

AN ABSTRACT OF THE THESIS OF

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The family context is an important aspect of a child's environment that can provide helpful resources for fostering positive development or can be a source of risk. One risk factor that is present in an overwhelming number of families is low income status (Child Trends Databank, 2019). Children growing up in families with low-income are at a greater risk for lower self-regulation skills and worse academic performance (Duncan, Brooks-Gunn, & Klebanov, 1994; McClelland & Wanless, 2012; Sektnan, McClelland, Acock, & Morrison, 2010; Wanless, McClelland, Tominey, & Acock, 2011). The present study examined how aspects of the family, specifically how child sleep duration, breastfeeding exposure, maternal education and employment status, parent marital status, and housing mobility, were related to the development of self-regulation and early literacy skills specifically for children living in low-income families at the fall of their kindergarten year. In order to examine these associations, a multiple regression framework was used as well as a quantile regression to examine if family characteristics related differently to self-regulation and early literacy at five different quantile positions (10th, 25th, 50th, 75th, 90th) in the distribution of these skills. Results revealed that children in the sample were demographically similar in their family characteristics; 96% of children received 8-12 hours of

sleep each night, 84% were breastfed, 62% lived with married/partnered parents, 77% of mothers completed 10-14 years of education, 55% of mothers were employed part-time or full-time, and 61% of children experienced 1-3 moves in the previous 5 years. Regression analyses revealed that breastfeeding exposure significantly and positively predicted self-regulation ($B = 15.76$, $SE = 8.06$, $p = .05$) and early literacy skills ($B = 23.94$, $SE = 8.24$, $p = .004$). Quantile regression analyses revealed that breastfeeding exposure predicted early literacy skills for children scoring within the 75th percentile ($B = 15$, $SE = 5.59$, $p = .008$) of early literacy skills. Results contribute to existing literature on how the family context impacts important developmental domains in a child's life and provides information on potential places of intervention for children who are living amongst pertinent risk factors.

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The Role of Family Characteristics in Predicting Self-Regulation and Early Literacy in
Kindergarten

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Isabella Sciuto, Author

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TABLE OF CONTENTS

	<u>Page</u>
1 Introduction.....	1
1.1 Theoretical Framework.....	2
1.2 Child Poverty	4
1.3 Family Characteristics	5
1.4 Developmental Outcomes In Early Childhood.....	11
1.5 Early Literacy Development.....	12
1.6 Early Childhood as an Important Developmental Window.....	13
1.7 The Present Study.....	14
2 Method.....	16
2.1 Participants	16
2.2 Procedure	17
2.3 Measures	17
2.4 Analytic Strategy	20
2.4 Missing Data	22
3 Results	22
3.1 RQ 1.....	22
3.2 RQ 2	23
3.3 RQ 3	23
4 Discussion.....	25
4.1 RQ 1.....	25
4.2 RQ 2	26

TABLE OF CONTENTS (Continued)

	<u>Page</u>
4.3 RQ 3	27
4.4 Practical Implication	28
4.5 Limitations and Future Directions	29
4.6 Conclusions	30
5 References	31
6 Appendix	41

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1. Kernel Density Plot of Self-Regulation by Breastfeeding Exposure.....	48
2. Kernel Density Plot of Early Literacy by Breastfeeding Exposure.....	48

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	T-test results comparing children with missing vs. non-missing family characteristics on main outcome variables	50
2	Descriptives of Sample Family Characteristics	51
3	Breakdown of Outcome Variables by Family Characteristics	52
4	Correlations Among Variables of Interest.....	53
5	OLS Regression models assessing the association between family factors and self-regulation.....	54
6	OLS Regression models assessing the association between family factors and early literacy.....	55
7	Quantile Regression Results Assessing Breastfeeding and Self-Regulation.....	56
8	Quantile Regression Results Assessing Breastfeeding and Early Literacy...	57

The Role of Family Characteristics in Predicting Self-Regulation and Early Literacy in Kindergarten

The family provides a unique and salient context for a child's development. However, families have different levels of resources available to foster a child's development. When a child is raised in a resource-depleted, or high-risk environment, they are more vulnerable to negative developmental outcomes; such as worse academic performance, increased behavioral problems, negative peer relationships, and decreased physical health (Masten & Reed, 2002; Masten & Gewirtz, 2006; O'Dougherty Wright, Masten, & Narayan, 2013). Children that demonstrate successful or positive outcomes despite presence in a high-risk, low-resource environment are said to demonstrate resilience (Gutman et al., 2003; Masten & Reed, 2002; Sameroff & Rosenblum, 2006). Examining family characteristics (especially in a low-income sample), and how they may contribute to developmental outcomes can assist in understanding how children develop resiliency within important environmental or contextual constraints.

The present study examines how family characteristics (including aspects of child sleep duration, breastfeeding exposure, parent marital status, parent education level, parent employment status, and housing mobility) are related to self-regulation (the ability for a child to inhibit certain responses in favor of others, switch their attention, and utilize their working memory; Best & Miller, 2010; McClelland, Geldof, Cameron, & Wanless, 2015) and early literacy skills in young children using an exclusively low-income sample. More specifically, the present study will examine to what extent family characteristics predict self-regulation and early literacy scores within the contextual constraints of a low-income family environment. Family characteristics will also be examined in relation to the distribution of self-regulation and early

literacy skills to explore whether the effect of family characteristics changes at the lower or higher end of these skills for children in low-income families.

One of the most well researched family characteristics that influences child health and wellbeing is income. Low-income status, often measured by living at or below the federal poverty line, is related to decreased cognitive achievement, lower self-regulation skills, worse vocabulary and math skills, and lower reading comprehension (Duncan, Brooks-Gunn, & Klebanov, 1994; McClelland & Wanless, 2012; Sektnan, McClelland, Acock, & Morrison, 2010; Wanless, McClelland, Tominey, & Acock, 2011). However, families in poverty are diverse, and offer different resources to their children beyond just their income. As a result, some low-income children demonstrate positive developmental outcomes such as high self-regulation and academic achievement despite their low socio-economic status. Family characteristics related to income include child sleep quality, breastfeeding rates, parent education levels, parent marital status, parent employment, and housing stability (Blair et al., 2012; Hoyniak et al., 2018; Iceland, 2013; Maldonado & Nieuwenhuis, 2015; Quigley et al., 2012; Schmitt, Finders, McClelland, 2015; Sektnan et al., 2010), but it is not clear which of these characteristics—or groups of characteristics—may act as resources that boost a child’s developmental trajectories in the face of poverty. In early childhood, important precursors to academic achievement include early literacy, as well as the development of self-regulation.

Theoretical Framework

The bioecological model. The grounding theory for the present study is the bioecological model. The bioecological model provides a framework for how a child’s environment influences their development. This framework emphasizes the bidirectional interactions between the more proximal processes in a child’s environment, such as their sleep duration, and the more distal

factors, such as their housing mobility (Bronfenbrenner, 1999; Wachs, 2015). Inherent within the bioecological model is its emphasis on the overlapping levels of influence surrounding a child that impacts their development.

Most central to the child is the microsystem, made up of proximal processes that encompass a child's direct interaction with his or her immediate physical and social environment (Bronfenbrenner, 1999; Wachs, 2015). One layer out from the microsystem lies the mesosystem, which forms linkages between a child's different microsystems. For example, breastfeeding exposure would be a part of a child's mesosystem, as it has important nutritional implications for the individual but also links the individual with their mother, who is part of their microsystem, through increased mother-child bonding (Wachs, 2015). The third layer, the exosystem, includes parts of a child's world that he or she does not directly encounter but that still affects their development by influencing lower levels of the system (i.e., a parent's job). The macrosystem, or the outermost layer, includes different belief systems, values, cultural practices, social policies, and living conditions (Wachs, 2015). Finally, the chronosystem, which cuts across the four previous levels, focuses on the time at which important events happen (developmental windows) as well as the overall time and history in which the person lives (Wachs, 2015).

For the purpose of this study, characteristics of the individual child were considered including children's nightly sleep duration, and exposure to breastfeeding, measured through direct child assessments and parent questionnaires and how they are related to child self-regulation and early literacy skills. The microsystem influences were assessed as maternal education levels and parent marital status, indicated by the parent through a questionnaire. Mesosystem influences on the child in this study include breastfeeding exposure as a way of connecting a child to their caregiver, measured by a parent questionnaire. Aspects of the child's

exosystem included maternal employment status and housing mobility, also measured through a parent questionnaire. Finally, the chronosystem was represented by the kindergarten year, the time at which these skills were assessed.

Child Poverty

As previously mentioned, living in poverty is a prevalent risk factor as children are among one of the highest populations living in poverty in the United States (Iceland, 2013). In 2016, 21% of children were living below the Federal Poverty Threshold (FPT; Koball & Jiang, 2018). In 2017, 17.5% of children were living 100% below the FPT (Child Trends Databank, 2019). There is a meaningful gap between the federal poverty line (approximately \$24,339 for a family of four) and the actual amount of income required to meet basic needs (approximately \$48,678 for the same family demographic; Koball & Jiang, 2018). This gap may contribute to challenges families experience when attempting to create a developmentally stimulating environment for their children (Vernon-Feagans, Hammer, Miccio, & Manlove, 2001). It is important to understand how this resource depletion impacts the way that children develop foundational skills for later life success.

Previous research has examined the influences of such resource-depleted environments and has shown poverty to be detrimental to children's outcomes. For example, living in a low-income household is associated with lower cognitive achievement as well as lower vocabulary, reading, and math scores (Duncan & Brooks-Gunn, Duncan, 2000; Brooks-Gunn, & Klebanov 1994; Sektnan et al., 2010). Further, children living in poverty are at risk for demonstrating lower IQ scores, increased behavioral problems, decreased likelihood of graduating from high school, increased risk of altered brain development, and much more (Hair, Hanson, & Wolfe, 2015; Korenman, Miller, & Sjaastad, 1995; McCloyd, 1998; Moore et al., 2002; Sektnan et al.,

2010). These increased risks may even appear before and during the entry into formal schooling (ages five to six in the United States). Wanless and colleagues (2011) found that children from low-income families enter into preschool with lower self-regulation skills than children from higher SES families. This is important as skills such as self-regulation develop rapidly during early childhood and have lasting effects on developmental outcomes across the life span (McClelland, Acock, Piccinin, Rhea, & Stallings, 2013). Nevertheless, despite the negative effects of poverty on child development, some children develop in similar ways to their more advantaged peers. Additionally, there is variability in levels of specific family characteristics present in families living in poverty; not all low-income families look the same (Koball & Jiang, 2018; Iceland, 2013; Masten & Reed, 2002; Roy et al, 2014; Schmitt, Finders, & McClelland, 2015). In light of these and similar findings, many researchers seek to investigate influences that can serve as protective factors against risk factors like low-income.

Family Characteristics

Adopting the bioecological model of development places special attention on how a child's environment impacts their development. Looking at how characteristics of the family relate to a child's cognitive development can offer unique windows into possible family-level interventions, as well as help identify which children may need intervention. The current study focused on proximal and distal factors in the child's family life (sleep duration, breastfeeding exposure, maternal education level, maternal employment status, parent marital status, and housing mobility) that are related to child cognitive development (self-regulation and literacy skills) in a low-income sample.

Sleep Duration. Sleep is critical for efficient functioning in many domains of the human life and is actively being examined as an important influence on the development of important

cognitive skills, specifically self-regulation and early literacy development, and is shown to be impacted by income level (Blair et al., 2012; Buckhalt, El-Sheikh, & Keller, 2007; Hoyniak et al., 2018). Researchers find that children living in low-income families are more likely to go to bed and wake up at later times than children from more affluent families, contributing to more delayed and disrupted sleeping patterns (Blair et al., 2012; Hoyniak, Bates, Staples, Rudasill, Molfese, & Molfese, 2018). This disrupted sleep may be more harmful for children from low-income families than children from high-income families (Buckhalt, El-Sheikh, & Keller, 2007). This is important because delayed sleep and wake patterns, as well as disrupted sleep, relate to worse sleep quality and cognitive performance (Hoyniak et al., 2018).

One of the main mechanisms through which researchers link sleep quality cognition is through activity and performance of the prefrontal cortex, the area of the brain responsible for self-regulation (Buckhalt, El-Sheikh, & Keller, 2007; Dahl, 1996). Researchers have found worse sleep quality and duration relates to poorer prefrontal cortex performance and activity (Buckhalt, 2011; McClelland et al., 2015) and subsequently, the ability to concentrate and focus attention, which are critical components of self-regulation skills (Buckhalt, 2011; McClelland et al., 2015). Researchers have also found that children ages zero to five years old with consistent normative sleep patterns (11-12 hours of sleep a night on average) are more likely to have stronger self-regulation skills at ages six to seven years old (Williams, Nicholson, Walker, & Berthelsen, 2016). Similarly, many researchers highlight the importance of sleep because of links between longer sleep duration, consistent sleep schedules, and earlier bed and rise times to better brain functioning, higher scores on academic achievement and cognitive tests, and increased self-regulation skills (Buckhalt, 2011; Buckhalt, Wolfson, & El-Sheikh, 2009; Touchette et al., 2007; Tso et al., 2016). Examining child sleep duration among children in low-income families

will help researchers to better understand whether healthy sleep duration can act as a resource to boost child cognitive development when contextual constraints such as low-income status are in effect.

Breastfeeding Exposure. Research on breastfeeding exposure and the development of self-regulation and early literacy skills is somewhat sparse. The available literature differs significantly on measurement (e.g., measuring breastfeeding duration, exclusivity, formula feeding) and outcomes. These inconsistencies have led to a lack of clarity and consensus on exactly how breastfeeding exposure and duration relates to important childhood cognitive skills such as self-regulation and early literacy (Huang, Peters, Vaugh, & Witko, 2014; Quigley et al., 2012; Koh, 2017). The research that is available suggests that links between breastfeeding exposure and duration and achievement and literacy are significant and positive after controlling for important demographic characteristics such as SES, maternal education, employment, and child gender, (Anderson, Johnstone, & Remley 1999; Huang, Peters, Vaugh, & Witko, 2014; Quigley et al., 2012; Koh, 2017). In other words, being breastfed and longer breastfeeding duration relates to stronger skills in children's achievement. Considering the important nutritional benefits of breastfeeding as well as benefits for the mother-child relationship (Gibbs & Forste, 2014), it is important to explore the relation between breastfeeding exposure, self-regulation, and literacy skills, especially in light of the fact that being breastfed could be a resource in the face of risk, such as living in poverty.

Parent Marital Status. Family structure is an important component of a child's environment that is related not only to income, but also child cognitive development. Parent marital status makes up a large part of family structure and has important effects on children's achievement related to self-regulation skills, literacy development, and reading comprehension

(Acs, 2007; Sarsour et al., 2011). Parent marital status has strong associations with family income levels such that single/non-married mothers are at a disproportionately high risk of living in poverty (Maldonado & Nieuwenhuis, 2015). Previous research finds that children living in single parent families have worse self-regulation skills than children living in two-parent families (Sarsour et al., 2011). Similarly, children living with cohabiting mothers display lower academic ratings and higher behavioral problems than children from other family structures (Thomson, Hanson, & McLanahan, 1994). Conversely, children with married parents display more positive outcomes in areas of math, reading, and vocabulary (Acs, 2007; Berger & McLanahan, 2015). These important connections between parent marital status and child cognitive outcomes make it an important component of the family to consider when examining children's self-regulation and early literacy skills, especially among a low-income group of children.

Maternal Education Level. Another important component of the family for children's later cognitive outcomes is maternal education level. Higher maternal education relates to higher academic achievement, literacy skills, and self-regulation for children (Bernier, Carlson, & Whipple, 2010; Sektnan et al., 2010; Magnuson, Sexton, Davis-Kean, & Huston, 2009). Further, maternal education is often an indicator of family SES and therefore linked with similar negative outcomes associated with living in poverty (McCloyd, 1998). Some researchers hypothesize that this strong connection may be due to the educational and financial resources parents are able to provide their children when higher education levels are present. Parents with lower levels of education may not be able to provide as many stimulating learning resources and may be less likely to engage in activities with children that foster higher self-regulation and literacy (such as amount of reading or level of vocabulary shared with children; Blau, 1999). Some studies have found that children with mothers who have lower levels of education display worse performance

in these important skills (Magnuson, Sexton, Davis-Kean, & Huston, 2009). Others have shown that children with parents with higher levels of education display increased inhibitory control, higher self-regulation, literacy and cognitive functioning (Bernier, Carlson, & Whipple, 2010). Further, research has found that children with young, less educated mothers see cognitive benefits from their mothers completing further education in the form of higher reading scores (Magnuson, 2007). Taken together, these findings highlight the importance of including maternal education levels in studies examining the development of self-regulation and early literacy in children living in low-income households.

Maternal Employment Status. Parent, specifically maternal, employment status also has important influences on children's cognitive development through links with self-regulation and early literacy (Brooks-Gunn et al., 2002). Maternal employment status directly impacts family SES through income received from working. Additionally, maternal employment status is linked with maternal education levels, such that individuals with higher levels of education are more likely to be employed full-time in higher paying jobs (McLanahan, 2004). Some contradictory findings within the literature on the impact of parent employment status on children's development may be capturing effects of family income and parent education levels together. For example, some researchers find that children with fully employed mothers do better on tests of early literacy skills (Schmitt, Sacco, Ramey, Ramey, & Chan, 1991). Additionally, children with parents whose employment status increased from part-time employment to full-time employment also perform better on early literacy than children with parents who are unemployed (Schmitt et al., 1991). Other studies find negative effects of maternal employment on child vocabulary and self-regulation when mothers enter employment during the first three years of their child's life (Bayard & Books-Gunn, 1991; Bernal, 2008; Brooks-Gunn et al., 2002;

Ruhm, 2004). Meanwhile, other studies find no associations between maternal employment, self-regulation, and early literacy skills (Kalil & Ziol-Guest, 2008). The majority of studies linking maternal employment to child outcomes examine employment within the first few years of a child's life. The present study sought to contribute to the literature by examining maternal employment during the time that children were in kindergarten in relation to their assessed self-regulation and early literacy skills. Examining parent employment status may help to clarify some of the contradictory findings existing in the literature and reveal whether employment status is an important characteristic of the family context contributing to the development of self-regulation and early literacy in children from an all low-income sample.

Housing Mobility. Housing mobility (how often a family has moved in the past 5 years) can be heavily impacted by income level and has links to child cognitive development through self-regulation and early literacy performance for children in early childhood. Previous research indicates that an increased number of moves relates to lower child inhibitory control and decreased early math and literacy skills (Schmitt, Finders, McClelland, 2015). Additionally, a threshold effect of mobility has been found, such that a high number of moves has more negative effects on children cognitive development than just one or two moves (Leventhal & Newman, 2010; Schmitt et al., 2015). Similarly, housing mobility poses a threat to a child's cognitive abilities in areas of verbal skills above and beyond other risks such as poverty, family changes, child maltreatment and other important risks (Fowler et al., 2015). Studies on housing mobility are few in number so more research is needed to fully understand the relationship between housing mobility and child outcomes. However, it is possible that stable housing could help boost child outcomes even in the face of poverty. In the present study, mobility was included to

explore the connection between the number of times a family has moved during the last five years and connections with children's self-regulation and early academic outcomes.

Developmental Outcomes in Early Childhood

Self-regulation. One prominent cognitive skill that begins to develop in early childhood is self-regulation. The concept of self-regulation is defined differently based on the field of study and the measurement utilized. For the purposes of this study, self-regulation is defined as a broad term that encompasses both top-down and bottom-up processes that regulate cognition, behavior, and physiological responses for the purposes of goal-directed behavior (Best & Miller, 2010; Blair & Raver, 2012; McClelland et al., 2015). Self-regulation is an umbrella term, which includes the integration of executive function components of inhibitory control (control of thoughts, attentions, immediate responses), attentional or cognitive flexibility (applying attention and shifting focus when needed while ignoring distractions), and working memory (actively working on and processing information; McClelland et al., 2015). The integration of these concepts is greater than the sum of its parts, and the integration of these skills has important implications for later academic achievement and adaptive goal directed behaviors (Blair & Raver, 2012; McClelland et al., 2014). For example, a child in a classroom with many other children may be told to work on a block-building task with his/her peer, therefore needing to take turns to build a complete tower. The child will need to inhibit their desire to go first instead of waiting their turn (i.e., inhibitory control), while holding the instructions in mind to finish the tower (i.e., working memory), and focusing his/her attention on the overall task at hand instead of on the other children or activities in the classroom (attentional flexibility). Thus, these skills are important for many different aspects of learning in classroom environments and become

increasingly important as children progress into formal school environments (kindergarten and beyond).

Researchers have recognized the benefits of self-regulation and have begun to examine this skill as an important developmental outcome in childhood (Blair & Raver, 2012; McClelland et al., 2015). Sektnan and colleagues (2010) reveal that self-regulation is related to income level, such that children living in poverty are at a greater risk of having lower self-regulation. However, children living in poverty that demonstrate high self-regulatory skills are more likely than their peers to have high academic achievement (McClelland et al., 2015; McClelland & Wanless, 2012). Examining which specific family characteristics are related to higher self-regulation may allow for further understanding of how these skills can be bolstered for children in low-income contexts. Given its role as an important developmental skill in early childhood, the present study examined the ways in which various family characteristics predict the development of self-regulation and literacy skills.

Early Literacy Development

Early literacy skills are essential for the development of later vocabulary and reading comprehension skills (Storch & Whitehurst, 2001). Previous research finds that early literacy skills in early childhood education have strong continuity with later literacy skills in elementary school (Storch & Whitehurst, 2001), thus making them a foundational skill for academic readiness among children. Researchers emphasize that reading skills do not start at entry to school, but much earlier (Lonigan, Burgess, & Anthony, 2000). These emergent literacy skills that develop even before preschool have strong predictive significance for later reading abilities in subsequent years of education (Lonigan, Burgess, & Anthony, 2000). Additionally, as previously mentioned, there are characteristics of the family, such as child sleep duration, parent

marital status, education, employment status, and housing mobility, that can impact the development of important academic skills in early childhood, especially the development of early literacy skills, reading comprehension, and vocabulary (Acs, 2007; Berger & McLanahan, 2015; Hoyniak et al., 2018; Huang et al., 2014; Quigley et al., 2012; Schmitt et al., 1991; Schmitt et al., 2015; Sektnan et al., 2010). Similarly, there is evidence demonstrating that children living in low-income households are at risk for demonstrating lower early literacy scores compared to their middle-class peers (Storch & Whitehurst, 2001; McClelland & Wanless, 2012; Vernon-Feagans, Hammer, Miccio, & Manlove, 2001). Children who achieve higher literacy skills despite low-income status, then, represent a model of resiliency. It is important to examine which family characteristics predict such resiliency in early childhood.

Early Childhood as an Important Developmental Window

Research on self-regulation and early literacy shows that the preschool and kindergarten years are an important developmental time to begin learning these skills and that these skills can be practiced and improved during this developmental period (McClelland et al, 2007; McClelland et al., 2015). Montroy and colleagues (2016) reveal that some children demonstrate faster gains in self-regulation in early preschool, arguing that learning these skills early on allows for the child to master and utilize them at an earlier age. Further, earlier mastery of these skills is beneficial for a child's academic achievement and school readiness skills, especially for entry into formal schooling (McClelland et al., 2007). Storch and Whitehurst (2001) also demonstrate strong links between emerging literacy skills in early childhood and literacy skills in later childhood, showing the continuity of these skills and importance of building a strong foundation. The kindergarten year may be a particularly salient time for children in the development of self-regulation and early literacy skills.

The Present Study

The present study utilized a low-income sample to examine the impact of child and family characteristics on patterns of development for two specific cognitive skills: self-regulation and early literacy. Child and family characteristics included features of the individual child (sleep duration, breastfeeding exposure) the child's microsystem (parent marital status and maternal education levels), mesosystem (breastfeeding exposure), exosystem (maternal employment status and housing mobility), and chronosystem (the fall of the kindergarten year). For the scope of this study, the chronosystem was represented as the kindergarten year as early childhood is a malleable time in which certain influences may have more of an impact on child outcomes than during middle or late childhood (Appleyard et al., 2005). This study had three main research questions:

1. *What are the descriptive properties of the distribution of family characteristics (child sleep duration, breastfeeding duration, maternal education, parent marital status, maternal employment status, and housing mobility), self-regulation, and early literacy skills among a sample of high risk, low-income kindergarteners at the fall of the kindergarten year?*

In light of previous research finding variability in levels of family characteristics among families living in low-income environments (Koball & Jiang, 2018; Iceland, 2013; Masten & Reed, 2002; Roy et al, 2014; Schmitt, Finders, & McClelland, 2015) it was hypothesized that there would be variability in levels of family characteristics among children in the low-income sample. Specifically, it was hypothesized that some children would receive fewer than the recommended hours of sleep, would have low levels of being breastfed, have mothers with education levels being at or below a high school education and instances of maternal

unemployment and part time employment, and experience instances of housing mobility in the first 5 years of their lives, compared to the average in the sample.

2. *What family characteristics (sleep duration, breastfeeding duration, maternal education, parent marital status, maternal employment status, and housing mobility) are significantly associated with self-regulation and early literacy skills for children from low-income families in fall of kindergarten?*

Although research has found general links between these family characteristics, self-regulation, and early literacy (Acs, 2007; Berger & McLanahan, 2015, Brooks-Gunn, Han, Waldfogel 2002; Buckhalt, El-Sheikh, & Keller, 2007; Huang et al., 2014; Magnuson et al., 2009), it is less apparent which of these factors—or groups of factors—might predict higher self-regulation and literacy skills among a sample of low-income kindergarten-aged children as they transition to formal schooling. It is expected that maternal education will be one of the strongest predictors of self-regulation and early literacy (Sektan et al., 2010; Magnuson et al., 2009). It was also hypothesized that maternal employment status, parent marital status, housing mobility, breastfeeding duration, and child sleep will be significantly and positively associated with self-regulation and literacy skills in the fall of kindergarten.

3. *Does the association between family characteristics, self-regulation, and early literacy skills differ for children in the 10th, 25th, and 50th percentile of the distribution of self-regulation and early literacy skills as compared to children in 75th and 90th percentile of the distribution of these skills?*

In line with research on the development of resilient behaviors (Masten & Reed, 2002; Masten & Gewirtz, 2006), it was expected that higher maternal education, full-time employment, longer sleeping duration, being breastfed, having married parents, and low housing mobility

would be especially beneficial for children at the lower end (10th and 25th percentile) of the distribution who are showing low levels of self-regulation and/or early literacy skills.

Method

Participants

A sample of 246 kindergarteners was used from a study examining self-regulation skills among low-income children (McClelland et al., in preparation). All children were enrolled in kindergarten programs after attending Head Start preschool programs and came from low-income families living in Oregon. Children are eligible for Head Start services if (1) the Head Start classroom has space, (2) their family receives TANF, ERDC, or SSI-disability benefits, or is homeless, (3) the child is in foster care, (4) or their family's total income, after taxes and for the last 12 months, is not over the amount allowed under the Federal Poverty Guidelines based on the number of people in the family (OSU Child Development Center, n.d.; U.S. Department of Health & Human Services, 2019). For example, the Federal Poverty Guideline for a family of four is \$26,200 (HHS Poverty Guidelines, 2020). If there are four people in a child's family and the family income is above \$26,000 then that child would not be eligible to receive Head Start services. Low-income status for the present sample was therefore determined by a child's enrollment in a Head Start preschool. Among the sample, 52% were female and children were on average 5.62 years old ($SD = .31$). Parents were allowed to select from a list of multiple racial/ethnic identities for their children, 76% of children were White, 20% were Latino/Hispanic, and 4% marked another race/ethnicity. Among those (26%) that marked more than one race/ethnicity, the highest number were Latino/Hispanic and White with the next most frequent being African American and White. The majority of children were assessed in English with 5.03% of children assessed in Spanish.

Procedures

Data were collected during the fall of the kindergarten year. Trained and certified research assistants conducted all direct assessments of self-regulation and academic achievement. Assessments were conducted at children's schools during the fall of kindergarten. Children were tested individually for a maximum of 20 minutes to complete all assessments. In order to prevent participant burden and fatigue, assessments were completed across at least two sessions during the fall. When a teacher denoted that a child was a Spanish speaker, indicating they were an English Language Learner, they were paired with a bilingual assessor and administered a test of English proficiency, the Pre-Language Assessment System (PreLas), to determine if they should be assessed in Spanish or English.

Measures

Family Characteristics. Surveys were sent out in the mail to all of the parents with participating children. The surveys included a range of questions that asked for information such as the child's primary language, daily sleep duration, overall health status, parents' employment, and marital status, etc. Once completed, surveys were mailed back to the researchers.

Sleep duration. Child sleep duration was measured by a one-item, open response question: "On average, how many hours of sleep does your child get each night?"

Breastfeeding exposure. Breastfeeding exposure was composed of one item, asking if the child was ever breastfed or fed breastmilk through a bottle (0 = no, 1 = yes).

Marital status. Parent marital status was made up of a single question with four choice options. Participants were asked "what is your current marital status?" and prompted to check either single, married/partnered, divorced/separated, or widowed.

Maternal education. Information on maternal educational levels was gathered by a one-item continuous question asking, “approximately how many total years of education have you completed?” For clarification purposes, an example was given suggesting that if they have completed 12 years of education for a HS diploma to write 12 and if they completed 10 years of schooling and earned a GED to write 10.

Maternal employment. To report information of employment status, mothers were asked to choose from three possible options to describe their employment status: full-time, part-time, or unemployed.

Housing mobility. Information on housing mobility was gathered from a single continuous question, “how many times has your family moved in the past 5 years?”

Self-regulation. Self-regulation was measured using the Head-Toes-Knees-Shoulders Revised (HTKS-R) direct assessment (McClelland et al., 2019). This assessment is designed to measure components of executive functions, inhibitory control, attentional flexibility, and working memory (McClelland et al., 2014). Children are given instructions and asked to do the “opposite” of what the assessor tells them to do (e.g., when told to “touch your head” the correct response is to touch your toes). The task gets progressively harder as new commands are introduced (e.g., “touch your knee” and “touch your shoulder”). The HTKS-R measure has a total of 22 practice items and 37 test items. Children can be given a score of 0 for an incorrect response, a score of 1 for self-correcting an incorrect response, or a score of 2 for a correct response (McClelland et al., 2014). In total, there are 118 possible points including practice and test items. In previous research, the HTKS has been significantly related to teacher ratings of self-regulation (McClelland et al., 2014; McClelland et al., 2019). For the present study, the HTKS-R had an internal reliability alpha of .93.

Early Literacy. The Woodcock-Johnson III (WJ-III) Letter Word Identification test (WJLW) was used to measure early literacy skills and developing word-decoding skills in kindergarten (Muñoz-Sandoval, Woodcock, McGrew, & Mather, 2005b; Woodcock, McGrew, & Mather, 2001a). Children are asked a series of questions related to letter and word identification. For example, children are asked to select the letter “b” and “c” out of a list of various letters and then the word “cat” out of a selection of 4 words. As the task progresses in complexity, children are asked to read back words to the assessor such as “was” and “they”. For each question children either receive a score of 0 or 1 (0 = incorrect, 1 = correct). Scores were converted into age-normed W-scores for interpretation purposes so that researchers can examine if children are performing at appropriate developmental levels for their age (Woodcock, McGrew, & Mather, 2001a). The ceiling rule is reached when children receive a score of 0 on six consecutive highest-numbered items administered. The WJLW is a standardized assessment that has demonstrated strong test-retest reliability of 0.96 (McGrew & Woodcock, 2001).

Covariates. The present study controlled for child age, gender, and English Language Learner (ELL) status because these three factors have been found to be significantly related to self-regulation and early literacy skills (McClelland et al., 2015; McClelland & Wanless, 2012; Schmitt, Geldhof, Purpura, Duncan, & McClelland, 2017). It was important to control for age, as the kindergarten year is an important window for the development of self-regulation and early literacy skills and children may develop these skills at different rates depending on age (Schmitt, Geldhof, Purpura, Duncan, & McClelland, 2017). Additionally, it was important to control for gender as research has found that girls tend to have stronger self-regulation skills than boys in early childhood (McClelland et al., 2015). Finally, ELL status was controlled for as previous research has found that ELL status can be a risk factor to the development of self-regulation and

may impact the rate at which these skills develop (McClelland & Wanless, 2012; Wanless, McClelland, Tominey, & Acock, 2011).

Analytic Strategy

All research questions were examined using Stata 15 (StataCorp, 2017) to examine the distribution of family characteristics in the sample, descriptive statistics were analyzed for average child sleep duration, breastfeeding exposure, maternal education, parent marital status, maternal employment status, and housing mobility. Then we examined the average HTKS-R and WJLW scores, examining ICC's to see if scores differed based on classroom clustering. The ICC scores for HTKS-R and WJLW in fall of kindergarten ranged from .03 for WJLW to .10 for HTKS-R, which is within a range where nesting is needed (Hox et al, 2010; McClelland et al., 2019). All analyses, therefore, accounted for classroom clustering. Due to the amount of missing data in the sample regarding family characteristics, missing data analyses were run to examine any important differences between children in the sample with complete data and children with missing data on outcome variables of interest (self-regulation and early literacy). T-test analyses revealed no significant differences between these two groups (see Table 1).

For the second research question, asking what specific family characteristics relate to child self-regulation and early literacy scores, simple correlations were run first. To further probe these associations, multiple regression was run using the SEM command in Stata15 to utilize a full information maximum likelihood (FIML) estimator to handle all missing data (Acock, 2012). Regression models were specified as a multiple regression equation with one main outcome variable and multiple predictor variables. Regression analyses controlled for child age, gender, and ELL status. Fall self-regulation scores were regressed on the family characteristics of interest (i.e., child sleep duration, breastfeeding exposure, maternal education, parent marital status,

maternal employment status, and housing mobility). Next, Fall WJLW scores were regressed on the same set of family characteristics. Regressions were run using the SEM command in Stata15 to account for missing data using FIML. The distribution of scores on the HTKS-R (self-regulation) displayed some non-normality with a skewness value of -0.51 and a kurtosis of 1.94. The distribution of scores on the WJLW (literacy) displayed a skewness value of .62 and kurtosis of 6.62 (for Stata a kurtosis of 3 is equivalent to a normal distribution). Previous research using these measures has found similar results of non-normality with skewness and kurtosis not meeting guidelines for extreme values (see McClelland et al., 2007).

For the last research question that examined if the association between family characteristics, self-regulation, and early literacy were different based on a child's position within the distribution of scores, a quantile regression was run, dividing the outcome variables at the 10th, 25th, 50th, 75th, and 90th percentiles, similar to how previous research has divided quantiles (Chae et al., 2018; Konstantopoulos et al., 2019; Zhang, et al., 2015). The quantile regression allowed for examination of how the predictor variables of interest may differentially relate to self-regulation and early literacy instead of solely focusing on the conditional mean as with a multiple regression. More specifically, the quantile regression allowed the effect of family characteristics to vary across quantiles of child scores which enabled a closer examination of the effects of the predictors at the 10th, 25th, 50th, 75th, and 90th percentile of the distribution (Chae et al., 2018; Koenker & Hallock, 2001; Parente & Santos Silva, 2016). The quantile regression was run using the qreg2 command in STATA recommended by Parente & Santos Silva (2016), in order to account for clustered standard errors at the classroom level within nested data (see also Konstantopoulos et al., 2019). Unfortunately, the quantile regression commands in Stata does not allow for the use of FIML. So the quantile regression was run using listwise deletion. In

order to account for the biased standard errors that listwise deletion produces, a bootstrapping approach was attempted. However, there was no way to account for clustering with the bootstrapping approach. Given the ICC values mentioned above, the present study favored the clustering approach, so the quantile regression was run using data from children who had complete data on the predictor variables.

Missing Data

Overall, there was a substantial amount of missing family characteristic data in the sample. In the fall of kindergarten, 246 children participated in the overall study. Of these children, few had complete family characteristic data ($n = 110$). There was 35-48% missingness for all family characteristic variables across the sample (see Table 1). Missingness on family characteristic data was not significantly predicted by any covariates. Additionally, there were no significant differences in outcome variables based on missingness (see Table 1). Analyses were run using a full information maximum likelihood (FIML) approach to account for this missing data on predictor variables.

Results

RQ 1) What are the descriptive properties of the distribution of family characteristics, self-regulation, and early literacy skills among a sample of high risk, low-income kindergarteners at the Fall of kindergarten?

An overview of family characteristics are presented in Table 2. Children on average were 5.62 years old at fall of kindergarten ($SD = .31$) and 52.40% were female. Among the family characteristics, 25% of children lived in a single parent/never married home, 57.7% lived with married or partnered parents, and 13% lived with divorced or separated parents. Forty-five percent of mothers were unemployed, 21% worked part-time, 34% worked full-time, and on

average had 12.20 years of education. Eighty-four percent of children were breastfed at some point in their life; the average duration of breastfeeding was 10.07 months ($SD = 9.65$ months). Families, on average, moved 1.6 times over a span of 5 years ($SD = 1.54$ years), with 8 moves being the maximum. Finally, children, on average, slept 9.91 hours a night ($SD = 1.29$ hours). To further examine the distribution of self-regulation based on family characteristics HTKS-R (self-regulation) and WJLW (literacy) scores, see Table 3.

RQ 2) What family characteristics are significantly associated with self-regulation and early literacy skills for children from low-income families in the fall of kindergarten?

Results revealed that breastfeeding exposure (whether or not a child was ever breastfed) emerged as a significant predictor of child self-regulation and early literacy skills. Children who were breastfed scored 15.76 points higher ($SE = 8.06, p = .05$) than children who were never breastfed on the HTKS-R (self-regulation) and 23.94 points higher ($SE = 8.24, p = .004$) on the WJLW (literacy). It is important to note that parents reported that the majority (84%) of children in the sample were breastfed so there was less variability on this specific variable of interest. Child sleep duration, maternal education, maternal employment status, marital status, and housing mobility did not emerge as significant predictors of child self-regulation or early literacy scores at the fall of kindergarten, within the multiple regression framework, see Tables 6 and 7.

RQ 3) Does the association of family characteristics, self-regulation, and early literacy skills differ for children in 10th, 25th, and 50th percentile of the distribution of self-regulation and early literacy skills when dividing children's outcomes into quantiles as compared to children in the 75th and 90th percentile of the distribution of these skills?

A quantile regression was run assessing the effects of all predictors on the outcome variables of interest in line with the a priori hypotheses examining multiple predictors. This

analysis revealed similar findings as the multiple regression; breastfeeding exposure remained the only significant predictor of self-regulation and early literacy skills in the quantile regression. Due to breastfeeding consistently emerging as the only significant predictor of self-regulation and early literacy skills, post-hoc analyses were then run examining breastfeeding as the only predictor of self-regulation and early literacy skills in the quantile regression. This allowed for a more parsimonious model and was more appropriate for the missing data approach used for this analysis thus, post-hoc analyses are reported and explained here. Additionally, because the research question is interested in exploring the association of specific family characteristics at five different quantile positions (10th, 25th, 50th, 75th, 90th) in the distribution of outcome variables, and not between subgroups of family characteristics (e.g., children whose moms are employed part time and were also breastfed), a bivariate conditional quantile regression was run looking solely at the effect of breastfeeding duration on the outcome variables; similar to how previous research has conducted bivariate quantile regressions, specifically with academic outcomes (see Penner & Pret, 2008). To see kernel density plots examining the outcome variables by breastfeeding exposure see, Figure 1 and 2. The kernel density plots show that children who were breastfed had higher frequency of higher scores on the self-regulation and early literacy assessments. This means that children who were breastfed demonstrated higher self-regulation and early literacy scores more frequently compared to children who were never breastfed. However, it is important to note that within the kernel density plot, there are only 21 children who were not breastfed being compared to 107 children who were breastfed. This raises an issue of not having enough power to detect significant differences between these two groups. For the quantile regression analyses, the outcome variables were divided at the 10th, 25th, 50th, 75th, and 90th percentiles. Results of the bivariate quantile regression revealed a significant and

positive association between breastfeeding exposure and literacy for children scoring in the 75th percentile of early literacy skills ($B = 15, SE = 5.59, p = .008$). The association between breastfeeding exposure and self-regulation scores was the same across the distribution of self-regulation.

Discussion

Results of the present study show that breastfeeding exposure was the only family factor that was significantly related to higher child self-regulation and early literacy scores in the fall of kindergarten within a multiple regression framework. Breastfeeding exposure was shown to be significantly related to early literacy skills for children scoring within the upper end (75th quantile) of the distribution of early literacy scores revealing that the effect of breastfeeding exposure increased for children with higher literacy scores.

RQ 1: The Distribution of Family Characteristics, Self-Regulation, and Early Literacy Skills

Results revealed a relatively homogenous sample of low-income families with little variability in range of values across many of the assessed family characteristics. Children on average lived with married parents (57.7%). Although maternal education ranged from 4-23 years, 77% of mothers had completed 10-14 years of education, demonstrating a relatively restricted range in education among this sample of all low-income families. There was very little variation in breastfeeding exposure with 84% of children being breastfed at some point. Similarly, there was little variation in average sleep duration with over 96% of children receiving 8-12 hours of sleep, which is around the appropriate average amount of sleep for their age (9-11 hours). Finally, there was some variation in housing mobility which ranged from 0-8 moves across the sample. However, the most frequent number of moves was between 1-3 moves over

the past 5 years, which accounted for 61% of children in the sample. Further, 27% of children did not experience any moves. The only family characteristic that had more variability was maternal employment status with 45% of mother being unemployed and 55% experiencing part-time or full-time employment. The distribution of self-regulation scores on the HTKS-R revealed some variation in scores with the mean being 71.96 ($SE = 32.22$) out of a possible 118 points. The distribution of literacy scores on the WJLW was normal with the average score being 343.68 ($SD = 28.33$).

The current sample focused on children from low-income backgrounds, and although there was some variation in family characteristics it was within a restricted range. As a group, children did not show high levels of risk as indicated by extremely low levels of family characteristics, beyond their low-income status. Children in the sample had normative levels of sleep duration, most were breastfed, parents had normative levels of education completion, most were married, and most did not have a high number of moves. The only family characteristic that showed variability across the sample was maternal employment status with 45% of mothers being unemployed and 55% having some sort of employment (part-time or full-time). Overall, the sample was fairly similar in their levels of family characteristics.

RQ 2: Family Characteristics and their relation to Self-Regulation and Early Literacy

Results from the present study revealed that breastfeeding exposure significantly predicted children's self-regulation and early literacy scores at the entry to formal schooling. Children who were breastfed experienced roughly a 16-point increase in self-regulation scores and about a 24-point increase in early literacy scores as compared to children who were never exposed to breastfeeding. These associations may be due to the fact that the majority of children in the sample were breastfed (84%), however this could point to the importance of breastfeeding

as a protective factor for children when risk is present in their lives. Breastfeeding not only provides important nutrients for a child, but it can also facilitate important mother-child bonding time, that research has found to be beneficial to child outcomes (Gibbs & Forste, 2014). Future research should probe this specific relationship further to see what the mechanisms are behind this association. Maternal education, maternal employment status, marital status, housing mobility and child sleep duration were not significant predictors of children's self-regulation or early literacy skills. This could be due to the fact that children in the sample were demographically similar in regard to the ranges and levels of family characteristics they experienced. There may not have been enough variation in family characteristics to detect significant differences across children in the sample or the effect of any one variable may not stand out alone as a predictor. In contrast, if we were able to compare this sample with a more advantaged sample, perhaps we would see that this group is homogenous in experiencing risk (e.g., lower scores across all outcome measures), which could indicate that it is not necessarily any one risk factor that predicts risk or resilient behavior, but a combination.

RQ 3: The association of breastfeeding exposure, self-regulation, and early literacy at five different quantile positions in the distribution

After completing multiple regression analyses, the present study examined if breastfeeding exposure differentially impacted children's self-regulation and early literacy scores for children scoring within five different quantile positions (10th, 25th, 50th, 75th, 90th) in the distribution of these skills. Due to limitations of the conditional quantile regression approach and its susceptibility to covariates changing the conditional distribution as highlighted by Killewald and Bearak (2014), only two bivariate quantile regressions were run; one solely examined breastfeeding exposure and self-regulation and one examined breastfeeding exposure and early

literacy, without the presence of any covariates. Results revealed that the effect of breastfeeding exposure on early literacy skills increased for children with higher literacy skills. More specifically, only children in the 75th percentile of early literacy scores experienced a beneficial effect of breastfeeding exposure on literacy skills. The effect of breastfeeding exposure on self-regulation was similar for children scoring at different quantiles (10th, 25th, 50th, 75th, 90th) in the distribution of self-regulation scores. The current study utilized a more simplistic conditional quantile regression analysis to only begin exploring the associations between breastfeeding exposure and self-regulation and breastfeeding exposure and early literacy at different points in the distribution of these skills. Future research should consider the use of an unconditional quantile regression, as suggested by Killewald and Bearak (2014) which defines quantiles before the regression to help reduce the effect of spurious associations between the outcome variable and covariates. Additionally, if the sample utilized for the quantile regression was larger giving the analysis more power, it would be essential to examine the effect of important covariates on the conditional distribution (see Penner & Paret, 2008). Because of these reasons, the present quantile regression results should be interpreted with caution.

Practical Implications

As previous research has documented, self-regulation and early literacy skills are important developmental outcomes for children that can be impacted by growing up in a resource depleted environment (McClelland, Geldhof, Cameron, & Wanless, 2015; Sektnan, McClelland, Acock, & Morrison, 2010). However, there are other important characteristics within the family that can help to mitigate some of the risks of living in low-income environments (Masten & Reed, 2002; Masten & Gewirtz, 2006). Identifying which family factors relate to the development of self-regulation and literacy skills might shed light on what family characteristics

serve as risks and which serve as resources in different contexts and levels. Examining these associations within a quantile regression framework can provide useful information, beyond just mean-level analyses, for how family characteristics might be differentially relating to children who score in the lower ends of the distribution compared to children who score within the upper ends. This information can provide researchers and practitioners with a more holistic view on a child's life providing insight on where exactly to intervene in a child's life when necessary. The present study sought to provide this information and found that among a sample of all low-income kindergarteners, breastfeeding exposure is an important and positive predictor of children's self-regulation and early literacy scores, especially for early literacy skills among children scoring within the very upper ends of the distribution of early literacy skills.

Limitations and Future Directions

The present study has some important limitations that need to be addressed. First, there was a substantial amount of missing data on many of the family variables of interest. Although there were no significant differences between children with and without this data, more data may reveal significant associations between some of the family characteristics and children's self-regulation and early literacy scores. Another limitation was the slightly non-normal distribution of the outcome variables of interest. A more normal distribution may provide more information on how family characteristics influence a child's position in the sample distribution on important skills, specifically when using a multiple regression framework. Lastly, the present study only examined one time point, the fall of kindergarten. Future research should examine multiple time points as well as other important family characteristics such as breastfeeding exclusivity as previous research has found important links between breastfeeding exclusivity and cognitive abilities in young children (Quigley et al., 2012; Koh, 2017). Lastly, comparing family

characteristics of children from different socioeconomic backgrounds may give a better indication of which family characteristics are acting as resources and which ones are acting as risks to a child's development.

Conclusion

Results from this study revealing breastfeeding exposure as predictive of child self-regulation and early literacy demonstrate that the family is an important context for development, in early childhood and across the lifespan. Although the sample had a small range of values among the family characteristics (children lived in families with similar levels of maternal education, similar marital statuses, low housing mobility, normative sleep durations, and majority were exposed to breastfeeding), this study examined important family characteristics and helped clarify contradictory findings regarding how certain characteristics of the family are related to child's development in areas of self-regulation and early literacy for children living in low-income families. Overall, low-income status may not necessarily mean that children will be at a disadvantage cognitively when there may be other positive aspects of their families that are working to support their development. Comparisons between this sample and a more advantaged sample using these same variables would further elucidate these connections to determine if children in this more disadvantaged sample are demonstrating resilience or risk collectively. Future research should examine the mechanisms through which these family characteristics work in conjunction with one another to act against some of the negative or risk aspects of a child's environment.

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Appendix

Table 1

T-test results comparing children with missing vs. non-missing family characteristics on main outcome variables

HTKS by missing vs. non-missing	<i>T</i> (df)	<i>P</i> value	<i>n</i> _{missing} (%)	<i>M</i> of HTKS
Mom Education	<i>t</i> (244) = 0.17	0.85	87 (35.4)	
Mom Employment	<i>t</i> (244) = .54	0.59	86 (35)	
Marital Status	<i>t</i> (244) = .19	0.85	86 (35)	
Mobility	<i>t</i> (244) = .36	0.72	85 (34.6)	
Breastfeeding Exposure	<i>t</i> (244) = -.26	0.80	118 (48)	
Sleep	<i>t</i> (244) = -.29	0.77	118 (48)	
WJLW by Missing vs. non-missing	<i>t</i> (df)			
Mom Education	<i>t</i> (244) = -.15	0.88	-	
Mom Employment	<i>t</i> (244) = -.51	0.61	-	
Marital Status	<i>t</i> (244) = -.28	0.79	-	
Mobility	<i>t</i> (244) = -.31	0.76	-	
Breastfeeding Exposure	<i>t</i> (244) = -.82	0.41	-	
Sleep	<i>t</i> (244) = -.34	0.73	-	

Table 2

Descriptives of Sample Family Characteristics (N = 246)

Variables	<i>n</i> (%)	<i>n</i> _{missing} (%)
Maternal Education		87 (35.4)
Less Than High School	36 (24.16)	
High School	60 (40.27)	
Some College	36 (24.16)	
College	17 (11.41)	
Maternal Employment		86 (35)
Unemployed	72 (45)	
Part time	34 (21.25)	
Full time	54 (33.75)	
Parent Marital Status		85 (34.6)
Single	40 (25)	
Married	142 (57.7)	
Divorced	21 (13.12)	
Sleep Duration	M=9.99, SD=1.29	118 (48)
Breastfeeding (Y/N)	107/21	118 (48)

Table 3
Means of Outcome Variables by Family Characteristics

Self-Regulation and Early Literacy by Parent Employment Status				
	Unemployed (<i>n</i> = 72)	Mom Part Time (<i>n</i> = 34)	Mom Full Time (<i>n</i> = 54)	Missing (<i>n</i> = 86)
HTKS	69.92 (34.61)	77.47 (32.35)	74.15 (32.01)	70.78 (31.03)
WJLW	344 (25.17)	340.93 (21.92)	342.55 (27.11)	344.39 (32.58)
Self-Regulation and Early Literacy by Parent Marital Status				
	Single (<i>n</i> = 38)	Married (<i>n</i> = 86)	Divorced (<i>n</i> = 18)	Missing (<i>n</i> = 86)
HTKS	74.42 (31.95)	68.71 (34.55)	84.944 (25.79)	70.91 (31.09)
WJLW	341.16 (24.07)	342.90 (26.15)	349.33 (22.89)	344.22 (32.50)
Self-Regulation and Early Literacy by Breastfeeding Exposure				
	Yes (<i>n</i> = 107)	No (<i>n</i> = 21)	Missing (<i>n</i> = 118)	
HTKS	74.06 (32.56)	58.20 (37.08)	70.50 (31.06)	
WJLW	344.70 (23.19)	329.50 (28.68)	344.72 (32.97)	
Mean of Self-regulation and Early Literacy by missingness on Mom Education				
	Mean (<i>n</i> = 141)			Missing (<i>n</i> = 105)
HTKS	73.21 (33.20)			71.50 (31)
WJLW	343.45 (25.1)			343.99 (32.29)
Mean of Self-regulation and Early Literacy by missingness on Mobility				
	Mean (<i>n</i> = 143)			Missing (<i>n</i> = 103)
HTKS	72.59 (33.15)			71.10 (31.01)
WJLW	343.21 (25)			344.34 (32.51)
Mean of Self-regulation and Early Literacy by missingness on Sleep Duration				
	Mean (<i>n</i> = 119)			Missing (<i>n</i> = 127)
HTKS	71.35 (33.58)			72.54 (31.01)
WJLW	343.04 (24.97)			344.28 (31.24)

Table 4
Correlations Among Variables of Interest

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. HTKS-R													
2. WJLW	.41***												
3. Age (years)	.28***	.28***											
4. Male	-.02	-.02	-.05										
5. ELL	-.20**	-.20**	.04	.00									
6. Mom education	.17*	.17*	.02	-.08	-.36***								
7. Mom Part time	.07	-.04	-.05	-.07	-.05	-.02							
8. Mom Full time	.03	-.01	-.01	.12	.02	.12	-.37***						
9. Married	-.13	-.02	-.03	-.17*	.03	-.02	-.01	-.22**					
10. Single	.04	-.05	.06	.16	.04	-.04	-.02	.17	-.74***				
11. Divorced	.15	.09	-.03	-.02	-.10	.09	.04	.11	-.50***	-.22**			
12. Mobility	.05	.00	-.13	-.09	-.03	.28***	-.01	.11	.05	-.02	-.04		
13. Breastfeeding	.18*	.23*	.07	.10	.02	.06	.13	-.02	.11	-.02	-.07	-.02	
14. Sleep Duration	.06	.01	-.07	.04	.05	.13	.08	-.01	.06	-.05	-.02	.07	.10

Note. * indicates $p < .05$, ** indicates $p < .001$, *** indicates $p < .000$

Table 5
Family Characteristics by Breastfeeding Status

	Breastfeeding = Yes <i>n; M (SD)</i>	Breastfeeding = No <i>n; M (SD)</i>	Breastfeeding Missing <i>n; M (SD)</i>
Mom Education	107; 12.31 (2.59)	18; 11.89 (1.60)	34; 12.03 (3.29)
Part Time	26	2	6
Full Time	35	7	12
Single	27	7	6
Married	69	10	20
Divorced	10	3	8
Mobility	107; 1.56 (1.45)	20; 1.65 (1.66)	34; 1.71 (1.78)
Sleep Duration	107; 9.44 (1.30)	19; 9.58 (1.22)	2; 11 (1.41)

Table 6

Multiple Regression models assessing the association between family factors and self-regulation.

	Model 1			Model 2			Model 3			Model 4		
	<i>n</i> = 240			<i>n</i> = 240			<i>n</i> = 240			<i>n</i> = 240		
HTKS-R	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE(B)</i>	β
Age (years)	30.92**	6.84	.07**	31.09**	6.73	.29**	30.95**	6.75	.29**	30.82**	7.04	.29**
Male	-1.37	3.74	-.02	-1.46	3.99	-.02	-1.59	3.98	-.02	-2.10	3.80	-.03
Spanish	-27.22**	9.32	-.21**	-22.73*	9.87	-.18*	-21.53*	9.98	-.17*	-24.09**	9.23	-.19*
Mom Education				1.04	.90	.09	1.15	.87	.09	.65	.93	.05
Mom Part time				7.40	6.28	.09	6.97	6.39	.09	4.39	6.14	.06
Mom Full Time				10.81	5.80	.03	-.19	5.34	-.00	-1.39	5.30	-.02
Married							-6.82	4.92	-.10	-8.65	4.62	-.13
Mobility										1.39	2.08	.06
Breastfeeding										15.76*	8.06	.17*
Sleep										2.55	2.18	.10

Note. * indicates $p < .05$, ** indicates $p < .01$

Table 7

Multiple Regression models assessing the association between family factors and early literacy.

WJLW	Model 1 <i>n</i> = 243			Model 2 <i>n</i> = 242			Model 3 <i>n</i> = 243			Model 4 <i>n</i> = 243		
	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE(B)</i>	β
Age (years)	19.27*	5.33	.21	18.60*	5.32	.20*	18.38*	5.40	.20	15.67*	6.17	.17*
Male	-1.58	3.93	-.03	-1.60	4.06	-.03	-1.51	4.25	-.03	-3.62	4.05	-.06
Spanish	-13.81	10.26	-.12	-11.17	9.60	-.10	-11.05	9.66	-.10	-12.74	7.79	-.11
Mom Education				.71	1.23	.07	.74	1.23	.07	.34	1.22	-.03
Mom Part time				-4.89	6.37	-.07	-4.60	6.28	-.07	-7.91	5.57	-.11
Mom Full Time				-2.93	6.58	-.05	-2.44	6.53	-.04	-3.23	6.49	-.05
Married							.45	5.47	.01	-2.36	5.04	-.04
Mobility										.51	2.24	.03
Breastfeeding										23.94**	8.24	.31**
Sleep										1.29	1.99	.06

Note. * indicates $p < .05$, ** indicates $p < .001$

Figure 1

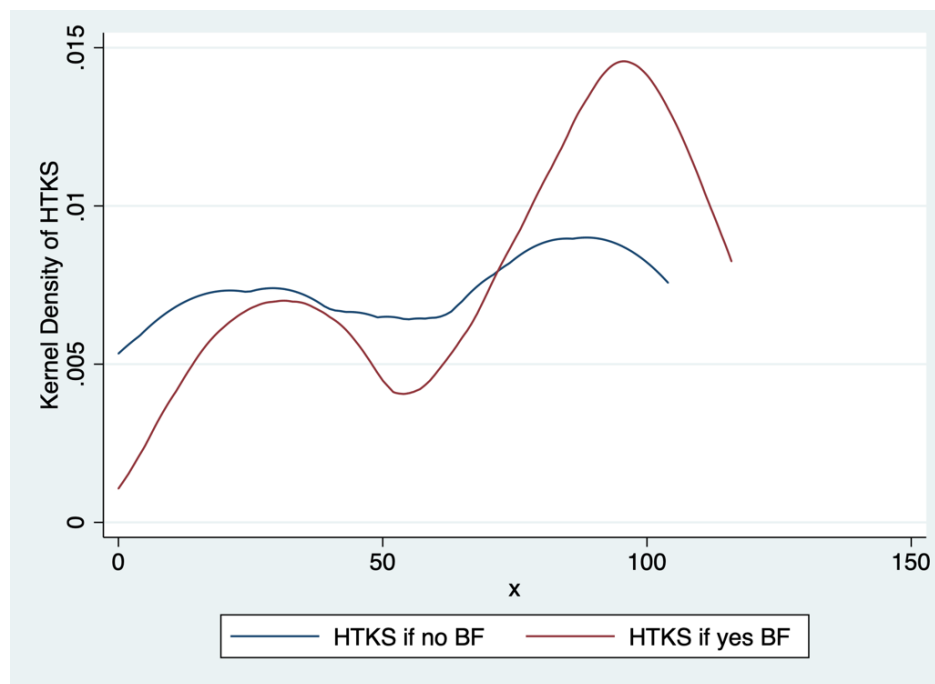
Kernel Density Plot of Self-Regulation Scores by Breastfeeding Exposure

Figure 2

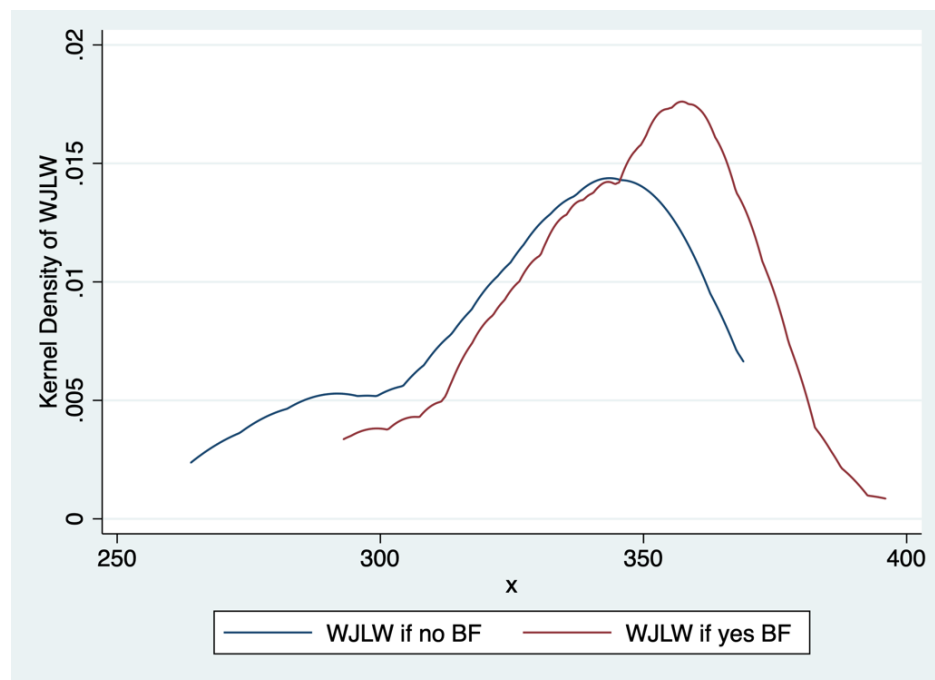
Kernel Density Plot of Self-Regulation Scores by Breastfeeding Exposure

Table 8
Quantile Regression Results Assessing Breastfeeding and Self-Regulation (N = 120)

	10 th quant.	25 th quant.	50 th quant.	75 th quant.	90 th quant.
HTKS-R	<i>B(SE)</i>	<i>B(SE)</i>	<i>B(SE)</i>	<i>B(SE)</i>	<i>B(SE)</i>
Breastfeeding	12 (10.48)	16 (14.30)	20 (21.64)	12 (9.64)	9 (6.37)

Note. * $p < .05$, ** $p < .001$, *** $p < .0001$

Table 9
Quantile Regression Results Assessing Breastfeeding and Early Literacy (N = 120)

	10 th quant.	25 th quant.	50 th quant.	75 th quant.	90 th quant.
WJLW	<i>B(SE)</i>	<i>B(SE)</i>	<i>B(SE)</i>	<i>B(SE)</i>	<i>B(SE)</i>
Breastfeeding Only	31 (16.05) ^t	17 (28.77)	13 (7.51)	15 (5.59)**	10 (6.66)

Note. * $p < .05$, ** $p < .001$, *** $p < .0001$, ^t $p > .06$

DEDICATION

This thesis manuscript is dedicated to the children and families who participated in this research project. Thank you for your dedication to improving the lives of children and families everywhere.