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YOUNG CHILDREN'S NUTRITION, GROWTH, AND COGNITIVE
DEVELOPMENT IN THE ECUADORIAN AMAZON

by

Kristin N. Murphy

A dissertation submitted in partial fulfillment
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Human Development and Family Studies

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2023

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ABSTRACT

Young Children's Nutrition, Growth, and Cognitive Development in the Ecuadorian

Amazon

by

Kristin N. Murphy, Doctor of Philosophy

Utah State University, 2023

Major Professor: Dr. Lisa K. Boyce
Department: Human Development and Family Studies

Many young children from Ecuador suffer from high rates of malnutrition and stunting that affects their long-term growth and development (World Bank, 2011; Keeley et al, 2019). Children from the Amazon region experience some of the highest rates of stunting (height-for-age) within Ecuador with 40% of boys and 34% of girls stunted (Houck et al., 2013). This dissertation aims to describe the nutritional patterns, parental engagement with children, growth status, and cognitive development of rural living children in the Amazon region of Ecuador using a mixed methods approach. Fifty children and their mothers were interviewed, completed several quantitative questionnaires, and participated in a development assessment.

Several overall dietary patterns were found. Almost all children were breastfed, there was a lack of routines surrounding dietary habits and meals, and Chicha (a traditional drink primarily made by fermenting yucca or cassava) was given to almost all children and often used as a meal supplement when food was not available. Three themes

emerged from qualitative interviews related to strengths parents have in feeding their children healthy diets; knowledge, autonomous and independent children, and supportive and responsive parenting. Five themes were found related to barriers parents have in feeding their children healthy diets. The first four themes related to barriers (lack of knowledge of healthy foods, lack of access to healthy foods, not enough money, and child's health) all related to or perpetuated the cycle of poverty families live in. These all influenced the last theme found, how difficult of an eater the child was. Strengths and barriers related to each theme are discussed. Children from this sample experienced high levels of stunted growth and cognitive delays (32% and 74%, respectively). Overall, my quantitative findings indicate that basic causes are impacting children's growth and development above and beyond underlying causes and immediate causes. With the exception of child gender, the only variables statistically significantly related to children's stunting levels or cognitive development were maternal education and domestic violence, both of which are part of the basic causes of child undernutrition. When considering results from both the qualitative and quantitative studies, the importance of maternal education on child development is emphasized.

(117 pages)

PUBLIC ABSTRACT

Young Children's Nutrition, Growth, and Cognitive Development in the Ecuadorian
Amazon

Kristin N. Murphy

The first few years of life are viewed as a critical period for development. Children who do not grow and develop well in these early years can experience life-long negative implications. Many children under the age of five in Ecuador suffer from high rates of malnutrition, stunting (low height-for-age), and delayed cognitive development. This dissertation aims to better understand why children from Ecuador, specifically from the Amazon region, are experiencing such high rates of delayed development. Fifty children and their mothers living in the Amazon region of Ecuador participated in this research study.

First, interviews were conducted by an Ecuadorian member of the research team with mothers to better understand the types of diets they feed their children, as well as any strengths and barriers they face in feeding their children a healthy diet. Parents discussed how almost every child was breastfed for at least six months, a practice that is known to help reduce the risk of developmental delays in children. Mothers did not follow any routines when feeding their children. For example, they did not eat a certain number of meals per day or at a certain time of the day. Strengths parents talked about included knowing what should be included in a healthy diet, having children who were independent and could eat on their own, and being supportive and responsive to their children's needs. Parents also discussed how they lacked knowledge of what foods they should be feeding their child, they did not always have access to healthy foods to feed their child, they did not have enough money to always feed their child a diverse diet, and that their child sometimes had illnesses or health issues that made it difficult for them to eat a diverse and healthy diet. All of these were related to the poverty these families experience, which in turn impacted how difficult of an eater their child was.

Next, I found a very high rate (32%) of children were stunted in growth, meaning that they were shorter than expected for their age. These children also had low levels of cognitive development. In fact, 74% had a cognitive delay, indicating that they could not understand, process information, and problem solve to the level that is expected of a child their age. Child gender, maternal education, and domestic violence were related to children's physical growth (their stunting levels) and/or cognitive development. Female children had better growth than male children, and children whose mother reported lower levels of domestic violence also had better growth. Lastly, children whose mother had completed higher levels of education had higher levels of cognitive development. When thinking about the interviews with mothers and the results from questionnaires they completed, improving maternal education seems to be one of the most impactful and best ways to help improve these children's physical growth and development so they can grow to their full potential.

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Lastly, to all my family and friends that have supported me in a wide variety of ways. Your support and help are what kept me going when I wanted to quit. Specifically, my parents, sister, and entire Murphy family for always listening to me talk about my dissertation even though you are probably not that interested. My boyfriend, Michael Davie, for being the most positive support as I worked to finish my dissertation, and helping me acknowledge and celebrate every step of progress I made along the way. And Madison Parks, the friend I do not get to see often but was more than willing to help a girl out when I needed help with Spanish.

Kristin N. Murphy

CONTENTS

	Page
ABSTRACT.....	iii
ACKNOWLEDGMENTS	vii
CONTENTS.....	viii
LIST OF TABLES	xi
LIST OF FIGURES	xii
CHAPTER I: INTRODUCTION.....	1
Sustainable Development Goals	3
Theoretical Framework	4
Conceptual Model.....	5
Current Study	7
CHAPTER II: Dietary Patterns of Children from the Amazon Region of Ecuador: A	
Descriptive, Qualitative Investigation.....	12
Theoretical Framework.....	14
Conceptual Framework.....	14
Dietary Diversity.....	18
Amazon Region of Ecuador.....	19
Family Practices.....	20
Current Study	23
Methods	24
Participants.....	24
Measures	25
Procedures.....	28
Analytic Plan.....	29
Results.....	32

What are the dietary patterns of children from the Amazon region in Ecuador?.....	32
What strengths do parents from the Amazon region in Ecuador already have or engage in pertaining to feeding their children healthy diets?.....	36
What barriers do parents from the Amazon region in Ecuador face in feeding their children healthy diets?	38
Discussion and Limitations.....	41
Dietary Patterns and Routines.....	41
Strengths and Barriers.....	45
Implications and Future Directions.....	49
CHAPTER III: Physical Growth and Cognitive Development in Children from the Amazon	
Region of Ecuador	59
Conceptual Framework.....	60
Developmental Indicators	61
Developmental Delays	62
Factors Related to Children’s Growth and Cognitive Development	63
Current Study.....	68
Methods	70
Participants.....	70
Measures	70
Methods	73
Analytic Plan.....	74
Results.....	75
Descriptive Statistics.....	75
Research Question One.....	76
Research Question Two	78
Research Question Three	80

Discussion..... 81

 Child Stunting 82

 Child Cognitive Development 84

 Limitations and Future Directions 88

 Conclusion 89

CHAPTER IV: DISCUSSION 98

 Children’s Dietary Habits 99

 Children’s Stunting and Cognitive Development 101

 Conclusion 102

 Curriculum Vitae 106

LIST OF TABLES

Page	
	Table 2.1 Summary of interview questions used to answer each research question..... 29
	Table 3.1 Descriptive statistics of study variables. 77
	Table 3.2 Correlations between study variables. 78
	Table 3.3 Summary of regression analysis predicting child stunting levels. 80
	Table 3.4 Summary of regression analysis predicting child cognitive development. 81

LIST OF FIGURES

Page	
	Figure 1.1 Conceptual framework of the determinants of child undernutrition that will be used to guide this research (UNICEF, 2015). 6
	Figure 2.1 Conceptual framework of the determinants of child undernutrition used to guide this study. (UNICEF, 2015).16
	Figure 2.2 Data analysis process for research question one.31
	Figure 2.3 Barriers parents face in feeding their children a healthy diet.39
	Figure 3.1 Multifactorial causes and consequences of child malnutrition in the Ecuadorian Amazon.....61
	Figure 4.1 UNICEF's framework adapted to fit this dissertation. 103

CHAPTER I

INTRODUCTION

Young children in Ecuador suffer from high rates of malnourishment (imbalances in energy and nutrient intake), stunting (i.e., low height-for-age), and developmental delays (World Bank, 2011). Undernutrition, one type of malnourishment, occurs when children do not get enough energy and nutrients in their diets and chronic, or recurring undernutrition results in stunting (WHO, 2011). Experiencing undernutrition and low levels of stimulation in early childhood permanently affects children's growth and development (Keeley et al., 2019) and puts them at higher risk for morbidity and mortality (Prendergast & Humphrey, 2014).

Undernourishment is associated with poor child developmental outcomes in the areas of physical, cognitive, social-emotional, and language development across a variety of low- and middle-income countries (Miller et al., 2016; Yousafzai et al., 2013). Children who are undernourished in the first few years of life are at a particularly increased risk for impaired growth and development (Handal et al., 2007; Grantham-McGregor, et al., 2007; Leonard et al., 2000). In urban areas of Ecuador, 20% of children under 5 years old are stunted (low height-for-age) and 8.4% of children under 5 years old are underweight (low weight-for-age). In rural areas of Ecuador children under 5 fare even worse with 40.0% of children under 5 stunted and 13.2% of children under 5 underweight (Walker et al., 2007). Parents, media, and educational and childcare facilities are all part of the culture surrounding children and have all been shown to greatly influence children's diets (Hart et al., 2015; Dixon et al., 2007), which in turn influence children's physical growth and cognitive development.

More specifically, among families in the Ecuadorian Amazon, a high rate of both boys and girls are stunted, with 40% and 34% stunted, respectively (Houck et al., 2013). Often times

the malnourishment and lack of access to clean drinking water that children in low- and middle-income countries experience also puts them at higher risk for disease such as worms and respiratory infection (Gendrel, et al., 2003; Radlovic, et al., 2016; Raza, et al., 2019). Diarrhea has been shown to be a good indicator of such health concerns in previous research as they lead to diarrhea which then makes children lose the nutrients they have consumed, resulting in malnutrition and stunting (Arini et al., 2020; Lutter et al., 1989; Rouhani et al., 2019). The problem is exacerbated further by the intergenerational transmission of stunting and the resulting developmental complications. Mothers who are malnourished and stunted as children have shorter statures as adults and are likely to have children with low birth weights which puts them at a higher risk for stunted growth (Prendergast & Humphrey, 2014). Latin American countries, including Ecuador, can focus on improving children's nutritional patterns and providing resources to families in the Amazon region to stop the intergenerational transmission of poor development.

These high rates of malnourishment and subsequent stunting that are seen in the Amazon region of Ecuador, are often used as an indicator of cognitive development, and should be addressed early in life. The first few years of life are viewed as a critical period for lifelong healthy development (Bornstein, et al., 2012; Keeley et al., 2019). What happens in the first 1000 days of life has implications for children's learning potential and productivity in adulthood. These concerning statistics regarding young children in Ecuador have not gone unnoticed. The Ecuadorian federal government has acknowledged these high rates of malnourishment, stunting, and poor development. One way they have tried to address this issue is by implementing the *Bono de Desarrollo Humano* (BDH) cash transfer program. This program is like several others in a variety of low- and middle-income countries. It offers cash incentives to families to

encourage the children's school enrollment and attendance, instead of keeping children home from school to work and earn income for the family. When children attend school, they have better cognitive development, are fed nutrient dense meals that help prevent malnourishment and stunting, and have lower rates of disease and mortality (Moncayo, et al., 2019; Schady et al., 2008). However, such programs have varied success around the world, and some researchers have shown that the BDH program does not have a significant impact on children's cognitive development, measured by academic test scores (Ponce & Bedi, 2010). A better understanding of children's current dietary patterns, what parents know about their children's growth and development, what parents believe will help their children's growth and development, and what specific nutrition and parent related factors are impacting the growth and development of young children in the Amazon region is needed to help inform future research, interventions, and government programs and policies.

Sustainable Development Goals

Internationally, the issue of early childhood nutrition and development has been addressed and made a primary concern by the United Nations. In 2015, the United Nations developed seventeen Sustainable Development Goals (SDGs) that stemmed from the efforts made on the Millennium Development Goals over the previous fifteen years (United Nations, 2015). The papers included in this dissertation focus on learning more about and adding information to the general literature on SDG goal two, specifically about rural living families in the Amazon region of Ecuador. The overall goal of SDG two is to end hunger, achieve food security and improve nutrition and promote sustainable agriculture. Specific objectives in SDG two that the papers in this dissertation will contribute knowledge to include ending malnutrition,

achieving specific international targets on stunting and wasting by 2025 in children under five years of age.

Theoretical Framework

It has been previously shown that varying aspects of the environment influence child development; Bronfenbrenner's bio-ecological theory provides an appropriate lens for this study (Bronfenbrenner & Morris, 2006). This theory can be explained through the Process-Person-Context-Time (PPCT) model. Process refers to the proximal processes that an individual experience on a daily basis. These are the interactions that occur in an individual's immediate environment, and they occur in an exceedingly complex process. The person, context, and time, the rest of Bronfenbrenner's PPCT model, refer to aspects or characteristics that influence these proximal processes. This study focuses on the context aspect of the theory, which helped guide the development of the conceptual model that will be discussed later. Context refers to the different systems that make up an individual's environment. The microsystem represents what immediately effects the individual (e.g., school, home, family). The mesosystem is how different microsystems interact (e.g., when a parent participates at school). The exosystem represents things that are not in the individuals' immediate environment but still influence them (e.g., father's work, parental education). Lastly, the macrosystem is the broader culture and society that influences the individual (e.g., policy, individualistic culture vs collective culture, urban vs rural living). Time, also termed the chronosystem is the historical time that influences how an individual develops (e.g., urbanization). This lens brings attention to the child's characteristics (level of malnutrition, gender, age, etc.), as well as characteristics of the family, home environment, cultural beliefs and practices, and historical timing that may influence the child's development in Ecuador. Gaining a better understanding of which aspects influence development

for this group of children will add to the present understanding of the relation among diet and child development.

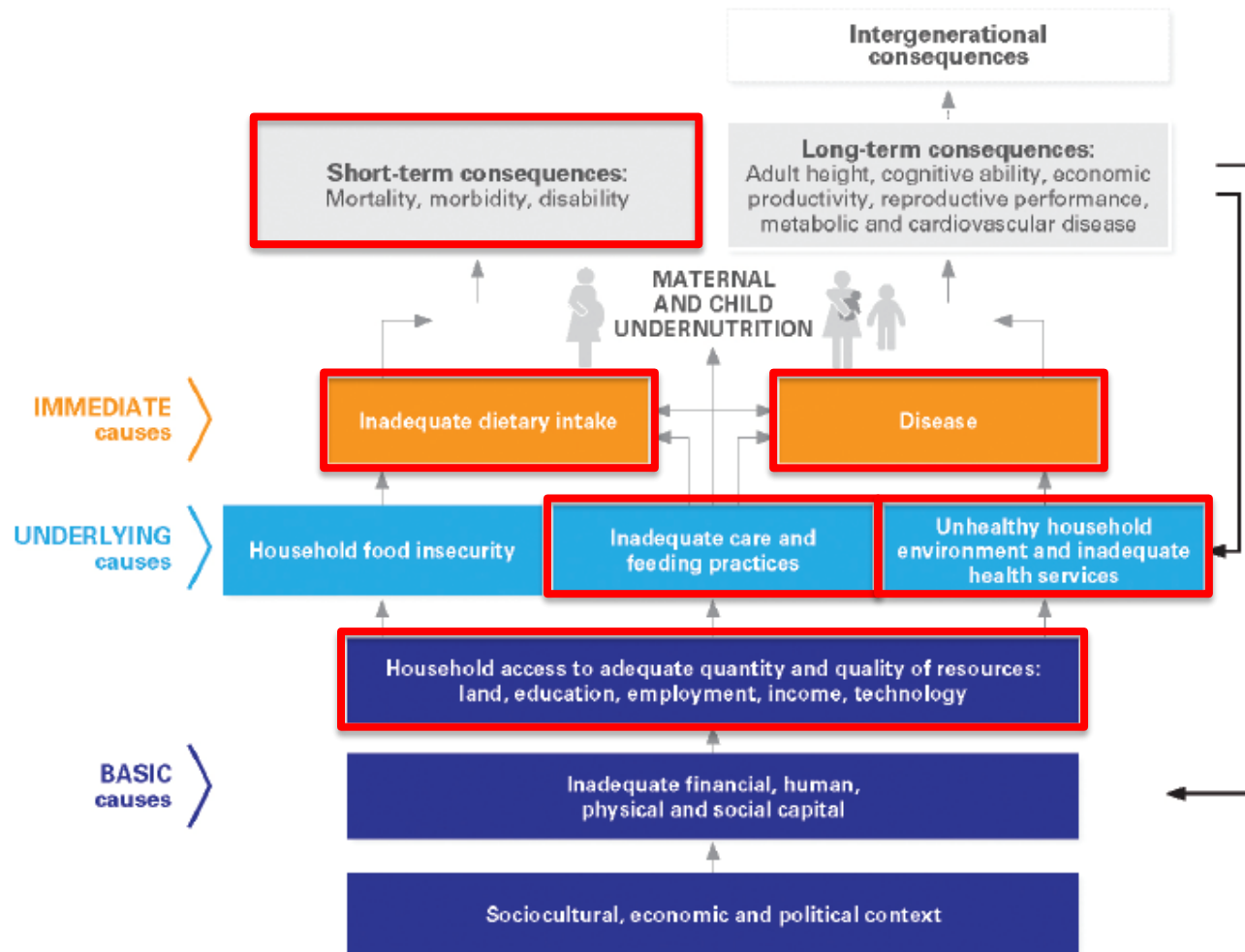
Conceptual Model

The United Nations Children's Fund (UNICEF) first developed a conceptual framework of child undernutrition in 1990. Prior to this framework, the broad and multifactorial determinants that cause malnutrition and help explain the short- and long-term outcomes from undernutrition were somewhat unclear. UNICEF has since updated this framework, as shown in Figure 1.1, integrating new knowledge and evidence on the underlying causes, consequences, and impacts of undernutrition (UNICEF, 2015). Included in this model are immediate, underlying, and basic causes of malnutrition. Immediate causes include children's inadequate dietary intake that would be considered part of children's microsystem. Moving down the model are broader and less direct causes of malnutrition that could be put in the remaining systems described by Bronfenbrenner. Underlying causes include those in the mesosystem, and basic causes include those in the exosystem and macrosystem.

Figure 1.1

Conceptual framework of the determinants of child undernutrition that will be used to guide this research (UNICEF, 2015).

UNICEF CONCEPTUAL FRAMEWORK OF THE DETERMINANTS OF CHILD UNDERNUTRITION



In developing this framework, UNICEF researchers chose to include generalized variables so that it could be used to inform children's development in a wide variety of settings and from all around the world (Keeley et al., 2019). This dissertation examines UNICEF's conceptual framework of the determinants of child undernutrition with a sample of young children from the Ecuadorian Amazon. Due to the limited scope of this study, I will focus on factors that may be influencing Ecuadorian children's nutritional patterns, growth status, and cognitive development. Areas of the framework that will be addressed in this study are outlined in red in Figure 1.1. This broad framework was used to guide the research questions and data collection for both studies in this dissertation. Specifically, it informed the interview questions and methodology of study one, and the outcomes and variables included in analyses of study two. The use of this model is presented in the following chapters. In this conceptual model the basic causes represent factors associated with both the macrosystem and chronosystem. I focus on the more immediate causes of children's growth and development. As you move up the model potential factors associated with the microsystem, mesosystem, and exosystem are considered, including common caregiving practices, maternal mental health, and household income. All these factors may be influencing children's actual nutritional intake (microsystem), which in turn is influencing children's nutritional and growth status, and their cognitive development.

Current Study

The overall goal of the present multiple paper dissertation is to describe the nutritional patterns, parental engagement with children, growth status, and cognitive development of rural living children in the Amazon region of Ecuador. The following papers first describe the diets of these young children, what strengths parents currently have, and what barriers parents face in feeding their children healthy diets. I then examine what factors are associated with and may be

impacting children's physical growth and cognitive development within families that live in this region. To achieve this, the set of studies utilized both qualitative and quantitative methods, driven by Bronfenbrenner's bioecological theory and UNICEF's conceptual framework of child undernutrition. Study one utilized a qualitative approach to describe the food selection and dietary diversity, as well as what factors parents report as having an influence on their children's diets. This paper examined factors that may contribute to this, specifically with rural living families in the Ecuadorian Amazon. The results will help inform future interventions and policies aimed at decreasing malnourishment and stunting rates in this area. Study two utilized quantitative data to describe children's growth status (i.e., stunting levels) and cognitive development, and explore the relationship between these two child outcomes and factors that may be influencing them such as dietary diversity, parental caregiving practices, socioeconomic status, parental mental health, income, and education. I used the findings from study one and previous literature as a basis for including certain variables in the quantitative analyses. I also used the factors parents describe in paper one and the subsequent model that was derived to interpret the results of study two.

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CHAPTER II

DIETARY PATTERNS OF CHILDREN FROM THE AMAZON REGION OF ECUADOR: A DESCRIPTIVE, QUALITATIVE INVESTIGATION

Children in Ecuador suffer from high rates of undernourishment (one type of malnourishment, when children do not get enough energy and nutrients in their daily diets) and stunted growth (low height-for-age) (World Bank, 2011). In fact, Ecuador has one of the highest rates of undernourishment in Latin America with 4.8 million and 24% of children under the age of five stunted in growth (Keeley et al., 2019). More specifically, differences in growth between the poorest and richest children in Ecuador are apparent. Of the richest 20%, 14% of children under the age of five are stunted and that number jumps to 37% amongst the poorest 20% of children (Keeley et al., 2019). When children experience chronic or reoccurring undernourishment early in life, their bodies do not have enough nutrients to grow to their full potential, resulting in stunting (WHO, 2011). As such, stunting is often used as an indicator of undernourishment in the literature and these poor health indicators have been shown to have negative implications on children's development, individual productivity, and community and national productivity in adulthood in a variety of Latin American countries and on a worldwide scale (Hoddinott et al., 2008; Miller et al., 2016; UNICEF, 2008; Yousafzai et al., 2013).

Beyond the high rates of undernourishment and stunting that have been observed in the past in Ecuador, the country is currently undergoing a transition to a more urbanized society, and this transition puts Indigenous and rural-living people at an even higher risk for undernourishment and poverty (Freire et al., 2014; Liebert et al., 2013; World Bank, 2011). This relationship between urbanization and malnourishment was predicted over twenty years ago by Barry Popkin (1998) who found increases in overweight and obesity at the beginning of world

urbanization across low- and middle-income countries (LMICs). When children experience malnourishment early in life, their bodies learn to conserve fat and energy more than those who do not experience malnourishment early in life (Popkin et al., 1996; Walker et al., 2007). Since more westernized diets are characterized by higher levels of processed carbs and fat, children who experience malnourishment and then switch to a more westernized diet are at a higher risk of having growth problems like overweight and stunting (Popkin, et al., 1996; Popkin, et al., 2001). Part of this urbanization process that is influencing Ecuadorian children's growth and development is market integration. Traditionally, Indigenous groups have been self-sustaining and have not participated in the market. Some examples of market integration include selling agricultural products or animals and wage labor outside of the local community. Houck and colleagues (2013) found that amongst different communities of the same Indigenous group, those who live farther away from main roads had less market integration and higher rates of stunting and malnourishment. However, when examining differences between Indigenous groups, they found that for some groups, traditional diets and less market integration was associated with lower rates of stunting and malnourishment. Ecuador has three national languages, many additional Indigenous languages spoken, and 14 different nationalities. There are also 24 different provinces that fit into four ecological regions: the mountains or highlands, the coast, the Amazon jungle, and the Galapagos Islands. The complicated and inconsistent relationships among market integration, diet, and child development that previous researchers have described is likely due to the cultural and ecological diversity within the country. What works for one group of people in one part of Ecuador may not work for another group or in another part of the country.

Over one million people of Ecuador's 17 million population are Indigenous and almost

one quarter of those Indigenous populations live in the rural Amazon area (IWGIA, 2019). The urbanization of these populations may be impacting their diets, as their access to foods is likely changing. Moreover, children in Ecuador who are stunted have decreased human capital and are less likely to develop to their full potential (Undurraga et al., 2018). Understanding what children from the Ecuadorian Amazon eat and the influences on their dietary patterns will help us understand what may be impacting their physical growth.

Theoretical Framework

Bronfenbrenner's bioecological theory, specifically the Process-Person-Context-Time (PPCT) model, posits that the interaction between processes and individual factors drives development in a variety of contexts and across time (Bronfenbrenner & Morris, 2006). This study focuses on the context under which an individual experiences these proximal processes surrounding food and nutrition. Bronfenbrenner describes the context in exceedingly distant systems that make up an individual's environment. The microsystem includes those that make up an individual's direct environment. The mesosystem describes how different microsystems interact. Factors that are not in the individuals' immediate environment but are still an influence, such as parents' work, make up the exosystem. The macrosystem includes broader cultural and societal influences, and the chronosystem considers the historical time that influences how an individual develops. This framework brings attention to a variety of different factors, from the child's characteristics such as gender and level of malnutrition, to the home environment, and familial and cultural practices surrounding nutrition and development.

Conceptual Framework

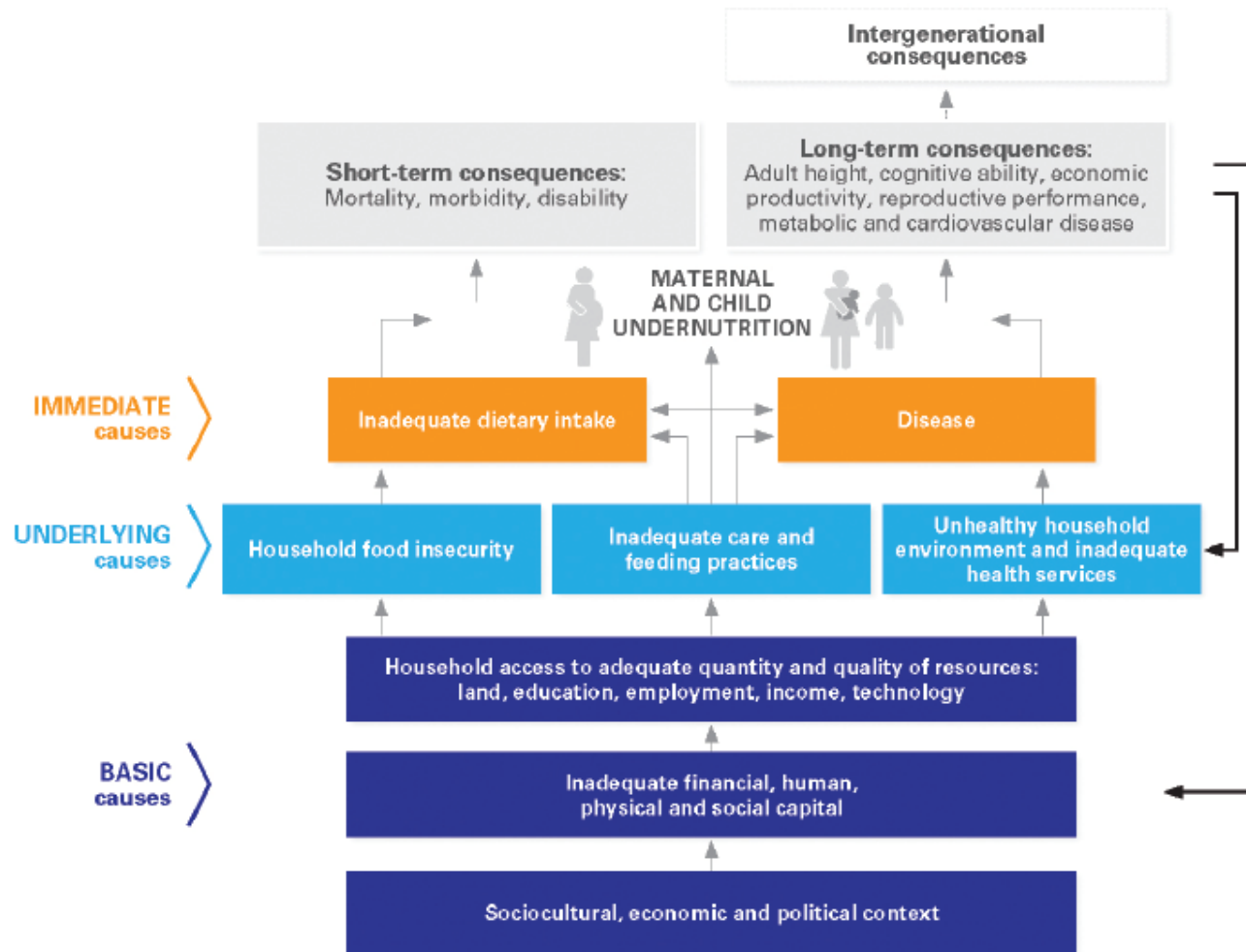
The United Nations Children's Fund (UNICEF) developed a conceptual framework of child undernutrition to explain the broad and multifaceted causes, consequences, and impacts of

childhood undernutrition (UNICEF, 2015; see Figure 2.1). This model includes immediate, underlying, and basic causes of malnutrition that correspond with Bronfenbrenner's contextual systems. In developing this model, UNICEF aimed to include all the broad, multifactorial causes as well as short- and long-term impacts of child undernutrition that apply to children from all around the world.

Figure 2.1

Conceptual framework of the determinants of child undernutrition used to guide this study. (UNICEF, 2015).

UNICEF CONCEPTUAL FRAMEWORK OF THE DETERMINANTS OF CHILD UNDERNUTRITION



This study used UNICEF's conceptual model as a guide to describe and understand the potential factors that may be influencing children's nutritional intake, growth status, and cognitive development in the Ecuadorian Amazon region. Since we did not know how this model functions with families from this area, more detailed qualitative data will help to guide future research and intervention efforts, helping focus these efforts more narrowly on the parts of the framework that may be more strongly impacting this specific population. Indeed, there are many different influences and factors that interact to result in the diet an individual child receives, and these can vary greatly depending on the environment. For example, a child repeatedly interacts with food daily and if their diet does not consist of healthy, nutrient dense foods (i.e., immediate cause of undernutrition) the child will be at risk for growth and developmental delays. However, young children do not often choose what they are going to eat, rather their parents select what foods to grow, purchase, and offer in the home environment based on their access to food (i.e., microsystem, underlying causes) and those decisions are often influenced by the parents' education and income levels (i.e., exosystem, basic causes), where they live, and cultural caregiving practices and beliefs (i.e., macrosystem, basic causes). Although this UNICEF model includes many factors that have potential to influence these children's development, it is beyond the scope of this study to examine them all. Instead, this study focuses on describing the nutrition of and caregiving practices surrounding food that impact Ecuadorian children's rates of stunting (i.e., portions of the microsystem and macrosystem, immediate, underlying, and basic causes). Using both Bronfenbrenner's bioecological theory and UNICEF's conceptual framework of child undernutrition as guides, interview questions were developed that will help to gain a deeper understanding of which parts of the model are applicable to these families.

Dietary Diversity

Researchers have shown that the first 1000 days of life, from the time of conception to the child's 2nd birthday is a critical period for children's development (de Onis & Branca, 2016; Keeley et al., 2019). Although it is possible to make up some developmental losses that originated in a child's early life (Prentice, et al., 2013), it is better to avoid those losses whenever possible in the first 1000 days of life. Some researchers disagree on what it is about nutrition and diet specifically that influences stunting and development in young children. First, researchers have found that micronutrient consumption such as B12, iron, iodine, folate, and calcium during prenatal development (via the mother's consumption) and the first few years of life act as a protective factor for children's healthy physical growth and cognitive development in low- and middle-income countries all around the world (Black et al., 2008; Darnton-Hill & Mkpuru, 2015). Fewer studies examine macronutrient intake but several researchers report it is actually macronutrient consumption which most commonly comes from animal sourced foods (e.g., milk, meat, eggs, fish) that are protective factors against stunting and developmental delay (Dewey, 2016; Headey et al., 2018). A meta-analysis suggests that single micronutrient interventions have no or very small effects on children's physical growth (Ramakrishnan et al., 2009). Furthermore, researchers working in Ecuador have found that it is a combination of micro and macronutrients that act as a protective factor (Roche et al., 2017), and it may be that children need a certain amount of diet diversity to get this combination of micro and macronutrients to protect against stunting (Motbainor et al., 2015; WHO, 2006).

Dietary diversity refers to the number of food groups an individual consumes in a day. Eating a variety of foods from a variety of food groups increases the amount and variety of nutrients a child receives and protects against stunting. Stunting during early childhood has long

term negative impacts on children's development resulting in increased morbidity and mortality, and lower levels of neurodevelopment, physical development, and a loss of developmental potential (McDonald et al., 2013; Prendergast & Humphrey, 2014). According to UNICEF (2019) 2 in 5 children aged 6 to 23 months in Latin America do not eat the suggested minimum dietary diversity, 30% are nutrient deficient in the essential nutrients typically consumed through animal sourced foods, and 20% do not eat any fruits or vegetables. Furthermore, Ecuador has the second highest rate of childhood stunting, wasting, and overweight in Latin America, trailing only Guatemala (Keeley et al., 2019). Increasing the amount of diet diversity young children receive in this country may decrease the high rate of stunting they are experiencing. However, given the great ecological and cultural diversity in Ecuador it is also important to understand the macrosystem and underlying and basic causes of undernutrition by region before trying to create and implement an intervention aimed at helping reduce stunting.

Amazon Region of Ecuador

The Amazon region includes eight different countries in South America. Ecuador contains only about 2% of the entire Amazon basin, however, this 2% makes up almost 35% of the total land and 80% of forested land in Ecuador. This region covers the most eastern, inland section of the country. Participants for this study are from one of six Ecuadorian Amazon provinces, Sucumbíos. Sucumbíos is in the far northeast corner of Ecuador and has a total population of 176,000 people, the majority of which live in rural communities. Specifically, participants live in the area of Limoncocha, about a two-hour drive from the city center of Sucumbíos and most well-known for its National Biological Reserve and oil field. A large portion of those who live in this area belong to the Indigenous Kichwa group. The Kichwa are believed to be ancestors of the Quijos and were first found in the 1400s. They have a deep

connection to Mother Earth and believe that there will be abundance in the Amazon when they have a good relationship with the land and its spirits. Since the early 1990's the Kichwa people have fought for their rights, land, and way of living within the country, however over time the government has granted foreign companies access to the Amazon. Most notably, the amount of oil drilling and extraction has continued to grow in this region of Ecuador. Urbanization impacted families when oil was discovered in the region, oil companies began to build roads to access the oil, and then migrants began settling there (Bilsborrow et al., 2004). Kichwa families from the Andes in Ecuador have expressed concerns about decreasing nutrition quality as urbanization occurs, more families shift away from their traditions and customs and toward more westernized employment and way of life, resulting in increased intake of fast food, poor meal timing, and a children's rejection of traditional foods (Chee, et al., 2019). On average, families in the northern Amazon have daily household incomes that fall significantly below the poverty line (US \$0.72 compared to the poverty line of \$1.25) and the heads of households have only six years of formal education on average (Torres et al., 2018). The low levels of education in the Amazon make it difficult for individuals in the Amazon to overcome barriers of market-integration they face even though higher market-integration has been shown to result in higher wages (Perez et al., 2015; Vasco et al., 2017). In fact, for every one year of additional formal education, annual income increased by US \$17 (Torres et al., 2018). That would mean an annual difference of over \$100 between a head of household with the average 6 years of education and a head of household who graduated high school. With an average income of just \$1524, that is an increase of almost 7%.

Family Practices

Although the nutritional intake of young children in Ecuador directly influences their

physical growth and development, integrated efforts targeting multiple aspects of children's environments are more effective and sustainable and can help children reach their full developmental potential (Britto et al., 2017; Engle et al., 2007; Yousafzai & Aboud, 2014; Yousafzai et al., 2018). In the State of the World's Children 2019 publication, UNICEF stated that "supportive systems" need to be utilized and coordinated with nutritional intervention approaches to help children reach their full developmental potential (Keeley et al., 2019).

One specific aspect of children's environments that impacts their growth and development is the cultural beliefs and familial practices surrounding food. These beliefs and practices can include important cultural foods families feed their children, how parents prepare and cook food for their children, and routines families have surrounding food and mealtimes (Fiese et al., 2012; Penafiel et al., 2016). Indeed, traditional foods and practices in Latin America, including lower levels of market integration, can be beneficial for children's development because they are often nutrient dense and unprocessed, such as fruits, vegetables, and animal sourced foods like meat and eggs (de Jesus Silva et al., 2017; Roche et al., 2007). However traditional foods are not always nutritious or unprocessed. Of particular concern in Latin America is a fermented drink called Chicha. Chicha is a traditional drink consumed in many rural parts of Latin America that may create a risk for children's development due to its alcohol content (Ramirez-Ubillus et al., 2017). Some researchers have found that market integration has resulted in Ecuadorian families relying more on low nutrient dense, high caloric foods that do not provide children with enough dietary diversity but are commonly found in stores (Houck et al., 2013; World Bank, 2011). However, it is unknown how Ecuador's urbanization is impacting the families living in the Amazon region because families often don't have easy access to stores and markets. It may be that parents do not have enough knowledge

about healthy diets and how to provide healthy diets, or enough consistent income to provide healthy diets for their children due to the general low levels of education that is common amongst families in the Amazon (Canelas & Salazar, 2014; Canelas, 2019). Ramirez-Luzuriaga and colleagues (2019) found that children from low-income, low-education, or Indigenous groups in Ecuador had disproportionately high rates of malnourishment compared to middle- and high-income and education and majority ethnic groups. In addition to urbanization, this lack of knowledge and income may be contributing to their dietary choices, impacting their children's development.

Also contributing to their children's development is parents' knowledge, or lack of, about the importance of having a routine. This lack of knowledge and consistent access to healthy food choices may also interfere with daily routines surrounding their consumption (e.g. regular family mealtimes). Indeed, families may eat food whenever they have it because they may be food insecure and not have consistent access to food or the income to consistently purchase food (Comisión Económica para América Latina y el Caribe, 2018). This may also be contributing to the high rates of stunting in the country because children are fed whatever food they have access to rather than a variety of nutrient dense foods or simply go without food for parts of the day. Parents may be more concerned about being able to feed their children at all and getting them enough calories rather than being able to consider the variety and amount of nutrients. For example, one common cultural practice in Ecuador is to breastfeed children (Keeley et al., 2019). Researchers have shown that breastfeeding has positive health and developmental benefits for children. The World Health Organization (WHO) recommends that infants worldwide be exclusively breastfed for the first six months of their lives (WHO, 2011). Infants who are breastfed have a lower risk of being overweight or obese, having respiratory infections, sudden

infant death syndrome, cognitive delays, and more (Ip et. al., 2007; Horta & Victora, 2013; Metzger & McDade, 2010). However, parents from rural Ecuador report choosing to breastfeed their children primarily because it is cheap and convenient, not because it provides all the nutrients children need for healthy development nor because it is a protective factor against any health and developmental concerns. This is concerning for multiple reasons. First, because mothers are breastfeeding out of convenience or not exclusively breastfeeding for six months and are not aware of or following the WHO guidelines for exclusive breastfeeding, which can have negative health impacts on their children, and second, because when mothers do introduce complementary foods to breastmilk they are not choosing appropriate, nutrient dense foods that infants need to grow and develop (Roche et al., 2011). These mothers might be malnourished or stunted themselves, so they can not pass on much needed nutrients to their children through breastmilk, resulting in an intergenerational transfer of malnourishment and stunting (Martorell & Zongrone, 2012; Perkins et al., 2016). Understanding these nutritional practices in more depth, the strengths parents already have, and the barriers parents face can help inform future interventions targeted at increasing parents' knowledge and access to a diverse and nutritious diet for their children. This subsequent increase in their children's dietary diversity could reduce stunting and help their children reach their developmental potential.

Current Study

The current study uses a qualitative approach to explore the nutritional patterns of families with young children from the rural Amazon region in Ecuador. The goal of this study is to gain a deeper understanding of these children's nutritional intake and to identify strengths the parents currently utilize from the varying levels of their environment, barriers to providing healthy diets to their children, and ways to overcome such barriers. This information can be used

to inform future efforts to develop effective and useful interventions to help families in the Amazon prevent stunting and promote development in their young children. The specific research questions are:

1. What are the dietary patterns of children from the Amazon region in Ecuador?
2. What strengths do parents from the Amazon region in Ecuador already have or engage in pertaining to feeding their children healthy diets?
3. What barriers do parents from the Amazon region in Ecuador face in feeding their children healthy diets?

Methods

Participants

Fifty parents with children between the ages of 11 and 38 months living in the Amazon region of Ecuador who were attending two programs serving young children were recruited to participate in this study. Attempts were made to recruit families that were representative of these two programs. Participants' demographic information including parent education levels, household income, child age, and child gender was measured using UNICEF's Multiple Indicator Cluster Surveys (MICS). The highest level of education mothers had completed was almost evenly split between primary (44%) and secondary (54%) schooling, with one mother having completed more than high school (2%). Household income ranged from zero to \$700 USD per month, with an average of \$178.20 USD per month. Mothers' were 26 years old, on average. The youngest mother was 17 years old and the oldest was fifty. Six mothers were adolescents, and 24 were under the age of 26. Children were between the ages of 11 and 38 months old, with a mean of 26 months. 58% of children were female. The majority (88%) of households spoke both Spanish and the local native language, Kichwa, and 88% of families

identified as belonging to the Kichwa ethnic group. The remaining 12% identified as ‘mixed’ ethnicity.

We aimed to include participants with differing family structures, income levels, education, and socio-economic status. Children with adolescent mothers were also prioritized as Ecuador has one of the highest rates of adolescent pregnancy in Latin America and these children are particularly vulnerable to experiencing developmental delays due to the increased risk factors they experience (Goicolea et al., 2009; Lewin et al., 2013). The sample demographics were representative of the programs where they were recruited and reflect the high rate of adolescent mothers in the country. Participants were only excluded if their children have a severe disability that influences their eating habits, physical growth, or cognitive development. Based on similar qualitative research conducted in Ecuador, a sample of fifty was chosen because we believe it provide enough data for saturation to be reached (Pera et al., 2019; Verstraeten et al., 2014).

Measures

Interviews

Each participant was asked about their children’s dietary patterns and what influences the nutritional choices they make for their children during semi-structured interviews.

Bronfenbrenner’s ecological model and UNICEF’s framework of undernutrition were used to guide the creation of the initial semi-structured interview questions. Questions were then translated to Spanish and remained in Spanish while they were reviewed and revised by several members of the research team including two members in Ecuador and a faculty member who is originally from Ecuador. The framework, theory, and previous literature, and the collaboration and input from the various members of the research team led to the development of the final

interview questions. The questions listed below are a back translation of the questions in English for this document as there is not a direct translation between English and Spanish for several of the words. For example, the word “meals” is an English word that has a vague definition, but the Spanish word ‘comidas’ was used during the interviews as this is culturally relevant to this group of families as snacking is reportedly not common, and it is a clear and well understood word by participants.

1. Exclusive breastfeeding is when a child eats breastmilk and no other food throughout the day or night. How long did you exclusively breastfeed your child?
 - a. If you are still exclusively breastfeeding, when do you plan to stop exclusively breastfeeding/start feeding your child foods other than breastmilk?
 - b. Why did you choose to breastfeed or not breastfeed your child?
2. Now I want to ask about what your child typically does in a day, from the time they wake up to the time they go to sleep.
 - a. How many meals do they normally eat in a day?
 - b. Do you have any daily routines for your child? If so, what are they?
 - c. Think about what your child ate yesterday. Please tell me all the foods they ate including drinks and breastmilk, when they ate them, and how much they ate.
3. How has COVID-19 affected your child’s diet?
 - a. If COVID-19 has changed your child’s diet a lot, what did they normally eat in a day before COVID-19 began?
4. What do you know about healthy diets for children? What about unhealthy diets?
5. Is it difficult to feed your child healthy foods? Is it difficult for you to eat healthy foods?
 - a. What, if anything makes it difficult to feed your child healthy foods?

As part of question two, the interviewer completed a 24-hour dietary recall table. Parents were asked about every food and drink the child consumed in the 24 hours before the interview, the number of times they ate or drank it, the times of day they ate or drank it, and an estimate of portion size. The Food and Agriculture Organization of the United Nations recommends using a 24-hour reference period because it is less likely to be subject to recall error, but they also state that the collection of multiple 24-hour recalls is more indicative of an individual's habitual diet than a single time point (FAO, 2018). The scope of this study did not allow for multiple 24-hour dietary recalls. However, the interviewer asked if the day recorded represents a typical day for the child as well as supplemental questions about the children's consumption of specific foods in the week previous as a way to check for accuracy and consistency in the parent's reporting and consistency of the child's consumption of these foods. This also allowed us to gain a deeper understanding of what influences children's dietary patterns for these particular foods and food groups. These supplemental questions include:

1. Can you explain what Chicha is?
 - a. Does your child drink Chicha? If yes, on average how many times a day do they drink it? How old was your child when they first drank Chicha? Why does your child drink Chicha?
2. How many times in the last week did your child eat fish? Why do you feed your child fish?
3. How many times in the last week did your child eat fruit? Why do you feed your child fruit?
4. How many times in the last week did your child eat vegetables? Why do you feed your child vegetables?

5. How many times in the last week did your child eat processed foods (e.g., potato chips, cookies, pastas)? Why do you feed your child processed foods?

Dietary Diversity

Dietary diversity (DD), the total number of food groups consumed by an individual in a 24-hour period, was assessed from the 24-hour recall for each child using the Food and Agriculture Organization of the United Nations (FAO) scoring guidelines (FAO, 2018). These guidelines include thirteen food groups: cereals; vitamin A-rich vegetables and tubers; white tubers; dark leafy green vegetables; other vegetables; vitamin A-rich fruits; other fruits; organ meat; flesh meat; eggs; fish; legumes, nuts, and seeds; and milk and milk products. According to the FAO, low DD is defined as < 3 food groups consumed, medium DD as 4–5 food groups, and high DD as > 6 food groups. Using these categories, DD based on a 24-hour recall is an effective tool for approximating children's nutritional status and dietary quality (Arimond & Ruel, 2004; Daniels, 2006; Kant, 1996). DD used to examine patterns and understand broad themes of children's dietary habits.

Procedures

Each interview was audio and video recorded, and participants chose to be interviewed in their homes or in the child development center that their child attends. The interviewer was trained in standardized interview procedures. Once reliable, the interviewer contacted mothers from the Amazon region through word of mouth and the child development centers where she works. Each mother was given an informed consent form, had the purpose and procedures of the research study explained, was asked if they had any questions, and was asked if they would like to participate in the study prior to starting the interview.

Analytic Plan

The study has a descriptive design. Table 2.1 summarizes which interview questions were used for analyses for each research question. NVIVO, a qualitative data analysis program was used to manage analysis of the data. This program helped organize and maintain the data with codes, notes for every member of the research team to view and edit. This program made creating summaries and visualizations quick and easy and was used by the research team in Ecuador to code the interviews in their native language, Spanish. Each participant was assigned an ID number to preserve anonymity. The project was approved by an ethics board in Ecuador prior to conducting any interviews and was approved by Utah State University's Institutional Review Board (IRB) before analysis began.

Table 2.1

Summary of interview questions used to answer each research question.

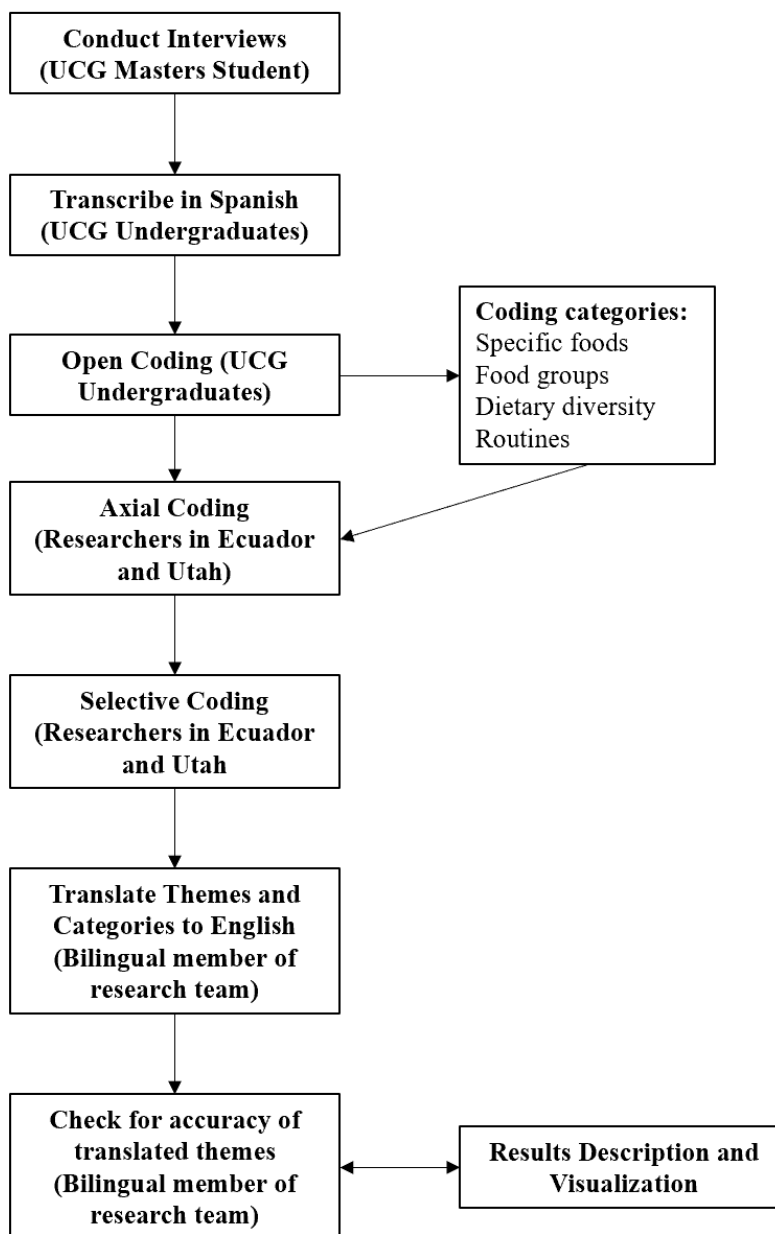
Research Questions	Interview Questions for Analyses
1. What are the dietary patterns of children from the Amazon region in Ecuador?	1, 1.a, 2.a, 2.b, 2.c, and the supplemental questions
2. What strengths do parents from the Amazon region in Ecuador already have or engage in pertaining to feeding their children healthy diets?	1.b, 3, and results from research question 1
3. What barriers do parents from the Amazon region in Ecuador face in feeding their children healthy diets?	4, 5

Data for research question one was analyzed using an inductive thematic content analysis approach (Elo & Kyngas, 2008). This allowed us to identify dietary patterns of children in this area including what specific foods children are eating, what food groups they are and are not eating, their level of dietary diversity, and routines they may or may not have surrounding food.

To ensure accuracy of coding, research assistants who are from and are familiar with the culture in Ecuador were recruited to transcribe and code the interviews in Spanish. This helped ensure the details of participants' culture were not misrepresented or incorrectly understood. The research assistants were trained in inductive thematic content analysis and ethical standards of research. Each research assistant reviewed and coded every interview for themes pertaining to dietary patterns of the children, and strengths and barriers parents face. This open coding phase was completed in Spanish. Codes were then compared between coders to ensure accuracy and trustworthiness. All research assistants then engaged in axial and selective coding phases where codes were related to one another and grouped into broader themes and categories. These were then translated to English and a bilingual member of the research team who is from Ecuador verified the translations and that cultural beliefs and values were not being lost in translation (see Figure 2.2 for full process). In addition to the qualitative analysis, DD was calculated and described for each child.

Figure 2.2

Data analysis process for research question one.



Data for research questions two and three were analyzed using a deductive thematic content analysis approach (Elo & Kyngas, 2008). This is used when researchers want to use existing theoretical ideas or models in a new context, such as the UNICEF model guiding this research. In

contrast, an inductive thematic content analysis is where researchers are creating broad ideas based on their specific data and results (Cantanzaro, 1988). This deductive thematic content analysis was used to help further research in identifying predictors of children's physical growth and cognitive development that will be addressed in paper two. The research assistants were also trained in this deductive method. They were each told to code the interviews by looking for two main categories: strengths and barriers. Codes were then compared between coders to ensure accuracy and trustworthiness, and codes were grouped into broader themes within each category. Themes and categories were then translated to English and the bilingual member of the research team checked the translations for errors.

Results

What are the dietary patterns of children from the Amazon region in Ecuador?

When asked about their children's diets and daily routines, parents discussed several different topics. First, they shared how breastfeeding is normal. Mothers exclusively breastfeed for at least six months and breastfeed for at least one full year. In only three cases did the mother report that she did not breastfeed for at least six months, and that was because she could not. In each of those cases the mother reported that if she were physically able to breastfeed, she would have. While this is a good, health promoting practice, mothers reported that they chose to breastfeed not for the positive benefits to the mother or child, but rather because it is a common, cultural practice. Several mothers stated they breastfed their child because 'it is natural'. Others reported that they chose to breastfeed simply because their child needed to be fed and it provided calories to make them full. Furthermore, many mothers explained that they knew it was healthy for their child to be breastfed because 'they say it is healthy for the child.' Referring to society in general, doctors or other public figures of authority, mothers described how they did not know

why it was healthy for the child or how the child was benefitting from being breastfed, but that they heard it was healthy so they believed it was. When mothers were asked why they chose to stop breastfeeding they reported one or more reasons. First, and most commonly because the child did not want to breastfeed anymore. Second, because the child got sick and they had to stop breastfeeding. And third, because the mother got sick, got an infection, or stopped producing milk. However, the mothers did not initially express these details. They talked about how their ‘milk wasn’t good anymore’ and that caused them to stop breastfeeding. It was not until probed to describe in more detail by the interviewer that most mothers gave such examples of why they stopped breastfeeding. There were some mothers who discussed the health benefits and were educated on why breastfeeding was beneficial, however this was a small portion of participants.

After asking about breastfeeding, the interviewer asked mothers about their child’s daily routines and what they normally ate in a day. The first and most notable theme found in this section of the data is that these mothers did not know what a routine is. The interviewer had to explain it prior to getting their response. Mothers talked about how routines are not a thing, they did not have any routines, they did not know what a routine was, and they did not know why it mattered or why a routine might be important for their child or their family. Still, there are some common things that families from this region reported doing. First, families eat three meals a day when ‘times are good’ and fewer meals when they are not. This meant that when parents were low on money or food, they would feed their child fewer meals to make the money and food they did have last longer. Second, these meals were not necessarily at a set time, or even around the same time each day. Parents fed their children ‘whenever they need’, meaning that parents fed their children meals whenever they asked for food or said they were hungry. When there was not enough food to have a meal and their child asked for something to eat, mothers would give them

Chicha, a traditional, cultural drink primarily made of yucca or cassava and left to ferment before drinking. Mothers often reported using Chicha as a meal replacement when the child was hungry and they did not have food to feed them. Mothers also reported feeding their children 'refrigerio'. This is a common word used in the region where the data was collected and it is similar to eating a snack. Parents fed their children refrigerios throughout the day, when the child asked for one, however when asked if refrigerio was like a snack, mothers did not know what the word snack meant. This was similar to not knowing what the word routine meant in that mothers did not seem to have forethought into when they were feeding their child. For these families, there is no such thing as planning out a snack to eat in between breakfast and lunch. This lack of routines did not only pertain to diets, when asked about routines in general mothers reported that their child sleeps, wakes up, eats, naps, bathes, and goes back to sleep again. They did not have routines as the word is typically used, rather the only common things they did throughout the day were necessities such as sleeping and eating. A small number of mothers also talked about daily activities including playing, learning, singing, and visiting extended family, and an even fewer number of mothers said their child participates in community activities such as playing sports and feeding chickens.

Pertaining to routines and food, parents were specifically asked about what their child had eaten in the last 24 hours. This interviewer led, 24 hour dietary recall is a common method used to examine dietary patterns and we expected to examine patterns and routines from this measure. However, we were not able to capture the validity of the measure the way we conducted it due to the cultural practices and ways of being of this group. Parents were asked several probing questions, and leading questions were used to get more information about each food the child ate in the 24 hours prior to the interview. After the probing and leading questions,

data was still not detailed enough to report valid results. Hypothesized reasoning for this and ways to improve are discussed in greater detail in the discussion section. Here, I will instead focus on five interview questions and responses where parents were asked about specific foods of interest with this group.

First, parents were asked about Chicha. Many parents reported giving their child Chicha because it is something ‘everyone drinks’, it is ‘good and takes away hunger’, ‘it is natural’, ‘it is part of the culture’, and ‘it is a custom to teach [their] children’. Seven parents said their child had never had Chicha. Of the children who did drink Chicha, they had a mean age of 8.6 months when they first had it and they typically drank it 4 days per week. Several parents reported giving Chicha to their child so they could ‘learn to drink it’ even though they explained that it made their child ‘hurt’ or not feel well, the child cried when they feed it to him/her, and some even vomited. Next parents were asked about fish. Eight parents reported that their child does not eat any fish and of those who do eat fish, they eat it about 3 days per week. The most common reasons for feeding their child fish were because the child likes it, and because it has nutrients to help the child grow. The third most common response was when parents run out of food they have purchased from the store, they must find their own food. As one parent put it “fish is the way of the native people.” Children are taught from a young age how to fish so they can catch their own food. The next two foods parents were asked about were fruits and vegetables. Only one parent reported that their child does not eat any fruit, and that is because they do not like it. In contrast, fifteen parents reported that their child does not eat vegetables and the most common reason why was because their child does not like them. Of those who do eat fruits and vegetables, children eat fruit five days a week and vegetables four days a week on average. Similar patterns were found for feeding or not feeding children fruits and vegetables: the child

likes or does not like to eat them, they are healthy and help the child grow, and they do not have enough money to buy them at the store so they eat what is easy for them to grow themselves. For example, several parents talked about their child eating papaya because it is a 'local fruit' so when the child sees it outside, they ask for it, and it is free and easily accessible for the parent to get it and feed it to the child. Lastly, parents were asked about processed foods. Fourteen parents reported that their child does not eat any processed foods. Children who do, eat them about 3 days a week. The majority of parents shared a general knowledge that processed foods are not healthy or less healthy, but they are cheap, easy, and their child enjoys them so they feed them to their child anyway. When discussing processed foods, a common pattern emerged where the children eat more fresh food at the beginning of the month, or right after they go grocery shopping, and more processed foods towards the end of the month when the fresh foods have been eaten or gone bad. Lastly, families were asked about how the COVID-19 pandemic impacted their lives and dietary routines. Families fit into one of two categories; families who experienced changes and families who did not experience changes. Those who experienced changes reported eating less quantity, eating less of the foods they really liked, eating more locally grown foods, losing jobs and opportunities to earn money such as selling goods at local markets.

What strengths do parents from the Amazon region in Ecuador already have or engage in pertaining to feeding their children healthy diets?

Mothers discussed several topics that pertained to strengths they already engage in. Three main themes were found; knowledge, autonomous and independent children, and supportive and responsive parenting. Parents had knowledge that eating healthy is important to help their children grow and develop, that fruits and vegetables are healthy, and that sweets, fats, and

processed foods are unhealthy. In addition, mothers talked about believing that it is a child's human right to be able to eat well and develop in a healthy way. The last bit of knowledge mothers discussed was how they perceived eating healthy to not be difficult, including feeding their children a healthy diet. The second major theme that arose was that children are independent enough to do their own activities such as eat, get dressed, and get up and go to bed on their own. Many mothers described this relationship that is referred to in Ecuador as 'apego.' Similar to attachment, apego refers to the positive relationship between mother and child, but that the child is also independent enough and has enough emotional regulation skills to not fully depend on the mother to be happy. In this region of Ecuador, having this relationship allows the mother freedom to garden, farm, fish, and do other activities necessary to survive, without worrying if the child will be upset, cry, or go without eating. These positive child characteristics may have to do with the last major theme found: supportive and responsive parenting. Mothers reported having positive interactions with their children on a daily basis. A wide variety of positive interactions were all very common. These interactions included 'practica de aprendizaje' or helping children learn or do school work, singing to their children, reading to them, and 'interacciones.' The term 'interacciones' directly translates to 'interactions' however this group of Ecuadorian parents used it to specifically refer to both being physically close and having warm verbal communication with children. This theme also encompassed more than just interactions between the mother and child. Mothers reported how the entire family, and sometimes the entire community, was involved in positive interactions with their children. Older siblings, cousins, and other extended family members acted as a support system to play with children, model behaviors, and help teach the younger children. Mothers reported this as something that does not just happen sometimes or for some families. They used the phrase 'entre

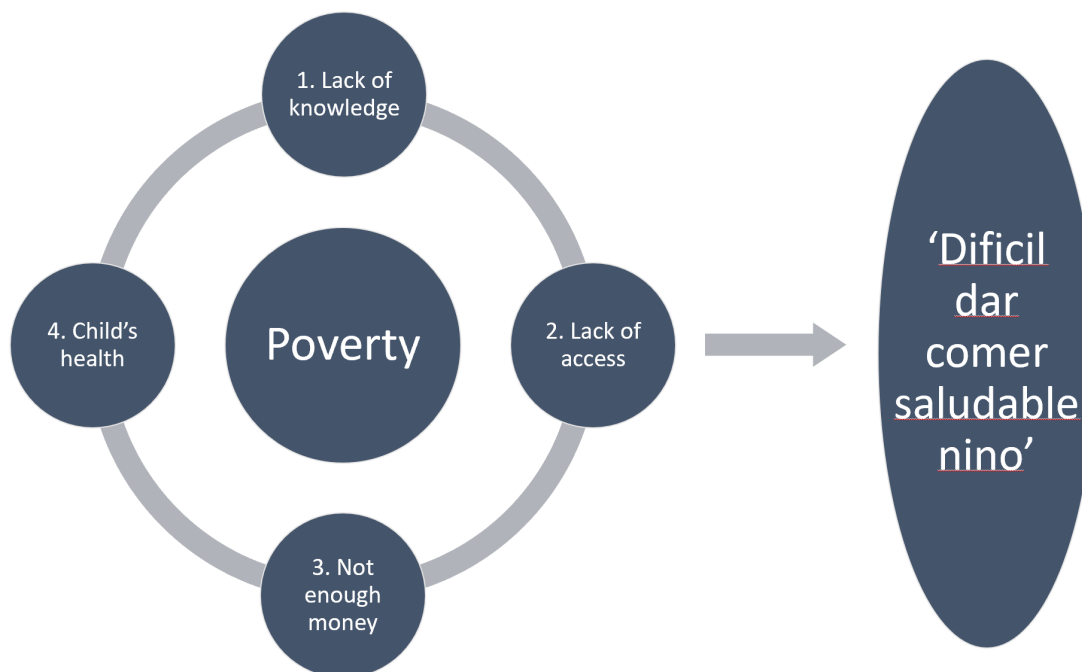
primos' which directly translates to 'between cousins.' This phrase exemplified how children in extended family have close, mentorship like relationships and that they are always modeling behaviors such as eating, sharing food, and doing schoolwork for the younger children.

What barriers do parents from the Amazon region in Ecuador face in feeding their children healthy diets?

Despite having several strengths, mothers also faced barriers in feeding their children healthy diets and helping them grow and develop to their full potential. Five different barriers were found amongst this sample of mothers, four of which fit under the broader theme of poverty: lack of knowledge, lack of access, not enough money, and children's health. The last barrier, the children being difficult eaters, appeared to be a result of poverty which is the underlying mechanism through which the first four barriers cause the children to become a difficult eater. Each barrier and the relationship between them are displayed in Figure 2.3.

Figure 2.3

Barriers parents face in feeding their children a healthy diet.



The first barrier parents discussed was that they had a lack of knowledge regarding healthy diets and development. When asked what they know about healthy diets, mothers reported that they did not know what a healthy or unhealthy diet is for mothers and for children. Second, mothers lacked access to healthy foods and a variety of foods. These families discussed their 'escasez alimento' or their 'food shortage.' It is difficult for these families to access a wide variety of foods because they only know how to grow and fish for what their culture and ancestors have grown and fished. They eat the foods that are locally available because they do not have the funds or ability to frequently travel to a grocery store or market that has a wider variety of foods. This leads into the third barrier parents face, not having enough money to eat a healthy diet or provide their children with a healthy diet. In their interviews, even mothers who had the knowledge of what a healthy diet is discussed that they did not have enough money to

provide that type of diet to their children. Many families said ‘compra primeros dias’ meaning they go to the grocery store once a month, they purchase what they have money for which is never enough to purchase everything they want, and when the food is close to running out towards the end of the month they must eat local foods or the less healthy, canned foods they purchased at the grocery store at the beginning of the month. The fourth barrier parents face is their children’s health and illness. ‘Problemas salud nino’ as many mothers put it, referred to their child getting sick and that making it difficult to feed them a diverse and healthy diet. When their child had diarrhea or was sick they had to feed their child a plain, simple diet that they are used to so as to not upset the child’s digestive system any more than it already is. Several mothers even explained that feeding their child a lot of vegetables or fresh foods that they are not used to eating would make them sick.

These four barriers all relate to and fit underneath the broad umbrella theme of poverty. The level of poverty these families live in contributes to or causes their lack of knowledge, lack of access, not having enough money, and child’s health problems and this includes the cultural beliefs and practices families engage in surrounding these four barriers. Furthermore, it is this poverty and subsequent barriers they face that leads to the child becoming a difficult eater. This was exemplified by many mothers who said ‘difícil dar comer sauldable nino’ which means it is difficult to feed their children healthy diets. Mothers discussed how their ‘nino come lo mismo’ or their child likes to eat the same thing all the time. When discussing and examining these barriers during the axial and selective coding phases, research assistants made it a point to state that the child becoming a difficult eater was not necessarily a responsibility of the parent for not teaching the child or of the child due to their temperament. It may be some combination, but more importantly the research assistants reported that it seemed to be caused by the poverty these

families experience.

Discussion and Limitations

Dietary Patterns and Routines

Parents of young children were interviewed to answer research question one. Several dietary patterns were found in relation to breastfeeding, what children do on a typical day, and what children typically eat. These all helped to answer research question one. However, the findings were not as expected. Although interview questions were written with the help of the Spanish speaking research team member and the interviewer who lives in the Amazon region in Ecuador, there were several questions that parents did not understand and they needed further explanation of the meaning of those questions prior to answering. This lack of understanding may be due to the low education levels, high poverty rates, and strong cultural practices that have been passed down from generation to generation (Penafiel et al., 2016). Even when parents were sure of the question being asked, responses were very minimal and when asked probing questions to gain a deeper understanding, parents gave short, non-explanatory responses. They referenced the strong cultural practices, as when asked why parents engage in a particular dietary pattern many responded by saying it was what they learned from their mother or grandmother. Families engage in the behaviors that their ancestors did, and when probed about possible ways to change, improve, or fix a problem they simply stated that they did not have any ideas and said that they behave the way they do “because that’s how my mom did it.” This finding supports previous literature about the strength of cultural practices that are passed down through generations, and that how families engage in dietary practices because it is what they have learned from older relatives, and not necessarily because it is the best or healthiest thing for their child (Keeley, et al., 2019). Almost all parents reported breastfeeding their child and many

explained because ‘it is healthy,’ but they did not know why it was healthy for the child. They only knew it was healthy because their mother or grandmother told them that it is. Similarly, when parents were asked how many times their child typically eats in a day, the research team expected parents to report the number of meals each child eats. Instead, parents reported things like “whenever we need” and “whenever we’re hungry.” This shows a lack of routine and pattern in their dietary patterns that could help these children grow and develop to their full potential.

When specifically asked about what routines they had for their child, almost all parents did not know what the word routine meant. Even after the interviewer explained it, parents did not think of their habits as a routine or a pattern. This common theme emphasized the need to educate this group of families on the importance of routines for children, and the specific benefits of eating a healthy diet such as how eating fruits helps children grow and develop. These families know they live in poverty, they know that eating a healthy diet is important for their child to grow and develop, but they did not report taking any action to try and lift themselves out of poverty or to improve their child’s dietary patterns. One example of how this type of thinking and effort could benefit these families is found in our results that only some families reported experiencing changes due to the COVID-19 pandemic. Families that did experience changes were also the ones who reported the father had lost his job, they had a decrease in income, or were put into deeper poverty by the pandemic. While there was some overlap in groups, most families who did not experience change were the ones who, prior to the pandemic, had higher poverty levels, very low income, and were already eating mostly local foods compared to families who did report experiencing change. The latter group, who held jobs and were taking steps to lift themselves out of poverty, reported engaging in more practices and patterns of the families who did not experience change including eating more locally grown foods.

To learn more about children's dietary patterns, we planned to use a 24-hour dietary recall to calculate the amount of dietary diversity these children ate. Past research has shown that the first 1000 days of life are a critical period for children's development (de Onis & Branca, 2016; Keeley et al., 2019), but that children in Latin America do not get enough dietary diversity to support their early growth and development (Keeley et al., 2019). However, the data gathered through the 24-hour recall was too ambiguous to confidently calculate the dietary diversity of each child. I assumed that parents participating in this research would have an awareness of and intentionality in what foods their children eat in a day, but this was not the case. Parents seemed to be more passive and focused on learned cultural behaviors over the type, quantity, and frequency of foods they gave their children and in their knowledge of healthy and unhealthy diets. Although this valuable finding represents an important place where future research and intervention should focus on, I could not calculate the dietary diversity of these children because we did not capture what the 24-hour recall was intended to measure. When studying this topic with this group of families in the future, researchers should consider adding additional and more detailed instructions to the standard recall interview that explains the level of detail wanted about each ingredient used in a meal. Although emphasis was put on the need for detail when training the interviewer, it was still difficult to get a detailed answer from parents so having more detailed explanation of the purpose of the 24-hour recall for participants may help alleviate some of this ambiguity. Asking families to photograph everything their child eats in a 24-hour period and conducting multiple 24-hour recalls are also ways that may improve the validity of this measure for this population. This finding also supports the idea that increasing cognitive flexibility could benefit this population by enabling them to think about their diets and how to improve them in a more active and creative way (Ionescu, 2012). Even though the 24-hour recall

data was not valid, I was able to examine dietary patterns in relation to five foods parents were asked about during their interview. Results indicated that in a typical week 2% of children did not eat fruits, 30% did not eat vegetables, and 16% did not eat fish. These percentages are different than what has been found in all of Latin America (Keeley, et al., 2019). Fewer children in this sample typically eat any fruits or vegetables (70%) compared to the 80% in Latin America who eat any fruits or vegetables. However, in this sample 84% of children eat fish, one type of animal sourced food, but in the sample from Latin America only 70% eat animal sourced foods on a regular basis. It is a combination of these and other foods that provide children with both micro and macronutrients that act as a protective factor against stunting (Motbainor et al., 2015; Roche, et al., 2017). More research is needed, but it seems that children in this area of Ecuador are receiving animal sourced foods, which provides them with necessary macronutrients, but may not be eating enough fruits or vegetables, which provides their bodies with micronutrients necessary for growth and development. It is also noteworthy that parents did not talk about dietary differences between seasons. This is likely due to the climate of the region and that local fruits and vegetables can be, and are grown all year round, but future researchers may want to further examine this idea.

Lastly, parents were asked about two foods considered not beneficial for children's development: Chicha and processed foods. Of this sample, only 14% of children did not drink this fermented drink. Many parents discussed believing it was healthy, feeding it to their child because it was filling, or because it was part of the culture. Parents began feeding this to their child when they were as young as four months old by putting it in their child's mouth, even when they did not want it or like it, and for some it made the child vomit. These responses represent the strong cultural practices amongst this group of families. Even though their children do not

like or want to drink Chicha, it is still expected to ‘learn to drink it’ because it is part of the culture. This is concerning as Ramirez-Ubillus and colleagues (2017) found that the alcohol content of this drink is a risk factor for children’s development. Future research should examine the alcohol content of the Chicha fed to children and examine specific negative and positive impacts of this drink. With this additional knowledge, future interventions could provide information to parents on how it might be impacting their children, as well as other ways parents could use yucca to feed their family or create a drink out of yucca that has lower or no alcohol content. When asked about processed foods, 28% of parents reported that their child did not eat processed foods and of those who do eat them, they eat them about 3 times a week. The reasoning parents gave for eating or not eating these foods related back to access to fresh foods and household income. Families’ access to fresh foods is part of Bronfenbrenner’s microsystem and UNICEF’s underlying causes, while household income is part of exosystem and considered a basic cause (Bronfenbrenner & Morris, 2006; UNICEF, 2015). This demonstrates how multifaceted and complex the barriers these families face are. It is not just one issue or even multiple issues that relate to one system, that lead to parents’ decisions. Rather there are many different issues at a variety of levels and in different parts of their lives that come together to influence their decisions surrounding food (Bronfenbrenner & Morris, 2006).

Strengths and Barriers

Parents discussed several strengths they already engage in when it comes to feeding their children healthy diets and encouraging strong growth and development. Themes included knowledge, autonomous and independent children, and supportive and responsive parenting. These three strengths all represent areas future research and intervention should focus on to help these families improve. Similar to the dietary patterns found, the information parents provided on

each of these three themes was quite general. For example, parents knew that feeding their child a healthy diet is necessary for them to grow and develop, but they did not know why or how eating healthy caused their child to grow and development. This emerged as both a strength and a barrier for this group of parents. Educating parents on this topic may help them become more emotionally committed to not just feeding their child healthy foods but encourage them to problem solve and think more critically about feeding their child a diverse and well-rounded healthy diet. The knowledge that parents have, or lack thereof is an example of a basic cause in UNICEF's framework of undernutrition (UNICEF, 2015). Although educating parents does not directly change the foods children eat, it would likely have a strong, indirect effect as parents put more forethought and intention into their family's dietary patterns and routines.

For children of this age range, having a healthy level of autonomy and independence was important to mothers. As indicated by the mothers in this study, this may be impacting children's diets because if they are not autonomous enough to eat on their own, they may not be fed the same as their more independent counterparts. If the child is physically able and willing to eat on their own, the mother is then able to eat a meal herself, clean up, or accomplish other tasks that she needs to get done. If the child is not able or willing to eat on their own they may have to wait until the mother has time and can feed them. As coders indicated, not being autonomous and independent was not due to a physical limitation due to the children's age, but rather an emotional and personal refusal by children to eat without the mother. Although these children are young, they are physically capable of eating on their own to a degree and the fact that they do not adds stress to the mothers, which could possibly have negative implications for the parent-child relationship and multiple domains of child development (Puff & Renk, 2014; Rahman et al., 2004).

Parents also discussed engaging in supportive and responsive interactions with their

children. These parents reported that they would be physically close to their child by picking them up, holding them, and hugging them, and speaking in soft, warm, happy voices to the child. These represent two more ways that future interventions could help these parents; by observing and learning more specifics about the behaviors parents engage in we could help encourage parents to focus on and engage in such behaviors more often. Since the idea of apego is already something known and familiar in this culture, it could be used as a starting point to provide information to parents about attachment relationships and temperament, why some children are more independent and perceived to be less difficult than others, and what parents can do to help increase apego. These interactions represent an underlying cause according to the framework of undernutrition (UNICEF, 2015). Although they are not directly related to dietary intake, parents recognize the importance of apego and these positive interactions, and this supports previous researchers' idea that supportive systems need to be included in nutritional interventions to help children reach their full developmental potential (Keelye et al., 2019; Yousafzai et al., 2018). Furthermore, the idea of older siblings and cousins modeling behaviors for younger children could be used to give knowledge to parents about the entire context that a child develops under, including aspects of their micro, meso, exo, and macrosystem they may not have otherwise thought about as impacting their child (Bronfenbrenner, 2006). This supports Britto and colleagues (2017) findings that nutrition interventions that include other aspects of the children's environment are the most effective. To execute such an intervention with this group of families requires careful consideration to be culturally sensitive, as will be discussed later.

The additional barriers of lack of access to food, not enough money, and child health all relate to poverty and as explained by the parents, result in more difficulty in feeding the child a healthy diet. These barriers, as the research assistants reported, all led to the child being a

difficult eater, and the poverty these families experience has greatly contributed to this by having unhealthy diets over the course of generations, making it a broad, cultural issue and not just a family or individual one. Due to the poverty these families experience, they eat less healthy foods and more foods they have traditionally grown or caught. Many of the parents go to the store once a month to buy food. As this market integration has helped in some ways, it has also negatively impacted these children's diets because parents purchase processed, canned, and less healthy foods from the store because they are cheaper than fresh foods and they stay good longer than fresh foods. Market integration has allowed parents the opportunity to go to the store and purchase a wider variety of foods than their ancestors ate from farming and fishing, however these families do not have the transportation or money to go to the store more than once a month. Just as Houck and colleagues (2013) found mixed results on the impact of market integration, this group of families experience both some benefits and some drawbacks. If families were able to increase their income and have better transportation to and from the store, they might be able to take advantage of the wider variety of fresh foods available and provide a more diverse and nutrient dense diet to their children. As it is now, children's bodies are likely learning to conserve fat and energy more than needed as families sometimes do not have enough food to feed the child a healthy diet (Popkin et al., 1996; Walker et al., 2007). Similarly, the finding from this study that children get sick or get diarrhea when eating new, fresh foods such as vegetables may be due to the lack of exposure over the first few years of their life, resulting in pickier and more difficult eaters because their bodies have adapted to and learned how to conserve the energy and nutrients they are used to eating (Popkin et al., 1996; Walker et al., 2007). As such, helping these families move out of poverty could help result in less difficult eaters. This exemplifies how changing an underlying basic cause in UNICEF's conceptual framework could

have a large impact on the direct causes of undernutrition, greatly impacting children's development.

Implications and Future Directions

Future research and intervention should focus on nutrition education and helping lift these families out of poverty to enable them to provide healthier diets for their children. However, the strong cultural beliefs and practices will need to be considered for interventions to make an impact. To enter this community, and others like it, as an outsider, be accepted, and have members of the community listen to and make changes based on your knowledge is historically a difficult thing to do. Researchers must be culturally sensitive and responsive to the wants and needs of members in the community (Chilisa, 2012). At the conclusion of the coding process for this research, the team developed several ideas and suggestions for how to help this community by encouraging small, culturally sensitive changes. First, work with local community leaders, doctors, nutritionists, and coordinators of the home visiting program already established to help gain access and acceptance into the community. Second, begin to cultivate other foods that can be easily grown in the area, educate parents on how they can grow and cook with them, and strengthen the green and self-sufficient economy they already engage in. Third, give information about what routines are and why they are important, using concepts and examples from the culture. Fourth, strengthen parenting practices by encouraging more positive parent-child interactions, encourage parents to have children participate in and learn community activities and cultural practices from a young age such as feeding the chickens, fishing, and gathering fruits. Fifth, educate parents on problem-solving skills and ways of thinking as well as more detailed information about why nutrition matters, what a healthy diet looks like, and specifically how it influences their child's growth and development. Addressing one or more of

these can help these children develop to their full potential.

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CHAPTER III

PHYSICAL GROWTH AND COGNITIVE DEVELOPMENT IN CHILDREN FROM THE AMAZON REGION OF ECUADOR

There is a large body of research supporting the idea that children's development in the first few years of life has lifelong lasting impacts, that early development is sensitive to children's early life environment, and that the first 1000 days of life is a critical period for development (Black et al., 2013; Bornstein et al., 2012; Grantham-McGregor et al., 2007; de Onis & Branc, 2016; Keeley et al., 2019). Children in low- and middle-income countries (LMICs) are at a particularly high chance of living in environments that adversely affect their development. In their State of the World's Children report, the United Nations Children's Fund (UNICEF) (Keeley et al., 2019) found that more than one in every three children worldwide are stunted, wasted, or overweight due to malnutrition and this has lifelong, negative impacts on children's growth and cognitive development, and limits their potential for learning.

Malnutrition, imbalances in energy and nutrient intake, has been recognized by the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2010) as a global health and education emergency. Researchers estimate that more than 200 million children under the age of five are not fulfilling their developmental potential by experiencing poor brain growth in early childhood, doing poorly in school, experiencing high fertility rates, having low incomes, and providing poor childcare for their own children which contributes to the intergenerational transmission of poverty (Bornstein et al., 2012; Grantham-McGregor et al., 2007; Black et al., 2016; Daelmans et al., 2016). This is important because it has long term impacts by reinforcing inequality in education, transmitting generational inequality in education and subsequently income and socio-economic status (SES) gaps, and decreasing the efficiency of investment in

school systems (UNESCO, 2010; Keeley et al., 2019). In fact, researchers conducted a meta-analysis of 10 LMICs and found that children who were stunted, wasted, underweight, or any combination of the three had a significantly higher risk of mortality (McDonald, et al., 2013).

In Latin America, almost 50% of children in third and sixth grade do not meet the ‘minimum proficiency level’ in reading or mathematics for their respective age (Global Education Monitoring Report, 2016). These poor cognitive skills are largely an effect of poor nutrition in the children’s first few years of life (Grantham-McGregor, et al., 2007; UNESCO, 2010; Keeley et al., 2019). Ecuador has the second highest rate of stunting in Latin America, behind only Guatemala. Nearly a quarter (24%) of children birth to four years old are stunted and this increases to 37% when looking at the poorest 20% of households (Keeley, et al., 2019). About 60% of third grade students in Ecuador are not proficient in reading, and this number increases to about 80% by the sixth grade. Not only are children behind in this indicator of cognitive development, but instead of playing ‘catch up’ they are falling further behind their peers as they get older. We see a similar but less severe trend when looking at proficiency in mathematics. About 55% of third graders and 58% of sixth graders are not proficient in math. Although the number of children enrolled in school in Ecuador has increased over the past decade, there is a large percentage of children who start school at a disadvantage due to the malnutrition and poverty they experienced in their early years (UNESCO, 2016). Overall, growth and development of children in Ecuador is a major concern.

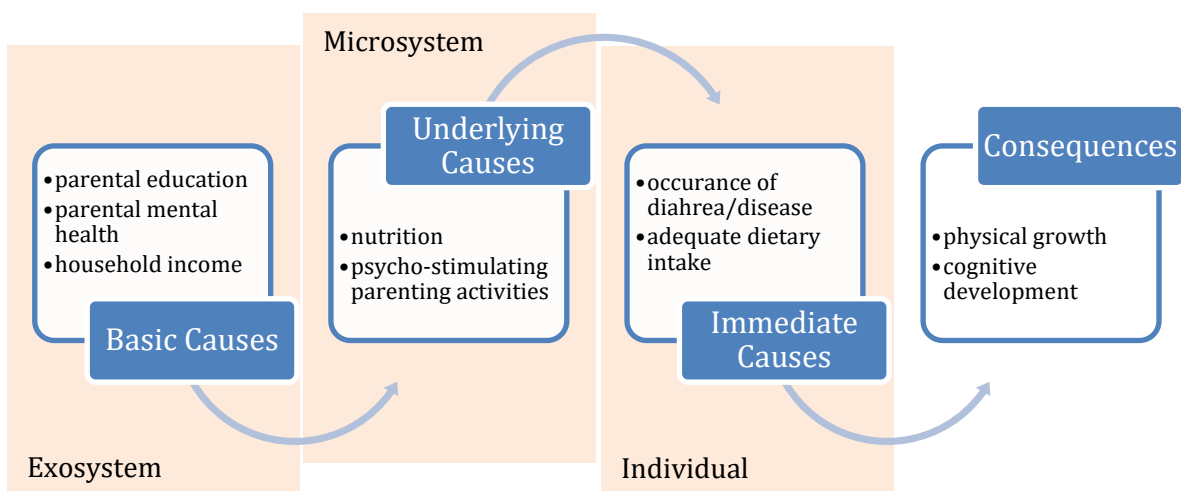
Conceptual Framework

Bronfenbrenner’s bioecological model emphasizes how a variety of contexts come together to influence behavior and development (Bronfenbrenner & Morris, 2006). UNICEF’s conceptual framework of child undernutrition explains the many influences, consequences, and

impacts of children's undernutrition that correspond with the different contexts in Bronfenbrenner's model. According to Bronfenbrenner the microsystem is made up of an individual's direct environment such as dietary patterns, caregiving practices, and parental mental health. According to UNICEF immediate causes of undernutrition include the foods they eat, and underlying causes include their home environment and caregiving practices their parents engage in. This study focuses on understanding aspects of Bronfenbrenner's microsystem and UNICEF's immediate and underlying causes that influence children's dietary patterns as well as consequences of undernutrition including poor growth and cognitive development, as shown in Figure 3.1.

Figure 3.1

Multifactorial causes and consequences of child malnutrition in the Ecuadorian Amazon.



Developmental Indicators

Several researchers have examined the physical growth and cognitive development, as

well as the relation between children's physical growth and cognitive development. This work has been done in Ecuador, in regions of the Amazon located in countries other than Ecuador, and in developing countries throughout the world (Houck et al., 2013; de Onis & Branc, 2016; Prendergast & Humphrey, 2014; Schady, 2011; Schady et al., 2015; Scharf et al., 2017; Westgard & Alnasser, 2017). Stunting is often used as a surrogate for measuring cognitive development because it is easier to measure and is considered the best indicator of children's overall health and wellbeing, and the best predictor of cognitive development (Bornstein, et al., 2012; de Onis & Branca, 2016; Grantham-McGregor, et al., 2007). Children are stunted in growth if they have a length/height-for-age measurement that falls below two standard deviations of the median on the World Health Organization Child Growth Standards (WHO, 2006). However, in their meta-analysis McDonald and colleagues (2013) found that children with multiple growth deficits (i.e., stunted and wasted or stunted and underweight) are at a higher risk of mortality in LMICs. Measuring stunting, wasting (low weight-for-height), and underweight (low weight-for-age) may give us a better idea of children's overall development than measuring stunting alone.

Developmental Delays

Westgard and Alnasser (2017) found developmental delays in rural communities in the Amazon region of Peru, including delays in communication and gross motor skills. In the Bolivian Amazon region, childhood stunting was associated with low math and writing skills (Undurraga et al., 2018). For children aged 6 to 16 years old, a change in status from not stunted to stunted decreased the probability of knowing math or writing skills compared to children who were not stunted at both time points. In contrast, children who moved from stunted to not stunted did not show improvements in math or writing compared to children who were not stunted at

either time point (Undurraga et al., 2018). These findings underscore the importance of addressing children's development from a very young age, to help them develop to their full potential and avoid the deficits in human capital that we see in children who are stunted in growth. In their study of young children's cognitive development in the highland region of Ecuador, Handal and colleagues (2007) found high rates of stunting, malnourishment, and developmental delays. Almost three quarters (73.4%) of four to five-year-old children had delayed problem-solving skills and more than half (53.4%) of children in their sample were stunted. This sample came from the Ecuadorian highlands where 76.6% of the mothers identified as Indigenous with the remainder identifying as Mestizo (i.e., mixed race) or White. The rates of stunting in these families from the highlands may be similar to that of the rural living families in the Amazon region in Ecuador and may help us hypothesize what we will find in the Amazon region. However, there are 14 different Indigenous nationalities in Ecuador, including 10 that live primarily in the Amazon. This much diversity makes it hard to generalize findings from one region of Ecuador to another, such as from the highlands to the Amazon. The current study examines similar rates of physical growth and cognitive development among rural living children in the Amazon region of Ecuador to better understand the scope of the problem in this region and what type of support these families need to help their children reach their full developmental potential.

Factors Related to Children's Growth and Cognitive Development

In addition to knowing the rates of developmental delay, researchers and policy makers need to understand what factors are associated with and potentially influencing children's development to implement effective interventions to help children from the Amazon region of

Ecuador reach their full potential. Previous researchers have found that several factors related to early childhood development in LMICs include nutrition and parental factors.

Nutrition Related Factors

Nutrition is an important factor that influences children's growth and development (de Onis & Branca, 2016; Engle et al., 2007; Walker et al., 2007). Just as it is used as an indicator of cognitive delays, stunting is also used and seen as the best indicator of malnutrition in early childhood. Rates of malnutrition and common nutritional practices vary between places and groups of people (Black et al., 2013; Leonard et al., 2000; Keeley et al., 2019). Children who have low levels of dietary diversity, a measure of the number of food groups an individual consumes in a day, are at a higher risk of becoming stunted (Motbainor et al., 2015; WHO, 2006; Roche et al., 2017). In Ecuador, having a healthy combination of both micronutrients and macronutrients can help prevent children from stunting (Roche et al., 2017). Ecuador is a very ecologically diverse country, where families from different regions have access to different foods, different breastfeeding and dietary patterns, and different levels of income and education that are all impacting children's physical growth and cognitive development (Leonard et al., 2000). Even though a common dietary practice mothers in Ecuador choose is breastfeeding, there are still high rates of stunting and cognitive delay amongst children (Keeley et al., 2019). This seems counterintuitive, as breastfeeding typically acts as a protective factor, promoting better child growth and development (Kramer & Kakuma, 2004; Victora et al., 2016; Walker et al., 2007). It may be that mothers are contributing to an intergenerational transfer of stunting and malnourishment because they are malnourished themselves, so their bodies do not produce nutrient dense breastmilk for their children (Perkins et al., 2016; Prendergast & Humphreys, 2014). This is concerning because children from two different regions, the highlands and the

coast, who had worse growth rates at the weaning from breastfeeding stage did not “catch-up” to their peers in either region by the time they were five years old, emphasizing the importance of understanding breastfeeding’s impact on these children’s growth and development as well as early intervention. Overall, Ecuador has very high rates of childhood stunting (Keeley et al., 2019). In combination, these findings exemplify the need for research in different regions of the country, such as the Amazon where very little research has been conducted, to help understand what the current nutritional practices are and how intervention and policy efforts can best help these children overcome current malnutrition they may be experiencing as well as avoid malnutrition altogether.

Parental Related Factors

A variety of parental factors have been shown to be associated with children’s development. First, overall household wealth and SES are associated with children’s physical growth and cognitive development across countries in Latin America and within Ecuador (Schady et al., 2015; Schady, 2011). These associations were found to be larger among older children than younger children, demonstrating that the developmental gap among children gets larger as they get older (Paxson & Schady, 2007). This may be due to the opportunities, support, and encouragement children from higher SES families and higher income countries receive. For example, a child from a high SES family within Ecuador may attend a better school or attend school at all, be exposed to a wider variety of psycho-stimulating environments, receive more academic and emotional support from family members, and eat a diet higher in diversity compared to a child from a low SES family within Ecuador. For families in the Amazon region of Peru, the primary water source is significantly associated with children’s developmental delay (Westgard & Alnasser, 2017). An analysis of data from 70 LMICs showed that children who had

access to higher quality water and sanitation had significantly lower odds of experiencing health problems including diarrhea, stunting, and mortality (Fink et al., 2011). Such environmental factors are also a possible mechanism through which SES impacts children's development such that families with higher SES have access to better water and sanitation.

Second, maternal stress and depression have been shown to negatively influence physical growth in early childhood among children in LMICs (Rahman et al., 2004). Researchers have estimated that maternal depression rates are higher in LMICs than in high-income countries, and that this has adverse effects on children's development, although the level of effect on children remains unclear (Herba et al., 2016; Parsons, et al., 2012; Rahman et al., 2013; Wachs et al., 2009). Previous research has shown that stress from one domain of life can spillover into another domain (i.e., financial stress can spillover into the parent-child relationship). This stress spillover may be negatively influencing children's growth and development through the types and amount of interactions parents have with their children. For example, parents with high levels of stress or that experience depressive symptoms have fewer and lower quality interactions with their children, and their children have more behavior problems when parents report high levels of stress or depressive symptoms (Puff & Renk, 2014; Pelaez et al., 2008). Parenting practices and the type of early interactions children have with their parents can influence the negative impact maternal stress and depression have on children's physical, cognitive, and other developmental domains in LMICs (Black et al., 2008; Cooper et al., 1999; Christodoulou et al., 2019). More research is needed to understand this relationship in Ecuador, specifically for families from the rural, Amazon region.

Third, a variety of parental variables have also been shown to be related to children's growth and development. Schady (2011) reports that maternal education and vocabulary skills

strongly influence children's cognitive development among children in rural areas of Ecuador, and that this relationship is stronger among older children. Torres and colleagues (2018) found that for every additional one year of formal schooling a parent had, the household income increased significantly for families in the Amazon region of Ecuador. Adolescent births are common in the Amazon region of Latin America and throughout Ecuador, and there have been political efforts to reduce the rate of adolescent births (Manosalvas, et al., 2022; WHO, 2017). The mother's age at their child's birth and the mother's education level are also associated with children's developmental delay (Westgard & Alnasser, 2017). Together these findings suggest that children of adolescent mothers are at a higher risk for cognitive delay because their mothers likely have lower levels of education and income.

Fourth, the home environment that parents create for children by engaging in a variety of caregiving practices is associated with cognitive development and on average, parents in countries with lower human development index scores engage in fewer stimulating caregiving practices compared to countries with higher human development indexes (Bornstein & Putnick, 2012; Jeong et al., 2016). In Ecuador, the quality of caregiving accounts for a statistically significant portion of the association between SES and children's cognitive development (Paxson & Schady, 2005). In a variety of other LMICs, parental stress and depression has been shown to negatively impact children's cognitive development through reduced frequency and quality of parent-child interactions (Wachs et al., 2009). More than 40% of mothers from the highlands region in Ecuador did not report engaging in any psycho-social stimulating activities with their children and children from these homes had lower levels of cognitive skills (Handal et al., 2007). Furthermore, Walker and colleagues (2007) emphasized cognitive caregiving practices as one of four main factors that need urgent attention and intervention in developing countries. These

findings suggest that the increased risk of developmental delay of children from low SES families or families with depressed mothers may be due to low levels of engagement and stimulation provided in these children's environments. Furthermore, parental factors including SES, mental health, education, income, and age, may influence children's growth and development because they all influence the type and amount of caregiving practices that children in the Amazon experience.

Current Study

As previously described, Ecuador is a very diverse country. Different regions of Ecuador differ in ecology, types of foods available and common dietary and breastfeeding practices, caregiving practices, SES, and parental mental health, income, and education. It is important to understand how these differences are associated with children's physical growth and cognitive development (Penafiel et al., 2016). It is known that the country has high rates of stunting and developmental delay (Keeley et al., 2019) but it is unclear exactly how children from the Amazon region of Ecuador fare. The current study will first examine the anthropometric growth indicators and cognitive development of children from this region of Ecuador. We will then examine what immediate and underlying (i.e., dietary patterns, caregiving practices) are associated with this group of children's growth and development. Knowing how the current developmental levels of children in the Amazon compare to national and international averages, and which factors are more strongly associated with growth and development for these children will give us more insight and understanding into what may be causing developmental and growth delays and help inform future research, programs, interventions, and activities aimed at helping improve these children's development.

Research Questions

1. How do children of the rural Amazon region in Ecuador compare to national and international developmental indicators of stunting and cognitive development?

I hypothesize that children from the Amazon region of Ecuador will have higher rates of stunting compared to the WHO's and UNICEF's national and international averages. I also hypothesize that most of these children's cognitive development will be below average for their age.

2. Are breastfeeding and diet diversity associated with children's stunting levels?
 - a. Do breastfeeding and dietary diversity predict children's stunting levels?

I hypothesize that higher levels of dietary diversity will predict lower levels of stunting, indicating healthy physical growth, in children from the Amazon region of Ecuador.

3. Are children's stunting levels, the amount of caregiving behaviors parents engage in with their children, maternal depression levels, maternal education levels, maternal age, and household income associated with children's cognitive development?
 - a. Does stunting predict children's cognitive development?
 - b. Do parental caregiving behaviors contribute to children's cognitive development beyond the impact of stunting?

I hypothesize that children with higher stunting levels will have lower cognitive development. Also, that children whose parents engage in more caregiving activities with them will have higher levels of cognitive development, and that parents' cognitive caregiving activities will contribute to children's cognitive development above and beyond the impact that stunting has on children's cognitive development.

Methods

Participants

Fifty parents and their children from the Amazon region of Ecuador were recruited to participate in this study by a master's student from Casa Grande University who currently works in a program serving young children in this region. This sample size was selected as this is an exploratory study and an a-priori power analysis indicated a minimum sample size of 43 was needed. Inclusion criteria include having a child 11- to 38-months-old and currently residing in the Amazon region. Parents interested in participating were only excluded if they had or their child had a severe disability that influences their nutritional habits, cognitive development, or physical growth. We aimed to include a diverse range of participants including those with differing SES, family structures, income levels, and education, but parents who were adolescent mothers were prioritized. This is due to the concern for the extremely high rate of adolescent pregnancy in Ecuador (WHO, 2017), and that children from these families are at an increased risk of experiencing developmental delays (Kingston et al., 2012; Lewin et al., 2013).

Measures

The Spanish version of all measures were used for this study.

Bayley Scales of Infant and Toddler Development-III (Escala Bayley de Desarrollo infantil-III; Bayley)

Children's cognitive development was measured by a trained master's student in Ecuador using the Bayley, an assessment scale that asks children to complete developmental tasks and answer developmental questions (Bayley, 2006). The Bayley is meant to assess children under 42-months old for developmental delays and risk of developmental delay in five domains, and to

provide information for the development of interventions. This study utilized the cognitive scale of the Bayley which takes about 20 minutes to complete and provides age normative scores. The cognitive scale has an overall reliability coefficient of .91 and has been translated and shown to be reliable and valid amongst Latin American children. Compared to other versions of this measure, the Bayley-III underestimates developmental delays in children and thus, using a higher cutoff score of 80 has been shown to accurately compensate for the underestimation (Johnson et al., 2014). Example tasks include hiding a bracelet underneath one of two washcloths and asking the child to find it, then repeating the task but hiding it under the opposite washcloth.

Multiple Indicator Cluster Surveys (MICS)

MICS is a questionnaire developed by UNICEF to measure the health and developmental status of children and their families in LMICs (UNICEF, 2006). The MICS for women was used to assess mothers' demographic data including education and age. Education was measured from one item that asks, "What is the highest level and grade or year of school you have attended?". Age was also measured by a single item that asks mothers to report how old they were in years.

The MICS for the home was used to describe aspects of the child's home including one question about household income and one family size question that asks the mother to list the name, gender, age, and relation to the target child for every member of the household.

Lastly, the MICS for children was used to measure children's anthropometric indicators, breastfeeding and dietary diversity, and parents' cognitive caregiving practices they engage in with the child. Children's length was measured while laying down for those under the age of two years, and children's height was measured while standing for those two years and older. Measurements were recorded on the MICS for children survey. Stunting levels were calculated using children's height and age. Z-scores were generated using the WHO Child Growth

Standards, where children are considered stunted if their height-for-age is below -2 SDs from the median (WHO, 2006). Children's age in months and gender was also included as single item questions and included as control variables in analyses. Mothers were asked two questions about whether they breastfed their child at all and if the child was still being breastfed. Children's dietary diversity was calculated by summing the total number of food groups the mother reported that the child consumed in the previous 24-hour period. The Food and Agriculture Organization of the United Nations (FAO) scoring guidelines were used which include seven different food groups for infants and children: grains, roots and tubers; legumes and nuts; dairy products (milk, yogurt, cheese); flesh foods (meat, fish, poultry and liver/organ meats); eggs; vitamin-A rich fruits and vegetables; other fruits and vegetables (FAO, 2018). A child that has consumed three or less food groups is considered to have low dietary diversity, medium dietary diversity if they have consumed four to five food groups, and high dietary diversity if they have consumed six or more food groups. Cognitive caregiving practices that parents engage in with their children was measured using UNICEF's guidelines. Mothers were asked how often they engaged in a variety of activities with their children in the past week. Response options were never, almost never, a couple times a week, or daily. UNICEF has identified three of those activities: reading books, telling stories, and naming, counting, and drawing as being important for children's cognitive development. These three items were summed to create the cognitive caregiving scale, with higher scores indicating that mothers engaged in more of these activities over the three-day period. This three item scale had a Chronbach's alpha of $\alpha = .52$ which was similar to the value Bornstein and Putnick (2012) found.

Center for Epidemiologic Studies Short Depression Scale (CES-D)

The 10-item CES-D questionnaire was used to assess maternal depression. It asks

participants to answer questions about how often they have felt certain feelings during the past week from ‘less than one day’ to ‘5 to 7 days’. The short form has been tested amongst Indigenous parents in Mexico and found to have no factorial differences compared to the normative sample of the CES-D (Franco-Díaz, et al., 2018). Example items include “During the past week things bothered me that usually don’t bother me” and “During the past week, I felt alone”. Cronbach’s alpha for the short form was .88.

Domestic Violence

A 20-item domestic violence questionnaire was used to examine the level of domestic violence these mothers were experiencing at home. Mothers were asked how often specific behaviors occurred and response options included ‘never’, ‘rarely’, ‘sometimes’, ‘frequently’, and ‘does not apply’. Higher scores indicate more domestic violence behaviors occurring. Example behaviors included ‘he limits/restricts interactions with family members’, ‘he accused you of being unfaithful’, ‘he threatened to hurt you physically’, ‘he twisted your arm/pulled your hair’, and ‘had sexual intercourse with you by force when you were not interested in having them’. This measure was developed with questions that would be applicable to women in another LMIC and has been shown to be valid and reliable (Indu et al., 2011). As suggested by the authors of the measure, a cutoff value of five was used to determine if participants were experiencing domestic violence or not.

Methods

Data was collected from the Sucumbíos province in the north eastern part of Ecuador. Sucumbíos is one of six Ecuadorian provinces in the Amazon and most people in this province live in rural communities. A master’s student from the Casa Grande University in Ecuador who works in a center serving young children in this province recruited participants through the

center and through her personal connection with the community. She was trained on ethical research practices and standardized assessment protocols for each measure used in the study and began collecting data after shown to be reliable on each measure. She conducted cognitive assessments with the young children. The master's student then met with the children's mothers to complete a variety of surveys where they were asked about depression, household and family demographic information, and children's diet and development.

Analytic Plan

The study has a descriptive design. Our hope is that this descriptive study can help increase our understanding of the relations among nutrition, caregiving practices, and child cognitive development, and inform future interventions to help children from the Amazon region in Ecuador reach their full developmental potential. Data were stored at Universidad Casa Grande (UCG). The master's student who collected the data was trained in practices regarding the protections of confidentiality of participants. She then used excel to enter only de-identified data and shared the excel file with the other members of the research team. Quantitative data analyses were then conducted using SPSS. Due to the small sample size, variables for regression analyses were carefully chosen based on previous literature, the correlation table, and the results of the qualitative portion of this study.

First, descriptive statistics of children's nutritional intake, parental caregiving, stunting rates, cognitive development, and demographic variables were explored. To answer research question one, children's levels of stunting and cognitive development was compared to country level norms from the WHO and international norms and averages from UNICEF. To answer research question two, Pearson correlations were examined to see if breastfeeding, diet diversity, mother's education level, household income, parental age, or child gender are associated with

children's stunting levels. Then, linear regression was used to test which variables predict children's stunting levels. Results from the correlation table and previous literature were used to determine which variables were included in the regression. Lastly, to answer research question three, correlations among children's stunting levels, mother's education levels, household income, parental age, maternal depression levels, child gender, and children's cognitive development were examined. Based on correlations and previous literature, a hierarchical linear regression was used to first examine if stunting predicts cognitive development for these children. The parental cognitive caregiving scale was then added in the second step of the hierarchical regression to test if the stimulation parents engage in with their children contributes to children's cognitive development above and beyond stunting.

Results

Descriptive Statistics

Maternal age ranged from 17 to 50 years, with an average of 26 years old, and children's age ranged from 11 to 38 months with an average of 26 months old. The majority (54%) of mothers had completed secondary education, but a large portion (44%) had only completed a primary level of education, and only 2% had completed any level beyond secondary education. The average monthly household income ranged from zero to \$700 USD with an average of \$178 USD. Child gender was somewhat evenly split with 42% male and 58% female children. 40% of families' main water source was a pipe inside the house. For 28% it was a pipe in the ground outside the house, 14% used a public tap, and 18% used a well. Of the 50 mothers in this sample, 14% or just seven mothers reported domestic violence levels below the cutoff value, meaning that 86% of the mothers were experiencing domestic violence. Participants also experienced high levels of depression with 96% of mothers scoring in the depressed range on the CES-D. On

average, mothers engaged in any of the three cognitive caregiving activities, as previously described, very infrequently. The average score of all three activities was between ‘almost never’ and a ‘couple times a week’.

Research Question One

Descriptive statistics are presented in Table 3.1. The average height for age z-score was 1.74 standard deviations below the norm. A z-score 2 standard deviations below the mean indicates stunted growth, indicating that 32% of children in this sample were stunted in growth. Compared to the UNICEF reported national percentage of stunting in children age birth to four years, this sample had a higher rate of stunting, supporting my hypothesis (Keeley et al., 2019). Of this sample from the Amazon region in Ecuador, 32% of children were stunted in growth which is 8% higher than the number of children stunted in growth throughout the entire country. More recent estimates from the UNICEF-WHO-WB Joint Child Malnutrition Estimates indicate a 23% stunting rate in Ecuador, indicating a 9% difference between the children from the Amazon region and all children in Ecuador (WHO, 2021). However, due to the COVID-19 pandemic data was not collected in 2020 and this is only an estimate. It is still unclear how the pandemic impacted child stunting for individual countries or on a worldwide scale. On an international level, the children in this sample also have a higher percentage of stunting compared to the 22% of children under the age of five years estimated by the UNICEF-WHO-WB Joint Child Malnutrition Estimates (WHO, 2021).

Similar to stunting rates, this sample had high rates of cognitive developmental delays. Children scored between the 1st and 38th percentile (composite score range 60-95) on the cognitive scale of the Bayley Scales of Infant and Toddler Development-III with a mean in the 11th percentile and a composite mean score of 79, indicating 74% of the children in this sample

had cognitive delays. This high rate of cognitive delays is even more than would be expected after seeing that 32% of this sample are stunted. It is also much higher than what we would expect when looking at national and international percentages of stunting as previously described (22% and 23%, respectively). When looking only at children who were stunted in growth, the mean cognitive score was in the 12th percentile and 67% had a cognitive developmental delay. This indicates that a high number of children who were not stunted in growth still had cognitive delays as indicated by their Bayley scores. In fact, 44% of children who were not stunted in growth scored below the cutoff on the Bayley cognitive scale, indicating a cognitive delay.

Table 3.1

Descriptive statistics of study variables.

Column Label	Mean	SD	Min	Max
Diet Diversity	4	1.14	2	6
Stunting (z-score)	-1.74	1.48	-8.24	0.48
Stunted (yes/no)	32%	68%		
Cog Development	79	6.93	60	95
Cog Caregiving	3.52	2.06	0	8
Child Gender	42%	58%		
Child Age	26.61	6.49	11.10	38.27
Mom Age	26.86	7.03	17	50
Mom Depression	14.62	3.69	8	26
Domestic Violence	13.02	7.73	0	32
Still Breastfeeding (yes/no)	10%	90%		

Note. Percent listed in columns starting on the left for gender are “male” and “female”; for education are “primary,” “secondary,” and “higher”; for water source are “pipe in house,” “pipe in ground,” “public tap,” and “well” respectively.

Research Question Two

Table 3.2

Correlations between study variables.

Column Label	Diet Diversity	Stunting (z-score)	Stunted (yes/no)	Cog Development	Cog Caregiving
Diet Diversity	---				
Stunting (z-score)	.18	---			
Stunted (yes/no)	-.33*	---	---		
Cog Development	.08	.04	.01	---	
Cog Caregiving	.10	-.04	-.06	-.14	---
Child Gender	.07	.23	-.15	-.10	-.02
Child Age	-.28*	-.03	.11	-.25 [†]	.12
Mom Age	-.23	.03	.19	-.18	.12
Mom Education	-.07	.09	-.22	.35*	-.05
Mom Depression	-.06	-.06	-.12	-.09	-.10
Domestic Violence	-.20	-.30*	.05	-.09	.03
Still Breastfeeding	-.13	-.01	.12	.30*	-.15

Note. ** $p < .01$. * $p < .05$. † $p < .10$.

Correlations between test variables can be found in Table 3.2. Results for research question two, which asked whether or not breastfeeding and diet diversity were associated with or predicted children's stunting levels, indicated that breastfeeding was not significantly related to children's stunting levels. However, diet diversity was negatively associated with whether or not children were stunted in growth such that children who ate foods from more food groups had less of a chance of being stunted in growth. Other variables expected to impact the relation between diet and stunting, based on previous literature and theory, were then explored. Children's gender was not statistically correlated with stunting; however, the association approaches statistical significance. The final correlation to note is the relation between stunting and domestic violence. Children whose parents reported higher levels of domestic violence had significantly higher levels of stunting.

Next, linear regression was used to test which, if any variables predict children's stunting levels. Due to the relatively small sample size, independent variables that were not significant or had not been shown by previous researchers to be related to children's stunting were trimmed from the model. Overall the model had a small adjusted R -squared of 0.12 indicating it explained 12% of the variance in children's stunting levels. As shown in Table 3.3, child gender was a significant predictor of children's stunting levels such that males had lower z -scores, indicating higher levels of stunting. Domestic violence was also a significant predictor of children's stunting levels such that for every one-unit increase in domestic violence, there was a .06 decrease in children's stunting z -score, indicating more stunted growth. Surprisingly, neither diet diversity or maternal education were statistically significant predictors of child stunting levels when child gender and domestic violence were also included in the regression model.

Table 3.3

Summary of regression analysis predicting child stunting levels.

Variable	B	SE	t	p
Constant	-2.04	0.95	-2.15	0.05*
Diet Diversity	0.12	0.18	0.68	0.50
Mom Ed	0.25	0.38	0.67	0.51
Child Gender	0.89	0.42	2.12	0.04*
Domestic Violence	-0.06	0.03	-2.32	0.03*

Note. Child Gender: 0 = male, 1 = female. * $p < .05$.

Research Question Three

Next correlations between children's cognitive development and all independent variables were explored to begin answering the last research question. Maternal education was positively and significantly correlated with children's cognitive development. Child age had a negative, significant relationship with cognitive development. Older children had lower cognitive development, which is not surprising as older children are expected to be able to do a lot more cognitively compared to younger children. A surprising non-significant result was that maternal depression was not related to cognitive caregiving or children's cognitive development. Although whether or not the child was still breastfeeding was significantly correlated with children's cognitive development, there was not sufficient variation to trust this result as all children had been breastfed to some degree and there were only five children who were still being breastfed. Of those five children, two were the youngest included in the sample at ages 11 months and 14 months. The remaining three were 19, 21, and 28 months old, and 48% percent of the whole sample were older than all five of the children still being breastfed. Furthermore, two of these five children were stunted in growth but had no cognitive delays and only one of these

children had a cognitive delay.

Regression results can be seen in Table 3.4. This model explained 11% of the variance in children's cognitive levels ($R^2 = .11$). Children's stunting levels were not significantly correlated with cognitive development and were dropped from the model. Maternal education was the only significant predictor of children's cognitive development such that for every one unit increase in maternal education levels, cognitive development increased 4.20 units. Parents' caregiving practices were then entered in the regression model. The cognitive caregiving scale, a sum of the three cognitive activities on the MICS, did not predict children's cognitive development but mothers' education level remained a significant predictor.

Table 3.4

Summary of regression analysis predicting child cognitive development.

Variable	B	SE	t	p
Constant	80.28	6.41	12.53	0.00**
Diet Diversity	0.34	0.86	0.40	0.69
Mom Ed	4.20	1.77	2.37	0.02*
Child Age	-0.19	0.15	-1.25	0.22

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

Discussion

Children from the Amazon region in Ecuador are experiencing high levels of stunting and cognitive developmental delays in comparison to both national and international standards, as hypothesized. Breastfeeding did not predict children's stunting levels, however that may be due to the lack of variability within this sample. Regardless, this finding went against what was hypothesized. Next, diet diversity was associated with children's stunting levels, however it did

not predict stunting levels when maternal education, domestic violence and child gender were included in the regression model. This finding partially supported the hypothesis that diet diversity would contribute to stunting levels even when controlling for other variables. Of all variables predicted to be associated with children's cognitive development, maternal education and child age were the only two variables significantly associated with cognitive development. Lastly, neither hypotheses regarding stunting or maternal caregiving practices predicting cognitive development were supported. Potential explanations for these findings will be discussed further.

Child Stunting

The average height for age z-score of this sample indicates that more children than expected have very low heights for their age. Previous researchers have reported stunting percentages between 14% and 40% within Ecuador depending on the population being examined, with samples from rural areas and poorer households having higher stunting rates (Keeley et al., 2019; Walker et al., 2007). With 32% of this sample from the Amazon region being stunted in growth, it is clear that these children are experiencing high levels of stunting compared to others of similar age.

Because breastfeeding is such a common occurrence in this region of Ecuador (Keeley et al., 2019), every child in this sample was breastfed. The high rate of stunting in this sample indicates that breastfeeding alone is not sufficient to prevent stunting. This may be due to intergenerational transmission of stunting as previous researchers have shown that mothers who are malnourished themselves pass their lack of nutrients onto their children through breastfeeding (Perkins, et al., 2016; Prendergast & Humphreys, 2014). With only five children still being breastfed, whom tended toward the younger age of children in this sample, it may be

that these children were just too young to be showing a developmental delay yet. Future research and intervention should consider the intergenerational effect that maternal stunting and low maternal dietary diversity may be having on children's growth and development, as well as focus on aspects related to healthy growth other than breastfeeding as it is a common practice and yet these children still have high levels of stunting and cognitive delay. Breastfeeding may also be used as a good access point to begin working with and educating families in this region of Ecuador.

Regression results indicated that while controlling for other variables, child gender and domestic violence were both significantly related to children's stunting levels. Maternal education and children's dietary diversity, unexpectedly, were not statistically significantly related to children's stunting levels. Although increasing children's dietary diversity and the combination of micronutrients and macronutrients they receive can reduce their risk of becoming stunted (Motbainor et al., 2015; WHO, 2006), when controlling for other variables dietary diversity was not related to stunting levels. The nonsignificant finding related to maternal education levels was also unexpected as higher maternal education levels have been shown to be associated with children's developmental delays (Westgard & Alnasser, 2017). These findings emphasize the importance of studying children's growth in different regions of Ecuador as different groups of children may need support in different areas due to the vast ecological and cultural diversity within the country.

My findings related to child gender and stunting levels demonstrate the opposite of what I hypothesized and what past researchers, described earlier in this paper, have argued (Houck et al., 2013). Due to cultural standards, male children have traditionally been prioritized over female children. It has been described this way because males are traditionally the breadwinners

and will become the ones who support their family financially, providing reason to prioritize their growth and development over female children's. However, in this sample female children had higher height for age z-scores. This finding may be an example of a small culture shift in this community as the high rates of teenage pregnancy in Ecuador has resulted in policy and program changes that focus on bringing awareness to female children and additional resources to adolescent girls (Manosalvas et al., 2022; WHO, 2017).

Next, my findings indicated that parents who experienced higher levels of domestic violence had children who experienced higher levels of stunting. Many researchers have studied the relationship between domestic violence, parenting, and child development, within and outside of LMICS. For example, Turunc and colleagues (2021) found that in over 16,000 families living in LMICs both paternal and maternal justification of domestic violence was related to decreased parental involvement, and that this justification of violence was indirectly associated with their children's development through parental involvement with their children. Jeong and colleagues (2020) also reported results from over 15,000 households in LMICs that indicated domestic violence had a negative relationship with early childhood development. This represents an important direction for future research, as reducing domestic violence in families from the Amazon region of Ecuador may help improve parenting practices and, in return, reduce child stunting rates.

Child Cognitive Development

Within this sample, 74% of children had a cognitive delay, a statistic much higher than expected when looking at stunting rates. Of those who were not stunted in growth, 44% did have a cognitive delay. This difference between stunting and cognitive delays is important to note as cognitive development is more intensive and takes longer to measure, thus stunting is often used

as a proxy for cognitive development in young children. Although country and international standards of cognitive development are more difficult to find there is some research on aspects of cognitive development. Compared to a sample from the Highlands region of Ecuador where 73% of four to five-year-old children had delayed problem-solving skills, this sample had similar cognitive delays with 74% of children in this sample from the Amazon having cognitive delays (Handal et al., 2007). The sample from the Highlands is a different region in the diverse country of Ecuador and the children in their sample were older than those in this research sample, so it is difficult to know how comparable these two samples are.

As for international standards, it is estimated that over 200 million children under the age of 5 years and living in LMICs have developmental delays. This includes cognitive, physical, and social-emotional delays. Researchers found that in every study they reviewed, stunting between the ages of 12 and 36 months was positively related to cognitive developmental delays (Grantham-McGregor et al., 2007). Together, these statistics emphasizes the importance of measuring these constructs in a variety of places and not just looking at national or international statistics when developing programs and policies. The high percentage of cognitive delays within this sample also indicates that there may be factors other than malnutrition and stunting that are impacting this group's cognitive development. Other aspects of the children's lives, such as parental mental health, psycho-stimulating parenting activities, and environmental factors could be contributing to children's cognitive delays. These findings support the use of the proposed conceptual and theoretical framework as shown in Figure 2 (Bronfenbrenner, 2006; UNICEF, 2015).

Regression results examining children's cognitive development showed that when controlling for other variables, the only statistically significantly related variable was maternal

education, even when maternal caregiving practices were added into the regression. Unlike other research demonstrating the importance of engaging in cognitive caregiving behaviors with children, the frequency that mothers engaged in these activities with their children did not impact their level of cognitive development. Another finding contradictory to previous research was that maternal depression was not related to cognitive caregiving or children's cognitive development (Rahman et al., 2004). It was expected that the high rates of maternal depression found in this sample would be related to the frequency of cognitive caregiving practices mothers engaged in, and in turn be related to children's cognitive development (Black et al., 2008; Cooper et al., 1999; Christodoulou et al., 2019). Cultural practices may help explain this nonsignificant finding as several mothers discussed how, contrary to western culture where mothers are encouraged to engage with their children regardless of whether or not other family members do so, this community emphasizes a more collective approach to engaging with children. If the mother does not have time to engage with the child, help with homework, or do another activity, it is very common for older siblings, cousins, or other family members to do so. It may be that to gain a better understanding of how cognitive caregiving activities impact these children's development future researchers need to look at these behaviors from a collective or community view, and that understanding how often others engage in these behaviors with a child may be an explanatory or protective mechanism that protects against the low number of times mothers personally engage with that child. Another possibility is that because mothers engaged in cognitive caregiving behaviors on average very infrequently, it is not that cognitive caregiving is not related to cognitive development, but that encouraging mothers to increasing this frequency may help boost children's cognitive development. It is common for these types of psycho-stimulating activities to not be occurring, or be occurring at very low rates within Ecuador and this has been

recognized as needing urgent attention in order to help improve children's cognitive levels (Handal et al., 2007; Walker et al., 2007). Although looking at in depth, multifaceted aspects of development, identified in my conceptual and theoretical framework (Bronfenbrenner, 2006; UNICEF, 2015), were beyond the scope of this study, future researchers should look into how these varying aspects of life may be connected to one another and holding these children back from developing to their full potential.

Although the finding regarding maternal education was not expected, it is not a surprising finding. The positive, significant relationship between maternal education levels and children's cognitive development supports the current policy and efforts being made in Ecuador to support adolescent mothers in completing their secondary education after becoming a mom (Manosalvas et al., 2022; WHO, 2017). As previous researchers have found, increasing maternal education levels does strongly impact children's cognitive development (Schady, 2011), and increases household income amongst families in Ecuador (Torres et al., 2018) which may be one mechanism through which parental education improves children's cognitive levels. Even when all other variables were included in the regression, an increase in maternal education was related to an increase in children's cognitive development and this may be a result of the political efforts in this region of Ecuador.

Current policy in Ecuador has emphasized the importance of educating mothers and keeping them in school, even after becoming pregnant and having a child (Manosalvas et al., 2022; WHO, 2017). Increased education levels of mothers in this region, where the equivalent of a high school diploma is seen as a good education, may represent an overall recognition of the importance of development and education. This supports the argument that what parents have (education, income) impacts early childhood development through what parents do (parent

involvement, sending children to preschool) (Rao, et al., 2021). For this sample of families, encouraging and assuring mothers complete their education is not only increasing their education level, but it may also be helping them recognize the importance of education all around, whether that education be at home through more parental engagement or through formal schooling.

Limitations and Future Directions

There were several limitations with this study. First, the language barrier between the participants and some members of the research team could have led to a misinterpretation of cultural practices. This was combatted by working with student and faculty researchers from Ecuador to develop all measures and methodological processes, as well as the translation, data entry, and interpretation of the data. It is important to build trust and rapport with community members and stakeholders of Indigenous communities when conducting research, and this study aimed to accomplish that by having a member of the community conduct all research and talk with stakeholders prior to beginning any data collection. Future researchers should continue these efforts as well as think about what they can give back to the community.

Second, even though the measures selected for this study have been used with similar populations, they may not be the best fitted for his population. For example, the 24-hour dietary recall questionnaire did not result in the detailed and useful information we had hoped it would due to the different language and cultural practices of this population. This should be considered and used as a lesson for future researchers to learn about their population and beta test measures whenever possible, prior to beginning data collection.

Lastly, the sample size for this study was relatively small, but it did meet the minimum sample size needed according to an a-priori power analysis. It is important to continue to support families and their children in this region by conducting further research to assure the findings in

this study are representative of the entire population.

Conclusion

Despite these limitations, this exploratory study still adds to the literature about child stunting and cognitive development for a group of families that are not commonly represented. Indeed, children were found to have high rates of stunted growth and cognitive developmental delays. Mothers did not engage with their children in activities that encourage cognitive development often, so it remains unclear if this psychosocial stimulation does not impact children's cognitive development or if the relationship was not captured in this study due to mother's infrequent engagement in these behaviors. Child gender, on the individual level, and domestic violence, on the basic causes level, were related to children's stunting levels above all other variables. When looking at children's cognitive development, only maternal education, on the basic causes level, was related. It is interesting to note that none of the variables included in this study that would be considered as underlying causes contributed to children's growth or development in a significant way. In sum, the present study demonstrated how varying levels of children's environments impact their growth and development, and emphasizes the need for further research into how these multifaceted variables may be interacting with one another to contribute to children's growth and development.

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CHAPTER IV

DISCUSSION

The goal of this dissertation was to explore the nutritional patterns, parental engagement, growth status, and cognitive development amongst young children living in the Amazon region of Ecuador. In 2015, the United Nations made childhood nutrition and development a priority when they stated that ending hunger, achieving food security and improving nutrition and promoting sustainable agriculture as one of their goals. Within this goal was the specific objective to end malnutrition and achieve specific international targets related to stunting and wasting in children under five years of age (United Nations, 2015). With the broad goal to add to the literature regarding this goal by examining children living in the Amazon region of Ecuador, I set out to better understand the current literature regarding this group of children and their families. I found that UNICEF had developed a conceptual framework of child undernutrition using Bronfenbrenner's bio-ecological theory as a guiding theory (Bronfenbrenner & Morris, 2006; UNICEF, 2015). This framework aims to help explain the causes of, and short- and long-term outcomes from child undernutrition.

This population of children from Ecuador was chosen as the focus of this research for a variety of reasons. First, the existing collaborative relationship between faculty at Utah State University and faculty at a university in Ecuador. Second, because Ecuador has a high rate of growth and developmental delays (Keeley, et al., 2019). And third, because the country of Ecuador has a very diverse physical and cultural landscape yet many statistics and researchers examine the country as a whole (Leonard et al., 2000). I found that although the UNICEF framework had been used in many LMICs throughout the world, there had been very little research done with children in the Amazon region of Ecuador from this lens. I focused on the

factors and aspects of the model that were likely influencing these children's nutritional patterns, growth status, and cognitive development to develop one qualitative and one quantitative study, and used the framework to guide research questions, methodologies, and data collection. For the qualitative study, I sought to describe the food selection and dietary diversity of children from this region as well as the strengths parents currently have, and what barriers they face in feeding their children healthy diets. For the quantitative study, I sought to describe children's growth status and cognitive development, and explore the relationship between stunting and cognitive development in young children.

Children's Dietary Habits

Results from this dissertation indicate that breastfeeding is a very common practice, that there are very few if any routines surrounding diets and mealtimes, and that these families' level of poverty fluctuates leading them to provide their children with more food when 'times are good' and less food when they are not. I also found that Chicha is commonly consumed, children are taught to like it, and it is often used as a meal replacement when food is not otherwise available. The last main finding pertaining to diet is that overall families did not put a lot of forethought or planning into their daily habits including diet, sleep, bathes, etc. Children are given foods they like, not given foods they do not like, eat many local foods such as fruit and fish as well as cheap and easy processed foods that do not spoil easily, are bathed when they 'need' to be, and go to bed when they are tired. Mothers reported having at least some knowledge about what is healthy, having autonomous and independent children who can feed themselves, and being supportive and responsive parents. However, mothers also discussed how the impacts of living in poverty made it difficult to provide healthy diets and routines for their children, and that this often led to children becoming picky, difficult eaters.

Most of these dietary habits stemmed from the core issue of poverty, with education and income being two main factors that impact children's dietary habits. For example, mothers talked about not knowing why or how Chicha may be negatively impacting their children, and mothers who experienced times when they could not afford to purchase food reported giving their children Chicha instead of a meal. Breastfeeding practices are another example of how poverty is impacting children. Every single child in this sample was breastfed and mothers reported knowing that breastfeeding promotes good growth and development, however they did not know how or why. Furthermore, the primary reason given for choosing to breastfeed was because it is free. These represent good access points for future researchers to utilize and build upon as they are both very common and accepted practices in this region of Ecuador, even though mothers do not have the resources or knowledge of how or why they should or should not be engaging in these practices.

One methodological lesson learned through this research was in regards to collecting data on these children's dietary habits. The 24-hour dietary recall presented problems and we were unable capture valid data from this measure. This is seen as a 'gold standard' method for collecting dietary information for its open-endedness and detail-oriented results (FAO, 2018), but the population that it is being used in should be highly considered. The sample used for this dissertation does not put emphasis on planning or tracking the foods, meals, or snacks they consume as is commonly done in Western culture. Contrary to the 24-hour recall used in the qualitative study, using the MICS questionnaire in the quantitative portion of the study worked much better to calculate dietary diversity for this population. The close-ended questions about specific food groups were easier for parents to remember, understand, and respond to. Although the MICS questionnaire questions do not give nearly as much detail compared to a 24-hour

recall, it can be more useful in that it is easier for researchers to capture the validity of the measure. Future researchers wanting to utilize a 24-hour recall should consider possible ways to improve the validity of responses. The scope of this study did not allow for advanced notice to families to keep track of what their children were eating, but it would be advantageous to provide families with journals or cameras prior to conducting the in-person 24-hour dietary recall. Doing so would help parents better remember what their children had eaten and give interviewers the opportunity to ask even more detailed questions regarding the foods. However, it is also important to consider research participants time when designing a study and if more detailed information is not going to be utilized, the MICS questionnaire is a quicker, easier to understand and conduct option as it still allows for collection of general dietary habit information.

Children's Stunting and Cognitive Development

In regards to physical growth and cognitive development, children in this sample had high levels of both stunted growth and cognitive developmental delays. As stunting is often used as a proxy for cognitive development in the literature, it was surprising to find that many children who were not stunted in growth did have cognitive delays. Child gender and domestic violence were both significantly related to children's stunting levels, such that boys were more stunted than girls, and more domestic violence was related to more stunting. Only mother's education levels were significantly related to children's cognitive development such that higher education was related to higher cognitive development. The amount that mothers engaged in cognitive caregiving activities with their children was very infrequent which makes it difficult to know if these activities do impact children's development or not. While this simplified look at children's growth and cognitive development does represent several entry points for intervention, it is not enough to get a comprehensive picture of the causes and consequences of children's

development. In this sample there are children who are stunted in growth but showing no cognitive delay, and there are children who are not stunted in growth but do have a cognitive delay. This is a great example of why all aspects presented in the model are needed. The more of these contributing factors we understand, including how they relate to one another, the better able we will be to help these children grow and develop.

Cognitive caregiving was not related to children's cognitive development within this sample, but since the mean frequency tells us that these behaviors are happening infrequently between mothers and their children, this is expected. This result demonstrates another entry point for future interventions. Encouraging more engagement between mother and child, providing more context to mothers about why it is important and how it helps promote development may increase the frequency in which they engage in such behaviors. A greater understanding of how cultural differences may be impacting this should be examined in future research as well. Several mothers in the qualitative portion of this dissertation discussed how older siblings and cousins often engage with the younger children, and are expected to do so, in activities that have been shown to promote cognitive development. Future researchers should examine whether anyone is engaging with these children or not, and whether there is a developmental difference between having mothers engage with their children versus other family or community members.

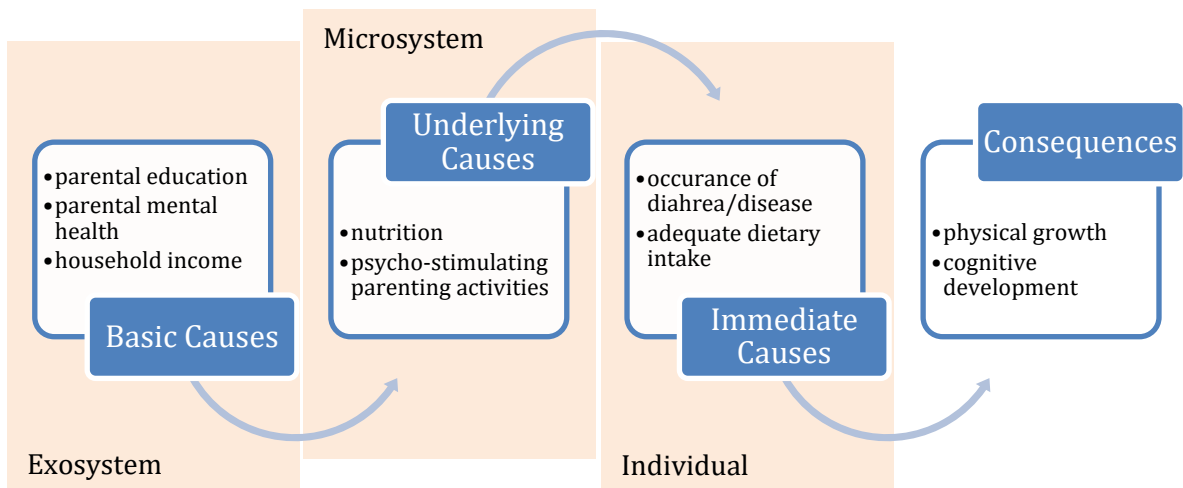
Conclusion

My goal for this dissertation was to examine some of the basic, underlying, and immediate causes and consequences of undernutrition for children in the Amazon region of Ecuador, as explained by UNICEF's conceptual framework of the determinants of child undernutrition. It is clear that this is a very multifaceted topic and even when including a variety of factors related to children's nutritional patterns, growth status, and cognitive development,

there are many things impacting children's growth and development in all levels of the framework. Figure 4.1 shows my adapted framework, demonstrating the multifactorial causes and consequences of child malnutrition in the Amazon region of Ecuador.

Figure 4.1

UNICEF's framework adapted to fit this dissertation.



Overall, my findings indicate that basic causes are impacting children's growth and development above and beyond underlying causes and immediate causes. With the exception of child gender, the only variables statistically significantly related to children's stunting levels or cognitive development were maternal education and domestic violence, both of which are part of the basic causes of child undernutrition. When considering results from both the qualitative and quantitative studies, the importance of maternal education on child development is emphasized. In both studies higher education levels resulted in improved child nutrition and development. It is important to not just educate mothers about what is healthy and what will help their children

reach their full developmental potential, but to also include aspects of why. Providing context to mothers about how and why these things will help their children encourages them more to engage in these healthy behaviors and helps them feel more invested in actually doing them. Based on previous literature, the findings are not what was expected, providing further support for the need to continue to expand knowledge on how aspects of these varying levels may be interacting with one another to impact development.

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EDUCATION

B.S. Family, Consumer, and Human Development 05/2015
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TEACHING EXPERIENCE

Utah State University, Graduate Instructor
HDFS 2660: Parenting and Child Guidance, Online [3 cr] Spring, Fall 2017
HDFS 2400: Marriage and Family Relationships [3 cr] Fall 2018, Spring 2019
HDFS 1500: Development Across the Lifespan [3 cr] Fall 2019

Utah State University, Graduate Teaching Assistant
FCHD 2660: Parenting and Child Guidance, Online [3 cr] Spring, Fall 2016
FCHD 1500: Human Development Across the Lifespan [3 cr] Fall 2017

Universidad Casa Grande, Instructor
Qualitative Research Methods for Teachers [Master's level]
2 sections Summer 2020, Planned: Summer 2021, Fall 2021

STATISTICS TRAINING

5 Graduate Level Statistics Courses:

Research Design and Analysis I & II, Dyadic/Longitudinal
Data, Extant/Secondary Data Analysis, Intro to R

4 Graduate Level Research Methods Courses:

Research Methods in Health Science, Research II:
Measurement, Qualitative Research Methods, Mixed
Methods Research

EMPLOYMENT AND RELATED EXPERIENCE

Evaluation Coordinator: 2021-2023
Utah Association of Family Support Centers
Assure all programs are meeting goals required by state and federal grants. Design, implement, and assess quantitative and qualitative research programs. Write up reports, conference presentations, and journal manuscripts. Provide statistical assistance to all 12 centers throughout the state when needed.

Graduate Research Assistant: 2015-2021
Child Care Access Means Parents in School
[CCAMPIS] Utah State University. Provide assistance to children, parents, and providers in the community. Conduct research and disseminate on national scale to influence university

resources available to student-parents, professionals' work, and future early childhood policy.

Center for Persons with Disabilities Faculty Fellowship 2018-2019

Graduate student researcher under Dr. Lisa Boyce's fellowship. Oversaw all data entry, data organization, and ran statistical tests for professional presentations. Oversaw team of 8 undergraduate students at USU, worked with two masters' level students at the Universidad Casa Grande in Ecuador.

Graduate Studies Director:

Utah State University Student Association 2017-2018

Chaired the Graduate Student Council and oversaw the Graduate Enhancement Award, member of the Graduate Council, assisted the Graduate Senator with Mental Health Week, Graduate Research and Collaborative Opportunities Grant, and the creation of a graduate student network.

Graduate Studies Senator:

Utah State University Student Association 2018-2019

Served on more than 25 university committees, created evaluation to assess the need for more family friendly resources on campus that resulted in building of a family-friendly study room and continued advocacy for student priority childcare on campus, oversaw Graduate Research and Collaborative Opportunities Grant.

PUBLISHED MANUSCRIPTS

Dotterer, A. M., Juhasz, A. C., Murphy, K. N., Park, S., & Boyce, L. K. (2020). Stress and family relationships among college student parents: A mixed methods study. *Journal of Social and Personal Relationships*, 0265407520975198.

Rombaoa Tanaka, N., Boyce, L. K., Chinn, C. C., & Murphy, K. N. (2020). Improving early care and education professionals' teaching self-efficacy and well-being: A mixed methods exploratory study. *Early Education and Development*, 31(7), 1089-1111.

RESEARCH EXPERIENCE

FUNDED GRANTS

The Impact of Food Sense Kids on Preschool Students' Vegetable Preference. Undergraduate Research and Creative Opportunities Grant Program, funded by The Office of Research and Graduate Studies, Utah State University. Hall, K., & Boyce, L. K., (\$1,345). 2015.

Child Care Access Means Parents In School. US Department of Education. Boyce, L. K., Juhasz, A., & Hall, K. (graduate assistant), (\$374,158). 2017.

UNFUNDED GRANTS

Childhood Obesity Prevention with American Indian Children. UAES Seed Grant, Utah State University. Boyce, L., & Hall, K., (\$61,509.94). 2017.

PROFESSIONAL PRESENTATIONS

- Hall, K. & Boyce, L. K., (2014, February). *Mother and Child Factor's Influence on Maternal Language*. [Poster Presentation]. Utah Conference on Undergraduate Research, Provo, UT.
- Hall, K. & Boyce, L. K., (2014, April). *Mother and Child Factor's Influence on Maternal Language*. [Poster Presentation]. National Conference on Undergraduate Research, Lexington, KY.
- Hall, K. & Boyce, L. K., (2015, April). *The Impact of Food Sense Kids on Preschool Students' Vegetable Preference*. [Oral Presentation]. National Conference on Undergraduate Research, Cheney, WA.
- Hall, K. & Boyce, L. K., (2016, March). *The Impact of Food Sense Kids on Preschool Students' Vegetable Preference*. [Poster Presentation]. Utah Early Childhood Conference, Weber, UT.
- Hall, K., Park, S. J., & Boyce, L. K. (2017, April). *Student parents' lack of attachment toward their children: A family systems perspective*. [Poster Presentation]. Society for Research in Child Development, Austin, TX.
- Hall, K., Boyce, L. K., & Ortiz, E. (2018, May). *Differences in parenting and child development in two regions of Ecuador*. [Poster Presentation]. World Association for Infant Mental Health world congress, Rome, Italy.
- Hall, K. & Boyce, L. K. (2019, April). *Student parents' stress and children's problem behaviors: An exploratory study*. [Poster Presentation]. Society for Research in Child Development, Baltimore, MD.
- Murphy, K. N., Boyce, L. K., & Ortiz, E. (2021, April 2-9). *Young children's nutrition, growth, and cognitive development in the Ecuadorian Amazon*. [Poster session]. Society for Research in Child Development, virtual.
- Murphy, K. N., Juhasz, A. C., & Boyce, L. K. (2021, June 22-26). *Fathering during college: A qualitative, multiple case study of father-child relationships*. [Poster Workshop]. World Association for Infant Mental Health world congress, Brisbane, Australia.

AWARDS AND RECOGNITION

Dean's List , Utah State University	08/2013-04/2015
Harriet R. Rasmussen Scholarship , Utah State University	2015-2016
Harriet R. Rasmussen Scholarship , Utah State University	2016-2017
Don C Carter Scholarship , Utah State University	2017-2018
Student Involvement & Leadership Center USU	
Student Association Scholarship , Utah State University	2017-2018
FCHD Phyllis R Snow Memorial Scholarship , Utah State University	2017-2018
Student Involvement & Leadership Center USU	
Student Association Scholarships , Utah State University	2018-2019
Distinguished Service Award , Utah State University	2017, 2020
Legacy of Utah State Award Nominee , Utah State University	2021

RELEVANT EXPERIENCE AND SERVICE

Utah Association for The Education of Young Children	02/2016-2019
Society for Research in Child Development, member	2017-Present
World Association for Infant Mental Health, member	2017-Present
Infant, Preschool Teacher , Adele and Dale Young Child Development Laboratory, Utah State University, Logan, UT.	Fall 2013, Spring 2015

Plan, prepare, and implement weekly lesson plans and conduct home visits.

Therapy Assistant, Child and Family Support Center, Logan, UT. 04/2014-04/2015

Manage therapists' schedules, write quarterly reports for grant funding, and manage data entry of entire center.

Nursery Aide, Child and Family Support Center, Logan, UT. 11/2013-10/2014

Schedule crisis and respite nursery visits for families, plan activities for children, care for children under 24-hour crisis care.

RESEARCH INTERESTS

Infant and toddler development: attachment, social-emotional development, motor development, and cognitive development.

Health and nutrition effects on infant and toddler development. Specifically: formula feeding vs. breastfeeding, healthy/natural eating habits, obesity, health related disease, and the role that nutrition and exercise, or active play, has on cognitive, physical, motor, and socio-emotional development.

The role familial and/or community culture and diversity plays on child development, including parental mental health.