indices of midlife indicators by means and standard deviations. Also, assuming initial equality between the two groups, based on the RCT design, the ten positive results for the education group on both indices results in a sign test significance at the $p < .01$ level. Additionally, the 48 month Stanford-Binet IQ scores differed significantly by group ($F(1, 25) = 24.94, p = .000$) between the early education group with a $M = 101.70$ ($SD = 10.28$) and the control group with a $M = 87.79$ ($SD = 13.64$) – a finding reported previously.

INSERT TABLE 2 & 3

INSERT FIGURE 2

Table 4 shows the full correlation matrix of variables. Participant gender did not correlate with group assignment, IQ at 48 months of age, midlife strength indicators, or midlife risk indicators. Group assignment positively correlated with IQ at 48 months of age and midlife strengths indicators and negatively correlated with midlife risk indicators. IQ at 48 months of age positively correlated with midlife strength indicators and negatively with midlife risk indicators. Midlife strength indicators negatively correlate with midlife risk indicators.

INSERT TABLE 4

Table 5 shows standardized beta weights for the regression analyses predicting midlife indicators. A significant interaction is present between group assignment and IQ at 48 months of age on midlife strength indicators ($\beta = -.215, p < .05$). The interaction is illustrated in Figure 3, indicating for participants assigned to the early education group, individuals with higher or lower IQ reported similar numbers of strength indicators in midlife. In contrast, for participants assigned to the control group, those with lower IQ at 48 months of age reported fewer midlife strength indicators than did those with higher IQ at 48 months of age.

INSERT TABLE 5

INSERT FIGURE 3

Discussion

The primary hypothesis of the Abecedarian Project, when it began in 1972, was that by providing high quality early and education to vulnerable children born into poverty with multiple risk factors during the first five years of life, school readiness and later school achievement would be significantly improved. Having regular exposure to repeated and consistent learning opportunities with well-timed and specific feedback, based on a child's demonstrated behavior, children in the early education group learned to be co-creators in their everyday world through

social and learning experiences. Additionally, the dyadic interactions between caregivers and children became the “primary mechanisms producing human development” (Bronfenbrenner & Morris, 1998, p. 994). The quality of natural teaching provided by responsive caregivers in the high-quality early care and education intervention environment provided children motivation to explore and learn with progressively refined skills that extended in other areas of their lives and throughout their lives as evidenced by our latest findings. As previously cited, participants in the early education group outperformed participants in the control group in areas of school performance, educational attainment, employment, and health outcomes (Ramey & Campbell, 1984; Ramey & Campbell, 1992; Campbell, et al., 2001; Campbell, et al., 2002; Campbell, et al., 2012; Campbell, et al., 2014).

Analysis of newly created midlife indices indicate patterns of midlife adjustment and less difficulty in midlife for participants randomly assigned to the early education group compared to the control group of the Abecedarian Project with no differences related to gender. The Abecedarian Project, now in its 5th decade of follow-up, is the most intensive early childhood intervention program provided to children from impoverished backgrounds with multiple risk factors to date. Due to the study’s randomized control trial design and low attrition rate, there is increased confidence in attributing midlife adjustment to early life experiences (i.e., Abecedarian intervention). While we do have a small sample size, the small sample size is offset by the degree of available longitudinal data allowing investigators to examine change over time in the same sample of participants. We also recognize the limitation of creating new indices to measure strength and risk in midlife in a post hoc analysis. However, appropriate standardized tools do not currently exist to measure successful aging in midlife in this way and while our indices are newly created both indices do have strong face validity as well the ability to be precursors for

more robust tool development in the future. Additionally, another advantage of the new indices is that the indicators can be found in general populations and could be potentially applied to existing data sets.

The results from the Abecedarian 5th Decade Follow-up are encouraging in framing our understanding of the early correlates and predictors of positive adult outcomes regardless of gender. Positive predictors of successful aging consist of factors associated with low probability of disease and disease-related disability, cognitive and physical capacity, and engagement in life (Rowe & Kahn. 1997; 2015). For participants in the Abecedarian Project, contextual factors related to Rowe and Kahn's (1997; 2015) work such as educational attainment, employment, health, personal resources, civic engagement, and relationships define successful aging. For example, results from our study indicate that individuals in the early education group report more indicators of successful adjustment in midlife and fewer indicators of difficulty in midlife as measured by the midlife indices of strength and risk. Additionally, participants in the early education group reported more indicators of successful aging regardless of IQ at age 4 years. While previous findings do demonstrate children in the early education group having higher IQ scores than their peers in the control group (Ramey & Campbell, 1984), our findings suggest that group assignment is more predictive of midlife strength indicators in the early education group. However, in the control group higher IQ is predictive of more indicators of strength in midlife. That is, for individuals in the control group to report more midlife strength indicators, participants in the control group had to have a higher IQ at age 4 (Figure 3).

As reported in prior publications, differences between groups which favor the early education group in the areas of education and employment are maintained in the Abecedarian 5th Decade Follow-up (Campbell et al., 2001; Campbell et al., 2002; Campbell et al., 2012). The

area of parental relationships in the Midlife Strength Index (see Table 2) is of particular interest because in the 1970's, when the Abecedarian Project began, there was much concern about disrupting mother-child relationships and attachment if children were cared for outside the home in the field of child development (Farran & Ramey, 1977). Due to these concerns, mother-child relationships were examined in a direct and scientific way in the Abecedarian Project with numerous publications detailing that there were no negative effects of mother-child relationships and attachment related to outside care of children in the early education group (Farran & Ramey, 1977; Ramey, Farran, & Campbell, 1979; Farran & Ramey, 1980; Ramey & Farran, 1981; Ramey, Yeates, & Short, 1984; Burchinal, Lee, & Ramey, 1989; Burchinal, Bryant, Lee, & Ramey, 1992). Our current findings continue to support results from aforementioned publications indicating significant differences between individuals in the early education group versus the control being "very close" to their parents or parental figures in midlife. We believe these results suggest the enduring influence of the early care and education intervention of Rowe & Kahn's (1987; 1997; 2015) engagement in life with family socioemotional relationships.

From the age 30 follow-up of the Abecedarian Project, results showed individuals who received the early care and education intervention graduated from college at significantly higher rates, were employed full-time at higher rates, were less likely to need public assistance, and more likely to report being in excellent health (Campbell et al., 2012). Results from the Abecedarian 5th Decade uphold these results and add to them when defining successful aging. Additionally, our results indicate significantly higher proportions of individuals having checking and savings accounts in the early education group than in the control group. An individual's ability to hold a job along with financial responsibilities such as home and car ownership are likely the product of having better cognitive ability, higher engagement in life, and lower

probability of disease and disease-related disability (Rowe & Kahn, 1987; 1997; 2015). We interpret these results as supporting the idea that the early education intervention's focus on response-contingent learning assisted individuals as they became older to have the motivation to explore and learn sophisticated skills aiding in positive life outcomes such as educational attainment, relationships with parents or parental figures, civic engagement, personal assets, and health that led to competency in many areas of their lives supporting attributes of successfully age in midlife.

The Abecedarian 5th Decade Study findings are complementary with other long-term follow-up studies of early care and education interventions. However, one important difference between the Abecedarian Project and other projects (e.g. Perry Preschool Study and the Chicago Longitudinal Study) is the continuous provision of early care and education beginning in infancy and continuing for the first 5 years of life. We do not know if the persistence of positive outcomes attributed to the early education group are a product of starting in infancy, but we do know that the Abecedarian treatment was more intensive than other programs in that it provided year around intervention in a university-based childcare center for 6 to 8 hours per day, 5 days per week from infancy to kindergarten entry. By providing children with consistent, varied, and interesting learning opportunities, children in the early education group matured into adults who learned and were motivated to be co-creators in their everyday lives. Results from the Abecedarian 5th Decade Study set the stage for plausible mechanisms for a developmental chain of positive outcomes from midlife into encore adulthood (ages 55 – 75 years) prior to cognitive and physical decline (Moen, 2016).

References

- Bayley, N., & Schaefer, E. S. (1964). Correlations of maternal and child behaviors with the development of mental abilities: Data from the Berkeley Growth Study. *Monographs of the Society for Research in Child Development*, 97, 1-80.
- Bronfenbrenner, U., & Morris, P.A. (1998). The ecology of developmental processes. In W. Damon, & R. M. Lerner (Vol. Ed.), *Handbook of child psychology: Vol. 1. Theoretical models of human development*. New York, NY: Wiley.
- Burchinal, M.R., Bryant, D.M., Lee, M.W., & Ramey, C.T. (1992). Early day care, infant-mother attachment, and maternal responsiveness in the infant's first year. *Early Childhood Research Quarterly*, 7, 383-396.
- Burchinal, M., Lee, M., & Ramey, C.T. (1989). Type of day-care and preschool intellectual development in disadvantaged children. *Child Development*, 60, 128-137.
- Campbell, F., Conti, G., Heckman, J., Moon, S., Pinto, R., Pungello, E., & Pan, Y. (2014). Early childhood investments substantially boost adult health. *Science*, 343, 1478-1485.
doi:10.1126/science.1248429
- Campbell, F.A., Pungello, E., Kainz, K., Burchinal, M., Yi, P, Wasik, B.H., Barbarin, O., Sparling, J.J., & Ramey, C.T. (2012). Adult outcomes as a function of an early childhood early educational program: An Abecedarian project follow-up. *Developmental Psychology*, 48, 1033-1043. doi:10.1037/a0026644PMID 22250997
- Campbell, F.A., Pungello, E.P., Miller-Johnson, S., Burchinal, M., & Ramey, C.T. (2001). The development of cognitive and academic abilities: Growth curves from an early childhood early educational experiment. *Developmental Psychology*, 37, 231-242.

- Campbell, F.A., Ramey, C.T., Pungello, E., Sparling, J., & Miller-Johnson, S. (2002). Early childhood early education: Young adult outcomes from the Abecedarian Project. *Applied Developmental Science, 6*, 42-57.
- Campbell, F.A., & Ramey, C.T. (1994). Effects of early intervention on intellectual and academic achievement: A follow-up study of children from low-income families. *Child Development, 65*, 684-698.
- Eichorn, D. H. (1973). The Berkeley longitudinal studies: Continuities and correlates of behavior. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement, 5*, 297.
- Evans, G. W., Li, D., & Whipple, S. S. (2013). Cumulative risk and child development. *Psychological Bulletin, 139*, 1342.
- Farran, D.C., & Ramey, C.T. (1977). Infant day care and attachment behaviors towards mothers and teachers. *Child Development, 51*, 1112-1116.
- Farran, D.C., & Ramey, C.T. (1980). Social class differences in dyadic involvement during infancy. *Child Development, 51*, 254-257.
- Herzog, A.R., & Morgan, J.N. (1992). Age and gender differences in the value of productive activities; Four different approaches. *Research on Aging, 14*, 169-198.
- Jones, H. E., & Bayley, N. (1941). The Berkeley growth study. *Child Development, 12*, 167-173.
- Kern, M. L., & Friedman, H. S. (2009;2008;). Early educational milestones as predictors of lifelong academic achievement, midlife adjustment, and longevity. *Journal of Applied Developmental Psychology, 30*, 419-430.
- McGinness, G., & Ramey, C.T. (1981). Developing sociolinguistic competence in children. *Canadian Journal of Early Childhood Early Education, 1*, 22-43.

- Moen, P. (2016). *Encore adulthood: Boomers on the edge of risk, renewal, and purpose*. New York, NY: Oxford University Press.
- Ramey, C.T. (2017). *Supporting adaptive brain and behavior: The Abecedarian approach to social, education, and health disparities*. Paper presented at the Symposium on Adaptive Brain and Behavior, Virginia Tech, Blacksburg, VA. Retrieved from https://static.vtc.vt.edu/media/documents/Supporting_Adaptive_Brain_and_Behavior_Nov_30_talk_final.pdf
- Ramey, C.T., & Campbell, F.A. (1984). Preventive early education for high-risk children: Cognitive consequences of the Carolina Abecedarian Project. *American Journal of Mental Deficiency, 88*, 515-523.
- Ramey, C.T., & Campbell, F.A. (1992). Poverty, early childhood early education, and academic competence: The Abecedarian experiment. In A. Huston (Ed.), *Children in poverty* (pp. 190-221). New York, NY: Cambridge University Press.
- Ramey, C.T., Campbell, F.A., Burchinal, M., Skinner, M.L., Gardner, D.M., & Ramey, S.L. (2000). Persistent effects of early childhood education on high-risk children and their mothers. *Applied Developmental Science, 4*, 2-14.
- Ramey, C.T., Campbell, F.A., & Ramey, S.L. (1999). Early intervention: Successful pathways to improving intellectual development. *Developmental Neuropsychology, 16*, 385-392.
- Ramey, C.T., Collier, A.M., Sparling, J.J., Loda, R.A., Campbell, F.A., Ingram, D.L., & Finkelstein, N.W. (1976). The Carolina Abecedarian Project: A longitudinal and multidisciplinary approach to the prevention of developmental retardation. In T. Tjossem (Ed.), *Intervention strategies for high-risk infants and young children* (pp. 629-665). Baltimore: University Park Press.

- Ramey, C.T., Farran, D.C., & Campbell, F.A. (1979). Predicting IQ from mother-infant interactions. *Child Development, 50*, 804-814.
- Ramey, C.T., & Farran, D.C. (1981). The functional concern of mothers for their infants. *Infant Mental Health Journal, 2*, 48-55.
- Ramey, C.T., & Smith, B.J. (1977). Assessing the intellectual consequences of early intervention with high-risk infants. *American Journal of Mental Deficiency, 8*, 318-324. PMID 836631
- Ramey, C. T., Sparling, J., & Ramey, S. L. (2012). *Abecedarian: The ideas, the approach, and the findings*. Los Altos, CA: Sociometrics Corp.
- Ramey, C.T., Yeates, K.O., & Short, E.J. (1984). The plasticity of intellectual development: Insights from preventive intervention. *Child Development, 55*, 1913-1925.
- Reynolds, A. J. (2000). *Success in early intervention: The Chicago child parent centers*. Lincoln, NE: University of Nebraska Press.
- Reynolds, A. J., Ou, S. R., & Temple, J. A. (2018). A Multicomponent, Preschool to Third Grade Preventive Intervention and Educational Attainment at 35 Years of Age. *JAMA Pediatrics, 172*, 247 – 256.
- Rowe, J.W., & Kahn, R.L. (1987). Human aging; Usual and successful. *Science, 237*, 143-149.
- Rowe, J.W., & Kahn, R.L. (1997). Successful aging. *The Gerontologist, 37*, 433-440.
- Rowe, J., & Kahn, R. (2015). Successful aging 2.0: Conceptual expansions for the 21st century. *Journals of Gerontology Series b-Psychological Sciences and Social Sciences, 70*, 593-596.
- Sameroff, A.J. (2009). *The transactional model of development: How children and contexts shape each other* (1st ed.). Washington, DC: American Psychological Association.

- Sameroff, A. J., Seifer, R., Barocas, R., Zax, M., & Greenspan, S. (1987). Intelligence quotient scores of 4-year-old children: Social-environmental risk factors. *Pediatrics*, 79, 343-350.
- Schweinhart, L. J. (2005). *Lifetime effects: the High/Scope Perry Preschool study through age 40* (No. 14). High/Scope Foundation.
- Sparling, J. J., & Lewis, I. (1984). *Learning games for threes and fours: A guide to adult and child play*. New York, NY: Walker
- Terman, L.M. (1925). Mental and Physical Traits of a Thousand Gifted Children. *Genetic Studies of Genius, Vol. 1. Mental and physical traits of a thousand different children*. Stanford, CA: Stanford University Press.
- Terman, L. M., & Merrill, M. A. (1972). *Manual for the Stanford-Binet Intelligence Scale*. Boston: Houghton Mifflin.
- The Annie E. Casey Foundation. (2017), *2017 kids count data book: State trends in well-being*. Retrieved from <http://www.aecf.org/m/resourcedoc/aecf-2017kidscountdatabook.pdf>
- U.S. Department of Commerce. (1971). *Current populations reports* (Series P – 60, No. 78). Retrieved from <https://www2.census.gov/prod2/popscan/p60-078.pdf>
- Walden, T., & Ramey, C.T. (1983). Locus of control and academic achievement: Results from a preschool intervention program. *Journal of Educational Psychology*, 75, 347-358.
- Weikart, D. P., Bond, J. T., & McNeil, J. T. (1978). *The Ypsilanti Perry Preschool Project: Preschool years and longitudinal results through fourth grade* (No. 3). High/Scope Foundation.

Tables and Figures

Table 1

Demographics of original and 5th decade study samples

Variable	Early education Group @ Entry (n = 57)	Control Group @ Entry (n = 54)	Early education Group @ Midlife (n = 42)	Control Group @ Midlife (n = 36)
Mean Maternal IQ	85.4 pts	84.5 pts	85.5 pts	84.1 pts
Mean Maternal Age at Birth	19.6 yrs	20.3 yrs	18.8 yrs	20.2 yrs
Mean Maternal Early education	10.5 yrs	10.2 yrs	10.5 yrs	10 yrs
% Below Poverty	100%	100%	100%	100%
% African American	94%	100%	98%	100%

Table 2

Midlife strength indicators by group assignment and percentage

Item	Early education (n = 42) (provided 5 yrs. of early education plus social and health services)	Control (n = 36) (provided social and health services)	<i>p</i> value
Early education			
Completed high school	97.6%	75.0%	0.00
Completed college degree	28.6%	13.9%	0.09
Completed graduate degree	7.1%	2.8%	0.37
Health			
Overall favorable health rating	52.4%	36.1%	0.11
Employment			
Employed full-time	78.6%	61.1%	0.08
Personal Resources			
Owens home	38.1%	25.0%	0.16
Owens car	100%	97.2%	0.46
Has a checking account	90.5%	72.2%	0.04
Has a savings account	92.9%	66.7%	0.00
Parental Relationships			
Rates parental/parental figure relationships as "very close"	85.7%	58.3%	0.00

Each level of early education includes lower achievement levels.

Table 3

Midlife risks indicators by group assignment and percentage

Item	Early education (n = 42) (provided 5 yrs. of early education plus social and health services)	Control (n = 36) (provided social and health services)	p value
Early education			
Did not complete high school	2.4%	25.0%	0.00
Health			
Overall unfavorable health rating	9.5%	19.4%	0.18
No health insurance	16.7%	30.6%	0.12
Employment			
Unemployed or part-time employment	19.0%	36.1%	0.08
Public Assistance			
Receives Disability/SSI	2.4%	11.1%	0.14
Receives housing assistance	4.8%	8.3%	0.43
Receives food stamps	28.6%	33.3%	0.42
Receives Medicaid	14.3%	22.2%	0.27
Civic Engagement			
Did not vote in last presidential election	9.5%	25.0%	0.06
Teen Parent			
Less than age 20 at 1 st child's birth	21.4%	44.4%	0.03

Table 4

Midlife indices: Bivariate correlation matrix

Variables	1	2	3	4	5
1. Sex	-				
2. Treatment group	0.107	-			
3. IQ at 48 months	-0.010	0.507**	-		
4. Midlife Strength Indicators	-0.086	0.415**	0.436**	-	
5. Midlife Risk Indicators	-0.135	-0.323**	-0.428**	-0.647**	-
<i>M</i>			95.31	2.96	1.22
<i>SD</i>			13.76	1.24	1.31

Note. ** Correlation significant at the 0.01 level

Table 5

Standardized beta weights for multiple regression models predicting midlife indices

Criterion	Midlife Strength Index	Midlife Risk Index
Treatment group	.225~	-.095
IQ at 48 months of age	.322**	-.379**
Interactions		
Treatment group X IQ at 48 months of age	-.215*	-.013
Model R ²	.272	.190

Note. ~p ≤ 0.10; *p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001

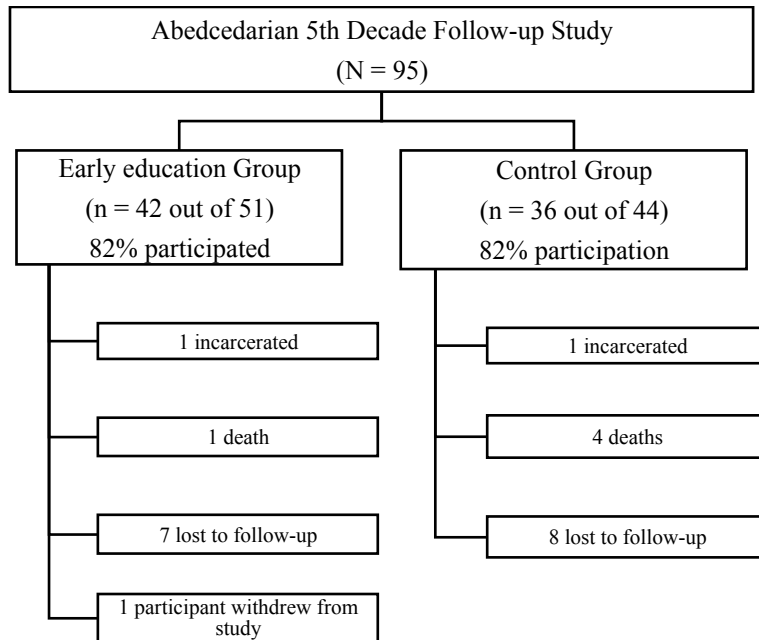


Figure 1. Abecedarian 5th Decade Study participant retention

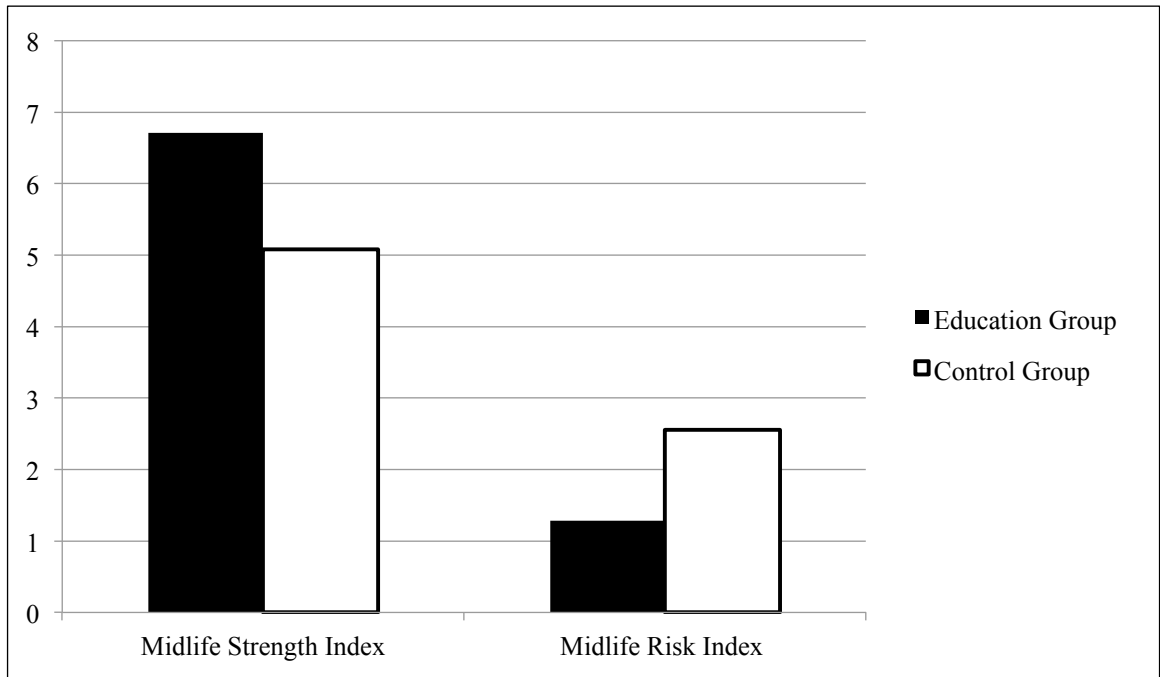


Figure 2. Midlife indices means by group assignment

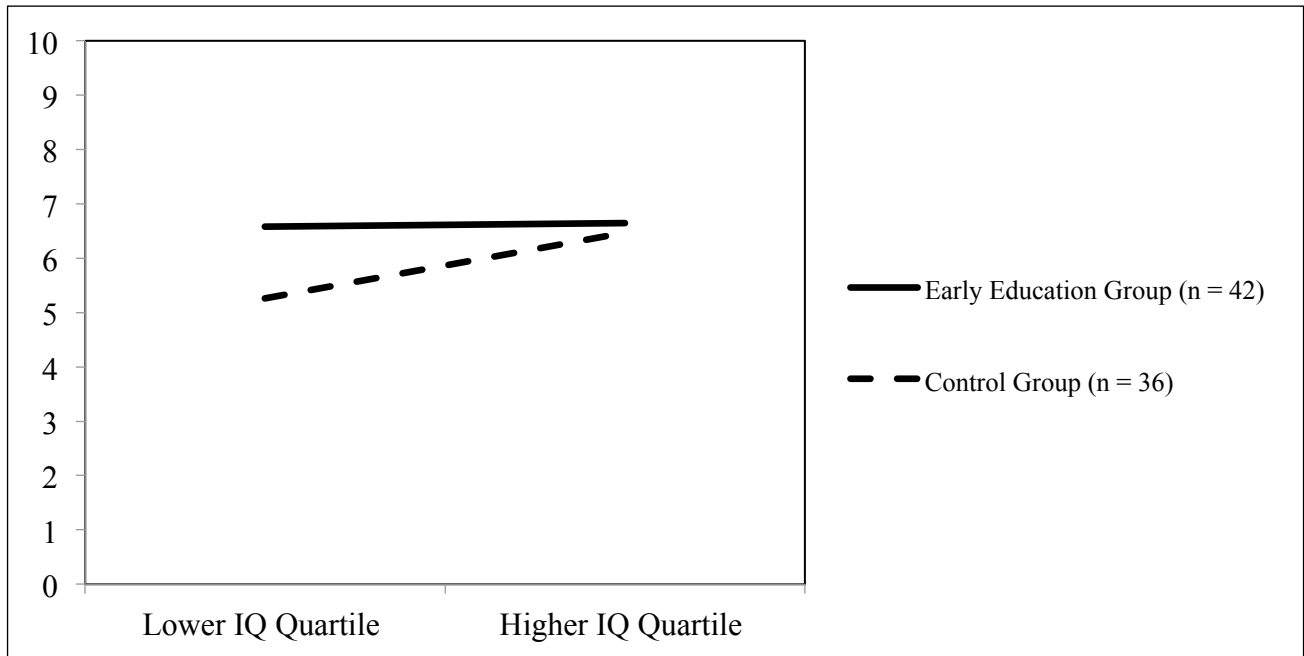


Figure 3. Mean number of midlife strength indicators by group and IQ at 48 months

Title: Economic and health locus of control in midlife linked to early care and education intervention

Abstract

Background: The extent to which a person believes he or she has control over their life is known as locus of control (LOC). It is a construct that has been linked to poverty and non-optimal outcomes, including the areas of health and economics. Correlational studies inherently lack reaching causal inferences about the role of early life experiences on LOC. In contrast, the present study builds on a randomized controlled study (RCT) of 5 years of high-quality early care and education, thus relying on prospective data from birth to the fifth decade of life for two groups of individuals who had markedly divergent early life experiences. The question is whether an early educational intervention can show an impact in midlife on LOC and general well-being in a cohort born into deep poverty.

Research Design and Methods: This study includes 78 individuals (39 - 45 years old): 42 had been randomly assigned to receive 5 years of high-quality early care and intervention along with extra medical and social services, 36 assigned to receive medical and social services only. All have participated in the Abecedarian Project since birth. Experienced interviewers blinded to participants' group assignment conducted interviews about midlife outcomes, including administration and scoring of standardized LOC tools about health and economics.

Results: Significant group differences favoring the early care and education group compared to the control group occurred in terms of perceived LOC, particularly for the subscale known as Powerful Others for both the Multidimensional Health LOC scale (Wallston, Wallston, & DeVellis, 1978) ($F(1,76) = 3.962, p = .05$) and the Economic LOC scale (Furnham, 1986) ($F(1,76) = 5.146, p = .026$). Descriptive self-report data (from ages 30 through their 40s) lend

further support to enduring benefits linked to the experimental early education group in terms of better outcomes in their own health and employment status in middle age.

Discussion and Implications: The longstanding deliberation about whether LOC can be influenced by life experiences received partial support from these findings. The theory that guided the experimental early care and education program of the Abecedarian Project was that emphasized active learning and use of response-contingent feedback starting in early infancy; this theory would predict that children would learn that their own actions exert positive control on problem-solving and outcomes. The data from midlife show a link of these early experiences to individuals not believing that “powerful others” determine their well-being, but rather that they are active participants who exert control over many aspects of their health and financial well-being. Earlier findings of consistent and multiple benefits of the early education also are discussed, and possibly provide mediating links that may account for the reported group differences. These results indicate the benefits of high-quality early care and education programs are far reaching and enduring.

Introduction

The extent to which a person believes he or she has power over events in their life is referred to as locus of control (LOC) (Rotter, 1966). J. B. Rotter (1966) coined the term LOC and grounded this construct in the principles of reinforcement and social learning theory (Rotter, 1971). Social learning theory posits that a person's behavior is influenced not just by psychological factors, but also by his or her social context and environment (Rotter, 1954). Rotter proposed there were two types of LOC, internal and external. A person with an internal LOC believes that he or she can influence life events and their outcomes, while a person with an external LOC emphasizes how outside and uncontrolled forces affect his or her life (Rotter, 1966). In this social learning framework, a person whose orientation of perceived control over their life outcomes being more internalized is likely to have had successes closely linked to their own actions, which in turn provides reinforcement that supports the utility of having an internal LOC. In contrast, a person with a predominantly external LOC orientation is likely to blame (or even sometimes credit) other individuals and factors such as chance and fate as the cause of their life outcomes (Carver & Scheier, 2000; Rotter, 1971). Control over outcomes in a person's life also relates to several constructs in the literature such as personal responsibility (i.e., one should prevent or solve potential problems and take actions to improve one's status), self-efficacy (i.e., a person's belief that they can shape and control life's outcomes) (Seeman, 1959), self-confidence (i.e., a strong belief in his or her own ability to tackle problems and make progress) (Yeager & Dweck, 2012), an incremental view of intelligence (i.e., a belief that through one's own efforts one can become more intelligent, rather than believing intelligence is a fixed trait) (Dweck, 2008), and resilience (i.e., the ability to recover well and often quickly from adverse events and life conditions) (Masten, 2001; 2018).

Similarities and differences among these key constructs are actively considered, although collectively these comprise what might be considered a generalized growth mindset and positive attitude that underscores the role of the individual in successfully constructing one's life trajectory and recovering from (rather than be permanently harmed by) the inevitable and multiple adversities that occur. Of high interest is promoting understanding of the origins of a strongly positive growth mindset, including identifying earlier antecedents in an individual's life that appear linked to more (or less) future successful outcomes and a greater sense of self-agency. Yeager and Dweck (2012) show, "...that students who believe (or are taught) that intellectual abilities are qualities that can be developed... tend to show higher achievement..." (Yeager and Dweck, 2012, p. 302). Additionally, Dweck (2008) found that a person's interpretation of adversities makes a difference. How an individual perceives a potentially difficult situation and then whether he or she seeks to respond actively to a challenge by initiating actions defines the process of resiliency; this resiliency process relies strongly on an internal LOC orientation (Masten, 2001; 2018). The implications of internal LOC and its closely related perception of self-efficacy may be far-reaching: the more a person feels powerless and socially alienated, for example, the stronger the likelihood that the person reports being externally oriented and the less likely the person is to have multiple indicators of positive outcomes or success (Seeman, 1959).

If a person feels powerless in one situation, does that person feel powerless in all situations or are these feelings situation-specific? Can a general life LOC scale adequately predict a person's LOC in distinctly different domains of life? Bandura (1986) argued that a general scale of LOC is unlikely to predict how people will behave in all situations, since people may bring different social learning experiences to bear on their perceptions of how much control

they have over domains such as their health, work, social relationships, and economic well-being. Accordingly, many specific LOC scales have been developed spanning the domains of academic, economic, health, and spirituality (Sakalaki, Richardson, & Bastounis, 2005). Closely related to domain specific LOC scales are personal learning experiences (VanDaalen, Niekerk, & Pottas, 1987). Declerck et al. elaborated further that LOC “rests on the assumption that people vary consistently in their individual social learning experiences, giving rise to further differences in the degree to which they are generally able to associate a reward or reinforcement with their own preceding behavior” (Declerck, et al, 2006, p.144). If LOC is, in fact, something that varies based on a person’s unique experiences, then a reasonable hypothesis is early life learning experiences may have an influence that extends over the lifespan, mediated by intermediary outcomes, and contributes to a belief of either having reasonable control over one’s outcomes, in specific areas such as health and economic well-being, versus feeling that powerful others and forces of chance are the determining forces in one’s life. These theoretical ideas have considerable support from a wide array of correlational and usually cross-sectional studies; rarely, however, are there longitudinal datasets or controlled experiments that manipulate the early experiences to assess more rigorously the importance of early life experiences on LOC in specific domains.

Health Locus of Control and Health Behaviors

Difficulty in predicting health behaviors led to the creation of health LOC scales in an effort to understand the relationship of LOC and a variety of health behaviors, attitudes, and situations (Wallston, Wallston, & Devellis, 1978). As defined by Wallston, Wallston, Kaplan, and Maides in the 1970s, an external LOC belief of health is the notion that a person’s health outcomes are mostly under the control of influential others such as medical professionals or

determined by fate or luck (Wallston, Kaplan, & Maides, 1976). An internal LOC belief in health is characterized by a person believing his or her health conditions or issues are predominantly a direct result of their own behavior or can be improved by the actions they take (Wallston, Kaplan, & Maides, 1976). Internal health LOC has been associated with increased knowledge about health and disease (Jacobs-Lawson, Waddle, & Webb, 2011). Jacobs-Lawson, et al. (2011) synthesized the research findings as lending support to the conclusion that better health “is associated with greater internal health locus of control,” while poorer health is linked to greater external LOC in the subdomain of chance and powerful others (Jacobs-Lawson, et al, 2011, p.174). Furthermore, health LOC aids in understanding social inequalities of health in that a person from a lower socioeconomic background may have different expectations about his or her ability to influence their own health due to less favorable life circumstances (Poortinga, Dunstan, & Fone, 2008).

Economic Locus of Control and Socioeconomic Status

Economic LOC has been proposed as a potentially important mindset orientation that may help explain variations in socioeconomic status, economic behaviors or decisions, and about earnings and wealth (Furnham, 1986). Furnham developed an economic LOC scale specifically to investigate facets of organization and occupational behavior through its structure, correlates, and demographic factors (Furnham, 1986). In particular, the economic LOC tool permits investigation about the degree to which an individual believes economic outcomes are due to his or her efforts, as opposed to luck, fate, chance, or powerful others (Furnham, 1986; Salamanca, Fourage, de Grip, & Montizann, 2016). For individuals with an economic external LOC orientation, they tend to see self-motivation, active efforts, and seeking rewards as factors that are beyond their reach or that will be ineffective, because they believe that other individuals are

far more powerful and that other external forces are dominant (Heaven, 1989). An internally-oriented individual in the domain of economics would view taking actions such as saving money, learning about money management, and avoiding debt as worthwhile behaviors to improve their financial well-being (Sakalaki et. al., 2005). For individuals who are born into poverty (often inter-generational) and who continue to live in poverty for many years, there are multiple factors that potentially could shape their adult economic LOC, including their own educational attainment and work history and the degree to which they have taken active control in areas that increase or slow down one's accumulation of financial and material resources (Wardle & Steptoe, 2003).

Persistent poverty is, in fact, often driven by constraints external to the individual (Dalton, Ghosal, & Mani, 2016). Historically, some individuals who express an internal LOC develop a negative view of poverty that blames "poor people" as having qualities associated with passivity or lack of self-efficacy behaviors (Heaven, 1989; Furnham & Gunter, 1984). Such harsh judgments do not adequately consider complex and multi-level factors associated with poverty. Yet there are data that support the prediction that an individual's experience of actually having personal control or lack of control is a product of what already has occurred in his or her own life (Cobb-Clark, 2015; Ramey & Walden, 1983). In the past, studies in the United States have found that LOC does tend to be more externally oriented in individuals who are economically impoverished and in those who are African-American compared to those from higher socioeconomic status backgrounds or those who are White/Non-Hispanic, middle/upper-class (Ramey & Campbell, 1976; Ramey & Walden, 1983; Heaven, 1989; Poortinga, et al., 2008). For individuals born into poverty, what they observe firsthand as experiences they and those in their innermost social networks encounter may defy the idea that "they can produce

desired effects and forestall undesired ones by their actions” (Bandura, 2000, p.120). In other words, individuals born into poverty may have very few experiences that reinforce a belief that they are effective “actors” in their own lives rather than “observers” (Nasser & Abouchedid, 2006). If internal and external beliefs are no longer thought to be the inverse of each other (Luszczynska & Schwarzer, 2005) and are accepted as being multidimensional (Furnham, 1986; Wallston et al., 1976; 1978), then what are the most likely potential influences that reinforce individuals’ ability to see themselves as positive actors in or constructors of their own life’s favorable outcomes?

Almost all studies in relation to poverty and LOC are descriptive and cross-sectional in nature which makes it difficult to investigate whether or not potential influences such as early life experiences can aid in promoting favorable outcomes and impact a person’s perceived control over events in their life. In contrast, the Abecedarian Project that began in 1972 provides an exceptionally strong research design that permits exploring – prospectively and experimentally - the association of early life experiences and LOC in areas of high importance, health and economic, that impact a person in midlife. Published findings from the Abecedarian Project over the first four decades of life have consistently shown significant positive outcomes favoring individuals in the early care and education group compared to those in the control group in the areas of increased tested IQ, school performance, reading and math achievement, educational attainment in adulthood, employment, and health outcomes (e.g., Ramey & Campbell, 1984; Ramey & Campbell, 1992; Campbell, et al., 2001; Campbell, et al., 2002; Campbell, et al., 2012; Campbell, et al., 2014). One study reported differences in children’s academic LOC in elementary school (Walden & Ramey, 1983) as a function of receiving the Abecedarian early care and education intervention. Combined, the reported benefits of the

Abecedarian Project intervention create a life history for those in the early care and intervention group that provided a significantly distinct set of life experiences – ones that are consistent with having antecedents to support a lower external LOC and a higher internal LOC later in life (Heaven, 1989; Jacobs-Lawson, et al, 2011; Wallston, Wallston, & Devellis, 1978). Therefore, we hypothesized based on the content of the actual experimental treatment with a focus on response contingent learning provided during the first five years of life and the cumulative evidence of many positive outcomes from the age of 18 months through to age 37, that in the fifth decade of life there would be group differences detected concerning LOC both in the life domains of health and personal economics.

Methods

Study Sample. Recruitment began for the Abecedarian Project, an in-depth study of children born into poverty with multiple risk factors, in 1972. Inclusion criteria for the Abecedarian Project was based on 13 socio-demographic factors that were weighted and combined into a high-risk index (Table 6). Criterion for inclusion in the Abecedarian Project was a score of 11 or more on the high-risk index (Ramey & Smith, 1977) as well as infants needed to appear free of biological conditions with known links to mental, motor, or sensory disabilities (Ramey et al., 1976). Scores on the high-risk index at entry ranged between 11 and 37 with mean a score of 20.70 ($SD = 5.52$) for families who enrolled in the Abecedarian Project. Local social service agencies and prenatal clinics within the catchment area of the project assisted in identifying potential study participants (Ramey et al., 1976).

INSERT TABLE 6

Four cohorts of families enrolled in the Abecedarian Project between the years of 1972 and 1977. A total of 109 families with 111 infants (1 set of identical twins, 1 sibling pair),

accepted their random assignment to participate in the Abecedarian Project; 57 infants (28 girls and 29 boys) were randomly assigned to the education group and 54 infants (31 girls and 23 boys) were randomly assigned to the control group. Of the 109 original families, 107 were African American, and two were White. At entry of the project, 76 percent of children lived in female-headed households with 66 percent of mothers not having high school diplomas (Ramey & Campbell, 1984). Baseline characteristics of participants in the 5th Decade Follow-up are summarized in Table 7 and indicate no significant group differences from the originally enrolled sample. This is important, supporting the view that there has not been differential attrition associated with treatment group. Most of the attrition is due to death, some to loss of contact information, and a very few due to incarceration.

INSERT TABLE 7

The Abecedarian Project took place in a small, relatively affluent, university town with a median income of \$19,200 in 1970 and a high proportion of the population with advanced degrees (U.S. Department of Commerce, 1971), due the university being the major employer. A wide range of human service agencies were available to economically poor families living in the area as well as programs providing housing, fuel subsidies, food supplements, and job training to those in need. In addition to the wide-range of services available to families, a large teaching hospital and two publically funded health clinics for patients of low income were accessible. All of the Abecedarian Project families, thus, had potentially easy access to a high degree of material, fiscal, and social supports in the locale (Campbell & Ramey, 1994).

The Abecedarian education treatment. The primary goal of the Abecedarian Project was to test whether providing a high quality early care and education intervention from birth to school entry could exert a strong effect on preventing cognitive impairments and later poor

school achievement. The intervention was designed to provide children from extremely low resource (financial, social, and educational) families with a highly responsive and intellectually stimulating full day, year round program beginning in infancy (Ramey, et al., 2012). A particular concentration of the Abecedarian Project's curriculum was on the infant and young child as being an active learner and contributor to daily experiences. Also included was an emphasis on the child being skilled in communicating their feelings, interests, and ideas in their interactions with adults, peers, and the environment. The trained teachers and caregivers offered a rich set of learning experiences (in a detailed curriculum known as *Leaningames*, c.f. Sparling and Lewis, 1984) and provided stability in positive social-emotional relationships with the children. The active and individually paced learning experiences were accompanied by adult expressions of warmth, acceptance, and positive regard. Additionally, adults were taught to allow children as much autonomy and independence as reasonable to support curiosity and creativity while maintaining children's safety (McGinness & Ramey, 1981). Through repeated exposure to well-timed and specific feedback (i.e., response-contingent learning) in daily routines and activities caregivers in the early care and education setting were able to support children's ability to see themselves as co-creators influencing and responding to the environment around them. This intervention program therefore laid the foundation for acquiring a sense of self-efficacy, internal LOC, and a self-agency. The systematic child-centered intervention provided by the Abecedarian Project occurred six to eight hours per day, five days per week, 50 weeks per year starting as early as six weeks of age until school entry into kindergarten (McGinness & Ramey, 1981; Ramey & Campbell, 1984; Ramey et al., 2012).

In order to control effects that could confound the focus of the primary study hypothesis (i.e., that education early in life makes a lasting and large difference), the Abecedarian Project

offered to the families and children in both the early education group and the control group a set of services relating to free infant nutritional support, free or no cost medical/health care in accordance with American Academy of Pediatrics, and extensive free social supports to families. This allowed for concluding that early care and education intervention was the likely causal factor in different outcomes, rather than simply offering lots' of early care and good nutrition and family supports that inherently would be associated with an early education program.

Current sample and attrition. Individuals were contacted by letter or telephone inviting them to enroll in the Abecedarian 5th Decade Follow-up by the original family coordinator of the Abecedarian Project from 1972. Data collection took place between 2016 and 2017 via in-person face-to-face sessions. Project funds compensated participants for their time and travel. All aspects of the study protocol had Institutional Review Board approval.

Five participants died (1 education; 4 control) between the age 30 follow-up study and the 5th Decade Follow-up (ages 39 to 45) reducing the number of potential participant recruitment to 98 individuals (Figure 4). Of the potential 98 participants still living, one participant from the education group withdrew from the study and two participants (1 education; 1 control) were in prison making them ineligible to participate in the study further reducing the potential population to 95 for the 5th Decade Follow-up. Seventy-eight individuals out of the 95 potential participants (82%) agreed to take part in the current study. Of the 78 participants who agreed to participate in the 5th Decade Follow-up, 98% were African American, 42 adults (20 female and 22 male) were in the education group and 36 in the control group (21 female and 15 male).

INSERT FIGURE 4

Data collection occurred in individualized sessions lasting three to four hours beginning with informed consent followed by an interview and functional magnetic resonance imaging (fMRI) brain scan. The interview portion of the individualized session consisted of two portions. The first portion of the interview involved an open-ended narrative interview conducted by the original Principal Investigator of the project typically lasting five to fifteen minutes with participants being asked to share about their current lives, aspirations for the future, and what being a part of the research project has meant to them. The second portion of the interview was a semi-structured interview conducted by interviewers blinded to participants' group assignment lasting 45 to 60 minutes. The semi-structured interview consisted of questions relating to education, household composition and residence history, relationships with parents or parent figures, employment and benefits, health and health care, health locus of control, economic locus of control, and community involvement.

The final component of the 5th Decade Follow-up was a separate session of fMRI scanning and neuroeconomic games lasting 40 to 60 minutes. The fMRI scans were carried out by a MRI research technologist, blinded to participant group assignment, who screened participants to ensure their safety. We do not include these data here.

Multidimensional Health Locus of Control. The Multidimensional Health Locus of Control Scale (MHLC) (Wallston, Wallston, & DeVellis, 1978) includes 18 self-report items that assess an individual's beliefs on what influences their health. The scale consist of three subscales, each with six items:

1. Internal belief (personal control over positive health outcomes)
2. Chance belief (no personal control over health outcomes)
3. Powerful other belief (health is dependent on doctor or on the behavior of others)

Participants responded to each item on a six-point Likert scale with a score 1 indicating “strongly disagree”, 2 indicating “moderately disagree”, 3 indicating “slightly disagree”, 4 indicating “slightly agree”, 5 indicating “moderately agree”, and 6 indicating “strongly agree.” Scores for each of the three subscales range from 6 to 36. Reliability of MHLC is high (0.83 - 0.85) (Furnham & Steele, 1993). The scale has been used in various populations and is considered valid (Athale, Aldridge, Melcarne, Samady, & Robins Sadler, 2010; Casey, 1992; Rodriquez-Rosero, Ferriani, & Dela Coleta, 2002; Ubbiali, Donati, Chiorri, Brehani, Cattaneo, Maffei, & Visintini, 2008). Using the Cronbach’s alpha test, reliability of the MHLOC for the current samples ranges from 0.71 - 0.74

Economic Locus of Control. The Economic Locus of Control Scale (ELOC) consist of 40-items to assess an individual’s belief of how much control they have over their work and money-related aspects of their lives (Furnham, 1986). The scale consist of four subscales:

1. Internal (personal control over financial positive outcomes)
2. Chance (luck or chance control financial outcomes)
3. External denial (denial of existence of poverty)
4. Powerful others (other’s power over a person’s financial position)

Participants responded to each item on a seven-point Likert scale with a score 1 indicating “strongly agree”, 2 indicating “moderately agree”, 3 indicating “slightly agree”, 4 indicating “slightly disagree”, 5 indicating “moderately disagree”, 6 indicating “strongly disagree”, and 7 indicating “undecided.” In an effort to make results consistent between LOC scales, the ELOC items were reverse-coded, so that higher scores reflected a greater degree of belief in each scale. Additionally, “Undecided” was recoded to a score of 3.5 rather than 7 in order to reflect neutrality on the scale, rather than artificially skew the scores toward “strongly agree.” With the

current study sample, scores range from 17 – 42 on the internal subscale of ELOC, 4 -24 on the powerful others subscale, 6 – 36 on the chance subscale, and 5 – 25 on the external subscale. ELOC is reported to be reliable (0.78) (Furnham, 1986) and valid (Van Delen, Van Niekert, & Pottas, 1987). Using the Cronbach's alpha test, reliability of ELC for the current sample ranges from 0.56 – 0.73.

Data analysis

An intent-to-treat analysis plan was used to estimate the impact of the Abecedarian early care and education treatment on midlife locus of control measures including descriptive statistics. The primary method of data analysis included repeated measures multivariate analyses of variance (MANOVA) with random group assignment as the between-groups factor and subscales of MHLC and ELOC as the within-group factors. Further analyses of variance (ANOVA) were conducted to examine between group differences of individual MHLC and ELOC subscales.

In an effort to understand MHLC and ELOC in the context of real world outcomes, a Pearson's correlation was used to measure the strength and direction of association between locus of control factors and Midlife indicators relating to health and economics. Due to the variables of gender, random group assignment, and health and economic items being treated as dichotomous variables, a point-biserial correlation was used to measure the strength and direction of association between dichotomous variables and factors of locus of control.

Results

Group Comparisons. Means and percentages by group (education group and control group) are presented in Table 8. The education group reported significantly lower levels of belief on the Powerful Others subscales of both the MHLC and ELOC, as well as marginally

significant less belief on the external subscale of the ELOC. Individuals in the education group were also more likely to have completed high school, have full time employment, and have close relationships with their parents or parental figures.

INSERT TABLE 8

Multidimensional Health Locus of Control. A MANOVA of the Multidimensional Health Locus of Control subscales (Internal, Powerful Others, and Chance) did not reveal significant overall main effect with group ($F(2, 35) = .13, p = .73$). However, a main effect does exist within MHLC ($F(1, 35) = 2.05, p = .001$) and a marginal main effect exists for random group assignment ($F(1, 35) = 3.86, p = .057$). Figure 5 graphically depicts estimated marginal means by group for the subscales of MHLC. Further analyses, using an analysis of variance, of the MHLC subscales did reveal for participants who did not receive the early education treatment reported powerful others as having more influence over health outcomes ($F(1, 76) = 3.962, p = .05$) with a $M = 19.64$ ($SD = 6.53$) than did participants who did received the education treatment within the Abecedarian Project with a $M = 16.86$ ($SD = 5.82$) with an effect size of 0.48. No significant proportional differences exist for the MHLC subscales of internal locus of control or chance locus of control.

INSERT FIGURE 5

Due to the ANOVA results finding significant proportional differences between groups within the powerful others subscale of the MHLC, a full correlation matrix table of variables (Table 9) was constructed based on the literature based on the results from the ANOVA. Variables within the correlation matrix were based on previous findings in the literature and include MHLC's powerful others (Jacobs-Lawson et al., 2011; Luszczynska & Schwarzer, 2005; Poortinga, Dunstan, & Fone, 2008; Wardle & Steptoe, 2002), group assignment (Jacobs-Lawson

et al., 2011; Wardle & Steptoe, 2002), sex, education (Jacobs-Lawson et al., 2011; Poortinga, Dunstan, & Fone, 2008; Wardle & Steptoe, 2002), work (Jacobs-Lawson et al., 2011; Poortinga, Dunstan, & Fone, 2008), health insurance (Jacobs-Lawson et al., 2011; Luszczynska & Schwarzer, 2005), reliance on disability services (Jacobs-Lawson et al., 2011; Poortinga, Dunstan, & Fone, 2008), and participants reporting chronic health condition (e.g. high blood pressure, diabetes, asthma or chronic lung issues, gastrointestinal issues, mental health, and trouble sleeping) (Jacobs-Lawson et al., 2011; Luszczynska & Schwarzer, 2005; Poortinga, Dunstan, & Fone, 2008; Wardle & Steptoe, 2002). Stronger belief in the power of others (e.g. higher scores on the Powerful Others subscale) positively correlated with not having finished high school, unemployment or part-time work, reporting poor health, receiving Medicaid, receiving disability services, and having chronic health conditions.

INSERT TABLE 9

Economic Locus of Control. A MANOVA of the Economic Locus of Control subscales (Internal, Powerful Others, Chance, and External/Denial) did reveal a significant interaction effect with group $F(3, 105) = 2.77, p < .05$ in addition to a strong main effect of ELOC type $F(3, 105) = 170.46, p = .001$ and a marginal main effect exists for group $F(1, 105) = 2.84, p = .10$. Figure 6 depicts estimated marginal means for the subscales of ELOC. Further analyses, using an analysis of variance, of the ELOC subscales revealed that for participants who did not receive the early education treatment they reported powerful others having more influence over economic outcomes ($F(1, 76) = 5.146, p = .026$) with a $M = 12.92$ ($SD = 5.40$) than did participants who did received the education treatment within the Abecedarian Project with a $M = 10.44$ ($SD = 4.23$) with an effect size of 0.59. Additionally, the same analysis of variance indicated a trend for participants who did not receive the education treatment reporting more external economic locus

of control ($F(1,76) = 3.359, p = .071$) with a $M = 11.90$ ($SD = 5.18$) than did participants who did receive the education treatment with a $M = 10.05$ ($SD = 3.73$) with an effect size of 0.50. No significant proportional differences existed within the ELC subscale of internal locus of control or chance locus of control.

INSERT FIGURE 6

Due to the ANOVA results finding significant difference occurring on only the powerful others subscale of the ELOC, a full correlation matrix table of variable (Table 10) was constructed based on the literature and results of the ANOVA. Variables within the correlation matrix are based on previous findings in the literature and include with ELOC's powerful others (Cobb-Clark, 2015; Furnham, 1986; Furnham & Gunter, 1984; Furnham & Steele, 1993; Heaven, 1989; Heaven & Furnham, 1987; Nasser & Abouchdid, 2006; Van Daalen, et al., 1989) and the variables of group assignment (Dalton, Ghosal, & Mani, 2014; Furnham & Steele, 1993; Heaven, 1989; Heaven & Furnham, 1987; Van Daalen, et al., 1989) sex, education (Cobb-Clark, 2015; Furnham & Gunter, 1984; Furnham & Steele, 1993; Heaven, 1989; Heaven & Furnham, 1987; Van Daalen, et al., 1989), work (Cobb-Clark, 2015; Coleman & DeLeire, 2003; Heaven, 1989; Heaven & Furnham, 1987; Nasser & Abouchdid, 2006; Van Daalen, et al., 1989), parental relationships (Furnham & Gunter, 1984; Heaven, 1989), personal assets (e.g. owning a home, owning a car, having checking account, and having a savings account) (Coleman & DeLeire, 2003; Furnham & Gunter, 1984; Heaven, 1989; Heaven & Furnham, 1987; Salamanca, et al., 2016) and receipt of public assistance (e.g. housing assistance, disability services, and Medicaid) (Coleman & DeLeire, 2003; Furnham & Gunter, 1984; Heaven, 1989; Heaven & Furnham, 1987). Scores on the Powerful Others subscale positively correlated with not graduating from high school, working part-time or being unemployed, and receiving public

assistance, while having close parental relationships, and amount of personal assets negatively correlated with ELC's powerful others.

INSERT TABLE 10

Discussion

This study reports on the Abecedarian Project in its 5th decade of follow-up (ages 39 – 45), the most intensive early care and education intervention provided to children from impoverished families with multiple risk factors. The primary focus of the Abecedarian Project, when it began in 1972, was to provide vulnerable children high-quality early care and education for the first five years of life to prevent cognitive impairments to improve school readiness and later school achievement. Results during program implementation and those from follow-up studies during adolescence, young adulthood through age 37 confirm the early care and education intervention was able to prevent cognitive impairments and support later development (Ramey et al., 2012). The theory that children learn best when they are active constructors of their daily experience by receiving response-contingent feedback in order to problem solve to become more resilient to life's difficulties is the theory that guide the five year high-quality early education program. Thus, we hypothesized the cumulative effect of receiving the high-quality early care and education intervention for the first five years of life with decades of opportunities to solve a wide array of problems would result in the early education group reporting higher levels on internal LOC and reduced levels of external LOC as measured by the health and economic LOC scale in midlife.

We did not detect a strong internal versus external difference between the early education group and the control group, however, group differences were detected within the subscales of external LOC in both health and economic LOC scale. Analyses of the Multidimensional Health

Locus of Control (Wallston, et al., 1978) scale reveals the early education group reported a reduced belief of powerful others in their lives than did the control group. The same is true for Furnham's (1986) Economic Locus of Control scale as well as results indicating a trend within the early education group reporting a reduced belief of external factors influencing their economic behaviors in addition to the reduced belief of powerful others. Our findings are consistent with Jacobs-Lawson, Waddle, and Webb's (2011) work that found reduced levels of powerful others and external factors are a result of early life experiences and educational attainment. Perhaps the reduced belief that powerful others exert control over behaviors for individuals in the early education group sets the stage for individuals to actively guard their health and finances as demonstrated in group differences in related to personal assets, education, employment, health, and relationships (Table 3).

We also hypothesized group differences would exist on internal factors related to locus of control, but no significant group differences existed within the internal subscale of health or economic locus of control. Based on previous research, it has been well established that internal and external locus of control are not an inverse of one another (Heaven & Furnham, 1987; Luszczynska & Schwarzer, 2005; Wallston et. al., 1976). Living in poverty has been attributed to having a more external perception of control over a more internal perception (Heaven, 1989; Heaven & Furnham, 1987; Wardle & Steptoe, 2002), conceivably the null outcome of the internal LOC subscale in both the health and economic scales could be attributed to our sample coming from economically disadvantaged families with multiple risk factors. Historically, Americans tend "to attribute poverty to negative individualistic rather than structural or socioeconomics" (Heaven, 1989, p. 316), but for individuals who grew up in poverty their view

of poverty may be related to societal causes (external) rather than individualistic factors (internal) (Heaven, 1989).

Social support in the form of high quality relationships, as experienced by the early education group, is associated with better health and economic behaviors (Dalton, Ghosal, & Mani, 2014). Individuals who experience positive relationships are better off than those who are isolated or involved in stressful relationships as a product of social risks (e.g. poverty, disability, high mortality) (Dalton, Ghosal, & Mani, 2014; Lachman & Agrigoroaei, 2010). While individuals in the early education group lived in the same type of conditions as the control group, the control group lacked the rich early learning environment with warm and responsive caregivers to support their learning, language, and socialization. Therefore, the control group reporting increased levels of powerful others having greater influence over their health and economic behaviors makes sense and is supported by the literature (Heaven, 1989; Heaven & Furnham, 1987; Wardle & Steptoe, 2002). Early experiences of living in immense poverty with multiple risk factors can have effects persisting into adulthood resulting in increased levels of resignation to life's circumstances (Heaven, 1989; Heaven & Furnham, 1987; Wardle & Steptoe, 2002) and feelings of having less control over one's life (Dalton, Ghosal, & Mani, 2014; Poortinga, Dunstan, & Fone, 2008). For example, people who believe powerful others have greater influence on their lives can "succumb to an illness due to lack of health behaviors, but they rely completely on the help of doctors, which is external (powerful others), to deal with the illness" (Luszczynska & Schwarzer, 2005, p. 635), therefore, perpetuating a person's belief that others have control over their health. Perceptions of control involve a belief that a person can influence what happens in their life and to what extent those actions bring about desired outcomes (Lachman & Agrigoroaei, 2010).

These results support the recognized objectives of the Abecedarian approach in developing strong contingency responses and reinforcement. Individuals engage in behaviors due to the expectancy of a reward and the potential value of the reward (Rotter, 1954). For children who received the early care and education treatment in the Abecedarian Project, their “reward” was consistent learning opportunities that provided well-timed and specific feedback by caring and responsive adults in a rich learning environment that focused on language and social interactions on a daily basis. The underlying theory guiding the intervention is that young children learn and remember best when they are active in being able to influence and respond to the environment around them, therefore, providing children motivation to continue to explore and learn increasingly refined skills to be proficient in many areas of their lives (Ramey, et al, 2012). “The development of a belief of behavior-reinforcement contingencies is likely a particularly important influence” (Nowicki & Strickland, 1973, p. 148) that helped shape children in the early education group by developing not just their expectancy of reinforcement, but problem solving behaviors as part of generalized expectancy (Furnham & Steel, 1993; Hattie, Biggs, & Purdle, 1996; Hattie & Timperley, 2007).

References

- Athale, N., Aldridge, A., Malcarne, V. L., Nakaji, M., Samady, W. & Robins Sadler, G. (2010). Validity of the multidimensional health locus of control Scales in American sign language. *Journal of Health Psychology, 15*, 1064-1074.
- Bandura, A. (2000). Cultivate self-efficacy for personal and organizational effectiveness. In Locke, E.A. (Ed.), *The Blackwell Handbook of Principles of Organizational Behavior*. (pp. 120 – 136). Oxford, UK: Blackwell Publishers, Inc.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Campbell, F., Conti, G., Heckman, J., Moon, S., Pinto, R., Pungello, E., & Pan, Y. (2014). Early childhood investments substantially boost adult health. *Science, 343*, 1478-1485.
- Campbell, F.A., & Ramey, C.T. (1994). Effects of early intervention on intellectual and academic achievement: A follow-up study of children from low-income families. *Child Development, 65*, 684-698.
- Campbell, F.A., Pungello, E., Kainz, K., Burchinal, M., Yi, P, Wasik, B.H., Barbarin, O., Sparling, J.J., & Ramey, C.T. (2012). Adult outcomes as a function of an early childhood educational program: An Abecedarian project follow-up. *Developmental Psychology, 48*, 1033-1043.
- Campbell, F. A., Pungello, E. P., Miller-Johnson, S., Burchinal, M., & Ramey, C. T. (2001). The development of cognitive and academic abilities: Growth curves from an early childhood educational experiment. *Developmental Psychology, 37*, 231-242.

- Campbell, F.A., Ramey, C.T., Pungello, E., Sparling, J., & Miller-Johnson, S. (2002). Early childhood education: Young adult outcomes from the Abecedarian Project. *Applied Developmental Science, 6*, 42-57.
- Carver, C.S., & Scheier, M.F. (2000). Autonomy and self-regulation. *Psychological Inquiry, 11*, 284 – 291.
- Casey, T. (1992). *Validity of the multidimensional health locus of control scales in a health promotion program: An investigation of factor structure*. Paper presented at the Annual Meeting of the Southwest Educational Research Association: Houston, TX.
- Cobb-Clark, D. (2015). Locus of control and the labor market. *IZA Journal of Labor Economics, 4*. Retrieved from <https://izajole.springeropen.com/articles/10.1186/s40172-014-0017-x>
- Coleman, M., & DeLeire, T. (2003). An economic model of locus of control and the human capital investment decision. *Journal of Human Resources, 38*, 701-721.
- Dalton, P. S., Ghosal, S., & Mani, A. (2016). Poverty and aspirations failure. *The Economic Journal, 126*. 165-188.
- Declerck, C. H., Boone, C., & De Brabander, B. (2006). On feeling in control: A biological theory for individual differences in control perception. *Brain and Cognition, 62*, 143-176.
- Dweck, C.S. (2008). Can personality be changed?: The role of beliefs in personality and change. *Current Direction in Psychological Science, 17*, 391-394.
- Furnham, A. (1986). Economic locus of control. *Human Relations, 39*, 29-43.
- Furnham, A., & Gunter, B. (1984). Just world beliefs and attitudes towards the poor. *British Journal of Social Psychology, 23*, 265-269.

- Furnham, A. & Steele (1993). Measuring locus of control: A critique of general, children's, health-and work-related locus of control questionnaires. *British Journal of Psychology*, *84*, 443-479.
- Hattie, J., Biggs, J., & Purdie, N. (1996). Effects of learning skills interventions on student learning: A meta-analysis. *Review of Educational Research*, *66*, 136;-136.
- Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, *77*, 81-112.
- Heaven, P. C. L. (1989). Economic locus of control beliefs and lay attributions of poverty. *Australian Journal of Psychology*, *41*, 315-325.
- Heaven, P. C. L., & Furnham, A. (1987). Race prejudice and economic beliefs. *The Journal of Social Psychology*, *127*, 483-489.
- Jacobs-Lawson, J. M., Waddell, E. L., & Webb, A. K. (2011). Predictors of health locus of control in older adults. *Current Psychology*, *30*, 173-183.
- Lachman, M., & Agrigoroaei, S. (2010). Promoting functional health in midlife and old age: Long-term protective effects of control beliefs, social support, and physical exercise. *Plos One*, *5*, Retrieved from <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0013297>
- Luszczynska, A., & Schwarzer, R. (2005). Multidimensional health locus of control: Comments on the construct and its measurement. *Journal of Health Psychology*, *10*, 633-642.
- Masten, A. S. (2001). Ordinary magic: Resilience processes in development. *American Psychologist*, *56*, 227-238.
- Masten, A.S. (2018). Resilience theory and research on children and families: Past, present, and promise. *Journal of Family Theory and Review*, *10*, 12-31.

- McGinness, G., & Ramey, C.T. (1981). Developing sociolinguistic competence in children. *Canadian Journal of Early Childhood Early education, 1*, 22-43.
- Nasser, R., & Abouchedid, K. (2006). Locus of control and the attribution for poverty: Comparing lebanese and south african university students. *Social Behavior and Personality: An International Journal, 34*, 777-796.
- Nowicki, S., & Strickland, B.R. (1973). A locus of control scale for children. *Journal of Consulting and Clinical Psychology, 40*, 148 – 154.
- Poortinga, W., Dunstan, F. D., & Fone, D. L. (2008). Neighborhood deprivation and self-rated health: The role of perceptions of the neighborhood and of housing problems. *Health and Place, 14*, 562-575.
- Ramey, C.T., & Campbell, F.A. (1976). Parental attitudes and poverty. *Journal of Genetic Psychology, 128*, 3-6.
- Ramey, C.T., & Campbell, F.A. (1984). Preventive early education for high-risk children: Cognitive consequences of the Carolina Abecedarian Project. *American Journal of Mental Deficiency, 88*, 515-523.
- Ramey, C.T., & Campbell, F.A. (1992). Poverty, early childhood education, and academic competence: The Abecedarian experiment. In A. Huston (Ed.), *Children in poverty* (pp. 190-221). NY: Cambridge University Press.
- Ramey, C.T., Collier, A.M., Sparling, J.J., Loda, R.A., Campbell, F.A., Ingram, D.L., & Finkelstein, N.W. (1976). The Carolina Abecedarian Project: A longitudinal and multidisciplinary approach to the prevention of developmental retardation. In T. Tjossem (Ed.), *Intervention strategies for high-risk infants and young children* (pp. 629-665). Baltimore: University Park Press.

- Ramey, C.T., & Ramey, S.L. (1998). Prevention of intellectual disabilities: Early interventions to improve cognitive development. *Preventive Medicine, 27*, 224-232.
- Ramey, C.T., & Smith, B.J. (1977). Assessing the intellectual consequences of early intervention with high-risk infants. *American Journal of Mental Deficiency, 8*, 318-324.
- Ramey, C. T., Sparling, J., & Ramey, S. L. (2012). *Abecedarian: The ideas, the approach, and the findings*. Los Altos, CA: Sociometrics Corp.
- Rodriguez-Rosero, J. E., Ferriani, M. G. & Dela Coleta, M. F. (2002). Multidimensional Health Locus of Control Scale- MHLC: Validation study. *Revista Latino-Americana de Enfermagem, 10*, 179-184.
- Rotter, J.B. (1954). *Social learning and clinical psychology*. Englewood Cliffs, NJ: Prentice-Hall.
- Rotter, J.B (1966). Generalized Expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied. 80*. 1-28.
- Rotter, J.B. (1971). *Clinical psychology* (2d ed.). Englewood Cliffs, NJ: Prentice-Hall.
- Sakalaki, M., Richardson, C., & Bastounis, M. (2005). Association of economic internality with saving behavior and motives, financial confidence, and attitudes toward state Intervention1. *Journal of Applied Social Psychology, 35*, 430-443.
- Salamanca, N., de Grip, A., Fouarge, D., & Montizaan, R. (2016). Locus of control and investment in risky assets. *IZA Journal of Labor Economics*. Retrieved from <http://ftp.iza.org/dp10407.pdf>
- Sherman, L. W. (1984). Development of children's perceptions of internal locus of control: A cross-sectional and longitudinal analysis. *Journal of Personality, 52*, 338-354.

- Seeman, J. (1959). Toward a concept of personality integration. *American Psychologist, 14*, 6333-637.
- Sparling, J. J., & Lewis, I. (1984). *Learning games for threes and fours: A guide to adult and child play*. New York, NY: Walker
- Ubbiali, A., Donati, D., Chiorri, C., Bregani, V., Cattaneo, E., Maffei, C. & Visintini, R. (2008). The usefulness of the multidimensional health locus of control form c (MHLC-C) for HIV + subjects: An italian study. *AIDS Care, 20*, 495-502.
- U.S. Department of Commerce. (1971). *Current populations reports* (Series P – 60, No. 78). Retrieved from <https://www2.census.gov/prod2/popscan/p60-078.pdf>
- Van Dalen, H. Van Niekerk, E. & Pottas (1987). The validation of Furnham's locus of control scale for a black southern african group. *Journal of Industrial Psychology, 15*, 12-21.
- Yeager, D. S., & Dweck, C. S. (2012). Mindsets that promote resilience: When students believe that personal characteristics can be developed. *Educational Psychologist, 47*, 302-314.
- Walden, T. A., & Ramey, C. T. (1983). Locus of control and academic achievement: Results from a preschool intervention program. *Journal of Educational Psychology 75*, 347.
- Wallston, B. S., Wallston, K. A., Kaplan, G. D., & Maides, S. A. (1976). Development and validation of the Health Locus of Control (HLC) scale. *Journal of Consulting Clinical Psychology, 44*, 580-585.
- Wallston, K. A., Wallston, B. S., & DeVellis, R. (1978). Development of the multidimensional health locus of control (MHLC) scales. *Health Education Monographs, 6*, 160-170.
- Wardle, J., & Steptoe, A. (2003). Socioeconomic differences in attitudes and beliefs about healthy lifestyles. *Journal of Epidemiology and Community Health, 57*, 440-443.

Tables and Figures

Table 6. *Eligibility High Risk Index for mothers in original Abecedarian study*

Factor	Weight
Mother's education level ^a	
6	8
7	7
8	6
9	3
10	2
11	1
12	0
Father's education level ^a	
6	8
7	7
8	6
9	3
10	2
11	1
12	0
Family income (per year)	
1,000	8
1,001 – 2,000	7
2,001 – 3,000	6
3,001 – 4,000	5
4,001 – 5,000	4
5,001 – 6,000	0
Father absent for reasons other than health or death	3
Absence of maternal relatives in local area (i.e. parents, grandparents, or brothers or sisters of majority age)	3
Siblings of school age who are one or more grades behind age-appropriate grade or who score equivalently low on school-administered achievement test	3
Payments received from welfare agencies within past 3 years	3
Record of father's work indicated unstable and unskilled or semi-skilled labor	3
Records of mother's or father's IQ indicate score of 90 or below	3
Records of sibling's IQ indicate score of 90 or below	3
Relevant social agencies in the community indicate that the family is in need of assistance	3
One or more members of the family has sought counseling or professional help in the past 3 years	1
Special circumstances not included in any of the above that are likely contributors to cultural or social disadvantage	1

(Ramey & Campbell, 1984, p. 517)

Note: Criterion for inclusion in high-risk same is a score of 11.

^aLast grade completed.

Table 7. *Demographics of original and 5th decade study samples*

Variable	Early education Group @ Entry (n = 57)	Control Group @ Entry (n = 54)	Early education Group @ Midlife (n = 42)	Control Group @ Midlife (n = 36)
Mean High-risk Index	19.9 pts	21.5 pts	19.5 pts	22.0 pts
Mean Maternal IQ	85.4 pts	84.5 pts	85.5 pts	84.1 pts
Mean Maternal Age at Birth of Study Participant	19.6 yrs	20.3 yrs	18.8 yrs	20.2 yrs
Mean Maternal Early education	10.5 yrs	10.2 yrs	10.5 yrs	10 yrs
% Below Poverty	100%	100%	100%	100%
% African American	94%	100%	98%	100%

Table 8. *Midlife outcomes for early education and control groups*

Item	Early Education (n = 42) (provided 5 yrs. of early education plus social and health services)	Control (n = 36) (provided social and health services)	X^2	F
Multidimensional Health Locus of Control Scales				
Internal LOC	26.38	27.03		0.23
Powerful others LOC	16.86	19.64		3.69*
Chance LOC	15.25	16.89		1.19
Economic Locus of Control Scales				
Internal LOC	34.55	33.78		0.42
Powerful others LOC	10.44	12.92		5.15*
Chance LOC	15.18	17.29		2.43
External LOC	10.05	11.90		3.36~
Receives Public Assistance	.50	.75		1.19
Finance-related Personal Assets (total possible = 4)	3.21	2.61		7.70**
Education				
% Did not complete high school	2.4	25.0	8.87**	
Employment				
% Unemployed or working part-time	19.0	36.1	2.87~	
Health				
% Reports poor overall health	9.5	19.4	1.58	
% No health insurance	16.7	30.6	2.11	
% Received Medicaid	14.3	22.2	0.83	
% Receives disability/SSI	2.4	11.1	2.46	
Mean Chronic health conditions	0.7	1.1		2.27
Parental Relationships				
% Rates parental/parental figure relationships as "very close"	85.7	58.3	7.39**	

Note. ~ $p \leq 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$

Table 9. *Multidimensional Health Locus of Control Scales: Bivariate correlation matrix*

Variables	1	2	3	4	5	6	7	8	9	10
1. MHLC Powerful Others	-									
2. Group Assignment	-.223*	-								
3. Sex	.131	.107	-							
4. Did not graduate from high school	.324**	-.337**	.020	-						
5. Unemployed or working part-time	.246*	-.192*	.002	.372**	-					
6. Reports poor overall health	.334**	-.142	-.237*	.175	.252*	-				
7. No health insurance	.017	-.164	.089	.245*	.285**	-.047	-			
8. Receives Medicaid	.258*	-.103	.024	.220*	.469**	.194*	-.256*	-		
9. Receiving disability	.406**	-.178	-.249*	.369**	.313**	.345**	-.143	.560**	-	
10. Has chronic health conditions	.296**	-.170	-.055	.275**	.323**	.444**	-.034	.222*	.230*	-

*Correlation is significant at the 0.05 level (1-tailed) **Correlation is significant at the 0.01 level (1-tailed)

Table 10. *Economic Locus of Control Scales: Bivariate correlation matrix*

	1	2	3	4	5	6	7	8
1. ELOC Powerful Others	-							
2. Group assignment	-.252*	-						
3. Sex	.028	.107	-					
4. Did not graduate from high school	.310**	-.337**	.020	-				
5. Unemployed or working part-time	.379**	-.192*	.002	.372**	-			
6. Very close parental relationships	-.352**	.308**	-.002	-.286**	-.283**	-		
7. Personal assets	-.330**	.303**	-.094	-.285**	-.369**	.223*	-	
8. Receives public assistance	.227*	-.124	-.173	.262*	.463**	-.175	-.128	-

*Correlation is significant at the 0.05 level (1-tailed) **Correlation is significant at the 0.01 level (1-tailed)

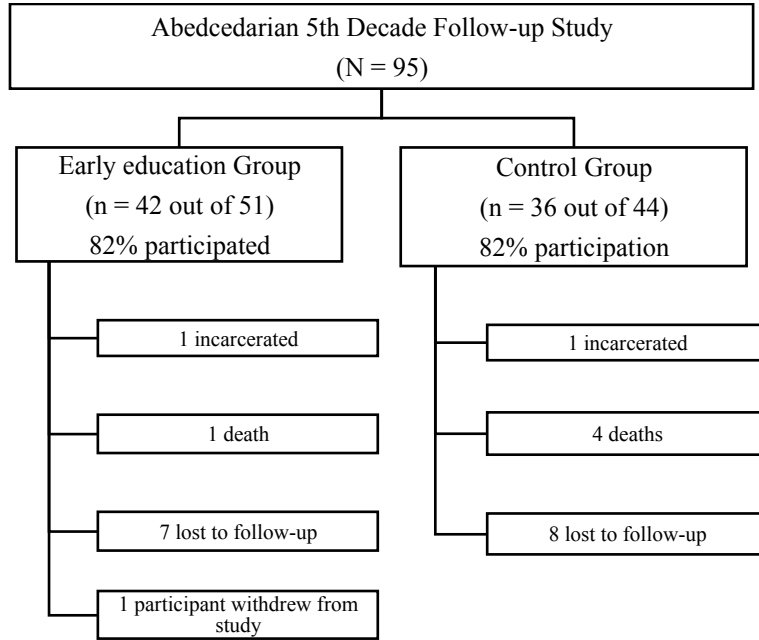


Figure 4. *Abecedarian 5th Decade Study participant retention*

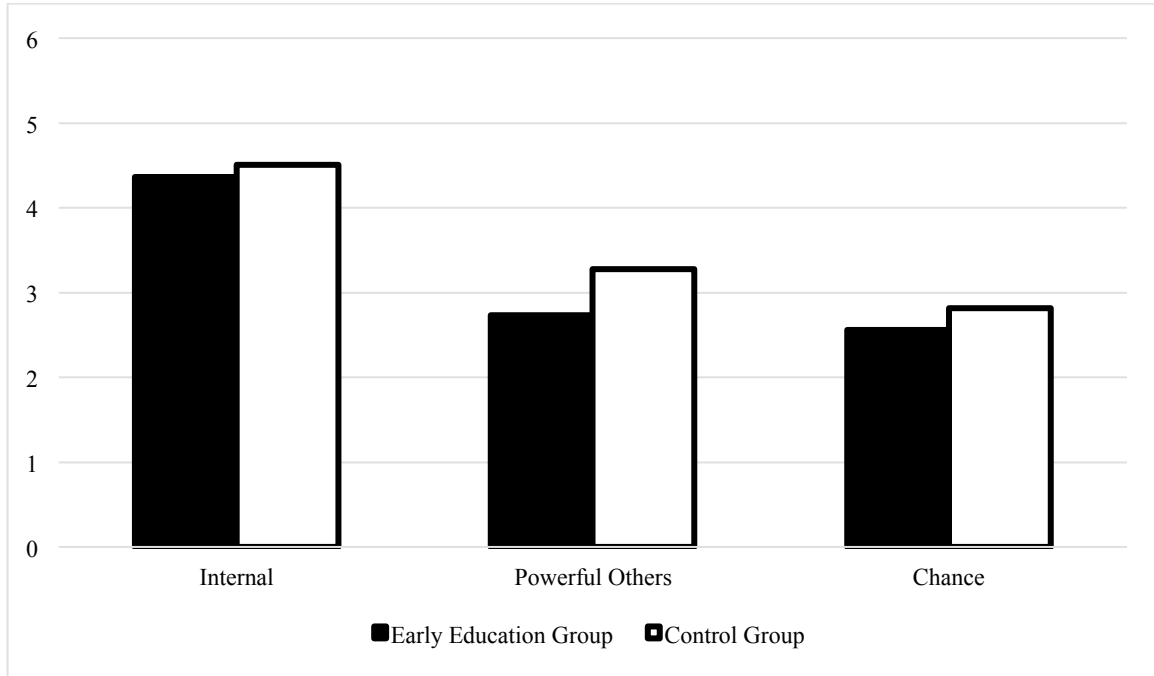


Figure 5. *Multidimensional Health Locus of Control means by scales and treatment group.*

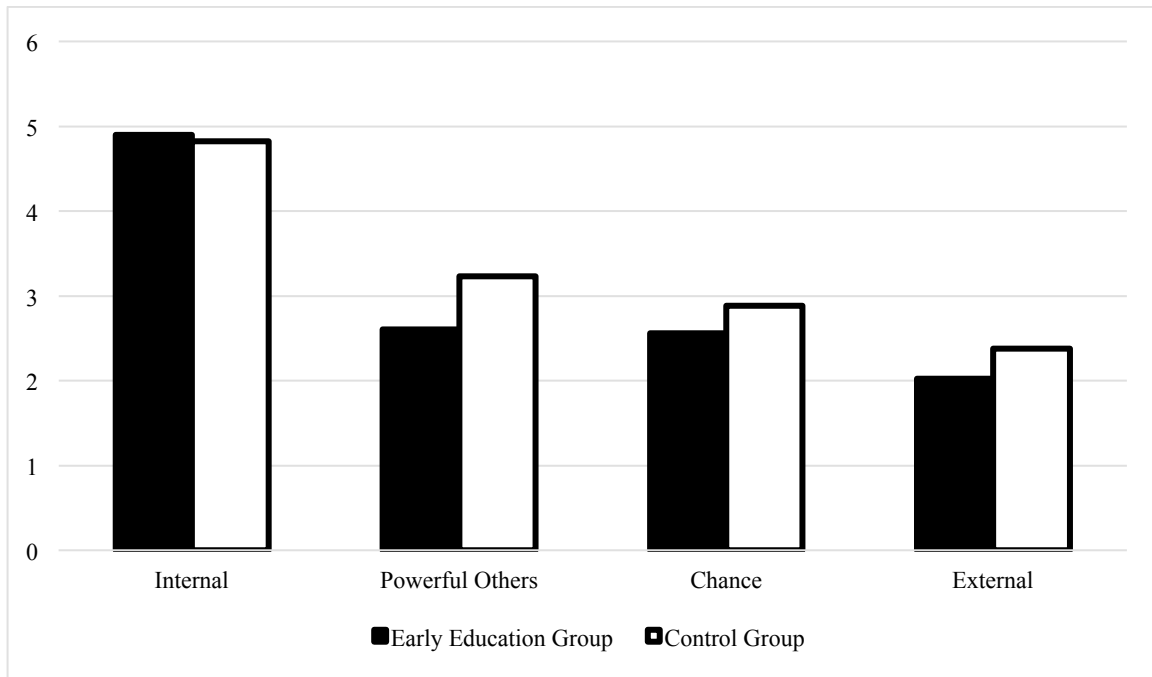


Figure 6. *Economic Locus of Control means by scales and treatment group.*

CHAPTER 4: CONCLUSION

The Abecedarian Project differs from other early childhood intervention research studies in two unique and important ways. The first is that the Abecedarian Project provided high-quality early care and education beginning in infancy for the first five years of life to children in the early education group. The second is the supplemental services were provided to those in both the early education and control groups: the rationale was that poor nutrition, inadequate healthcare, lack of needed family supports were known to be harmful to young children. Accordingly, providing both groups with these basic supports allows for testing whether the early care and education intervention was a causal factor in changing child outcomes.

The new findings from the Abecedarian 5th Decade Follow-up affirm and extend the many previous published findings that consistently demonstrate that the early education group has significantly more favorable and fewer negative outcomes at all tested ages from 18 months to 35 – 37 years of age. What is novel about these findings in midlife is they include indicators not previously reported, particularly concerning financial assets, civic engagement, personal relationships with both parents, and LOC in the domains of health and personal finances. The multiple positive outcomes in midlife that significantly relate to the early education intervention represent what we now think of as a culmination of doing well at each successive stage of life. This is in contrast to a simple model in which the early education intervention causes better outcomes decades later. Specifically, for participants in the Abecedarian Project's early education group, their successive achievements at each life stage began even prior to entering school. As preschoolers, they demonstrated better cognition, language, and social interaction skills. When they entered the school age period, they demonstrated a consistent pattern of higher reading and math achievement, being promoted to the next grade on time, and not requiring

special education services. The culmination of the school age period is the universally accepted goal of earning a high school degree, which 98 percent of the early education group attained versus 25 percent of controls. The transition into the adulthood age period is distinguished by continuing education and entry into the competitive workforce while avoiding major risks to later adult achievement such as becoming a teen parent, abusing substances, and being incarcerated. Success during the K-12 years affords advantages to individuals from all walks of life and showed a strong relationship for the Abecedarian Project participants in their early adult outcomes. The early education group earned a four-year college degree at nearly four times the rate of the control group. They obtained higher rates of employment and earned more money, waiting until becoming older to become parents, and showed multiple signs of more positive health outcomes in their 30s compared to the control group. These findings support our model of a culmination of successes at multiple stages of life.

Midlife represents a new stage of life that broadly represents a period of fulfillment of life goals and responsibilities centered on the intertwined areas of family, work, and health. Midlife also provides a time to prepare for the future and maintain intergenerational relationships. Thus, the early educational group showing indicators of successful aging at significantly higher levels than the control group indicates that these individuals face the challenges and rewards of midlife. Their self-report of LOC showed that they neither blamed nor credited “powerful others” for their accomplishments for health and financial well-being. The positive outcomes in midlife show continued success at yet another period of life.

What about the early education intervention likely could account for doing well at so many different stages of life? One is that being more intelligent as indexed by IQ scores sets the stage for higher levels of learning. The IQ group difference at age 4 was 14 points: the early

education group had a $M = 101.70$ ($SD = 10.28$) – that is they performed at the national average – versus the control group with a $M = 87.79$ ($SD = 13.64$). The control group was similar to their own mothers in terms of IQ while the education group performed at a significantly higher level. The findings from this follow-up affirm that early IQ is predictive of more positive aging and fewer risks in midlife for those in both groups. For those who received the early education, the effect of IQ was lesser than for those in the control group. We interpret this to support the conclusion that a high-quality early education gives children many skills for success in school even beyond extra IQ points.

Individuals in both groups were born into extreme economic poverty in a community that was well-resourced and predominately White. While race was not an inclusion criteria, 98 percent of the individuals are African American which in the United States is associated with a multitude of adverse life experiences most notably racism and its correlated association with inequality in education, employment, and healthcare. Although the Abecedarian Project did not directly change these long standing oppressive societal factors, the early education program offered children the exceptional opportunity to become active learners who learned to be responsible for controlling and shaping many of their daily learning experiences. Their daily achievements were celebrated by responsive and caring adults. By virtue of having multiple opportunities to choose their own activities on a daily basis, being provided consistently varied and interesting learning opportunities with well-time specific feedback, children in the early education group acquired the tools to be co-creators in their own social and learning experiences. We think these rich early learning experiences contribute substantially to the positive chain of cumulative experiences at successive age periods.

The theory that children learn best when they are active constructors of their daily experiences by receiving response-contingent feedback can also facilitate becoming resilient to life's difficulties. These findings from the Abecedarian 5th Decade Follow-up partially support the longstanding debate that early learning experiences can influence Locus of Control. While we detected higher internal locus of control in the early education group, this was not statistically significant. The group differences that were significant concerned "powerful others" within the subscales of external LOC in both the health and economic LOC scales. Our findings are consistent with Jacobs-Lawson, Waddle, and Webb's (2011) work that found reduced levels of powerful others and external factors are a result of early life experiences and educational attainment. Perhaps the belief that "powerful others" exert less control over behaviors for individuals in the early education group sets the stage for individuals to actively guard their health and finances in midlife; in fact, these individuals realized more personal assets (auto, home, and checking and savings accounts), full-time employment, better health, and closer relationships with their parents and parent figures.

The Abecedarian 5th Decade Follow-up results support the idea that a positive chain of cumulative life experiences starting in infancy can allow a person to develop a greater sense of self-efficacy and a reduced belief of "powerful others" controlling a person's life leading to successful aging. Providing high-quality early care and education to vulnerable children with the recognized objectives of developing infants and children as active learners and contributors has practical implications in midlife, just as it did in earlier life stages. This counters the skepticism that early education produces only short term and small magnitude benefits or that the circumstances of one's birth determine one's future success.

References

- Athale, N., Aldridge, A., Malcarne, V. L., Nakaji, M., Samady, W. & Robins Sadler, G. (2010). Validity of the multidimensional health locus of control Scales in American sign language. *Journal of Health Psychology, 15*, 1064-1074.
- Bandura, A. (2000). Cultivate self-efficacy for personal and organizational effectiveness. In Locke, E.A. (Ed.), *The blackwell handbook of principles of organizational behavior* (pp. 120 – 136). Oxford, UK: Blackwell Publishers, Inc.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Bayley, N., & Schaefer, E. S. (1964). Correlations of maternal and child behaviors with the development of mental abilities: Data from the Berkeley Growth Study. *Monographs of the Society for Research in Child Development, 97*, 1-80.
- Bronfenbrenner, U., & Morris, P.A. (1998). The ecology of developmental processes. In W. Damon, & R. M. Lerner (Vol. Ed.), *Handbook of child psychology: Vol. 1. Theoretical models of human development* (5th ed.993 – 1028). New York, NY: Wiley.
- Burchinal, M.R., Bryant, D.M., Lee, M.W., & Ramey, C.T. (1992). Early day care, infant-mother attachment, and maternal responsiveness in the infant's first year. *Early Childhood Research Quarterly, 7*, 383-396.
- Burchinal, M., Lee, M., & Ramey, C.T. (1989). Type of day-care and preschool intellectual development in disadvantaged children. *Child Development, 60*, 128-137.
- Campbell, F., Conti, G., Heckman, J., Moon, S., Pinto, R., Pungello, E., & Pan, Y. (2014). Early childhood investments substantially boost adult health. *Science, 343*, 1478-1485.

- Campbell, F.A., Pungello, E., Kainz, K., Burchinal, M., Yi, P., Wasik, B.H., Barbarin, O., Sparling, J.J., & Ramey, C.T. (2012). Adult outcomes as a function of an early childhood early educational program: An Abecedarian project follow-up. *Developmental Psychology, 48*, 1033-1043.
- Campbell, F.A., Pungello, E.P., Miller-Johnson, S., Burchinal, M., & Ramey, C.T. (2001). The development of cognitive and academic abilities: Growth curves from an early childhood early educational experiment. *Developmental Psychology, 37*, 231-242.
- Campbell, F.A., Ramey, C.T., Pungello, E., Sparling, J., & Miller-Johnson, S. (2002). Early childhood early education: Young adult outcomes from the Abecedarian Project. *Applied Developmental Science, 6*, 42-57.
- Campbell, F.A., & Ramey, C.T. (1994). Effects of early intervention on intellectual and academic achievement: A follow-up study of children from low-income families. *Child Development, 65*, 684-698.
- Carver, C.S., & Scheier, M.F. (2000). Autonomy and self-regulation. *Psychological Inquiry, 11*, 284 – 291.
- Casey, T. (1992). Validity of the multidimensional health locus of control scales in a health promotion program: An investigation of factor structure. Paper presented at the Annual Meeting of the Southwest Educational Research Association: Houston, TX.
- Cobb-Clark, D. (2015). Locus of control and the labor market. *IZA Journal of Labor Economics, 4*. Retrieved from <https://izajole.springeropen.com/articles/10.1186/s40172-014-0017-x>
- Coleman, M., & DeLeire, T. (2003). An economic model of locus of control and the human capital investment decision. *Journal of Human Resources, 38*, 701; 721;-721.

- Dalton, P. S., Ghosal, S., & Mani, A. (2016). Poverty and aspirations failure. *The Economic Journal*, *126*, 165-188. 10.1111/eoj.12210
- Declerck, C. H., Boone, C., & De Brabander, B. (2006). On feeling in control: A biological theory for individual differences in control perception. *Brain and Cognition*, *62*, 143-176. 10.1016/j.bandc.2006.04.004
- Dweck, C.S. (2008). Can personality be changed?: The role of beliefs in personality and change. *Current Direction in Psychological Science*, *17*, 391-394.
- Eichorn, D. H. (1973). The Berkeley longitudinal studies: Continuities and correlates of behavior. *Canadian Journal of Behavioural Science*, *5*, 297.
- Evans, G. W., Li, D., & Whipple, S. S. (2013). Cumulative risk and child development. *Psychological Bulletin*, *139*, 1342.
- Farran, D.C., & Ramey, C.T. (1977). Infant day care and attachment behaviors towards mothers and teachers. *Child Development*, *51*, 1112-1116.
- Farran, D.C., & Ramey, C.T. (1980). Social class differences in dyadic involvement during infancy. *Child Development*, *51*, 254-257.
- Furnham, A. (1986). Economic locus of control. *Human Relations*, *39*, 29-43.
doi:10.1177/001872678603900102
- Furnham, A., & Gunter, B. (1984). Just world beliefs and attitudes towards the poor. *British Journal of Social Psychology*, *23*, 265-269.
- Furnham, A. & Steele (1993). Measuring locus of control: A critique of general, children's, health-and work-related locus of control questionnaires. *British Journal of Psychology*, *84*, 443-479.

- Hareven, T. K. (1994). Aging and generational relations: A historical and life course perspective. *Annual Review of Sociology*, 20, 437-461.
- Hattie, J., Biggs, J., & Purdie, N. (1996). Effects of learning skills interventions on student learning: A meta-analysis. *Review of Educational Research*, 66, 136;-136.
- Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, 77, 81-112.
- Heaven, P. C. L. (1989). Economic locus of control beliefs and lay attributions of poverty. *Australian Journal of Psychology*, 41, 315-325.
- Heaven, P. C. L., & Furnham, A. (1987). Race prejudice and economic beliefs. *The Journal of Social Psychology*, 127, 483-489.
- Herzog, A.R., & Morgan, J.N. (1992). Age and gender differences in the value of productive activities; Four different approaches. *Research on Aging*, 14, 169-198.
- Jacobs-Lawson, J. M., Waddell, E. L., & Webb, A. K. (2011). Predictors of health locus of control in older adults. *Current Psychology*, 30, 173-183.
- Jones, H. E., & Bayley, N. (1941). The Berkeley growth study. *Child Development*, 12, 167-173.
- Kern, M. L., & Friedman, H. S. (2009). Early educational milestones as predictors of lifelong academic achievement, midlife adjustment, and longevity. *Journal of Applied Developmental Psychology*, 30, 419-430.
- Lachman, M., & Agrigoroaei, S. (2010). Promoting functional health in midlife and old age: Long-term protective effects of control beliefs, social support, and physical exercise. *Plos One*, 5, Retrieved from <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0013297>

- Luszczynska, A., & Schwarzer, R. (2005). Multidimensional health locus of control: Comments on the construct and its measurement. *Journal of Health Psychology, 10*, 633-642.
- Masten, A.S. (2018). Resilience theory and research on children and families: Past, present, and promise. *Journal of Family Theory and Review, 1*-20.
- Masten, A. S. (2001). Ordinary magic: Resilience processes in development. *American Psychologist, 56*, 227-238.
- McGinness, G., & Ramey, C.T. (1981). Developing sociolinguistic competence in children. *Canadian Journal of Early Childhood Early education, 1*, 22-43.
- Moen, P. (2016). *Encore adulthood: Boomers on the edge of risk, renewal, and purpose*. New York, NY: Oxford University Press.
- Nasser, R., & Abouchedid, K. (2006). Locus of control and the attribution for poverty: Comparing lebanese and south african university students. *Social Behavior and Personality: An International Journal, 34*, 777-796.
- Nowicki, S., & Strickland, B.R. (1973). A locus of control scale for children. *Journal of Consulting and Clinical Psychology, 40*, 148 – 154.
- Poortinga, W., Dunstan, F. D., & Fone, D. L. (2008). Neighborhood deprivation and self-rated health: The role of perceptions of the neighborhood and of housing problems. *Health and Place, 14*, 562-575.
- Ramey, C.T. (2017). *Supporting adaptive brain and behavior: The Abecedarian approach to social, education, and health disparities*. Paper presented at the Symposium on Adaptive Brain and Behavior, Virginia Tech, Blacksburg, VA. Retrieved from https://static.vtc.vt.edu/media/documents/Supporting_Adaptive_Brain_and_Behavior_Nov_30_talk_final.pdf

- Ramey, C.T., & Campbell, F.A. (1976). Parental attitudes and poverty. *Journal of Genetic Psychology, 128*, 3-6.
- Ramey, C.T., & Campbell, F.A. (1984). Preventive early education for high-risk children: Cognitive consequences of the Carolina Abecedarian Project. *American Journal of Mental Deficiency, 88*, 515-523.
- Ramey, C.T., & Campbell, F.A. (1992). Poverty, early childhood early education, and academic competence: The Abecedarian experiment. In A. Huston (Ed.), *Children in poverty* (pp. 190-221). New York, NY: Cambridge University Press.
- Ramey, C.T., Campbell, F.A., Burchinal, M., Skinner, M.L., Gardner, D.M., & Ramey, S.L. (2000). Persistent effects of early childhood education on high-risk children and their mothers. *Applied Developmental Science, 4*, 2-14.
- Ramey, C.T., Campbell, F.A., & Ramey, S.L. (1999). Early intervention: Successful pathways to improving intellectual development. *Developmental Neuropsychology, 16*, 385-392.
- Ramey, C.T., Collier, A.M., Sparling, J.J., Loda, R.A., Campbell, F.A., Ingram, D.L., & Finkelstein, N.W. (1976). The Carolina Abecedarian Project: A longitudinal and multidisciplinary approach to the prevention of developmental retardation. In T. Tjossem (Ed.), *Intervention strategies for high-risk infants and young children* (pp. 629-665). Baltimore: University Park Press.
- Ramey, C.T., Farran, D.C., & Campbell, F.A. (1979). Predicting IQ from mother-infant interactions. *Child Development, 50*, 804-814.
- Ramey, C.T., & Farran, D.C. (1981). The functional concern of mothers for their infants. *Infant Mental Health Journal, 2*, 48-55.

- Ramey, C.T., & Ramey, S.L. (1998). Prevention of intellectual disabilities: Early interventions to improve cognitive development. *Preventive Medicine, 27*, 224-232.
- Ramey, C.T., & Smith, B.J. (1977). Assessing the intellectual consequences of early intervention with high-risk infants. *American Journal of Mental Deficiency, 8*, 318-324.
- Ramey, C. T., Sparling, J., & Ramey, S. L. (2012). *Abecedarian: The Ideas, the approach, and the findings*. Los Altos, CA: Sociometrics Corp.
- Ramey, C.T., Yeates, K.O., & Short, E.J. (1984). The plasticity of intellectual development: Insights from preventive intervention. *Child Development, 55*, 1913-1925.
- Reynolds, A. J. (2000). *Success in early intervention: The Chicago child parent centers*. Lincoln, NE: University of Nebraska Press.
- Reynolds, A. J., Ou, S. R., & Temple, J. A. (2018). A Multicomponent, Preschool to Third Grade Preventive Intervention and Educational Attainment at 35 Years of Age. *JAMA Pediatrics, 172*, 247 – 256.
- Rodriguez-Rosero, J. E., Ferriani, M. G. & Dela Coleta, M. F. (2002). Multidimensional Health Locus of Control Scale- MHLC: Validation study. *Revista Latino-Americana de Enfermagem, 10*, 179-184.
- Rotter, J.B. (1954). *Social learning and clinical psychology*. Englewood Cliffs, NJ: Prentice-Hall.
- Rotter, J.B (1966). Generalized Expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied. 80*. 1-28.
- Rotter, J.B. (1971). *Clinical psychology* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall
- Rowe, J.W., & Kahn, R.L. (1987). Human aging; Usual and successful. *Science, 237*, 143-149.
- Rowe, J.W., & Kahn, R.L. (1997). Successful aging. *The Gerontologist, 37*, 433-440.

- Rowe, J., & Kahn, R. (2015). Successful aging 2.0: Conceptual expansions for the 21st century. *Journals of Gerontology Series b-Psychological Sciences and Social Sciences, 70*, 593-596.
- Sakalaki, M., Richardson, C., & Bastounis, M. (2005). Association of economic internality with saving behavior and motives, financial confidence, and attitudes toward state Intervention1. *Journal of Applied Social Psychology, 35*, 430-443.
- Salamanca, N., de Grip, A., Fouarge, D., & Montizaan, R. (2016). Locus of control and investment in risky assets. *IZA Journal of Labor Economics*. Retrieved from <http://ftp.iza.org/dp10407.pdf>
- Sameroff, A.J. (2009). *The transactional model of development: How children and contexts shape each other* (1st ed.). Washington, DC: American Psychological Association.
- Sameroff, A. J., Seifer, R., Barocas, R., Zax, M., & Greenspan, S. (1987). Intelligence quotient scores of 4-year-old children: Social-environmental risk factors. *Pediatrics, 79*, 343-350.
- Schweinhart, L. J. (2005). *Lifetime effects: the High/Scope Perry Preschool study through age 40*. High/Scope Foundation.
- Sherman, L. W. (1984). Development of children's perceptions of internal locus of control: A cross-sectional and longitudinal analysis. *Journal of Personality, 52*, 338-354.
- Seeman, J. (1959). Toward a concept of personality integration. *American Psychologist, 14*, 633-637.
- Sparling, J. J., & Lewis, I. (1984). *Learning games for threes and fours: A guide to adult and child play*. New York, NY: Walker.

- Terman, L. (1925). *Mental and physical traits of a thousand gifted children, genetic studies of genius*. Stanford, CA: Stanford University Press.
- Terman, L. M., & Merrill, M. A. (1972). *Manual for the Stanford-Binet Intelligence Scale*. Boston, MA: Houghton Mifflin.
- The Annie E. Casey Foundation. (2017). *2017 kids count data book: state trends in child well-being*. Retrieved from <http://www.aecf.org/m/resourcedoc/aecf-2017kidscountdatabook.pdf>
- Ubbiali, A., Donati, D., Chiorri, C., Bregani, V., Cattaneo, E., Maffei, C. & Visintini, R. (2008). The usefulness of the multidimensional health locus of control form c (MHLC-C) for HIV + subjects: An italian study. *AIDS Care*, 20, 495-502.
- U.S. Department of Commerce. (1971). *Current populations reports* (Series P – 60, No. 78). Retrieved from <https://www2.census.gov/prod2/popscan/p60-078.pdf>
- Van Dalen, H. Van Niekerk, E. & Pottas (1987). The validation of Furnham's locus of control scale for a black southern african group. *Journal of Industrial Psychology*, 15, 12-21.
- Yeager, D. S., & Dweck, C. S. (2012). Mindsets that promote resilience: When students believe that personal characteristics can be developed. *Educational psychologist* 47, 302-314.
- Walden, T., & Ramey, C.T. (1983). Locus of control and academic achievement: Results from a preschool intervention program. *Journal of Educational Psychology*, 75, 347-358.
- Wallston, B. S., Wallston, K. A., Kaplan, G. D., & Maides, S. A. (1976). Development and validation of the Health Locus of Control (HLC) scale. *Journal of consulting clinical psychology*, 44: 580-585.

- Wallston, K. A., Wallston, B. S., & DeVellis, R. (1978). Development of the multidimensional health locus of control (MHLC) scales. *Health Education Monographs*, 6(2): 160-170.
doi:10.1177/109019817800600107
- Wardle, J., & Steptoe, A. (2003). Socioeconomic differences in attitudes and beliefs about healthy lifestyles. *Journal of Epidemiology and Community Health*, 57, 440-443.
- Weikart, D. P., Bond, J. T., & McNeil, J. T. (1978). *The Ypsilanti Perry Preschool Project: Preschool years and longitudinal results through fourth grade*. High/Scope Foundation.

Appendix A

PART 1. NARRATIVE SECTION

Your thoughts and feelings about being in this study since you were born.

We are interested in hearing your thoughts and feelings about being in this study for all of your life. We are interested in knowing anything you would like to share. If you tell us something that we would like to hear more about, we may ask you “Please tell me a bit more about that.” For this first part of our session, we will be video recording you. This is because we want to be sure not to miss anything. (If interviewee asks about “how much” we want to hear; we will respond by saying “Usually people like to talk about this for 5 to 15 minutes. But if you would like longer that is okay.”)

(Cameras turned on)

1. To begin, tell us about yourself for a few minutes. (Self-introduction for about 1 to 3 minutes.)
2. What do you remember about being in this study project? How have you felt about this? (about 3-5 minutes)
3. Are there some things about yourself or your current life you would like to share with us?

PART 2. CURRENT LIFE SITUATION SECTION

A. Education Questions

1. Are you currently in school or any adult vocational program?
 - a. No (*Go to B*)
 - b. Yes

2. What type of school or training are you in?
 - a. In a GED program to get a HS diploma
 - b. At a vocational/technical school
What is your area of study? _____
 - c. Community college
 - d. Four-year undergraduate college or university
 - e. In graduate school
 - f. Other (Please specify) _____

3. What is your highest level of education?
 - a. Some college
How long did you attend? ____ (semesters)
 - b. Associates degree
 - c. Certificate
 - d. Master's degree
 - e. Doctoral degree

4. If you completed a degree or certificate program, what year did you complete it in?
Year _____

5. What was your major or certificate in?

6. Did you have difficulty learning in schools?
 - a. Yes
 - b. No

7. If yes, did you receive special education supports and services?
 - a. Yes
 - b. No

8. If yes, what types of special education supports and services did you receive?

9. What grade did you begin receiving special education services?
_____grade

10. What grade did you end receiving special education services? _____grade

B. Household Composition and Residence History

1. Please tell me about your present living circumstances. Where are you living now?
Please give me your exact full address.

_____ (Street address)

_____ (City) _____ (State) _____ (Zip)

_____ (Email address)

_____ (Best phone numbers to contact me)

2. Who lives in this home?
 - a. I live alone (*Go to #4*)
How long have you lived alone? _____ (years) _____ (months)
 - b. I live with others
How many people are in the home? Count those who usually live there even if they are away temporarily. Enter number _____
 - c. Other living circumstances. Describe:

3. Who are the other people? **SHOW CARD LISTING ROLES OF OTHERS**

- Married spouse
- Partner
- # My children _____
- # Other children _____
- # My parents (mother, father; step-mother, step-father) _____
- # My partner/spouse's (mother, father; step-mother, step-father) _____
- # of other relatives _____
- # of friends _____
- Other people. Describe _____

4. Do you rent or own this home?

- a. Rent
- b. Own
- c. Other. Describe: _____

5. Are you satisfied with your current living and housing arrangements?

- _____ Yes, very satisfied
 _____ Yes, satisfied
 _____ No, not satisfied, why? (record response)

C. Relationship/Involvement with a Significant Other

The next set of questions concern your own family – your spouse or partner and children. There are many families who differ in their living situations and relationships to each other.

1. Are you currently....
 - a. Married
 - b. Not married but in a meaningful relationship, or
 - c. Not married and not currently in a meaningful relationship
 - d. Other. Describe: _____

2. If in a meaningful relationship (see above), for how long?
 - a. Less than 1 year
 - b. # of years _____