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Nutritional Status and Risk Factors for Children ≤ 5 Covered by the Family Health Program in Vespasiano, Minas Gerais, Brazil

By

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Master of Public Health

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Abstract Cover Page

Nutritional Status and Risk Factors for Children ≤ 5 Covered by the Family Health Program in Vespasiano, Minas Gerais, Brazil

By

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B.A. University of California at Berkeley, 2001

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An abstract of

A thesis submitted to the Faculty of the Rollins School of Public Health of Emory University

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Abstract

Nutritional Status and Risk Factors for Children ≤ 5 Covered by the Family Health Program in Vespasiano, Minas Gerais, Brazil

By

Regina Holan Gould

Background: Extensive evidence shows that growth deficiencies in childhood are associated with higher mortality, increased susceptibility to infectious disease, and delayed physical and cognitive development.[1-4] Due to limited epidemiological data in Vespasiano, Minas Gerais, Brazil there is a pressing need to assess the nutritional status of children under five in the municipality in addition to any risk factors associated with anthropometric failures.

Objectives: The objective of this study is to identify factors associated with the nutritional status of children five years and younger, covered by the PSF (O Programa de Saúde da Família), in the municipality of Vespasiano, Minas Gerais, Brazil from June 2010 to July 2010.

Methods: We examined the nutritional status of children five years and younger who use the services of Brazil's primary health care program (PSF), in Vespasiano, Minas Gerais state, Brazil. In order to determine risk factors associated with undernutrition, we collected data through household self-report surveys regarding caretaker demographics, access to healthcare, child feeding practices, diarrhea prevalence, and nutritional information. A proportionally allocated stratified random sample of n=265 households was selected (completed 219, 82% response rate). The height and weight of one child age 0–59 months living in the sampled households was measured. Children were classified as stunted (low height-for-age) or underweight (low weight-for-age) if their z score fell below -2 (<3% of the reference population). Chi-squared and multivariate logistic modeling was used in the analysis.

Results: The majority of the respondents were married females, minimally educated and unemployed. The median monthly household income was self-reported at 969 Brazilian Reais (~577 USD). The mean prevalence of stunting in Vespasiano was 8%, underweight status was 2% and no wasting was found in our study population. The 2-week period prevalence of household reported diarrhea in children 5 years and younger in Vespasiano was 17% during the months June-July. 39% of caretakers reported exclusively breastfeeding their child for the first six months. The majority of respondents said that they did not receive information regarding child diarrhea and nutrition. No exposure variables were significant with the outcomes of anthropometric failures except for those caretakers that received nutritional information were significantly more likely to have a stunted child (OR=3.15, 95% CI: 1.04, 9.58, p=0.043).

Discussion: Overall anthropometric failure in children five years and younger was low in Vespasiano whereas diarrhea prevalence was high. This prevalence of undernutrition and diarrhea in Vespasiano helps define a baseline for future research in the community. Furthermore, the demographic profile collected not only helps to characterize the population of Vespasiano but may also help to illuminate other potential risk factors associated with undernutrition in children five years and younger.

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LITERATURE REVIEW

GLOBAL PERSPECTIVE OF MALNUTRTION

Under-nutrition during childhood is a major health concern in developing countries.[1] Regardless of the etiology, undernutrition in childhood health inevitably affects growth.[5] Extensive evidence shows that growth deficiencies in childhood are associated with higher mortality, increased susceptibility to infectious disease, and delayed physical and cognitive development.[1-4] These growth deficits can lead to scholastic underachievement and lower productivity in adult life.[6] For these reasons, reducing the prevalence of under-nutrition by half in under-fives is a major focus of the Millennium Development Goals developed by the United Nations in 2000.[7]

Despite anticipated progress in the global situation of under-nutrition, advancement has been irregular in different regions of the world.[8] The worldwide underweight prevalence of children under five was projected to decline from 26.5% in 1990 to 17.6% in 2015.[2] However, many developing regions are not expected to achieve the 2015 Millennium Development goals by (MDG's) of reducing the prevalence of under-nutrition by half in under fives.[2, 6] As the world enters into the final five years to achieve the MDGs, 129 million children are underweight and 195 million children are stunted globally.[9] For example, Eastern Africa, Western Africa and Central America have shown very little progress in decreasing undernutrition prevalence of children under five.[2] Northern Africa and the Caribbean show modest improvements; whereas decreases in undernutrition prevalence in South-eastern Asia, South-central Asia and South America have been observed.[5, 2] Ultimately, anthropometric failures are expected to decrease in

all sub-regions except the sub-regions of sub-Saharan, Middle, Western, and Eastern Africa. These regions are projected to see large increases in the number of undernourished children.[2] In contrast, all sub-regions in Latin America were forecasted to experience decreasing trends in under-nutrition by 2015.[2] Specifically, the prevalence of underweight children in Latin America was expected to decline from 8.7% in 1990 to 3.4% in 2015, a change of –61% (95% CI, –77% to –35%).[2]

Despite the overall prospective decline in anthropometric failure prevalence since 1990 in Latin America and from and other developing countries, undernutrition remains to be the underlying cause of 53% of all deaths in children younger than age 5 years.[10] Responsible for 11% of the total global DALYS lost, child undernutrition is the underlying cause of 3.5 million deaths worldwide and 35% of the disease burden in children five and under.[2] 35% of the disease burden in children less than 5 years and 11% of total global DALYs.[2] Ultimately, the number of global deaths in children younger than 5 years old related to anthropometric failures comprises the largest percentage of any risk factor in this age category.[10]

DEFINTION OF NUTRITIONAL ASSESSMENT

Anthropometric measurements are an important tool for growth assessment.[5, 8] They can measure and define the nutritional status and health of a child to help identify biological dangers signs and implement necessary interventions.[5] The most common type of anthropometric measurements for child growth assessments are: (1) low weight-for height (wasting) (2) low height-for-age (stunting) (3) low weight-for-age (underweight).[5] Stunting indicates chronic under-nutrition resulting from long-term exposure to food deprivation, disease and/or illness. [10]

Wasting detects acute under-nutrition due to more recent illness or a lack of food. Underweight status is used to attempt to assess both chronic and acute under-nutrition, although cannot differentiate between them. Standard z-scores are commonly used to compare the categories of stunting, wasting and underweight status to international growth curve charts or reference populations. These growth curves and cut off points are developed and published by organizations like the World Health Organization (WHO).[11] Standard z-scores indicate how many standard deviations a data point falls above or below the mean. For example, a z-score of 0 is the mean which equates to the 50th percentile on a growth chart for the reference population (average normal growth).[12] A -2 z-score represents minus two standard deviations from the reference mean or below the third percentile of the reference growth curve.[12] Children who fall below -2 z-score of the reference population are categorized as being wasted, stunted or underweight (or to have anthropometric failures and thus are undernourished) by the WHO.[5, 10, 11] Children who fall below -3 z-scores (<1%) are considered to be severely undernourished and are at a highly elevated risk of death.[5, 10, 11] In a well nourished population, virtually no children should fall below a -3 z-score.[11] Z-scores of -2 reflect dangerous impediments to normal child development. [5, 10] Assessing child growth in this manner can be vital in determining the most appropriate interventions to take for improving child health.[5, 10]

SOCIAL DETERMINANTS AND INDICATORS FOR UNDERNUTRITION

Shorter height, lower educational achievement, reduced productivity in adulthood and higher morbidity (susceptibility to infectious diseases) and mortality are all outcomes that have been linked to child under-nutrition.[13] Accordingly, child growth and nutritional status are strong predictors of social progress, future human capital and of the health of future generations across

the globe.[9] Child undernutrition is also associated with a range of social determinants such as poverty, low maternal education, diarrheal illness, poor child feeding practices, and lack of access to health care. [8, 13]

An extensive amount of literature suggests that poverty is closely associated with child under-nutrition and remains an alarming problem in the world's developing regions. [4, 14-16] The major risk factor for undernutrition is poverty affecting food security and dietary intake.[17] The recent Lancet series of papers on maternal and child nutrition builds on a framework that recognizes poverty as one of the major underlying causes of undernutrition in children.[6, 9, 18] Furthermore, in a study conducted on feeding practices in Southern Ethiopia, researchers found that stunted children came from households of lower socio-economic status (SES) than non-stunted children ($P < 0.05$).[19] In lower SES households, children are more likely to have an inadequate food supply and are exposed to poorer living conditions (e.g. lacking proper sanitation and clean drinking water), which in turn lead to disease and further under-nutrition.[4, 20] Some of the causes of poverty include lack of resources, an unequal income distribution, conflict, and hunger itself.[17]

Strong associations have also been found between childhood anthropometric failures (lower child length-for-age and weight-for-age) and children with less educated mothers.[3, 9] According to a long-term prospective cohort study conducted in Brazil, Guatemala, India, the Philippines and South Africa, under-nutrition (measured as low birth weight in offspring) was strongly associated with less maternal schooling.[9] In addition, deaths due to diarrhea, pneumonia and other infectious diseases were particularly common among infants born to women with little or no schooling compared to infants born to mothers with better education (9+ years of schooling).[3,

[21] In a study that examined the relationship between maternal education and stunting in Kenya, children born to mothers with primary education were found to be at 94% lower odds of having stunted growth compared to mothers with no primary education ($P < 0.01$).[22]

In addition to low maternal education, diarrheal illness is a major risk factor associated with poor nutritional status in children.[23, 24] Diarrhea leads to weight loss and anthropometric failures.[25] For example, children with a higher prevalence of diarrhea had the greatest growth deficits, and this same group almost always had one or more bouts of diarrhea.[21] In malnourished individuals, the infections are even more debilitating. Another multi-country analysis of the effects of diarrhea on childhood stunting reveled the odds of stunting at age 24 months increased with each diarrheal episode before the age of 24 months (all $P<0.001$).[24] The adjusted odds of stunting increased by 1.13 for every five episodes (95% CI 1.07–1.19), and by 1.16 for every 5% unit increase in longitudinal prevalence (95% CI 1.07–1.25).[24] These results are in line with the premise that a higher overall burden of diarrhea increases the risk of stunting.

Furthermore, malnutrition is a cyclical process in which intestinal infections lead to malnutrition which in turn worsens enteric disease.[26] According to diarrhea and malnutrition research done by Kenneth Brown *et al.,* infection negatively affects nutritional status through decreases in dietary intake and intestinal absorption, along with increased breakdown and isolation of nutrients necessary for tissue development.[27] Conversely, malnutrition can predispose an individual to infection because of the harmful impact on the barrier protection (skin and mucous membranes) and corresponding negative changes in immune function.[27] Thus, achieving normal nutrition becomes difficult due to damage of the absorptive function of the body as a result of multiple

and repeated episodes of enteric infections.[26] Damage to intestinal absorption is especially troublesome in children whose nutritional intakes are insufficient.[25]

However, breastfeeding early in a child's life is one of the best ways to ensure adequate nutrition regardless of socioeconomic status and education.[28] Exclusive breastfeeding for the first six months of life is vital because breast milk supports immune function, normal growth, sensory and cognitive development and protects infants against infectious and chronic diseases.[29] However, worldwide, less than 40% of infants younger than six months of age are exclusively breastfed.[30] In a study on feeding practice and nutritional status among children aged 6 to 18 months in North Vietnam, researchers found that non-exclusive breastfeeding (OR 4.38, p=0.009) were associated with being underweight in the children.[31] Exclusive breastfeeding for the first six month has also been found to accelerate weight and length gain in the first few months, with no measurable deficit by twelve months old. These results add support to current WHO and UNICEF feeding recommendations.[29] Proper growth and development in turn decreases childhood illnesses such as diarrhea or pneumonia, and allows for quicker recovery during illness regardless of socioeconomic status.[32]

Lastly, lack of access to health care is a major contributing factor in the adequate growth of children.[1] In a recent study on child malnutrition in Nigeria, regional deficiencies in health care access information translated into statistically significant reductions in the sample children's height-for-age and weight-for-age z-scores.[33] Similar results were found in research carried out by Monteiro *et al.* (2009) that explored the decline in undernutrition in Brazil between 1996 and 2007. Monteiro and colleagues found that health care access (evaluated by six or more antenatal

visits) had a strong inverse relationship between undernutrition.[1, 34] Thus, frequency of anthropometric failures in children tended to increase with less access to health care.[1, 34] Overall, Monteiro et al. (2009) found that the prevalence of under-nutrition in Brazil fell by approximately 50% from 1996 to 2006/7.[1] According to Monteiro, twelve percent of this reduction could be attributed to expansion of universal healthcare services to the Brazilian population in the early 1990's.[1]

INTERVENTIONS FOR UNDERNUTRITION

Worldwide, cost effective interventions for under-nutrition can be broken down into the two major categories**:** prevention and treatment.[9, 35] Key prevention interventions include exclusive breast feeding for children under six months of age, improved and fortified complimentary foods for children six months to two years of age, vitamin A and iron supplementation for children 6-59 months of age and improved water, sanitation, hygiene practices for the household and diarrhea prevention measures such as rotavirus vaccination and zinc supplimentation.[9, 35] Diarrhea leads to weight loss and anthropometric failures.[25] Therefore, Rotavirus vaccination (one of the leading pathogens responsible for diarrhea[36]) and zinc supplementation (decreases the mean incidence of diarrhea by 20%[37]) are vital for the prevention of diarrhea and under nutrition for children under five.[9, 35] Important treatment interventions include the management of severe acute malnutrition (SAM) with ready-to-use therapeutic foods (RUTF), along with the care of moderate acute malnutrition (MAM) with improved, fortified foods of children under five years of age.[9, 35] Chronic parasitic infections can also lead to malnutrition.[38] Therefore, focus on immediate deworming of children is extremely important in the treatment undernutrition. Lastly,

in addition to the prevention measures discussed, the immediate treatment of diarrhea symptoms with oral rehydration solutions (ORS) is vital in the prevention of nutrient and weight loss that can lead to anthropometric failures.[25,35]

Prevention and treatment based interventions are best implemented on children under two years of age. Children are especially vulnerable because the first 1,000 days of a child's life is a period of rapid growth and health insults during this time are potentially permanent (e.g. cognitive development and anthropometric failures).[39] For example, stunting is especially difficult to reverse after 36 months of age Therefore, attention must be focused on interventions in pregnancy and in young children, especially those under 24 months of age.[18]

It should be further noted that there is a need for a multisector collaboration to treat the underlying causes of undernutrition. While these interventions serve to prevent and treat under-nutrition, they do not address many of the underlying causes of under-nutrition. In order to accomplish sustainable improvements in child nutritional status, these interventions should be considered in conjunction with strategies to address wider goals such as income and gender equality and access to water, sanitation, education and health care.[35]

HEALTH SYSTEM ROLE FOR CHILD HEALTH IN BRAZIL

Child undernutrition in Brazil has greatly declined over the past few decades due Brazilian improvements in maternal schooling, increased purchasing power of families, universal health care expansion and improvements in sanitation.[1, 13, 34] Based on regular nationwide anthropometric surveys conducted since the 1970s, the prevalence of childhood under-nutrition has decreased at an annual rate of 6.3% in the proportion of children with height-for-age deficits.

[1] Research conducted by Monteiro et al. (2009) found that the prevalence of under-nutrition fell by approximately 50%, from 13.5% (95%CI: 12.1,14.8) in 1996 to 6.8% (5.4, 8.3) in 2006/7.[1] Furthermore, the national prevalence of stunting (height-for-age) declined steadily from 37.1% to 7.1%. over a 33-year period (1974–75 to 2006–07).[13] The prevalence of stunting dropped from 59.0% to 11.2% in the poorest quintile and from 12.1% to 3.3% among the wealthiest quintile.[13] The decline in stunting was particularly steep in the last ten years (1996 to 2007).[13] Monteiro's *et al.* (2009) findings linked declining undernutrition to the improvement of four factors: of the total decrease in prevalence of stunting observed in Brazil between 1996 and 2007, 25.7% was due to increased maternal schooling, 21.7% was due to increased purchasing power of families, 11.6% was due to expansion of healthcare, and 4.3% was due to improvements in sanitation.[1, 13]

Sustaining the decline in the under-nutrition of children under five will depend on the continuation of economic and social policies that Brazil has implemented in the past few decades. [1, 13, 34] Improvements that have increased the purchasing power of the poor and public investments intended at expanding essential services such as sanitation, education and universal healthcare among all of the Brazilian population.[1, 13, 34] However, it should be noted briefly that recent evidence shows that due to many of these improvements in economic and social policies, Brazil's population is now shifting from anthropometric failure to overweight status in certain demographic populations.[13, 34, 40] There is no evidence that children less than five are significantly more overweight. However, Brazilian children older than five had rapid increases in overweight and obesity between 1974–75 and 2002–03 in more economically developed regions. Rapid increases in obesity during this time period were also found among all higher-

income groups and among lower-income women living in the more developed regions.[40] As an epidemiologically transitioning country, Brazil is in a unique position to consider the dual burden of undernutrition and obesity as a major public health concern for the future health and well being of its citizens. [41]

SUS/ PSF ROLE IN CHILD HEALTH

In the nineties, Brazil implemented a public and universal health care system known as the Unified Health Care system or Sistema Único da Saúde (SUS) in Portuguese.[42] This system is arranged around principles of universality, equity, administrative decentralization with a particular focus on rural and marginalized communities.[42-44] As part of this development, the Family Health Program (Programa de Saúde da Família – PSF) emerged as a means to create closer ties between families and health care teams in the interest of improving health education, prevention and primary care services.[1, 42, 44]

The PSF involves a team of health professionals (physician, nurse, a nurse assistant, and community health workers) that serve health beneficiaries through household visits and primary care services including prenatal and postnatal visits. Each PSF team is assigned to a geographic location, where they are responsible for enrolling and monitoring the health status of the population they are serving. Physicians and nurses provide primary care services in health facilities located within the community, whereas the community health agents provide health promotion and education services during household visits once per month.[43]

The expansion in the country of the Family Health Program that increased access of mothers and children to health care services coincides with the decline in child under-nutrition, morbidity and

mortality.[44, 45] In 1998, 3,062 PSF teams were present in about one fifth of Brazilian municipalities and provided services to roughly ten million people. In 2006, 26,729 teams were present in over 90% of municipalities, serving an estimated 86 million citizens.[1] Several studies have suggested that primary health care programs like the PSF have played an important role in the reduction of infant under-nutrition, morbidity and mortality in Brazil.[1, 13, 44, 45] Research conducted by Macinko et al. (2006) found that as PSF coverage expanded, infant mortality rates (IMR) tended to decline from 1990 to 2006.[45] Furthermore, several studies carried out by Monteiro *et al.* (2009) found an inverse relationship between access to healthcare (measured by four or more prenatal visits which are an integral component of the PSF services) and the prevalence of stunting.[1, 13]

Although nationwide anthropometric data has been carried out since the 1970s by the ministry of health, the study population in the municipality of Vespasiano, Minas Gerais, South East Brazil has minimal epidemiological data. In addition there is no data on the effectiveness of the PSF and its relation to the prevalence of under-nutrition in children under five in this region. Since the implementation in 2004[46] of the epidemiological branch of National Health Care System regarding nutrition (Sistema de Vigilância Alimentar e Nutricional – SISVAN), only one year of anthropometric data on less than five-hundred children in the entire municipality has been recorded.[47] Due to these limited epidemiological data, there is a pressing need to assess the nutritional status of children under five in the municipality in addition to any risk factors associated with anthropometric failures.

GOALS AND AIMS OF THESIS

The goal of this thesis is to identify factors associated with the nutritional status of children ≤ 5—covered by the PSF—in the municipality of Vespasiano, Minas Gerais, Brazil from June 2010 to July 2010. The specific aims of the thesis are:

(1) to examine the relationship between the nutritional status of children ≤ 5 in the community and demographics of caretakers in Vespasiano;

(2) to assess the relationship between nutritional status of children ≤ 5 in community and complementary feeding practices;

(3) to evaluate the relationship between nutritional status of children ≤ 5 in community in relationship to diarrhea prevalence;

(4) to examine the relationship between the nutritional status of children ≤ 5 in the community in relationship access to health care at the PSF.

SIGNIFICANCE

It is widely known that under-nutrition greatly decreases a child's chance of survival when inflicted with an infectious agent.[3, 21, 25-27] Assessing community nutritional status of those children under five and their caretakers of childbearing age involved in the Family Health Program (PSF) will provide PSF teams with vital information about the communities in which they work. From this assessment, the PSF teams will be able to identify new ways in which to better serve their community in preventing and controlling childhood morbidity and mortality as it relates to under-nutrition and associated risk factors with anthropometric failures.

CONTRIBUTION OF STUDENT

For the following manuscript, I designed the study, developed the data collection tools and databases, assisted in the compilation of the Institutional Review Board (IRB) study protocol, and managed data collection and entry. In addition, I conducted quality control and analyses of all databases, wrote all sections of the manuscript, and developed all tables and figures.

MANUSCRIPT

INTRODUCTION

Under-nutrition during childhood is a major health concern in developing countries.[1] Extensive evidence shows that growth deficiencies in childhood are associated with higher mortality, increased susceptibility to infectious disease, and delayed physical and cognitive development.[1-4]. Worldwide, undernutrition is the underlying cause of 53% of all deaths in children younger than age 5 years.[10] In Brazil, child under-nutrition has declined over the past few decades due to Brazilian improvements in maternal schooling, increased purchasing power of families, universal health care expansion and improvements in sanitation.[1, 13, 34] Based on regular nationwide anthropometric surveys conducted since the 1970s, the prevalence of childhood under-nutrition has decreased at an annual rate of 6.3% in the proportion of children with height-for-age deficits. [1] Monteiro's *et al.* (2009) findings linked declining undernutrition to the improvement of four factors. Of the total decrease in prevalence of stunting observed in Brazil between 1996 and 2007, 25.7% was due to increased maternal schooling, 21.7% was due to increased purchasing power of families, 11.6% was due to expansion of healthcare, and 4.3% was due to improvements in sanitation.[1, 13] Sustaining the decline in the under-nutrition of children under five will depend on the continuation of economic and social policies such as the universal health care system Brazil has implemented in the past few decades. [1, 13, 34]

In the nineties, Brazil implemented a public and universal health care system known as the Unified Health Care system or Sistema Único da Saúde (SUS) in Portuguese.[42] This system is arranged around principles of universality, equity, administrative decentralization with a

particular focus on rural and marginalized communities.[42-44] As part of this development, the Family Health Program (Programa de Saúde da Família – PSF) emerged as a means to create closer ties between families and health care teams in the interest of improving health education, prevention and primary care services.[1, 42, 44] The PSF involves a team of health professionals (physician, nurse, a nurse assistant, and community health workers) that serve health beneficiaries through household visits and primary care services including prenatal and postnatal visits. Each PSF team is assigned to a geographic location, where they are responsible for enrolling and monitoring the health status of the population they are serving. Physicians and nurses provide primary care services in health facilities located within the community, whereas the community health agents provide health promotion and education services during household visits once per month.[43]

Evidence shows that the expansion in Brazil of the Family Health Program that increased access of mothers and children to health care services coincides with the decline in child under-nutrition, morbidity and mortality.[44, 45] In 1998, 3,062 PSF teams were present in about one fifth of Brazilian municipalities and provided services to roughly ten million people. In 2006, 26,729 teams were present in over 90% of municipalities, serving an estimated 86 million citizens.[1] Several studies have suggested that primary health care programs like the PSF have played an important role in the reduction of infant under-nutrition, morbidity and mortality in Brazil.[1, 13, 44, 45] For example, Monteiro et al. (2009) found that the prevalence of under-nutrition in Brazil fell by approximately 50% from 1996 to 2006/7.[1] According to Monteiro, twelve percent of this reduction could be attributed to expansion of universal healthcare services to the Brazilian population in the early 1990's.[1] Monteiro *et al.* (2009) also found an inverse relationship

between access to healthcare (measured by four or more prenatal visits which are an integral component of the PSF services) and the prevalence of stunting.[1, 13] Furthermore, research conducted by Macinko et al. (2006) found that as PSF coverage expanded, infant mortality rates (IMR) tended to decline from 1990 to 2006.[45]

Although nationwide anthropometric data has been carried out since the 1970s by the ministry of health, the study population in the municipality of Vespasiano, Minas Gerais, South East Brazil has minimal epidemiological data. In addition there is no data on the effectiveness of the PSF and its relation to the prevalence of under-nutrition in children under five in this region. Since the implementation in 2004[46] of the epidemiological branch of National Health Care System regarding nutrition (Sistema de Vigilância Alimentar e Nutricional – SISVAN), only one year of anthropometric data on less than five-hundred children (ages 0-3) in the entire municipality has been recorded in Vespasiano.[47] Due to this limited epidemiological data, there is a pressing need to assess the nutritional status of children under five in the municipality in addition to any risk factors associated with anthropometric failures.

Therefore, the goal of this manuscript is to identify factors associated with the nutritional status of children ≤ 5—covered by the PSF—in the municipality of Vespasiano, Minas Gerais, Brazil. We examined the nutritional status of children ≤ 5 by collecting data through household surveys conducted during the months of June 2010 to July 2010 that focused on demographics of caretakers, complementary feeding practices, diarrhea prevalence, and access to health care at the PSF. We also assessed nutritional status by taking anthropometric measurements of children ≤ 5 after conducting the interview process with the caretakers. Assessing community nutritional

status of those children under five and their caretakers of childbearing age involved in the Family Health Program (PSF) will provide PSF teams with vital information about the communities in which they work. From this assessment, the PSF teams will be able to identify new ways in which to better serve their community in preventing and controlling childhood morbidity and mortality as it relates to under-nutrition and associated risk factors with anthropometric failures.

METHODS

Sample Population

219 households were surveyed in the region of Vespasiano, Minas Gerais, Brazil in July 2010. The study population consisted of primary caretakers of children 5 and under covered by the Programa de Saúde da Família, PSF (Family Health Program) in all 10 of the PSF unit coverage areas in Vespasiano: Celvia, Jardim da Glória, Morro Alto 1, Morro Alto 2, Morro Alto 3, Nova Pampulha, Nova York, Oeste, Suely, and Vila Esportiva. Human research ethics approval for this study was granted by Emory University Internal Review Board (IRB) and FASEH (Faculdade da Saúde e Ecologia Humana, Vespasiano, MG, Brazil) IRB.

Household selection

Lists of all households with at least one child 5 years or younger and covered by PSF (N=2,017) were compiled by each PSF unit. Using a random number generator for initiation and proportionally allocated stratified random sampling methods by PSF unit, 265 households were selected.[48] Total household selection included all households with children under the age of 5, with a caretaker above the age of 18. Those households with children that had recently turned 5 were excluded (5 years and 31 days excluded, 5 years and 30 included). If a household had more than one child under 5, the child with the nearest upcoming birthday was selected. If a

household had moved but another child under 5 covered by the PSF with a caretaker was present, they were considered eligible for the survey. If the caretaker was eligible and interested, the purpose of the study was explained and oral consent to participate was obtained from the respondent and documented on the consent form from the unumerator before the survey took place. A copy of the study description was given to each respondent. Over ten hours of nutrition, anthropometric and survey training was conducted prior to data collection with all enumerators. After pilot testing with caretakers of children ≤ 5 at the Celvia health post pediatric unit the instruments were revised several times. Feedback of study participants and PSF staff members were taken into account before final surveys were conducted in the field. Of the 265 households attempted, 9.1% were found to be ineligible (family had moved, primary caretaker was under 18, or the child was older than 5 years), and 8.3% were unreachable. Two attempts were made with each household with a community health agent present before dropping them from the sample. The final sample contained 219 households, with a response rate of 82%.

Data Collection

The survey collected information on access to healthcare, diarrhea prevalence, nutrition, water, sanitation, and hygiene. The height and weight of one child age 0–59 months living in the sampled households was measured. Trained medical students from the medical school in Vespasiano measured the recumbent length of children aged up to 23 months and the standing height of older children with a master trainer present in the field at all time. The trained teams measured weight and height using international standard portable SECA scales for weight and SHORR boards for height (Arthur S. Shorr & Associates, Inc. Woodland Hills, CA). All children were weighed and measured wearing light clothing and no shoes. Birth dates were

obtained from the Caderneta de Saúde da Críanca (an informational booklet parents receive from the Brazilian government when a child is born). Each child was measured twice for inter-observer reliability, except in the event where the child was not compliant (crying or fussing). We found a 99.9% Spearman's rho correlation coefficient between the measurements of Observer 1 and Observer 2, indicating a high degree of accuracy.

Data Entry and Cleaning

All surveys were double entered by separate staff in Epi Info (version 3.5.1, provided by the CDC Atlanta, GA) and cleaned using the compare feature of Epi Info. Differences were documented in a Microsoft Excel log, and the original source documents were referenced to decide on any discrepancies. Resolutions were made, and the master database was saved in Epi Info (version 3.5.1).

Statistical Analysis

Using Child Growth Standards of the World Health Organization (WHO) children were classified as stunted (height-for-age), wasted (weight-for-height) or underweight (weight-for-age) if their z score fell below -2 (<3% of the reference population).[5, 49] All children less than six months of age were excluded from nutritional analysis as pre-mature status of infants was not assessed in the survey data. Statistical analysis was completed in Microsoft Excel (Microsoft Corporation, location=Washington?, USA) and STATA version 11.0 (StataCorp LP, Texas, USA). Chi^2 tests, multivariate linear and logistic and linear models were used in the analysis. The dependant variable of interest was stunting and underweight status (no prevalence of wasting was found so the dependent variable was excluded from analysis). After looking at for collinearity, all probable interaction terms with independent exposure variables and available

demographic confounders were considered while building the model. The final logistic model for stunting and underweight status was selected as the best performer as it provided the highest adjusted R-squared value and most precise odds ratios. An $\alpha=0.05$ was used to determine significant results.

RESULTS

Population Demographics

In order to better understand the characteristics of the primary caretakers of children five years and younger covered by the PSF in Vespasiano, State of Minas Gerais, Brazil we collected data on socio-economic status and demographic factors of the study population (Table 1). A total of 219 of caregivers were interviewed (82% response rate). The majority of the respondents were married females, minimally educated and unemployed (and not actively looking for employment). Most of the caretakers interviewed were the mother of the child in the household. Regardless of employment status, the median monthly household income in Vespasiano was self-reported at 969 Brazilian Reais (~577 USD based on January 2010 exchange rate of 1 USD=1.68 Brazilian Real[50]). When taking into account the number of household members this monthly income supported, median monthly income per person was found to be 188 R$ (~112 USD based on January 2010 exchange rate of 1 USD=1.68 Brazilian Real[50]). This demographic profile observed across units indicated the potential for certain variables such as education and income to be important risk factors for anthropometric failures and the need to analyze them carefully.

Nutritional Status of children ≤5

Anthropometric measurements were taken of children five years old and younger to quantitatively assess the nutritional status of the child (Table 2). Anthropometric measurements are an important tool to assess growth deficiencies as they can measure and define the nutritional status and health of a child to help identify biological dangers signs.[5, 8] Children were classified as stunted (low height-for-age) or underweight (low weight-for-age) if their z score fell below -2 (<3% of the reference population).[5, 49] The mean prevalence of stunting in Vespasiano was 8%, underweight status was 2% and no wasting was found in our study population (Table 2). Stunting ranged from 14% in units such as Nova Pampulha to 0% in units such as Oeste and Morro Alto III. Underweight status ranged from 7% in Celvia to 0% in several units such as Seuly and Jardim da Gloria.

Risk Factors for Anthropometric Failures

Because we were looking at the nutritional status of children, it was necessary to look at possible risk factors associated with anthropometric failures such as complementary feeding, water and sanitation practices, nutritional information received from the PSF, diarrhea prevalence and demographics. Caretakers were asked a variety of questions regarding feeding practices such as when they initiated breastfeeding, how long they exclusively breastfeed and when complimentary foods were first introduced to their child. In Vespasiano, the majority of children five and under were breastfed within the first day of life (data not shown). However, only 39% of caretakers reported exclusively breastfeeding their child for the first six months and the average age of food introduction was at five months. (Table 3 and Figure 1)

Caretakers were then asked a number of questions regarding water filtration, treatment, basic sanitation and food hygiene. The survey revealed that 94.5% of households' maintained in-house piped water, 64.9% treated (filtered or boiled) water before drinking and 4.1% used bottled/mineral water for drinking (data not shown). With relation to basic sanitation, 80.4% of respondents had a toilet with attached piping. However, 17.8% did not have an in-house toilet and/or used an outhouse. The majority of caretakers (>85%) reported cooking their meat completely, refrigerated perishable materials and separated perishable products from cooked foods. 80.8% of caretakers reported washing their hands before cooking and serving food (data not shown).

Caretakers were also asked to report any case of diarrhea in the past two weeks in their children ages five and under. The 2-week period prevalence of household reported diarrhea in children 5 years and younger in Vespasiano was 17% during the months June-July (Table 3). When stratified by unit, over one-third of all children less than five years old in the health unit Celvia and Morro Alto I had experienced diarrhea in the past two weeks (Figure 2). The average diarrhea prevalence ranged from 38% in Celvia to 7% in Jardim da Gloria.

Lastly, caretakers were asked if they received information regarding nutrition and diarrhea prevention for their child and if so, where they received the information. In general, the majority of caretakers reported not receiving information regarding child nutrition (60%) and diarrhea (62%) (Table 3). However, the caretakers who received this information obtained it from the PSF staff at the local unit (>56%) and were highly satisfied with the information that they received (>87.4%) (data not shown).

A multivariate logistic regression model was then built in order better determine the possible relationships between anthropometric failures and the risk factors explored above. Demographic variables such as the education of the caretaker, age of child and monthly income of the household was also taken into account in the model. No exposure variables were significant with the outcomes of anthropometric failures except for those caretakers that received nutritional information were significantly more likely to have a child with an anthropometric failure. For example, those caretakers who received nutritional information regarding their child were also more likely to have a stunted child than those caretakers who had an adequately nourished child (OR=3.15, 95% CI: 1.04, 9.58, p=0.043). These results help illuminate that there currently is no clear relationship between the risk factors explored in this population of PSF users in Vespasiano and anthropometric failures in children five years and younger.

DISCUSSION

Extensive evidence shows that growth deficiencies in childhood are associated with higher mortality, increased susceptibility to infectious disease, and delayed physical and cognitive development.[1-4] The goal of our study was to identify potential factors associated with anthropometric failures in children five years and younger, covered by the PSF, in the municipality of Vespasiano, Minas Gerais, Brazil from June 2010 to July 2010. Our results found that the overall prevalence of anthropometric failures is comparable to the national average in Brazil but are difficult to compare to local SISVAN results. The two week period prevalence of diarrhea is quite high in Vespasiano compared to last year's results despite proper water and sanitation practices by the community. Lastly, no exposure variables were significant with the outcomes of anthropometric failures except for those caretakers that received nutritional information were significantly more likely to have a child with an anthropometric failure.

The rates of anthropometric failures in Vespasiao were quite low and comparable to the national average in Brazil (7% for stunting in 2007 according to *Monteiro et al.).* [13] The mean prevalence of stunting in Vespasiano was 8%, underweight status was 2% and no wasting was found in our study population. However, our results were substantially lower than reported by SISVAN in 2009 (stunting=33%, underweight=12%, wasting=4%) predominantly due to the fact that the epidemiological service used <15% of the reference population as the cut-off for an anthropometric failure. Our study used the WHO international standard cut-off value of <3% of the reference population (z-score < -2). Furthermore, anthropometric techniques varied between the study enumerators and the PSF unit staff who report anthropometric information to SISVAN. Our enumerators from the medical school in Vespasiano obtained over ten hours of training prior

to beginning data collection with international standards and equipment. They were also required to measure children twice for intra-observer reliability. However, according to a colleague's evaluation of the professionals at the PSF units, the staff used flexible tape measurers and desk top scales common for newborns. Furthermore, there was no consistency when the professionals measured the children lying down versus standing up. For example, the question was asked "until what age should children be measured lying down"? Twenty percent of the professionals at the units said that they did not know.[51] Furthermore, only 30% of the non-professional staff at the PSF units (nurses, nurse aids who were predominately responsible for measuring and weighing the children) actually received any form of child growth monitoring training. Additionally, 94% of them believed that they needed more training related to child nutrition.[51]

Furthermore, we found no significant relationship between exposure variables and the outcomes of anthropometric failures except that those caretakers that received nutritional information were significantly more likely to have a stunted child (OR=3.15, 95% CI: 1.04, 9.58, p=0.043). Our hypothesis to explain this finding was that only those caretakers who had a child with anthropometric failures received nutritional guidance. In other words, distribution of nutritional information did not cause stunting but likely, caregivers of stunted children were more likely to receive nutritional information.

Diarrhea prevalence in Vespasiano was found to be quite high compared to past research done in the community. The 2-week period prevalence of household reported diarrhea in children five years and younger in Vespasiano was 17% during the months June-July, greater than twice was

reported the previous year by a colleague assessing user perceptions and satisfaction of the PSF (7% in 2009).[52] When stratified by unit, over one-third of all children five years and younger in the health unit Celvia and Morro Alto I had experienced diarrhea in the past two weeks as compared to the low of 7% in Jardim da Gloria (Figure 2). In comparing last year's study results and to PSF diarrhea surveillance from 2009, Celvia also consistently reported high rates of diarrhea prevalence.[52, 53] We postulate that this was not due to poor water and sanitation practices as the study found that 94.5% of households had in-house piped water, 64.9% treated (filtered or boiled) water before drinking and 4.1% used bottled/mineral water for drinking. The majority of caretakers (>80%) in all units practiced adequate food hygiene: cooked meat completely, refrigerated perishable materials, separated perishable products from cooked foods and washed their hands before cooking and serving food. Our most likely theory was that we surveyed caretakers directly in the middle of a summer peak in diarrheal illness or some unknown environmental agent at Celiva, but we have no data to confirm this hypothesis.

There were many strengths to this study. Our data is more likely to be representative of the entire PSF population because we randomly sampled all caretakers of children 5 years or under in Vespasiano who are covered by the PSF units. Furthermore, we stratified the sampling frame by the PSF unit so that we had an even distribution of selected individuals according size of the unit so as to equally represent the population size. Furthermore, our enumerators from the medical school in Vespasiano obtained over ten hours of training prior to beginning data collection with international standards and equipment. They were also required to measure each child twice for intra-observer reliability which gave our measurements a high degree of accuracy. Lastly, the multivariate logistic and linear regression models in the data analysis allowed for the

inclusion of both demographic and behavioral variables in determining significant risk factors for undernutrition while adjusting for potential confounders such as education, age and income.

Our study also had several limitations. The development of our random sample depended on the ability of the PSF community agents to compile lists of all households in their region. A small minority of the lists presented to the study staff were outdated and illegible. This could have been a potential source of selection bias. The study also required involvement of PSF community agents to accompany all enumerators to each household to conduct the surveys. Agents were asked to step outside during the interview process and participants were informed that we were not associated with the PSF or government. Regardless, this still may have been a major source of respondent bias. Furthermore, the responses to the majority of the survey were based on self-reporting and therefore we have no way of validating this data.

In conclusion, we found that anthropometric failures in children five years and younger in Vespasiano were low but diarrhea prevalence was quite high. The low rates of stunting, wasting and underweight status showed that the establishment of the Family Health Program in Brazil has had positive effects on the community. Not only does this prevalence of undernutrition in Vespasiano helps define a baseline but may also help future researches look closer at other issues related to nutrition (e.g. obesity). As Brazil's epidemiological transition shifts from developing to developed country, consistent height and weight measurements will continue to be vital in the nutritional assessment of the population. Therefore, concentrated training efforts on proper growth monitoring for nurses and nurse auxiliars is needed while continuing training of agents related to child feeding practices since these professionals are more likely to weigh and measure

the children when entering the units. Attention should also be focused on providing more verbal information (and training) on nutrition and diarrhea to caretakers via community agents to all children. Education should not be solely focused on those caretakers that have undernourished children. Despite good water, sanitation and safe food practices, diarrhea prevalence was high. Caretakers should be aware of the signs and symptoms of diarrhea and its appropriate treatment. Therefore, future research needs to be focused on the unknown source of outbreaks in units with consistently high diarrhea prevalence.

CONCLUSIONS

- A total of 219 caregivers were interviewed. The majority of the respondents were married females, minimally educated and unemployed (and not actively looking for employment). Most of the caretakers interviewed were the mother of the child in the household and the average age of the child measured was two years old. Regardless of employment status, the median monthly household income in Vespasiano was self-reported at 969 Brazilian Reais with a median monthly income per person of 188 R$.
- Overall stunting and underweight status of children five years and younger is low in Vespasiano based on a z-score < -2 (<3% of the reference population). Rates in Vespasiano are similar to the national average for Brazil (8%). However, our results cannot be compared to local prevalence's due to differences in technique, training of staff, age ranges of children measured and reference population values reported by SISVAN
- The majority of respondents said that they did not receive information regarding child diarrhea and nutrition however, were highly satisfied with the information that they received. Those that received nutritional information from the PSF were significantly more likely to have a child with an anthropometric failure.
- When comparing other risk factors to undernutrition we found that caretakers who did not complete 8th grade were more likely to have a child with an anthropometric failure.

- Prevalence of diarrhea is high particularly in units such as Celiva, however caretakers in all units stated that they practiced safe food techniques, proper hygiene methods and sanitation.
- However, children who did not have diarrhea in the past two weeks were more almost three times more likely to be stunted as compared to those children who had diarrhea in the past two weeks (OR=2.76, 95% CI: 0.82, 9.28, p=0.100).
- Caretakers initiated breastfeeding properly, however, failed to exclusively breast feed for the recommended amount of time. Caretakers who stated that they had access to the PSF and exclusively breastfed their child for the first six months of life were more likely to have a child with anthropometric failures
- We hypothesize that the reasons for the higher anthropometric failures in those who accessed the PSF more often, breastfed exclusively and did not self report diarrhea status of their child is due more to the difference in socio-economic status rather than the risk factor itself. Future research is needed in a non-PSF comparison group to validate some of these unusual findings.
- Finally, findings from this study allow for the PSF teams to better identify new ways in which to better serve their community in preventing and controlling childhood morbidity and mortality as it relates to under-nutrition and associated risk factors.

PUBLIC HEALTH IMPLICATIONS/RECOMMENDATIONS

- Overall anthropometric failure in children five years and younger are low and diarrhea prevalence was high in Vespasiano.
- This prevalence of undernutrition in Vespasiano helps define a baseline for future research in the community (e.g. trends over time, obesity status of population etc).
- Furthermore, the demographic profile collected not only helps to characterize the population of Vespasiano but may also help to illuminate other potential risk factors associated with undernutrition in children five years and younger.
- Consistent and standardized height and weight measurements need to be taken of all children to track these trends over time in each PSF unit (e.g. all children older than two years old should be measured standing up with the same techniques and equipment throughout all the PSFs).
- SISVAN should begin to use WHO international standards for nutrition assessment such reporting all children from the ages of 6 months to 5 years old and reporting cuts off at the appropriate reference population (-2 z-score or <3% the reference population).
- Training efforts should be concentrated on growth monitoring for nurses and nurse auxiliars as these professionals are more likely to weigh and measure children.
- It is vital to provide more verbal information (and training) on nutrition and diarrhea to caretakers via community agents to all children. Education should not be solely focused on those caretakers that have undernourished children.

Caretakers should be aware of the signs and symptoms of diarrhea, appropriate treatment and its effect of nutritional status of young children.

- Despite good water, sanitation and safe food practices diarrhea prevalence is high. More information needs to collected regarding the source of seasonal outbreaks in units with consistently high diarrhea prevalence.
- Exclusive breastfeeding practices should continue to be encourage along with improving the food variety of children five years and younger.
- Lastly, future research in the region of Vespasiano should include a non-PSF control group.

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TABLES AND FIGURES

Table 1: Characteristics of Primary Caretakers of Children ≤ 5 years covered by Programa de Saúde da Família in Vespasiano, State of Minas Gerais, Brazil, 2010.

Characteristic	n *	%†† , mean ± SD
Age	**n=219**	33 ± 11
Household Income	**n=214**	969R±577R***
Education Level	**n=219**	
Never attended school or some primary school (0-8)	100	46%
Completed primary school (8-11)	50	23%
Completed secondary/high school or more (11-Technical)	69	31%
Female **Gender**	**n=219**	94%
Marital Status	**n=219**	
Married	113	52%
Single but living with partner	58	26%
Single	32	15%
Separated, Divorced, or Widowed	16	7%
Relation to Child	**n=219**	
Mother	153	70%
Grandmother	29	13%
Other †	37	17%
Religion	**n=219**	
Evangelical	108	50%
Catholic	86	39%
Other**	8	3%
Employment	**n=219**	
Full-time employment	34	15%
Part-time employment	31	14%
Unemployed, Actively looking for employment	53	24%
Unemployed, Not looking for employment	99	46%
Don't know or refused	2	1%

*Categories have varying n's based on response rates for each field
† Examples of other relationships to child: babysitter, aunt, father, grandfather
**Categories of other religions include: Christian, Spirit, none
†† Percentages rounded to the nearest whole number
***One outlier removed due to implausible value (7000R) 1 USD=1.68 Brazilian Real

Table 2: Nutritional Status of Children ≤ 5 years Covered by Programa de Saúde da Família in Vespasiano, State of Minas Gerais, Brazil, 2010.

Unit	n	*† % Stunted	**Stunted mean z-score ± SD	*† % Underweight	**Underweight mean z-score ± SD
Celvia	15	13%	-0.15± -0.61	7%	0.08 ± -0.52
Vila Esportiva	21	10%	-0.31± -0.55	5%	0.10± -0.47
Jardim da Gloria	25	12%	-0.18± -0.61	0%	0.05± -0.44
Morro Alto I	16	13%	-0.64± -0.58	0%	-0.08± -0.71
Morro Alto II	19	11%	0.00± -0.47	5%	0.55 ± -0.61
Morro Alto III	16	0%	-0.33± -0.81	0%	-0.23± -0.71
Nova Pampulha	22	14%	-0.20 ± -0.44	5%	0.15± -0.52
Nova York	18	6%	-0.31± -0.61	6%	0.03± -0.61
Oeste	23	0%	-0.15± -0.52	0%	0.18± -.050
Suely	29	3%	0.05± -0.61	0%	0.23± -0.64
TOTAL	204	8%	-0.20± -0.55	2%	0.13± -0.55

***Prevalence based on z-scores <-2 (<3% of the reference population) of children ages 6 months-5 years old**

†Percentages rounded to the nearest whole number

****Mean z-scores and S.D. rounded to the nearest 2 decimal points**

Table 3: Caretakers Report of Exclusive Breastfeeding and Diarrhea Prevalence in Relationship to Nutritional Status in Children ≤ 5 years Covered by Programa de Saúde da Família in Vespasiano, State of Minas Gerais, Brazil, 2010.

	n*	%†, p
Exclusive Breastfeeding**	**n=210**	
No††	127	60%
Caretaker received information regarding nutritional information for child	**n=218**	
No	132	60%
Diarrhea in the past 2 weeks	**n=218**	
Yes†††	38	17%
Caretaker received information regarding diarrhea control and prevention for child	**n=219**	
Yes	82	37%
No or Don't know	137	62%

*Categories have varying n's based on response rates for each field and age of child per category

**Caretakers who reported not exclusively breastfeeding for the first six months of child's life

†Percentages rounded to the nearest whole number and may not add up to 100% for all fields

††Of those caretakers not exclusively breastfeeding 44% (p=0.148) of children were stunted and 40% (p=0.337) were underweight. Prevalence based on Z-scores <-2 (<3% of the reference population) of children ages 6 months-5 years old.

†††Of those children whose caretakers reported diarrhea in the past two weeks 31% (p=0.177) were stunted and 20% (p=0.936) were underweight.

Table 4: Multivariate Logistic Regression Model for Stunting and Underweight Status among Children ≤ 5 According to Caretaker Schooling, Age of Child, Monthly Family Income, Access to Health Care, Breastfeeding Practices, Information Received and Diarrhea Prevalence in Vespasiano, State of Minas Gerais, Brazil, 2010.

		Adjusted Stunting n=197[†]			Adjusted Underweight n=197[†]		
Variable	**n[†]**	**OR**	**95% CI**	**p-value**	**OR**	**95% CI**	**p-value**
Education of Caretaker	204						
Completed primary school or more		0.47	0.15, 1.43	0.182	0.17	0.16, 1.92	0.154
Never attended/some primary school		1.00 (REF)			1.00 (REF)		
Child Age (yrs)	204	1.35	0.88, 2.08	0.171	2.58	0.96, 7.20	0.337
Monthly Income[††]	204	1.00	0.998, 1.01	0.608	1.00	0.998, 1.01	0.783
Access to PSF	199						
Yes or sometimes		1.47	0.48, 4.51	0.503	1.50	0.21, 10.6	0.686
No		1.00 (REF)			1.00 (REF)		
Exclusive Breastfeeding	201						
Yes		2.40	0.81, 7.11	0.115	5.26	0.51, 54.6	0.092
No		1.00 (REF)			1.00 (REF)		
Received Nutritional Information	204						
Yes		3.15	1.04, 9.58	0.043*	11.1	0.90, 136.1	0.060
No		1.00 (REF)			1.00 (REF)		
Child Diarrhea Past Two weeks	204						
Yes		1.00 (REF)			1.00 (REF)		
No		2.76	0.82, 9.28	0.100	2.00	0.18, 22.8	0.574

[†]Categories have varying n's based on response rates and missing values for each field
[††]1 USD=1.68 Brazilian Real
*P-value <0.05
**Prevalence based on Z-scores <-2 (<3% of the reference population) of children ages 6 months-5 years old

Figure 1: Caretakers Report of Exclusive Breastfeeding Practices in the First Six Months of Life in Children ≤ 5 Covered by Programa de Saúde da Família in Vespasiano, State of Minas Gerais, Brazil, 2010.

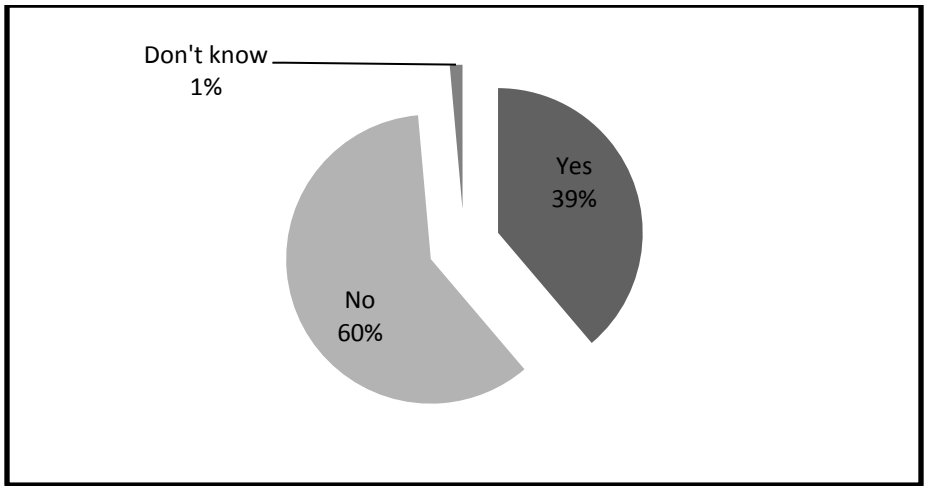
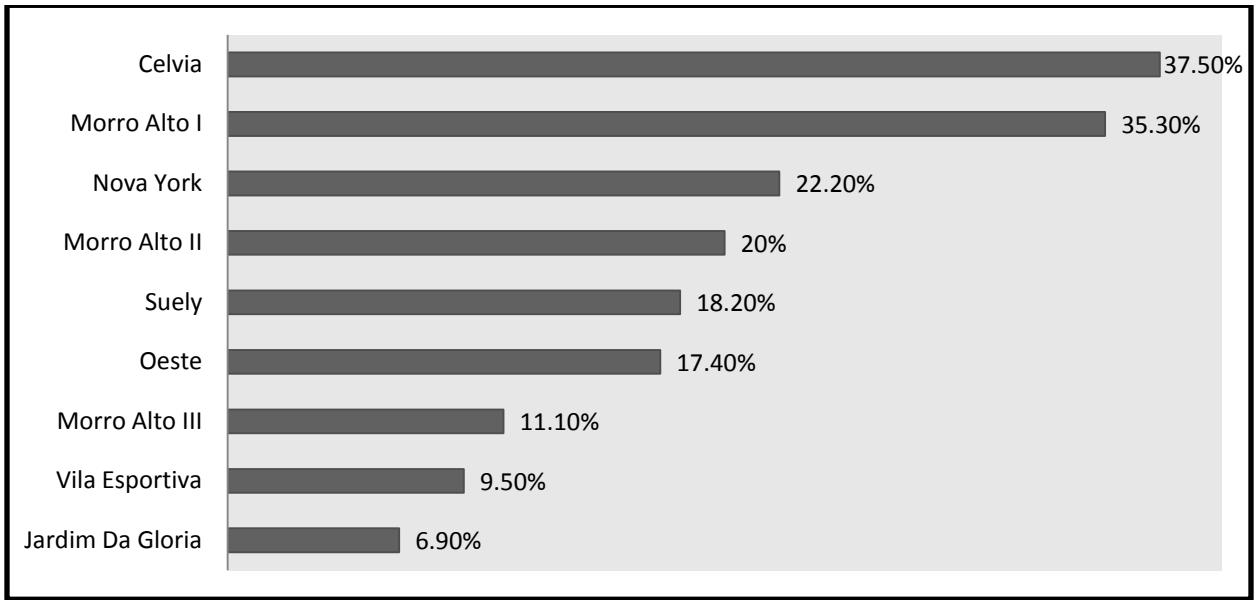


Figure 2: Caretakers Report of Diarrhea Prevalence in the Past Two weeks by Unit in Children ≤ 5 Covered by Programa de Saúde da Família in Vespasiano, State of Minas Gerais, Brazil, 2010.



APPENDIX I– Supplemental Tables

Table 1: Multivariate Linear Regression Model for Stunting in children ≤ 5 years covered by Programa de Saúde da Família in Vespasiano, State of Minas Gerais, Brazil, 2010

Variable	Coefficient	P value
Caretaker Education	**2.354937**	**0.584**
Family Monthly Income	**0.002709**	**0.454**
Age of Child	**-1.135658**	**0.487**
Access to PSF	**-5.898538**	**0.195**
Exclusive Breastfeeding	**4.879401**	**0.266**
Diarrhea in Past 2 Weeks	**2.559541**	**0.636**
Received Nutritional Information	**-7.73406**	**0.070**

Table 2: Multivariate Linear Regression Model for Underweight in children ≤ 5 years covered by Programa de Saúde da Família in Vespasiano, State of Minas Gerais, Brazil, 2010

Variable	Coefficient	P value
Caretaker Education	**2.05361**	**0.637**
Family Monthly Income	**0.00206**	**0.576**
Age of Child	**-1.033811**	**0.536**
Access to PSF	**1.342431**	**0.771**
Exclusive Breastfeeding	**-5.697377**	**0.199**
Diarrhea in Past 2 Weeks	**-7.289255**	**0.174**
Received Nutritional Information	**-5.470047**	**0.205**

APPENDIX II – Institutional Review Board Approval-Emory University

EMORY UNIVERSITY

Institutional Review Board

FROM: Aryeh Stein, PhD
Co-Chair
Emory University IRB

TO: Juan Leon, PhD/MPH
Principal Investigator

CC:			
	Holan	Regina	MedInfect
	Khawja	Amina	Global Health
	Mues	Katherine	Global Health
	Perez	Lilian	Public Health
	Shukla	Urmy	Graduate Sociology

DATE: April 26, 2010

RE: **Notification of Amendment Approval and Expedited Approval Determination**
AM3_IRB00020524
Amendment 3 for IRB Study #IRB00020524
Evaluation of the Family Health Program in Vespasiano, Brazil

This is your notification that your above referenced amendment was reviewed and APPROVED by the IRB on **4/21/2010**.

Changes to Consent Form(s)
Changes to Protocol Document(s)
Changes to Advertisements
Changes to study enrollment
Other changes

The amendment changes the status of this study to Expedited (5 and 7), 45 CFR 46.404, single parent consent. Assent for children under 5 years is waived. This approval is valid from **4/21/2010 until 4/20/2011**.

Thereafter, continued approval of this study is contingent upon the submission of a renewal form that must be reviewed and approved by the IRB prior to the expiration date of this study.

Any serious adverse events or issues resulting from this study should be reported immediately to the IRB and to any sponsoring agency (if any). Amendments to protocols and/or revisions to informed consent forms/process must have approval of the IRB before being implemented.

All inquiries and correspondence concerning this protocol must include the IRB number and the name of the Principal Investigator. If you have any questions or concerns, please contact the IRB office at 404-712-0720 or at email address irb@emory.edu. Our web address is http://www.emory.edu/IRB. Thank you.
Sincerely,

Aryeh Stein, PhD
Co-Chair
Emory University Institutional Review Board
This letter has been digitally signed

APPENDIX III – Institutional Review Board Approval-FASEH

Faculdade da Saúde e Ecologia Humana
Comitê de Ética em Pesquisa

DECLARAÇÃO

Declaramos que o projeto de pesquisa **"Avaliação do Programa de Saúde da Família em relação à vacinação, vigilância nutricional, e as doenças diarréicas em Vespasiano, Brasil."** (N° 365/2010), Pesquisador responsável José Antônio Guimarães Ferreira e demais pesquisadores: Juan S. Leon, Eric Daniel Mintz, José Geraldo Leite Ribeiro, Urmy Shukla, Amina Khawja e Regina Holan foi aprovado em reunião extraordinária do Comitê de Ética em Pesquisa da Faculdade da Saúde e Ecologia Humana no dia 27 de abril de 2010. Por se tratar de pesquisa com cooperação estrangeira, o pesquisador deverá aguardar o parecer da Comissão Nacional de Ética em Pesquisa – CONEP para o início da coleta dos dados.

O relatório final ou parcial deverá ser encaminhado ao CEP um ano após o início do projeto.

Vespasiano, 29 de abril de 2010.

DR. GUSTAVO NUNES TASCA FERREIRA
Fisioterapeuta
CREFITO 4/[illegible]-F

Gustavo Nunes Tasca Ferreira
Coordenador do CEP – FASEH

Rua São Paulo, 958 - Jardim Alterosa -Vespasiano - MG - CEP 33200-000 – Telefone: 2138-2900

APPENDIX IV – Survey Instrument

Survey ID _____ Interviewer ID _____

Pesquisa na comunidade: Avaliação do Programa de Saúde da Família em relação à Vacinação, Nutrição e as doenças diarréicas em Vespasiano.
Brasil: Julho de 2010, Emory RSPH e escola de Medicina da FASEH

Data da entrevista: dd/mm/aa __ __/__ __/__ __PSF _____ Household ID_____
Hora de início da entrevista ____:____ am/pm
PARTE 1: Dados demográficos do entrevistado

Primeiro eu farei algumas perguntas sobre você

1. a. Qual a sua idade? _____ anos
   b. Qual a sua data de nascimento? (dd/mm/aa): __ __/__ __/__ __

2. Qual o seu estado civil? *(favor marcar apenas uma opção – a mais recente)*

0. Solteiro(a)
1. Solteiro, mas mora com parceiro (a)
2. Casado (a)
3. Separado (a)
4. Divorciado (a)
5. Viúva (a)
68. Outros (especificar): _____
88. Se recusou a responder

3. Qual o seu sexo?
   1. Masculino
   2. Feminino
   88. Se recusou a responder

4. Qual a sua religião?
   1. Católica
   2. Protestante
   3. Evangélica
   4. Espírita
   5. Cristão
   6. Nenhuma
   68. Outra (especificar): _____
   88. Se recusou a responder

5. Como você descreveria sua raça? _____

6. Como você avaliaria a renda mensal da sua família?
   1. Satisfazemos nossas necessidades facilmente.
   2. Satisfazemos nossas necessidades.
   3. Dificilmente satisfazemos nossas necessidades

7. Você está empregado?
   1. Sim, tempo integral fora de casa

2. Sim, meio período fora de casa
3. Sim, tempo integral em casa
4. Sim, meio período em casa
5. Não, mas estou a procura
6. Não, nem estou a procura

88. Se recusou a responder

8. Qual a renda mensal aproximada de sua familia? $R _____/mês
(tente obter as melhores estimativas. Caso o cuidador se negue a responder escreva N / A no espaço).

9. Quantas pessoas são beneficiadas por esta renda?: _____

10. Qual a sua escolaridade?

0. Nenhuma
1. Ensino Fundamental incompleto
2. Ensino Fundamental completo
3. Ensino médio incompleto
4. Ensino médio completo
5. Nível técnico
6. Ensino Superior
7. Pós-graduação

88. Se recusou a responder

PARTE 2– Acesso e Utilização do Serviço de Súde *Eu vou te fazer perguntas sobre seu acesso ao serviço de saúde.*

11. Quando seu(sua) filho(a) fica doente, qual o primeiro lugar que você procura por tratamento?
1. Farmácia
2. Curandeiro
3. PSF
4. Hospital
5. Posto de saúde
6. Clínica particular
7. Família e amigos
8. Trata em casa

12. Quais os principais motivos para procura do PSF em relação a saúde da sua criança? (pode marcar mais de um).

1. Diarréia
2. Vacinas
3. Consultas regulars
4. Nutrição e Desenvolvimento
5. Febre, resfriado, etc.
68. Outros (especificar): _____

13. Qual o seu principal meio de transporte para o PSF mais próximo?
1. A pé
2. Bicicleta
3. Carro
4. Moto
5. Ônibus
68. Outro _____

14. Quanto tempo aproximadamente você leva para chegar ao PSF mais próximo? _____ minutos

15. Você tem disponibilidade de levar seu filho(a) ao PSF durante o horário de atendimento médico?
1. Sim
2. Não
3. As vezes (explique): _____

16. Você está em casa durante as visitas das agentes de saúde do PSF?
1. Sim
2. Não
3. As vezes (explique): _____

17. Você tem algum problema na obtenção de cuidados de saúde para seu filho no PSF?
1.Sim(explique):_____
2. Não
3. As vezes (explique): _____
68. Outro, especifique: _____

Parte 3 - Prevenção e controle de diarréia
As próximas perguntas serão sobre prevenção e controle de diarréia na sua casa.

18. Você recebe informações a respeito de prevenção e controle de diarréia em crianças? (se "não" ou "não sei", pule para a pergunta 22).
1. Sim
2. Não
98. Não sei

19. De quem você recebeu informações a respeito de prevenção e controle de diarréia em crianças? (Por favor escolha a principal fonte)
1. Equipe da unidade do PSF (enfermeira, médico, auxiliar de enfermagem)
2. Agentes comunitários do PSF
3. Amigos e família
4. Caderneta da criança
68. Outros (por favor especifique)_____

(Prestar atenção às unidades de PSF que funcionam na mesma estrutura dos postos de saúde)
20. Que tipo de informação você recebe deles*?*
_____

_____

21. Você está satisfeito (a) com as informações sobre prevenção e controle de diarréia que recebeu para a sua criança?
1. Sim
2. Não
98. Não sei

22. Qual é a sua fonte regular de água para beber. *Por favor escolha uma das seguintes opções*:
1. água encanada dentro de casa
2. lagoa ou rio
3. água da chuva
4. poço ou cisterna
5. água mineral
68. Outro (por favor especifique)_____
98. não sei

23. Você trata, ferve ou filtra sua água para beber?

1. Sim
2. não
3 . às vezes
4. N/A (uso água mineral)
98. não sei

24. Você trata, ferve ou filtra a água todas as vezes antes de usá-la para cozinhar ou lavar frutas e verduras?
1.Sim
2.Não
3. às vezes
98. não sei

25. Você lava as frutas e verduras todas as vezes antes de cozinha-los ou servi-los?
1.Sim
2.Não
3.às vezes
98. não sei
26. Como é o sistema de esgoto da sua casa? Por favor escolha uma das opções.
1. esgoto encanado
2. esgoto sem encanamento
3. fossa/ não tem sistema de esgoto
68.Outro (por favor especifique)_____
98. não sei

27. Você cozinha bem a carne antes de servir?
1. Sim
2.não
3. às vezes
98. Não sei

28. Você refrigera todas as carnes, alimentos perecíveis e sobras na sua casa?
1.Sim
2.Não
3. às vezes
98. não sei

29. Quando você armazena comida, você separa carne crua/ produtos perecíveis de comidas cozidas?
    1. Sim
    2. Não
    3. às vezes
    98. Não sei

30. Você lava as mãos com água e sabonete antes de cozinhar, servir as refeições e comer?
1. Sim
2. não
3. às vezes
98. não sei

31. Você lava as mãos da sua criança com água e sabonete antes das refeições?
1.Sim
2. Não
3. às vezes
98. não sei

Parte 4- Estado nutricional das crianças menores de 5 anos de idade

As seguintes perguntas são apenas sobre a crianças com 5 anos ou menos, com a data de aniversário mais próxima. Se a criança estiver engessada ou com muitos curativos, não meça! Selecione a próxima criança com o aniversário mais próximo, com 5 anos ou menos.

Peça para ver a caderneta da criança

32. Quantos anos sua criança tem? Anos____ ____ Meses____ ____

33. Qual a data de aniversário da criança*? (Confira na caderneta):* **dd/mm/aa ___ ___/___ ___/___ ___** *(Se não sabe dia ou mês, coloque 01,01)*

34. Qual o sexo da sua criança?
1. Masculino
2.Feminino

35. Qual seu parentesco com o(a) *(nome da criança*)?
1.mãe
2.pai
3. avó
4. avô
5. Tia
6.Tio
68. Outros (especificar): _____

36. Você já recebeu orientações a respeito de nutrição infantil para (nome da criança)? (Se Não/NS, vá para a questão 40).
1. Sim
2. Não
98. Não sabe

37. De quem você recebeu as orientações a respeito de nutrição infantil? (Favor escolher a fonte principal)
1. Equipe PSF na unidade (enfermeira, médico, auxiliar de enfermagem)
2. Agentes comunitários do PSF
3. Amigos e família
4. Caderneta da criança
68. Outro (favor especificar) _____

38. Que tipo de informação nutricional você recebeu?
_____

_____

39. Você está satisfeito com as informações que você recebeu a respeito de nutrição para a seu/sua filho(a)?
1. Sim
2. Não
98. Não sabe

40. Você tomou ácido fólico quando estava grávida de (nome da criança)?
(Se N/A, passe para a pergunta 43).
1. Sim
2. Não
3. N/A- não é a mãe
98. Não sei

41. Você recebeu atendimento pré-natal no PSF, quando você estava grávida de (nome da criança)? (Check-up para ver como o bebê estava se desenvolvendo durante toda a gravidez)? (Se não, passe para a pergunta 43).
1. Sim
2. Não
3. N/A- não é a mãe
98. Não sei

42. Quantas vezes você foi ao PSF para as visitas de pré-natal durante a gravidez de (nome da criança)?
_____

43. A(O)(Nome da criança) foi amamentado(a) no seio materno no mesmo dia em que nasceu?
1. Sim
2. Não
98. Não sabe

44. A(O) (Nome da criança) foi amamentado(a) no seio materno exclusivamente nos 6 primeiros meses de vida?
1. Sim
2. Não
3. N/A – A criança é menor de 6 meses
98. Não sabe

45. Qual era a idade de (nome da criança) quando começou a receber outros alimentos?Meses_____
(Se não se aplica, escreva N/A. Ex: Se a única fonte de alimentação da criança ainda é a amamentação).
46. Desde ontem neste horário, a criança foi amamentada?
1. Sim
2. Não
3. N/A a criança não está sendo amamentada no seio materno
98. Não sabe
47. Desde ontem neste horário, quantas vezes (nome da criança) foi amamentado(a)?
1. Uma
2. Duas
3. Três
4. Quatro
5. Cinco ou mais
6. Nenhuma
7. N/A a criança não está sendo amamentada no seio materno
98. Não sabe

48.Ontem, durante a noite, ou hoje, (nome da criança) consumiu algum dos seguintes alimentos (24 horas)?

1. Pão ou arroz (feitos com trigo ou farinha branca)	Y	N	NS
2. Feijão, legumes ou ervilhas (sólido ou pastoso)	Y	N	NS
3. Derivados do leite (leite, iogurte, queijo)	Y	N	NS
4. Carnes de peixe ou frango (sólido ou pastoso)	Y	N	NS
5. Ovos	Y	N	NS
6. Frutas ou vegetais (sólido ou pastoso)	Y	N	NS
7. Bolos, biscoitos, doces	Y	N	NS
8. Sucos	Y	N	NS
9. Chá	Y	N	NS
10. Outros líquidos	Y	N	NS

49. Nas últimas duas semanas, (nome da criança) teve diarréia?
1. Sim

2. Não
98. Não sabe

50. Quantos episódios de diarréia (nome da criança) teve no último ano? _____

51. A(O) (Nome da criança) está fazendo suplementação alimentar de?

1. Ferro	Y	N	NS
2. Suplementação Protovit (ou outro multi-vitamínico)	Y	N	NS
3. Suplementação de vitamina A	Y	N	NS
4. Nenhum			

68. Outros (especifique) _____

52. Quanto tempo (nome da criança) fica exposto ao sol diariamente?
1. 15 minutos por dia
2. Menos de 15 minutos por dia
3. Mais de 15 minutos por dia
98. Não sabe

53. A(O) (Nome da criança) foi hospitalizado(a) no último ano? (Se Não, ou NS, pular para questão 56)
1. Sim
2. Não
3. Não sabe

54. Se sim, qual o motivo? _____

55. Por quanto tempo (nome da criança) ficou hospitalizado? _____ dias.

Parte 5 - Questões sobre Imunização
Eu vou perguntar algumas questões sobre a vacinação/imunização da criança:
56. *Pergunte ao cuidador para mostrar-lhe a Caderneta da criança. Confira todas as vacinas que a criança recebeu. Se a Caderneta não estiver disponível, pergunte oralmente ao cuidador:*

Idade	**Vacinas**	**Doses**	**Recebido? (Verificar se sim)**
Ao nascer	56a. BCG - ID	dose única	
	56b.Vacina contra hepatiteB	1ª dose	
1 mês	56c.Vacina contra hepatiteB	2ª dose	
2 meses	56d. Vacina tetravalente (DTP + Hib) = (Tetra)	1ª dose	
	56e. VOP (vacina oral contra pólio)	1ª dose	
	56f. VORH (Vacina Oral de Rotavírus Humano)	1ª dose	
	56g. Vacina Pnemococica 10 valente (Pneumo)	1ª dose	
3 meses	56h. Vacina Conjugada Meningite C (MMC)	1ª dose	
4 meses	56i. Vacina tetravalente (DTP + Hib) –(Tetra)	2ª dose	
	56j. VOP (vacina oral contra pólio)	2ª dose	
	56k. VORH (Vacina Oral de	2ª dose	

	Rotavírus Humano)		
	56l. Vacina Pnemococica 10 valente (Pneumo)	2ª dose	
5 meses	56m. Vacina Conjugada Meningite C (MMC)	2ª dose	
6 meses	56n. Vacina tetravalente (DTP + Hib) = (Tetra)	3ª dose	
	56o. VOP (vacina oral contra pólio)	3ª dose	
	56p. Vacina Pnemococica 10 valente (Pneumo)	3ª dose	
7 meses	56q. Vacina contra hepatite B (Hep B)	3ª dose	
9 meses	56r. Vacina contra febre amarela (FA)	dose inicial	
12 meses	56s. SRC (triplice viral)	1ª dose	
	56t. Vacina Conjugada Meningite C (MMC)	Reforço ou dose unica	
15 meses	56u. VOP (vacina oral contra pólio)	Reforço	
	56v. DTP (triplice bacteriana)	1º Reforço	
	56w. Vacina Pnemococica 10 valente (Pneumo)	Reforço	
>6 meses a <2 anos a comobidadge 3-9 anos	56x. Influenza A (HINI)	1ª dose	
	56xx. Influenza A (HINI)	2ª dose	

57. Quais são algumas das dificuldades para vacinar (nome da criança)? (pode marcar mais de um)
    1. Unidade de PSF muito distante
    2. Falta de transporte para o PSF
    3. Meus horários não permitem
    4. Não possuo informação suficiente sobre vacinação
    5. Não desejo ter meu filho(s) vacinados
    6. Não tem dificuldade
    68. Outras, especifique: _____

58. Na sua opinião, quão importante para a(o) (nome da criança) é vacinar?
    1. Muito importante
    2. Alguma importância
    3. Não tão importante
    4. Não é importante
    98. Não sei

59. Você sente que possui informações suficientes sobre vacinação?
    1. Sim
    2. Não
    3. Um pouco

60. Qual é sua fonte primária de informações sobre vacina?
    1. A caderneta
2. Funcionários do PSF
3. Amigos ou família
4. Campanhas na comunidade
68. Outra (especifique) _____

61. Na sua opinião, Qual a melhor maneira de se informar sobre vacinas?
    1. Através de material impresso
    2. Oralmente, através de discussão com trabalhadores de saúde
    3. Atividades na comunidade
    68. Outra (especifique)

62. Se você NÃO vacinou a(o) (nome da criança), por favor, explique por que (limite de espaço disponível – se não se aplica, escreva N/A)
_____

63. Você tem algo a acrescentar que nós não tenhamos discutido?
_____

Parte 6: Medidas Antropométricas
Agora eu vou pesar e medir a(o) (nome da criança) *para avaliar seu crescimento*
Pesar e medir criança com menos de cinco anos que tenha o recente aniversário mais próximo. NÃO meça nenhuma criança que esteja engessada, com curativos extensos (?) ou deficiências que o impeça de ser medido.

64. Altura da criança (observador 1): ____ ____ ____ . ____CM

65. Peso da criança (observador 1): ____ ____ . ____ KG

66. Altura da criança (observador 2): ____ ____ ____ .____CM

67. Altura média da criança: ____ ____ ____ . ____ ____ CM

For Anthro calculator use observer 1 measurements:

68. Percentil peso para altura (wasting) (see WHO Anthro calculator): ____ ____ . ____ ____%

69. Percentil peso para idade (underweight) (see WHO Anthro calculator): ____ ____ . ____ ____%

70. Percentil altura para idade (stunting) *(see WHO anthro calculator):* ____ ____. ____ ____%

71. BMI para idade *(see WHO anthro calculator):* ____ ____. ____ ____%

72. Cicule os medidas realizadas:
    1. Peso
    2. Altura
    3. não foi possível realizar
    4. Outros (especifique): _____

73. Simal de cacifo (circle one)?: Positivo Negativo

74. A caderneta estava presente? *Sim* Não

AGRADEÇA o participante por sua cooperação
CERTIFIQUE que todos os dados foram completados corretamente
CONFIRA se os números de identificação estão no alto de cada página

Horário do fim da entrevista: ____:_____