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Walden University

College of Health Sciences

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Valescia Xenobia John

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the review committee have been made.

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Walden University
2017

Abstract

Factors Affecting Inadequate Growth During Early Childhood in Guyana, South America

by

Valescia Xenobia John

MS, Rutgers, 2003

BS, Oakwood University, 1998

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

November 2017

Abstract

Children under 5 years of age in Guyana are at an increased risk for inadequate growth. According to the United Nations Development Programme, 1 out of 3 children of preschool age are undernourished globally. This is a major public health concern as undernourishment in children under 5 years can lead to lifelong health complications. The study assessed the relationship between inadequate growth and urban classification in children under 5 years in Guyana, South America, after controlling for the following variables: mother's level of education, mother's age at birth of the child, household size, wealth, and marital status. The study framework combined the social ecological theory/model with concepts of malnutrition. The study used data from the 2009 Guyana Demographic and Health Survey, a quantitative, cross-sectional study. Logistic regression was used to test for a statistically significant association between inadequate growth and urban classification. There was a statistically significant bivariate relationship between inadequate growth and urban classification, which was no longer significant after controlling for sociodemographic covariates. Age, OR = 0.98; 95% CI = 0.96, 1.00; p =.033 was marginally significant and wealth, OR = 0.54; 95% CI = 0.37, 0.80; p = .005 were statistically significant, after controlling for sociodemographic covariates. There was a significant relationship between urban classification and mother's age at birth of child, mother's level of education, wealth quintile, and marital status. This study, which identified the need for targeted interventions, such as education, job placement, adequate housing, and appropriate nutrition, based on mother's age and wealth, will lead to positive social change in Guyana.

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Dedication

I dedicate this dissertation to my mother, Magdalene John, nee Trim and my father, Clovis Lucius John. This road has been long, winding, and arduous, but through it all they have been with me, and my biggest supporters and cheerleaders every step of the way. Their constant fervent prayers have been a great source of strength and comfort through many sleepless nights, and during my darkest hours. I am truly blessed to still have my parents with me and their values and teachings have helped me all through life, right up to this point. Mom and daddy, your labor and living have not been in vain.

I also dedicate this work to the memory of my maternal grandmother Caroline Deta Archer-Trim and my paternal grandmother, Cecilia George-John. Though they did not live to see this day, I know they would have been extremely proud of me.

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Chapter 1: Introduction to the Study

Background

The health of the world's children, including resolving issues with malnutrition, was a priority established by the Millennium Development Goals (MDG) (United Nations, 2013). Undernourishment, or the prevalence of undernourishment, was typically defined as the proportion or the percentage of the population not receiving enough food, or failing to meet the basic requirement for utilization of dietary resources (United Nations Development Programme [UNDP], 2014). Annually, undernourishment was attributed to more than 50% of deaths in children under five years, and out of the 10.8 million deaths annually in developing countries, 54% could be a direct link or implication (Darteh, Acquah, & Kumi-Kyereme, 2014). In addition, children under five years who were undernourished were susceptible to a reduced immune response, malaria, HIV, and other communicable diseases. Communicable diseases could also increase the risk of undernourishment (Thorne et al., 2013).

The prevalence of undernourishment, based on rates of stunting (height-for-age that is greater than two standard deviations below the mean) published in the 2014 Human Development Report, was 18.2% in Guyana, 9.8% in the Dominican Republic, 8.8% in Suriname, and 7% in Brazil (UNDP, 2014). According the UNDP, Guyana was 121st of 187 nations for human development needs. The 2013 MDG Report for the Caribbean, Southern Asia, and sub-Saharan Africa listed their first priority goal as reducing the proportion of malnourished children under five years by half to eradicate extreme poverty and hunger (United Nations, 2013). The United Nations (2013) reported

that this proportion remained unacceptably high and at that time, the 2015 MDG goal was not likely to be met.

One of the best ways to measure children's health and nutritional status is to assess growth. Any changes in the health and nutritional status of children will affect their growth (de Onis, Monteiro, Akre, & Clugston, 1993). Growth assessment of children is also an excellent measurement of a population's quality of life (de Onis et al., 1993). Stunting and wasting, which will be referred to as *inadequate growth*, are chronic and acute forms of undernutrition. These occurrences are often seen in children less than five years of age in developing countries (Darteh et al., 2014; Thorne et al., 2013). Undernutrition during early childhood has been associated with developmental delays, including lowered physical and cognitive responses (Gaskin, Nielsen, Willie, & Durant, 2014). These developmental delays can carry over into adolescence and adulthood where they are expressed as a diminished capacity for physical and work activity (Gaskin et al., 2014).

Stunting is defined as short or having a height-for-age that is greater than two standard deviations below the mean or below the fifth percentile in height-for-age (Adekanmbi, Uthman, & Mudasuru, 2013; Martorell & Young, 2012). Wasting is defined as low weight for length or height (Martorell & Young, 2012). Stunting and wasting are public health indicators used to assess nutritional programs, formulate intervention programs, and measure the general impact of poverty (Martorell & Young, 2012). In the Caribbean, inadequate growth has not been well-defined or researched as other developing countries, such as those in Africa, have been the focus of international efforts

due to the higher rate of undernourishment (Gaskin et al., 2014). While the geographical location of the country of Guyana is in South America, it is still considered a part of the Caribbean, as it is a Caribbean Community and Common Market (CARICOM) country, and the official language spoken is English (Gaskin et al., 2014). Despite the availability of studies on inadequate growth in Guyana, there are very few studies that have attempted to examine urban classification and the factors related to this variable in this specific region of Guyana that the current study focuses on. The gap in the literature supported that in the past there had been little attention to this in research. An understanding of the role of environment, specifically the differences in urban and rural residence could lead to policy changes that might mitigate this ongoing problem.

It is important to note the role of urban classification. Several studies had shown that in general, children who resided in rural areas had a poorer nutritional status than those who lived in urban areas (Fotso, 2007; Garrett & Ruel, 1999; Hartley, 2004; Kamal, 2011; Kwena et al., 2003; Pörtner & Su, 2013; Smith, Ruel, & Ndiaye, 2005). Urban regions offered more opportunities for growth, development, education, and advancement. Mothers who resided in urban areas were more likely to have a higher level of education, have a higher level of responsibility in making decisions for their families, were generally better cared for and knew how to take care of themselves, as well as being able to access resources and services for themselves and their children. These factors played a significant role in the nutritional status of children (Fotso, 2007; Smith et al., 2005).

Mother's education had also been shown to play a significant role in the nutritional status. Sanitation, flushable toilets, and access to running water were also more available in urban areas compared to rural ones (Smith et al., 2005). Food insecurity was less likely in urban areas, although in recent years, due to the high influx of people to urban areas, the urban poor have increased. However, inadequate growth was still developing at a higher rate in rural versus urban areas (Fay, 2005; Fotso, 2007; Garrett & Ruel, 1999; Hartley, 2004; Kamal, 2011; Pörtner & Su, 2013; Smith et al., 2005). The present study analyzed the association of urban classification, which remains the independent variable utilized to predict inadequate growth as the response. The characterization of this variable is being presented and discussed further. An understanding of the relationship of urban classification of a mother's residence and inadequate growth after adjusting for other potential risk factors identified where additional resources and efforts were needed to address this issue. Stunting and wasting were often used as tangible markers for malnutrition. The objective of the present study was to assess the association between residence, environment, and malnutrition. The results of this study filled a gap in the current knowledge of this relationship and could inform policy related to nutritional needs in Guyana and other CARICOM countries.

Problem Statement

Inadequate growth, beginning in early childhood, was a substantial contributor to the global burden of disease (Caulfield, de Onis, Blössner, & Black, 2004). In Guyana, nutritional deficiencies accounted for 3.2% of deaths in children under five years old (Pan American Health Organization, 2012). Governmental intervention was required to

address the issue of malnutrition in children under five years in Guyana. Diseases such as diarrhea, pneumonia, malaria, and measles often occurred in children who were undernourished; these acute and chronic diseases increased a child's risk of death (Caulfield et al., 2004).

In December 2013, the Guyana Ministry of Health (GMOH) issued a document titled *Health Vision 2020: Health for all in Guyana: A National Health Strategy for Guyana 2013 -2020* outlining a comprehensive national and global health plan for the country (GMOH, 2013). There were several components to the Health Vision 2020 plan including food security and nutrition. This plan incorporated the Guyana National Nutrition Strategy, 2011 – 2015, as a means of reinforcing the policy, planning, and resource framework for enhanced nutrition; the goal of which was to better the quality, variety, and sufficiency of the population's diet, and thus, reduce the prevalence of malnutrition, especially among children and pregnant women (GMOH, 2013). The current study contributed to the extant understanding of the risks associated with malnutrition by investigating other risk factors that may be contributing to inadequate growth, as a marker for malnutrition, in the population of interest. The focus of this study was on the risks associated with urban versus rural residence. Urban classification also served as a marker for maternal level of education, level of responsibility, self-efficacy, and access to resources, all factors that played a significant role in the nutritional status of children (Fotso, 2007; Smith et al., 2005). This study serves as a window of opportunity for such policies to be formulated. The missing gaps are wealth and age of the mother, which could be incorporated into health policies in addressing

malnutrition. The results of this current study contributed to current attempts to solve the public health problem of inadequate growth in children under five years due to malnutrition that has contributed to greater than 33% of global child mortality (Ahmed et al., 2009). There was limited research on malnutrition in Guyana, in general, and none that could explain the relationship between urban classification and inadequate growth in children under five years in Guyana. This quantitative study was designed to elucidate whether urban classification was associated with inadequate growth among children in Guyana, in order to fill the research gap, and influence future policies about food security and distribution and help to improve health outcomes in children under five years.

Purpose of the Study

The purpose of this study was to determine the relationship between inadequate growth and urban classification in children under five years in Guyana, South America. Stunting and wasting was a common phenomenon in children under five years in developing countries (Demissie & Worku, 2013). The physical environment could also impact the nutritional status of children (Ferguson, Cassells, MacAllister, & Evans, 2013). There are not sufficient studies to clearly characterize the role of physical environment such as urban classification in malnutrition. This study was proposed to help fill the gap in the existing available literature. A quantitative, nonexperimental, and observational, cross-sectional design was used to explore the relationship between inadequate growth and urban classification in children under five years of age while controlling for mother's level of education, mother's age at birth of the child, household size, wealth, and marital status.

Research Questions and Hypotheses

The following research questions and hypotheses were developed from the review of existing literature in the area of inadequate growth in children under five years in Guyana.

Research Question 1—Quantitative: Is there an association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status?

$H_0$1: There is no association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status.

H_a1: There is an association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status.

Research Question 2—Quantitative: Is there an association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for other variables: mother's level of education, mother's age at birth of the child, household size, wealth, and marital status?

$H_0$2: There is no association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for confounders.

H_a2: There is an association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for confounders.

Urban classification was coded as 1 = urban, 0 = not urban, which justifies its scale of measurement as binary (MOH et al., 2010). Nonurban areas referred to population healthography—place or geography has been implicated in health situations and outcomes. Rural areas with often additional characters of low education, poverty, and inadequate environment (poor housing), tend to carry adverse health consequences relative to urban areas in Guyana. Seventy-one percent of the population resided in the rural or nonurban areas, while the remainder resided in urban areas (MOH et al., 2010).

Theoretical Framework for the Study

I used the social ecological theory/model (SET/M), in combination with the conceptual framework of malnutrition. The SET/M:

> Is a theory-based framework for understanding the multifaceted and interactive effects of personal and environmental factors that determine behaviors, and for identifying behavioral and organizational leverage points and intermediaries for health promotion within organizations. There are five years nested, hierarchical levels of the SET/M: individual, interpersonal, community, organizational, and policy/enabling environment. (UNICEF & 3D Change, 2009, p. 1)

This theory focused on several influential levels or categories such as individual, interpersonal, organizational, community, public policy, and the notion that a person's behavior shapes and is shaped by the social environment. The objective was to identify

the environmental risk factors associated with malnutrition to inform policy and allow for more targeted interventions to improve children's physical and social environment (Glanz & Bishop, 2010; Stokols, 1996). This theory is relevant to the purpose of this study in implying the role of urban classification in malnutrition. The theoretical model stresses physical and social environment in predisposition to health, which is specifically the intent of the current study.

Ghazi, Mustfa, Aljunid, Isa and Abdalqader (2013) discovered a different yet interesting perspective on the link between the environment and inadequate growth. They used a cross-sectional study to look at malnutrition in three - five year olds in war-torn Baghdad City, Iraq. Since 2003, Baghdad City has been geopolitically unstable. This instability had an adverse effect on the health of its citizens, and in particular its children. While most researchers looking at malnutrition found associations with a mother's education and lower income, Ghazi et al. (2013) did not. While the outcomes in these two studies were different, it reinforced the link between urban classification and the environment. The type of environment a child grows up in, has a definite impact on the development of their cognitive, social and emotional skills. Furthermore, these differences can manifest themselves through disease or inadequate growth, and an urban or rural environment can either diminish or exacerbate the effect (Ferguson et al., 2013).

The model of risk identification in the current study involved variables that characterized environment as social and physical. The implication of urban classification as place and health was considered as an integral part of the social and physical environment. Also, within this model, wealth, which reflected socioeconomic

components of the social and physical environment, was considered. These variables either individually or combined translated meaningfully to the theoretical framework utilized in the study. Typically, the multifactoriality in terms of malnutrition was reflected in this theory. In effect, the application of this theory as a framework allowed for multiple risk factors to be examined in association with malnutrition.

In 1991, UNICEF recognized that several factors such as human and environmental resources, the economy, and the policies and ideologies of a given country all played a role in the existence of malnutrition (Gross et al., 2000). Thus, the fusion of SET/M and physiological concepts related to malnutrition, framed my research as presented in Figure 1.

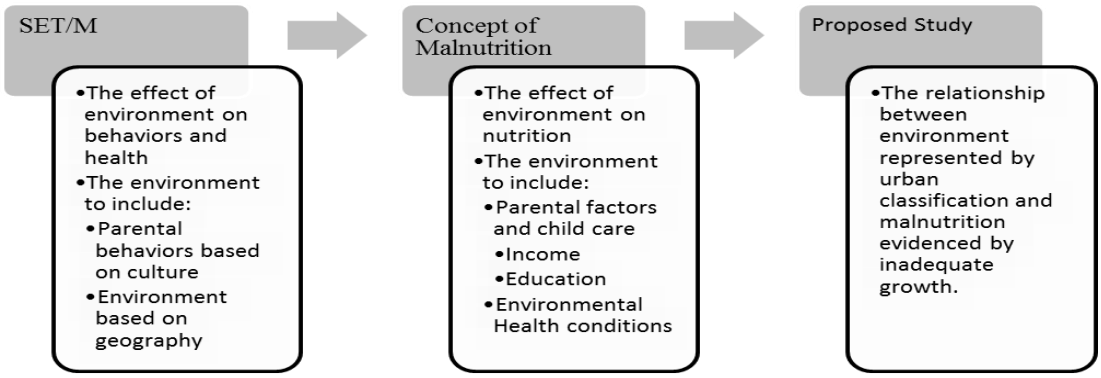

Figure 1. The fusion of theory and concept (John, 2014).

Nature of the study

The nature of the study was a quantitative, nonexperimental, and observational, cross-sectional design using secondary data collected from Guyana's 2009 Demographic

Health Survey (GDHS). The 2009 GDHS was implemented by the Ministry of Health (MOH) and the Bureau of Statistics (BOS), with technical assistance from ICF Macro. The survey was completely funded by the local mission of the United States Agency for International Development (USAID/Guyana) under the MEASURE DHS program. There were no incentives for the completion of the survey, and participants were free to decline at any time. The data for the 2009 GDHS was collected over a period of five months from March to July 2009. The 2002 Population and Housing Census was the basis for the 2009 GDHS sample design. The 2009 GDHS sample of households were selected using a stratified, two-stage cluster design consisting of 330 clusters, which were required for a sample of about 6,590 households. There were 16 teams of interviewers, and three questionnaires were used: the Household Questionnaire (HQ), the Women's Questionnaire (WQ), and the Men's Questionnaire (MQ) (MOH et al., 2010).

The methodology that was utilized to analyze these data was logistic regression. One of the main advantages of using secondary data was that it already existed. Thereby, saving the researcher time and resources, this could be enormous in the case of primary data collection (Sørenson, Sabroe, & Olsen, 1996). Generally, secondary data sources have adequate sample sizes, are representative of the target population, and reduce the probability of bias being introduced into the study (Sørenson, et al., 1996).

Quantitative research is more formal, objective, and systematic and uses numerical data collection (Owens, 2002). A quantitative methodology is focused on unbiased objective measurements how data retrieved via surveys, polls, or questionnaires and are analyzed numerically, mathematically, or statistically (Labaree, 2016). A

quantitative methodology can also be used to operationalize previously collected data by employing computational procedures. The objective of quantitative research is to collect data numerically and make it generalizable in a specific population or use it to explain a specific occurrence (Labaree, 2016).

In reviewing the literature on inadequate growth, I found that the majority of studies used quantitative data collection and analysis tools because this methodology allowed for more latitude with respect to sampling (Owens, 2002). I used inadequate growth as a measureable marker for malnutrition. Prendergast and Humphrey (2014) showed that there was precedence for my use of inadequate growth in this paper. An observational, cross-sectional design aligned with the problem statement, purpose, and nature of the study. Therefore, I proposed to examine data collected on the dependent variable (DV) and the independent variable (IV) at a single point in time, over a short period of time. The DV based on the test statistic, namely logistic regression model does not require the assumption of the shape and distribution of the variable. This variable is measured on a binary scale and as an outcome variable, justifies the regression model. The IV was urban classification, which encompassed urban and rural or nonurban. The covariates were mother's level of education, mother's age at birth of the child, household size, wealth, and marital status. The study gave a glimpse of the frequency of inadequate growth and the association with urban classification.

Given the nature of survey data, the scale of measurement of the outcome variable, namely inadequate growth as well as the predictor variables, which are measured on mixed scales (continuous, discrete, and categorical). A generalized linear

model, namely logistic regression is appropriate in assessing the effect of the association between urban classification and inadequate growth. The cross-sectional design allowed me to examine the association between urban classification (IV) and inadequate growth (DV), as well as the influence of potential confounders, though it did not demonstrate a causal relationship.

Definition of Terms and Variables

Urban classification: An umbrella term created to classify urban and rural or nonurban. The US Census Bureau defines rural as any area that is outside an urban area or urban cluster, and urban as an area that has a population of at least 50,000 (Coburn et al., 2007; Hart, Larson, & Lishner, 2005). Guyana consists of 10 regions, with specific classification into rural and urban. Rural and urban areas are further classified into coastal, and a separate classification of interior, with the possibility of a small sample and the potential for statistical instability in the process of assessing urban classification and inadequate growth. The classification of Guyana was clustered into: (a) urban and (b) rural. Therefore, for the purpose of this study, urban refers to all regions qualified by urbanization, while rural refers to all regions not considered to be characterized by urbanization.

Inadequate growth: An umbrella term created to classify stunting and wasting. Inadequate growth can also be considered as a failure to thrive in children usually within the first two years of life (Jeong, 2011).

Mother's education: The level of education achieved by the mother (MOH et al., 2010).

Mother's age: The age of mother at her first pregnancy (MOH et al., 2010).

Household size: How many children are in the household (MOH et al., 2010).

Marital status: This is defined as whether the mother was never married, married, living together, divorced/separated, or widowed (MOH et al., 2010).

Socioeconomic status (SES): This is used to describe the level of wealth or income level of a particular household (MOH et al., 2010).

Assumptions

The following assumptions were made for this study:

- The sampling scheme could yield valid and generalizable results.
- The data from the 2009 DHS for Guyana from the USAID database were continuous, normally distributed, and representative of the study population.
- If there was any missing data from 2009 GDHS from the USAID database, it was completely random and did not demonstrate bias.

The following assumptions were made based on the use of Chi-square test:

- A particular subject can only fit in one level of each of the variables, which means that the variables must be categorized as mutually exclusive.
- Each subject can provide data for one cell in the Chi-square.
- There must be independence between the study groups.
- There must be two categorical variables, at the nominal level. The data can be ordinal, and if not, interval or ratio data can be made into ordinal categories.

- "The value of the cell *expecteds* should be five or more in at least 80% of the cells, and no cell should have an expected of less than one. This assumption is most likely to be met if the sample size equals at least the number of cells multiplied by five" (McHugh, 2013).

The following assumptions were made based on the use of logistic regression:

- There must be an independence of errors.
- Continuous variables should be linear in the logit.
- There should not be multicollinearity or strong outliers.
- For each covariate, there should be at least 10 to 20 occurrences.

Scope and Delimitations

The study population was children under five years of age living in Guyana, South America. While the 2009 GDHS was collected to look at a number of different factors, the data was delimited for the purpose of this study to focus only on demographics and nutrition of children and adults. Research efforts were performed as prescribed by the research questions and overall study objectives as they were described in Chapter 3. In terms of generalizability, this study was considered generalizable because it had enough statistical power to have an observable association, providing it truly existed (Kukull & Ganguli, 2012). Construct validity could affect generalizability because the study must be deemed internally valid based on the design or experiment. A further discussion of construct validity could be found in Chapter 3. The results could only be externally valid if it was applied in a general or specific sense to other studies or samples (Kukull & Ganguli, 2012). Bias could occur because of accidental errors in

obtaining and enrolling participants, which was referred to as selection bias, and how information was gathered from the participants, otherwise known as information bias (Kukull & Ganguli, 2012).

Limitations

The following limitations were considered for this study:

- Unanticipated inadequate sample size could reduce the power of the proposed analysis to identify relationships that are significant—this introduces the possibility of a Type 2 error. Should this occur, I might have to reduce the number of variables included in the logistic regression or find additional sources of data, perhaps using information gathered in other CARICOM countries.

- There is also a possibility of missing data, but that can be addressed by reducing the model or including additional data.

Significance

This study had the potential to contribute to the extant understanding of the risk factors associated with inadequate growth in children less than five years of age, early childhood, in developing nations, using the currently understudied population of Guyana, South America. Inadequate growth was a marker for quality of life, as well as a significant cause of developmental delays and diminished capacity. The purpose of this study was to look at the risk factors associated with inadequate growth in children less than five years of age in Guyana. This paper represented an original contribution to

understanding the risk factors associated with inadequate growth in Guyana, South America.

An understanding of the risk factors associated with inadequate growth was needed if the problem was to be appropriately addressed. An increased awareness of the problem of inadequate growth during early childhood as well as a better understanding of the factors associated with it could lead to targeted interventions, and potentially a reduction in prevalence in Guyana and other developing nations. Potential long-term benefits of this research, resulting in positive social change, included a healthier population with reduced morbidity and increased lifespan. The subsequent reduced medical costs resulting from this research's impact on population health was another example of its potential to result in positive social change.

In terms of positive social change at the individual level, mothers were often the primary care givers for children and invariably, they were responsible for providing food for the family, be it from earning wages or farming (International Center for Research on Women [ICRW], 2012). However, in many developing countries, women's contributions to the agricultural industry often went unnoticed. Many women were often not paid for their work. Poverty stricken countries that improved their agricultural sector saw growth in their overall economy. Additionally, when women farmers were compensated and had control of their earnings, they ensured that the nutritional, educational and health needs of their children were met (ICRW, 2012). An increased awareness of the risks for undernourishment among mothers may help them to identify issues in their diet (and their children's diet). My study results helped to target women in either the urban or rural

setting for counseling and education. At the community and/or societal level, there were likely limited funds to work on malnutrition – those funds needed to be targeted to the areas most in need of improvement. Guyana instituted the Basic Nutrition Program (BNP) in 2002. The BNP with assistance from the Inter-American Development Bank had been successful in lowering the prevalence of child malnutrition (30% reduction in wasting; 21% reduction in stunting) using pointed interventions in many of Guyana's rural, underserved interior regions. Interventions included supplementing nutrients, educating mothers about breast feeding and providing food coupons (Seopaul, 2014). However those improvements were not in all regions. My proposed study helped communities and drove policies to help those areas most in need of intervention. This study has further effect positive social change in Guyana by (a) creating an understanding of the burden of child malnutrition for relevant policy and advocacy changes, (b) identifying factors hindering reduction of child malnutrition, (c) targeting specific groups living in rural or urban localities, and (d) bringing about changes in government and public sector nutrition for children, particularly those living in deprived communities.

Summary

This chapter provided an introduction to my proposed dissertation beginning with a background of inadequate growth in children under five years of age and the association with urban classification in Guyana, South America. In it, I addressed what is currently known about inadequate growth, risk factors, and the role of the environment, while recognizing that there is limited research on this phenomenon in Guyana. In this chapter,

I also defined the problem, research questions, and the purpose and significance of the study.

Chapter 2 includes an in-depth review of the literature related to inadequate growth, urban classification, and the theoretical and conceptual framework of malnutrition that the study hinges on. It also provides detail on the country of Guyana and its unique cultural characteristics, as well as geographical and sociodemographic characteristics of the country that are pertinent to the current study.

Chapter 3 contains a detailed discussion of the research design, rationale, and study methodology. The target population is described as well as the logic used to select the outcome variables. Confounding variables are described and methods to control confounding effects during analysis are proposed.

Chapter 2: Literature Review

Introduction

The prevalence of undernourishment based on rates of stunting published in the Human Development Report 2014 was 18.2% in Guyana, 9.8% in the Dominican Republic, 8.8% in Suriname, and 7% in Brazil (UNDP, 2014). The UNDP listed Guyana as 121 of 187 nations for human development needs. A study conducted by UNICEF, the World Health Organization (WHO), The World Bank, and United Nations, found that approximately 7.6 million children younger than five years of age died annually and 21,000 children younger than five years of age died daily, with more than one-third of these deaths being attributed to malnutrition (UNICEF, 2011). The MDG Report 2013 listed reducing the proportion of children younger than five years of age who were malnourished by half as one of the targets for their number one goal (United Nations, 2013). In 2013, The United Nations reported that the proportion remained unacceptably high and that it was unlikely that the 2015 MDG goal would be met. In the present study, I explored the association of urban classification and inadequate growth in children younger than five years in Guyana.

This literature review began with an outline of the theory and the constructs of malnutrition guiding this research. The literature review included a summation of what was understood about inadequate growth, its current associations, and those anthropometric characteristics that help framed the course and direction of this inquiry. I examined the factors that contributed to inadequate growth in children younger than five years in Guyana. Finally, I considered the literature pertaining to the explanatory

variables as they related to the concept of malnutrition in children younger than five years of age.

Literature Search Strategy

The purpose of this literature review search was to present study results associated with the independent variable, urban classification, and the dependent variable, inadequate growth. In this literature review, I considered the extant literature on the significance of the relationship between urban classification and inadequate growth. I explored the influence of any potential confounders, including, mother's level of education, mother's age at birth of the child, household size, wealth (socioeconomic status), and marital status. I performed a search of pertinent literature using several databases including CINAHL Plus, PubMed, Academic Search Complete, and MEDLINE through the available resources of Walden Library, Google and Google Scholar. The search specified only those articles in refereed journals dated between the years of 2000 through present. I used search terms such as: *factors associated with stunting and wasting, articles on stunting in children under five years old in Guyana, social change implications for research on stunting and wasting in children under 5 years of age, what are the similarities between stunting and wasting, do rural areas in the Caribbean have a higher proportion of people in poverty, Social Ecological Theory, theoretical framework- the advanced epidemiological triangle, stunting, wasting, inadequate growth, malnutrition, undernutrition, Guyana, poverty in Guyana.* These relevant search terms were used to maximize the number of responses. The search

strategy included the use of Boolean operators and a combination of the key indexing terms. Finally, I conducted a secondary search using the references of included studies.

I researched articles discussing the prevalence of stunting and wasting in developing countries, as well as factors relating to them. Older references were consulted for foundational theories of stunting and wasting since their relevance is unchanged by the passing of time. The population of interest for this study was children under five years of age in Guyana, South America.

Conceptual and Theoretical Frameworks

I have based this study on a fusion of the SET/M and the constructs of malnutrition and inadequate growth in children. The theory provided the independent variable on which I focused and framed the purpose and the potential significance of the study, while the constructs of malnutrition supported the dependent variable and my proposed methodology.

The SET/M

The SET/M focused on several influential levels or categories such as individual, interpersonal, organizational, community, and public policy and the idea that a person's behavior shapes and is shaped by the social environment (Glanz & Bishop, 2010; Stokols, 1996). The objective of SET/M was on integrating a person's efforts to change their health behaviors using environment-driven interventions to improve their physical and social environment (Glanz & Bishop, 2010; Stokols, 1996). To accomplish this, I first needed to study the impact of environment on the inadequate growth of children in Guyana.

Krieger (2001) discussed how social epidemiology has progressed into the 21st century. The term social epidemiology encompassed three broad areas: psychosocial; the political economy of health or the social production of disease; and ecosocial theory, otherwise known as SET. SET as previously stated, had many integral levels, and took into account the social determinants of health. The study of ecology is the interaction of living things with everything else around them (Krieger, 2001). The ecological perspective must include a scale, organizational levels, fluid states, mathematical models, and understanding how general concepts relate to rare occurrences (Krieger, 2001). Ecosocial theory was therefore an essential component of social epidemiology as it helped to elucidate the interaction between the social and biological environment.

Bradley and Corwyn (2005) explored SET/M by using the HOME Inventory to measure how a child's familial environment can impact their development. The HOME Inventory measured the amount and kind of parental/family encouragement and stimulation a child received at home. It covered all aspects of the familial organization, routines, involvement of extended family, and utilization of community resources pertaining to children. This study measured warmth/responsiveness, harshness/discipline, and stimulation/teaching using several different items. Specifically, Bradley and Corwyn (2005) reviewed studies on how the differences in culture and socioeconomic status (SES) impacted parenting styles using the original and modified versions of the HOME Inventory.

The three areas measured were all impacted by culture and SES. Factors such as culture, geographical location, and daily routines impact how emotions are organized and

expressed. Studies were done on several African countries, Latin America and the Caribbean, of which Guyana is a part; using the United States and Europe as reference/baseline countries. Of particular interest to me was the Caribbean as it provided potential insight into my population of interest. In terms of parental warmth/responsiveness, Latin America and the Caribbean did not have a clear result (Bradley & Corwyn, 2005). In Paraguay, Argentina, and St. Vincent, the responsiveness scores for children were lower than normal values for the United States, while Costa Rica and Chile were not that much lower than the United States (Bradley & Corwyn, 2005).

In looking at cultural differences with regard to responsiveness, there was not a significant difference between Latin American and United States and European results. However, Latin American parents were less likely to be overly affectionate with their children if a visitor was present in the home. St. Vincent, a Caribbean country, required the HOME Inventory scale to be adjusted for the area of warmth/responsiveness as praising children was not important to the measurement, primarily because parents typically do not focus on children developing a sense of independence and self-improvement (Bradley & Corwyn, 2005).

Most of the studies conducted in Africa centered on infants or children of preschool age. However, in a study in Kenya, the HOME Inventory was used for children in middle childhood, and the results indicated that children were not encouraged by their parents to participate in adult conversations during the home visits because children should defer to adults as a sign of respect. There was however positive response from parents if their children were praised by visitors and parents would often answer the

questions that were posed to their children during the home visits (Bradley & Corwyn, 2005). The same area of measurement was modified for the Yoruba and Nagpur, India based on cultural differences. Nagpur, India has a similar tradition that children must show deference to adults, and it was improper for them to speak with being granted permission, especially if nonrelated visitors were present. If adults were speaking and a child interrupted or attempted to contribute the conversation, they were promptly quieted (Bradley & Corwyn, 2005).

There was a marked difference observed with display of affection relative to SES. Gender also played a role in that there was a positive relationship between maternal responsiveness and SES (Bradley & Corwyn, 2005). In the Caribbean, by the time children reached 3 years of age, mothers were more hands-off. Children were often given chores, were required to run errands, as well as supervise and take care of younger siblings. In St. Vincent and Dominica parents often described their children using negative terms and most parents did not praise their children within a given week, as per the HOME Inventory on parent responsiveness. Children were found to be more likely to achieve and be socially functional based on the responsiveness of parents. While this idea was supported by global findings, they were variegated. In St. Vincent, there was a relationship to problems with conduct and in Jamaica it was related to motor skills and general cognitive results. In general, there was a significant difference in the frequency of warmth/responsiveness worldwide, which reflected cultural norms and SES (Bradley & Corwyn, 2005).

While the study by Bradley and Corwyn (2005) did not look at differences between urban and nonurban, they highlighted differences between regions such as Latin America, the Caribbean, Africa, Europe, and the United States. Items such as punishment were harder to measure because severe punishment is associated with maladjustment, whereas in other regions, the findings were not definitive. The SET/M underscored the need for a greater understanding of the impact of culture on parenting and the development of the child (Bradley & Corwyn, 2005). This theory lent itself to the current study in that it highlighted how all the different aspects of the framework of malnutrition contributed to inadequate growth, while it also provided a model for individual and community interventions.

Factors Contributing to Malnutrition

The factors that contributed to malnutrition encompassed socioeconomic and demographic variables, child characteristics, and child caring practices, environmental health conditions, and maternal caring and characteristics (Mengistu et al., 2013). In terms of the current study, environmental health conditions were the same. Ferguson et al. (2013) reviewed the impact of the physical environment on child development. They reviewed several areas of the physical environments. Of importance to this study were water pollution, sanitation, and access, and housing quality, which may all differ based on urban classification and could have had an impact on malnutrition. Ferguson et al., (2013) were quick to point out the lack of data and information for the global South, which included Central and South America, the majority of Asia, and Africa. This supported the gap in the literature for Guyana, located in South America. The bulk of

studies done in this area have focused on North America and Western Europe. This framework took into consideration many factors that could be associated with under nutrition. These factors varied based on regions, communities, and time. Identification of the factors that were specific to the country of Guyana could help to alleviate nutritional problems (Mengistu et al., 2013). A schematic of the factors contributing to malnutrition was shown in Figure 2.

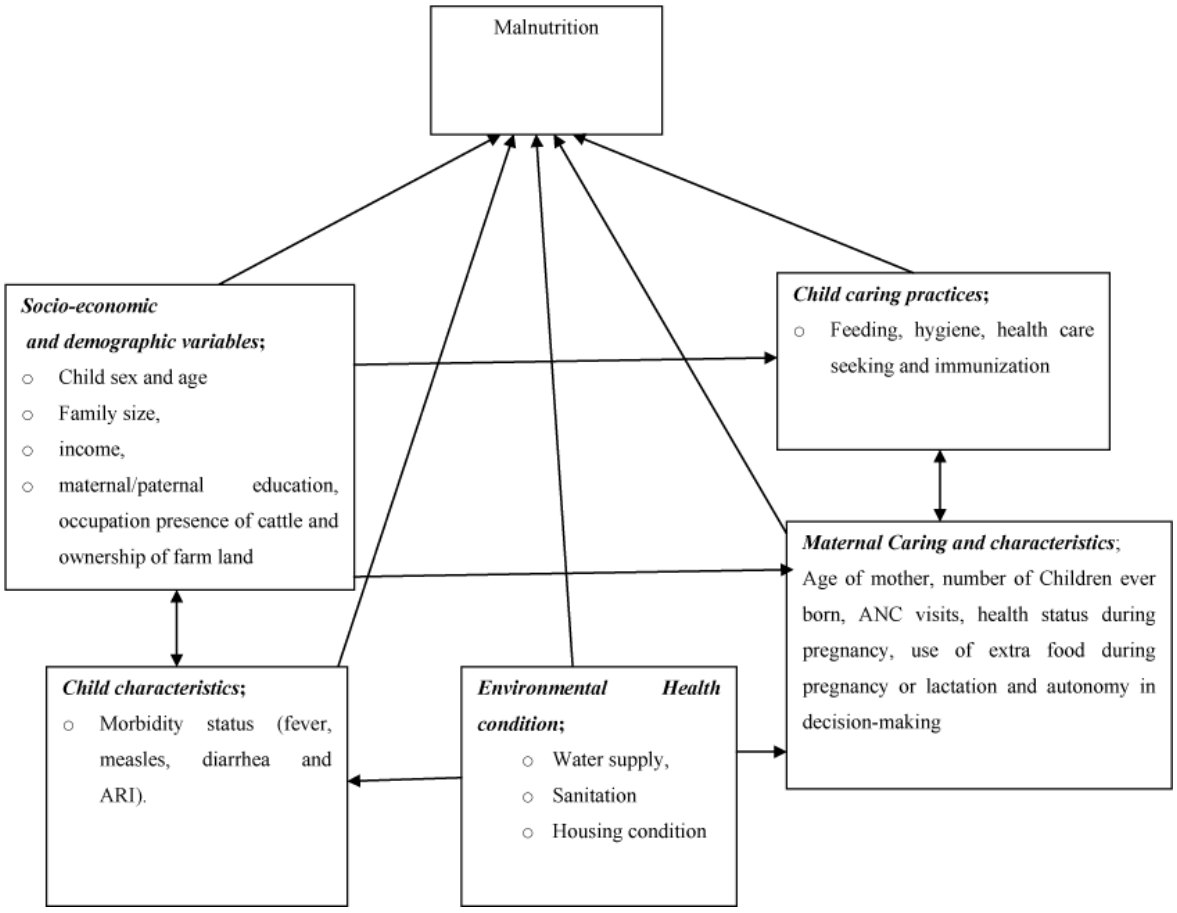

Figure 2. Factors contributing to malnutrition (Mengistu et al., 2013).

The underlying causes of malnutrition as indicated by Mengistu et al. (2013) were supported by the UNICEF which grouped them into three major categories: household

food insecurity, inadequate care, and unhealthy household environment and lack of health services, better known as poor public health (UNICEF, n.d.). Similarly, Demissie and Worku (2013) examined the same categories, as it pertained to malnutrition in children under the age of five years and found that the underlying causes of malnutrition were the same. According to Gross et al. (2000) food and nutrition security was defined as the availability, accessibility, and satisfactory use of adequate food; meaning quality, quantity, safety, and sociocultural acceptability for everyone at any point in time in order to exist in a happy and healthy environment. It therefore stood to reason that if these conditions were not being met, then there was food insecurity. In Figure 3, which was a duplicate of Figure 1 in Chapter 1, I demonstrated how the theory and factors worked together to support my research. The diagram was a fusion of the SET/M and factors that contributed to malnutrition.

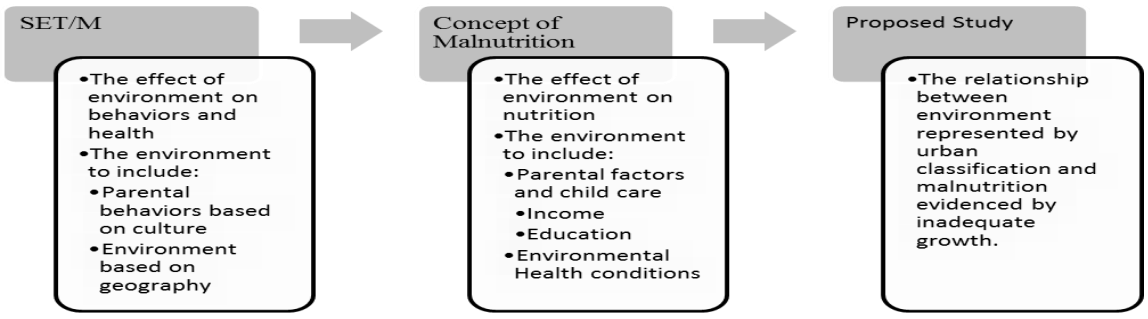

Figure 3. The fusion of theory and concept (John, 2014).

Target Population

In this study, I focused my research on the country of Guyana, its geography, demographics, and its women and children. Guyana was in the northern part of South America, and was the only English-speaking country in the region. Guyana gained its independence from Britain in 1966. It was the third smallest South American country following Suriname and Uruguay. It bordered the North Atlantic Ocean to the north, and Brazil to the south; situated between Venezuela and Suriname (Mullenite, 2015; Pelling, 1997). Guyana had a hot, humid, tropical climate with two rainy seasons; one from May to August, and the other November to January. Due to having two rainy seasons, Guyana often experienced flash-flooding, that could cause water pollution from the agricultural and industrial sectors, as well as sewage and deforestation (Mullenite, 2015; Pelling, 1997). The two largest ethnic groups were those of African descent from African slaves, and those of Indian descent from indentured laborers. Due to the lack of quality of education and opportunities, as well as inadequate medical resources, Guyana had one of the highest emigration rates in the world, with more than 55% of nationals living in other Caribbean countries, North America and Europe (Mullenite, 2015; Pelling, 1997).

Even though Guyana had one of the highest emigration rates worldwide, the country still managed to meet the MDG5 to improve maternal health (Gaskin et al., 2014; Pablos-Mendez, Valdivieso, & Flynn-Saldaña, 2013). However, Guyana did not achieved the other part of the goal, which was to end preventable child deaths; that is, an under-5 mortality rate (U5MR) of 20 deaths per 1,000 live births. In 2003, Guyana had 37, and most recently, they were at 36 (Gaskin et al., 2014; Pablos-Mendez et al., 2013).

Of note, in Guyana, maternal education was associated with infant mortality if the mother did not complete primary school (Gaskin et al., 2014).

The Global Nutrition Report submitted by the International Food Policy Research Institute (IFPRI) compiled nutrition country profiles for several countries. The 2014 profile for Guyana highlighted several areas that included economics and demography; child anthropometry, adolescent and adult nutrition status; intervention coverage and child-feeding practices; underlying determinants; and financial resources and policy, legislation, and institutional arrangements. The area that was most significant to the current study was child anthropometry. Child anthropometry data was only available up to the year 2009, which was also the year of the last DHS data that was available, and was used for the current study. The number of children under five years of age that were affected by stunting in 2009 was 18,000; wasting, 5,000 or 5%; and severe wasting was 1% (IFPRI, 2014).

The prevalence of stunting in children under five years increased from 14% in 1997 to 20% in 2009 (IFPRI, 2014). The mean prevalence of stunting based on wealth quintile showed that the wealthiest quintile had the least percent of stunting; approximately 13% and the poorest quintile had almost 33%, indicating a relationship between SES and malnutrition (IFPRI, 2014). The World Health Assembly (WHA) had four indicators: under-5 stunting, under-5 wasting, under-5 overweight, and anemia in women of reproductive age (WRA). In terms of progress made against these global targets, Guyana was off course with data only up to 2009 for stunting, wasting, and overweight, and 2011 for anemia in WRA (IFPRI, 2014). The 2014 Nutrition Country

Profile for Guyana had no available data for severe acute malnutrition based on geographic location. This study filled the gap by identifying the role that social factors, most specifically urban classification played in malnutrition.

Inadequate Growth and Urban Classification

Inadequate Growth due to Malnutrition

Many potential factors could be involved in the pattern of stunting and wasting. In developing countries, malnutrition was a significant public health crisis (Lustig, 2011; Martorell & Young, 2012; Müller & Krawinkel, 2005; Siddiqi, Haque, & Goni, 2011). The areas most affected were sub-Saharan Africa, Asia, and some countries in the Caribbean (Lustig, 2011; Martorell & Young, 2012; Müller & Krawinkel, 2005; Siddiqi et al., 2011). Poverty and inequality are two factors that are often attributed to malnutrition. While these factors have seen a drastic decline over the past 10 years in the Caribbean and Latin America, the improvements have been inconsistent. Many countries in Latin America and a few countries in the Caribbean have still not succeeded in reducing the prevalence poverty and inequality, as it related to malnutrition; therefore, the MDG goals are in jeopardy (Lustig, 2011).

One of the best ways to measure children's health and nutritional status is to assess growth. Any changes in the health and nutritional status of children will affect their growth (de Onis et al., 1993). Children's growth assessment is also an excellent measurement of a population's quality of life (de Onis et al., 1993). Stunting and wasting, referred to as inadequate growth, were chronic and acute forms of under nutrition. These occurrences were often seen in children under five years of age in

developing countries (Darteh et al., 2014; Thorne et al., 2013). Under-nutrition during early childhood was associated with developmental delays, including lowered physical and cognitive responses (Gaskin et al., 2014). These developmental delays carried over into adolescence and adulthood where they were expressed as a diminished capacity for physical and work activity (Gaskin et al., 2014).

In this study, inadequate growth was defined as either stunting or wasting. Stunting was defined as short or having a height-for-age that was greater than two standard deviations below the mean or below the fifth percentile in height-for-age and was a consequence of chronic undernutrition, causing diminished growth in a linear fashion (Adekanmbi et al., 2013; Caulfield et al., 2006; Martorell & Young, 2012). Wasting was defined as low weight for length or height that was less than two z-scores mean and national reference. Wasting was acute, which lead to severe weight loss, and this phenomenon was a useful indicator for occurrences like famines (Caulfield et al., 2006; Martorell & Young, 2012; World Bank 2006).

In order to measure the impact of poverty, formulate intervention programs, and assess nutritional programs, public health indicators like stunting and wasting were generally utilized (Martorell & Young, 2012). In the Caribbean, inadequate growth was not well defined or researched; likely because the prevalence, while higher in the US, was lower than in other developing countries (Gaskin et al., 2014). There were no studies on risk factors associated with inadequate growth in Guyana. Thus, the lack of empirical research represented a gap in the literature.

All of the studies previously cited provided evidence that malnutrition contributed to inadequate growth. Lustig (2011) compiled information on poverty, inequality and the MDGs in Latin America and the Caribbean for the Colombian government for the Sixth Summit of the Americas held in September 2011. In this report, Lustig (2011) concluded that there were five years main areas that Latin America and the Caribbean needed to focus on: (a) initial legislation to assist those currently excluded from social services, mainly the vulnerable population such as the very poor, at risk youth, and those who suffer adverse events; (b) provide more opportunities for everyone, primarily through education irrespective of SES, ethnicity, gender, or age; (c) a reduction in maternal and other preventable deaths; (d) cease spending that doesn't fairly distribute income, impose higher taxes on the wealthy, and use public funding to decrease poverty; and (e) assess the effectiveness of current policies and legislation to reduce inequality and poverty.

Martorell and Young (2012) investigated patterns of stunting and wasting in preschool children from India and Guatemala as per the WHO standards and the WHO/National Center for Health Statistics (NCHS) reference. Data for India was obtained from the 2005-2006 National Family Health Survey (NFHS3), and for Guatemala, data was taken from the 2008-2009 Reproductive Health Survey. Data analysis included descriptive statistics and multiple logistic regression that was performed by country with stunting and wasting as the dependent variable, and the independent variables were age of child, male sex, wealth index, mother's height, mother's BMI, and mother's age. The analysis and chosen variables, supported the choice for the current study.

Müller and Krawinkel's (2005) findings were integral to the current study because it reviewed malnutrition and health in developing countries. Their study looked at the direct and indirect causes of malnutrition, which included pathophysiological, epidemiological, and clinical aspects of protein-energy malnutrition and micronutrient deficiencies as well as the overseeing and administration. The primary cause of malnutrition was determined to be poverty, which was considered a potential confounder in the current study. Guyana's designation as a developing country was in line with the overview presented by Müller and Krawinkel (2005) because it provided insight as to how developing countries could deal with the prevalence of malnutrition. Siddiqi et al., (2011) was relevant to my proposed study in that (a) it showed a high prevalence of stunting, and (b) stunting was strongly associated with maternal factors. The study's aim was to look at the differences and similarities of risk factors associated with malnutrition in Bangladeshi children younger than five years of age. Similar to my study, the researchers used the Bangladesh Demographic and Health Survey (BDHS) from 2007 to look at stunting, wasting, and underweight, and analyzed the data via logistic regression and Chi-Square tests. Demographic and socioeconomic factors were found to have an association with malnutrition. Study strengths included: the use of a DHS as well as a reference population in order to determine children's growth status. Siddiqui et al., (2011) also used child growth standards from the WHO based on international samples, which allowed their data to have a comparison.

Urban Classification

The role of urban classification in relationship to environment and nutritional status was significant. Several studies showed that in general, children who resided in rural areas had a poorer nutritional status than those who lived in urban areas (Fotso, 2007; Garrett & Ruel, 1999; Hartley, 2004; Kamal, 2011; Kwena et al., 2003; Pörtner & Su, 2013; Smith et al., 2005). Fotso (2007) examined the differences between the urban and rural areas as it related to child malnutrition. The urban population saw a dramatic increase over the past few decades, over 50% back in 2007. According to the WHO (2017), the urban population increased to 54% in 2014. The current trend predicts that between 2015 and 2020, there will be a 1.84% increase, annually. Due to the mass migration to urban areas to seek opportunities, the population exploded with typically disadvantaged families, who may have experienced difficulty adjusting to an urban lifestyle. In sub-Saharan Africa, a region not unlike the country of Guyana, the economy has declined, despite the surge in urbanization (Fotso, 2007). Fotso (2007) found that over time, the supposed urban advantage that children had in terms of nutrition had decreased. What appeared to have protective effects on the phenomenon were the mother's education and a higher SES. The author used several models to control for various SES measures such community SES, household wealth, mother's education, father's education, and mother's occupation. He found that community SES decreased the urban-rural gap, so that children were less likely to experience malnutrition. However, when all of the SES measures were included there was no significant change. The difference between malnutrition in urban versus rural areas were almost the same.

Interestingly, Fotso (2007) also found that the urban-rural differentials were significant, as was the expectation that malnutrition in children was higher in rural versus urban regions. Controlling for SES measures was found to eliminate the gap.

Pörtner and Su (2013) looked at data from the 2005-2006 NFHS3, which provided information about child health in rural, urban and slum areas. The aim of the study was to elucidate what fueled the differences in child health by looking at the impact of household characteristics, environmental conditions, and wealth. Pörtner and Su (2013) found that the highest occurrence of malnutrition was in rural areas, with children in the slums being less malnourished, and children in urban areas were the least malnourished. Similar to the study by Fotso (2007), the researchers found that when variables such as parental education, mother's height, and state and survey month fixed effects were controlled for, the urban health advantage decreased, and there were no significant differences in child health in rural and slum regions. In fact, controlling for household wealth and area characteristics, slum children were more malnourished than rural children were. Pörtner and Su (2013) concluded that simplistic averaging showed children in rural areas were the most malnourished, with children in urban areas being the least malnourished and those in slum areas falling somewhere in between. Children's health situations changed however with migration from rural areas to slum areas. This gave credence to the influence of urban classification as it related to inadequate growth in children under five years.

Smith et al. (2005) investigated 36 developing countries including some countries in Latin America and the Caribbean (Guyana was not included) to determine why

childhood malnutrition was higher in rural areas versus urban ones. Their findings were found to be consistent with previous research, which showed the nutritional status of children to be higher in urban regions. In addition, they found that in Latin America and the Caribbean the rate of stunting in rural areas was twice that of urban areas. Urban regions offered more opportunities for growth, development, education, and advancement. Mothers who resided in urban areas were more likely to have a higher level of education, have a higher level of responsibility in making decisions for their families, were generally better cared for, and knew how to take care of themselves, as well as how to access resources and services for themselves and their children. These factors played a significant role in the nutritional status of children (Fotso, 2007; Smith et al., 2005).

Potential Confounders

The concept of confounding was contingent upon three conditions:

The factor must:

C1 be a cause of the disease, or a surrogate measure of a cause, in unexposed population; factors satisfying this condition are called risk factors and

C2 be correlated, positively or negatively, with exposure in the study population. If the study population is classified into exposed and unexposed groups, this means that the factor has a different distribution (prevalence) in the two groups and

C3 not be an intermediate step in the causal pathway between the exposure and the disease

New stricter condition, now replacing C3:

C3a not be affected by the exposure (McNamee, 2003).

However, while all confounders might have met these conditions, the factors that met these conditions may not have caused confounding. In that case, another definition of confounders might be applicable, as it took into consideration non-comparability (McNamee, 2003). Confounding was therefore defined as:

A lack of comparability between exposed and unexposed groups arising because, had the exposed actually been unexposed, their disease risk would have been different from that in the actual unexposed group, or a bias in the estimation of the effect of exposure on disease, due to inherent differences in risk between exposed and unexposed groups (McNamee, 2003).

SES. Inadequate growth was not limited to the Caribbean, and specifically Guyana. It was alarmingly prevalent in Sub-Saharan Africa and South Asia (Martorell & Young, 2012; Müller & Krawinkel, 2005; Siddiqi et al., 2011). Numerous studies were done in these regions. However, studies in the Caribbean were extremely limited. Many of the factors that were found to have a direct correlation to inadequate growth in children under five years in these regions were also attributed to inadequate growth in children in Guyana. There were several socioeconomic, demographic, child-rearing, and environmental factors that contributed to inadequate growth in children less than 5 years (Yimer, 2000). One of the primary socioeconomic factors was household wealth, or the existence of poverty.

Poverty was often regarded as an issue that occurred in rural areas because of a lack of access to resources and services. As of 2005, almost three-quarters of the

population in Latin America and the Caribbean were living in the cities, making it an urban region. Higher income, more access to services, lower incidence of poverty; were all factors that were usually associated with urban areas (Fay, 2005). In general, this proved to be true since in Latin America the incidence of urban poverty was 28%, which was half of rate of poverty in rural areas and extreme poverty was one-third of the rate in rural areas [12%] (Fay, 2005). However, 60% of the poor, and 50% of the extreme poor lived in urban areas (Fay, 2005). Statistical trending predicted that if poverty rates continued at the same rate, by the year 2015, 66% of the poor in the Caribbean and Latin America were living in urban areas (Fay, 2005).

To a great extent, poverty was location specific. In urban areas, the economy was largely dependent on the exchange of currency for goods and services; therefore earning a wage was essential to survival (Fay, 2005). Underprivileged people living in urban areas were faced with several concerns: a steady income, maintaining housing, self-preservation from violence and crime, and staying healthy (Fay, 2005). The SES of a household was a direct indicator of food security. Yimer (2000) found that there was an association with SES and children's nutritional status. SES influenced the nutritional status of children because it determined how much food children received and consumed, whether or not they used health services, and had access to clean water and sanitation amenities (Yimer, 2000). SES also had an inverse relationship to stunting, since children from poor families were 1.9 times more to be stunted versus those from wealthier families (Yimer, 2000). Malnutrition was also more prevalent in rural areas (Yimer,

2000); supporting the premise for the current study, that malnutrition was affected by urban classification.

SES was also found to have an effect on the nutritional status of children less than five years of age in Hawassa, Southern Ethiopia (Wolde, Belachew, and Birhanu, 2014). Data for this study was collected using a structured interviewer administered questionnaire. Children ages 36-47 months from low SES households were 2.9 times more likely to have inadequate growth, specifically wasting. Overall, children from low SES households were 4.4 times more likely to be wasted in comparison to those from high SES households (Wolde et al., 2014).

Mother's education. Several studies have identified maternal education as having an effect on the occurrence of inadequate growth (Abuya, Ciera, & Kimani-Murage, 2012; Demissie & Worku, 2013; Siddiqi et al., 2011; Wolde et al., 2014; Yimer, 2000). The study by Abuya et al. (2012) was different in that they chose to look at the effect of mother's education on children's nutritional status in slum areas in Nairobi, Kenya. Traditionally, cities had a modicum of protection against malnutrition, because the assumption was that there was more access to services. However, in recent years, unsatisfactory health and poor nutrition increased in urban areas because more people were living in slum areas, as urban populations increased and the availability of adequate housing did not increase with it (Abuya et al., 2012). The findings showed that mothers who were educated only up to the primary level had 43% of children stunted, while those who obtained a secondary education only had 37% of children stunted (Abuya et al., 2012). While Abuya et al. (2012) observed that the addition of SES changed the effect of

education on stunting slightly, mother's education was still more significant, and consequently SES did have a significant effect on stunting as previously discussed.

Methodology

The two inferential statistical analyses I selected for this project were the Pearson's Chi-square test, and multivariable logistic regression. Pearson's Chi-square test was often referred to as the test for independence, and was used to determine if there was a relationship between two categorical variables based on the nature of the secondary data; determine if the sample selected were generalizable; and evaluate whether there was a normal or geometric distribution of the data (Diez, Barr, & Çetinkaya-Rundel, 2015; Field, 2009). This test allowed me to examine if there was a significant association between the IV, urban classification, and the DV, inadequate growth due to malnutrition. It did not allow for control of all potential confounders.

As the DV was measured on a binary scale, inadequate growth was categorical, with only two possible responses, inadequate growth, and not inadequate growth. Inadequate growth was an umbrella term created for combining stunting and wasting, which was already operationalized in the dataset. I proposed to use multivariable logistic regression to test the association of inadequate growth and urban classification after adjusting for any potential confounders. Potential confounders originated from the literature and demonstrated through Chi-square tests that they influenced the association of urban classification and inadequate growth. The primary association of the DV and IV will be considered significant, and the null hypothesis for the second RQ will be rejected, if the OR has a significance of $<.05$.

Summary

This chapter provided a guide to the search strategy, highlighted the key search terms and search engines used, and a detailed review of the literature related to inadequate growth, urban classification, and the SET/M and conceptual framework of malnutrition, which were the foundation of the study. In it, I also provided essential details about the population of Guyana and its unique cultural characteristics, as well as the geographical and sociodemographic characteristics of the country that were pertinent to the current study. Research conducted by UNICEF, the WHO, The World Bank and United Nations, found that approximately 7.6 million children less than five years of age died annually, and 21,000 children less than five years of age died daily, with more than one third of these deaths being attributed to malnutrition worldwide (UNICEF, 2011). In Guyana, limited research was done on this issue; therefore, this study proposed to fill this gap. In this chapter, I discussed at length the dependent variable of inadequate growth, the independent variable of urban classification, and potential confounders related to mother's characteristics. Research from studies conducted in other countries suggested that non-urban children were more likely to suffer malnutrition than their counterparts in the urban areas do, though much of the observed difference was eliminated after controlling for SES. These results were not conclusive and may differ when the children of Guyana are the target population. The chapter concluded with examples of the proposed methodology for the current study.

Chapter 3 presented a detailed discussion of the research design, rationale, and study methodology. The target population was described as well as the logic used to

select the outcome variables. Confounding variables were described and methods to control confounding effects during analysis were proposed. Finally, validity issues related to the proposed use of secondary data and ethical considerations were discussed.

Chapter 3: Research Method

Introduction

The purpose of this study was to explore the relationship between inadequate growth and urban classification in children under five years in Guyana. Stunting and wasting was a common phenomenon in children under five years in developing countries. Stunting was defined as short or having a height-for-age that was greater than two standard deviations below the mean or below the fifth percentile in height-for-age (Adekanmbi et al., 2013; Martorell & Young, 2012). Wasting was defined as low weight for length or height (Martorell & Young, 2012). Stunting and wasting were public health indicators used to assess nutritional programs, formulate intervention programs, and measure the general impact of poverty (Martorell & Young, 2012). The physical environment has affected the nutritional status of children. This association was not fully understood in Guyana. This study proposed to help fill the gap in the existing available literature and investigated the association between inadequate growth and urban classification in children under five years of age in Guyana, South America. A quantitative, nonexperimental, and observational, cross-sectional design was used to explore the relationship between inadequate growth and urban classification in children under five years of age while controlling for mother's level of education, mother's age at birth of the child, household size, wealth, and marital status.

In this chapter, I presented the research questions and hypotheses, discussed the rationale for the proposed research design, and explained how it aligned with existing knowledge. I discussed the population and sampling method as well as the recruitment

method utilized for the 2009 GDHS. I discussed the instrumentation and materials used by the 2009 GDHS, which included steps taken to enhance reliability and validity. I also discussed the data analysis methods in detail. The next section addressed threats to internal and external validity, as well as measures for minimization. Finally, I discussed ethical considerations with the use of secondary data and the protection of participants, and summarized the chapter.

Research Questions, Design & Rationale

Research Questions

Research Question 1—Quantitative: Is there an association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status?

$H_0$1: There is no association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status.

H_a1: There is an association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status.

Research Question 2—Quantitative: Is there an association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for other variables: mother's level of education, mother's age at birth of the child, household size, wealth, and marital status?

$H_0$2: There is no association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for confounders.

H_a2: There is an association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for confounders.

Research Design and Rationale

Through this study, I hoped to gain a better understanding of the impact that urban classification had on inadequate growth. To explore this relationship, I conducted a secondary analysis of the 2009 GDHS dataset. This study examined two research questions, the first addressed the relationship between urban classification of residence and its association with mother's education, mother's age at birth of child, household size, wealth quintile, and marital status. The second question addressed the relationship between urban classification and inadequate growth after controlling for confounders. To address my research questions, a quantitative, cross-sectional design was used on the 2009 GDHS data. The main purpose of a cross-sectional study was to establish prevalence (Mann, 2003). At a specific point in time, the number of cases in a population was referred to as prevalence. At that specific point in time, all required measurements were made on each individual (Mann, 2003). Participants were assessed at one specific point in time to determine if there was exposure or not, and whether or not they had the outcome of interest (Mann, 2003). The assessment at one specific time-point was a possible limitation because there was no way of determining if being exposed to the

disease occurred before during or after it began (Levin, 2006). Because the sequence of events was unknown, causality could not be inferred (Levin, 2006).

Cross-sectional studies were advantageous because participants were not exposed, and then given or denied treatment, so there were few ethical issues. Data was collected all at once, with one group being used, and in this way, several outcomes could be studied, which made this type of study design cost effective. Cross-sectional studies typically utilized questionnaires or conducted participant interviews (Mann, 2003).

The use of secondary data was chosen due to the availability of the GDHS. Secondary data was more accessible, and more cost effective versus primary data collection. In addition, the use of secondary data did not intrude on participants, and in the case of the GDHS, the sample was large and covered the entire country (Carlson & Morrison, 2009). One disadvantage in using secondary data was that there was little control regarding data collection, accuracy, and variables (Carlson & Morrison, 2009). Concerning the GDHS, another disadvantage was that no more DHS were done after the year 2009. In Guyana, there was very little change in the nutritional status of children since 2000. Data from the 2006 Multiple Indicator Cluster Survey round 3 (MICS3) and the 2014 Multiple Indicator Cluster Survey round 5 (MICS5) published by the BOS, MOH, and UNICEF (2008, 2015), were relatively similar. According to the data, the prevalence of stunting was 13.7% in 2006, compared to 12.0% in 2014. The prevalence of wasting was 7.6% and 6.4% for 2006 and 2014, respectively. In 2000, the prevalence of stunting and wasting was 10.8% and 10.6% respectively. The reality was that in a developing country like Guyana, the financial resources were simply not available for

consistent research and monitoring. In addition to the lack of resources, there was also a lack of skilled personnel available to undertake this kind of research, as evidenced by the fact that the 2009 GDHS was in partnership with USAID. These issues were a contributing factor as to why a more recent GDHS did not exist.

Setting and Sample Size

Source of Secondary Data

The survey covered several different areas such as fertility, family planning, sexual activity, HIV awareness as well as other infections, infant and child mortality, and the health and nutritional status of mothers and children. The BOS and the MOH conducted the survey in Guyana. USAID provided funding for the survey and contracted ICF Macro of Calverton, Maryland to provide technical assistance. The inclusion and exclusion criteria for the GHDS were described in detail in Table 1. The participants of the GDHS were sampled according to the inclusion and exclusion criteria.

Table 1

Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
Women and men ages 15-49 years who were permanent residents of the household or visitors who were present the night before survey was administered, children under five years of age, marital status, education, wealth quintile, religion and ethnicity, residence (urban/rural)	Women and men below age 15 years and above age 49 years; children born before 2004 Ineligibility due to no adult being present to be interviewed despite several attempts

Procedures for Recruitment, Participation, and Data Collection

For administrative purposes, Guyana was divided into 10 regions, and to conduct the census, the regions were further divided into enumeration areas (EA), which were either rural or urban. Recruitment for the GDHS study was done via a stratified two-stage cluster sample design. The BOS used the 2002 Population and Housing Census as the master sample for the 2009 GDHS. The sample consisted of 330 clusters, with 6,590 households. To ensure that the number of survey respondents were representative of the population, weights were calculated instead of using self-weighted samples.

The data for the 2009 GDHS was collected over a period of five months from March to July 2009. There were 16 teams of interviewers, with each team having a supervisor, a field editor, two male and two female interviewers, and a driver. Ninety-six fieldworkers collected data from the Coastal EA and later 60 fieldworkers collected data from the Interior EA. There were three questionnaires used for the 2009 GDHS: the HQ, the WQ, and the MQ. These questionnaires were patterned after the MEASURE DHS program. USAID and Guyana collaborated to adjust the questionnaires to make them representative of Guyana by focusing on issues such as general health, family planning, and population. Since this study was done using questionnaires, participants fulfilled their study requirements as soon as the survey was completed, so there was no need for any debriefing. Follow ups were done if at the time of attempt, no eligible adult was at home. The women's and men's questionnaires were similar, but the men's was shorter because it did not include any questions about reproductive history, or maternal and child health and nutrition.

Original Data Instrumentation and Materials

The 2009 GDHS was a collaboration of the MOH & BOS, Georgetown, Guyana, ICF Macro who provided technical assistance, and USAID. It was a part of the worldwide MEASURE DHS program, created to help developing countries collect, analyze, and distribute data on maternal and child health, family planning, and fertility. As mentioned above, three questionnaires were used for the 2009 GDHS: the HQ, the WQ, and the MQ. The HQ was used to collect information on the characteristics of the individuals listed in the household, which included sex, age, education, and relationship to the head of household, material used for flooring, and possession of durable goods was collected as data for the dwelling. The WQ was used to collect data from all eligible women age 15-49 years. Women were asked about background characteristics, birth history and childhood mortality, knowledge and/or use of family planning, fertility preferences, breastfeeding and infant feeding practices, prenatal and delivery care for children, marriage and sexual activity, just to name a few. The MQ was used to collect data from eligible men age 15-49 years, and collected similar information as the women with the exception of reproductive history, maternal and child health and nutrition.

Data validity. Efforts were made by field workers to minimize missing data/interviews by making multiple trips to homes to interview households if no adult was present at the time of the first visit. Out of 5,547 eligible women identified, 4,996 women completed the interviews, equaling a 90% response rate. Out of 4,553 eligible men identified, only 3,522 men completed the interviews, equaling a 77% response rate.

Numbers were weighted in order to ensure that there was a sufficient number of survey responses for each region based on the actual population distribution.

Proposed Study

Population and sampling method. This was a secondary analysis of the data collected in the 2009 GDHS, which was a nationally representative sample survey of women, men, and children. The current research study focused on the nutritional status of children under 5 years of age. The research population for the proposed study included 4,996 women and 3,522 men, and valid weight and height measurements were collected for 2,059 children under five years of age.

Sample size. The research population for the proposed study included 4,996 women and 3,522 men, and valid weight and height measurements were collected for 2,059 children under five years of age. I used GPower 3.1 software to determine the sample size needed for the current study (Faul, Erdfelder, Lang, & Buchner, 2007). Whereas the overall sample involved 2,059 children, the section on malnutrition only comprised of 1,549, justifying the rationale for this sample size utilized in the study. The sample utilized in this study reflected excess sample based on the sample size estimation of 988. This number was identified to be adequate in detecting the difference between rural and urban areas with respect to malnutrition, implying adequate statistical power, $1 - \beta \geq 80\%$.

Data collection process for my study. I contacted the DHS Program, and created an account. In creating an account, I was required to provide a rationale as to why I would need access to the specific dataset. After requesting access, my account was

reviewed and I was granted permission via an email message, which was attached in the appendix.

Study Variables and Covariates

The study variables listed in Table 2 were selected based on the research questions, literature review, and data available in the secondary dataset. The variables were taken from the 2009 GDHS.

Table 2

The Dependent Variable, Independent Variable, and Covariates

Variable	Variable Name	Variable Source	Potential Responses	Level of Measurement
Dependent	Inadequate growth	GDHS	Yes/ No (stunting & wasting)	Binary
Independent	Urban classification	GDHS	(urban or rural/non-urban)	Binary
Covariate	Mother's level of education	GDHS	No education Primary Secondary More than secondary	Ordinal
Covariate	Mother's age at birth of child	GDHS	15-19 20-29 30-39 40-49	Ordinal
Covariate	Household size	GDHS	Size range	Continuous
Covariate	Wealth quintile	GDHS	Lowest Second Middle Fourth Highest	Ordinal
Covariate	Marital status	GDHS	Never married Married Living together Divorced/separated Widowed	Nominal

These variables were introduced in Chapter 1 and discussed in detail in Chapter 2. Here I specified the operational definitions:

Inadequate growth: An umbrella term created to classify stunting and wasting. Inadequate growth was also considered as a failure to thrive in children usually within the first two years of life (Jeong, 2011). The original study defined stunting as children whose height-for-age Z-score were below two standard deviations (-2 SD). These children were considered short based on their age and had chronic malnutrition. Wasting was defined as children whose weight-for-height was below two SDs. These children were considered thin based on their age and had acute malnutrition (MOH et al., 2010). I combined these two outcomes, while avoiding the duplication of records for children who were both, otherwise known as underweight.

Urban classification: An umbrella term created to classify urban and rural or non-urban. The original study classified residence as Total Urban with sub-categories of Georgetown (urban) and Other (urban); Total Rural; Total Coastal with sub-categories of Coastal (urban) and Coastal (rural); and Total Interior. In addition, all of Guyana was divided into 10 regions as per the Census Bureau.

Mother's education: The level of education achieved by the mother (MOH et al., 2010).

Mother's age: The age of mother at her first pregnancy. In the original study, in describing the micronutrient intake among children, the mother's age was categorized into an ordinal variable (MOH et al., 2010).

Household size: How many children were in the household (MOH et al., 2010). This was a continuous variable representing the actual number of children specified.

Wealth: This was used to describe the level of wealth or income level of a particular household (MOH et al., 2010). The original study used a method by Gwatkin, Rutstein, Johnson, Suliman, Wagstaff, and Amouzou (2007) to establish wealth quintiles. The study used the wealth index, which was used in many counties to determine household income inequities, health outcomes and the utilization of health services. The wealth index was configured by assigning a "weight or factor score to each household asset through principal components analysis. The resulting asset scores were standardized in relation to a standard normal distribution with a mean of zero and a SD of one. These scores were summed by household and individuals were ranked according to the total scored of the household in which they reside. The sample was then divided into population quintiles—five years groups with the same number of individuals in each. At the national level, approximately 20% of the population was in each wealth quintile" (Gwatkin et al., 2007).

Marital status: This was defined as whether the mother was never married, married, living together, divorced/separated, or widowed (MOH et al., 2010).

Data Analysis Plan

The software that I used for analyzing the 2009 GDHS was SPSS version 23 statistical software. The description was divided by the two research questions.

Descriptive Statistics

I analyzed the descriptive statistics, which included frequency, percentage, measures of central tendency, and the number of valid cases for all variables listed in Table 2.

Bivariate Statistics

Pearson's Chi-square test, often referred to as the test for independence was used to determine if there was a relationship between two categorical variables based on the nature of the secondary data; determine if the sample selected was generalizable; and evaluate whether there was a normal or geometric distribution of the data (Diez et al., 2015; Field, 2009). This test allowed me to examine if there was a significant association between the IV, urban classification, and the DV, inadequate growth due to malnutrition. It did not allow for control of all potential confounders.

Multivariable Statistics

Logistic regression. The logistic regression model is appropriate in terms of application in the analysis of a sample data, when the dependent or response variable is measured on a binary scale (e.g. yes = 1 and no = 0), and the independent or predictor variable is measure on a mixed scale implying either a binary, nominal, categorical, or continuous scale (Field, 2009). In logistic regression, P(Y=1) was the probability of the event occurring and the dependent variable was coded accordingly. That was, for a binary regression, the factor level 1 of the dependent variable represented the desired outcome. The model should have been fitted correctly. Neither over fitting nor under fitting should occur because only variables that showed potential confounding effects or were clinically or biologically relevant such as age were included in the model for adjustment for the relationship between urban classification and inadequate growth. In addition, the model would have little or no multicollinearity. That was, that the

independent variables would be independent from each other (Field, 2009). For my study, logistic regression was appropriate, as the DV, inadequate growth was categorical, with only two possible responses, inadequate growth, and not inadequate growth. Now, I discussed how this applied to my research questions.

Research Question 1: Is there an association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status? The following hypotheses were developed to address Research Question 1:

$H_0$1: There is no association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status.

H_a1: There is an association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status.

To answer the first research question, I proposed to use multivariable logistic regression to test the association of urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status.

The primary association of the DV and each of the IVs will be considered significant, and the null hypothesis for the first research question will be rejected, if the OR has a significance of $p < 0.05$.

Research Question 2: Is there an association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after

controlling for other variables: mother's level of education, mother's age at birth of the child, household size, wealth, and marital status? The following hypotheses were developed to address Research Question 2:

$H_0$2: There is no association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for confounders.

H_a2: There is an association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for confounders.

To answer the second research question, I proposed to use multivariable logistic regression to test the association of inadequate growth and urban classification after adjusting for any potential confounders. Potential confounders originated from the literature and demonstrated through Chi-square that they influenced the association of urban classification and inadequate growth. The use of multivariable logistic regression in cross-sectional studies determined OR with multiple covariates or IVs (Field, 2009). The odds of something happening was are defined as the probability of something happening divided by the probability of something not happening. The equations used to explain this definition that event not occurring were:

Odds =P(event)/P(no event) and P(no event Y) = 1 – P(event Y) [Field, 2009].

The assumption required by multivariable logistic regression was that there was a linear change with multiple covariates based on the natural logarithm of the odds of the

outcome or logit (Field, 2009). In my study, either children experienced inadequate growth, or they did not.

The relationship between urban classification and inadequate growth was summarized by the OR and the respective *p*-values and 95% CIs for each covariate. Those covariates determined to be confounders based on the binary statistics and a backwards stepwise method of regression was included in the regression models to evaluate the relationship between the IV and DV, after controlling for their influence. The final model provided OR and significance ($p \leq 0.05$) for the included covariates as well as the IV and DV. These contributed additional understanding of the relationship of environment to inadequate growth in Guyana's children.

Threats to Internal and External Validity

The term validity was described by Cook and Campbell (1979) as the most suitable estimation about the veracity or fallacy of propositions, and in turn, the idea of causation. Prior to this description of validity Campbell and Stanley (1963) proposed two kinds of validity: internal and external. Internal validity was focused on whether or not the experimental treatments had any effect, and external validity focused on the generalizability of variables, settings, populations, and time.

Internal Validity

In order to establish causality among variables, determining the accuracy of a study's findings was the first step toward ensuring internal validity (Perry-Parrish & Dodge, 2010). Internal validity was concerned with the quality of the data. In addition, internal validity may depend on confounding, which is the mixing effect of a third

variable in the observed association. As this was a cross-sectional study, there was no control group, however, I attempted to control for as many potential confounders as possible. Controlling for these potential confounding variables ensured the internal validity of these findings.

External Validity

The external validity of the study design was concerned with the generalizability of the findings to other conditions, settings, populations, or variables referred to the extent to which observed effects could be generalized to other populations or conditions (Campbell & Stanley 1963). It was important to consider external validity in order to determine if the study findings suggested a relationship between urban classification and inadequate growth in children under five years. The best control for external validity was a sample that reflected the population. The results could be used to draw conclusions about Guyana. In order to be able to draw conclusions about other countries, I needed to compare the demographics between Guyana and other countries and only if the population demographics and other factors I considered in the analysis were very similar would I be able to generalize outside of Guyana. The sample used here based on the sampling technique is representative of Guyana, justifying the generalizability of these findings in a comparable context of this study in a different setting.

Ethical Considerations

This was a secondary analysis of data. Prior to my use of this data, all of the records from the 2009 GDHS were de-identified to protect the anonymity of the survey participants. The names of participants or any other identifying information did not

appear on any of the documentation that was used for the current study. As such, the use of the 2009 GDHS did not pose any risk to the survey participants for the proposed study. Written consent was obtained from the DHS program, overseen by ICF International. ICF international used study ID codes with unique combination of letters and numbers. Participants' names did not appear on any documents as they were encoded into alphanumeric IDs upon entry. There were no potential risks to the participants in this proposed research. I was given permission by the DHS program to use the database and I had to create a password to gain access to the database. No one else was able to access the database without first gaining written consent from the DHS program, and the database contained file protection layers so the data could only be read, and no changes could be made or re-written. In order to protect the rights of the participants of the 2009 GDHS, I submitted my study to the IRB at Walden University to be reviewed and approved before beginning data analysis. The IRB approval number was 01-05-17-0266452. Steps were taken to protect the data, including analysis of unidentifiable coded GDHS data. Access to the data was requested from ICF International and approval was granted.

Summary

Chapter 3 provided the detailed methodology for this quantitative secondary data analysis. The proposed study was an observational cross-sectional design using secondary data accessed from the most recent GDHS collected in 2009. I determined that a sample size of 988 was required and that the secondary data had valid measurements for 2,059 children, thus there was an adequate sample size for the proposed study. My

data analyses consisted of univariate descriptive statistics, including mean, standard deviation, and frequency; bivariate statistics, including Chi Square and t tests; and multivariable logistic regression model to test the hypotheses associated with my two research questions. First, that there was a relationship between urban classification and inadequate growth in children under five years in Guyana, South America, after controlling for potential confounders. Second, that there was an association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status. I concluded with a discussion of internal and external validity and ethical considerations.

In Chapter 4, I review the purpose, research questions, and hypotheses. I will discuss the data collection and report the findings from the statistical analysis, organized by the research questions and hypotheses. I will use tables and figures to illustrate the results, as appropriate and summarize the answers to the research questions.

Chapter 4: Results

Introduction

The purpose of this quantitative, cross-sectional study was to determine the relationship between inadequate growth and urban classification in children under age five years in Guyana, South America while controlling for mother's level of education, mother's age at birth of the child, household size, wealth, and marital status. The prevalence of inadequate growth in Guyana was 27.4% based on results of the current study. The health conditions of stunting and wasting are global public health issues. In the past, research has tended to focus on them individually, but recently researchers are beginning to understand that both problems need to be addressed in tandem and must be a research priority in health, specifically pediatric health (Angood et al., 2016). Significant progress has been made in the worldwide improvement of stunting and wasting levels in children under five years. Stunting has seen a global reduction from 40% in 1990 to 32% in 2005 to 25% in 2011. In Asia the prevalence of stunting decreased from 188.7 million in 1990 to 98.4 million in 2010. In Latin America and the Caribbean, the prevalence went from 13.7 million in 1990 to 7.4 million in 2010, which is almost a 50% decrease (Angood et al., 2016). Wasting has had an 11% decrease over the past 20 years. Similar to stunting, Asia has 70% of the world's wasted children (Angood et al., 2016).

Globally, 23% of children under 5, are malnourished and less than 5% of children in the United States are malnourished (Malnutrition, n.d.). The prevalence in Guyana closely mirrors that of the world, and is higher than the percentage for Latin America and the Caribbean (10%) (Malnutrition, n.d). This phenomenon was not fully understood in

Guyana. This study proposed to help fill the gap in the existing available literature and investigated the association between inadequate growth and urban classification in children under five years of age in Guyana, South America.

To achieve this purpose, this current study sought to answer the following research questions and address the associated hypotheses:

Research Question 1: Is there an association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status?

$H_0$1: There is no association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status.

H_a1: There is an association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status.

Research Question 2: Is there an association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for other variables: mother's level of education, mother's age at birth of the child, household size, wealth, and marital status?

$H_0$2: There is no association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for confounders.

H_a2: There is an association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for confounders.

In this chapter, the results of the statistical analyses used to answer the research questions are presented in detail. The data collection process will be discussed and the descriptive statistics of the target population will be reported. The results are organized and presented as per the research questions and hypotheses. Finally, the results are summarized in terms of the hypotheses.

Data Collection

Pre-existing data from the 2009 GDHS, which was collected over a five month period from March to July 2009, were obtained. Data abstraction began after formal approval from the Walden Institutional Review Board and ICF Macro. The sampling design was previously described in Chapter 3. The original sample for mothers and their children under five years was 2,178. After missing and improbable values were deleted, based on greater than 3 SD from the mean, for child's height and weight, the sample available for analysis was 1,549.

Data Processing

The data was cleaned using SPSS version 23 statistical software. In order to check the data for errors, a frequency distribution was performed on each variable, to see if the data fell within the expected range. The cases were then sorted by descending order. Since the data used was pre-existing, the values were deleted for cases that had errors identified, so it was treated as a missing value in SPSS.

Statistical Analysis

The statistical analyses were carried out using SPSS version 23 statistical software. To address the research questions, bivariate tests including Chi-square, OR, and *t* tests to examine the association between the independent variables and inadequate growth and the association between the independent variables and urban classification were conducted.

Results

Descriptive Statistics

Table 2 in Chapter 3 presented how each of the study variables was used to answer both research questions. The descriptive statistics for the study population are presented in Table 3 and Table 4.

Table 3

Descriptive Statistics: Categorical Variables (N = 1549)

Categorical variable	Responses	Frequency	Percent
Inadequate growth	Not wasted or stunted	1124	72.6
	Wasted and/or stunted	425	27.4
Urban Classification	Urban	298	19.2
	Rural	1251	80.8
Mother's education	No education	51	3.3
	Primary	379	24.5
	Secondary	1031	66.6
	Higher	88	5.7
Wealth quintile	Poorest	633	40.9
	Poorer	280	18.1
	Middle	263	17.0
	Richer	199	12.9
	Richest	174	11.2
Marital Status	Never married	127	8.2
	Married	682	44.0
	Living together	649	41.9
	Widowed	3	0.2
	Divorced	4	0.3
	Not living together	84	5.4

In the current sample population, 425 children (27.4%) were wasted and/or stunted. Table 3 shows that the majority of the population resided in the rural areas, and that the majority of mother's only achieved a secondary level of education. Most families were in the poorest wealth quintile, which coincides with most people living in

rural areas. Of note, most people were either married or living together. In the Caribbean, common-law marriage is very prevalent, which is living together for an extended period of time.

Table 4

Descriptive Statistics: Scalar Variables (N = 1549)

Scalar variable	Mean	Median	SD
Age	27.74	27	6.69
Household size	5.91	5	2.386

The average age of the mother at the birth of her first child was 27.74, and the average household size 5.91.

Bivariate Statistics

The results of these analyses are presented in Tables 5, 6, 7, and 8.

Table 5

Association between Urban Classification and Categorical Covariates

Categorical variable	Urban *n* = 298 *n* (%)	Rural *n* = 1251 *n* (%)	OR	Confidence Interval (OR)	Pearson's X^2 (df)	*p*
Mother's level of education					96.58 (3)	<.001
No education	7 (2.3)	36 (3.4)	1	referent		
Primary	17 (5.6)	283 (26.4)	3.217	1.247, 8.298		
Secondary	231 (76.5)	708 (66.0)	.597	.261, 1.363		
Higher	47 (15.6)	45 (4.2)	.185	.075, .459		
Wealth quintile					271.17(4)	<.001
Poorest	12 (4.0)	373 (34.8)	1			
Poorer	42 (13.9)	256 (23.9)	.193	.099, .376		
Middle	55 (18.2)	215 (20.1)	.124	.064, .238		
Richer	70 (23.1)	140 (13.1)	.063	.033, .121		
Richest	124 (40.9)	88 (8.2)	.022	.012, .042		
Marital status					67.41 (5)	<.001
Never married	44 (14.6)	67 (6.3)	1			
Married	141 (46.8)	396 (36.9)	1.866	1.22, 2.86		
Living together	85 (28.2)	549 (51.2)	4.267	2.74, 6.64		
Widowed	0 (0)	2 (0.2)	3.264	.133, 79.93		
Divorced	2 (0.7)	0 (0)	.034	0, 17.74		
Not living together	29 (9.6)	58 (5.4)	1.332	.741, 2.394		

[a] Independent OR of rural

Table 5 shows the association between categorical covariates and urban classification, implying potential predictors of rural or urban classification. There was a significant association between urban classification and all potential covariates. Compared to mothers with no education, those who had primary education were three times as likely to live in a rural area OR = 3.22; 95% CI = 1.25, 8.30; $p < .001$. Mothers with a higher level of education were 81% less likely to live in a rural area, OR = 0.19; 95% CI = 0.75, 0.46; $p < .001$.

While there was a significant association between wealth quintile and urban classification, none of the individual quintiles was very different when compared to those in the poorest wealth quintile.

Compared to never married mothers, those who were living together were over four times as likely to live in rural areas, OR = 4.27; 95% CI = 2.74, 6.64; $p < .001$. Similarly to those living together, those who were widowed were over three times as likely to live in rural areas, OR = 3.26; 95% CI = 0.13, 79.9; $p < .001$, compared to never married mothers.

Table 6

Urban Classification and Scalar Covariates

Scalar variable	Urban *n* = 302 Mean (SD)	Rural *n* = 1072 Mean (SD)	*p*
Age	29.66 (6.49)	27.19 (6.65)	<.001
Household size	5.85 (2.49)	5.93 (2.36)	.590

Table 6 demonstrated that there are statistically significant differences between urban and rural residence based on the mother's age and therefore the mother age is related to urban classification of residence. Household size was larger in rural areas versus urban areas. The significantly associated variables from Tables 5 and 6 will be used in the multivariable model to answer RQ1.

Table 7 shows the association between categorical covariates and inadequate growth, implying potential predictors of inadequate growth. There was a significant association between inadequate growth and urban classification, OR = 0.69; 95% CI = 0.49, 0.92; $p = .011$. Compared to mothers with no education, those with a primary level were 12% less likely to have children with inadequate growth, OR = 0.88; 95% CI = 0.45, 1.72; $p < .001$. Mothers with a higher level of education were 70% less likely have children with inadequate growth, OR = 0.30; 95% CI = 0.13, 0.69; $p < .001$.

Table 7

Association between Inadequate Growth and Categorical Covariates

Categorical variable	Not stunted or wasted *n* = 1124 *n* (%)	Stunted and/or wasted *n* = 425 *n* (%)	OR[a]	Confidence Interval (OR)	Pearson's X^2(df)	*p*
Urban classification					6.524 (1)	.011
Urban	245 (23.6)	57 (17.0)	.688	.49, .92		
Rural	793 (76.4)	279 (83.0)	1	referent		
Mother's level of education					26.02 (3)	<.001
No education	27 (2.6)	16 (4.8)	1			
Primary	199 (19.2)	101 (30.1)	.881	.45, 1.72		
Secondary	732 (70.6)	206 (61.3)	.487	.26, .92		
Higher	79 (7.6)	13 (3.9)	.295	.13, .69		
Wealth quintile					37.16 (4)	<.001
Poorest	249 (24)	135 (40.1)	1			
Poorer	225 (21.7)	73 (21.7)	.596	.42, .84		
Middle	216 (20.8)	54 (16.0)	.458	.32, .66		
Richer	171 (16.5)	39 (11.5)	.423	.28, .64		
Richest	177(17.1)	36 (10.7)	.376	.25, .57		
Marital status					15.77 (5)	.008
Never married	84 (8.1)	27 (8.0)	1			
Married	421 (40.6)	116 (34.4)	.837	.52, 1.35		
Living together	453 (43.6)	182 (54.0)	1.224	.77, 1.95		
Widowed	2 (0.2)	1 (.3)	1.000	.06, 16.34		
Divorced	2 (0.2)	0 (0)	.157	.00, 81.58		
Not living together	76 (7.3)	11 (3.3)	.436	.202, .94		

[a] Independent OR of stunted and/or wasted

Compared to the poorest wealth quintile, those in the poorer wealth quintile were 40% less likely to have children with inadequate growth, OR = 0.60; 95% CI = 0.42, 0.84; $p < .001$. Those in the richest wealth quintile were 62% less likely to experience inadequate growth, OR = 0.38; 95% CI = 0.25, 0.57; $p < .001$.

Compared to never married mothers, those who were living together were 22% more likely to have children with inadequate growth, OR = 1.22; 95% CI = 0.77, 1.95; $p = .008$. The odds of experiencing inadequate growth if the mother was divorced equaled that of the odds of experiencing inadequate growth if the mother was never married, hence the probability of experiencing inadequate growth is the same as being widowed or never married.

Table 8

Inadequate Growth and Scalar Covariates

Scalar variable	Not stunted or wasted *n* = 1037 Mean (SD)	Stunted and/or wasted *n* = 336 Mean (SD)	*p*
Age	28.02 (6.53)	26.87 (7.11)	.009
Household size	5.89 (2.43)	5.99 (2.24)	.516

The findings displayed in Table 8 show that there were statistically significant differences between children experiencing inadequate growth based on the mother's age and therefore the mother's age was related to the outcome of inadequate growth in the child. The significantly associated variables from Tables 7 and 8 will be used in the multivariable model to answer RQ2.

Assumptions

The outcome variable for RQ1 and RQ2 are both binary, the model has been parsed using bivariate statistics, and the sample size is sufficient to power the analysis. The assumption related to multicollinearity using bivariate correlations was tested. The correlations conducted using all of the explanatory variables yielded results that ranged from +/- .015 to +/- .426. The highest correlation (+/- .426) was found between education level and wealth index. As none of the correlations exceeded .7, the assumption of no multicollinearity was met.

Research Question 1

Is there an association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status?

In Tables 5 and 6, the bivariate association between the independent variables, mother's level of education, mother's age at birth of the child, household size, wealth, and marital status; and urban classification was presented. In Table 9, the results of the multivariable logistic regression conducted to consider each of these variables and the association with urban classification of residence. In Table 10, information on the model fit is presented.

Table 9

Effect Parameters for Logistic Regression Model of Urban Classification and Covariates

Independent variable	*B*	Wald	OR	95% Confidence Interval		*p*
				Lower	Upper	
Age	-.047	15.88	.955	.933	.977	<.001
Mother's level of education[a]						<.001
Primary	1.960	11.72	7.099	2.312	21.801	
Secondary	1.023	3.72	2.781	.984	7.860	
Higher	.680	1.38	1.975	.634	6.147	
Wealth quintile[b]		118.74				<.001
Poorer	-1.670	20.90	.188	.092	.385	
Middle	-2.011	30.14	.134	.065	.274	
Richer	-2.616	50.95	.073	.036	.150	
Richest	-3.489	89.05	.031	.015	.063	
Marital status[c]		17.83				.003
Married	.964	11.48	2.372	1.439	3.909	
Living together	.854	10.76	2.350	1.410	3.916	
Widowed	-.127	.005	.881	.028	28.005	
Divorced	-.2637	.647	.072	.000	44.183	
Not living together	.202	.337	1.223	.619	2.416	

[a] Index value is No education
[b] Index value is Poorest
[c] Index value is Never married

Table 9 presents the results for the effect parameters for the logistic regression model of urban classification. Unlike the model for inadequate growth, in this model all of the variables remained significantly associated with urban classification. There is a significant association with mother's level of education and urban classification. Compared to mothers with no education, those with primary education were 7 times as likely to reside in rural areas, OR = 7.10; 95% CI = 2.31, 21.80; $p < .001$. Compared to

poorest, poorer were 81% less likely, OR = 0.19; 95% CI = 0.09, 0.39; $p < .001$, and middle wealth quintile were 87% likely, OR = 0.13; 95% CI = 0.07, 0.27; $p < .001$ to reside in rural areas. The results for marital status showed that married and living together were twice as likely to live in rural areas compared to never married (OR = 2.37; 95% CI = 1.44, 3.91; $p = .003$ and OR = 2.35; 95% CI = 1.41, 3.92; $p = .003$, respectively). Age was also significantly assocciated with the model, OR = 0.96; 95% CI = 0.93, 0.98; $p < .001$.

Table 10

Model of Urban Classification Fit and Diagnostics

Statistical test	Result
Hosmer and Lemeshow	X^2 4.700; df 8; p Value .789
-2 Log likelihood	1117.61
Cox & Snell R Square	0.213
Nagelkerke R Square	0.328

Table 10 summarizes the fit and diagnostics for the model of urban classification. The Hosmer and Lemeshow test suggests that the models is a good fit as $p = .789$ (> .05). The pseudo R^2 values show approximately how much variation in the outcome is explained by the model. The Nagelkerke R^2 suggests that the model explains approximately 33% of the variation in the model.

Research Question 2

Is there an association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for other variables:

mother's level of education, mother's age at birth of the child, household size, wealth, and marital status?

Multivariable logistic regression was used to test the association of inadequate growth and urban classification after adjusting for the confounders identified using the bivariate tests. Of the variables presented in the research question, only household size was omitted due to those bivariate test results. In Table 11, the results of the regression model were presented, while in Table 12, information was presented on the model fit.

Table 11

Effect Parameters for Logistic Regression Model of Inadequate Growth

Independent variable	*B*	Wald	OR	95% Confidence Interval		*Global p*
				Lower	Upper	
Urban classification[a]	.044	.056	1.045	.724	1.509	.813
Age	-.022	4.620	.978	.959	.998	.033
Mother's level of education[b]		7.430				.061
Primary	.015	.002	1.015	.513	2.008	
Secondary	-.371	1.165	.690	.351	1.354	
Higher	-.654	1.984	.520	.209	1.292	
Wealth quintile[c]		14.486				.005
Poorer	-.424	5.636	.655	.461	.929	
Middle	-.611	9.493	.543	.368	.801	
Richer	-.671	8.811	.511	.328	.796	
Richest	-.631	6.136	.532	.323	.877	
Marital status[d]		7.328				.199
Married	-.176	.475	.839	.508	1.383	
Living together	-.044	.031	.957	.585	1.565	
Widowed	-.179	.016	.836	.050	13.932	
Divorced	-1.511	.223	.221	.000	116.204	
Not living together	-.921	5.310	.398	.182	.871	

[a] Index value is Rural; [b] Index value is No education; [c] Index value is Poorest; [d] Index value is Never married

In Table 11, the results for the effect parameters for the logistic regression model of inadequate growth were presented. In this model, the association between urban classification and inadequate growth was no longer significant after adjusting for mother's level of education, mother's age at birth of the child, wealth, and marital status, OR = 1.05; 95% CI = 0.72, 1.51; p = .813. Marital status was found to be not statistically significant in the association. Those who were married, living together, widowed, divorced, or not living together were all very similar to each other, with all marital status levels being less likely to experience inadequate growth, when compared to those who were never married. For example, living together, OR = 0.96; 95% CI = 0.59, 1.57; p = .199. Mother's level of education was also found to not be significant, with only primary being slightly different from secondary and higher, such that mothers with primary level of education were slightly more likely to have children with inadequate growth compared to those with no education, OR = 1.02; 95% CI = 0.51, 2.01; p = .061. Overall, wealth quintile was found to be significant, with all quintiles similar to each other. For example, middle, OR = 0.54; 95% CI = 0.37, 0.80; p = .005. Age was also found to be significant, OR = 0.98; 95% CI = 0.96, 1.00; p = .033.

Table 12

Model of Inadequate Growth Fit and Diagnostics

Statistical test	Result
Hosmer and Lemeshow	X^2 4.857; df 8; p .773
-2 Log likelihood	1471.76
Cox & Snell R Square	0.04
Nagelkerke R Square	0.06

Table 12 summarizes the fit and diagnostics for the model of inadequate growth. The Hosmer and Lemeshow test suggests that the models is a good fit as $p = .773$ (> .05). The pseudo R^2 values show approximately how much variation in the outcome is explained by the model. The values for the Cox & Snell R^2 and the Nagelkerke R^2 are very similar for this model and suggest that the model explains approximately 4% and 6% of the variation in the model, respectively.

Summary

The first hypothesis tested whether there was an association between urban classification of residence and demographic and socioeconomic factors. Based on the findings, the null hypothesis that there is no association between urban classification of residence and demographic and socioeconomic factors could be rejected.

The second hypothesis tested whether there was an association between inadequate growth and urban classification and controlling for potential confounders. Based on my findings, I was unable to reject the null hypothesis that there is no association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for confounders. However, age and wealth were found to have a significant association with inadequate growth.

Chapter 5 summarizes, analyzes, and interprets key findings from these results and discusses how it relates to existing knowledge based on the literature review and the Social ecological theory/model that was the framework for the current study. The limitations and strengths of study will be discussed. Finally, recommendations for further research as well as the implications for positive social change will be discussed.

Chapter 5: Discussion, Conclusions & Recommendations

Introduction

The purpose of this quantitative, nonexperimental, cross-sectional study was to elucidate the relationship between inadequate growth and urban classification in children under five years of age while controlling for mother's level of education, mother's age at birth of the child, household size, wealth, and marital status. In this study, I explored the phenomena of stunting and wasting in children under five years in Guyana, South America. I sought to understand the relationship between nutritional status and of urban versus rural. In addition to determining the relationship between inadequate growth and urban classification, I looked at the influence of potential confounders: mother's level of education, mother's age at birth of child, household size, wealth quintile, and marital status.

Research Questions

The following research questions were formulated to address the purpose of my research:

Research Question 1: Is there an association between urban classification of residence and mother's level of education, mother's age at birth of the child, household size, wealth, and marital status?

Research Question 2: Is there an association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for other variables: mother's level of education, mother's age at birth of the child, household size, wealth, and marital status?

Summary of Key Findings

The main findings of the study, presented in detail in Chapter 4, are summarized based on the research questions. For RQ1, the key finding was that age, mother's level of education, wealth, and marital status were significantly associated with urban classification. For RQ2, the key finding was that after age and socioeconomic factors were introduced in the model, the association of urban classification and inadequate growth was no longer significant.

Interpretation of the Findings

Associations between urban classification, inadequate growth, mother's level of education, wealth, and marital status were explored using Chi-square, and logistic regression models. Mother's age at birth of child and household size in relation to urban classification and inadequate growth were assessed using an independent sample *t* test, since the data (household size and age) met normality and equal variance assumptions. Descriptive statistics were presented in Tables 3 and 4. Most people lived in rural areas (80.8%). Of note, only 27.4% of children experienced inadequate growth, compared to 72.6% who did not. The highest level of education for mothers was secondary and almost 41% of people were in the poorest wealth quintile. Most couples were either married or living together. The average age of mother's at birth of child was 27.74% and the average household size was 5.91. A study by Wolde, Belachew and Birhanu (2014) had similar results for their descriptive statistics. The highest level of education for mothers was secondary (31.3%), and most families had more than 5 members (56.3%). Interestingly, most of the respondents were in the high SES tertiles, in comparison to my

study, which found most people to be in the poorest wealth quintile. The majority of women were homemakers, which indicates that the family could be supported on one income, that of the husband, so that the effects of stunting and wasting were mostly observed in those from the low SES tertile (Wolde et al., 2014). The results from tables 3 and 4 were aligned with what was expected with the exception of inadequate growth. I theorized that there would be more children with inadequate growth based on the high level of poverty, but that was not the case. Even though more people resided in rural areas, there were still less children who experienced inadequate growth.

In Table 5 and Table 7, I presented the results for urban classification of residence with the categorical covariates, and the results for urban classification and inadequate growth, using OR and Chi-square. The data from table 5 supported previously published findings on the association between urban classification and mother's level of education, wealth quintile, and marital status (Fotso, 2007; Garrett & Ruel, 1999; Smith et al., 2005).

The *p* values from Table 7 indicated that mother's level of education, wealth quintile, and marital status had a significant association with inadequate growth and urban classification. These bivariate statistical results are supported by Abuya et al., (2012) and Wolde et al. (2014) who demonstrated a link between inadequate growth and the aforementioned factors. These findings may indicate a possible dose effect, where the middle and richer quintile are less likely than poorer to have inadequate growth. Residing in low income rural areas increases the chance of children experiencing inadequate growth.

In table 6 and table 8, I presented the results for the scalar variables using *t* tests. In those tables, the comparisons of inadequate growth and urban classification, suggested that inadequate growth in children occurred more frequently in mothers who started having children at a younger age as compared to older mothers; mothers who started having children at a younger age were also more likely to live in rural areas. Household size did not have a significant association inadequate growth or urban classification.

To answer RQ1, multivariable logistic regression was used to obtain the results for urban classification and the association of each of the variables. Table 9 showed all variables to be associated with the model of urban classification. While age was found to be significant, the OR was difficult to interpret. In general, it suggested that the likelihood of rural residence decreased slightly with each additional year of age of the mother. In addition, many of the confidence intervals had very large ranges, so results should be taken cautiously. For this RQ, the the null hypothesis was able to be rejected. The results show that there were definited differences in age and socioeconomic indicators based on urban classification. Srinivasan, Zanello, and Shankar (2013) used the 2007 and 2006 DHS datasets for Bangladesh and Nepal, respectively to look at rural-urban disparities in child nutrition. Unlike the current study, Srinivasan et al. (2013) used quantile regression (QR) to determine the outcomes of child nutrition relative to individual and household characteristics. The authors found that mother's education and wealth index had a significant association with height-for-age z scores (HAZ) or stunting in both urban and rural regions. Higher wealth index was positive associated with HAZ scores in rural and urban areas, and is stronger in the upper distribution in urban areas.

These results rare similar to the current study, in that inadequate growth is mitigated if wealth and education are the same for everyone, therefore the rural-urban disparities are diminished.

To answer RQ2 multivariable logistic regression was used to test the association of inadequate growth and urban classification after adjusting for the confounders identified using the bivariate tests. Household size was excluded based on the bivariate test results. Table 11 shows that after age and socioeconomic factors were introduced, there was no longer a significant association between inadequate growth and urban classification. This suggested that the differences between urban and rural with inadequate growth were due to differences in SES. The variability was attenuated by SES, such that if everyone had the same level of education and income it would negate the effect of inadequate growth. Therefore, the null hypothesis that there is no association between urban classification and inadequate growth due to malnutrition in children under five years in Guyana, after controlling for confounders could not be rejected. In the model, mother's level of education and marital status were no longer significant based on global *p* values and individual confidence intervals. However, within marital status, there was still a significant association when comparing not living together to never married, based on the confidence intervals. Overall, wealth quintile was found to be significant. While age was significant, the OR was difficult to interpret. In general, it suggested that the likelihood of inadequate growth decreased slightly with each additional year of age of the mother.

These finding highlights the importance of the mother's age, education level, SES, and marital status. In general, SES is the great equalizer. Van de Poel, Hosseinpoor, Speybroeck, Van Ourti and Vega (2008) reported on socioeconomic inequality in malnutrition in Sub-Saharan Africa, south and Southeast Asia, eastern Mediterranean, Latin America, and the Caribbean using the most recent DHS. Interestingly, Guyana was not included in the list of Latin American and Caribbean countries, even though at the time of publication their 2005 DHS was available. The broad finding was that in the majority of countries, stunting and wasting disproportionately affected those in the lower SES quintiles. Latin America and the Caribbean had the largest concentration index of socioeconomic inequality in stunting. The effect of wasting was much smaller and south and Southeast Asia had the largest concentration index. However, in terms of socioeconomic inequality in malnutrition, there was no definitive association between average stunting, and a partial association with wasting (Van de Poel et al., 2008). Across these countries, wealth was inversely correlated with stunting. The current study supports this observation, since in our data wealth was associated with inadequate growth compared with poverty. Therefore, interventions to lower the average level may not be generally beneficial. Interventions should be region specific. For example in Latin America and the Caribbean, policies that focus on the poor may yield more generalizable results, whereas in sub-Saharan countries, focusing on the general population in addition to the poor, may yield more fruitful results (Van de Poel et al., 2008). On the basis of these findings, policy formulation to address inadequate growth must address the following: a) poverty reduction through employment opportunity and

governmental/social assistance, and b) education intervention in rural areas on healthy balanced nutrients in enhancing growth and development.

Limitations of the Study

Inspite of the strength of this study in attempting to indicate the association between urban classification and inadequate growth, there are a few limiations. First, due to the nature of this preexisting cross-sectional data and the design employed (cross-sectional design), causal relationship is difficult to establish. Another limitation is misclassification. It can occur because the data used was preexisting therefore, there is there is a potential for misclassification bias.

The study was also limited because of the reliance on archival data from 2009. Since the 2009 DHS, Guyana has participated in several MICSs (MICS3, MICS5), with the latest one done in 2014. However, Guyana has not conducted another DHS due to a lack of resources. In 2009, the per capita gross domestic product (GDP) was US$ 2,629. In 2015, it was US$ 3,754 (BOS, 2017). The use of archival data does not allow for follow up, or additional questions to be asked, so research questions can only be framed around the variables that are available. Another limitation is that there is no participation in the data collection, so conclusions about how the data collection was done can only be drawn from the information provided (Johnston, 2014). The study results are generalizable in that it represents a real population, and the findings are in line with those of the study and current trends. In addition the sample is representative of the target

population, and the sample size was large enough, thus strengthening the power of the study.

Recommendations

Based on my review of the available literature, to my knowledge there have not been any studies done to determine the relationship between inadequate growth and urban classification in children under five years in Guyana, South America. Several studies have broadly focused on the phenomena of stunting and wasting in Latin America and the Caribbean, and Guyana is usually included, but to the extent that a study has focused on Guyana, it is novel. Since my study found that age and SES were significantly associated with inadequate growth, efforts should be focused on the education of parents about waiting to have children at a later age and improving the SES of their families.

In 2013, one of the six most important risk factors around the world was child and maternal malnutrition (Forouzanfar et al., 2015). The authors classified stunting and wasting as behavioral risks, and that these risks accounted for more than half of the mortality and over a third of the Disability-Adjusted Life Year (DALYs) worldwide, highlighting the need for targeted interventions. The authors also found that social, economic, and cultural factors could influence behavioral risk outcomes. These findings support the findings of the current study, which showed that SES had a strong association with inadequate growth (Forouzanfar et al., 2015). The concept of behavioral risks is why the SET/M was chosen for this study. McLaren and Hawe (2005) simplified the SET/M in such a way as to incorporate physical, social, cultural,

historical, ecological, and environmental perspective at both the local and global level, while including a person's behavior and attributes. In the current study, all aspects of this theory are incorporated. The behavioral change required invariably lies with the mother. As evidenced worldwide, when women and girls are educated, the economic power of a country is strengthened, thereby contributing to the financial stability of the nation (Islam & Biswas, 2015).

Kamal, Rosliza, and Aynul (2010) utilized the 2007 Bangladesh DHS and found that 61.3% of children were born to women aged 13-24 years. In the poorest and poorer households, there was a statistically significant association with stunting in children under age five years. Stunting decreased based on wealth status, such that a child in the poorest household was 3.25 times more likely to be stunted, versus a child in a higher wealth quintile was only 1.75 times more likely to be stunted compared to a child in the richest quintile. This study supports the current finding and highlights the need for ways to improve the SES of families.

With regard to the data availability and quality, it is recommended that the GMOH consider conducting another DHS. It has been eight years since the last DHS was done. During that time, Guyana has participated in several MICSs, the latest being 2014. However, these surveys are not as robust and in-depth as a national DHS, and as such do not capture all of the information that is typically included in a DHS. This is important because it will provide valuable information for policy makers and future researchers. Coupled with the lack of resources, was the dearth of qualified and trained personnel available to conduct that magnitude of research, since the GDHS was done in

collaboration with USAID. Therefore, there is a need for the MOH and BOS to concentrate on funding and education of personnel in order to be able to spearhead another DHS.

Specifically, policy formulation and implementation should address the effect of climate change on urban classification. The current study found that those in lower wealth quintiles were more likely to live in rural areas, and as such are extremely vulnerable to changes in climate and weather (Dulal, Shah, & Ahmad, 2009). The elderly, children, poor, and indigenous residing in rural and coastal areas are in danger of being overlooked and disregarded. These groups often have little or no access to services and resources in the event of a natural disaster, and are mostly dependent on farming, agriculture and fishing (Dulal et al., 2009). Those in urban areas tend to have more access to services and are better able to withstand natural disasters from a structural standpoint. Therefore, policies should include: a) access by all members of society, b) access to fair management of goods and services, c) the right to quality and availability of current goods with fair management, and d) outcomes that determine that programs and policies are equitable for all members of society (Dulal et al., 2009).

Implications for Social Change

The goal of stymieing inadequate growth is to have a healthier population with an increased lifespan, while reducing child morbidity. In addition, lessening the drain on the economy because of high medical costs is another reason to prevent inadequate growth. The findings of this study have identified several factors that contribute to inadequate

growth. Identification of these factors can contribute to the design of prevention strategies to reduce inadequate growth and assist in understanding and preventing stunting and wasting in developing countries, such as Guyana through comparative analyses of data from previous global studies.

The results of the current study have implications for positive social change because it shows that having children at a later age and a higher SES can be protective for inadequate growth. One of main ways to reduce the prevalence of inadequate growth is family planning. Singh, Darroch, Ashford, and Vlassoff (2009) reported on the costs and benefits of investing in family planning. In 2008, there were 1.4 billion women of reproductive age (15-49 years) in developing countries. Out of those women, 818 million wanted to avoid getting pregnant. Unfortunately, 215 million women do not have access to modern contraceptives (Singh et al., 2009). As of 2015, the number of women of reproductive age in developing countries with an unmet need for modern family planning, which included postponement of next birth, stopping childbearing completely, but not using any modern contraceptive methods had increased to 225 million (Naik & Smith, 2015). The implication for positive social change is tremendous. If couples are assisted with being able to have the number of children they actually want at the healthiest time in their lives, family planning will greatly influence nutrition. If mothers are taught, how to properly space their pregnancies, the long-term nutritional benefits for both mothers and children are endless. Family planning can lessen the number of high-risk pregnancies by not having children too young or too old, which can improve nutritional outcomes (Naik & Smith, 2015).

Proper family planning relies on education. Studies have shown that mothers who were educated were less like to have children who experienced inadequate growth (Abuya et al., 2012; Abuya, Onsumu, Kimani, & Moore, 2011). A study by Goswami & Das (2013) used the 2005-2006 National Family Health Survey (NFHS) for all Indian states to look at the prevalence of anaemia in children 6-59 months. Similar to the current study, Goswami & Das (2013) analyzed the data using binary logistic regression and found that over 75% of the survey respondents lived in rural areas, the majority of people were from the poorest wealth index (25.4%), and 69.5% of children were anemic with the majority of them living in rural areas. Mother's level of education, mother's age at first birth, household wealth index, along with other factors were significantly associated with children's anaemia status. When mothers are educated, the health outcomes of children are improved. When mothers are taught about the risks for undernourishment, it can assist them in pinpointing problems with their children's diet, as well as their own. In this way, the current study results facilitated counseling and education for women about proper family planning and improving SES.

However, implications for positive social change also need to be implemented at the community and/or societal level. This is where the government of Guyana becomes an integral partner. Mullenite (2015) did an in-depth assessment of Guyana's coastal drainage and irrigation system. This is important to the current study in that in the rural areas, the population relies heavily on agriculture to increase the domestic supply of food, with the main crops being rice and sugar. In 2008, the Ministry of Agriculture established the 'Grow More Food Campaign' to encourage households to invest in

backyard garden, to lessen the dependence on the government (Mullenite, 2015). This intervention fosters positive social change for the community by making people self-sufficient. In growing their own food, families will be able to have a surplus in addition to food items purchased. This would increase the availability of food and food security in the household, thus reducing the prevalence of undernourishment. In addition to increasing food availability, this provides a method for economic improvement, thus raising the SES of the family.

This study is suggestive of the need to formulate policy on childhood development and growth. These policies should address relevant resources in enhancing appropriate growth and development in the targeted population, namely rural areas. Specifically, policy needs to be formulated to address the income differential through education, job placement, adequate housing, and appropriate nutrition, as well as birth control, and regulation in decreasing teen pregnancy rates.

Conclusion

The purpose of this study was to elucidate the relationship between inadequate growth and urban classification after controlling for potential confounders including, mother's level of education, mother's age at birth of the child, household size, wealth, and marital status. In summary, the key findings were that there was no association between urban classification and inadequate growth. However this study has clearly identified age and SES (wealth quintile) as contributors to the health conditions of stunting and wasting in children under age five years in Guyana, South America.

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Appendix A

Data Use Authorization

You have been authorized to download data from the Demographic and Health Surveys (DHS) Program. This authorization is for unrestricted countries requested on your application.

All DHS data should be treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey.

The data sets must not be passed on to other researchers without the written consent of DHS. Users are requested to submit a copy of any reports/publications resulting from using the DHS data files. These reports should be sent to: archive@dhsprogram.com.

To begin downloading datasets, please login at http://www.dhsprogram.com/data/dataset_admin/login_main.cfm. Once you are logged in, you may also edit your contact information, change your email/password, request additional countries or Edit/Modify an existing Description of Project.

If you are a first time user of DHS Data, please view the following videos on downloading and opening DHS data:
http://www.dhsprogram.com/data/Using-DataSets-for-Analysis.cfm#CP_JUMP_14039

Some more resources to help you analyze DHS data efficiently are available at: http://dhsprogram.com/data/Using-Datasets-for-Analysis.cfm and on the DHS Program User Forum at: http://userforum.dhsprogram.com.

The files you will download are in zipped format and must be unzipped before analysis. Following are some guidelines:

After unzipping, print the file with the .DOC extension (found in the Individual/Male Recode Zips). This file contains useful information on country specific variables and differences in the Standard Recode definition.

Please download the DHS Recode Manual: http://dhsprogram.com/publications/publication-dhsg4-dhs-questionnaires-and-manuals.cfm

The DHS Recode Manual contains the documentation and map for use with the data. The Documentation file contains a general description of the recode file, including the rationale for recoding; coding standards; description of variables etc. The Map file contains a listing of the standard dictionary with basic information relating to each variable.

It is essential that you consult the questionnaire for a country, when using the data files. Questionnaires are in the appendices of each survey's final

report: http://dhsprogram.com/publications/publications-by-type.cfm.

We also recommend that you make use of the Data Tools and Manuals: http://www.dhsprogram.com/accesssurveys/technical_assistance.cfm.

DHS statistics can also be obtained using the STATcompiler tool: http://www.statcompiler.com. This tool allows users to select countries and indicators to create customized tables. It accesses nearly all of the indicators that are published in the final reports. Authorization is not needed to use the STATcompiler.

For problems with your user account, please email archive@dhsprogram.com.

For data questions, we highly recommend that users register to participate in the DHS Program User Forum at: http://userforum.dhsprogram.com. The User Forum is an online community of DHS data users and contains discussions about many DHS analysis and dataset topics. Please search the contents of the forum, and if you do not see your question addressed, consider posting a new question for users to discuss.

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Login Email: valescia.john@waldenu.edu
Password: (use the password you entered when you registered)