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Exploring the Impact of Early Head Start Program Participation and Family Structure Stability on Child School Readiness

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Abstract

The EHS program is an early intervention that focuses on impoverished families with children up to three years old aimed at mitigating developmental gaps through family support services. In this study, I set out to assess the impact of Early Head Start (EHS) program participation on a child's school readiness, considering the role of parent's marital status and family background characteristics.

Using descriptive statistics, intent-to-treat and regression analysis methods, I analyzed data from the study Early Head Start Research and Evaluation (EHSRE). These analyses showed the direct effects of EHS participation on children's school readiness and indirect effects due to family stability and demographic characteristics. The results showed that EHS program participation alone did not have a significant effect on children's academic achievement, as measured by standardized tests (Picture Peabody Vocabulary Test, Woodcock-Johnson Applied Problems subset, and Woodcock-Johnson Letter Word Identification test). Family structure stability did not show a significant association with school readiness either. However, the interaction between program participation and marital status at baseline demonstrated a significant positive relationship with the WJ-AP and WJ-LWI scores.

The primary conclusion drawn from this study is that while the EHS program and family structure stability did not significantly impact early academic outcomes on their own, the role of demographic characteristics such as child's gender, race, maternal education, and poverty ratio, are crucial to consider in early intervention program design. This study offers insights into the multifaceted factors associated with early academic achievements, emphasizing the necessity of a comprehensive approach in early intervention programs. Further research is recommended to delve into additional variables, like the quality of parenting and home environment, to enhance our comprehension of early interventions' impacts.

Keywords: Early Head Start, family structure, educational achievement, early intervention program, school readiness, regression analysis.

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1. Introduction

1.1 Background and Motivation

Early childhood, stretching from birth to five years of age, is universally acknowledged as a critical period in an individual's developmental trajectory. The experiences, environments, and interventions encountered during this phase significantly shape cognitive, social, emotional development and, by extension, their lifetime outcomes (Shonkoff & Phillips, 2000). Economically disadvantaged populations, in particular, face an array of challenges that can impede developmental outcomes and educational attainment, giving rise to enduring disparities in human capital formation.

The Early Head Start (EHS) program in the United States, designed specifically for low-income families with young children, serves as a significant intervention for mitigating developmental and educational disparities. EHS programs aim to foster the social, physical, cognitive, and emotional development of toddlers and infants through developmentally enriching caregiving. They also support parents in achieving their roles as primary caregivers and educators, promoting self-sufficiency in numerous areas such as housing stability, continued education, and financial security. Despite the broad objectives and extensive reach of EHS programs, there remains much to explore about the nuanced impact of these interventions, particularly in how they interact with family structure and background characteristics to shape educational outcomes.

1.2 Research Problem and Objectives

One area receiving increasing attention is the role of family structure and stability, as they shape the experiences of a child in their early years. Family structure changes have been associated with shifts in economic circumstances, time availability, and parental resources. These changes can introduce significant stress, causing residential instability and fluctuations in social networks, leading to adverse child outcomes (Holmes and Rahle, 1967; Osborne and McLanahan, 2007). Notably, though an initial "marriage premium" – a boost in child outcomes related to parents being married at

birth – can exist, this effect often subsides by age five, underlining the importance of continuous family stability (Craigie et al., 2012).

While the influence of EHS program participation on developmental outcomes has been documented, understanding how this effect varies with family structure and background can provide valuable insights for further refining program design and targeting interventions. The significance of these dynamics cannot be overstated in a society marked by demographic heterogeneity.

Guided by this, the present study aims to fill this knowledge gap by exploring the primary research question:

“To what extent can the impact of Early Head Start program participation on educational achievement outcomes be explained by differences in family structure and family background characteristics?”

Given the foundational research and societal beliefs around early childhood interventions and family stability, the hypothesis is that participation in the Early Head Start (EHS) program and stable family structures would positively influence a child's educational outcomes. This hypothesis emerged from the understanding that comprehensive early interventions like EHS could foster cognitive development, and that stable family structures would provide the necessary environment for consistent learning, support and less emotional stress.

1.3 Thesis Outline

To explore these relationships, this thesis will be structured accordingly. The following section is an in-depth overview of the Early Head Start program, to give background and context for this study. The literature review section provides an overview of the literature surrounding early childhood and how it affects later life outcomes, focusing on the Early Head Start program, family structure and stability. The Theoretical Framework section highlights the economic theories and empirical findings used to support the

hypothesis. Following this, the Methodology section outlines the research design, including the statistical methods and techniques used to test the hypothesis and interpret the data. The Results section presents the findings of the multiple analyses performed, whereas the final segment concludes the research, discussing its implications for policy and practice and suggestions for future research.

Through this examination, this thesis seeks to extend our understanding of the relationships between family structure, stability, and child educational outcomes, offering insights that could improve early interventions.

2. The Early Head Start (EHS) Program: An In-Depth Overview

The Early Head Start program is a community-focused initiative that is federally funded, in the United States of America that serves low-income families with pregnant women, babies and toddlers up to three years of age (*Head Start: Background and funding* 2014). It was established as part of the Head Start program in 1994 by the United States Department of Health and Human Services to improve disadvantaged children's development and health and to strengthen families and their communities.

The EHS program is designed around comprehensive, multifaceted services which include prenatal and postpartum support for expectant mothers, education for infants and toddlers, parenting education, health and nutrition services, and case management to connect families with additional community resources. One of its distinctive features is the strong emphasis on family engagement. The program encourages parents' involvement in their children's learning and development and offers resources to support their own educational and economic goals.

A significant component of the EHS program involves home visits. Trained professionals conduct these visits to support parent-child relationships and family well-being, promote child development, and connect families with necessary health and social services. These visits typically occur on a weekly or biweekly basis, depending on the family's needs.

The EHS program focuses on several key areas, including improving prenatal outcomes and enhancing child development, promoting healthy family functioning, strengthening the role of parents as the primary influencers in their children's lives, and fostering self-sufficiency among families through community partnerships and support.

Eligibility for the EHS program primarily hinges on income level; families must be at or below the federal poverty line to qualify. Additionally, other groups such as children in foster care, families experiencing homelessness, or those receiving public assistance may also be eligible. The program is designed to serve the youngest members of the population; therefore, children are typically enrolled as infants and can receive services up until the age of three, or until they transition into Head Start or another early learning setting.

In essence, the EHS program embodies a holistic approach to early childhood education by addressing the physical, cognitive, socio-emotional, and relational aspects of development while empowering parents and leveraging community resources. Its goal is to lay a solid foundation for lifelong learning and resilience among children from low-income families.

3. Literature Review

The foundation for lifelong learning, behavior, and health is laid down in early childhood. Different elements such as genetics, environment, experiences, and relationships collectively influence the brain's architecture and functioning, thereby defining the path for cognitive, social, emotional, and physical development (Shonkoff & Phillips, 2000). Early experiences and interventions are critical not just for fostering immediate growth, but also for influencing long-term outcomes related to learning, behavior, and health, a perspective that profoundly informs the research objectives of this thesis.

To understand the context of this research and the population being studied, a more in-depth look at Early Head Start (EHS) programs is necessary. Originating from the Head Start Act in 1965, EHS was introduced in 1994 to enhance the development of low-

income infants and toddlers and to promote healthy family functioning (Administration for Children & Families, 2014). With a two-generation approach, EHS not only addresses the developmental needs of children from birth to age three but also provides direct support to parents.

The EHS program focuses on several key areas, including improving prenatal outcomes and enhancing child development, promoting healthy family functioning, strengthening the role of parents as the primary influencers in their children's lives, and fostering self-sufficiency among families through community partnerships and support.

EHS programs deliver services through three major models: home-based, center-based, and a combination approach. The home-based model, involving weekly visits by trained professionals, emphasizes parental involvement in the child's learning and development while providing family support services. The center-based model offers childcare services and parent involvement activities in a classroom setting. The combination approach merges both models, providing center-based early learning experiences along with regular home visits and has been proven to have the strongest impact on children's outcomes (Love et al. 2005).

Eligibility for the EHS program primarily hinges on income level; families must be at or below the federal poverty line to qualify. Additionally, other groups such as children in foster care, families experiencing homelessness, or those receiving public assistance may also be eligible. The program is designed to serve the youngest members of the population; therefore, children are typically enrolled as infants and can receive services up until the age of three, or until they transition into Head Start or another preschool setting. EHS gives importance to a smooth transition to ensure continued support for the child's development.

Thus, EHS is uniquely positioned to influence a child's readiness for school, the family environment, and parent-child interactions, key areas that have been found crucial for child outcomes. Its goal is to lay a solid foundation for lifelong learning and resilience among children from low-income families. This thesis aims to analyze the impact of this

vital program on children's educational outcomes in the context of various family structures.

Brooks-Gunn and Markman (2005) critically examine the role of parenting behaviors in contributing to racial and ethnic disparities in school readiness. They emphasize the complex interplay between socioeconomic conditions, parenting behaviors, and school readiness. They highlight how maternal sensitivity and the provision of learning experiences, often influenced by socioeconomic status, can enhance a child's readiness for school. Their work emphasizes the efficacy of both home and center-based interventions that incorporate a parenting component, demonstrating improvements in parental nurturing, discipline, and communication skills, particularly in families with behaviorally challenging children.

Their research suggests that these interventions can potentially reduce ethnic and racial gaps in school readiness, as they serve a higher percentage of minority families and appear to have stronger positive effects for black families compared to white ones. These findings underscore the relevance of this thesis's focus on Early Head Start programs, which incorporate a strong parenting component, serve low-income families and offer home-based, center-based and combined services.

In their comprehensive work, Currie and Almond (2011) contribute significantly to our understanding of the key role early childhood experiences play in human capital development. Beginning with the premise that human capital encompasses a wide range of skills beyond those measured by traditional academic tests, Currie and Almond argue that non-cognitive skills, such as motivation and self-control, are as crucial for long-term success as cognitive abilities. These skills, they argue, begin developing before age five, further emphasizing the importance of early interventions.

The authors highlight the importance that home environment and parental involvement play in early child development, suggesting that interventions that support parents in creating a nurturing environment can be particularly effective. However, they caution against viewing these interventions as a "cure-all" for socioeconomic inequalities, noting

that many disadvantaged children may need additional support to overcome these outset adversities.

They also provide evidence for the high return on investment of early childhood intervention programs, suggesting that these programs can break the cycle of poverty by improving the human capital of disadvantaged children. They argue that interventions in early life are particularly effective because they can affect the trajectory of child development in multiple domains and potentially modify the family environment to better support child-rearing.

In light of these findings, the authors advocate for a life cycle approach to human capital development, one that begins well before formal schooling and extends throughout an individual's life. This perspective informs the direction of the present thesis, which focuses on the Early Head Start program as an intervention targeting the critical period of development before age five.

In their later paper Almond, Currie, and Duque (2018) expand on their previous research and undertake a comprehensive review of literature that explores the long-lasting impacts of early-life conditions on adult outcomes. The authors consolidate a wide array of research, ranging from economics, epidemiology, and developmental psychology, to construct a nuanced understanding of the enduring influence of childhood circumstances on an array of adult outcomes, encompassing educational attainment, labor market success, health, and even criminal behavior.

At the heart of their argument is the notion that childhood represents a critical period when investments (or lack thereof) can bear significant long-term consequences. This idea aligns with the "fetal origins" hypothesis, which proposes that adverse conditions during prenatal and early postnatal life can result in long-term effects on health and economic outcomes. They emphasize the 'sensitive periods in early life during which certain skills and capabilities are more readily shaped, reinforcing the necessity of targeted interventions like the EHS program during these critical developmental phases.

Evidence of the effectiveness of Early Head Start programs is provided through research by Love et al. (2005). The research particularly showcases the program's impact on both children and their parents, emphasizing the intricate relationships between program participation, parental involvement, and child development outcomes.

They found that children enrolled in these programs showed improved language and cognitive development and social-emotional well-being. Also, parents who participated in Early Head Start programs reported more involvement with their children, along with increased use of positive parenting practices promoted through parental guidance services during the course of the intervention.

The authors mention the Early Head Start program's potential to reduce developmental disparities and improve outcomes for children from low-income families, suggesting that the intervention acts as a buffer against the detrimental impacts of being born into poverty. Initiatives incorporating both center-based and home-visiting services had stronger impacts than purely home-based or center-based programs. Additionally, impacts were stronger in programs that fully implemented the performance standards and that provided higher quality services. However, the authors also recognize that variability in outcomes is also dependent on the quality of program implementation and family engagement. This aligns with the hypothesis of this thesis, which implies that Early Head Start programs can have a mitigating effect on the challenges faced by economically disadvantaged people, but could also depend on family structure and other individual characteristics.

In their study, Catherine Tamis-LeMonda and others (2019) explore the predictive impact of the early home learning environment on children's academic skills by the 5th grade. They used a longitudinal research design based on EHSREP data that included infants to fifth graders, focusing on the role of the home learning environment on children's language, literacy, and mathematics skills.

The researchers identified that the home learning environment includes aspects like parents' verbal responsiveness and quality of maternal engagement, the availability and use of learning materials such as books, and parents' teaching of basic skills. They

found that these aspects of the home environment in the child's early years significantly predicted their academic skills by the 5th grade, with stronger early home environments being associated with better academic outcomes.

The study highlights the importance of early language experiences and literacy activities at home in predicting later academic success. It was found that not only direct teaching activities but also indirect ones such as casual conversations and storytelling, play a crucial role in developing children's academic skills.

In understanding the role of family structure and stability on children's outcomes, particularly school readiness, the work of Waldfogel, Craigie, and Brooks-Gunn (2010) is instrumental. Using data from the Fragile Families and Child Wellbeing Study, they explored how single-parent and cohabiting families impact the cognitive, behavioral, and health outcomes of children when compared to those born into married-couple households.

Their exploration focused on five crucial pathways: parental resources, parental relationship quality, parental mental health, parenting quality, and father involvement, as well as the consideration of the types of individuals who opt for different family structures and the role of family stability. They found that the impacts of family structure and stability on children's outcomes were not uniform. For instance, they found family instability to be more influential on cognitive and health outcomes than family structure, whereas for issues with behavior, being raised by a solo mother, irrespective of the stability or instability of the family conditions, seemed to have more impact than instability alone. Crucially, their findings suggested that children brought up in steady single or cohabiting parental situations face fewer risks compared to those raised in unstable circumstances, reinforcing the role of stability in children's outcomes.

Craigie, Brooks-Gunn, and Waldfogel's (2012) article explores the interesting influence that the role of family structure and stability has in molding children's outcomes. Using data from the Fragile Families and Child Wellbeing Study, the authors examine how the health, behavioral and cognitive outcomes of five-year-old children vary according to their family structure and respective stability.

The authors' use of the term "fragile families" to describe families in which a child is born to unmarried parents is particularly relevant to this thesis. Craigie et al. (2012) assert that these households typically experience greater instability and less parental support, leading to less favorable outcomes when compared to families where parents are married (Waldfogel et al., 2010; Kalil & Ryan, 2010). This provides an interesting framework to examine the influence of family structure on the impact of Early Head Start program participation on the educational achievement of children.

They make use of Social Stress Theory to potentially explain the impact of changes in family structure on child outcomes. They argue that modifications in family structure are often associated with changes in time, parental and economic resources, resulting in increased stress and adverse child outcomes. This perspective shows the potential role of Early Head Start programs as mitigators of social stress by providing consistent, enriching environments for children irrespective of their family structure or income level.

The influence of family structure and dynamics on a child's development can evolve as time progresses. The researchers have observed that, while being born into marriage provides initial benefits for children, possibly due to the effect of marriage premium, these advantages tend to subside over time, especially in areas like cognitive development.

Finally, the authors propose that family instability can lead to adverse child outcomes due to increased residential instability, intensified social stress and disruption in social networks. This insight underscores the importance of looking beyond just the fixed elements of family composition. It is equally important to understand the ongoing stability aspect when evaluating how the Early Head Start program can influence participants.

4. Theoretical Framework

The theoretical framework of this thesis incorporates perspectives from a range of academic literature on early childhood circumstances, parenting practices, early

intervention programs, family structure and stability, and their collective impact on individual life outcomes.

Building upon the "fetal origins" hypothesis, Almond et al. (2018) argue for the existence of sensitive periods in child development when experiences and environmental conditions can have lasting effects on health, education, and economic achievements. This perspective underscores the importance of early childhood as a crucial period for interventions.

Cunha and Heckman's (2007) work on the technology of skill formation introduces an economic perspective, emphasizing the cumulative and dynamic nature of skill formation. Early investments, they argue, can enhance the effectiveness of later ones, thus amplifying the importance of interventions during these sensitive periods.

Brooks-Gunn and Markman (2005) stress the pivotal influence of how parents raise and guide their kids when it comes to preparing them for school. This signals the importance of early intervention programs that incorporate parental behavior modules and a focus on early home environments. They suggest that improvements in these areas can potentially bridge the concerning gaps in school readiness, especially the differences seen among various ethnic and racial groups.

Taking this idea further, Craigie et al. (2012) shed light on the concept of "fragile families", where children are born to unwed parents. These families typically face more ups and downs and their children often do not fare as well. Drawing upon the Social Stress Theory, they argue that changes in family structure often accompanied by variations in parental resources and economic means can induce stress and result in adverse child outcomes, thus emphasizing the need for stable, supportive environments.

Drawing inspiration from Currie and Almond's (2011) insights, it becomes evident how pivotal early life circumstances and interventions are in human capital development. Their findings offer empirical evidence that early experiences can cast long shadows on

education, health, and financial results in later life. This idea is present throughout the vast body of research on this subject.

In this thesis, the intention is to further explore and expand on this layered theoretical backdrop. I delve into the effects of participation in the Early Head Start program on educational success, taking into account the intricacies of a child's early environment, family structure and stability. This exploration contributes to the wider academic conversation, offering a nuanced understanding of the factors influencing child development and how early-stage interventions can effectively navigate and address them.

5. Methodology

In this chapter, the methodological approach used in this study is outlined and discussed. I took a quantitative approach to better understand how stable family structures might affect school preparedness in children participating in the Early Head Start program. Opting for quantitative methods allowed for measuring the target variables in a clear-cut way and utilizing statistical techniques to accurately assess program effects on the sample in question.

5.1 Data Description and Collection

The data used in this research paper is based on a longitudinal design, retrieving data from the Early Head Start Research and Evaluation (EHSRE) Study, which covers a period from 1996 through to 2010. This study was meticulously crafted and employed a large-scale random selection process. It tracked 3,001 children and their families in 17 different locations throughout the United States. The collected data encompassed a broad spectrum of information, including family demographics, living conditions, and metrics of school preparedness. For analysis purposes, families were categorized into two primary groups: those who benefited from the Early Head Start services (program

group) and those who didn't (control group). Both groups had comparable characteristics and were eligible to participate in the Early Head Start program.

The study's data, collected from 17 sites representative of different program models, ethnic or racial compositions, urban-rural locations, program auspices, and program experiences over three phases: Birth to Three, Pre-Kindergarten Follow-up, and Elementary School Follow-up. Baseline data was collected from the Head Start Family Information System (HSFIS) and the MPR Tracking System. This data encompassed a variety of aspects including the program involvement of each case, characteristics of the focus child, attributes of the applicant, mother and details of family circumstances.

Parental interviews were conducted at several intervals—6, 15, 26, 14, 24, and 36 months after random assignment—collecting data on service usage, progress toward economic independence, health conditions, child development, and family dynamics. Concurrently, child and family assessments were performed at 14, 24, and 36 months, using field observations and specific tools like the Bayley Assessments, Peabody Picture Vocabulary Tests, and video recordings of parent-child interactions to understand children's behavior and home environments.

This rich dataset allows for the exploration of the impact of the Early Head Start program on children's educational outcomes while controlling for a wide range of influencing factors. The use of a random assignment design further enhances the robustness of this study, enabling the isolation of the effect of the EHS program from other potential confounding factors.

5.2 Variables of Interest

The principal variables of interest in this study are based on family structure from birth and from birth to 36 months. Several binary variables were employed capturing different family situations, like the mother of the focal child living with the husband at baseline. To capture the stability and instability of family structure, different variables were used considering spouse or no spouse for the focal child's mother at baseline stable and the

continuation or disruption of this relationship throughout the next waves. The variables used for measuring stability do not allow the situation where the relationship changes more than once in the following waves to avoid non-distinct subsets of observations and avoid multicollinearity.

Children's early mathematical skills, including counting, reading numbers, and basic arithmetic, were evaluated using the Applied Problems subtest from the Woodcock-Johnson Psycho-Educational Battery-III Tests of Achievement or Bateria III Woodcock-Muñoz (Woodcock and Johnson, 1989; Woodcock and Muñoz-Sandoval, 1996). This subtest was administered in a parallel manner to both English and Spanish-speaking children in the total sample. The Letter-Word Identification subtest was likewise employed to determine children's capacity to identify letters and words. Children's vocabulary was assessed by the Picture Peabody Vocabulary Test-III (PPVT) or Test de Vocabulario en Imagenes Peabody (TVIP; Dunn & Dunn, 1997), a standardized receptive vocabulary test. This test evaluates children's vocabulary by instructing them to select a picture in response to a spoken word prompt. For ease of use in this analysis and considering the small sample of Spanish-speaking children, the Spanish test counterparts were merged into compound variables PPVT and WJ-AP respectively.

Multiple demographic variables were used to control for potential confounding effects, including the child's gender, primary caregiver's race (white, black, Latinx, or other), mother's education level (less than, equal, or more than 12 years), whether the mother was employed/in school or not, welfare receipt, English proficiency, participation in the Early Head Start program, family income as the poverty ratio, and employment or schooling status of the caregiver.

5.3 Data analysis

The data analysis for this research was conducted using descriptive statistics, regression analyses, and the Intent-to-Treat (ITT) model to effectively investigate the primary research objective: discerning how the factors of marriage at baseline, stability

at 36 months, and program participation, influence academic achievement (measured by PPVT, WJ-AP, and WJ-LWI scores). The regression analyses were executed using the statistical software STATA.

Firstly, descriptive statistics were generated to obtain a clear perspective on the variables in focus. This step was crucial for grasping the overall patterns, data spread, and distinct features of the dataset, giving a general overview of the characteristics of the sample. Information such as the number of observations, mean, standard deviation and the minimum and maximum of the variables under study can be distinguished.

After the descriptive analysis, I applied the Intent-to-Treat (ITT) approach to determine the effect of the intervention. There are several benefits to employing an ITT analysis such as minimizing bias, addressing missing data and attrition, which is inherent in any longitudinal study, and thus reflecting more real-world scenarios where not all participants comply with recommended treatment. In this thesis, the main strength of the ITT approach lies in its capacity to yield an impartial assessment of the intervention's influence on the broader population. This is accomplished by contrasting the mean outcomes of the designated intervention group with those who weren't selected, regardless of their true participation levels. To estimate the ITT effects, I executed a series of regression analyses that served to assess the impact of the Early Head Start (EHS) intervention on a child's school readiness.

It's noteworthy to mention that while the Local Average Treatment Effect (LATE) model could have been useful to estimate the effect of the intervention on the subset of the population that complied with the intervention assignment, it was not feasible to implement due to the unavailability of essential variables in the data set. The LATE model requires a variable indicating randomization into the treatment or control group and another variable indicating whether someone participated in the intervention. Due to the nature of this longitudinal study, there was some attrition, but most participants took part in the interviews and surveys albeit irregularly. Unfortunately, these variables were not reported in the data set, and hence the LATE analysis could not be performed.

The first stage of the regression analysis utilized the 36-month family stability variables (Spouse BL, M/L thr., No Spouse BL, M/L thr., No spouse BL, not M/L thr.) as dependent variables, with program participation as the key independent variable. These regressions were run separately for each of the 36-month variables, providing unique insights into their individual effects while also accounting for additional control variables.

The next step of the study incorporated the estimates derived from the initial stage into a subsequent series of regression analyses. The educational performance indicators (PPVT, WJ-AP, and WJ-LWI) measured at pre-kindergarten level were designated as dependent variables. Meanwhile, program participation, marital status at childbirth, and the three stability variables at 36 months were considered as independent variables.

A separate multivariate regression was also conducted on school preparedness outcomes, factoring in an interaction variable that combined program involvement and marital status at baseline, in addition to other reference variables. The purpose of this inclusion was to determine if this combined factor had a pronounced effect on the children's early academic results within the sample, thus testing if marriage premium is present.

Through using these diverse analytical approaches, the objective was to deliver detailed insight into the influence of EHS intervention and the significance of consistent family structures on the academic preparedness of young children in economically disadvantaged families. The findings from these analytical processes were used to investigate the central research question.

6. Results

6.1 Descriptive Statistics Analysis

Table 1 showcases the details of the study sample's characteristics. The analysis encompasses 2,977 participants, with an even split between individuals participating in the EHS Program and those who did not (average = 0.50, standard deviation = 0.50). At

the outset, 25% of participants were cohabiting with their husbands. Among those married or cohabiting from the start, 25% maintained that status throughout the research duration, until the third wave of interviews when the focus child was 36 months old. Conversely, for those initially single, 22% eventually married or began living with a partner, while 30% continued their single status for the entire study duration.

The children’s cognitive ability was measured using the PPVT, WJ-AP, and WJ-LWI tests at the Pre-K stage. The average PPVT score was 90.84 (SD = 16.19), WJ-AP was 88.22 (SD = 19.91), and WJ-LWI was 89.29 (SD = 13.90). Half of the children in the study were males (mean = 0.51, SD = 0.50).

The sample was racially diverse, with approximately equal proportions of White (37%) and Black (35%) participants, followed by Latinx (24%) and 5% belonging to other racial groups. Mothers' education varied, with 48% having less than 12 years of education, while 29% and 24% had completed 12 years and more than 12 years, respectively.

Financial hardship was indicated by a 35% AFDC receipt rate and an average poverty ratio of 60.67. Additionally, 44% of caregivers were either employed or in school. English was the predominant language among participants (79%). These statistics give an initial understanding of the demographic and socio-economic factors of the participants in this study.

Table 1

Descriptive Statistics for the Study Variables

| Variable | N | Mean | SD | Min | Max |
|--|----------|-------------|-----------|------------|------------|
| EHS Program | 2,977 | 0.50 | 0.50 | 0 | 1 |
| Lives With Husband at baseline | 2,977 | 0.25 | 0.43 | 0 | 1 |
| Spouse at Baseline, Married/Lived Throughout | 1,566 | 0.25 | 0.43 | 0 | 1 |

| Variable | N | Mean | SD | Min | Max |
|--|----------|-------------|-----------|------------|------------|
| No Spouse at Baseline, Married/Lived Throughout | 1,566 | 0.22 | 0.42 | 0 | 1 |
| No Spouse Baseline, not Married/Lived Throughout | 1,566 | 0.30 | 0.46 | 0 | 1 |
| Pre-K PPVT | 1,841 | 90.84 | 16.19 | 40 | 152 |
| Pre-K WJ-AP | 1,868 | 88.22 | 19.91 | 0 | 143 |
| Pre-K WJ-LWI | 1,867 | 89.29 | 13.90 | 44 | 184 |
| Male | 2,948 | 0.51 | 0.50 | 0 | 1 |
| Race: White | 2,925 | 0.37 | 0.48 | 0 | 1 |
| Race: Black | 2,925 | 0.35 | 0.48 | 0 | 1 |
| Race: Latinx | 2,925 | 0.24 | 0.43 | 0 | 1 |
| Race: Other | 2,925 | 0.05 | 0.21 | 0 | 1 |
| Mom Ed: < 12 years | 2,870 | 0.48 | 0.50 | 0 | 1 |
| Mom Ed: = 12 years | 2,870 | 0.29 | 0.45 | 0 | 1 |
| Mom Ed: > 12 years | 2,870 | 0.24 | 0.43 | 0 | 1 |
| AFDC receipt | 2,380 | 0.35 | 0.48 | 0 | 1 |
| English Speaker | 2,876 | 0.79 | 0.41 | 0 | 1 |
| Poverty Ratio | 2,451 | 60.67 | 52.63 | 0 | 618.29 |
| Caregiver Employed/In School | 2,977 | 0.44 | 0.50 | 0 | 1 |

Note. WJ-AP is Woodcock-Johnson Applied Problems subtest. WJ-LWI is the Woodcock-Johnson Letter Word Identification subtest. WJ-PV is the Woodcock-Johnson Picture Vocabulary subtest. PPVT is the Picture Peabody Vocabulary Test. The Spanish test counterparts were merged into compound variables PPVT and WJ-AP respectively for ease of use.

6.2 Intent to Treat Analysis

Table 2 in the Appendix presents the results of the intent-to-treat analysis, investigating the effect of the Early Head Start (EHS) Program on child educational outcomes as measured by the PPVT, WJ-AP, and WJ-LWI. Program participation did not significantly impact the scores on these measures. Gender was significantly associated with all outcomes, with male children scoring lower on the PPVT (-2.98, $p < .01$), WJ-AP (-2.68, $p < .05$), and WJ-LWI (-4.07, $p < .001$) than their female counterparts. The racial background was a significant predictor, with Black children scoring significantly lower on the PPVT (-6.23, $p < .001$) and Latinx children scoring significantly lower on the WJ-LWI (-7.84, $p < .001$) compared to other races.

Maternal education was significantly associated with all outcomes, with children of mothers with less than 12 years of education scoring significantly lower on all three outcomes. In contrast, children whose mothers had more than 12 years of education scored significantly higher on the PPVT (5.75, $p < .001$). This suggests that lower levels of maternal education may correspond to less effective educational support or resources at home, leading to lower achievement levels for children. A higher poverty ratio had a small but significant positive impact on all outcomes ($p < .01$ for PPVT and WJ-LWI, $p < .05$ for WJ-AP), as did English language proficiency for PPVT (3.68, $p < .05$).

These results suggest that, while EHS program participation did not have a direct significant impact on the educational outcomes measured, several socio-demographic factors, such as gender, race, maternal education, poverty level, and English language proficiency, significantly influenced the children's performance. There could be several unobserved factors that also influence academic performance such as educational activities at home, daily reading, or access to scholarly materials which were not taken into account.

6.3 Regression analyses

Table 3 illustrates the first stage of regression analysis evaluating the influence of program participation and additional control factors on the three binary family structure variables at 36 months: 'Spouse at Baseline, Married/Lived Throughout (Spouse BL, M/L thr.)', 'No Spouse at Baseline, Married/Lived Throughout (No Spouse BL, M/L thr.)', and 'No Spouse Baseline, not Married/Lived Throughout (No Spouse BL, not M/L thr.)'.

EHS Program participation did not significantly influence any of the family structure variables. Socio-demographic factors such as race, maternal education, and AFDC receipt, however, demonstrated significant associations. This could suggest that these socio-demographic elements play a more pronounced role in shaping family structure. For instance, socioeconomic factors, as indicated by AFDC receipt, might contribute to family stability or instability, influencing decisions about marital status and living arrangements. No significant factors emerged in the 'No Spouse at Baseline, Married/Lived Throughout' category.

For families with a spouse at baseline that lived together throughout, there was a significant negative association with maternal education less than 12 years (-0.06 , $p < .05$) and AFDC receipt (-0.21 , $p < .05$), while a significant positive association was seen for caregivers who were either employed or in school (0.10 , $p < .05$). This suggests that higher education and economic stability may play a role in maintaining the family structure. The positive association seen with caregivers being either employed or in school may reflect the beneficial effects of employment or educational engagement on family stability.

Lastly, for the 'No Spouse Baseline, not Married/Lived Throughout' category, families who were recipients of AFDC showed a significant positive association (0.13 , $p < .05$), and those where the primary caregiver was employed or in school demonstrated a significant positive association (0.10 , $p < .05$).

To summarize, the EHS Program did not significantly influence the family structure outcomes at the 36-month mark, but other demographic factors, like maternal education, AFDC receipt, and caregiver employment status, had significant correlations.

In the second stage of regression analyses, shown in Table 4 of the Appendix, the impacts of EHS Program participation and family structure stability at 36 months on child academic outcomes were evaluated, specifically for the Picture Peabody Vocabulary Test (PPVT), the Woodcock-Johnson Applied Problems subset (WJ-AP), and Woodcock-Johnson Letter Word Identification test (WJ-LWI).

The EHS Program's effects on PPVT and WJ-AP were positive but not statistically significant. An insignificant negative impact was noted on the WJ-LWI. The family structure variables 'Spouse at Baseline, Married/Lived Throughout', 'No Spouse at Baseline, Married/Lived Throughout', and 'No Spouse Baseline, not Married/Lived Throughout' did not exhibit any statistically significant impacts on the three academic outcomes, suggesting that family structure and stability may not have a strong influence on these early academic achievements in this sample.

Other control variables demonstrated statistically significant associations. Male children scored lower on all tests, with significant negative impacts found on PPVT and WJ-LWI. Children of white race were associated with higher scores on PPVT and WJ-LWI, while children from black racial backgrounds showed significantly higher scores on the WJ-LWI test. Mother's education appeared to influence the child's scores: those with mothers who had less than 12 years of education scored significantly lower across all tests, while those with mothers who had more than 12 years of education showed significantly higher scores on the WJ-AP. Lastly, the poverty ratio was positively associated with higher scores on all three tests, but no significant association was found for the caregiver's employment/school status.

To summarize, the EHS program and family structure at 36 months do not appear to have a significant impact on early academic outcomes, but certain demographic characteristics like gender, race, maternal education, and poverty ratio do play significant roles.

Table 5 presents the outcomes of a regression analysis that delves into the impacts of both program participation and marital status at baseline on the school readiness measures: PPVT, WJ-AP, and WJ-LWI. Observing the EHS Program's independent effect, the data indicate that participation in the program impacts scores across all three indicators negatively; however, these differences do not achieve statistical significance. Similarly, living with a husband at the baseline has been linked with negative scores in all three readiness measures, but these results, too, do not hold significant statistical weight.

Of notable interest is the interaction term, representing the intersection of being in the program and marital status at baseline. This interaction demonstrated a statistically significant positive relationship with the WJ-AP and WJ-LWI scores and an almost significant positive relationship with PPVT ($p < 0.10$). This suggests that while the individual effects of either being part of the EHS program or being married might not notably enhance school readiness scores, the combination of the two presents a significant positive influence, predominantly evident in WJ-AP and WJ-LWI scores.

The findings highlight the intricate dynamics of factors shaping child educational trajectories. Gender, maternal education, and poverty ratio manifested significant correlations with the academic progress of focus children based on the ITT assessment, yet the definitive impact of the EHS program remained ambiguous. The first-stage regression analysis showed significant associations between family structure and program participation, especially regarding the receipt of AFDC financial aid and caregiver employment or education status. However, the second-stage regression revealed no clear link between family structure at birth and subsequent academic achievement. Nonetheless, the interaction of program engagement and marital status did exhibit a notable positive correlation with two of the three readiness metrics for schooling. The results of these analyses portray the complexity of factors that could directly or indirectly influence the school readiness of children, beyond EHS program participation alone. It is important to understand and use these results to further improve early intervention programs geared toward minimizing the achievement gap for underprivileged children.

7. Conclusion and Discussion

In this study, I set out to investigate the influence of the Early Head Start (EHS) program and family structure on child school readiness, focusing on three academic achievement scores measured at pre-kindergarten level: the Picture Peabody Vocabulary Test-III (PPVT), the Applied Problems subtest from the Woodcock-Johnson Psycho-Educational Battery-III Tests of Achievement (WJ-AP) and the Letter-Word Identification subtest (WJ-LWI). The results provide a layered perspective, broadening the current academic discourse in several ways.

The primary finding is that child gender, mother's education level, and poverty ratio were significantly associated with children's academic performance, more so than the effect of participation in the EHS program. Additionally, preliminary findings did not underscore a straightforward link between family structure stability and a child's educational trajectory, contrary to some existing studies. This suggests that the impact of family dynamics on learning outcomes might harbor complexities not previously acknowledged, potentially mediated by a range of other factors not explicitly considered in this analysis. Considering recent research into EHS, later time-specific variations in home quality during the first five years might be more significantly associated with school readiness (Duncan et al., 2023). In their study, the EHSRE dataset confirmed a significant association between variations in home quality during the initial five years of life and academic performance after elementary school.

However, the introduction of the interaction term between EHS program participation and marital status in our regression model offers a fresh dimension to the discourse. While neither EHS program participation nor marital status singularly showed marked effects, their interaction term did present statistically significant positive relationships with two academic scores: WJ-AP and WJ-LWI. This intriguing result signals that the combined effect of program participation and stable family structure might present a unique advantage, especially in the realms of problem-solving skills and literacy.

This study's main hypothesis that EHS program participation and stable family structures would have a positive effect on child educational outcomes was only partially

supported. While the impact of the EHS program alone was not significant in this study, its relationship with family structure requires further investigation. This could be due to the inconsistency in the age at which children joined and departed from their Early Head Start program, given that programs had the flexibility to enroll families either prenatally or during the child's first year of life. This accentuates the importance of understanding the conditions that optimize the effectiveness of the EHS program.

Therefore, the question, "To what extent can the effect of Early Head Start program participation on educational achievement outcomes be explained by differences in family structure and family background characteristics?" has an elaborate answer. It highlights the complex interaction of various factors associated with a child's academic success, emphasizing that while programs like EHS are essential, they are part of a broader set of influences. Additionally, follow-up formal education between ages three to five shows a significant positive effect when children have also participated in Early Head Start (Chazan-Cohen & Kisker, 2013), suggesting that the EHS effect might be more pronounced at a later stage in child development. Further research is needed to isolate these effects and potentially inform enhancements to the EHS program that account for these variables, thus maximizing its intended effects.

In terms of societal implications, the strong association between the mother's educational level and child outcomes underscores the importance of supporting women's education as a means of enhancing child development. Programs aimed at breaking the intergenerational cycle of educational disadvantage could have significant societal benefits. Additionally, considering the association of the poverty ratio with academic performance, policies aimed at mitigating the effects of poverty on families could also significantly contribute to improving child educational outcomes.

For future research, it would be beneficial to further explore the relationship between family structure, EHS program participation, and other additional factors that may impact child educational outcomes. This could involve examining the associations with other variables such as parental practices, community resources, and other support programs, along with parent-child relationships and home environment quality.

Combining insights from previous research into the socioemotional complexities of family dynamics and the quality time parents spend with their young engaging in activities that foster academic growth and creativity, a more all-encompassing picture of the factors that affect child academic outcomes can emerge. It would also be informative to investigate why the EHS program did not have a significant effect in this study and delve deeper into the interaction between program participation and family structure.

Lastly, following up on the later life outcomes of the families in this longitudinal study would provide valuable insight into the long-term effects of start-of-life family structure and early intervention participation on economically disadvantaged people. Considering observable differences in background characteristics, identifying positive outcomes from EHS program participation during the later stages of a child's life might demonstrate the program's effectiveness in reducing initial socioeconomic disparities. Through these investigations, we can continue to build a more comprehensive and nuanced understanding of the factors associated with child educational outcomes, ultimately informing more effective policies and interventions.

Appendix

Confidentiality Measures:

The confidentiality of the participants in the EHSRE study was strictly maintained. Data from 24 families with certain circumstances, such as the death, miscarriage, or adoption of the focus child, were excluded. As a safeguard, the study sites were not revealed due to relatively small sample sizes, and identifiable details such as childcare provider and data collector ID numbers were omitted.

Date variables, including the date of random assignment and the dates of data collection, were combined and rounded to the quarter midpoint to further protect confidentiality. The ages of the focus children at the time of data collection were maintained, but specific birth dates were omitted.

Data related to other household members were similarly adjusted; specific dates of birth were replaced with the age in years at data collection time, and some ages were bottom- or top-coded.

Changes were also made in household composition information to ensure privacy, resulting in possible inconsistencies in the total count and the sum of each member type. These measures ensure participant confidentiality while maintaining data integrity for the research.

Tables:

Table 2

Intent-To-Treat Analysis of Program Participation on Child Educational Outcomes

| Variables | PPVT | WJ-AP | WJ-LWI |
|------------------|-------------|--------------|---------------|
| EHS Program | 0.78 | 0.93 | -0.33 |

| Variables | PPVT | WJ-AP | WJ-LWI |
|--------------------|-------------|--------------|---------------|
| | (0.85) | (1.10) | (0.76) |
| Male | -2.98** | -2.68* | -4.07*** |
| | (0.85) | (1.10) | (0.76) |
| Race: White | 3.85* | 2.26 | -4.03 |
| | (1.67) | (3.06) | (2.11) |
| Race: Black | -6.23*** | -5.38 | -2.15 |
| | (1.73) | (3.12) | (2.15) |
| Race: Latinx | - | -4.01 | -7.84*** |
| | | (3.14) | (2.17) |
| Race: Other | -1.80 | - | - |
| | (2.44) | | |
| Mom Ed: < 12 years | -3.59*** | -9.86*** | -5.80*** |
| | (1.04) | (1.45) | (1.00) |
| Mom Ed: = 12 years | - | -7.00*** | -1.59 |
| | | (1.49) | (1.03) |
| Mom Ed: > 12 years | 5.75*** | - | - |
| | (1.15) | | |
| AFDC receipt | -0.89 | -1.20 | -1.60 |
| | (0.97) | (1.25) | (0.86) |
| English Speaker | 3.68* | 2.74 | -1.27 |
| | (1.66) | (2.12) | (1.47) |
| Poverty Ratio | 0.03** | 0.02* | 0.02** |
| | (0.01) | (0.01) | (0.01) |

| Variables | PPVT | WJ-AP | WJ-LWI |
|------------------------------|--------------------|--------------------|--------------------|
| Caregiver Employed/In School | 0.95 (0.89) | 1.32 (1.15) | 1.06 (0.79) |
| Constant | 88.10*** (1.61) | 93.79*** (3.42) | 98.12*** (2.35) |
| N | 1228 | 1247 | 1246 |
| R ² | 0.177 | 0.108 | 0.104 |
| F | 23.83*** | 13.60*** | 12.96*** |

Note: * p < .05, ** p < .01, *** p < .001. Standard errors are in parentheses. Some values were omitted due to collinearity.

Table 3

First Stage Regression Analysis of Family Structure at 36-Months on Program Participation and Additional Control Factors

| Variables | Spouse BL, M/L thr. | No Spouse BL, M/L thr. | No spouse BL, not M/L thr. |
|------------------|----------------------------|-------------------------------|-----------------------------------|
| EHS Program | -0.02 (0.02) | -0.02 (0.02) | 0.02 (0.03) |
| Male | -0.03 (0.02) | -0.01 (0.02) | 0.00 (0.03) |
| Race: White | 0.05 (0.06) | -0.05 (0.06) | 0.06 (0.07) |
| Race: Black | -0.12 (0.06) | -0.02 (0.06) | 0.15 (0.07) |

| Variables | Spouse BL, M/L thr. | No Spouse BL, M/L thr. | No spouse BL, not M/L thr. |
|------------------------------|----------------------------|-------------------------------|-----------------------------------|
| Race: Latinx | -0.11 (0.07) | 0.07 (0.07) | -0.01 (0.07) |
| Race: Other | - | - | - |
| Mom Ed: < 12 years | -0.06 (0.03) | 0.02 (0.03) | 0.04 (0.03) |
| Mom Ed: = 12 years | -0.03 (0.03) | 0.02 (0.03) | 0.02 (0.03) |
| Mom Ed: > 12 years | - | - | - |
| AFDC receipt | -0.21 (0.03) | -0.03 (0.03) | 0.13 (0.03) |
| English Speaker | -0.28 (0.05) | 0.06 (0.05) | 0.03 (0.05) |
| Poverty Ratio | 0.00 (0.00) | -0.00 (0.00) | -0.00 (0.00) |
| Caregiver Employed/In School | -0.17 (0.03) | 0.03 (0.03) | 0.10 (0.03) |
| Constant | 0.64 (0.07) | 0.18 (0.07) | 0.14 (0.08) |
| N | 1,070 | 1,070 | 1,070 |
| R ² | 0.24 | 0.01 | 0.09 |
| F | 30.36*** | 1.03 | 9.40*** |

Note: * p < .05, ** p < .01, *** p < .001. Standard errors are in parentheses. The values for other races and mothers' education over 12 years were omitted due to collinearity.

Table 4

Second Stage Regression Results for Academic Achievement Variables (PPVT, WJ-AP, WJ-LWI) with Program Participation and Family Structure and Stability at 36 Months as Predictors

| Variables | PPVT | WJ-AP | WJ-LWI |
|----------------------------|---------------------|-------------------|--------------------|
| EHS Program | 0.78 (0.85) | 0.93 (1.10) | -0.33 (0.76) |
| Spouse BL, M/L thr. | -0.80 (1.63) | 2.82 (2.07) | 0.23 (1.40) |
| Spouse BL, M/L thr. | 0.27 (1.60) | 1.54 (2.03) | 0.25 (1.38) |
| No spouse BL, not M/L thr. | -0.05 (1.50) | 0.90 (1.90) | -0.15 (1.29) |
| Male | -2.73** (1.05) | -1.62 (1.34) | -4.30*** (0.90) |
| Race: White | 6.72* (2.77) | 8.55*** (2.60) | 4.21* (1.76) |
| Race: Black | -5.03 (2.85) | 0.12 (2.69) | 5.84*** (1.82) |
| Race: Latinx | 1.28 (2.87) | - | - |
| Race: Other | - | 6.07 (3.62) | 7.37** (2.45) |
| Mom Ed: < 12 years | -10.09*** (1.37) | -3.59* (1.68) | -6.51*** (1.18) |

| Variables | PPVT | WJ-AP | WJ-LWI |
|------------------------------|--------------------|--------------------|--------------------|
| Mom Ed: = 12 years | -6.49*** (1.37) | - | -1.99 (1.18) |
| Mom Ed: > 12 years | - | 6.43*** (1.75) | - |
| AFDC receipt | -1.61 (1.26) | 0.26 (1.61) | -1.12 (1.09) |
| English Speaker | 3.10 (2.02) | 0.48 (2.56) | -1.72 (1.73) |
| Poverty Ratio | 0.03* (0.01) | 0.04* (0.02) | 0.02* (0.01) |
| Caregiver Employed/In School | 0.11 (1.11) | 1.46 (1.41) | 1.01 (0.96) |
| Constant | 93.54*** (3.35) | 79.23*** (3.06) | 90.53*** (2.12) |
| N | 843 | 848 | 849 |
| R ² | 0.20 | 0.13 | 0.12 |
| F | 15.42*** | 8.85*** | 8.15*** |

Note: * p < .05, ** p < .01, *** p < .001. Standard errors are in parentheses. Some values were omitted due to collinearity.

Table 5

Regression Analysis of School Readiness Including Interaction Term of Program Participation and Marital Status at Baseline as Predictors

| Variables | PPVT | WJ-AP | WJ-LWI |
|---------------------------------|--------------------|--------------------|--------------------|
| EHS Program | -0.16 (.15) | -0.66 (.50) | -1.44 (1.59) |
| Living with husband at baseline | -0.37 (.26) | -0.47 (.26) | -1.72 (1.36) |
| Program X Married | 3.24 (1.74) | 5.44* (2.28) | 3.71* (2.25) |
| Male | -2.97*** (3.49) | -2.66* (2.42) | -4.09*** (5.41) |
| Race: White | 3.68* (2.20) | 2.27 (0.74) | -4.03 (1.91) |
| Race: Black | -6.17*** (3.57) | -4.97 (1.59) | -2.08 (0.97) |
| Race: Latinx | - | -3.68 (1.17) | -7.76*** (3.58) |
| Race: Other | -2.00 (0.82) | - | - |
| Mom Ed: < 12 years | -3.49*** (3.36) | -9.88*** (6.81) | -5.9*** (5.90) |
| Mom Ed: = 12 years | - | -7.19*** (4.83) | -1.74 (1.69) |

| Variables | PPVT | WJ-AP | WJ-LWI |
|------------------------------|-------------------|----------------|-----------------|
| Mom Ed: > 12 years | 5.86*** (5.08) | - | - |
| AFDC receipt | -.59 (0.60) | -.67 (0.53) | -1.54 (1.74) |
| English Speaker | 4.01* (2.39) | 3.39 (1.59) | -1.18 (0.80) |
| Poverty Ratio | .03** (2.81) | .02 (1.61) | .02** (2.74) |
| Caregiver Employed/In School | 1.16 (1.27) | 1.70 (1.45) | 1.08 (1.35) |
| Constant | 87.88*** | 93.20*** | 98.64*** |
| N | 1228 | 1247 | 1246 |
| R ² | 0.18 | 0.11 | 0.10 |
| F | 20.56*** | 12.18 | 11.38*** |

Note: * $p < .05$, ** $p < .01$, *** $p < .001$. Standard errors are in parentheses. Some values were omitted due to collinearity. Program X Married is the interaction term between EHS Program participation and living with husband at baseline.

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