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Ripple Effects of the Belo Monte Dam: A Syndemic Approach to Addressing Health Impacts for the Downstream Community of Gurupá

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Ripple Effects of the Belo Monte Dam: A Syndemic Approach to Addressing Health Impacts for the Downstream Community of Gurupá

by

Cynthia A. Pace

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy Department of Anthropology College of Arts and Sciences University of South Florida

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ABSTRACT

This dissertation examines the public health impacts of a large dam project on a downstream community using the framework of Syndemic Theory. The particular focus is the Belo Monte Dam, located in the Brazilian Amazon, and its impact on the community of Gurupá, Pará. At the present time the Belo Monte Dam, which is nearing completion, stands out in scale as being the world’s third largest dam complex. Gurupá is a community well known (and well-studied) in the social science literature as Amazon Town. The aims of this study are to assess the pre-existing public health of Gurupá, as well as the current and future health impacts associated with dam construction by (a) assembling a comparative list of known health impacts created by the construction of hydroelectric dams world-wide, (b) conducting ethnographic research focusing on the public health system in Gurupá, and (c) integrating these data using Syndemic Theory to create a heuristic model of health impacts to be used by public health workers to assist in the mitigation of negative public health impacts.

This research is significant to the advancement of the scholarly literature in that it uses syndemic theory in a new way, thereby broadening the relevance and applicability of the approach. The syndemic framework postulates that the concurrent presence of two or more ill-health conditions in a population can lead to a dynamic interaction in which each of the conditions shapes and worsens the other. The widespread presence of two or more poor health conditions within a population can lead to an aggregate of health issues that collectively and substantially lower the health status of the entire community. By studying communities worldwide that have dealt with the aftermath of dam construction, this dissertation creates a
model suggesting the high likelihood of certain diseases and socio-environmental factors combining and leading to ill health in a syndemic fashion. The model can then be tailored to the specifics of this case study.

Gurupá is the focus of the study. The community is unique for the region as it has been the subject of several ethnographies since the 1940s. This dissertation makes use of these decades of research as a base line to evaluate current changes in the public health system as impacted by the dam. With this base-line as a starting point, the study combines a review of epidemiological data, ethnographic observations, interviews with public health professionals and the local population, and a health and food frequency survey to identify what factors are most detrimental to the community’s health in reference to the Belo Monte dam construction.

The results of this study identify risks from increases in intestinal parasites (due to poor water quality and sanitation), increases in rates of malaria and dengue fever, increases in potential stressors (e.g. from increases in violence and drugs associated with migration of new people into the community), and a surge in sexually transmitted infections. As research shows, these factors combine to create a breakdown in community cohesion, which has been a key factor in keeping Gurupá healthier than its surrounding towns. Community cohesion is described as a mutual trust and camaraderie among community members that provide a safety net against common problems. Community cohesion also allows for a sense of social control that is not attainable when community members are strangers or do not trust each other. If there is a lack of trust within the community then it is less likely that individuals will do things based on the greater good.

As seen with previous studies, syndemic theory usually examines one public health issue and postulates about the different factors that go into its proliferation. This research instead takes
a known risk factor to population health, dam construction, and uses syndemic theory to hypothesize about all the potential impacts so as to create a model that can be used to mitigate said impacts. Studying the impacts of dams and their syndemic effects on populations tie previous environmental, anthropological, public health, and biological studies together showing how all factors combine and mutually impact each other, which provides the foundation for a nonlinear approach to solving Amazon specific public health issues.
CHAPTER ONE:

INTRODUCTION

There are more than 57,000 large dams in existence around the world today (International Rivers 2018). Many of these dams were built with the purpose of combating poverty through cost-effective energy production, supplying drinking water, and improving agricultural production (World Health Organization 2000; World Commission on Dams 2000; Scudder 2006). Despite these commendable goals, time and time again researchers have documented that dam construction negatively impacts surrounding human populations through environmental degradation and adverse health effects (World Commission on Dams 2000; Scudder 2006). In many cases, the environmental, health, and associated social costs outweigh the benefits to economic development, especially for local populations (de Faria et al. 2017; Fearnside 1999, 2016; Lees et al. 2016; Cochrane et al. 2017).

In terms of the human health impacts, there is considerable literature on the types and severity of negative effects from dams worldwide (Braun 2010; Cao et al. 2012; Erlanger et al. 2008; Fearnside 1999, 2016; Goldsmith and Hildyard 1986; Lerer and Scudder 1999; Scudder 2006; World Commission on Dams 2000; World Health Organization 2000; Kirchherr et al. 2016). Unfortunately, this information is rarely
integrated into dam planning. Making matters worse, health officials, researchers, and Non Governmental Organizations (NGOs) who attempt to mitigate the negative impacts of dam construction rarely possess data organized into cohesive models or frameworks to account for the complexities of health-environmental-and social interconnections. To address these problems, this research applies Singer’s (2009) syndemic theory to health impacts of dams as a way to explain the interrelated and often compounded effects of environmental changes, social inequality, and multiple diseases that negatively influences humans.

Syndemic theory offers a unique framework to study the health impact of dam construction. It postulates that the concurrent presence of two or more ill-health conditions in a population can lead to a dynamic interaction in which each of the conditions shapes and aggravates the other, thereby amplifying their separate effects (Bulled and Singer 2011; Everett and Wieland 2012; Gonzalez-Guarda et al. 2012, 2017; Halkitis et al. 2012; Himmelgreen et al. 2009, 2013; Kline 2012; Mustanski et al. 2014; Romero-Daza et al. 2012; Singer and Clair 2003; Singer 1996; Willen et al. 2017; Singer and Snipes 1992; Tsai and Burns 2015). When Singer first coined the term syndemic (a combination of the words synergy and epidemic) he emphasized the fact that diseases and ill-health do not happen in a vacuum. For example, considering the 2017 outbreak of Cholera in Yemen that involved over 200,000 cases and killed 1,300 people, syndemic theory shows how this was not a random happenstance. The outbreak was preceded by, and made much worse by, widespread problems of malnutrition, disrupted sanitation and a lack of access to clean water all due to civil war (Bruwer 2017). Treating the Cholera
outbreak as an isolated incident ignores the larger socio-political forces at play that both create and exacerbate the situation.

Applied to the problem of health and dam construction, a framework based on syndemic theory can tie previous environmental, political, anthropological, public health, and biological studies together showing how all factors combine and negatively impact each other, thereby weakening the overall health status of human populations. The research presented here applies such a framework as it focuses on the massive Belo Monte Dam being built along the Xingu River in the eastern part of the Brazilian Amazon. The dam will be the third largest in the world and produce an estimated 11,233 megawatts of energy (Diamond and Poirier 2010; Governo Federal do Brasil 2009; Norte Energia 2014). The widely reported destruction of rainforest (approximately 400 square kilometers), the displacement of 20,000 people in the vicinity of Altamira (the urban center closest to the dam site), and the influx and then departure of an estimated 50,000 workers is only the beginning of problems as the dam will create long-term socio-economic, environmental, and public health problems in an extensive area along the Xingu River (Anderson and Elkaim 2018; Diamond and Poirier 2010; The Guardian 2016; Sullivan 2016; Harris 2015).

To assess local-level health impacts, research focuses on a community located downstream from the dam as a case study. The municipality of Gurupá is located 188 kilometers downstream from the Belo Monte Dam at the confluence of the Xingu and Amazon Rivers. The community (town population near 11,000 and the surrounding
municipality 26,000 – IBGE 2010) is included in the ‘indirect impact’ area for the dam (Governo Federal do Brasil 2009).

The community is paradigmatic for the research focus in three ways: (1) Gurupá, as most of the Amazonian “ribeirinho” [river bank dwellers] communities, is dominated by an agro-extractivist economy with subsistence farmers (growing manioc as the staple), extractivists (açaí, timber, and palm hearts), and subsistence/commercial fishers/shrimpers fully dependent on the river for their health and livelihood (Wagley 2014; R. Pace 1998). This dependence makes the population very susceptible to a long list of changes expected by the creation of the dam. (2) Because it is a downstream community with the indirect impact designation, government officials and public health
researchers have assumed Gurupá will experience little health impact from the dam, although this is contrary to global research. As a result, officials have done minimal preparation for potential health impacts. In general, analysis of downstream communities like Gurupá, is crucial since over the long run they receive the brunt of socio-environmental and health impacts as they are very susceptible to worsening water quality and disruptions of natural flood regimes and typically lack proper healthcare resources (Adams 2009; Scudder 2006; World Commission on Dams 2000; Ligon et. al. 1995). (3) The community is the best studied ribeirinho/agro-extractivist community in the social sciences providing an invaluable base-line to understand health impacts in a holistic fashion (see Wagley 1953 and 2014; Galvão 1955; Oliveira 1991; Pace 1998; Royer 2003; Pace and Hinote 2013).

Already during the fieldwork portion of this research from 2015-2016 the municipality of Gurupá has experienced impacts associated with the dam—which is still under construction during the time of this study. For example, there has been a strain on the local health services as medical personnel are diverted to the dam site in Altamira to care for the burgeoning numbers of sick and injured construction workers. Regional hospital beds (for patients too ill for care in local facilities) are in such short supply that one doctor commented that ill patients in outlying communities like Gurupá have died waiting for an available bed (C. Pace 2013). In addition, according to the Secretary of Health in Gurupá, increases in the incidence of dengue fever are attributed to an upsurge in movement of people to and from Altamira (C. Pace 2013). Water quality issues have arisen as suspected contaminants from the construction site have travelled downstream. The rural workers union and health officials have called several emergency meetings to
discuss the problem.

Since the date for completion and full operation of the dam is projected for 2019, the purpose of this research is to assess the current public health infrastructure of the community of Gurupá, gathering a wide variety of social, environmental, and health data, including 60 plus years of ethnographic research in the area (including 10 years of my personal experience). These data are combined with the worldwide literature on the health impacts of dams and syndemic theory, creating a likely scenario model. These data form a cohesive model accounting for the complexities of health-environmental-and social interconnections. Based on the model, recommendations for mitigation strategies are articulated and will be given to the public health officials from the region as well as other interested stakeholders.

Chapter Overview

The following is an overview on the contents of this dissertation. Chapter 2 will discuss the background information necessary to put this research project into context by providing a brief overview of previous studies examining the impacts that large hydroelectric dams have had on communities globally. It will also cover syndemic theory, which includes the background of the concept as well as examples of how it has been used in medical anthropology and public health studies. This section will elucidate the overlapping and interacting factors that create and mutually enhance disease and illness as well as provide common critiques of the theory. Chapter 3 includes a detailed description of the research site including its geographical location, demographics, historical context, and connection to the national and global political economy. Placing
the town of Gurupá in a national/global context illuminates how economic and political power is asserted in the planning process with little to no regard for the people inhabiting the region.

Chapter 4 describes the mixed methods used in this study and an overview of the data collected. Chapter 5 covers a detailed description of the public health system in Gurupá and in Brazil as a nation. This chapter reveals how resources flow through the public health system, how they are used, and what health means to the community. In Chapter 6, quantitative results are presented from the project’s health surveys, food frequency questionnaires, and anthropometric measurements. These data provide a holistic overview of the baseline health status of Gurupá.

For Chapter 7, qualitative findings are discussed, highlighting the major themes that emerged from interviews and ethnographic observations. The discussion of syndemic theory and how it can be applied to the public health impacts of the Belo Monte Dam through a heuristic model is found in Chapter 8. Chapter 9 is the conclusion to the research, which provides recommendations to mitigate potential negative impacts.

Research Questions

Research on the health impacts of the Belo Monte dam in Gurupá was divided into two phases. The first phase includes the qualitative portion of the research. I chose to use qualitative methods for the first phase because at the beginning of the research I was still establishing rapport and getting acquainted with different members of the community, which lends itself to more in-depth interviews. The qualitative data collected were then used to formulate parts of the
quantitative phase.

For the first phase I focused on the following set of questions:

(1) What is the structure of the local and regional health care system?
What do the care professionals identify as the strengths and weaknesses of the system? What changes do they foresee with the dam completion?

(2) How do community members view their current health status?

(3) What changes to their health or health care do they anticipate within the coming years and what is the general opinion on, and discourse about, the Belo Monte Dam?

For the second phase of research I focused on questions such as:

(1) What are the public health impacts of the Belo Monte dam on the downstream riverine community of Gurupá? Will there be changes in infectious disease rates, nutritional status/food security, or access to healthcare? Will there be increases in malaria, dengue fever, and waterborne illnesses ranging from dysentery to diarrhea due to environmental changes and problems with water quality?

(2) Do the data collected identify syndemic relations? What is the relationship between the various health impacts?

(3) How can different stakeholders such as grassroots organizations, NGOs, and local government agencies use this information to mitigate
the health care problems? How can data on unanticipated syndemic relationships be used to “fill in” the gaps of public health care?

Background to the Study: Plans and Delays

This dissertation is an anthropological analysis of the public health system of the small riverine town of Gurupá, which is on the cusp of significant changes created by the Belo Monte Dam construction. Initially, I designed the research project to assess public health impacts of a completed dam project, as the initial turbines were to be functional in 2015. Yet as I started the fieldwork (2015-2016) it became abundantly clear that the dam would not be completed during my time in the field. The Belo Monte Dam, in fact, has been a focus of controversy, and construction delay, dating all the back to the 1970s. The dam project has been proposed, reworked, and shelved many times due to economic, political, and environmental concerns, including a series of work stoppages due to legal problems after dam construction was well underway in the 2010s.

One of the more famous conflicts over the dam occurred in 1989. At this time the national electric company, Electrobrás, was planning to construct approximately 297 dams in Brazil with 79 of them being in the Amazon region (Fearnside 2006). As the plans for the first proposed dam in the vicinity of the Belo Monte site were discussed, strong opposition spearheaded by Indigenous peoples and their supporters emerged. For example, the First Encounter of the Indigenous Nations of the Xingu in 1989 held in Altamira brought together various Indigenous groups, as well as environmentalists, activists, and international celebrities, to draw attention to the negative impacts these
Two iconic media events occurred during this period of protest that likely had some impact on delaying construction for years. The first was the very public support of the British singer Sting who brought the issue to the world stage. In conjunction with Sting’s support was the dramatic show of force by Tuire Kayapó, a woman leader of the Kayapó, who waved a machete in the face of Electrobrás’s chief engineer for the dam during a public forum (Barbosa 2000, Hall and Branford 2012, Perez 2015). The second media event was the televised testimony of Kayapó caciques (chiefs) protesting the dam at the World Bank, an agency that was financing much of the project. Whether or not these events were directly tied to the World Bank’s decision to cancel this first attempt to build the dam is unclear (there were also political changes occurring in the Bank at the time resulting in the “greening” of its lending policies and in an economic sense the dam was very costly and risky making it less desirable—see Barbosa 2000:70-71), but to the public they represented a clear and defiant statement of opposition.

Nonetheless, in 2005 the project resurfaced, this time financed principally by the Brazilian government during a period of economic prosperity. The plan for the dam passed through Congress, but then entered a six-year long legal delay because of incomplete environmental impact assessments (Fearnside 2006, Perez 2015). It was not until January of 2011 that Belo Monte’s installation license was finally granted. This milestone, however, was immediately followed by a court order to suspend the license in February of 2011 due to more compliance deficiencies and environmental concerns (Perez 2015). By March the suspension was overturned and construction activities began.
again. From that point there have been at least 8 more orders to suspend the Belo Monte project. The stoppages came from failures to: hold prior consultations with dam-affected populations (especially Indigenous groups), fulfill the requirement of a mitigation action plan, create compensation measures for those impacted, and complete infrastructure projects such as building bridges, fixing the local sewage system, resettling populations and demolishing and removing structures and vegetation from areas to be flooded (Perez 2015).

Most recently in 2016, the federal court suspended Belo Monte’s installation license due to failure to provide adequate housing to those impacted by the dam. Norte Energia (now managing the dam’s construction) had proposed building three different sized houses out of concrete blocks, but only constructed the smaller size and made them out of cinder blocks. The resulting problems were that larger families could not fit in one house and the cinder block structures did not support the traditional sleeping hammocks that most people use in the Amazon (hammocks are both cooler and less expensive than beds). Additionally, the houses were not built to local codes, forcing the town of Altamira to make amendments to their building codes to accommodate the houses. Opponents of the dam are challenging this change as unconstitutional (Sullivan 2016).

**Background to the Study: Personal Experiences**

At the time of writing this dissertation, the estimated competition date for a fully functioning dam is in 2019. For this reason my research has shifted from studying the health impacts in Gurupá created after the completed construction of the dam to the analysis of the recent history of Gurupá’s health care system, which will serve as a base-
line study to understand changes coming from the dam. The benefit of having lived and
worked in the area of study off-and-on for over 10 years allows me to have a unique
longitudinal perspective on the dam’s impact on Gurupá.

I first came to know Gurupá in 2005 during an ethnographic field school held in
the community. At this time I had just completed my first year as an undergraduate at
Middle Tennessee State University and decided to spend my summer travelling and
learning anthropological research methods. Armed with one year of Portuguese, a
research project to measure the undernutrition rates of children, and several college-ruled
notebooks, I got my first taste of ethnography. The journey to Gurupá started with an
eight-hour plane ride from the United States to the city of Belém in the state of Pará.
Belém is the last major city before traveling up the Amazon River to the smaller
community of Gurupá. Gurupá is accessible primarily by riverboat, although small planes
can fly in and out on a small runway, usually in the event of a medical emergency. The
riverboat leaves once a week, traveling from Belém all the way to Manaus, which is a
five-day trip. Fortunately, the trip to Gurupá is only 24 to 36 hours depending on tides,
weather, and how much cargo must be loaded or unloaded along the way.

For most of my time in Gurupá I resided in the town (described in Chapter Two),
but critical to my study, I also twice visited the city of Altamira, where the dam is being
built and where the biggest impact has been so far. The trip to Altamira can be by river
boat from Gurupá, a 12 hour trip up the Xingu River with a stop in Victoria and a quick
taxi ride to the city. Alternatively, from Belém the trip is a difficult 20-hour bus ride
along paved and dirt roads full of potholes. Arrival in Altamira is typically chaotic, as the
city has exploded in population and is haphazardly organized. Navigating the city with its
snarling traffic is always problematic. I did manage to find and speak with several of the most active voices against the dam, members of NGOs who fight social injustice in the Amazon. For example I met briefly with the Instituto Socioambiental (Socioenvironmental Institute) or ISA in 2012 to discuss my project when Altamira was in the throes of protest against the dam. Many activist organizations from across the globe had traveled to the location as a show of force against the project. Revisiting Altamira in 2015, however, was a vastly different experience. The activist organizations had departed having failed to stop Belo Monte from happening. They moved on to new proposed dam sites leaving ISA alone to fight for the people’s rights in the wake of the beginning stages of construction on Belo Monte.

Back in Gurupá, the inevitability of the dam brings to the surface certain truths. It is clear that government planners on the regional and national level will (and have) use(d) any means necessary to complete big development projects with little to no regard for the ones most affected (Schmink and Wood 1984: 419-438, Silva 2009). The attitudes of people in Gurupá reflect these understandings with one local health care worker stating, “the government does not care about the Amazon; we are invisible to them” (C. Pace 2015). Stephen Nugent (1993) has written about this problem of invisibility and how outsiders have not taken the Amazon populations seriously. He states that Amazonians are either being subsumed under the rubric of nature which denies them a separate social existence (particular the indigenous populations), or disappear under a formal invisibility manufactured by developers who view them as a social pathology that impedes economic development (Nugent 1993: 6, 35, 39). I personally recorded derogatory discourses about people from the Amazon while spending time in the South of Brazil. I was told more than
once that the only thing in the North (Amazon) are lazy Indians who just want to steal the
White people’s land and make it a reservation and take everything the White man worked
hard to create (C. Pace 2013).

With the multitude of development projects occurring in the Amazon, many
justified through national discourses on invisibility such as these above, there is constant
struggle in communities like Gurupá to defend resources and livelihoods from outside
interests. In this dissertation I focus on challenges to public health that stem from the
Belo Monte dam, a megaproject that will benefit others while bringing little if any value
to the local community—but assuredly create long-term social and environmental
hardships according to the existing literature on dam impacts world-wide. I include
information about the local health and the public health system in Gurupá, both its
strengths and weaknesses, to address some of the areas that are more vulnerable to dam
impacts. I combine these data into a model using the theory of syndemics to connect
social, political, and environmental impacts with those of particular epidemics. The goal
of the research is to create a model that can be used by those who want to strengthen the
community-led health programs likely impacted by the dam, including using these data to
petition the government for specific resources needed as the short and long-term health
problems manifest in the community.
CHAPTER TWO:

LITERATURE REVIEW

The process of damming rivers is a practice common to humanity that predates the Neolithic Period (McCully 2001). Throughout time there have been multiple reasons to construct dams, ranging from the regulation of seasonal flooding, management of water for irrigation, to the storage of water for arid regions. More recently dams have been built for recreational purposes and, more importantly, to produce hydroelectric power. Today large hydroelectric dams are responsible for 19% of the world’s total electricity production (Perlman 2012). Given the growing energy needs worldwide, the search to find ways to create greater amounts of electricity from renewable resources like water has become of mounting global importance. In the haste to fulfill the economic benefits of renewable energy, however, planners often ignore what happens to the people living near these large development projects.

Drawing from a list of approximately 50,000 large dams in existence around the world (large dams are defined by measuring 15 or more meters from the base to the top—McCully 2001), researchers have documented that dam construction negatively impacts surrounding human populations, with environmental degradation and adverse health
effects being the two most detrimental failings (World Health Organization 2000).

Concerning the latter, there is considerable literature on the types and severity of health impacts from dams worldwide (Braun 2010; Cao, et al. 2012; Erlanger, et al. 2008; Fearnside 1999; Goldsmith and Hildyard 1986; Lerer and Scudder 1999; Scudder 2006; Sleigh and Jackson 2001; World Commission on Dams 2000; World Health Organization 2000). Some well documented problems include malnutrition due to decreases in the variety of fish in the river, the spreading of infectious disease due to increased migration to the area, and reduced access to health services after populations are displaced from their homes (Erlanger, et al. 2008; Gaur and Patnaik 2011; Sleigh and Jackson 2001).

One of the most menacing issues with dam construction projects, however, is the contamination of water. This along with changes in water flow and canalization allow vector-borne diseases to flourish, especially in tropical areas (Lerer and Scudder 1999).

**Dam Impacts**

The World Health Organization (2000), or WHO, recommends that health impacts from dams be sorted into six categories: communicable diseases, non-communicable diseases, injury, nutrition, psychosocial disorder, and social well-being. The WHO also suggests that the level of priority given for each category, in terms of migration, be left up to the local community. Later in this dissertation I will use the theory of syndemics to disentangle the dynamic interactions occurring on the local level involving the changing environment, migration of populations into the area, increases of communicable diseases, forced displacement and resettlement of populations, loss of land and livelihoods, changing dietary patterns, and the disruption of access to health and
public services and how each category of dam impacts, listed above, may contribute to and exacerbate the other categories to provide a bleak outlook on population health if not properly addressed. But first, I will begin by highlighting some of the major health issues that occur globally in each of these categories.

**Non-communicable diseases**

Non-communicable diseases that are directly linked to dam construction and implementation include poisoning by biological toxins, minerals, and pesticides (World Health Organization 2000). They may also include cardiovascular disease, diabetes, or cancer as indirect impacts of changing dietary patterns, subsistence strategies, or stress levels (increased and sustained cortisol levels) caused by lifestyle changes created by the impacts of dams. These latter effects, however, are discussed in the nutrition and psycho-social diseases sections that follow. This section will focus on problems of toxin release caused by the processes of dam construction.

In a very important comparative case from the Brazilian Amazon, the Tucuruí Hydro Power Complex, located along the Tocantins River which is to the east of the Xingu River where the Belo Monte dam is located, chemicals were used to defoliate large areas to be flooded by the dam reservoir. Over time the chemicals entered the local water supplies. According to local reports, as a consequence a significant number of dam construction workers and native people in the surrounding area died from consuming contaminated water (LaRovere and Mendes 2000).

In other cases worldwide, high levels of mercury have been found in people living downstream from dams, especially in watersheds located near mines. Bacteria in the reservoir water convert any mercury in the water from the dam into methylmercury,
which is a central nervous system toxin. These toxins are ingested by various plants and animals over time and work their way up the food chain where they are concentrated in fish. When a human population consumes the fish, they are exposed to a high concentration of methylmercury. This is of great concern to pregnant women because these chemicals adversely affect the development of the brain and nervous system of fetuses, causing damage to memory, attention, language and motor skills (Burma Rivers Network 2012).

Another health impact of poor water quality caused by dams is cyanobacteria, which is a type of microscopic algae produced from quickly eutrophied (nutrient enriched) water such as the water found in dams of tropical areas. For example, the construction of the Three Gorges Dam in China led to an elevation of water temperature and a reduction in the flow of the Yangtze River, thus creating conditions ideal for the growth of cyanobacteria (Bartram and Chorus 2002). These cyanobacteria can cause a range of gastrointestinal and allergenic illnesses in humans. Some cyanobacteria can even promote liver cancer during chronic low exposure over a long period of time. The worst known case of cyanobacterial toxin poisoning actually occurred in the Brazilian city of Curaru in the state of Amazonas. In 1996 patients who were undergoing dialysis used water from a reservoir. The toxin went straight into their bloodstream and this direct exposure killed more than 50 people (World Health Organization 2000).

A subset of health problems related to water and dams is the lack of planning in case of a dam break. Ideally there should be contingency plans to deal with the devastating environmental damage, possible loss of life, and water contamination. Contingency plans, however, are infrequently made. This is exactly what happened in
Brazil on November 5, 2015 at the Fundão Dam in the state of Minas Gerais, which broke and released 60 million cubic meters of mining waste in a massive flood that resulted in 19 deaths (Breslin 2015; The Guardian 2015). The Brazilian mining industry is being charged with negligence in regard to operating and maintaining the dam, suggesting that safety regulations were ignored and that the biggest environmental disaster in Brazil’s history, as described by the environment minister Izabella Teixeira, could have been averted (The Guardian 2015). Samarco, one of the companies held legally responsible for the disaster is reported to have been forewarned of a possible dam rupture in 2013 yet never came up with a contingency plan (Guardian 2015). This is the fifth dam break to occur in the state of Minas Gerais in the last decade and brings up serious questions regarding how safety is assessed. It also leads to questions about the haste to build dams to fulfill the massive energy needs of the country and whether or not this will result in more disastrous dam breaks.

According to Scudder (2012), the greatest, immediate risk from dams actually comes from operational inefficiencies, especially for downstream communities. In back-to-back years (1999 and 2000) the poorly managed Yali Dam in Vietnam released flood waters that killed and injured villagers in downstream communities as well as completely destroyed crops and livestock reaching all the way to Cambodia. In China a series of dam breaks killed an estimate of 230,000 people in 1975 (McCully 2001). In addition to the mismanagement of dams, Patrick McCully (2001) found that overtopping is the single major reason for the failings of dams. Engineers build dams to withstand the maximum flood estimates, however climate change is not a factor in these estimates. According to the Intergovernmental Panel on Climate Change the planet will warm considerably by the
end of the century causing global rains to increase by 2-4 percent, thus increasing the likelihood for exceeding spillway capacity (McCully 2001). The panel has highly recommended that all past, present and future dams take into account the effects of global warming to mitigate any negative impacts that arise with dam failings (Khagram 2004).

Returning to the case of the Fundão Dam break in Brazil, there were additional deaths and injuries caused by the sudden flooding and consequential mudslides. Towns like Bento Rodrigues that were in the direct path of the break have been destroyed, leaving more than 500 people homeless. As the mining waste from the iron ore mine moved through the River Doce Watershed many downstream communities have had their main water source polluted. More than 200 towns, some with as many as 278,000 inhabitants, are struggling with contaminated water and no idea as to when the water will be safe to drink again (The Guardian 2015, ABC 2015). The waste, which includes heavy metals and chemicals, has travelled 500 kilometers to reach the Atlantic Ocean killing fish and aquatic life along the way (ABC 2015). The Royal Society of Chemistry based in Europe states that in addition to metals such as mercury, arsenic, chromium and manganese, the dam water also contains harmful bacteria (Massarani 2015). This is a very serious impact specifically to downstream communities who were once thought of as out of the impact area. Due to this particular dam break’s magnitude, the long-term effects have not been fully assessed, but the damage to health, society, livelihoods, and the environment is likely to be immense and last for decades (Massarani 2015).

**Nutrition**

Nutrition and food insecurity are factors of great concern for communities displaced by dam construction. Yvonne Braune (2010) writes about the unintended
nutritional consequences of compensation programs in Lesotho, Africa. The Lesotho Highlands Water Project (LHWP) is a large scale, multi-dam development project, which began in 1989 and was completed in 2009. It is a joint project between the Lesotho and South African governments (Keketso 2003). The series of dams were constructed to supply South Africa with water and to generate power for Lesotho. Around 400 families in the Maluti Mountains of Lesotho were relocated and 20,500 residents of this area were affected in some way by the LHWP.

Braun (2010) shows the importance of understanding how several seemingly unrelated factors of dam construction and relocation can act upon each other to produce a variety of unintended consequences. For this specific project, planners developed policies to mitigate the negative impacts felt by the community living in the area where the dam was to be constructed. In Lesotho however, the policy developers did not understand how the role of gender within the household would be affected by giving the compensation money only to the men. Giving money to the men provided them with power over domains that were traditionally controlled by women, thus creating unequal access to household resources. Women were more likely to be in poverty and at risk nutritionally in Lesotho and those who lost land due to the multi-dam project were even more vulnerable to these risks. With the loss of land women were not only forced to feed their family with less available and less varieties of food, but they also were deprived of growing food in their gardens to sell as supplemental income. With the simple act of giving the men the compensation as heads of the household, women’s rights were diminished and food insecurity increased.
In addition to reinforcing gender inequalities, the compensation received for lost land was inadequate (Braun 2010). For fields larger than 1,000 square meters, the government gave a food package to the family, which was meant to replace what the household would have produced from its fields. The food packages were to be delivered once a year and the program was to last for a total of 15 years. The community members who saw their land as providing them with financial security, however, saw this program as unfair. What would happen to their families once the food packages stopped? Not having land to pass down to their children and their children’s children was of major concern to the population. Braun (2010) concludes that both the material and psychological impacts on the community must be considered when developing policies related to population displacement from dams.

In another study Kedia (2004) examines how food production strategies changed among resettled populations due to the Tehri Dam construction in North India. The resettlers went from having a diverse, high-protein diet in the mountains of the middle Himalayas to subsisting on a nutrient-poor, high carbohydrate diet in the plains of the foothills of the Himalayas. They also went from producing food for consumption to producing food for cash as they increasingly became involved in a market economy. Not only did this influence nutrition, but it also affected their entire lifestyle. Being more cash dependent forced resettlers into urbanized lifestyles and exposed them to consumer products. Adult male resettlers developed addictions to alcohol and tobacco for which they spent a considerably greater amount of money than their counterparts still living in the mountain villages. Poor nutrition, alcohol and tobacco were risk factors for cardiovascular disease, obesity, diabetes, domestic violence and other health conditions.
From research, Kedia (2004) offered policy suggestions for the government that included providing more food assistance for the resettlers, as well as teaching them new subsistence practices that would help them provide for themselves and not be so dependent on the market economy.

In many cases it is not only displaced populations, but also downstream communities that suffer from food insecurity and poor nutrition as a result of the building of large dams, especially for the purposes of regulating river flow for hydropower or irrigation (Scudder 2012). Hyrdroelectric dams require a constant flow of water through the turbines to generate electricity. This demand can interfere with the natural flood regimes of rivers that are important to traditional agricultural systems as well as a means to replenish ground water and fishing resources (Saarnak 2003). In Brazil, the Tucuruí Dam has had many negative impacts on fisheries that affect the variety and quantity of fish available to riverine communities who rely on fish as a dietary staple. Worldwide, dams are responsible for the endangerment and/or loss of one-fifth of the world’s freshwater fish population (McCully 2001). The Sobradinho Dam, also in Brazil (the state of Bahia), has negatively affected 11,000 downstream communities that practice flood recession agriculture resulting in food shortages and lowered productivity of the region (Scudder 2012).

Saarnak (2003) discusses the impacts of hydroelectric dams on downstream communities in the Senegal River Valley. Traditionally the people inhabiting this flood plain have adapted to live and work with the natural rises and falls of the river. When the rainy season flooded the river, fishers spanned out throughout to region to work. When the water receded, the fishers would leave the area and flood recession farmers would
take over the valley. When the Manantali Dam was built for the purpose of hydropower, the flow of the river was subjected to the power demands of the country. To produce more energy, the dam released water, thereby creating downstream flooding, but without notifying the farmers. The floodwaters wiped out newly planted crops and resulted in massive crop failure (Saarnak 2003). In addition, the reservoir decreased the sediments that the naturally flowing river contained so that when the valley was flooded it no longer held the same fertilization properties for the fishers and farmers and thereby directly impacted the food availability for the region.

**Psycho-social disorders, social well-being and injury**

Displacement of people is one the most studied social impacts of development. Many social scientists, especially anthropologists, are dedicated to understanding the processes that displaced and resettled people must go through to be able to adapt to their new settings (Cao, et al. 2012; Cernea 2000; Heming, et al. 2001; Oliver-Smith 2009; Scudder 2012). This process is a delicate one and involves many factors as entire communities are moved from a place where they have lived, sometimes for generations. Gaur and Patnaik (2011) discuss in their study how the Korwa, an indigenous group of Central India, perceive their health since they were removed from their homes located in the forest tracts. The research focuses on the experiential health, or how people’s embodied experience of their state of being is formed by a complex relationship between physical, emotional, environmental, and social factors of living. Within this framework Gaur and Patnaik examine the concept of liminality and health. Liminality refers to the state of being betwixt and between, or being out of place due to, in this case, forced
displacement. The article observes that the Korwa are suffering from a loss of experiential health because they are taken away from their familiar lifestyles (the forest provides for them) to a new environment where they must work in wage labor. The Korwa feel that this is not healthy and therefore have mental distress in addition to higher rates of parasitic- and vector-borne diseases.

Resettlement projects have been highly unsuccessful and have continuously impoverished communities over the past 50 years. An important theoretical model for resettlement proposed by Cernea (2000) is the Impoverishment Risks and Reconstruction model, which seeks to identify risks associated with forced displacement and illuminate the processes necessary for the reconstruction of livelihoods. The model highlights the negative effects that populations may incur due to forced displacement such as: bringing about landlessness, joblessness, homelessness, marginalization, food insecurity, increased morbidity and mortality, community disarticulation, loss of access to public services, and loss of civil and human rights. Host populations, groups that will receive people migrating in from being displaced or to work on the dams, are also considered in this model.

Displacing populations without proper planning can lead to communities lacking access to clean water and basic sanitation facilities, such as in the case of the Nam Theun II hydroelectric project in central Laos (Erlanger, et al. 2008). Approximately three-fourths of the individuals examined for this survey of resettled communities were infected with an intestinal parasite while about 20% had at least two intestinal parasites. Malnutrition was a problem for one out of every six children in the community along with moderate levels of anemia. The resettled community might have serious mental
health risks from loss of land, community, resources and displacement. For the downstream community there are likely to be many changes in ecology that will affect the social structures and livelihoods of the population. Factors such as uncertainty, enforced reorganization of subsistence patterns, and loss of social coherence is associated with psychosocial stress. These stressors can be perpetuated by drug abuse, depression, and new residents migrating to the area, causing further tensions and conflict (Erlanger, et al. 2008).

Injury is another factor that is significant when discussing impacts on health. Workers may suffer from any number of work related injuries in the construction phase of dam implementation. For example, in one anecdotal case from the Belo Monte Dam, on May 30, 2015 there were three work related deaths. A large silo holding approximately 500 tons of cement fell off of a truck as workers were unloading it killing three and injuring another three workers (Harris 2015). This may have been an oversight in health and safety regulations or just an accident that can occur when working with these large construction materials, but this type of injury and fatality cannot be ignored in the health impacts of dams. Workers at the Belo Monte dam site did report that the working conditions to which they were subject to were atrocious and likened it to being in prison (Jagger 2013). There are many occupational risks that come with working in construction, but those risks are amplified when companies neglect employees and their working conditions.

**Communicable Disease**

The following section will focus on health impacts that are specific to tropical regions like the Amazon. The WHO Human Health and Dams report (2000) recognizes
that hot and humid tropical climates suffer from greater rates of communicable diseases which, when coupled with environmental changes and migration of populations occurring in relation to dam construction, can lead to devastating effects upon local communities. Communicable diseases are the most easily quantifiable impacts from hydroelectric dam projects. Dams create pools of standing water, which allows mosquitos to reproduce at rapid rates. This not only makes life intolerable— with biting intensity measured at 600 bites per hour on exposed humans for the Tucurui region of Brazil—but also increases the possibility that the mosquitos carry malaria or dengue (Fearnside 1999).

There are approximately 18.9 million people living near large dams in tropical areas worldwide who are at a higher risk of malaria (Yewhalaw, et al. 2013). In addition, mosquitos can migrate for up to 50 km (approximately 31 miles), or even farther with prevailing winds or river traversing boats, so the number of people affected by dam induced increases of malaria is likely to be much higher (World Health Organization 2000). A study conducted in the Narmada Valley, India shows the result of the Bargi Dam, a multi-purpose irrigation and hydroelectric dam, on rates of malaria. Prior to the construction of the dam in 1996 malaria epidemics were very rare with an overall prevalence of malaria at 19%. In 1997 these rates rose to 91% with the only obvious local change being the Bargi Dam (Singh, et al. 1999).

Another ecological effect of tropical dams is an overabundance of aquatic macrophytes, which are plants that live in or near water (a water lily, for example). The roots of these plants are breeding grounds for animal vectors associated with diseases such as schistosomiasis, malaria, cholera, gastroenteritis, enterovirosis, arbovirosis and filariasis (Erlanger, et al. 2008). Schistosomiasis has been a problem in many areas where
dams have been constructed —such as the Aswan Dam in Egypt. This is a parasitic flatworm found in snails that can bore through the skin of a person who wades or swims in water contaminated with infected snails. In the case of the Aswan Dam the incidence of infection with schistosomiasis rose from 21% to 75% and as high as 100% in some communities (Goldsmith and Hildyard 1986). Many of these areas are rural with very little access to health services. Leaving an infection like schistosomiasis untreated can not only damage organs and tissue, but also weaken the body leaving it vulnerable for other diseases.

Another likely facet contributing to the spread of communicable diseases is the creation of new jobs and the expansion of infrastructure, which produces a steady stream of migrant workers to the dam construction sites. Since the jobs created consist mainly of manual labor, the majority of the migrant workers are male. Sex work is a well-known consequence of this scenario, which increases the rates of sexually transmitted diseases such as HIV and hepatitis B (Erlanger, et al. 2008; Lerer and Scudder 1999). Returning to the example of the Lesotho Highlands Water Project or LHWP, Braun (2010, 2011) discusses the unequal burdens placed on women due to their exclusion from receiving development compensation. Given their poverty and the competition for work in an economy with few opportunities, some women were pushed into sex work. Not surprisingly, the LHWP work site ranked as the third highest in the prevalence of HIV/AIDS in a country that already has the third highest HIV/AIDS rate in the world (Braun and Dreiling 2010; Willemse 2007, Workman and Ureksoy 2017). In 2009, when the construction of the five major dams was complete, AIDS was reported as the leading cause of death in all hospital wards, with a total of 14,000 AIDS related deaths overall for
the year (Olowu 2014).

Overcrowding and less than favorable sanitary conditions are known factors for the spread of disease leading to major epidemics (WHO 2016). A study by La Rovere and Mendes (2000) showed a major problem with the Tucuruí Dam was the doubling of the population due to labor immigration. The lack of adequate provisions for housing led to the emergence of shantytowns (favelas) and the relocation of people to surrounding islands with little to no infrastructure. Access to schools, medical facilities, and public services necessary for families was limited. Infant mortality rates for the municipality were six times greater than the rest of the state once dam implementation had begun. Increases of malaria, diarrhea, respiratory problems, and even an outbreak of typhoid fever in 1981 were found to be among the most daunting health consequences.

Finally, a recent threat to public health, specifically in Brazil, is the emerging Zika virus. The Centers for Disease Control and Prevention cited in their January 2016 edition of Morbidity and Mortality Weekly Report (Hennessey et al. 2016) that between 440,000–1,300,000 cases of Zika were reported in Brazil in 2015. Zika virus is a vector borne disease that occurs from mosquito-to-human transmission, but has also been passed through sexual and blood transmission. *Aedes aegypti* is the mosquito that carries Zika virus as well as other endemic diseases such as dengue fever and chikungunya, which also have similar symptoms. Although 80% of those infected with Zika will be asymptomatic and those who are symptomatic will not result in fatality, there is a concern with how this virus infects pregnant woman. According to the Brazilian Health Ministry, there was an increase in children born with microcephaly in 2015, which causes an infant’s head to be much smaller than normal and results in stunted brain growth and
development (WHO 2016). The tissue of several infants born with microcephaly did contain some traces of Zika virus, but further studies must be conducted to give a clear causal relationship between Zika and microcephaly (Hennessey et al. 2016). Nonetheless, Zika, as any vector borne disease is likely to be on the rise with the increase in standing pools of water that are common around dam sites.

**Political Economy of Health**

All of these health issues that I have discussed in this section can be placed within a syndemic framework in order to show how they can be interlocked with each other and with societal and global factors such as economics and politics, resulting in mutually worsening health effects. It is important to note, however, that syndemics falls under a larger more widely used theoretical tradition called the political economy of health. This theory, which I will simply call political economy throughout the rest of the dissertation, seeks to uncover the underlying factors of poor health by examining macro-level structures such as policy impacts, the allocation of resources, or the effects of capitalism (Singer 1995).

The political economy approach was used as early as the 1840s in Friedrich Engels’s publication about the working class of England (Engels 1845). In his work he states that the poor health of the working class was due to the social organization of British capitalism which created poor living conditions, overcrowding, food insecurity, and a lack of access to physicians (Baer 1982). Farmer et al. (2004) builds on and refines this approach by using the concept of structural violence—a term originally used by Johan Galtung (1969) wherein individuals within a society are harmed by institutions
which block them from meeting basic needs. It is a system where elite sectors of society utilize classism, racism, sexism, ageism, and other forms of oppression to exert power over the marginalized, keeping them disenfranchised for the elite’s own gain.

Like political economy and its correlate structural violence, syndemic theory highlights the macro-level factors involved in causing poor health. But syndemic theory can advance these approaches even further by pointing out how ill-health factors intermingle to create extreme disease clustering within an already disadvantaged population. I wish to first examine some of the factors related to political economy and then later I will discuss how syndemic theory fits within political economy to create a holistic picture of health and health systems.

As an example of the political economy approach to health, The Guardian (2017) examined how the Zika virus has been spreading throughout Brazil, highlighting the inefficiencies in national infrastructure and the role politics. The report begins with the Brazilian government not meeting the basic sanitation needs of people, with more than half of the population lacking access to sewage collection and clean drinking water. Communities are faced with collecting clean water where they can find it and storing it in their houses. This practice, unfortunately, creates the perfect opportunity for mosquitoes to breed in stagnant water containers maintained in residential areas. The Guardian goes on to show how the recent corruption scandals in Brazil may have caused the former president, Dilma Rousseff (who in December of 2016 was impeached for breaking budget rules, causing the government accounts to appear in much better shape than they were at the time), to remove a public health doctor from his position in the ministry of health who may have had more insight into how to fight the communicable disease
outbreaks. Instead Rousseff put a psychiatrist in this position so that she could pass government bills in order to not face impeachment (Guardian 2017).

There are also political processes behind the ability of municipalities in Brazil to provide health services to their populations as shown by Mobarak, Rajkumar, and Cropper (2005). According to the authors, there are three types of decentralization for the allocation of health care funds that occur at the municipal level: full state management, basic assistance management, and full county system management. Under the full state management the state government has complete control of the health system and can determine the funds and types of provisions allotted to the municipalities. With the basic assistance management the municipality manages all primary health care, but leaves the more complex services to the state government. For the full county system management, complete control of primary care and complex services goes to the municipality.

In order for a municipality to apply for full county system management it must be deemed fit to handle the decentralized administrative role by a judge at the federal government level. If a municipality has full management of their healthcare (in 1999 about 8% had full management status while 80% were under basic assistance), then the transfers required for reimbursement are subject to an annual ceiling, which is decided upon through political negotiations with the federal government (Mobarak, et al. 2005). As a result of these systems, municipalities which are more politically favorable to the party in power, or that have closer political ties to the state, are more likely to be granted full county system management as well as have a more relaxed budget to use towards health care. The fact that the more rural and impoverished North has fewer and poorer public health services may be, in part, due to the lack of political interest that the higher
levels of government have for this region (Bliss 2010). When federal or state
governments provide subsidies for multimillion-dollar projects surrounded by
controversy and possibly even corruption, instead of dispersing more funds for healthcare
or infrastructure to the most impoverished areas, they are further widening the income
gap and creating even more poverty and suffering.

The Broader Political Economy

In the last decade there has been more research on the negative impacts of large
dams than in the last 50 years combined. Given the data on harmful effects, why, then, do
large dam projects continue to receive planning priority and receive copious funding? To
answer this question we must take a look at the larger factors at play. For example, in the
case of Brazil it is clear that factors such as growing national energy demands, the push
to become a successfully developed country in the global economy, and its global
spotlight as the host of both the 2014 FIFA World Cup Soccer games and the 2016
Summer Olympics drive many of the government’s decisions potentially including the
construction of hydroelectric dam projects. The rate at which Brazil is trying to
accomplish these goals does not seem to allow for slow and deliberate decisions about
what is best for all communities being impacted.

This type of mindset is not limited to Brazil as countries all over the world look to
dam construction as a means to increase energy production and gain a spot in the global
economy. Indeed, since the United States began construction on the many dams that
helped “conquer the Wild West,” large dams are seen as, “potent symbols of both
patriotic pride and the conquest of nature by human ingenuity” (McCully 2001: 24). The
notion of progress seems to envelop these dam projects whether it is progressing from developing to a developed nation, progressing into a more equal society by distributing water and resources, or progressing towards the future with dreams of clean renewable energy. The symbolism and rhetoric around dam projects have even been seen to take a religious tone as seen in the speech by the first Prime Minister of India when he spoke at the opening of the Bhakra Dam.

> Which place can be greater than this, this Bhakra-Nangral, where thousands and hundreds of thousands of men have worked, have shed their blood and sweat and laid down their lives as well? Where can be a greater and holier place than this, which we can regard as higher?

It seems that when a dam becomes shrouded in symbolism, the men that laid down their lives become less about poorly managed work environments and more about honor, pride and a testament to humanity’s conquest over nature.

In the case of the Maheshwar Dam in India, the fact that the government’s top priority was dedicated to proving that it could attract international investors greatly hindered the consideration of more beneficial alternatives. This leads to perhaps the most salient driver of development; the profitable nature of these projects. The World Commission on Dams (2000) estimates that $2 trillion have been spent on dam projects throughout the 20\(^{th}\) century. This money goes to dam building corporations who then use part of the funds to create a powerful pro-dam lobby to influence nations. Furthermore, when there are billions of dollars to be made with little to no transparency required, this easily lends to the familiar practice of corruption.

From China to Brazil to India, industries that profit from dam construction are oftentimes tied to governmental agencies (i.e. Department of Agriculture or Energy)
creating a common interest of profitability and an environment for bribery, kick-backs, and overall indifference to objection (McCully 2001). Aid agencies are also involved in this culture of corruption by the notion of “tied aid”—a practice that requires borrowers to only purchase equipment and other necessities for dam construction from the donor country. This was the case in the UK when, in 1993, the National Audit Office found that approximately £234 million in subsidized loans were being given to fund the Pergau Dam in Malaysia despite the conclusion that this project was unnecessary and going to cost the Malaysian people £100 million more in electricity charges. In addition, the two biggest construction companies in the UK were awarded contracts for the dam without any regard to competition from other outside construction companies. Both companies were also big contributors to the Conservative Party (McCully 2001).

It is clear to see that the lucrative nature of dam building takes precedence over the numerous negative impacts that have been outlined in this chapter. The global workings of market economies are a huge factor in a nation’s ability to make decisions that affect the most vulnerable in any society and as shown above, when the most vulnerable are ignored, poverty and disease reign. Dams allow the most powerful groups to encroach upon and lay claim to the previously communal land and resources of the most politically and economically weak groups of people in the name of progress. As McCully (2001:24) concluded, “The massive momentum provided by bureaucratic structures, careers, ideologies and profit has kept the big-dam machine rolling over the past six decades with few insiders questioning the damage done or evaluating whether the promised water, food, and prosperity for all have been realized.”
**Syndemic Theory**

Within the study of global health there has been an increased awareness that single diseases do not act alone or exist in a vacuum shut away from the outside environment (Singer and Clair 2003; Singer 1996; Singer, et al. 2012; Singer and Snipes 1992). This approach, however, runs counter to the models used in modern Western biomedicine, which works within a reductionist framework isolating each illness into separate pathogens with a distinct set of symptoms (Singer 2009). By contrast, the theory of syndemics posits that diseases interact with each other causing people with co-morbidities to suffer jointly and mutually aggravating effects. On a community and population health level this framework allows for a holistic view of all factors that influence health. It also challenges the practice of blaming poor health on individual behaviors.


Once a disease becomes endemic in a region with multiple existing health disparities, it takes little time before a cascading effect to occur which can lead to
multiple epidemics happening simultaneously. Multiple infections pose a unique threat to healthcare providers who must be aware of how certain pathogens interact with others in order to mitigate the effects of co-morbidity. A well-documented example of this is the Human Immunodeficiency Virus (HIV) and tuberculosis (TB). Exposure to TB in individuals is 800 times more likely to result in an active TB infection in those with HIV than those without this co-infection (Singer 2009). This is due to the fact that HIV blocks the immune system thus allowing TB to be more effective in infecting an individual. Tuberculosis may also activate T cells that are more likely to be susceptible to HIV infection. In addition, these two infections can accelerate the effects of each other causing the rapid deterioration of health in a population. Understanding how diseases interact with each other is crucial to those working in community health. This allows healthcare professionals to understand the course of disease transmission and identify those most at risk.

Malnutrition is another factor involved in many syndemic relationships. Much research has gone into the effects of poor nutrition on the immune system. Singer (2009) details three ways in which malnutrition can pose a threat to the health of individuals and leave them open to infection. First, insufficient protein intake can severely hinder the immune system’s ability to fight off infection as well as increase muscle weakness and impair cognitive functioning (Jeejeebhoy 2000). Second, nutrients called anti-oxidants are required to fight off oxidative stress. If these nutrients are absent, then oxidative stress can enhance viral replication, weaken cell repair activity, and contribute to an overall loss of immune function. Finally, micronutrient deficiency weakens the body’s ability to protect itself from infection by impairing epithelial cells, which produce a protective
barrier against pathogens. Deficiencies in vitamins A, D, E and zinc can also affect T-cell responses (Kau, et al. 2011). In these ways, once the balance of food security is tipped in a negative way and the local diet changes significantly there is certainty that detrimental health consequences that will emerge.

Another advantage of using a syndemic perspective is the ability to identify other factors that contribute to disease and illness in a broad social context. For example, syndemic theory has shown how factors such as poverty, structural violence, and the environment create and aggravate health disparities, thus contributing to a greater burden of disease for certain populations. Medical anthropologists and public health officials have embraced this framework for its ability to illuminate social and environmental factors that have a heavy impact on population health. With this knowledge, it is more likely that proper actions can be taken to really address the cause of certain epidemics.

**Case Studies: Syndemic Research**

One of the very first syndemic relationships examined in the literature is what is known as the SAVA (substance abuse, violence and AIDS) syndemic (Singer 2009). This cluster of risk factors has a profound effect on many different populations from Hispanic women, MSM (men who have sex with men), to drug users. Once a single disease is detected in an individual, a working knowledge of syndemic theory can provide a warning that other factors may be working on this individual to increase the suffering and burden of disease. For example, in a study conducted by El-Bassel et al. (2011) a random sample of 416 women who were in methadone treatment programs was surveyed about the life experiences. Eighty-eight percent of the women in the program had self-reported
personal experiences with physical or sexual abuse in their lifetimes. These women were also more likely to report no or inconsistent condom use and were less likely to request partners to use condoms. When physical violence leads to fear of requesting condom use from partners, the risk of becoming infected with HIV increases. Stress stemming from intimate partner violence has been shown to trigger relapse in drug using women and it is well noted that intravenous drug use is also a risk factor for HIV (El-Bassel, et al. 2011). Stress has been shown to weaken the immune system and increase the likelihood of multiple infections and dismal health outcomes (Singer and Clair 2003; Singer 1996, 2009). Drug use also interacts directly with AIDS to worsen both conditions (Singer 2009).

To add to this complicated condition, Himmelgreen et al. (1998) show in a study of 41 drug-using Hispanic women and a control group of 41 non-drug using Hispanic women that the drug users are more likely to be food insecure and live in extreme poverty than the control group. Limited access to food, general disinterest in eating, and a focus on drug needs rather than food preparation all contribute to the increased levels of malnutrition among these drug-using women. Accounting for malnutrition and poverty in the SAVA syndemic formation further complicates the burden and susceptibility of disease within this population.

One of the most critical lessons learned from syndemics research is the necessity to understand the complicated ways in which the socio-cultural environment impacts human biology and individual decision-making regarding one’s health and well-being. If public health programs only take a biomedical approach to HIV and treat all cases the same, as a disease isolated from the social context, they frequently end up with
unsuccessful interventions. It is also important to understand the specific cultural context in which communities live in order to determine risk factors for disease.

Paul Farmer is a medical anthropologist and physician whose work exemplifies how society, culture, and history are factors that affect the most vulnerable populations. Through his ethnographic studies, Farmer also shows the importance of understanding health and illness within a cultural context and not through a global or Western lens. One such example comes from Farmer’s work in a rural village in Haiti. In 1956 Haiti’s largest hydroelectric dam was built on the Riviére Artibonite which promptly flooded out the peasants living on the banks of the river. Many fled to the nearby hilltops, receiving little to no compensation for the land they left behind. Due to this sudden major upheaval and the fact that everything had to be left behind, the residents of the newly created community of DoKay reported feeling dazed and unable to act decisively (Farmer 2006). Community members lost their crops and their ability to feed their children. Without a single economic option in sight to make up for this loss, poverty and high levels of depression began to affect the population. In addition, the community did not have access to proper sanitation and clean water, thereby incurring high rates of typhoid fever as well as high infant mortality rates stemming from diarrheal disease. As mentioned previously, persistent malnutrition and food insecurity worked to aggravate these diseases by suppressing the immune system. When the river was dammed and the community displaced this set off a ripple effect of impacts ultimately resulting in widespread poverty. Weakened immune systems, poor sanitation, and no viable economic options set the stage for the HIV and TB syndemic to hit this community very hard.
Since the majority of HIV cases that came through the clinic in Do Kay were women, Farmer (2001) conducted a small study of 50 women to distinguish specific risk factors for HIV for this population. Twenty-five of these women had symptomatic HIV infections while the other twenty-five formed the control group of seronegative women. The most striking result showed that risk factors for women in Do Kay were not linked to prostitution, high numbers of partners, illicit drug use, or blood transfusions. Instead, the HIV positive women were all similar in the fact that they had lived in Port-au-Prince, worked as a servant, and had sexual partners who were transient and more likely to be at a higher risk for HIV.

The women’s scenarios were similar: they had tried to escape their economic situations by leaving Do Kay to work as servants in Port-au-Prince, where the likelihood of contracting HIV is much higher. They were also more likely to form relationships with men who were soldiers, truck drivers, or construction workers. Men in these professions had daily salaries and were seen as more economically secure. However, the men in these professions moved back and forth from rural areas to the city and often had multiple sexual partners, thus increasing their risk of HIV. It is clear to see from this ethnographic study that the risk factors of HIV in Do Kay are particular to the community’s culture and history. They are not the same risk factors found in urban areas of Haiti or in the United States, places where most of the public health publications and programs are created for HIV/AIDS prevention.

Workman and Ureksoy (2017) have, more recently, used syndemic theory to examine the role of water insecurity in a previously explored syndemic relationship between food insecurity, HIV/AIDS, anxiety, and depression. Approximately 514,000
Basotho, citizens of Lesotho, require humanitarian assistance due to the decades-long drought causing major disruption in the food supply. The lack of opportunity for farming has thrown the country into poverty with a 45% unemployment rate. This, in turn, increases the anxiety and depression felt throughout the country as it suffers through environmental, economic, and social stresses.

Workman and Ureksoy sought to include water insecurity as a prominent stressor in the everyday lives of the Basotho. They found that while quantity of water is important, it was the quality of the water and their perception of its cleanliness that caused the most stress and anxiety within the sampled population. Increased stress and anxiety within the community has an increased and additive effect on depression. HIV/AIDS also increases stress and anxiety due to a family member’s death or having to take in an orphan whose parents died from AIDS. Losing a family member and taking in an orphan also led to increased food insecurity. Studies like this are crucial in obtaining a more complete understanding of syndemic dynamics as the health and well-being of populations are constantly being impacted by ever-changing factors surrounding them.

**Critique of Syndemic Theory**

Despite the strengths of syndemic theory, it is still a relatively new theory in medical anthropology and public health and has not been fully tested in a wide variety of settings. The theory’s novelty and its lack of critical scholarship pointing out gaps and flaws is, in and of itself, a weakness. As work in syndemics continues to gain momentum and more and more syndemic relationships are postulated, it will be important to verify they met the definition established by Singer and are actually syndemic relationships. For
example, in order for a group of afflictions to be considered syndemic they must be occurring as simultaneous epidemics within a population, they must be acting upon each other in a negative way to increase the burden of disease, and they must include biological agents of disease as well as social determinants. Singer offered this critique about his theory, “[One problem] stems from the challenge of differentiating two or more components of a single disease from two or more interacting diseases” (2009, 30). This is a note of caution that a researcher must be able to show that the health conditions in a population meet all of the criteria of a syndemic, which may be difficult to prove at times given the complexity of these interactions. Tsai and Burns (2015) make the same critique from a quantitative perspective. The article describes the difficulty in obtaining a quantifiable result that is statistically significant enough to prove that the interaction of certain diseases are indeed additive and mutually enhance poor health.

One safeguard against misidentifying syndemic relationships is to discuss potential co-interactions within a broader framework of political economy of health. In this way if the studied relationships turn out to not be syndemic, the broader theory still allows detailed analysis of complex health conditions. The research results should enable a better understanding of problems a population faces and allow better intervention strategies.

It is also important to separate syndemics from globalization. Although both are frameworks used to describe the effects and interconnectedness of social, political, environmental and economic systems, syndemic theory focuses much more heavily on the social injustices that tend to come with globalized societies and how they interact to double the burden of disease on populations.

elite of Brazil largely accepted this viewpoint as well. All saw the people of the Amazon (both indigenous and peasant) as poor, ignorant, and backward. They were unable to cope with the environment and make it productive, and thereby were a barrier to development (Nugent 1993). Economic expansion through development projects directed by outside groups became the solution to the problem (Robock 1963). These projects, however, continued the past patterns of predatory extraction. Timber, palm-hearts, and minerals were extracted with little concern for the impact on ecosystems or the local people’s lives. Development was measured in gross profits with little regard to distribution of resources or rising poverty levels (Barbosa 2000).

In the 1980s, however, there was a paradigm shift among social scientists and environmentalists to view the ‘traditional’ life of the rural peoples of the Amazon as a sustainable adaptation that leads to rain forest conservation. Discussions arose of “primitive ecological knowledge” that must be preserved for the well-being of the tropical ecosystem (Milton 2013; Bodley 1996; Posey 1983). Indigenous and traditional peoples (e.g. peasants) were labeled ‘guardians of the rain forest’ and all of its resources (Hall 1997, Barbosa 2000). These pro-environment messages are now part of the mind-set of many if not most Amazon peoples. When asked, most will respond with unease to the notion of deforestation. Yet, as a paradox, developmentalist discourses are also widespread and are still a strong force guiding policy in the region.

The simultaneous acceptance of conflicting discourses on pro-development and pro-environment is exactly what is going on in areas being impacted by the Belo
Monte Dam. For example, in the municipality of Gurupá, just downstream from the proposed Belo Monte dam project, the paradox of pro-development and pro-environment sentiments was captured in a survey conducted between 2007-2009 by Richard Pace and Brian Hinote (2013) concerning people’s attitudes toward the Belo Monte Dam, still in its planning stages. When asked, 63.4 percent of respondents said they were in favor of the Belo Monte Dam, citing the anticipated economic and development benefits. However, when asked about environmental issues of deforestation and if conserving the biodiversity of the rainforest is of great value, the majority of respondents agreed to this as well. In fact, 99 percent of the respondents replied positively to the question, “Should the rain forest be conserved to ensure future biodiversity?” What many in the survey were missing was the connection between the construction of the Belo Monte Dam and the wide-spread environmental destruction this would cause.

The connection between dam construction and public health is even more obscure in the minds of many in Gurupá. In part, this is understandable since even with a thorough review of information released in official government documents, NGO reports, or coverage by the media, a person will find little discussion of potential health problems, particularly for downstream communities like Gurupá. Elsewhere in the world there is an abundance of literature assessing health implications of dam projects, but this information is not readily available to the communities that need it now. For this reason it will be integral for this project to take the health factors associated with the creation of large hydroelectric dams and relate them to the daily life and health structure of Gurupá. In order to do this,
however, one must have a clear understanding of how things work in Gurupá. The following sections will provide historical and cultural background on Gurupá, which will provide cultural context to understand the health care system and the changes it is undergoing.

**Getting to Gurupá – Some Personal Notes on Entrance into the Field**

I remember clearly my arrival by boat in January of 2015 as I began my dissertation research. The first quarter moon hung above the distant city lights of Gurupá as we rounded the last delta island. As the boat got closer to the landmass illuminated by streetlights, the captain slowed the engines. From the deck I could see the letters of the hand painted sign above the dock growing larger. My travel companion/research assistant and soon to be fiancé—Cesar Cisneros—and I stood eagerly at the front of the boat, him in Brazil for only the second time and myself feeling like a seasoned veteran having traveled to Brazil multiple times. It was after midnight when the boatmen threw the big braided rope over a tree-sized pole sunk deep into the bottom of the river in the port of Gurupá. Once securely tied up, we disembarked, uneasily guiding our oversized luggage down an aluminum ramp to shore, barely wide enough to walk comfortably.
The walk from the dock to our pre-arranged accommodations was roughly a quarter-mile over cobbled and aged roads. The graffiti I spotted on the side of buildings and walls was striking to me, as it was something new, although the stray dogs wandering the town were not. Even though this was one of several times that I had been in Gurupá,
arriving in the middle of the night makes for a sleepy and disorienting reentry. The walk seemed longer than expected. In each hand I carried a fully packed suitcase that weighed what I would later learn to be the same as a bushel of açai seeds—that is roughly between 15 and 22 kilograms.

I still felt the same exhilaration upon arriving as I did the first time in 2005, and actually every time since. Some twelve years ago I stepped off of the same boat onto the same road and up to the same house where I would live. This time, however, my trip was not limited to a summer. I would spend the next year working and living among people that have become lifelong friends. As daunting a task as it was to spend such a long time away from my family and friends, excepting Cesar, the warm welcome I received as I entered my research home calmed my nerves. It was as if I had just seen them yesterday and we picked right back up as if no time had passed at all. It is easy to feel this level of comfort with the people of Gurupá, whether you have known them for years or just met them. The openness and hospitality of the community to researchers and my family in particular are some of the attributes that make this town unique.

The municipality of Gurupá, with its estimated population of 30,727 (IBGE 2010), is located at the confluence of the Xingu and Amazon Rivers (see figure 3.3 below). The population is largely ribeirinho—literally meaning riverbank peoples. They are subsistence farmers (manioc being the staple), extractors of forest commodities (rubber, timber, oleaginous seeds, açai, Brazil nuts), and subsistence fishers who are often referred to as “agro-extractivists,” or by the pejorative term “caboclo” (Harris 1998; R. Pace 1998; Wagley 1953). In the beginning of the 2010s nearly 70 percent of the population
lived in the countryside and approximately 30 percent in town (IBGE 2010). As will be
discussed later, this pattern is changing rapidly.

![Map of Gurupá, Pará](image)

**Figure 3.3 Map of Gurupá, Pará**

Gurupá is a poor place by Brazilian standards. The state of Pará, where it is located,
has an overall rural poverty rate of 58.4 percent, with 44 percent living in extreme
poverty (Pace and Hinote 2013). The municipality of Gurupá does not have many natural
resources or infrastructure with which to generate great amounts of economic wealth. For
the rural dwellers the main economic activity is agro-extractivism. In terms of farming,
the staple crop is manioc produced in small slash-and-burn plots (*roças*). Manioc is
consumed as *farinha* (toasted manioc flour), *beiju* (manioc “bread”), *mingau* (manioc
porridge), and tapioca (prepared as a spongy bread). Rice, beans, corn, squash, and a number of fruit trees compliment manioc production. In terms of extraction, the main resources are timber, açaí, and heart of palm. Within recent years, açaí production has greatly increased, stimulated by growing regional, national, and global interest in the fruit. Gurupá is now experiencing a modest economic boom due to the fruit export. Subsistence and commercial fishing and shrimping are also an option, but in Gurupá not much money is made from this.

In town the largest employer is the municipal government. Occupations include civil servants, health and education professionals, health care and educational assistants, as well as transportation and custodial services. In the private sector most jobs are in sales in small-scale retail stores, service jobs in restaurant/bars, and innumerable part-time or temporary jobs involving manual labor. There are a few businesses specializing in furniture production and mechanical repair, but they are all small-scale enterprises.

In the social science literature much has been written about the municipality of Gurupá. Charles Wagley, for example, wrote his classic ethnography, *Amazon Town*, about the community following research in the 1940s. Amazon Town has become the base-line reference for nearly all studies focusing on the traditional rural populations of the Amazon and is still widely cited today. Following in Wagley’s footsteps and continuing the tradition of research in Gurupá are his students Eduardo Galvão (*Santos e Visagens – Saints and Spirits*), Arlene Kelly (*Family, Church and Crown: A Social and Demographic History of the Lower Xingu Valley and the Municipality of Gurupá, 1623-1889* in 1984) and Richard Pace (*The Struggle for Amazon Town: Gurupá Revisited* in 1998, *Amazon Town TV* in 2013, and an updated version of Wagley’s *Amazon Town* in
2014). These and additional researchers who spent substantial time in the community and produced significant publications are found in Table 1. Collectively, these works provide valuable longitudinal data to contextualize recent changes in the region.

Table 1. Gurupá Researchers and Principal Works. Source: Hendrickson, Pace, Miller, and Hurst-Dodd 2013.

<table>
<thead>
<tr>
<th>Year</th>
<th>Author</th>
<th>Title</th>
<th>Edition/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1953</td>
<td>Charles Wagely</td>
<td><em>Amazon Town</em></td>
<td>New York: Macmillan.</td>
</tr>
<tr>
<td>1955</td>
<td>Eduardo Galvão</td>
<td><em>Santos e Visagens</em></td>
<td>São Paulo, Companhia Editôra Nacional.</td>
</tr>
<tr>
<td>1997-02</td>
<td>FASE.</td>
<td><em>Boletim Projecto FASE Gurupá</em>. Belém: FASE.</td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Author(s)</td>
<td>Title and Details</td>
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A Brief History of Gurupá

In the early 1600s Dutch traders were among the first Europeans to document their arrival in Gurupá. At the time they encountered numerous Indigenous groups in the Xingu and Lower Amazon region with whom they traded through a series of trading posts. In 1609 the Dutch constructed a fort in Gurupá named Mariocaí, the native Tupí word for the area and population living there at the time (Wagley 2014, Kelly 1986). Groups of Irish and English settlers also founded settlements in the region, trying to establish tobacco plantations (Kelly 1986). All groups remained in the area until the Portuguese, who claimed the area, decided to dispel the foreigners. Through a series of military engagements, the Dutch lost their fort at Mariocaí and they, along with the English and Irish colonists were killed, imprisoned, or fled (Kelly 1986). In 1623 the Portuguese rebuilt the fort and named it Saint Anthony of Gurupá. There were several additional military conflicts with the English, Dutch and a group of 22 Irish families who moved to the area in 1621, and later the French, but the Portuguese remained in control and persevered (Kelly 1986).

The Portuguese, unlike the Dutch, were not in the Amazon to set up trading posts. Instead they set out to colonize the region and claim the indigenous peoples for the Catholic Church and the Portuguese crown. The Portuguese enslaved the indigenous populations, who were used for labor in transportation (paddling canoes) and to collect forest resources to export back to Europe. Gurupá’s fort became the staging grounds for brutal slaving raids throughout the region. The Church, most notably the Jesuits, accompanied the raids and always claimed a portion of the captives for their missions. Slaves forced into labor for the colonists died in large numbers, so the majority of the
surviving indigenous populations were found in the missions. This became a point of contention between colonists wanting more slave labor and the mission system, which developed a near monopoly on indigenous labor for transportation and collection of forest goods (Kelly 1986).

By 1639 the population of Gurupá had grown large enough to be classified as a town (Kelly 1986). Its success can be attributed to the favorable position of the fort upon a bluff making it advantageous for the Portuguese soldiers to keep an eye on who was coming and going along the river (Wagley 2014). Boats passing by were required to stop and pay taxes at Gurupá, making it a well-known stopping point along the Amazon River.

In 1757 the Jesuits were expelled from Brazil and their mission system secularized. During this period, known as the Directorate (1754-1799), the Portuguese state sought to increase the economic output of the Amazonian colonies to make up for the Portuguese loss of Asian lands to the Dutch (Kelly 1986). The new law gave equal rights to indigenous people, although far from a humanitarian policy; the real reason was to allow the Portuguese to force the population into the labor force for state projects. Eliminating the protections previously set forth for the indigenous groups through the mission system was detrimental to the surviving Native American cultures. By disbanding the indigenous groups and putting them into small, supposedly more efficient European-style family units, the Portuguese colonies deprived them of their social capital and ability to pool resources to aid one another (R. Pace 1998). The Directorate, however, was largely ineffective in increasing any economic profit from the colonies and was finally abandoned in 1799, leaving in its wake a newly created impoverished class of formerly

After the Directorate, Gurupá suffered a deep economic depression triggered by over-extraction of forest resources, loss of labor (due to the decimation of the Native Americans), and a decline in the international market for tropical products (R. Pace 1998). Unrest was brewing from the rural underclass as they continued being exploited by an evolving debt-peonage system, eventually known as aviamento. Unrest culminated in the Cabanagem Revolt between 1822 and 1836. The rebellion was by cabanos, a newly emerging peasantry in the Amazon, against the Brazilian Imperial Government. The revolt was one of the bloodiest uprisings of all Brazilian history (Anderson 1985; R. Pace 1998; Cleary 1998; Simmons et al. 2007; Harris 2010). Fifteen to twenty percent of the population was lost during this time as the Portuguese reasserted control over the region (Kelly 1986).

In 1839, following the Cabanagem, a new law went into effect forcing men who did not own land or were unemployed to serve in state sponsored projects—called the Workers’ Corps. Gurupá became one of the nine military posts that were centers for the Workers’ Corps (Kelly 1984). Military commanders abused workers in the corps by forcing them to work on private pursuits for their own personal benefit, eventually resembling a type of pseudo-slavery (R. Pace 1998).

By 1842 the town of Gurupá had two streets and two town squares for its residents to gather. The areas of town were divided into a city (cidade) where the Europeans lived closest to the river, and the village (aldeia), where the remnants of indigenous peoples and mixed residents lived. These times were difficult for Gurupá as
money and resources were almost non-existent. Boats no longer stopped in Gurupá, having found an alternate route to the North, which bypassed the town. The fort was abandoned and the town was in shambles (Wagley 2014, Kelly 1986). A new system had come into play during this time, built from the lack of currency and resources available. This system, called aviamamento, consisted of a chain of debt, from the lowly agro-extractivist, through the landowner or trading post merchant, called the patrão (boss), and upwards through various levels until it reached the international financial institutions of Europe (R. Pace 1998).

The system operated as a classical “siphon economy” where raw materials and wealth left the region, keeping the local population in a constant state of poverty and vulnerability (Ciccatell 1999; Pace 1998; Wagley 1953). Although the aviamamento system allowed traders to maintain economic ties to the local inhabitants, or ribeirinhos, who could then purchase goods and medicine, the system produced perpetual indebtedness, or debt-peonage. In many ways aviamento was more akin to slavery than a market system. Prices were frequently manipulated since the traders held a monopoly on imported goods (R. Pace 1998). Without much to offer the outside world, the Amazon remained a poverty stricken region.

However, opportunity and prosperity were just around the corner for Gurupá, sparked by foreign interest in the region’s wild rubber. From the 1870s-1910s Gurupá and the Amazon region enjoyed a surge in export known as the rubber boom. The population in Gurupá is thought to have doubled at this point with 20 general stores opening, a weekly newspaper being circulated, and goods and imports coming in constant flows to the city. There were even extravagant balls with live orchestras held in the mansions of the rubber
barons (Wagley 2014). The city had gotten the economic boost it so desperately needed to build up and grow. In 1912 plans to build the town hall were drawn up and an Italian engineer was brought in to supervise the project. It was to be the grand two-story center of pride in the town. Unfortunately, before the building was completed the rubber bust hit. The building was not completed for many decades.

As high as the lavish lifestyle was during the rubber boom, it was just as low for the bust. After the British took seeds from rubber trees out of Brazil and modified the trees though grafting to produce more latex, the seedlings were transplanted to Malaysia to establish plantations. The mass production of easily accessible trees, plus the cheap labor of Malaysia, led to a decline in the world price of rubber. Rubber production was no longer as profitable in the Amazon since the creation of plantations was largely impossible due to the particularities of the ecosystem (Robuck 1963). This devastated the regional economy, leaving it to contend with five decades of economic depression.

Gurupá was now a site where pessimism, isolation, and poverty were endemic. Agricultural production was minimal, there was little revenue from extraction, and health care was at its lowest point due to the paucity of riverboats stopping in town with food and medical supplies (Wagley 2014). Life was difficult and the poverty of the era would have a profound and lasting impact on the health of the future generations of Gurupá. By 1920 the population of Gurupá had decreased to just 300 inhabitants and communication with the outside world was nearly nonexistent (Wagley 2014).

The remaining population of Gurupá, although ravaged by nutritional decline, out migration of the men to find work, and the decimating impact of disease (e.g. malaria, dysentery, small pox, typhoid), carried on into the next couple of decades until
circumstances created by World War II ironically brought good fortune to the town. In 1942 as the Malaysian rubber fields were taken over by the Japanese, the allied forces turned to the Amazon for rubber. Brazil and the United States signed the Washington Accords and new programs were established to increase rubber production (Wagley 2014).

It was under the Washington Accords program that Charles Wagley first came to Gurupá in 1942. He was part of the public health initiative to combat poor health of the rubber tappers, particularly high incidences of malaria (Wagley 2014). Wagley worked with the newly formed *Serviço Especial de Saúde Pública* (Special Service for Public Health), or SESP. He was sent to Gurupá during this time to set up health posts and increase access to medical care. Wagley and his teams also implemented aggressive prevention measures to reduce the breeding grounds of mosquitoes to reduce vector-borne diseases (Wagley 2014). Many people of Gurupá today look back on this time as a period when the community was strengthened and given an opportunity to get back on its feet. In fact, many of the mosquito-control practices and the strong emphasis on community-centered healthcare continue in present day Gurupá (Chapter 5 will provide an in-depth analysis on the history of public health in the Amazon and Gurupá).

Once the war was over the United States withdrew funding and the municipality slipped back into economic depression. The town continued without industry, which meant few jobs and little hope for growth (R. Pace 1998). Education was substandard. The illiteracy rate in the town was at about 40 percent, while a very high 80 percent in the rural areas (R. Pace 1998). There were about seven one-room primary schools with limited supplies for a municipality of 7,000 people at the time. Although conditions in the
schools were challenging and teachers very often taught without receiving payment for months at a time, many people in Gurupá identify the addition of the schools as a huge improvement allowing their children to receive at least the basics of education (R. Pace 1998).

The 1970s brought about more turmoil in the history of Gurupá (see R. Pace 1998). Under the military dictatorship (1964-1985), the state embarked upon a major push to develop the Amazon’s resources to fuel the industrialization of the South and, by the 1980s, pay mounting international debt. Conflict over land ownership increased as large companies, often subsidized by the state, sought to extract timber and heart of palm from the region. Due to a lack of land demarcation, poor administrative records, and the historical practice of communal land ownership, most people in Gurupá never had land titles. As the large business interests began appropriating land, legally, and more often than not, illegally, resistance grew from displaced farmers. With the guidance of the Catholic Church, following the tenets of Liberation Theology, the local priest worked with the rural workers union to protest land expropriation. Paralleling the strategies of other social movements in the Amazon (e.g., the rubber tappers of Acre under the leadership of Chico Mendes – Allegretti 2008), the Church-Rural Union coalition used Brazilian land law (*posse* or homestead rights) to claim public land with no legal title. The technique proved successful. Interviews with the participants of this campaign by R. Pace (1998) reveal that the successes of this movement in gaining land titles led to a powerful sense of empowerment and social cohesion as well as providing newly founded community-wide organization through the rural union local groupings and especially the ecclesiastical base communities (*comunidades eclesiastical de base*) or CEBs of the
Catholic Church. Both of these organizations later became important bases for health care initiatives, which is described in Chapter Five.

**Quotidian Life in Gurupá Today**

By the 2000s, life in Gurupá had changed considerably from its history of isolation and oppression. Today there is greatly increased mobility within and beyond the municipality by motorized boat, increased connections to the outside world from access to Western medicine in the hospital to even the Internet, and greater freedom for previous forced labor/debt peonage relations. To get a feel for daily life today in Gurupá, and to provide cultural context to the changes occurring within the public health system, what follows is a description of quotidian life in the community.

A typical day in Gurupá has many variations depending on the time of year and the commitments individuals may have to work, family, and friends. Yet, the cadence of the day is generally the same. The morning starts just after sunrise for your average Gurupaense. Living just two degrees south of the equator, sunrise and sunset vary little throughout the year. In both the town and the countryside it is still common to wake to the sound of roosters crowing, sometimes long before sunrise. In town, just before sunrise there is the sound of motorbikes rushing a few earlier risers to their jobs. Intermingled with the noise of motors are the cries of bread vendors walking the streets and offering their goods. By eight o’clock the streets start to fill up with people walking (or riding motorcycles) to work. Without fail, by nine o’clock there will have been at least one car passing by blasting announcements through giant subwoofers extruding from the trunk of the car. The cars bring news of the day's activities, meetings, local advertisement, and also announcements such as birthdays.
Places to eat breakfast in town keep strict hours if you need your morning coffee and tapioca (basic breakfast meal). All service is between 6:00 and 8:30 am, and if you happen to wonder in at 9:00 am you will be turned away. However, if one knows how things work in Gurupá, you can time visits to friends knowing that the encounter will not be complete until cafezinho (expresso coffee) or suco (fruit juice) is offered.

After a full morning of work Gurupaenses usually head home around 11:30 or noon to have their lunch. Midday is the hottest time of the day with the sun directly overhead. It is not safe to be out in direct sunlight and the heat reflected off all the concrete and asphalt, which can cause serious problems of overheating. People stay indoors or in the shade from noon to about 4:00 pm. Many shops will close for the afternoon as well. The ability to ride around in the midday sun on a fast moving motorcycle, however, has made this behavior less mandatory. Getting from one side of town to the other can take only a minute or two on a motorcycle instead of 15-20 minutes needed to walk.

After resting indoors and napping after lunch, the community members head back out around 4:00 pm and work until 7:00 pm. The streets fill up first with motorcycles, then with pedestrians. A complicated pattern of navigation ensues as pedestrians and motorcycles compete for space on the streets due to the paucity of sidewalks in town. As per Brazilian law, pedestrians yield to all motorized traffic. There are sections of streets still dominated by pedestrians, and kids still play in the streets (soccer, dodge ball, even an interesting version of cricket), but these spaces are now confined to less traversed streets, many of which are located in the back part of town away from the river.
Figure 3.4 One of the main praças where the town gathers on weekends. Source: Author

Figure 3.5 Teenagers play pick-up soccer game after lunch. Source: Author
The evenings are much cooler for people to be outside and socialize. There are two plazas where people can meet for a beer, to watch TV in public or, depending on the time of year, practice for the local dance competitions. Weekends are reserved for various church services and the promenade, or tradition of walking up and down First Street (cruising on foot along the street closest to the river) between the Catholic Church and the plazas. Although there are motorcycles milling in and out on First Street, it is common knowledge that pedestrians own the street on weekend evenings.

Walking around town, except in midday, you can witness a wealth of activity. There are children playing in the streets or walking home from school dressed in their uniforms (classes are held in morning, afternoon, and then evening sessions so children are coming and going throughout the day). Most elementary school students will attend school in the morning or afternoon while the older high school students attend in the evening.
Passing by the houses and glancing through open windows and doorways, one can see people hand washing and hanging out their laundry to dry. Some people own their own washing machine, but everyone uses the tropical sun to dry their clothes. Shop owners are either busy attending to clients or bored sitting behind desks and playing with their phones. Cell phone reception is limited in the town with only one mobile company, TIM, having mediocre service. Every now and then cell reception will just stop working for days or even a week. When this occurs most cell phones become substitute cameras, iPods, or Gameboys. The younger generations pass music and videos along to each other using Bluetooth and have successfully built up this system of connectivity despite the lack of service.

The town is set up in a grid system, as has been described in the literature since Walgey’s *Amazon Town*. There have been some important expansions as the town has grown from a population of 3000 in the 1980s, to 10,000 in the 2010s, and now, by some local estimates, approaching 20,000. Yet, the streets still run numerically from the river. First Street is closest to the river with Second Street coming next all the way to the farthest regions—about 10 streets altogether. The side streets are known as *travessas*, but not many people know the actual names given to the streets.
There are several neighborhoods that have arisen over the last 10 years – Xingu, Fortaleza, and Horto being the largest. The Xingu neighborhood is the oldest of these and is located to the west of the Gurupá on the outskirts of the town. Although people have lived here for a decade, there are still houses being built, often in any space available. To navigate through this area there are systems of wooden platforms that connect the houses and are raised above the standing water below. Since parts of the Xingu neighborhood are a 15 to 20 minute walk from the town center small shops selling essential items and foods are spread throughout. There are also soccer fields where neighborhood families can engage in friendly tournaments.

Fortaleza and Horto are younger neighborhoods than the Xingu. The Fortaleza area (located just below Gurupá’s fort, hence the name) is built up more commercially than the other neighborhoods. They have markets to buy fish and fresh produce, a place to sell timber extracted from the forest, and even their own dock.
Figure 3.8 (top) and Figure 3.9 (bottom) Second Street is mostly commercial. Source: Author

Figure 3.10 Walking down the street in Xingu. Source: Author
Horto on the other hand is the newest and fastest growing neighborhood. It is located straight back from the river behind the historic Jewish Cemetery. Horto is the least developed with myriad of houses backed up against one another. Most of the houses have an outhouse located very close to the house (approximately 20 feet) that empties into the standing water below.

Figure 3.11 Standing water in Horto. Source: Author

Streetlights are not common in these areas making night travel more dangerous. Rafael, a man in his 30s who has worked for the rural workers union for some time, told me that families living in the interior who want a place to stay in town during festival time build these houses. He mentioned that most of the time they seemed to be unoccupied, especially since the new municipal government has taken away the free rides in their trucks into town from the countryside because of budget cuts. Yet, taking a quick tour through the area shows that there are, in fact, many families living in the neighborhood. People living here are generally more impoverished and their houses have
poor sanitation. A conversation with one of the local nurses revealed that it is from this neighborhood that most of the cases of childhood diarrhea arise. These are also the sites where the houses are built above standing water and have the most issues with mosquitoes. There is a clear class divide the farther one ventures away from the river or the farther one builds into a swampy area. There are also few stores and no markets for consumer items. In fact, besides the impromptu soccer field by the airport, there are no commercial or public commons, nor signs of community cohesion like the other neighborhoods.

For the older, established areas of Gurupá, a sense of community is most prominent in the day-to-day. Starting with the morning announcements there is always something going on for the community to celebrate or commemorate. I have sat while eating breakfast many mornings when the announcement car would drive by with the times for the local soccer matches or church festivals. The soccer games, in particular, were part of the local entertainment and sparked friendly rivalries. Attending these big community events and being able to join in on the joking that happened the next morning over breakfast made it possible to feel like a part of the community.

I was also able to participate in community life by offering tangible services. Using Cesar’s considerable photography/videography skills, we began to record events for people in Gurupá. This, in turn led to invitations to weddings, religious ceremonies, and even being asked to make a short film for real estate purposes. We used USB drives to pass along the footage for free and became known as the unofficial documentarians of the town. People whom we had never met or even seen around town approached us and promptly pointed out which of their friends and family members needed their picture
taken at the moment. Watching the people’s faces light up as they viewed the images made it all worthwhile.

Enjoying celebrations and special occasions like Carnival or saint’s festivals are another way in which the community unites. Each neighborhood block is responsible for a team to enter a dance competition or a parade or a specific task for the Church. Again, friendly competition and fun drives these community activities and gives Gurupaenses something to look forward to and practice for every month of the year.

The festival of the most beloved saint of Gurupá, Saint Benedict, is such an important event that most people celebrate it first and then Christmas, which occurs at the same time, as a secondary celebration if they celebrate it at all. Families from the interior and those that have moved away to bigger cities will flock back to Gurupá in droves to be able to participate in the festivities. Masses held at the Catholic Church are filled to the brim with parishioners who come together to pray. The much loved Bishop Erwin Krautler who was in charge of the entire Xingu region until his retirement in 2016 makes a special trip to Gurupá every year for the São Benedito celebration. The Bishop will also travel every other year to celebrate confirmations in Gurupá. About 70 percent of the town is Catholic with Protestants such as Evangelicals, Jehovah Witnesses, and Pentecostals making up the remaining 30 percent. However, since religion has been so tied to the culture of Gurupá, you will find most community members, Catholic or not, out at saint festivals enjoying time with friends and families.
CHAPTER FOUR: 
METHODS AND DATA COLLECTION 

The Brazilian Case: Site Justification 

Brazil is considered a middle-income country and is in the process of an accelerated transition in demographics (rapid urbanization over the last six decades) and nutrition and epidemiologic profiles, while continuing to face overwhelming social and economic inequalities (Aquino, et al. 2012; Victora, et al. 2011). Brazil struggles with incredibly high rates of income inequality. Beginning in the 1980s, for example, Brazil has repeatedly ranked in the top percentile of the planet’s most unequal countries in terms of income disparity—including on more than one occasion being ranked as the worst in the world (UNDP 1993; 17). This gap is clearly reflected in the health sector where the burden of infectious disease and inadequate access to health care has affected the poor, rural regions (the rural North and Northeast of Brazil) at much higher rates.

This trend continues today. For example, child mortality rates are twice as high in the North and Northeast of Brazil, with the indigenous populations, found mostly in these areas, lagging even farther behind in health indicators (Victora, et al. 2011). Deaths from HIV/AIDS and respiratory infections have increased and the high rates of tuberculosis and Chagas diseases have remained unchanged since the 1980s (Barreto, et al. 2011;
Victora, et al. 2011). In addition, infectious diseases such as dengue fever are completely unaffected by control efforts and have continued to wreak havoc through continual epidemics.

In fact, one year after the construction of Belo Monte began, the town of Altamira had an average of 30 suspected cases of dengue fever coming into the hospital on a daily basis from the construction sites—a number much higher than in the previous year (Peduzzi 2012). Nationally, between the years 2000 and 2009 there were approximately 3.5 million reported cases of dengue fever, of which 845 were fatal. Efforts to control the abundance of the mosquito responsible for dengue fever, Aedes aegypti, have been challenging due to the limited access to proper infrastructure and sanitation (Barreto, et al. 2011; Teixeira, et al. 2013).

Chronic, or non-communicable diseases (NCD) are also distressing the poorest regions of Brazil. Although the NCD mortality rate has decreased between 1996 and 2007, the highest rates of mortality are still found in the North and Northeast regions, which also includes the largest increase in diabetes mortality (Victora, et al. 2011). The rates of overweight/obesity, diabetes, hypertension, and cancer (breast, lung, prostate and colon) have been increasing since 1996 with cardiovascular diseases, diabetes, cancer and chronic respiratory disease accounting for 58 percent of all deaths (Schmidt, et al. 2011). Type 2 diabetes has been on the rise as a public health problem in Brazil, as throughout much of the world. According to a national registry for diabetes and hypertension 1.6 million people in Brazil are living with diabetes. Of these cases 4.3 percent have had a diabetic foot disorder, 2.2 percent an amputation, 7.8 percent renal disease, 7.8 percent myocardial infarction and 8 percent a stroke (Schmidt, et al. 2011).
In a study by Garcia Rosa et al. (2013) researchers identified connections between some of Brazil’s staple foods and the incident rate of diabetes. The researchers used biochemical, anthropometrical, and blood pressure measurements to test for diabetes. They also used medical records as a baseline, reviewing them once again after 5 years (2006-2011). To assess food consumption, a semi-quantitative food frequency questionnaire for Brazilian staple foods of rice, beans and manioc flour were given. Daily food intake in grams was measured for these foods to be able to compare them to diabetes outcome status. The results found that individuals who developed type-2 diabetes had higher frequencies of red meat consumption and less consumption of manioc flour. Surprisingly, manioc flour consumption had an inverse association with developing diabetes and may be an example of a food with protective qualities against type 2 diabetes (Garcia Rosa, et al. 2013). White rice and beans, on the other hand, showed an increased risk for the disease.

Another rising non-communicable disease is cardiovascular disease, which has become the leading cause of death in Brazil, with hypertensive heart disease rising from 11 percent to 13 percent in 2007, ischemic heart disease remaining at 30 percent, and cerebrovascular disease at 32 percent of all mortalities. The increases in some of the nutrition related NCDs (cardiovascular, diabetes, cancer) are attributable to what is known as the nutrition transition. This concept was proposed by Barry Popkin (1993) to describe a shift in dietary consumption of traditional diets to a more Westernized diet high in sugars, fats, and industrialized products. Along with changing levels of energy expenditure these shifts are usually a result of economic, demographic, environmental, and cultural transitions within a society. Although these rapid changes in diet and activity
are influencing the amount of nutrition related non-communicable diseases globally, they seem to have the greatest effect on low- and middle-income countries.

Popkin (2004), for example, looked at nutrition transition in rural China in the 1970s. At the time there was a prevalence of widespread food insecurity, limited access to transportation, no television, and minimal processed food, and most occupations were extremely labor intensive. In a matter of 30 years this population experienced great changes in nutritional status—shifting from an undernourished population to high rates of obesity. During an 8-year study examining the BMI of adults (age 20-45), Popkin (2004) and colleagues found that prevalence of overweight and obese men doubled from 6.4 percent to 14.5 percent and increased by 50 percent from 11.5 percent to 16.2 percent for women. These increases correlate with China’s rural population’s transition to modern technology to lessen the amount of labor-intensive work, consumption of soft drinks and processed foods, uses of mass transit, increases in watching television (now found in nearly all homes), and a reduction in riding bicycles (especially for children). The trend of increased sedentary lifestyles and poor diets is creating an unequal burden of disease on the poor who continue to suffer from lingering communicable diseases and limited health care access.

Several studies in Brazil have shown the nutrition transition by looking at population-based surveys with women between 1975 and 1997. At the beginning of the study in 1975, Monteiro et. al. (2004) found the number of underweight women was twice as many as overweight women. However, by 1997 this shifted to more than two cases of obesity to one case of underweight. Pereira et al. (2012) takes this information one step further to examine the saturated fat, trans fat, and sugar consumption in the
Brazilian diet through individual dietary intake surveys and non-consecutive food records. Changes in the diet came from income growth and changes in the overall food system of Brazil, particularly the increase in use of modern supermarkets and the promotion of processed foods and beverages with low nutrient density. The ease of access and the convenience of these products have led to a high intake of saturated fat and sugar in the Brazilian diet. In addition to processed foods this study found a higher consumption of red meats, which has been associated with cardiovascular disease (Pereira, et al. 2012). Overall the surveys found a decrease in household food availability, except for bakery products, sweets, soft drinks and ready-to-eat processed meals, and very high levels of sugar, saturated and trans fats in the daily consumption habits of the Brazilian population.

The shift in dietary patterns and physical activity in Brazil has been noted in all regions. Data from the Amazon, however, are more limited. One example is the study of ribeirinhos by Silva and Padez (2010). This study examined 304 adults living in the Amazon basin by taking anthropometric measurements to determine rates of overweight and obesity. Evidence of a high prevalence of overweight/obesity was found in the adults of this region as a result of Western influences and the nutrition and epidemiologic transition. As access to healthcare, vaccinations, and better incomes increase the population is less strained by preventable disease and therefore can spend more money on processed foods eventually leading to higher body mass. Other consumer goods are also more available to the people of this region like cigarettes. The ability to purchase cigarettes is a sign of high social status, thus contributing to the cardiovascular problems seen in overweight/obese populations.
Another study done by Piperata (2007) used anthropometric measurements along with structured interviews to understand the factors relating to health and nutrition for this population. Piperata found a high degree of stunting, which signifies nutritional stress or poor health during growth and development. In fact, children aged one to six had a high prevalence of parasitic infection along with illness such as diarrhea and respiratory infections. This is due to limited access to healthcare and the poor sanitary conditions of these communities—most people drink, bathe, wash clothes, and dump trash and human waste directly into the river.

However, when short-term nutritional status was measured (the degree of wasting among all age groups in a population) the study found normal rates except in some adult males. Men who were directly employed by wage labor jobs showed higher rates of overweight and obesity. Through the structured interviews the researchers discovered that men who worked in wage labor were often fed at least three times a day while at work. Meals were usually buffet style allowing them to eat as much as they wanted and the foods served were energy dense foods. Wage labor jobs included grounds keeper, cook, motorboat drivers, and other less physically demanding jobs.

This study allows for a unique look into the nutrition transition. Since the men were showing the highest amounts of body fat percentage and higher BMIs, it is easy to see the effect of a more sedentary profession and higher consumption of processed foods. Women continued to work in subsistence labor in order to be able to feed themselves and their children and thus maintained high levels of physical activity (Piperata 2007). Dufour and Piperata (2014) have refined the concept of the nutrition transition to look more closely at the nuances involved in joining a market economy. Instead of a linear
transition from under nutrition to over nutrition with the onset of more processed foods in the diet, there are more complex issues at play between differing populations. Even within the same population there are still differences in age, sex and income when it comes to nutritional health. The data collected work to bridge the gaps in the literature about overall health and nutrition of people living in the Amazon Basin as well as daily life activities and behaviors that impact health changes.

Beyond a handful of health studies such as Silva and Piperata’s, little is known about the health of rural inhabitants of the Amazon. Most of the health statistics concerning the North of Brazil are measures of health for those living in the urban capitals and the indigenous tribes throughout the area (NAEA 2006; Piperata, et al. 2011). The information that is known paints a bleak picture for the Amazon. Although important strides have been made to improve health indicators such as infant mortality, life expectancy, vaccinations, and nutritional status, the rate of change is slow, unevenly distributed among urban centers of the region, and greatly lags behind the rest of the country (IBGE 2010). The few studies that venture out to the rural regions of the state of Pará have noted that only 6.5 percent of households are connected to a sewage system (NAEA 2006; Piperata 2007). This means that many households are dependent on the river for domestic consumption and it is not surprising to see populations with high rates of intestinal parasites (Piperata 2007; Silva 2001, 2006; Silva 2003). Other serious health concerns show high rates of food insecurity, violence, slave labor, teenage pregnancies, and child malnutrition (NAEA 2006).

Infectious diseases are serious issues in this area with the highest concerns over malaria, viral hepatitis leprosy, tuberculosis, leishmaniasis, dengue fever, and AIDS.
Very little is known about HIV infection and local perceptions or behaviors in the rural Amazon. But due to limited education and health access, the potential for significant casualties from this and other diseases is daunting. Infectious diseases, hunger, poor sanitation, limited access to healthcare, and the emergence of chronic diseases such as diabetes, cancer, and hypertension are contributing to what is known as the double burden of disease (Marshall 2004).

The importance of gathering relevant health data that accurately depict life in the Amazon basin cannot be overstated. The complexities of a vulnerable population who are integrated into and affected by the environment must be understood so that when issues arrive, such as the construction of the Belo Monte Dam, health will not be ignored. In order to conduct this research project, the methods utilized build upon previous research in the area in an effort to provide a consistent and comparative source of information and a means to monitor change.

**Research Design**

As explained in the Introduction, the specific aim of this research is to explore the potential health impacts of the Belo Monte Dam on the downstream community of Gurupá through a syndemic framework. The research was divided into two phases. Throughout the first phase I examined the follow research questions:

(1) What is the structure of the local and regional health care system?

What do the care professionals identify as the strengths and weaknesses of the system? What changes do they foresee with the dam completion?
(2) How do community members view their current health status?

(3) What changes to their health or health care do they anticipate within the coming years and what is the general opinion on, and discourse about, the Belo Monte Dam?

For this phase I took a close look at public health organization in the local community and region. Through interviews with key personnel and participant-observation I examined challenges to the public health system, specifically focused on the community level (hospital, health posts, and public health offices). In addition, I investigated local perceptions of health and the environment in Gurupá and how community members have or have not incorporated the Belo Monte dam into their health discourse. Through participation-observation and informal and structured interviews, data were collected on the structure and functioning of the health care system, perceptions of problems/gaps in policy and policy administration, as well as local understanding of changes occurring in a holistic context (environmental, economic, demographic, family-kinship, politics, religion, and world view). Data were also collected from a wide array of healthcare professionals, NGOs, and community members in Gurupá as well as in Altamira—headquarters of many agencies and organizations involved with the Belo Monte Dam project. The interviews with health professionals helped me to increase the knowledge on specific viewpoints held by each stakeholder.

For the second phase of research I focused on questions that explored the most probable health impacts affecting downstream communities, such as:

(1) What are the public health impacts of the Belo Monte dam on the downstream riverine community of Gurupá? Will there be changes in
infectious disease rates, nutritional status/food security, or access to healthcare? Will there be increases in malaria, dengue fever, and waterborne illnesses ranging from dysentery to diarrhea due to environmental changes and problems with water quality?

(2) Do the data collected identify syndemic relations? What is the relationship between the various health impacts?

(3) How can different stakeholders such as grassroots organizations, NGOs, and local government agencies use this information to mitigate the health care problems? How can data on unanticipated syndemic relationships be used to “fill in” the gaps of public health care?

Current and historical data were collected from all local health sources (public health and the local hospital archives), from the existing global literature, and from data obtained from phase I research in Gurupá. As far as the quantitative data is concerned, I utilized a version of the Short Form-36 Health Survey, which is one of the most common instruments used in health research (D’Souza, et al. 2013; Laguardia, et al. 2011; Liang, et al. 2006; Pheley, et al. 2002; Sabbah, et al. 2003; Zhu, et al. 2012). This survey aims to identify changes in health status over time using a standardized set of multi-dimensional health concepts (Laguardia, et al. 2011). Data are collected on certain health status indicators with thirty-six questions regarding physical functioning, physical role limitations, bodily pain, general health, social functioning, emotional role limitations, and the mental health of the respondent. This survey has been translated into Portuguese and validated with Brazilian populations showing its ability to be culturally appropriate (Pheley, et al. 2002). The short version of this survey is 10 percent to 20 percent less
accurate than the longer forms; however, the levels of reliability and validity are above the recommended minimum and it only takes approximately 5 to 10 minutes to complete (Laguardia, et al. 2011). Therefore it is an ideal tool to use in combination with other surveys and will not result in respondent fatigue. Although many researchers have administered the SF-36 Health Survey in health care facilities, the survey is versatile enough to be administered throughout a rural population. By capturing information from people who do not have access to health clinics or hospitals, the survey can create a broader view of overall health status by filling in the gaps of the rural people (Darko, et al. 2012).

The SF-36 Health Survey also gathers perceived health status. These data provide a more accurate picture of population health by allowing the researcher to interpret the nuances related to quality of life and general well-being, rather than solely analyzing the number of deaths reported for a population. Darko et al. (2012) have shown this advantage in a study focusing on the health of adult women in Accra, Ghana. The study found women reported over 30 worsening health conditions. This is important to note since some diseases may not be counted by the hospital data because they are in early stages and asymptomatic. In addition, the health survey can be interpreted to hint at possible risk factors for disease through responses.

A second research instrument I used is a food frequency questionnaire or FFQ. This instrument provides data to evaluate dietary intake patterns, which can add to the health profile of small, rural communities by showing variations in diet and access to certain foods. FFQs are commonly used to assess long-term dietary intake by listing a variety of foods and asking the frequency of consumption over the period of a week,
month, or even year (Gibson 2005). Specific categories of foods can be used during analysis to predict the intake for certain nutrients or non-nutrients in an individual. Fresh fruits and juices are examples of food items that can be used as predictors for vitamin C intake. Fats and cholesterol intake can be evaluated by measuring the prevalence of alcohol, artificial sweeteners and certain condiments (Gibson 2005). FFQs should list out pre-determined lists of foods native to the area and can be administered as a standard interview lasting 15 to 30 minutes. This technique is not very burdensome or invasive for the respondent and can be used with other surveys to collect information.

A study performed on preschool-aged children in the United States (Perez, Himmelgreen and Ferris 1997) exemplifies how an FFQ can provide a culturally appropriate snapshot of a group’s food intake. Researchers gave caretakers of the children a food frequency questionnaire with a list of 198 foods, which also included 30 Puerto Rican traditional dishes since the study sample was taken from a Latinx population. Data on cooking methods used in food preparation were collected as well. In order to better assess nutritional status, foods on the FFQ were grouped into categories important to child nutrition. The researchers also grouped food into the five categories used by the USDA Food Guide Pyramid (bread and cereals, meat and alternates, milk and dairy products, vegetables, and fruits) to facilitate comparisons among populations.

The results of the FFQ showed that preschool-aged children had a high frequency of artificially flavored beverages, whole milk, sweets and desserts, breakfast cereals, and foods high in fat. Vegetable consumption was below the minimal recommended level and 55 percent of the total daily fruit servings were coming from fruit juices. In terms of food preparation, caretakers most frequently used frying, stewing, and boiling. The researchers
concluded from the FFQ that preschool-aged children had poor dietary patterns lacking in vegetable intake and high in fruit juices, sweets, and high fat foods. The researchers suggested that the consumption of high fat foods could be reduced and the intake of nutritious foods be increased. If open-ended qualitative questions are added during the administration of the FFQ in communities, this could successfully fill in gaps about access to certain foods or possible explanations of food variety.

When the goal of the FFQ is to study associations between dietary habits and disease, then questionnaires should be able to rank respondents based on the frequency of consumption so that low intakes can be separated from high intakes. The analysis at this level involve an odds ratio or relative risk of disease (Gibson 2005). Most epidemiological studies use FFQs as the primary dietary assessment method (Masson, et al. 2003). This method was used to assess the consumption of carotenoids and the risk of lung cancer in a study in southwestern Finland (Holick, et al. 2002). Relative risks were computed by dividing the rates of the highest consumption rate quintiles by the lowest consumption rate quintiles. The study found that the consumption of foods rich in carotenoids was inversely related to the lung cancer risk (Holick, et al. 2002).

**Sampling**

For this study, the SF-36 Health Survey short form adapted to Brazil and a FFQ specific to the Amazon were combined into an interview schedule (given the low literacy rates of many in Gurupá). This instrument was administered to a clustered sample of households within the community to capture varying socioeconomic statuses and subsistence patterns. The interview schedules were administered to one adult female and one adult male per family (the self-identified heads of household if available). Piperata
(2007) used this technique in her study to administer household characteristic surveys and semi-structured interviews. This combination of surveys captures critical information about illnesses and ill-health conditions that have occurred during the previous year in the community as well as illnesses/ill-health/socioeconomic status. I use random sampling within each designated strata for a total of 100 surveys. The interviewer randomly chose houses in each by approaching every third house spanning the geographical region until the desired number of houses was visited.

**Data Collection**

To help complete the surveys I hired two research assistants. Both of the research assistants were natives of Gurupá, although one had just recently moved back from Altamira while the other lived there her whole life. The research assistant who had lived in Gurupá her whole life helped with most of the survey distribution. She had gone to the Federal University of Pará to study anthropology and has an interest in research methods and data collection. Her family is well established in Gurupá and she was able to conduct surveys in all neighborhoods with ease. The second research assistant did fewer surveys, but is a data analyst for the Secretary of Health and helped me pilot the surveys. Within the past two years he had moved back to Gurupá to take care of family members. He states that he is a native of Gurupá, but spent his school age years growing up in Altamira. He is currently taking online classes to become a computer programmer.

Both of the assistants were paid 10 reis per survey completed, which translates to about $5 per survey. They were compensated in cash once the surveys were returned to me. Altogether, the research assistants and I completed 101 health surveys and food
frequency questionnaires. We spent from May until July disseminating the surveys, during the rainy season. Unfortunately, we were unable to distribute the surveys again to the same households during the dry season and some of the results may be affected by seasonality.

Limitations

Any anthropologist who has done fieldwork can attest to the truth of Murphy’s Law, “Whatever can go wrong, will go wrong.” The nature of our research is built on human cultural and societal interactions, which we know to be in a constant state of flux. The idea for my research project came along in 2011 when the government granted Norte Energia a permit to begin construction on the Belo Monte Dam on the Xingu. This seemed timely since I was just beginning my doctorate program and by the time I would be able to conduct field research the dam would be complete. Thus, my dissertation was focused on studying the public health impacts that would affect Gurupá. Belo Monte has been shrouded in controversy since the 1970’s when it was first proposed to the public. Throughout the years human rights activists and environmentalists alongside indigenous groups and community members around Belo Monte worked hard to stop the dam from being built. Judges would halt construction based on several injunctions including Norte Energia’s failure to consult the indigenous people whose land and livelihoods would be impacted, failure to fully complete the environmental impact assessments, human rights violations, and most recently its involvement in the corruption scandal of the Brazilian government. Each time the dam was halted there would be a higher court somewhere that would grant permission to build again and again because the Brazilian government would
not have this multimillion-dollar project canceled. The constant delays meant that in 2015 when I began my fieldwork, the dam was still not complete. Studying the public health impacts of a dam that had not started working was not going to suffice for a dissertation. Therefore, with the help of my committee, we were able to come up with a better plan and arrive at the current research project involving Gurupá as a case study to create a heuristic model of public health impacts of dams. In the end, I believe that this iteration of the project will be more beneficial to the town of Gurupá as a model to help in identifying most salient impacts and how they are syndemically related to others.

A second limitation of this study occurred when bureaucratic delays of the Brazilian government prevented me from being able to return to Brazil and complete the anthropometric measurements of children that I had originally planned to do. Although this would have provided an updated snapshot of nutritional health when added to the anthropometric measurements taken in Gurupá in 2005 and 1986, this portion of the research was only adding to the baseline health survey for the dissertation and not absolutely vital to the findings of this study. The data from health records, interviews, food frequency questionnaires, observations and the health survey have provided the wealth of information necessary to create the syndemic model which will be discussed in the following chapters.

**Broader Impacts and Ethical Considerations**

Through gathering data on health trends from Gurupá into the syndemic framework, the research will contribute not only to the theoretical understanding of dams’ health impacts on a downstream community, it will also provide valuable data and
models for stakeholders to use in order to improve future planning. These data will allow local community leaders and NGOs to better plan for the full range of health issues likely to come from large hydroelectric projects in the Amazon Basin.

The research project adheres to the Institutional Review Board guidelines for ethics for the University of South Florida (IRB Pro00017815). Informed consent has been gathered from all participants with the right to refuse to participate or stop participation at any point during the process. Access to the raw data is limited to the researcher and research assistants. No identifying personal information was used in data collection to ensure privacy and confidentiality of those participating in the study. Data are kept on my computer under password protection. The findings of the study will be disseminated to the community, but will not contain any information that will cause members of a small community to identify each other. Written and oral reports will be made available to the community members and results will be left with the Secretary of Health, director of the hospital and the Mayor. The data are also accessible to the Institutional Review Board at the University of South Florida upon their request in accordance with their Human Research Protection Program Policy 701 Section 5.1.17.
CHAPTER FIVE:
RESULTS: PUBLIC HEALTH IN GURUPÁ

During the late 1980s Brazil underwent a major shift in the way healthcare was managed and provided nationwide. This reform created the Sistema Único de Saúde (Unified Health System) or SUS. The new system focused on providing comprehensive universal healthcare to all citizens of Brazil. In order to understand how the Belo Monte Dam will affect Amazonian populations, and particularly the community of Gurupá, it is necessary to first review the history of SUS within the overall historical context of Brazilian public health. I will follow with an overview of how SUS functions in the rural states of the Amazon. Finally, I will provide a review of the literature associated with health behaviors and access to healthcare in the Amazon.

History of Public Health in Brazil

The Portuguese colonization of Brazil began in the 16th century and the main forms of institutional health care at this time were a handful of hospitals in São Paulo, Salvador, Belém, and Olinda. By the late 1820s, institutions for sanitary control of ports and epidemics were established (Paim et al. 2011). The first steps toward the formation of the current health care system, however, began in 1923 with the Eloy Chaves Law. This law created retirement and pension funds for certain occupations, initiating the first
Brazilians social security model. Also during this time health professionals formed a dual health system, one for preventative public health services and one for curative social security services (Canut 2012; Paim et al. 2011). During the presidency of Getúlio Vargas (1930-1945) the government created different ministries, which sought to institutionalize public health, social security, and occupational health. These ministries, however, were sorely underfunded. Health coverage at this time was only available to those in the urban workforce, excluding rural workers and the unemployed from receiving health care services.

It was during World War II that Brazil, in partnership with the USA, developed its first national health care system (Wagley 2014). Called the Serviço Especial de Saúde Pública (the Special Service for Public Health) or SESP, the agency oversaw the nation’s public health planning and implementation. After the war ended, and international funds were withdrawn, the agency suffered. For about a decade, however, SESP had success in dealing with some critical health problems in the Amazon, which I will cover in greater detail later in this chapter.

During the military dictatorship of 1964-1985 the health care system was again reorganized through centralization and was administered by a large bureaucracy with a directive to expand and reach a greater portion of the population. For the first time in Brazilian history, large numbers of rural workers were included in the system. With this increase in demand, the military government increasingly turned to the private sector to build hospitals and expand capabilities. Eventually the restrictions of the growing privatized system, coupled with the inability of the government to meet the demands of an overextended healthcare system, led to an unequal and fragmented health care system.
Due to these problems, a large portion of the Brazilian population was once again excluded from the predominantly private health services located in urban areas.

The next phase of health care development occurred during the recession of the mid 1980s with serious talk about healthcare reform (Paim, et al. 2011; USA 2013). An ideological shift in the country mandated that as a fundamental social and political right, health care should be provided free of charge by the government to every citizen. In other words, health was seen as an irrefutable human right and the government was responsible for delivering it.

The Unified Health System came into existence through the constitution of 1988 during the 8th Annual Conference of Health. In addition to universal healthcare coverage, the Brazilian Constitution also outlined the duties of the state to guarantee this through economic and social policies required to promote curative services as well as monitoring of health and providing preventative services to reduce the risk of disease (USA 2013). The organizational principles behind SUS, or Unified System of Health, declared that it function as a regionalized and hierarchal network and would be both administratively and politically decentralized to allow for the participation of all stakeholders, including community members, for the improvement of provision of healthcare services (Sistema Único de Saúde n.d.).

At the municipality level local governments were charged with providing primary health care services and were responsible for the management and allocation of funds and resources. This policy assumed that community members would vote on issues important to them and that local governments would have a more in depth understanding of what is most needed in their area. In this way policy planners figured that the decentralized...
nature of SUS would allow each municipality to flourish. It was the duty of the state to assist the municipality to set policy goals as well as provide 18% of the funding to the Municipal Health Fund (Mobarak et al. 2005). The federal government provided 54% of the funding to the National Health Fund, which distributed money to the municipalities through 78 different programs (Joint Learning Network 2014).

The federal government was also responsible for national regulation of health care, developing national policies, and managing the private sector activity. The private health sector stepped in to provide insurance coverage to many of the middle and upper class citizens of Brazil through the Supplementary Health Program (SHS). Those who could afford private health care could also utilize the SUS resources for more complex procedures, which might not be covered under the private sector.

In addition to providing hospitals and clinics to the public, the government took an active approach to health with the creation of the Family Health Program, *Programa Saúde da Família* (PSF), and the Community Health Agents Program (PACS) in 1994. Community outreach and preventive family health care were achieved through teams of health care professionals and trained community health workers who delivered care to households and communities (Joint Learning Network 2014). The outreach teams were initially responsible for approximately 800 to 1,000 families, but have increased these numbers exponentially since their creation in 1994 to 32,000 units available to the public in 2008 (Joint Learning Network 2014).

Evaluations of PSF and PACS have shown the programs produce positive results due to their ability to follow families through time on a regular basis, thus allowing health care workers to have intimate knowledge of the community. With greater knowledge
comes the ability to better educate about diseases endemic to the area and specific health practices and beliefs. This familiarity also enables the PSF to detect any differences in health that may lead to an early detection of disease that may require specific attention. The already established organization of these units increases the ease with which interventions and programs can be implemented (Rocha and Soares 2010). As Rocha and Soares (2010) concluded in their studies, PSF has been highly effective in reducing mortality, especially among infants in the poorest regions of Brazil.

After eight years of program implementation, researchers estimated the reduction of infant mortality of the Northern region of Brazil to a low of 15 per 1,000 as opposed to the national average of 27 per 1,000 (Rocha and Soares 2010). When comparing Brazil to other Latin American countries, Brazil rose from 26th out of 33 for infant mortality rates in 1990 to 19th out of 33 in 2006 (Joint Learning Network 2014; Macinko, et al. 2006). Hospital admissions declined by 24% on a national level between 1999 and 2007, and at the state level, those that had greater PSF coverage also reported lower hospital admissions (Dourado, et al. 2011). As these evaluation studies have shown, the SUS and its outreach programs successfully improved health and well-being of the population.

Despite these gains, the amount of coverage that the municipalities can offer varies from location to location and in some cases inhibits this success. Mobarak, Rajkumar, and Cropper (2005) explain the political processes behind the ability of municipalities to provide health services to their populations. There are three variations of decentralization that occur at the municipal level: full state management, basic assistance management, and full county system management. Under the full state management the state government has complete control of the health system and can
determine the amount of funds and types of provisions allotted to the municipalities. The basic assistance management level allows the municipality to manage all primary health care, but leaves the more complex services to the state government. In the last version, full county system management gives complete control of primary care and complex services to the municipality. In order for a municipality to apply for full county system management, a judge at the federal government level must deem it fit to handle the decentralized administrative role.

If a municipality has full management of their healthcare (in 1999 about eight percent had full management status while 80 percent were under basic assistance and two percent under full state control), then the transfers required for reimbursement are subject to an annual ceiling which is decided through political negotiations with the federal government (Mobarak, et al. 2005). Municipalities which are politically aligned with state and national political parties in power are more likely to be granted full county system management as well as have a more relaxed budget to use towards health care. Municipalities not aligned with parties in power, in contrast, typically have less control over the management of resources and often have fewer resources allotted to them as well. Additionally, the overall lack of political interest in the rural and impoverished northern region of Brazil due to the lack of its political capital to influence decision makers on the national level more than likely results in fewer and lower quality public health services than in the industrial South (Bliss 2010).

Amazonian Public Health in Context

Brazil’s northern region is typically idealized by most outsiders as an endless expanse of lush green forests, diverse and exotic plant and animal life, and groups of
indigenous people living in harmony with their environment, untouched by the modern world: a type of preserved Garden of Eden (Slater 2001). These images of the Amazon, of course, are far from reality. Most inhabitants of this region, by contrast, live in urban spaces of 20,000 or more people (IBGE 2010). Some of these towns and cities, like Marabá and Altamira, are located along relatively recently constructed highways that dissect the region. Others live in the more traditional river towns and cities like Belém, Manaus, and Santarém.

A third group, referred to as ribeirinhos (river bank peoples), live in rural areas reachable only by small motorboat or canoe through what seems, to the untrained eye, miles of deceptively identical tributaries. In these expansive areas, infrastructure is next to non-existent, education is limited, and access to health care is minimal. Described as an invisible population due to their traditional lifestyle and loose politico-social organization (Nugent 1993), this group has received little attention from the government or individual politicians (Silva 2004a, 2004b, 2009). Even development projects in the region, such as the Transamazon highway and large hydroelectric dams which were purportedly designed to relieve poverty by improving the economy and bringing people into the region, more often than not actually brought environmental degradation, population displacement, and the marginalization of populations (Cummings 1995; de Sousa Júnior and Reid 2010; Diamond and Poirier 2010; Fearnside 1999; Fearnside 2006; Hall and Branford 2012; LaRovere and Mendes 2000). In terms of public health, the Amazon’s lack of political power results in a general lack of medical resources. Due to this pattern, critics of the Belo Monte Dam believe that the project will follow in the
footsteps of other development projects and result in impoverishment and abandonment for the local population. This, however, does not have to be the case.

The Case of SESP

In the name of development, in July of 1942 the Brazilian Ministry of Health and the Institute of Inter-American Affairs (IIAA) of the United States created a rural comprehensive health service program in the Brazilian Amazon. SESP, as the program was called, was created during World War II to improve health conditions of the regional population in order to facilitate the flow of raw materials critical for the war—in particular rubber since the Japanese had overrun the rubber fields of Malaysia (Mayberry and Baker 2011). At this time the underdeveloped Amazon region was suffering greatly from the prevalence of malaria and other infectious diseases. Over the next seven years SESP endeavored to improve public health in the region. Among the most successful of its programs was the establishment of health posts in more than 30 rural Amazon towns that had no previous access to Western medical care. In addition, SESP installed water supply systems, and sanitary privies, and implemented an aggressive anti-malaria campaign, which included regular sprayings of DDT throughout the communities. As part of the plan to bring migrant workers from other regions of Brazil into the Amazon basin to tap rubber, SESP worked tirelessly to screen and immunize some 50,000 workers, thereby mitigating the spread of disease via transient populations (Mayberry and Baker 2011). This initial public health effort was critical to improving the overall health of the ribeirinho population and laid the foundation for future development of clinics and hospitals in the region.
Even after the end of the war in 1945, SESP continued to provide and promote basic health service to small rural populations. Health services included maternal and child health, improvements in sanitation and water systems, vaccinations, epidemiological monitoring, and the collection of statistical information (Mayberry and Baker 2011). Much of the success that SESP achieved can be attributed to its policy of integrating community participation into its projects. For example, SESP created the visitadora (visitors) program to train first aid specialists. Vistadoras were members of the local community trained to go out into the towns or villages and direct people in need of healthcare services to the health posts. American and Brazilian registered nurses working for SESP trained more than 100 visitadoras each year, which also included midwives who were instructed in the fundamentals of Western obstetrics. The visitadoras were also trained to provide immunizations, educate the public about nutrition, and collect information on growth and disease monitoring. The success of this program was rooted in the recognition that planned home visits were much more effective in reaching the rural population for primary care than relying on patients to seek out the few and often distant health post. Visitadoras spent half their time visiting homes and the other half at the health post providing curative services.

One particular case study of a successful SESP program was in Gurupá. Anthropologist Charles Wagley was instrumental in bringing SESP to Gurupá (Wagley 1953). Wagley was head of the Health Education Division of the SESP and later the Assistant Superintendent of SESP. From 1942 to 1945 he worked as the director of a program focused on the health of migrant workers recruited from the Northeast of Brazil to work the rubber trails of the Amazon – the so-called Soldados da Borracha (rubber
soldiers). He first visited Gurupá in 1942 when his team began distributing anti-malaria medicine, developing educational materials describing how tropical diseases were spread and how they could be prevented, building latrines, and establishing the health post. Once these initial tasks were completed, Wagley worked with the medical staff to create policies that would successfully implement the goals of SESP in Gurupá.

In Gurupá the benefits of the SESP were first felt in 1943 when the community’s health post was established. The next year, Gurupá was able to construct a more substantial building for the health post, install sanitary privies in 90 percent of the dwellings in the town, and vaccinate 100 percent of the population against small-pox. Within a two-year time span (1944-1945) 6,329 people were treated in Gurupá’s health post (R. Pace 1998). The visitadoras of Gurupá were utilized to make home health visits and educate rural families on the benefits of public health. SESP also involved the community schools in teaching children good health habits through the introduction of a health club. Finally, every three months a team of SESP workers would come and spray DDT in the community, reducing mosquito breeding and diminishing the incidence of malaria.

In each of these activities, Wagley was instrumental in adapting public health needs to local realities, as well as attempting to integrate folk views into public health education (Sá and Sá 1990). Beyond the aid brought by SESP during the 1940s, Wagley’s presence in the community and resulting publication of *Amazon Town* provided the community with notoriety among policy makers. This notoriety provided dividends, as the community was one of few that later managed to obtain funding for a hospital.
Post SESP Gurupá

Unfortunately, the success of the SESP did not last long. After 1960 the US handed complete control of SESP to the Brazilian Ministry of Health and it became known as the FSESP (SESP Foundation). Throughout the 1960s FSESP began to decline as the government looked to the states to finance the health services. The states, however, did not contribute, which led to a precipitous decline in many services (Moitta et al. 1985). When Wagley revisited Gurupá in 1962, FSESP, facing bankruptcy nationally, had withdrawn much of its funding for the region. Wagley noted that employees were not being paid for their services and the health posts were in disarray and in desperate need of repair. Amoebic dysentery was widespread and malaria was once again wreaking havoc throughout the Amazon.

When a student of Wagley, Darrel Miller, visited Gurupá in 1974, he observed that the town population had doubled since Wagley’s first visit, to 1,300 residents (Miller 1975). Roads were beginning to be paved, bicycles were in use, electricity ran from dusk until about 11:00 pm, and most houses had running water which greatly decreased the occurrence of dysentery. Since SESP was no longer functioning as a source of healthcare, a new governmental organization named FUNRURAL (Rural Workers Assistance Fund) together with Assistência Adventisita (Adventist Assistance) had taken over and was in the process of building a new hospital where the old SESP health post had been. FSESP had not been able to secure a permanent physician since 1960 and according to Miller, FUNRURAL brought new hope to the people of Gurupá, offering to provide two or three new doctors for the hospital they were constructing. The hospital was finally inaugurated 1976 and opened its doors to the public.
By the 1980s, near the end of the military dictatorship, Gurupá was a much different place. The town, once again, received very little support from state and federal governments and since Gurupá was not seen as important to the national economy, or by this point, national security, the amount of funding going into health care was non-existent (Magee 1987). Although the fairly new hospital was complete and staffed, inadequate medical supplies and technical support, along with low salaries created a high turnover rate among employees. Most doctors, dentists and other professionals left Gurupá after one or two years in search of higher paying jobs with better infrastructure. The high rate of personnel turnover created serious healthcare discontinuities in the town. The turnover left the remaining staff at a severe disadvantage to make much of a dent in the common illness at this time: intestinal parasites, venereal diseases, hepatitis B, infectious diarrhea, and whooping cough (Magee 1987).

Other problems created health care difficulties such as, for example, the X-ray machine in the hospital had not been used in three years in 1984 because it was missing a part that the state would not replace. At one point the dentist drill blew a fuse and remained useless because the dentist could not convince anyone from the state to come out to Gurupá and fix it (Magee 1987). Reliance on pharmaceutical medicine for treatment of illness was not an option for many since medicines were always hard to find in town. Therefore, many in the community had to rely on folk medicine and the medicinal plants that they planted in their backyards. It would have been difficult in Gurupá not to feel the utter sense of invisibility from the state and federal governments when it came to health care. Even the town’s biochemist stated in 1985 that he did not
believe in public health. He told researchers that public health is a myth that the government talks about, yet no money ever comes for it (R. Pace 1998).

To add to this, the attitudes of the health professionals did little to gain the trust of the community. Oftentimes these professionals came from low rated medical schools and were not competitive enough in terms of training and competence to make a good living by practicing medicine in the larger urban centers. Doctors, dentists and other professionals came to Gurupá as a last resort. For example, Pennie Magee (1987) notes during her time in Gurupá the poor attitude of the town’s doctor towards her patients. At one point the doctor warns Magee to be careful because all of the people of Gurupá lie and she has learned to ignore everything they tell her about their illness. The doctor ignored all community participation utilized during the time of SESP. She refused to meet with community health midwives to train them, instead preferring to spend that training time with the hospital aids. The doctor had no interest in the local people and no interest in remaining in Gurupá any longer than necessary. As a result, her ethnocentric and condescending views and actions caused a rift in the way the population viewed Western medicine and the hospital for some time.

By 2005, when I first visited Gurupá, there were glimmers of hope that a link could once again be made between the folk views maintained by the community and the views of the hospital staff. I learned about, and came to know, several well-liked workers in the hospital who had gained good reputations in the community by incorporating their regional knowledge of folk medicine into Western medicine. A very well-liked physician by the name of Dr. Julia gained high praise from the community when she took an interest in the medicinal plants that community members were using and growing in their
back gardens for everyday aches and pains. She lamented that the community knowledge of plant uses was diminishing and strongly encouraged people to begin to teach and pass down the local knowledge. Community members were excited to share and felt more like participants in their own healthcare. Eva, a housewife in her 70s with an impressive back garden stated, “Our knowledge is important and Dr. Julia understood that.” (C. Pace 2013). The doctor had even gone so far as to choose some community leaders with expertise to help build up a laboratory specific for medicinal plants. All this ended, however, when the local government changed and the new mayor saw no benefit in these actions. According to Eva, the new mayor was so opposed to the doctor’s work that she eventually left Gurupá for a bigger city, unable to complete her laboratory (C. Pace 2013).

Several health care workers and local pharmacists were also very beneficial in bridging the gap between the jargon spoken by the doctors and others at the hospital and the local dialect. For example, I observed Antonio who ran one of the town’s pharmacies interact with customers. He would spend the extra time to explain in common terms what the medicine being prescribed was, what it did, and what to expect from it. Another factor that helped build rapport between the healthcare workers and the community was the municipality-wide vaccination campaigns. These national campaigns occurred twice a year and required much community participation. Local businesses would donate ice to keep the vaccinations cool, boats for transportation would be donated so that workers and volunteers could reach the most remote places, and volunteers from all professions would attend training sessions and then set out with vaccines for polio, measles, and DPT. The success of the vaccination campaigns is very much a function of widespread community
support and participation in the program, according to the regional public health officers (C. Pace 2015).

By the mid-2000s the healthcare system in Gurupá was once again functioning fairly well for a small Amazonian town. As initially established by Wagley and SESP, the hospital and health posts once again worked very closely with the community. Workers for the Posto de Saúde das Famílias (Family Health Post) or PSF would make house calls in town and the surrounding rural hamlets to make sure there are no health problems needing attention. The Secretary of Health still runs the highly successful vaccination campaigns twice a year to make sure that all the children are up to date on their inoculations. These campaigns have significantly reduced chronic childhood diseases. In addition, the aggressive treatment of malaria outbreaks (isolation of those infected, medication, and selective spraying of DDT) has all but eliminated the parasite from the municipality. Currently, the only occurrences of malaria are brought in from other locales.

In 2005, I began to conduct research assessing the level of undernutrition among the town’s children and to compare these data to similar data gathered in 1984. The nutritional research was carried out in each of the schools in the town. The research team took anthropometric measurements from children who assented with permission from the school, and then recorded and analyzed the data. Our team consisted of undergraduate anthropology students and employees of the hospital. The hospital also donated the use of their scales. In 2007 and 2009 I returned to Gurupá to update my findings.

The results of the nutritional research between 1986 and 2005 showed improvements made in child nutrition. Gurupá’s rate of stunting (as measured in the
sample population) fell from 32.2% to 15.9%. Stunting is usually associated with chronic nutritional deficiencies and chronic disease, resulting in a low height-for-age. Since Gurupá’s rates had decreased by half, the data suggest an improvement in living conditions. Factors that might have contributed to this decrease include the expansion of riverboat transportation (from twice a week to daily service) resulting in an increased supply of food and other products.

Table 2. Rates of Stunting, 1986 and 2005.

<table>
<thead>
<tr>
<th>Negative Z scores for Height for Age</th>
<th>Sample in 1986 (N = 472)*</th>
<th>Sample in 2005 (N = 572)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 5 = 2</td>
<td></td>
<td>- 4 = 3</td>
</tr>
<tr>
<td>- 4 = 3</td>
<td></td>
<td>- 3 = 10</td>
</tr>
<tr>
<td>- 3 = 29</td>
<td></td>
<td>- 2 = 78</td>
</tr>
<tr>
<td>-2 = 118</td>
<td></td>
<td></td>
</tr>
<tr>
<td>152 or 32.2% of total</td>
<td>91 or 15.9% of total</td>
<td></td>
</tr>
</tbody>
</table>

Source: Roe-Fehrman and C. Pace 2007. *Ages 5-15 years old

Another potential reason for the decrease in the prevalence of low height-for-age children is that more food may be locally grown and distributed in the town’s farmers markets. Additionally, there is the on-going economic boom in açaí and heart of palm production. This boom generates a consistent income for growers and harvesters at the household level, which in turn stimulates other sectors of the economy. As a result, there is more money circulating in town. With the increase, families are able to purchase more and a better variety of food, thus decreasing the chronic undernutrition children were facing.

The implementation of the Conditional Cash Transfer Program, *Bolsa Alimentação* (Food Grant), in 2001 may have also been a contributing factor to the
decreasing undernutrition rates in Gurupá. The program required 85% school attendance and families also had to complete prenatal exams and maintain all vaccinations current for children from birth to the age of 6. If all requirements were met the families would receive an allotment of money to purchase food for the children (Soares 2012). So in addition to more money flowing into the community there were also safeguards put in place to ensure the reduction of inequality among its most vulnerable populations.

In Table 3 I present a collection of disease rates in Gurupá from research conducted by R. Pace (1998) between the years 1981 and 1985 as well as data collected from my recent study in 2015 and 2017. Using this information allows for a comparative snapshot of the baseline health of Gurupá over a 34 year period of time. The data collected in the 1980s show cases of infectious diseases that have since been eradicated from Gurupá. Better sanitation practices and increased vaccinations have led to the disappearance of measles, cholera, and tetanus, while the campaign to spray DDT and enforce strict monitoring policies have curbed the existence of malaria. We see that tuberculosis and leprosy were problems back in the 80s and continue to persist, although there have been some significant decreases in the recent years, most likely due to the access to healthcare and the increased presence of doctors in the area.

The 2012-2014 portion of data is a limited list of illnesses the hospital had recorded and a list of the incidence of reportable diseases. The numbers on these data sheets are most likely low estimates of disease rates since not all people in Gurupá who become sick seek professional health care. Many prefer to self-medicate.
Table 3. Individuals with Reportable Diseases 1981-2014

<table>
<thead>
<tr>
<th>Disease</th>
<th>Cases between 1981-1985</th>
<th>Number of (new) cases 2012</th>
<th>Number of (new) cases 2013</th>
<th>Number of (new) cases 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIDS</td>
<td>-</td>
<td>3</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>Cholera</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dengue</td>
<td>-</td>
<td>19</td>
<td>-</td>
<td>14</td>
</tr>
<tr>
<td>Hanson’s Disease (Leprosy)</td>
<td>30</td>
<td>14</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>Hepatitis</td>
<td>41</td>
<td>-</td>
<td>53</td>
<td>6</td>
</tr>
<tr>
<td>Malaria</td>
<td>189</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Measles</td>
<td>77</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tetanus</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>28</td>
<td>5</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Vaginal Discharge Syndrome</td>
<td>-</td>
<td>114</td>
<td>71</td>
<td>69</td>
</tr>
<tr>
<td>Venomous Animal Bites</td>
<td>-</td>
<td>74</td>
<td>81</td>
<td>92</td>
</tr>
</tbody>
</table>
Interviews with the public health workers in 2015 revealed that at this point in time tuberculosis and leprosy were the main concerns as they have not been able to break the chain of infection for these diseases. There have not been any significant increases, yet the steady rate of infection is of utmost concern to the municipality. The rate of AIDS has also risen, which spurred the nurse João to plead with the government for better testing measures so that health providers do not have to wait for the patient to go to Belém to get tested. As of yet, these expedited local tests have not made it into the healthcare budget. In addition, venomous animal bites have been on the rise throughout the past couple of years, which could pose a further problem if Belo Monte impacts the habitat of snakes and other animals and creates more contact with people. In terms of other changes, the Secretary of Health in collaboration with the Catholic Church conducts monthly workshops on women’s health. During the workshop free exams are offered. Also, throughout the year one of the clinics on the outskirts of town is opened specifically for women’s health appointments on Wednesdays.

Overall, in comparison to neighboring communities, Gurupá is faring relatively well in terms of healthcare. Figure 5.1 shows the rates of malaria from 2008 through 2014 for Gurupá as well as the cities and towns that surround it. This provides some insight into how endemic the rates of malaria are in this area as well as the success Gurupá has had with staving off large numbers of infections.
The general decline in malaria from 2008 to 2014 can be seen in Figure 5.1, but with a spike in 2011 when construction on the Belo Monte Dam began. This is the same information that was reported from several sources during this time and seems to have disproportionately affected the closest downstream towns from Altamira and Vitória do Xingu where the dam is located. Gurupá, on the other hand is one downstream community that has kept malaria rates so low that it is barely visible on the graph. Porto de Moz in particular is only a couple of hours trip from Gurupá by speedboat, yet has had significantly higher rates of infection than Gurupá. This lends to the hypothesis that Gurupá heath care workers have been working much closer with the local community to control the rates of disease, especially when it comes to malaria.

I have also spoken with many health professionals who offer anecdotal evidence of Gurupá’s health status. For example, when a Navy medical ship was visiting Gurupá in
2009, I was able to talk with a gynecologist about the healthcare of nearby communities
the boat visits. The physician made it clear that out of the three municipalities, Gurupá
had the best public health system. The local government, health posts, and hospital do a
good job with the health demands of the population. The physician reported that she only
saw coisas bobas (silly, trivial, common health problems) here. Overall she had good
things to say about Gurupá’s public health system even though it is not perfect. She
mentioned that the Navy would not visit Gurupá as frequently since they are not needed
as much.

When I asked her about the biggest health problem in Gurupá, she spoke from the
viewpoint of her specialty and indicated that family planning is a major issue. The doctor
stated that the minds and beliefs of the people are hard to conquer. She has tried to
educate her patients about contraceptives, but men do not want to use condoms and
women must have the money for birth control. The form of birth control she referred to is
a monthly injection that is offered for free at health posts or hospitals. However, the
supplies usually run out and patients must obtain the injections from a pharmacy at about
10 reis per shot (about $5 US dollars at the time), which is very expensive for the average
rural dweller. Another barrier to birth control is gossip or folk beliefs. The doctor said she
hears women say they do not want birth control because a neighbor told her that it made
her sick or a cousin said it gave her ulcers. These types of beliefs are hard to overcome
when the doctor is only here for three days.

The Navy physician’s comments were instructive and offered an excellent
negative contrast to the practice of public health in Gurupá. The Navy practiced top-
down, minimal interaction medicine. There was little attempt to understand the local
culture and the local folk view was simply seen as irrational and problematic. In other words, a cultural approach to public health was not utilized. If the Navy physician had interacted with the town’s public health officials (which she and the rest of the crew oddly did not), then maybe she might have realized that the cultural and community-centric approach to public health, pioneered by Charles Wagley and SESP in Gurupá, is a major reason for the overall health status of the community. Yet, in the mid-2000s health care resources and professionals are unevenly distributed in the region with only about 17,000 doctors for over 14 million inhabitants. This is seven times lower than the ratio of doctors to inhabitants in other areas of Brazil, such as the city of São Paulo (Paixão, et al. 2009). As I discuss in Chapter 6, at the end of its construction, the Belo Monte Dam poses a threat of unleashing floods of unemployed migrants into towns like Gurupá. The hospitals in the city of Altamira have already been overrun by the influx of people migrating to work on the dam (Leite, et al. 2013). If care is not taken to tend to the health needs of the migrant population as well as the host communities where they will end up, as it was in the time of SESP with the rubber tapper population, then the population health and the already strained hospital resources will be severely impacted.

A valuable comparative study in the region conducted by Schmink and Wood (1992) offers insight into how populations deal with large-scale projects, in this case the construction of the PA-279 state highway. Schmink and Wood focused in part on the small rural town of São Felix do Xingu. As a result of highway construction, rapid urbanization occurred when rural to urban migrants sought new opportunities away from the traditional extractive activities and the aviamento system (an exploitative system of debt-credit). With the influx of migrants into the town came increases in crime, violence,
and prostitution. The local fishing based economy was also experiencing changes due to pollutants from nearby mining projects which drastically decreased fish stocks. In addition to pollution, São Felix also felt the pressures from other fishing towns and tourists fishing for sport, which further decreased the fish population. Food variety and consumption also decreased during this time. Schmink and Wood showed a drop of 68 percent of the total number of foods, especially fruits and vegetables, consumed within a 2-year span. Families experienced hunger due to their lack of income and the increased commercialization of food. The main health problems at this time included malnutrition and malaria, the latter tied to increased breeding grounds for mosquitoes due to the mining projects. Health services did improve during this time, but the quality of life declined.

Those working in the public health sector in Gurupá are overwhelmed by the task at hand, trying to keep a politically ignored, economically weak, and impoverished (by Southern Brazil’s standards) community healthy. Now even more uncertainty has entered the arena with the political mayhem following the impeachment of President Dilma Rousseff in 2016 and the certain reductions in important programs like the Bolsa Família. Although Dilma is also responsible for pushing the Belo Monte Dam project through without proper environmental and social impact analyses, the community fears that with her gone much needed financial assistance will disappear as well. Bolsa Família is a conditional cash transfer program run by the Social Development Ministry that was implemented in October of 2003 in order to help condense all of the previous conditional cash transfer programs into one entity (Soares 2012). The total household income and the number of children in the family determine the benefits that each family receives in
addition to the available government budget. According to the Social Development Ministry’s website (Desenvolvimento Social e Agrário 2015), in September of 2015 there were over 13 million families receiving the Bolsa Familia. In Gurupá the majority of the population is receiving some sort of aid from the Bolsa and they would take a large economic hit if the program disappeared.

This political-economic change, when combined with many other potential changes stemming from the Belo Monte Dam, is just the beginning of a complex chain of events with multiple facets and outcomes. Each impact that reaches Gurupá will have its own ripple effect throughout the public health system, likely triggering, and worsening other impacts.
As summarized in Chapter Four (methods), quantitative data for this project come from official Brazilian census and local health databases as well as two surveys (n=100) administered simultaneously in the community of Gurupá. The surveys include one on perceptions of local public and personal health and a second on food consumption frequencies. In the paragraphs that follow I will discuss the survey demographics and compare the data we collected to the census data in terms of representativeness, then proceed on to discuss some of the findings of the surveys.

**Survey Data: Basic Demographics**

The sampled population for the health surveys and food frequencies questionnaires include community members from 17 years old to 74 years old. The mean age for the sample is 33 years old, which is slightly older than the 15-19 year old age that is the average for the municipality according to the Brazilian census (See Fig. 6.1). However, when children younger than 15 are excluded to match my sampling criteria then the average age from the census falls into the 30-34 years old (IBGE 2016). Figure 6.2 is the information taken from the Brazilian Census of 2010 (IBGE 2016).
The next question on the survey dealt with gender distribution. It was our intention to get an equal distribution of women and men to answer the survey. However, we found that women were more often home and more willing to answer the survey questions as you can see in Figure 6.3. The population count in Gurupá for the 2010
census according to IBGE (2016) consisted of 4,789 males (49.9 percent) to 4,791 females (50.1 percent). The sample size for this study consisted of 41 male and 59 female heads of households. The head of the household was self-identified as such and was a way for the study to identify one adult male and female who would know the most about the family including the questions about the children living in the household.

![Gender Distribution for Sample (n=100)](image)

Figure 6.3 Gender Distribution for Sample (n=100)

As shown in Figure 6.4 below, over 50 percent of the people whom we surveyed declare that they live with their partner, but are not married. There are several reasons for this. One, according to key consultants, is the rather extensive preparation called Pre-Cana, required to get married through the Catholic Church. This process is strictly enforced by the resident priest and involves a substantial time commitment to church activities in the year preceding the ceremony (during a mass in the interior I attended the priest remarked, “Getting the young people into the church to get married should be one of the top priorities for the community”). For those living in the rural countryside, the infrequent visitation by the priest (sometimes only once a year) can also delay or negate
the possibility of an official wedding. In addition, there are the typical costs associated with getting married (wedding and reception) which many in Gurupá cannot, or do not, want to pay. A final factor is that an official marriage is just not considered that important for many people (see Wagley 2014:168-178 for similar observations in the 1940s).

![Civil Status](image)

Figure 6.4 Civil Status of Sample (n=100)

One example demonstrating these problems occurred during my time in the field. We were invited to a group wedding in the interior of Gurupá. The location was a small community of houses off of a tributary of the Amazon River. Before the ceremony I spoke with one of the young couples about their upcoming nuptials. One groom reported, “Well we are already married in our eyes. We have a daughter and a son together, but since the priest doesn’t come very often to our community we might as well get married in the church [meaning the group ceremony].” That day three different couples were married and a handful of baptisms were performed since the next time the priest would be back that far into the rural interior was unknown.
The next two figures (6.5 and 6.6) show the birthplace of the survey respondent as well as their parents’ birthplace. The responses to these questions indicate some families’ longevity in the community, as well as the migration patterns from big cities or small interior towns to Gurupá. As one resident stated about migration, “The town of Gurupá is where you come when you live in the interior and want access to city conveniences like electricity and a wider variety of food. I heard once that one young lady was tired of fish and wanted to move to the city to have more access to meat.” Another newly immigrated man 23 years old stated that, “My family wanted to give me better access to schools and job opportunities. I now work in the Department of Education.”

![Birth Place](image)

Figure 6.5 Place of Birth for Sample (n=87)
Over half of the survey sample was born in Gurupá with most others born in interior rural areas near Gurupá, but within the municipality. Fewer were born in Belém, Breves, and other big cities. As per the inclusion criteria, all of the participants in the survey had lived in Gurupá for over 1 year. Figure 6.6 is the distribution of their parents’ birthplace, which indicates how long families have been in the area. As shown above, over half of the parents were born in Gurupá or the rural areas surrounding Gurupá in the same municipality. The respondents not only have lived in Gurupá for many years, but also have family roots in the area. Very few were from other big cities and no mothers were born in Belém. This shows that rural and urban Gurupá have had a stable population over the past few generations. José, an elder man in his 70s from town, for example, reported he could trace Gurupá’s history back to colonization. He told me, “When the Portuguese came to colonize Gurupá they killed most of the indigenous men and married the women. Most people in Gurupá have Portuguese and indigenous blood. In fact, my great grandfather was Portuguese and my great grandmother was indigenous.”
We also asked if families owned an additional house—a question designed to solicit information on seasonal or repeated migration patterns between the rural interior of Gurupá and the city. Only four percent of the survey sample answered that they own another residence in the interior. For example, Igor age 23, stated, “My family has a farm in the interior, but they wanted me to move to the city so I can build a little store to sell items and make a little bit more money on the side. I go back and forth often.” Fifty seven percent of the survey sample reported having only one residence, while thirty nine percent declined to answer.

Despite the low numbers in the survey, observations made on the outskirts of town showed many homes in various stages of completion. When asking key consultants about the houses, they reported that people from the interior build them to stay in town during festival time; otherwise they are left vacant. For example, Rafael age 50 commented, “Usually around the festival time (São Benedito Festival in December) we have so many people coming from out of town and so many family members coming in from the interior that all of the hotels are booked up and there is nowhere to stay! People have even started to build houses to stay in when they come for the festival.” The survey sample did not capture this pattern, largely due to the fact that no one was at home in these “festival homes” during the survey visit which was conducted at a non-festival time.

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>57 percent</td>
</tr>
<tr>
<td>Yes</td>
<td>4 percent</td>
</tr>
</tbody>
</table>
To understand the socioeconomic lifestyle of the survey respondents, questions about their principal occupation, monthly income, and perceived class status are included (see table 5 and figures 6.7 – 6.8). This information helps indicate what types of jobs are offered in Gurupá as well as what the typical earning power is for the population. The Brazilian Statistical Public Opinion Research Institute has a set of criteria to determine a family or person’s social class. It is based upon the level of disposable income retained after one’s basic needs are met. Based on this assessment Gurupá’s population is comprised of 95 percent of the population in either the higher or lower working class, with about 26 percent in the lower working class in abject poverty (R. Pace and Hinote 2014).

Table 5. Principal Occupation for Sample (n=100)

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative &amp; Clerical</td>
<td>20</td>
</tr>
<tr>
<td>Domestic Work/ Vocational</td>
<td>19</td>
</tr>
<tr>
<td>Housewife</td>
<td>15</td>
</tr>
<tr>
<td>Government</td>
<td>8</td>
</tr>
<tr>
<td>Healthcare</td>
<td>7</td>
</tr>
<tr>
<td>No Work</td>
<td>6</td>
</tr>
<tr>
<td>Small Business Owner/Employee</td>
<td>6</td>
</tr>
<tr>
<td>Education</td>
<td>4</td>
</tr>
<tr>
<td>Taxi Driver</td>
<td>3</td>
</tr>
<tr>
<td>Agriculture</td>
<td>2</td>
</tr>
<tr>
<td>Retired</td>
<td>2</td>
</tr>
<tr>
<td>Guard</td>
<td>2</td>
</tr>
<tr>
<td>Community Radio</td>
<td>1</td>
</tr>
<tr>
<td>No Answer</td>
<td>5</td>
</tr>
</tbody>
</table>
As shown in Figure 6.7, the people of Gurupá on average earn $678 reais (SD=511.93) per month (approximately $217.52 at the current exchange rate of R$3.12 to the US$1). Looking at Table 6, those working in administration along with vocational
jobs, such as carpentry, make up nearly 40 percent of the study sample. The third most
common occupation in the sample is a housewife. When combined with the six percent of
the sample who replied “no work” that leaves over 20 percent of the sample with no
income, meaning that they work in the home. This may influence the fact that even
though the cost of living is not very high in town, most people self-identified as “poor”
on the survey (approximately 70 percent) shown by the class distribution in Figure 6.8.
Many families still need the government welfare program, Bolsa Familia, to cover their
day-to-day expenses with 180 Reais per family per month, which is about US $55
(Illingworth 2016).

Those who move into Gurupá from the interior are generally from populations of
low socioeconomic status. In most cases they find or build houses on the freely available
land farthest from the river. Many have poor sanitation since latrines are built upon
stagnant water. The common practice in the interior is to construct a latrine over flowing
water, which disperses the waste. This does not work in town as places available for
construction are typically over stagnant water and waste does not wash away.

In terms of access to education, as Gurupá grows it has added more schools to the
city from kindergarten through 11th grade, since high schools in Brazil end a year earlier
than in the United States. From our survey results, 20 percent of the population
completed elementary school and 50 percent completed high school education. They
could read or write to some degree, although as indicated earlier, many could not
comfortably write out the answers to this survey necessitating the interview schedule
format. Each head of household was asked if they would like to complete the interview
schedule. Upon consent, they were asked if they preferred the questions read aloud. Only

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two of the 100 participants chose to review the survey questions on their own. Although more time consuming, this format allowed for more opportunities to have a conversation about the interview questions and open ended responses.

In addition to the K-11, the Federal University of Pará, located in the city of Belém, has experimented with offering a couple of undergraduate degrees taught over an extended period of time in Gurupá. The community now boasts several scores of residents (four percent of the sample from Table 6) with undergraduate degrees in pedagogy, computer science, sociology, and fine arts.

Table 6. Education Level (n=96)

<table>
<thead>
<tr>
<th>Level Completed</th>
<th>Percentage (n=100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No School</td>
<td>4.1</td>
</tr>
<tr>
<td>Elementary</td>
<td>20.8</td>
</tr>
<tr>
<td>Middle School</td>
<td>18.8</td>
</tr>
<tr>
<td>High School</td>
<td>50.0</td>
</tr>
<tr>
<td>University</td>
<td>4.2</td>
</tr>
<tr>
<td>Vocational Training</td>
<td>2.1</td>
</tr>
</tbody>
</table>

A majority of the overall sample in Gurupá has been able to complete their studies through high school and is able to read and write to some degree. The amount of students going on to the university level is still low as it requires moving away from family in Gurupá and living in a much bigger city of Belém, where it becomes much more expense to live. If students do make it out to study at the university it then becomes highly unlikely that they will return to Gurupá with their expertise because Gurupá cannot offer competitive wages. This was expressed to me by a student home for winter break.

“I really would love to come back and work as a nutritionist in Gurupá, but there are no jobs for me here. The only thing I can do is work in a school and they will not pay me very much. I will have better luck going to a bigger city even though I love it here.” –Student, age 19.

This seems to be a problem especially in the healthcare field. Not being able to earn
competitive wages causes those few medical students who would want to come back to practice in Brazil to not be able to do so, which means that foreign doctors with no ties to the community will have to keep coming in to fill these voids.

**Health Status**

For a brief look at how the town of Gurupá is faring compared to some of the other cities in the area refer to the figures below. Figure 6.9 gives a general idea of the population of the towns surrounding Gurupá. The cities are arranged from left to right with Senador José Porfirio being the closest town to Belo Monte, Porto de Moz about mid-point between Belo Monte and Gurupá, and the town of Afuá the farthest away from the dam. Although their towns differ in size, they have many of the same resources and environment as Gurupá.

![Population as of 2010](image)

Figure 6.9 Population of Cities in the Amazon Basin. Source: IBGE 2010
The following graph shows the rates of infant mortality along with childhood diarrhea hospitalizations in the respective cities. Keep in mind this information was collected in 2010, the year before the construction of Belo Monte began. Gurupá is faring much better than Senador Jose Porfírio and Porto de Moz in infant mortality and about the same with Afuá. This may be due to the fact that, according to a previous interview I had with a visiting doctor, Gurupá has better family planning services. Diarrhea hospitalizations are also low compared to the other cities except for Porto de Moz. This is likely due to the infrastructure in the towns as shown in the next Figure 6.10.

Figure 6.10 Rates of Infant Mortality and Diarrhea. Source: IBGE 2010
The figure below compares the percentage of the population with access to adequate sewage. In this respect Senador Jose Porfilio and Porto de Moz both have a higher percentage of people with proper sanitation, although the highest number is still only about 11%. This may be one of the indicators as to why Porto de Moz has much lower rates of diarrhea hospitalizations than Gurupá.

![Bar chart showing percent of population with adequate sewage](image)

Figure 6.11 Percent of Population with Adequate Sewage. Source: IBGE 2010

Compared to the towns that surround Gurupá it has been doing relatively well in population health. Although the health statistics in the Amazon are lower than Brazilian national standards and much lower than global standards, the people of Gurupá are surviving and gradually even improving throughout the years in certain areas (doctor to patient ratio, better transportation for medicine and more variety of food, continual focus on public health campaigns).

To begin the health survey portion of my research I wanted to know what the
local perception of health was for the residents of Gurupá. The survey included a series of questions about the health status and recent illnesses of the participants. Figure 6.12 lists the responses to the rating of people’s current health status. On a scale starting with 0 meaning very bad to 4 meaning excellent, we found the following views.

![Current Health](image)

Figure 6.12 Self proclaimed health status for sample (n=100)

When asked about their current health status 82% of respondents were feeling good, very good, or excellent with 70% in the good range. Only about 18% of respondents felt that their health was bad or very bad. Those in the bad category were usually older and had one or more chronic health problems. One man, in particular answered that his health was bad because, “I work with manioc and acai, working on the farm and in the forest is hard and my body often hurts because of this.”

The majority of the sample did classify their health as good because at the time of the survey they were not sick. There might have been times at peak cold and flu season that might have affected these answers, but for the most part if they are not in the hospital their health is good.
Approximately 83 percent of the respondents saw their health as the same, a little better, or much better than the previous year. This means that although access to medicines and to healthcare services are, in general, problematic for most (as discussed earlier), over half of those surveyed felt their health to be equal or better than last year. In part this may be reflective of preventative health practices that are being utilized in Gurupá. Less people need to go to the doctor, hospital, or take medicine due to healthy behaviors. Gurupá has always fared better in community health than those in surrounding towns of the same size due to a better economy, better diet, and a lack of malaria, to name a few reasons.

Figures 6.14 and 6.15 below refer to the question on the survey about illnesses the respondent has had over the previous year and any illnesses children in the household
have during the same time period. These are self-reported and may include some illness that were not reported by the hospital if survey respondents self-medicated.

*Seventeen percent of the sample population responded that they had not had any illnesses in the past year.

Figure 6.14 Illnesses in the Past Year (n=46)

Figure 6.15 Child Illnesses in the Past Year (n=23)
Seventy two percent of the survey respondents responded they were not ill or did not recall any illness. Among the illnesses reported, the most common ones were food poisoning, colds, and flu. From the conversations with key consultants, it is very likely that the illness rates are greatly underreported because most people do not view a common cold, seasonal flu or even food poisoning as being a reportable illness. These illnesses are more likely to be treated with home remedies instead of requiring a trip to the hospital and are therefore more forgettable.

For example, in Gurupá the rainy season (December through May) is the peak period for “gripe,” or common cold. It is a frequent topic of conversation in town whenever the days are especially rainy, slightly chillier, or cloudier than normal. The phrase, “que chuva!” or “what rain!” often precedes an in depth conversation about the gripe to come. Over breakfast one morning I recorded André (a 60 year old local merchant) commenting about the weather. He said, “There is so much rain right now. That means the gripe is coming. I heard the guy up the street got it and it was really bad this year. It always comes around, but it seems to affect people a lot harder now.”

Food poisoning tends to happen quite frequently as well. A conversation with my research assistant, a newly hired data analyst at the hospital, revealed that there are much higher rates of intestinal parasites in the population than there had ever been recorded by the hospital in previous years. My hypothesis is that this has to do with declining water quality in Gurupá. In fact, during one of my summer trips to Gurupá in 2012 there was a community meeting of many of the villages of the interior to discuss why rates of childhood dysentery seemed to be on the rise. One of the leaders of the meeting stated, “I believe that the waste from the construction of the Belo Monte Dam (which began the
year earlier in 2011) gets into the river and goes downstream to contaminate our water. This is why all of our children are getting sick more often. Someone needs to do something about this.”

The health officials in Gurupá also noticed a difference in the city. João, age 30, who works as a nurse, stated, “There are people here that just don’t know about sanitation. Especially the people who move from the interior think that they can live like they did out there, but being in the city is different and this is what we need to teach them to reduce the rates of dysentery in children.” João went on to talk about infrastructure and water sanitation in the city stating that the farther away you live from the town center the harder it is for you to get resources. There are even some areas that have no electricity lines because no one has cared to go out there and put more up. The water provided from the town’s well runs out and people are left without water for a period of time.

The response to the rates of child illnesses for the previous year was very low with only a handful of responses. Although I have seen many children get sick in Gurupá during my visits, I have observed that parents usually just let it run its course and chose to medicate their children with home remedies. The fact that the children did not need to go to the doctor may have led the survey respondents to exclude these types of illnesses when asked on the survey. Out of the other 23 percent of respondents, allergies were the most common illness. This is interesting, as I have not seen a category for allergy-induced illnesses (besides asthma) in the health data from the Secretary of Health. This may be due to the fact that allergies are a new diagnosis and have otherwise been classified as a cold or flu. This would be an interesting area for further inquiry.
The following two figures, Figures 6.16 and 6.17, show the answers to questions about health behaviors. Smoking and alcohol intake, of course, are clearly linked to heart disease, lung disease and cancer (Centers for Disease Control and Prevention 2015; American Heart Association 2016; National Institutes for Health 2017).

Figure 6.16 Percentage of Smokers for Sample and Frequency (n=100, n=14)

The results of the survey indicate that an overwhelming majority of survey takers (80 percent) answered that they do not smoke. Of the 18 percent that answered yes, 58 percent reported smoking 5 to 10 cigarettes a day. An analysis of the survey data also revealed that there were twice as many male smokers (12 of the 18) to female smokers (6 of the 18).
As for drinking alcohol, the population is close to a split down the middle with 44 percent responding that they do drink alcohol and 53 percent responding no. Of the 44 percent that answered yes, 74 percent only have 1 to 2 drinks a month and 5 percent have 12 or more per month (with 3 percent answering that they drink every day). All of the males responded to this question with 31 out of the 41 total answering yes, whereas 56 (total 59) women responded with 13 of them answering yes. In Gurupá it is much more acceptable for a male to go out to the bars and drink publically than for women to do so. Women’s drinking will usually occur during a festival or other event such as a wedding. It is worth noting that drinking and violence have been areas of concern with the community. Some worry that there are too many bars and young men are spending too much time there. However, my sample does not show any alarming trends towards an epidemic of alcohol abuse. This is not to say, however, that it should not be considered as a future impact in the public health of the community.
Perceptions of Health Care

Since many of the successful public health campaigns in the past have benefitted from strong community involvement, it is important to understand the population’s views on community health and their opinions on the health care system in general. To understand the view of health from a local, folk, or insider (emic) perspective I include the following open-ended questions about the health care system in Gurupá. These questions are designed to answer my research questions from Phase 1 of the study. I wanted to know how community members view their current health status and what they identify as the community’s most challenging health problems. I also wanted to know what they thought of the health care system and collect some of their personal stories about navigating this system when faced with an illness. Finally, these questions are also meant to capture the sample’s general opinion on the Belo Monte Dam and how (or if) they see their health or health care changing in the coming years.

Table 7. What do you think is good about the health system in Gurupá?*

<table>
<thead>
<tr>
<th>Answer</th>
<th>Percent of Respondents who cited each item (n=100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nothing Good</td>
<td>38.9</td>
</tr>
<tr>
<td>Patient Care</td>
<td>18.1</td>
</tr>
<tr>
<td>It is good, but needs improvement</td>
<td>19.4</td>
</tr>
<tr>
<td>Dentist/Doctors</td>
<td>22.3</td>
</tr>
<tr>
<td>X-Ray machine</td>
<td>1.4</td>
</tr>
<tr>
<td>It is close by</td>
<td>1.4</td>
</tr>
</tbody>
</table>
Tables 8 and 9 indicate local views on what is good and bad about the local health care system. In terms of positive views listed on Table 8, a little over 22 percent of the sample appreciate that the community has doctors and dentists (many surrounding areas still lack professional health care providers), around 18 percent like the patient care they receive, and just over 19 percent acknowledged health care is positive, but still needs improvement. However, nearly 40 percent answered that nothing is good about the systems. Representative of these negative views are the following comments expressed during interviews. “Almost nothing is good. The health of the municipality is horrible. They don’t have specialists or essential tests for screenings of diseases” – Female, age 33. “It has been a joke. I don’t think anything has been good. I hope that it gets better in the future.” – Male, age 21.

Table 9 lists the problems people perceive in the health care system. Over half of the survey responses declare that the major health issues in Gurupá are a lack of medicine and resources. It is common knowledge within the community that when the hospital is
low on medicines, it takes a long time to get more shipped in from Belém. This has been an ongoing issue for Gurupá and one that stems from the amount of state and national funding that is allocated for these purposes. This creates a difficult situation when it is the national government that determines the budget for healthcare and is the same entity that is deciding on development projects that will have adverse health effects for communities.

The doctors in Gurupá appeared to be seen as both good and bad components of the healthcare system. It seems that the quantity of doctors is an improvement, four more doctors as opposed to just the two that had originally practiced there.

“The healthcare system is average. We have doctors and nurses and people who help us” Female, age 20.

“In terms of patient care the professionals do not let a single patient go without being seen” – Female, age 33.

However, these doctors still cannot cover the entire municipality, so there may be times and places that a doctor is unavailable. The quality of doctor-patient interaction is another issue as noted by the poor patient care responses. As stated in the qualitative section earlier, there is a sentiment that the doctors patronize or are dismissive of patients, which seems to be reflective in the views of the survey respondents as well.

“In Gurupá there is no priority for children, pregnant women and the elderly. They don’t have medicine at the hospital and many times we are treated with ignorance by the health professionals” – Female, age 24.

“In my opinion we need a hospital that does not have prejudice against the patients and that have all of the medicine that are necessary for the population” – Female, age unknown.

“Some of the medical professionals do not know us and treat the patients with like they are ignorant because of their social status” – Male, age 23.
Each survey respondent was asked what the most serious diseases in Gurupá are in order to obtain a better understanding of what the community perceives to be important health issues. Figure 6.18 shows the percentage of community members who mentioned one of these diseases.

**Figure 6.18 Serious Disease Identified by the Sample (n=100)**

Most people who answered the question did not choose just one disease, but instead put several that they thought affected the town. Approximately 21 percent of those surveyed responded specifically with the pairing of AIDS and Dengue as two of the most serious diseases in Gurupá at the current moment. Below is the information gathered from the hospital records presented in Chapter 5; it is clear that AIDS has increased from 2012-2014 going from a prevalence of 3 known cases to 17 cases. Dengue has also been high with many of the individuals that were being interviewed knowing at least one person who had suffered from this disease.
Table 9. Individuals with Reportable Diseases 2012-2014

<table>
<thead>
<tr>
<th></th>
<th>Number of (new) cases 2012</th>
<th>Number of (new) cases 2013</th>
<th>Number of (new) cases 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dengue</td>
<td>19</td>
<td>N/A</td>
<td>14</td>
</tr>
<tr>
<td>AIDS</td>
<td>3</td>
<td>7</td>
<td>17</td>
</tr>
</tbody>
</table>

**Women’s Health Questions**

The following questions focus on the women taking the survey. Modeled after Hilton da Silva’s health survey (see appendix C), the questions take a snapshot of women’s health in Gurupá, which, according to the Navy Gynecologist I interviewed in 2009 (see Chapter 4), is better than other surrounding communities (C. Pace 2009).

![Number of Pregnancies](image)

Figure 6.19 Number of Pregnancies for Sample (n=53)

There were 59 women in this sample, 49 of which answered the question on how many pregnancies they have had. The majority of women (72 percent) had between one
to three pregnancies. From this data it seems that the number of women having large numbers of children is low. Three of the women who took the survey were currently pregnant and seven were currently breastfeeding.

It is important to note the method and location of childbirth as this gives some indication to the resources and trust in the health care system (Otis and Brett 2008; Kyumuhendo 2003; Bazzano et al. 2008). If women were having their babies at home more often, even when the hospital is near and available, then that could mean there is a disconnect between the mother and her trust in the hospital.

![Type of Birth](image1)
![Location of Birth](image2)

Figure 6.20 Method of Birth and Location (n=49, n=45)

Eighty percent of the women who had had children had a natural birth. As resources are scarce, C-Sections are usually not the preferred method of childbirth. During my most recent visit to Gurupá in 2017 one of my good friends had a family member go to the hospital to begin an induced labor only to be turned away because there was no running water in the hospital. Women with more complicated pregnancies are usually sent to Belém or Breves, which can be a very expensive endeavor. Even though the hospital lacks resources, it is still the preferred place for childbirth. Only 13 percent
of women have had home births.

Another way to determine the level of women’s health available is asking about prenatal care. Women both need to know it exists and also follow through with appointments in order to achieve the full health benefits it provides during pregnancy.

![Figure 6.21 Did you have Prenatal Care and how many times? (n=51, n=33)]

Although the percentage of women who had some sort of prenatal care is high (84 percent), about a quarter of them only went 1 to 3 times during pregnancy.

Finally, women must have access to cervical cancer screenings as a priority for women’s health (Landy et al. 2016). The municipality has made an effort to boost the number of women who receive screenings by creating an entire day in which the health posts are dedicated to women’s health issues as well as encouraging free screenings with workshops held in town.
Cancer came up in about 4 percent of the survey responses as a serious illness that Gurupá faces. Conversations with those working as technicians for the hospital revealed that cancer screenlings are difficult to provide due to the lack of resources. There are times, however, when Navy medical ships or other traveling physicians make it to Gurupá to perform these exams, or during women’s health conferences for the entire municipality. This could be a contributing factor to the 70 percent of women who have had a screening.

**Views on Health and the Belo Monte Dam**

Those on the forefront of public health in Gurupá whom I interviewed were honest in reporting that they just did not know what the impacts of the Belo Monte Dam would be. The purpose of this research was to expand the knowledge base of the public health impacts of dams to better prepare the community for future implications of Belo Monte.
The question below helped me to gauge what people’s existing knowledge and views are on the Belo Monte Dam.

![Image](image.png)

Figure 6.23 Will there be Impacts from Belo Monte in Gurupá? (n=80)

When asked about the Belo Monte Dam, responses to this question seemed to downplay potential health impacts in Gurupá. About 60 percent said there will be no impacts and 40 percent said there will be impacts. The community members either follow the rhetoric that the government releases and believe the dam to be a good thing in the name of progress and development, or they are swayed by the non-profits and Catholic Church that Gurupá will see negative consequences such as environmental destruction and population displacement. From the survey data, those who believe there will be an impact overwhelmingly mention the impacts on the water quality and flow of the river, which in turn will affect the amount of fish available. Among the comments collected are the following.
“With the contamination of the river it will hurt the water quality, which will hurt our health” – Female, age 24.

“It is going to affect us directly through the ecosystem and diminishing our source of food for the rural and urban communities” – Female, age 26.

“The dam will have an impact on Gurupá because we are going to have a river without fish, shrimp, etcetera.” – Male, age 23.

**Food Frequency Questionnaire**

In Gurupá, the purpose of administering the food frequency questionnaire is to gauge what foods are currently available to the community and how much is available. Not only does this food snapshot allow future researchers to have a baseline record of foods available prior to the completion of the dam, but it will also allow for an analysis of where the nutrition trend is leading and provide information for further action. We administered a Food Frequency Questionnaire or FFQ to the same sample as the health survey. Below are lists of foods that we asked respondents to note how frequently they were consumed. The choices for frequency of consumption are: never, monthly, weekly, or daily. The tables that follow lists the responses that are one or more times a day, never, or on a weekly basis.

<table>
<thead>
<tr>
<th>Table 10. Foods Consumed 1 or more times a Day</th>
<th>Percentage of people who responded “one or more times a day” (n=100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>91.6</td>
</tr>
<tr>
<td>Coffee</td>
<td>90.7</td>
</tr>
<tr>
<td>Farinha (manioc flour)</td>
<td>86.0</td>
</tr>
<tr>
<td>Garlic</td>
<td>66.8</td>
</tr>
</tbody>
</table>
Table 10 Continued

<table>
<thead>
<tr>
<th>Food</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onion</td>
<td>60.5</td>
</tr>
<tr>
<td>Bread</td>
<td>60.3</td>
</tr>
<tr>
<td>Rice</td>
<td>56.6</td>
</tr>
<tr>
<td>Açaí</td>
<td>49.5</td>
</tr>
<tr>
<td>Tomato</td>
<td>49.4</td>
</tr>
<tr>
<td>Beans</td>
<td>32.3</td>
</tr>
</tbody>
</table>

Table 11. Foods Never Consumed

<table>
<thead>
<tr>
<th>Food</th>
<th>Percentage of people who responded “Never” (n=100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peanuts</td>
<td>92.6</td>
</tr>
<tr>
<td>Broccoli</td>
<td>89.9</td>
</tr>
<tr>
<td>Peaches</td>
<td>83.5</td>
</tr>
<tr>
<td>Tucumã (a local fruit)</td>
<td>77.9</td>
</tr>
<tr>
<td>Strawberries</td>
<td>76.5</td>
</tr>
<tr>
<td>Sugar Cane</td>
<td>72.4</td>
</tr>
<tr>
<td>Honey</td>
<td>68.2</td>
</tr>
<tr>
<td>Pears</td>
<td>65.1</td>
</tr>
<tr>
<td>Heart of Palm</td>
<td>61.4</td>
</tr>
<tr>
<td>Melon</td>
<td>55.3</td>
</tr>
</tbody>
</table>

Table 12. Foods Consumed on a Weekly Basis

<table>
<thead>
<tr>
<th>Food</th>
<th>Percentage of people who responded “1 or more times a week” (n=100)</th>
</tr>
</thead>
</table>

143
Using the tables above one could construct an average food consumption pattern for the survey sample. Foods like rice, farinha (manioc), sugar, and coffee are consumed by over half of the sample one or more times a day—making these foods the base of the diet. Coffee is consumed in the morning for breakfast, often in the afternoon, and may also be offered as a cafézinho, translating as “little coffee,” when going to visit friends and family. The cafézinho is offered in the form of a shot of espresso with nothing in it but sugar. In an interesting twist from this pattern, four out of the six key consultant family homes that I routinely visited served carbonated soft drinks instead of cafézinhos.

The meats and other proteins in this FFQ are consumed at least once a week when available. When meat is not consumed there might be pasta available or sometimes the meal may just consist of açai, farinha, and rice. In town, the most available meats are beef followed by chicken. Fish is not sold commercially. There are small markets around town

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Beef</td>
<td>76.5</td>
</tr>
<tr>
<td>Chicken</td>
<td>64.2</td>
</tr>
<tr>
<td>Fish</td>
<td>63.9</td>
</tr>
<tr>
<td>Spaghetti noodles</td>
<td>55.8</td>
</tr>
<tr>
<td>Potatoes</td>
<td>51.1</td>
</tr>
<tr>
<td>Eggs</td>
<td>50.0</td>
</tr>
<tr>
<td>Crackers</td>
<td>43.7</td>
</tr>
<tr>
<td>Banana</td>
<td>42.7</td>
</tr>
<tr>
<td>Cabbage</td>
<td>38.1</td>
</tr>
<tr>
<td>Tapioca</td>
<td>32.1</td>
</tr>
</tbody>
</table>
where local fishers sell their daily catch. There were times during my research in Gurupá when I could not order fish in the local restaurants because there had been very little sold at the market that day. The changing eco-system and the potential reduction of some fish species is something to be aware of when thinking of environmental impacts of the Belo Monte Dam and how they will affect the nutritional status of downstream communities.

A number of fruits, vegetables, and nuts are among the foods listed as never consumed. Native fruit consumption is lower than I anticipated. In part this may have been a factor of the seasonality of the fruits and timing of survey. But from observations over the years in various town markets, local fruits, beyond bananas and a few pineapples, are rarely sold. If households have fruit trees in their backyards, then consumption may increase. But it appears that for most people in the town, fruit is simply not a major part of the diet. The amount of vegetables and nuts consumed is also low. In large part this pattern is a result of the relatively high costs of these items since they are mostly imported from other regions.

**Conclusion**

The health and food frequency surveys provide this research project with baseline information about health care status in Gurupá as well as local views of the healthcare system between the years 2015 and 2017. Although the majority (70 percent) of people ranked themselves as poor and had serious criticisms of the healthcare system in Gurupá, most (again 70 percent) also rated their current health status as good. Therefore, although things could always be better, from the perspective of the local population as represented in the survey sample, the community of Gurupá seems to be fairly stable in terms of
That being said, very few (12 percent) rated their health as “very good” or “excellent” making the likelihood of a decline to “bad” or “very bad” health status a likely scenario in the event of a major change. This is a key concern surrounding the health impacts of the Belo Monte Dam.

In terms of women’s health, there are a number of campaigns by the hospital and the Catholic Church that are working hard to promote women’s health. There are workshops every month that bring women from all over Gurupá and the interior to talk about issues and get advice from the doctors. The abundance of doctors from Cuba, especially female doctors, means that once a week they are able to dedicate the entire day specifically to women and women’s health issues. The success is showing given that the majority of women are keeping up with their appointments to be screened for cervical cancer, are making regular appointments for prenatal care, and having their babies at the hospital. There still needs to be some work done on the rates of STIs, however, as the numbers of hepatitis and vaginal discharge syndrome are still pretty high in the community.

Table 13. Individuals with Reportable Diseases 2012-2014

<table>
<thead>
<tr>
<th></th>
<th>Number of (new) cases 2012</th>
<th>Number of (new) cases 2013</th>
<th>Number of (new) cases 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaginal discharge syndrome</td>
<td>114</td>
<td>71</td>
<td>69</td>
</tr>
<tr>
<td>Hepatitis virus</td>
<td>N/A</td>
<td>53</td>
<td>6</td>
</tr>
</tbody>
</table>

Finally, the food frequency questionnaire is a baseline look at the types and varieties of foods community members are eating every day. Although this is just a mere snapshot of a sample of Gurupá, it is nevertheless helpful to have a standard from which
to judge change in the future. Future research will be needed to assess the nutritional status of the community once the dam has been functioning for a considerable amount of time. It is also important to look at certain items that are being consumed multiple times a day, such as sugar, cookies, and cake. Epidemic rates of obesity are not an issue in Gurupá at the present time. The data gathered by R. Pace (1986) and Roe-Fehrman and C. Pace (2006) show the percentage of school-aged children with z-scores for weight for height as being +2 and above as 3.4 percent and 3.49 percent respectively. Having a z-score of +2 signifies that the child is overweight/obese and in 2006 there were very few (although more than in 1986) cases. Yet, for 2014 alone the hospital recorded 287 new cases of hypertension and approximately 74 new cases of diabetes among adults, which indicates that chronic diseases related to nutrition, and eating habits are likely on the rise for this area (SIAB 2014). For the entire results of the FFQ, please refer to Appendix B.

The next chapter will discuss the qualitative portion of this research in order to produce a holistic picture of life and health care in the town of Gurupá. The qualitative data collected gives thick descriptions of what it is like to live in Gurupá, what the belief systems are and how this is used to communicate with one another and create health narratives. The interviews give the community members, health officials and hospital employees a voice to put all of this data into context and will aid greatly in determining best practices moving forward from the impacts predicted from Belo Monte.
CHAPTER SEVEN:
QUALITATIVE RESULTS

This chapter describes the results of participant observation and informal interviews I conducted during fieldwork from 2015-2017. I was fortunate to rent a room from the Secretary of Health, on the second floor of his family home, which allowed me to interact with all types of health care workers who came to visit informally, or who rented rooms there as well. Despite the proximity, there were still challenges to interactions since most health care workers were constantly traveling throughout the municipality to deal with one health issue after another. This meant that the time for interactions, let alone questions, was always limited. Notwithstanding this, over the prolonged research stay I was able to piece together enough discourse and observations to examine the key health issues for the community, particularly the ones foremost on the minds of the health care workers. The main themes I encountered were: benefits of community cohesion; healthcare and outsiders; lack of structure and organization of the public health system; migration from the interior; and drugs and violence.

Community Cohesion

Reading through the anthropological literature on Gurupá, a prominent pattern emerges of long-term active community participation in the sharing of tasks and risks.
Whether it is through communal work parties (*mutirão* or *convite*), adoption of needy children (*filhos de criação*), creation of fictive kin networks (*compradesco*), or even supporting a local soccer club, a support network tying the community together is readily available (Wagley 2014; R Pace 1998). This interconnection is noticeable when you spend time in the town and realize that nearly everyone knows everyone else and carries out some sort of social interaction, often on a daily bases.

These social interactions create a high measure of community cohesion. Kearns and Forrest (2000) comment, “A Community’s social cohesion results from the positive effect that a strong sense of belonging, or attachment to a place and residents’ identities intertwining with that of the place, has on notions such as adherence to common values and norms, the salience of past experiences and common ideas and culture.” When a community is invested in itself as collective, initiatives for health programs, or other types of community based projects, will typically lead to more successful results. This has been the case time and again in Gurupá when the community has banded together to overcome adversity.

According to my consultants, the decade of the 1980s was a critical period shaping the current form of community cohesion.

I studied theology in school and became a community leader for the Catholic Church. I fought for the social movement with the church to make sure that people didn’t have patrãoes (land owners who kept the community members under a system of debt peonage) anymore and that they had the rights to the land that they worked and lived on. I consider myself a revolutionary. Myself and other community members worked together to kick out corrupt leaders. It was a great time for the community. We all worked together. –Antonio, age 70

The anthropological literature supports this as well (Oliveira 1991; R. Pace 1998). During the period at the end of the military dictatorship that brutally ruled Brazil from
1965-1985, a social movement to protest social and economic inequalities emerged under the auspices of the Catholic Church. Using Liberation Theology as a theological base, the town’s Italian priest worked with the local rural workers union to secure small farmers and resource extractors’ legal claims to land title. The local landowning elite resisted the movement through threat and intimidation, ultimately resorting to voter fraud to halt elections in the rural union. Following discovery of the fraud, members of the opposition occupied the union building until state legal authorities were called to the town. In the end the social movement was successful in obtaining legal title to land for thousands of ribeirinhos, and from this base launched a successful political party (*Partido do Trabalhadores* or Workers Party) that governed Gurupá until 2016.

The Church/Rural Union social movement organization has contributed greatly to the community’s cohesion. Public health workers have repeatedly used its structure and social networks to successfully implement programs. In fact, all of the health education meetings and health fairs that I attended during my stay in Gurupá were hosted at the church. These have included children’s rights groups and women’s health groups, which hold workshops every month to discuss poignant health issues within the municipality.

One such workshop I attended was the Women’s Health Group. Women who represented most of the communities from the rural interior and many women from the town attended the workshop. There were presentations given by the Cuban doctors, local physical therapists, and nurses on topics ranging from breast cancer, and HIV prevention, to how to raise a healthy child. After a full morning of presentations the women gathered into small groups to discuss other pressing issues and how to effectively use the knowledge they had just gained in their communities. Next door in another church
building the town’s medical professionals were holding a small health fair for the participants to get examined for women’s health issues. During the exams women received much-needed healthcare and information on sexually transmitted infections. According to the local health officials I talked with, these types of workshops are well attended and the information learned is then disseminated throughout the municipality. The health officials insisted that this system is the principal reason that Gurupá is faring relatively well in terms of healthcare overall, in comparison to neighboring municipalities.

The workshops are created to address health issues deemed relevant by the community members. The most impressive part of this system is the fact that it is the community members, not the health professionals, who propose the topics. Taking a look at the topics covered during my research time has provided me a perspective into what the perceived health issues were for the community. For example, during the women’s health workshop one of the topics that the women in the area wanted to know more about was breast cancer. The incidence and prevalence of breast cancer is very small in Gurupá, but the women were concerned that they did not know enough. Through the workshop they were given an opportunity to speak with the local doctors to have specific questions answered.

The workshop lasted a full weekend and covered many health questions that the doctors do not have time to answer during typical office consultations. For example, during the meeting an elderly woman seated in front of me, who had travelled far from another region of the municipality, raised her voice to ask whether it is better in terms of warding off breast cancer if women breast-feed a lot or a little. The doctor responded,
saying that breastfeeding a lot helps to ward off breast cancer, even though there are other factors involved as well. The woman seemed happy with this answer. I overheard her daughter ask if she understood the doctor and she said “of course.”

The question and answer portion went on for a little bit longer with women asking additional questions about how they could prevent breast cancer. Some women asked questions on behalf of the few men attending the workshop as well. Although the questions were serious in tone the women still found humor in the very public discussion. The doctor ended the question and answer portion with the statement...

Women should take care not to get breast cancer because these parts are very useful to babies to feed them and to your husband as well.

The room erupted in laughter with the men nodding in agreement while the women clapped their hands and giggled.

There were over 100 women and about a dozen men who came to the workshop. The volunteers for the workshop made nametags for each participant. There was a concession area for refreshments and a little stand to sell T-shirts printed with *Encontro de Mulher de Gurupá 2015* (Women’s Encounter of Gurupá 2015). The workshop coordinators paid particular attention to those living in the rural interior with limited access to healthcare. The church hall was decorated with banners from each of these communities to show support for those who made the long trip to learn more about health for themselves and for their families. During the first day roll call the women were asked to sing songs about their communities and communicate specifics about their communities’ health care challenges.
Among the speakers at the workshops was a government representative who spoke about the need for women to be more involved in politics. Following this, one of the doctors from the hospital announced the type of consultations they would be doing across the street that day. Next a psychologist from another city spoke on how to raise children effectively. Her first question to the audience was, “Is there a right way and a wrong way to raise a child?” The crowd answered that there was, but the psychologist replied that in reality there were no wrong ways to raise a child. She continued, everyone just does what he or she can with what they have.

The psychologists made several points during her talk. First, she said that parents must be attentive to their children and what is going on in their lives. For example, if João really hates school, gets low grades, and doesn’t want to go to school, then you can’t just tell him to go no matter what. Instead, she maintained, you should try and find out what is going on to make him feel this way. She told the women that the best resources they have in Gurupá are CRAS and CREAS (Social Assistance Reference Center and Specialized Reference Center for Social Assistance, respectively) if their children need assistance with mental and behavioral health. Otherwise the children will have to go to Belém to see a professional.

The psychologist covered more topics such as whether or not you should hit your children as a punishment. Her viewpoint was that the children only learn about violence when they grow up with spanking as their punishment. She said that violence does not solve anything and that violence only propagates more violence. Punishments have to be a learning tool and children cannot just be told that they did something wrong; they have to learn from their mistakes so that they understand and do not make the mistake again.
This comment stimulated discussion, with a definite generational difference. Many of the elderly community members with whom I spoke throughout my research cited the very lack of corporal punishment as part of the problem with the youth’s behavior.

The youth in Gurupá do not obey their parents anymore. They watch these telenovelas and they see how the children talk to their parents on the TV and they try to mimic this behavior. And now the parents cannot even hit their children to discipline them because they will go tell the Consultario Tutelar (equivalent of child protective services) and the parents get in trouble! Imagine that! – Eva, *housewife, age 70*

Another aspect of the women’s health encounter involved the women breaking up into small groups to discuss common health issues in their communities. They were encouraged to come up with viable solutions to these issues through community involvement. The women seemed to really enjoy this portion of the day and spoke at length about specific issues they were facing. Health representatives were going around to the groups so that they would be better able to understand the health issues that women faced in their respective community.

In addition to providing a space for the doctors and health professionals to offer presentations to the community, the Catholic Church also provided the space for the clinic to be held during this time. Women attended the presentations that they chose and then walked across the street to see one of the doctors for any problem or for a checkup. This was especially helpful for the many women coming from the rural interior who were unlikely to get these health services in their local health post. The mobile dentist van was parked across the street in front of where the Cuban doctors were doing consultations so women were able to get their oral health checked as well. Some of the technicians from the hospital and health posts were doing the triage portion of the clinic, which included
blood pressure, height, and weight measurements. When asked about the talks that had been going on at the workshop all the women in the waiting room agreed that the topics were very good this year.

The fact that these types of workshops exist for the community will be extremely beneficial for mitigating health impacts from the Belo Monte Dam. The community building that occurs during these workshops and the number of people that attend allows health officials to have a great platform from which to pass along important health information that will reach even the most rural parts of the municipality. It is also a great way to keep track of what kinds of health issues the communities are currently facing.

In another example of community cohesion, senior citizens in the town have an active social organization that has its principal activity once a week. The local physical therapist, which works extensively with the seniors, described the group.

About 40 or so of them have come together on their own to form a senior citizen group. Since they are so organized I was able to work with them very easily and plan group hikes out to Jacupi [nearby creek] to encourage physical activity. They all had lunch together afterwards and were able to get out and about for the day to remain active. Not to mention it was a lot of fun! – Beatrice, physical therapist, age 30

The group also holds weekly dances at 10:30 in the morning to encourage physical activity. They gather in the town’s event space and play the music loud as they dance and reminisce on times long passed. Sometimes there will even be a local band that will play for the group. Leaders of the group like to hold a raffle and give away little gifts to encourage participation as well. Strong community ties have been an advantage for a town like Gurupá throughout the years. However, there are changes that may come into play that could disintegrate the communal bonds, which I discuss in the following sections.
Health and Outsiders

The issue of health and outsiders came up in two different contexts in Gurupá. The first was the presence of foreign doctors and problems of cultural fit. The second, with greater long-term consequences, was the influx of migrants from other communities to Gurupá. Each case is discussed below.

Foreign Physicians

One morning as I was making my daily rounds to visit people, I decided to stop into the health post down at the end of 5th street. The health post is located farther inland from the river and hospital to ensure access to the poor communities. When I arrived, Fatima, the wife of the Secretary of Health who works at this post, invited me to come in and tour the facilities. Although quite sparse in terms of equipment and even furniture, the health post offers essential services to community members since the hospital had changed its system. Now, all appointments are made through the health posts with primary care and smaller issues being dealt with by the doctors and techs at the post. I met with the doctor who had been placed in Gurupá as part of an international agreement between the Cuban and Brazilian governments to provide 400 doctors to rural areas of Brazil. Gurupá currently has four of those doctors working in several posts as well as the two Peruvian doctors that work in the hospital. The Cuban doctors’ contracts are a mandatory allotment of three years with a couple of breaks to return home for visits. Sometimes the doctors have a harder time adjusting to life in Gurupá especially if they are used to working in urban vs. rural areas. Many health issues seemed to be so trivial that is was difficult for them to understand why they kept occurring.
I observed the doctors interacting with patients on a couple of occasions. One by one they would come in with an issue and I would hear responses like, “Can you believe this woman still does something so silly as smoke?” or “This woman is so obese and she wonders why she has all of these health problems!” I watched the faces of the patients as recommendations were given in Portañol (Portuguese mixed with Spanish) like, “Well if your back is hurting then you don’t need to sleep in a hammock” and “You should always wear shoes in your house.” Some patients protested the recommendations with statements such as, “I work in the várzea [floodplain] all day and I can’t wear my muddy shoes inside my house” to which a reply was simply, “Well buy inside shoes.” The patients that I witnessed were often confused by what was trying to be communicated, but would usually nod their heads and agree because doctors are held in a position of authority with which you do not argue. On several occasions doctors would complete the diagnosis and ask if the patient had understood, to which the patient responded no. The doctors would then question why the patient did not ask questions earlier to which they responded; “You did not ask me earlier.” During conversations with community members about the foreign doctors in Gurupá I usually heard a lot of trepidation. Most times people laughed it off saying, “They speak funny and gave advice that does not really make sense.” – Lucia, age 38.

Not all of the doctors are problematic, however. Some are more accustomed to working in rural settings. The differences between these two types of physicians can be summed up with statements from doctors that I heard during my time in Gurupá.

I really want to make sure that people can understand my Portuguese. I know I have some pronunciation errors and I like to try and ask local community members how to correctly say things so I can remember for next time. – Doctor 1
On the other hand,

I don’t understand why people in Gurupá don’t speak Spanish. More people speak it in the world than do Portuguese. It should be a mandatory language to learn. I will probably never use Portuguese again when I am finished here. – Doctor 2

I heard many stories involving misunderstandings of the language and culture with the prospectus of a willingness to learn and improve from one doctor and a complete inability to step outside their own cultural views from another. One story involved a trip out to the interior when a doctor was recommending that a patient put “uma gota” or “one drop” of medicine in her eye. The patient did not understand what she was saying until finally with a lot of pantomime and the help from one of the patient’s daughters she finally figured it out using the colloquial term “pinga” or a drip.

I get so frustrated sometimes because I will be saying something perfectly fine in Portuguese and the older patients just cannot understand. Then all of a sudden their children repeat the exact same thing I said and that is when the patients understand! I am using the same words and they still do not understand. – Doctor

This view of the local community by outsiders is unfortunately common in the Brazilian Amazon, especially within the healthcare field. This was clear even in some of the healthcare professional’s interviews. An officer for child services spoke with me about both his professional and personal experiences with non-local doctors.

A man came to the office for help speaking with the hospital staff about the recent passing of his wife and baby during delivery. The man was being told two different stories from the nurse and from the doctor about what had happened with his wife. I went over to the hospital to speak directly with the doctor who seemed very inconvenienced by my questions. He spoke very harshly to me and said that it was not my business to which I replied, ‘It’s my job!’ The doctors here are always from somewhere else and they only stay for a certain amount of days and then leave. They don’t know the community. – César
The municipality of Gurupá does not receive much money from the state and national level to pay for their doctors. By urban Brazilian standards, the pay a doctor receives in a place like Gurupá is miniscule. The base paid is only about 40 thousand reis a year, or about US $13,000, although housing is included. For most Brazilian physicians the idea of working in a place so far away from family and for such low pay is prohibitive. In the case for the few Brazilian physicians who do take the job, they often negotiate a work schedule of 15 days in Gurupá followed by 15 days away (they usually return to Belém in their off time). The doctors become itinerant, which greatly affects the long-term sustainable health care for the town. The people of Gurupá understand that without a permanent presence the doctors have a falta de interes. The temporary nature of their employment creates a separation between doctor and patient.

As noted above, the doctors (particularly the foreign, but also the urban Brazilians) often do not understand the local or folk health views and behaviors of the community. Lacking this perspective, they frequently misunderstand patients’ responses. Adding in the definite social class differences between physician and patient, the result is that many physicians act in condescending ways to patients. This is a common theme I heard from the people of Gurupá when talking about the health care system. João, the former director of the hospital and one of the few certified nurses in Gurupá, acknowledges this, but has his own explanation for the cause.

The people do not want to listen to the doctors and they get angry with them because they try and tell them things to prevent illness. They [the patients] have the mindset of going to the doctor to get medicine and not a lesson on how to live a healthy life. I can also imagine the way some of the doctors are speaking to them that they are probably less inclined to listen as well.
The most common complaints coming from the local population stem from linguistic and cultural barriers. Views about foreign doctors and their poor fit have not changed much since the 1990s. However, according to my key consultants, there were a few doctors who were different and seemed genuinely interesting in learning about the community and working with the local population to improve community health problems. One of these doctors came to Gurupá from Cuba in the early 2000s and stayed for three years. When I asked several people around town about her they always had something positive to say. It seems she tried to interact with the community as much as possible and enjoyed being a part of community events. For example, Eva, an 80-year-old housewife that I interviewed remembered her fondly as she was very active in trying to teach the local community about the medicinal properties of the plants that grow in their backyards. Eva is from the interior and grew up knowing the local plants and how they are most commonly used for different ailments. She thought this was a great idea because it centered on community knowledge as a way to increase access to health resources that were already in people’s backyard, saving time and money. In many conversations I had I found the people of town spoke highly of this initiative not only because community members were treated as experts in the field, but also because they were called upon to pass the knowledge down to others and have an active role in the healthcare system.

Unfortunately, during her time in Gurupá the leadership changed and with a new mayor came a different outlook on healthcare. The government no longer supported the doctor’s take on the importance of local plants and preferred to focus on other initiatives. Eventually the doctor was met with so much governmental opposition that her superiors
decided that it would be better for her to move to another city. This caused some discord within the community. Whether or not linked directly to this event, the mayor at the time was not reelected for another term.

Migrant Influx

The Belo Monte Dam has already, and will continue to displace large numbers of people from their homes in Altamira. Gurupá’s Secretary of Health and the director of the hospital both pointed out to me that Gurupá is already a main stopping point for boats heading to and from bigger cities like Manaus, Belem, Santarém, Altamira, Breves and many more. They maintain that this could make the community an appealing place for the displaced to try and find a new home. They both emphasized that the city of Altamira is only about a 6-hour boat ride from Gurupá.

I made two trips to Altamira, once in 2012 when the dam construction was just under way and again during in 2015. In 2012 the attitude in the city among protestors of the dam seemed determinately defiant and optimistic. There were international organizations working with the indigenous groups and local communities to fight the construction of the dam every step of the way. International Rivers, Amazon Watch, and Instituto Socioambiental (ISA), to name a few, were all working together to organize protests in the community of Santo Antonio, the first community to be displaced. Over the next year these groups continued fighting hard to end the dam construction, but when I returned in 2015 all had given up save ISA. An employee explained that once it was apparent that the dam was going to be built all of the other organizations went on to protest dam projects in other places. ISA was left alone to mitigate the impacts of the
dam on the local community. Currently, the employee stated, ISA is fighting to force the construction consortium to fulfill its promises to the affected populations. He lamented that 70% of the dam had been completed and barely 30% of the promises to the communities had been fulfilled. In particular, housing that was supposed to be provided for relocating populations has yet to be provided. Coupled with the lack of basic sanitation and loss of jobs as the dam construction finishes, the potential for a large exodus of people from Altamira to places like Gurupá is high. The government organizations holding the energy consortium accountable say that they have yet to compensate the local community for the damages and losses incurred. An amount due of US$1 billion has barely been touched, and according to ISA, only 15% of the amount promised to protect indigenous lands has been spent. The results are great increases in illegal loggers invading indigenous lands (Sullivan 2016).

It is also plausible that people from Gurupá who go to work on the dam in Altamira will come back to Gurupá when they are sick. João put forth this hypothesis as he had already seen a couple of similar cases. He posits people return when sick probably due to the overcrowded hospitals in Altamira, as well as the desire to be with family in times of sickness. The movement of people back and forth to the dam construction site also leads to the possibility of disease transmission. One example is malaria, which does not occur in the municipality any more, but can be brought in from affected areas like Belo Monte.

The case of malaria is a key problem related to migration. The history of malaria prevention and the role of community cohesion in combating the disease goes back to the 1940s as described by Charles Wagley (2014) during his World War II efforts to boost
rubber production by combating the disease. For more recent times, I spoke with an older hospital technician about healthcare over the last three decades. She recounted that well into the 1990s many people were still contracting malaria. To once and for all deal with the problem, the Secretary of Health and the hospital created a surveillance system that extended through the different neighborhoods in both the town and rural interior.

Grouping by neighborhoods was already a familiar concept since the Catholic Church and Rural Union had already organized most of them during the last days of the military regime. These neighborhoods went on to sponsor neighborhood religious festivals for their community’s patron saint and even perform in quadrilhas (square dance) competitions and create floats for Carnival celebrations.

Building upon this structure, each neighborhood chose a community leader who would serve as a community health worker. This person received training from the hospital and Secretary of Health office. One of the tasks of the community health care worker was to find out if any members of the community had fallen ill from malaria. If so, the community health worker would alert the Secretary of Health who would then lead a team to spray the area to kill off the mosquito population as well as quarantine the infected individuals. In this way Gurupá relied heavily on support from the local community to encourage Public Health programs. Community health care workers were not only knowledgeable of their own neighborhoods, but they were able to disseminate information with ease. This created a sense of ownership in public health programs, which worked exceedingly well for malaria prevention. The hospital technician reminisced about this case and how successful it was when all members of the
community felt involved in taking responsibility for their own care as well as care for the neighborhood.

The community health worker program is still in place today, but the numbers of workers have decreased due to budget cuts. As a result, it is safe to assume that any increase in population due to migration will only create a wider gap for community participation in health programs. This, in fact, was a major concern expressed by regional public health officers who spoke at a health pre-conference held in Gurupá. The pre-conference was designed to determine the agenda for the general health meetings that would be open to the public the next month. The regional public health officers as well as the director of the hospital noted that Gurupá had been very successful with their public health campaigns, praising the child vaccination campaign, the eradication of endemic malaria for the past 9 years, and a much higher community health status than the surrounding towns. The official was empathetic that community health workers were essential to maintaining this high level of access to healthcare resources, but now the program was suffering from a lack of funding and training. The hospital employees added that now community health workers just go house to house completing questionnaires without knowing how to answer specific questions people have, identify potential health risks, or provide sound health advice. One hospital employee told me…

There will be times that I speak with the community worker about her visits. She will show me the completed survey and I will see that a pregnant woman responded that she has not had any pre-natal visits to the hospital. When I ask the community worker why she had not gone and if she gave her information about it she just replies that all she did was mark the answer and move on to the next house. – Teresa, hospital employee, mid-30s
The need for foreign doctors in Gurupá in recent years is largely due to an increasing population. Of the new Cuban doctors, some have been placed in the rural areas whereas the remainder, work in the town. The town, now over 10,000 people, has seen a slow but steady growth mainly from rural to urban migration from within the municipality. Lacking any industry, tourism, or commerce, Gurupá has developed infrastructure that is only slightly more complex than the average rural community. Yet, people continue to move to the town from smaller interior hamlets. I asked a couple that have lived in Gurupá for over 10 years why they thought people continue to leave the interior to seek town life.

I think that being in the interior is so isolated with limited amounts of electricity, nothing to do, no parties to attend, so they come to Gurupá looking for more things to do. If you ask them why they left the interior, however, they would tell you that they wanted their kids to get a better education. I’m not so sure about this though because most of the time these kids aren’t even in school but are out trying to make money for the family who moved here with nothing. – Henry, retired, Male, Age 70

This sentiment was echoed by César, an officer for child services, when asked about the most common issues he faces with adolescents in Gurupá.

There has been an increase of children moving from the interior to Gurupá trying to make money to send back to their families. Most of the time these children do not have any place to live or anyone looking after them. They end up on the street having to fend for themselves. – César

The hope of moving to Gurupá to make money for one’s family in the interior is the reason 22-year-old Igor ended up in town. We met at a town gathering after the arrival of the Bishop to Gurupá. Igor and his family came in from a small village so they could attend the rite of confirmation officiated by the Bishop, who was able to make this trip only once a year. As we spoke I found out that he intended to move in with a family
member on the outskirts of town, work as an office assistant for the Department of Education, and build a store so that his parents will have extra income. Igor’s family were cattle ranchers and did not feel that this livelihood would be lucrative enough to support everyone in the future, so they sent their son to Gurupá to work.

During my research I found this type of residential flexibility common. For example, during outings to the interior I would meet families whom I would then see back in the town of Gurupá quite often. They were always in town to visit family and attend events and to feel connected. The travel between interior tributaries and the town was so frequent in some cases that many people seemed to have just moved into their relatives’ houses. From the public health perspective, this type of mobility creates logistical problems since the official population count for a neighborhood, community, or the town may be one number, but the number of people actually seeking medical attention at the location is often much higher.

Life on the outskirts of town brought about other public health issues. For those living in the rural areas, one nurse said, sanitation means building a latrine downstream from the house so waste gets swept away by the river. When they move to the city, however, the land available for house construction is usually in swampy areas where water flow is limited. The migrants build their houses and latrines thinking of the rural pattern, but instead end up building latrines on water that is not free flowing. They wind up living above stagnant, polluted water. The nurse continued that this is a major health issue that the town has not yet addressed.

There is just not much education about how to stay healthy so people who live out in the outskirts of Gurupá continue to have uncovered water basins and do not properly dispose of waste. There are actually more cases of childhood diarrhea in the city than in the interior. In the interior waste
mostly flows with the river, but in the city it is stagnant. Even things like washing your hands and putting chlorine tablets in the water are things that people don’t know about. – João, Certified Nurse, male, age 30

The population growth that Gurupá has experienced over the years has led to the construction of several new neighborhoods. The municipal government has struggled to provide these areas with roads, which are often in swampy areas and require considerable landfill so the roads are not inundated during the rainy season. The city is also responsible for providing electricity to all homes within the city limits.

While most of the newcomers build their own houses, in a few cases, using federal grants, the municipality has constructed government housing. The purpose of such housing is to contend with the migrant influx, although it is extremely uncommon to see any person living on the street in Gurupá. The housing units follow blueprints from other parts of Brazil and are not particularly well designed for the Amazon. While on a walk through the government-housing sector one day I spoke with a woman who had been living there for a couple of months. She explained what it was like to reside in one of these houses. Her major complaint was the distance from the town center. She commented that she had come from the interior and enjoyed living in Gurupá, but the houses were so far away from the grocery stores and town center. She, like most people coming from the interior does not have any means of transportation, besides a boat, and Gurupá has no public transportation. Walking 20 minutes to walk to get groceries or get to the health post creates considerable difficulty.

She continued with her concerns…

I live here with my sons and I am very grateful that these houses exist because I have just been staying with friends before I moved in to this house. I don’t like that there are no streetlights back here. All we have are
the lights in the houses and it is not enough to be able to see at night. It can be very scary back here away from the town. – 60-year old woman

I asked her why there were not any streetlights and she shrugged her shoulders and said it is probably due to lack of interest (falta de interes). She said they have asked the local government many times about getting lights put in, but so far nothing has happened.

Although the city of Gurupá does see many people coming back and forth from rural areas to the town, it is not prepared to have an increase in people moving from the interior and building houses. One of the impacts from the Belo Monte Dam includes changes to the environment, which could have devastating impacts on the rural community. The families that are dependent on fishing or flood plain farming will be impacted by the decrease in number of fish and the change in water flow caused by the dam. If the environmental impacts affect the livelihoods of those in the interior they will have little left to sustain them and be forced to move into the city to try and make a living. If provisions are not made to accommodate this increase in population there will be more inadequate housing and the potential for crowded areas to turn into public health disasters.

**Drugs and Violence**

Many Gurupenses believe that there has been an increase in drug use and violence in recent years. Although there has been no research to document the view, it seems everyone in town has an anecdotal case to give as proof. Those who are to blame for the increase, in nearly all cases, are people not originally from Gurupá. Many are said to be individuals migrating in from the interior. The common view in town is that these people
are unknowns to the local folk and thus possibly dangerous, as they have no friends or family to hold them accountable for their behavior. The perceived threat to safety is very high and something that community members have been worried about for some time.

An officer of child services told me in an interview that he was concerned about the amount of drugs that have begun to come into the town within the last 2 years.

Gurupá is a very strategic place and I think this is how the drugs have been getting here. Most of the boats on the river going to Breves, Belém, Santarém, Altamira or Manaus make a stop in Gurupá, which means people and drugs can get in and out of Gurupá relatively easy. Drug traffickers come here to sell drugs and the teenagers get access to them. – César

He also lamented that there were no programs or activities for the youth in Gurupá to keep them off the streets and out of trouble.

In another interview I asked Julia, a local schoolteacher in her early 40s, what she thought about the view that there is a lot more violence in Gurupá than in the past. She stated that she agreed with this view. She teaches philosophy at the local schools and she went on to tell me that she thinks that the kids in Gurupá are acting out and spending too much time on the streets doing bad things. Eva, a local hospital tech, informed me that she went to a workshop earlier in the year to learn about how to detect if your child is using drugs. She said that this information was very important because drug use has become such a big problem and she wants to gather all the information to bring back to Gurupá and educate the parents. Unfortunately, there have been no attempts to monitor drug use in any capacity so reports of increased use remain circumstantial. Nevertheless, the perceived threat of increased drug use in adolescents could continue on to create a breakdown in community cohesion and trust.
Most of the cases of violence in Gurupá I collected were reported to me through the typical platform for community news dispersion—town gossip. Every morning while eating breakfast at a local restaurant, the owner would sit down and talk with us about the stories he had heard around town. Many times these stories involved bar fights with knives and once even a gun. He said that most of these bars are located on the outskirts of town where there are less police and less people. Linda, the restaurant owner’s wife and main cook also informed us of many local stories. She even believed she had a close encounter with bank robbers from the neighboring town that had made national news.

Linda commented….

I was just watching the news the other night and I saw that the bank in Porto de Moz had been robbed. There were five or more suspects that went in and took all the money by gunpoint. Well do you know that there was a group of five that came into one of the hotels where I work sometimes as a housekeeper and they looked like the group who robbed the bank! So, I went up to them to ask where they were from and where they were going. They seemed to be very vague on the details so I was extremely suspicious. I told them to come to the restaurant and eat and I could clean their room while they did so that I could look around some more, but they didn’t even want to eat! They only stayed one night and then left. I am sure that those were the bank robbers! Can you believe it? Here in Gurupá! I tried to use the computer to find their names, but I couldn’t find anything. Things like this can be so dangerous for Gurupá. – Linda, female, age 70s

Since the beginning of the construction of the dam there have been more news stories involving violence in the Amazon. One serious concern has been the increase in river piracy. Since boat travel is by far the most common means of transportation throughout the Amazon, the rise of piracy has the potential to impact nearly everyone. From Gurupá there are daily boats to Altamira, nearly daily boats to Belém, and when there is a soccer tournament going on in the interior, there are smaller boats constantly
shuttling people back and forth. Most stories of piracy involved armed bands that raid cargo barges. On a few occasions there is a report of bandits robbing passengers on smaller boats. The usually take cell phones, watches, and money. The general consensus in the press and locally in Gurupá is that piracy has increased because of the increase in cargo runs to Altamira due to the dam construction. Commerce has increased, but policing of the river by the coast guard has not, so the pirates are left with easy prey.

        Closer to home, but still related to the Belo Monte Dam construction, the director of CRAS, Roberta, told me that she very worried about the social impacts that the dam will have on the community. She explained that CRAS is an agency that works preventatively to pick out vulnerable families who may have some sort of issue or disability where they require extra help from the government. Once the families are identified and once the specific issues are ascertained, CRES functions as a cover agency to find resources in whatever area is needed for the family. She stated that although she already sees domestic abuse and mistreatment of the elderly population in Gurupá, she thinks that these things will become much worse following the influx of migrants once the Belo Monte Dam is complete. She added…

        I have already heard of teenage girls leaving Gurupá to work as prostitutes in Altamira at the construction site of Belo Monte. I don’t think this is very common, but it is something to be aware of as we continue our work.  
– Roberta, CRAS Director, female, age 50s

        The fear of increases in crime and violence are not new among Gurupáenses. A study done by Pace and Hinote (2013), shows that the perception of danger in Gurupá has jumped from 76.8% of the population maintaining that Gurupá is not at all dangerous in 1986 to 80.2% believing that Gurupá is “more or less dangerous” in 2009 compared to a
meager 17.8% stating that it is not dangerous at all. Pace and Hinote posit that the increase in perceived fear of crime and violence come from an increase in media consumption. The nightly news is filled with stories of shootings, robberies and other crimes and although the stories tend to come out of big cities such as Rio or Belém people feel as though the world around them is also getting more dangerous. Indeed any mention of petty crime in Gurupá leads to a conversation on how dangerous Gurupá has gotten throughout the years. Yet, fear of increased crime and violence, still has an impact on stress levels and on community cohesion, which could break down due to lack of trust in the community as a safe place.

**Lack of structure and Organization**

If there is one thing Gurupaenses have no trouble agreeing on, it is the fact that there are not enough resources to take care of the health needs of the community. The hospital often runs out of medication, despite persistent requests from suppliers, and is forced to wait until the next riverboat is able transport a new shipment. Those times in between shipments can really stress the resilience of the healthcare community. Community members blame the health care officials and the overall system for not securing resources; health care officials blame the local government for *falta de interes*, at the same time the local government is blaming the national government for the same thing.

In Gurupá it is the responsibility of the Secretary of Health to manage resources. At the head of this operation is Hector, the Secretary of Health appointed by the ruling municipal political party. If there is any money allocated through the government for
health he is the one who makes the decisions on where to use it. He is the most informed member of the community about health trends and he is always working on ways to improve the situation of his community. Hector knows exactly where the deficiencies are in resource allocation and continuously works to positively shift that balance.

Living in the same house as Hector afforded me a unique opportunity to understand the process of managing health issues in Gurupá that requires around the clock work. As someone who must be informed of any health issues in town he is constantly being called on his cell phone and rushing off to deal with new situations. I remember one evening I was invited to join him and his wife as they enjoyed a few beers with co-workers in their living room. The conversation soon focused on all of the hardships healthcare workers must face. I had already heard some of the issues that the Cuban doctors faced, but this was an in-depth look at how public health officials who had been born and raised in Gurupá viewed their work and the health of their community. The particular day had been busy with unexpected health issues. They mentioned a case of yellow fever that popped up in Gurupá. Hector said that it was a child who went to Amapá from Gurupá and was diagnosed there. Reports then came in from the municipality about a dead monkey in the forest so they sent a team out to investigate and confirm whether it was yellow fever. If so, they would have to isolate the area and monitor for yellow fever from now on. This does not happen frequently so, Hector emphasized it is important to get everything under control as soon as possible. They continued on speaking about tuberculosis and leprosy, which had both increased in the municipality within the last couple of years. Mary, who is an employee of the Secretary of Health, commented…
Tuberculosis is a big problem here. People do not respect that they have to cover their mouths a certain way so as not to infect their families. I once saw a mother with tuberculosis with her daughter who was extremely anemic and already had a poor immune system. I tried to explain that she had to protect herself and her daughter especially since she could get TB very easily, but I don’t know if she will listen. Cases like this are common here. There was another man who did not take care of himself and ended up infecting his grandson who lived in the same house. – Mary, age 55

I asked if Gurupá had a big problem with multi-drug resistant TB because people do not take their medicine. All agreed that they did. They told me that one of the jobs of the community health workers is to visit individuals with TB to ensure that they are taking their medication every day. At this point Hector got a phone call about a bad motorcycle accident and he had to leave to coordinate the flight to the hospital in Belém since the local hospital could not handle the trauma. It was 9:00 at night, but Hector was always on call as the Secretary of Health. As Hector left, one of his fellow co-workers mentioned how stressful the job must be and that sometimes they just have to get together and drink some beers to relax. He also lamented that the health staff do not get much vacation time because there are not enough resources or personnel to take over if they leave.

This type of on-the-go attitude was apparent any time I ran into Hector in town. He was always on his way to another meeting to discuss a pressing health issue. When he did travel it was usually with a particular health team into the interior to provide services for people in need. His wife Fatima accompanies him on most of these trips, as they are both in the health care field. She works hard to continue educating herself by going to trainings and workshops and then bringing back information in order to inform the community on important health issues. The commitment to health care even extends to
their three children. Their eldest just finished her studies to become a nutritionist. The second born has begun his first semester at a university in Belém to become a physical therapist and their youngest son aspires to become a medical doctor.

Hector’s eldest and only daughter spoke with me while she was home on vacation about wanting to work in Gurupá, but that there were no positions available for a nutritionist. The only venue for her to work is at the local public schools. In this position she would have to fight against great odds to provide children with healthy meals. She laments that it would just be a constant struggle because the government does not care about providing healthy foods in the schools of the Amazon. She continued…

If any kid in Gurupá has a food allergy or some sort of special need in nutrition they will not get any support from the school and their parents will have to make them food to bring. The government only supplies kids with about 30 centavos [9 cents] per kid to buy a snack during school. Sometimes the state will provide the other 70 to make 1 real [31 cents], but even this only gets kids crappy processed snacks that are not very nutritious. – Hector’s daughter, age 23

In the health survey I administered in the town (see previous chapter), there was not a single respondent who concluded that all of the community’s health care needs were met. When asked about what is good about Gurupá’s health care system 40.3% of respondents stated “nothing.” When asked what is bad about the system 81.2% of all respondents had at least one critique. Sixty one percent had more than one critique of health care in Gurupá. The Director of Child Services mentioned that a major problem in Gurupá is the lack of structure and organization. This is a common theme among the community members of Gurupá as well. It is well noted that the hospital often runs out of medication as well as working with run down equipment—that is if they even have the equipment at all for even the most routine procedures. That the medicine runs out and
equipment is inadequate comes from a lack of coordination between the federal, state, and local health care workers according to the Child Services Director. Without better organization and structure the entire community feels the impact of a system that does not get adequate funding from the state and national levels.

Every now and then I would spot a health care employee out and about in town and engage in informal conversation about their everyday experiences in the health field. This was the case one afternoon when I saw the physical therapist out at a restaurant. She was born and raised in Gurupá, but got her degree elsewhere. I spoke with her for a while and she told me that it is hard to be a physical therapist here because there are not many resources for her to use. Beatrice stated…

I am the only physical therapist in town. I have a very small room in one of the health posts where I can see my patients, but I have to share it with others. I try and do the best I can with what I have. – Beatrice, Physical Therapist, age 30

She continued complaining how difficult it is to want to try and help, but not have enough resources to do so.

Another example of the lack of organization occurred during the Women’s Health Workshop. The health professionals emphasized the importance of screening for breast cancer. The women were told that yearly mammograms were essential for women over 40. Later on, I interviewed Benedita, a 60-year-old technician at the hospital, and asked what she thought about the talks at the workshop. She commented…

The workshop is always very good for people to learn information about health issues. The problem is that when the women are told that how important it is to get screened for breast cancer once a year they find themselves in a tough situation as Gurupá does not have a mammography machine. Women have to go to Breves or Belém where the wait time is so long that they have to make an appointment at least 6 months in advance.
Not many women are going to do all this work, especially if they feel healthy.

According to João, the local certified nurse, Gurupá is in desperate need of an epidemiological system of monitoring disease trends. There is little money put towards the prevention and maintenance portion of healthcare and this, according to João, is the fault of the local government for not prioritizing these things, or a falta de interes once again. This topic of conversation came up during the regional health pre-meeting. All of the disease reports must go to a central location in the town of Breves where they are analyzed for the entire region of Marajó. Only after this can the information be dispersed to the municipalities so that each location can design a plan of action. This poses a problem if a quick moving epidemic occurs since the communication between the central location and each town is slow.

Problems with organization and personnel had also led to a reduction in the vaccination rate for children in recent years, according to the nurse. There was a time when I first visited Gurupá that the public health workers boasted a near 100% vaccination rate in the municipality. When I asked about that vaccination program in 2015-2017 I was told that it had greatly declined. The principal reason is the lack of training of health care workers to head up these campaigns. Mary, one of the participants in the vaccination campaigns commented about logistical problems with transportation. She told me,

Last time we went out to vaccinate children we got so many complaints because the boat had left by 11am and many people missed their opportunity to get their children vaccinated. We tried to talk to the boat driver about this, but he did not feel like he needed to stay longer. We used to go door to door in addition to being in one central location out in
the tributaries to make sure that all children were covered, but now we cannot find a boat driver to take all that time.

Another Health Department employee named Judith, age 35, noted that the growing population of Gurupá, and particularly the potential growth it faces in the upcoming decade would only exacerbate the need for more health professionals. Judith stated,

There are 103 communities in the municipality of Gurupá and in order to get to all of them we will need more health professionals. We also need to include the community as active agents of the health programs. If you do not include the population and make them excited about health and give them responsibilities in this you will not have a successful program because no one will care enough to make it their own.

The following chapter will put together the quantitative and qualitative data collected through fieldwork and literature reviews to produce a predictive model of possible syndemic interactions stemming from the Belo Monte Dam that could impede the health and well-being of the people of Gurupá. The main purpose of the model is to elucidate the complicated manner in which disease interact with each other and with the environment and to help community members, law and policy makers, and health officials determine how to create interventions that will address all the illnesses interacting with each other to create an unequal burden on the most vulnerable populations.
CHAPTER EIGHT:
SYNDEMIC MODEL OF POTENTIAL DAM IMPACTS FOR GURUPÁ

The construction and implementation of the Belo Monte Dam has and will continue to have wide-spread effects. The dam is tied into Brazil’s engagement with globalization, the energy demands of a growing population, and the desire to continually raise the GDP of the country. At the same time the immense corruption revealed by the so called “Lava Jato” (Car Wash) criminal investigation shows that Belo Monte and other dams have been deeply entwined in big business greed and unethical politics (Amazon Watch 2016). Within this macro-context of corruption, it is not difficult to see how a disregard for the dam’s negative impacts on the local populations formed at the highest levels. This disregard has already created rising health problems in Altamira such as: violence, sexually transmitted infections, dengue fever, and overcrowding in the hospitals. These problems are spilling over into neighboring communities, such as the case of Gurupá.

The dam is what Singer (2013) refers to as a disruptive biosocial process. This is a process that creates situations and interactions among diseases, which cause an increased burden of poor health among the most vulnerable populations. In the case of Gurupá, the health problems already present in the town will be negatively impacted and their
intensity multiplied by a slew of new environmental, social, and health problems associated with the dam. This combination has the potential to lower the health status of the whole community and allow opportunistic diseases to develop in a population with weakened immune systems.

To understand this process, I have created a model to represent the dam’s potential impact. The model is driven by the data collected from the surveys, interviews, and health reports for Gurupá. Each health impact in the model was identified by the community as being salient to protection to the public health of the town.

**Creating a Syndemic Model**

The ability to visually demonstrate the complexities of syndemics in model form has been a challenge, to say the least. Mapping the interconnections of every disease, illness, or ailment that affects a community results in a complex model of intertwined arrows and boxes. To make sense of these connections ideally would require a more interactive model than the 2D model that I present here. Nonetheless, as I begin to unpack the model and all its layers, the interactions will become clear and the predictions I make will fit nicely into the model. This model is created by combining previous research by scholars about the public health impacts of dams with my basic, baseline assessment of health care and health care resources in Gurupá throughout my fieldwork (2015-2017).

The model presented in figure 8.1 has three main layers within concentric circles. The outermost layer is comprised of the direct impacts of the Belo Monte Dam. These factors will have powerful and long-term effects that will ripple down to the community
and individual level of health and wellness. They include factors like water quality, population flow, and river topology. A legitimate environmental impact assessment conducted at the beginning of the project might have lessened the negative consequences of these impacts, but there was little pressure from the federal and state level to conduct such a study. As mentioned previously, the environmental impact assessment did not fully evaluate many of these factors due to pressing timelines for construction administered by the government (Fearnside 2014). Therefore, what we are seeing now is a reduction in water quality, large population increases met with limited resources to accommodate them and changes in the flow of the river (Barros et al. 2017).

Moving toward the center, the next level contains factors from the community level. By community level I mean the factors that affect the larger community as a whole and that can interact with individual health factors to worsen the health status of citizens of Gurupá. In this circle, the model shows how the community level factors affect each other and how they in turn impact an individual’s health. This level will be the most important for Gurupá as this is the level where the community can have the most mitigating power. For example, if public health campaigns are created to address sanitation issues in houses far away from the center of town this will help immensely in containing many individual level diseases like malaria, Zika, or intestinal parasites. I will go into more detail about each syndemic interaction in the next section.

Finally, the innermost circle contains the individual level factors that contribute to ill health. These factors include stress, malnutrition, and diabetes that stem from an increase in violence as well as increases in population flow caused by the dam. Although these factors directly impact the health of the community members they are usually
indirect impacts from the dam itself. This is why it is important to be able to trace the syndemic relationships back to the direct impact of the dam itself. The following section

Figure 8.1 Syndemic Model for Dam Impacts

will present each syndemic relationship denoted by the model as well as put it into context from my qualitative and quantitative data.

**Syndemic Relationships**

Beginning from the outermost circle are the categories population flow, stagnant water, water quality and river topology. Each of these is a direct impact of the
construction and maintenance of the dam. Approximately 8,000 male workers have moved to Altamira to work on the dam and will eventually move out when construction is complete. If there is a population increase in Gurupá caused by the outmigration of construction workers in Altamira, then this will put a strain on the community in the areas of healthcare resources, increased violence, and stress.

Currently, one of the strengths of Gurupá’s public health system, as indicated by the following comment from the survey, is that “Every patient gets seen because of all the doctors that are here now.” Ready access to physicians is possible because of the agreement with Cuba to send doctors to the rural areas of Brazil. The doctors are only able to attend to the number of people in Gurupá at the moment. If there is an increase in population this accessibility will be diminished. In addition, the doctors from Cuba are only contracted for 3-5 years and most will return to their home country or to jobs that will pay better after their contract is complete. This could leave Gurupá with a severe medical personnel shortage precisely as the demand for access increases due to the indirect impact of Belo Monte. The strain on the healthcare system in turn could create stress within the community and, as a result, any influx of diseases that normally would be taken care of by the public health system might be beyond its capacity.
Figure 8.2 Population Flow Syndemic 1 – Top image is the screen shot of the animated Model
Following the colored lines of the model we can see the syndemic relationships created by each level’s factors. The green line of population flow hits several community factors in addition to healthcare shortage (as shown by a circle near the factor) such as crime influx, violence, and wildlife displacement. Not only does the model portray possible syndemic relationships, but it also shows the pathways of certain relationships that have already been proposed by Merrill Singer and others. One such example is known as the SAVA Syndemic, Substance Abuse, Violence and AIDS. In the model we see that an increase in population will increase crime rates and violence at the community level. With the amount of unknown people coming into the community of Gurupá there are bound to be more avenues for violence and crime. Being that those coming into the community are mostly male ex-construction workers from the dam, there are likely to be increases in prostitution and illegal sex trafficking in Gurupá. This has already occurred in Altamira with the influx of workers. Increased migration to Gurupá may lead to stress, fear of violence, and substance abuse, which can lead to the deterioration of community cohesion. Combined with the increased risk of multiple epidemics acting upon each other in a small community like Gurupá, any reduction in community cohesion means a loss of one of Gurupá’s greatest strengths in healthcare.

Figure 8.3 below shows the route in which population flow travels to affect healthcare shortage and urbanization. The strain on the healthcare system then has an effect on stress, while urbanization increases the likelihood of violence and prostitution. Then ultimately these factors have an effect on the
individual level creating added stress, increases in drug (or other substance) abuse and HIV/AIDS.

Figure 8. 3 Population Flow Syndemic 2
In Gurupá these factors are worsened by increased poverty created by the influx of people, at the same time there is a likely decrease in livelihood, particularly access to diminishing fish stocks caused by the dam. Ultimately, with prostitution, violence, and increased crime (including substance abuse) comes the likelihood of contracting HIV/AIDS. All of these factors have additive power over the others when placed in an environment of poverty and limited healthcare resources. One of the nurses of Gurupá has already expressed the need for better HIV/AIDS testing sites.

“Already we have had people here that have to wait a long time to find out whether they are HIV positive. Since we do not have the resources to test here they must travel to Belem, get the tests done, travel back to Gurupá and wait for the results to be send electronically to Gurupá. This can take a while since Gurupá does not regularly have Internet access.” – João, nurse

In addition, there exists the likelihood of certain diseases becoming comorbid, or infecting people at the same time given the weakness in their immune system. When comorbidities hit an epidemic level, they are considered to have a Syndemic Relationship. One such example is HIV/AIDS and tuberculosis. Both HIV/AIDS and TB have been on the rise in Gurupá and they both have the ability to affect each other, thus making their effects on the immune system two-fold. This combined with poor living conditions, poor nutrition, and poor water quality create extremely vulnerable populations.

The final community factor that is also influenced by population flow is deforestation. According to a community member, “When new people move into Gurupá
they do not have much money. This means they will go cut down trees from the forest to build their houses. They don’t ask permission, they just use our resources here in Gurupá” – Henry, age 70s. If many people are moving into the vacant areas of Gurupá then the likelihood of deforestation increases. This has already been a problem in Altamira (Brodwin 2013). If future migrants to Gurupá are recruited into timber extraction, this will have an effect on deforestation as well. Environmental destruction will have a very large impact on the town of Gurupá. It will not only increase violence in the area, as evidenced by the recent shooting in Altamira of the Secretary of the Environment, but also affect those that create livelihoods from farming, fishing or extracting acai, heart of palm and other resources. Without a viable livelihood there may be an economic and employment void creating a strain on Gurupá’s already strained economic growth. There may be an outmigration of people moving to Belém, Breves, or Santarem to try and look for work, which will increase the population of these towns creating more favelas, shantytowns and susceptibility to disease. Diminished economic opportunities could create a rise in sex work and risky behaviors as well. This could happen in Gurupá or in one of the bigger cities and still affect Gurupá given the fluidity of people between towns and cities.
This is reminiscent of what Farmer (2001) observed in a rural village in Haiti where the women who contracted HIV/AIDS were bound by the fact that they all had worked as servants in the city of Port-ou-Prince or had highly transient sexual partners, such as truck drivers. Even though the rates of transmission had been low in the rural town itself, the flow of people to and from areas of high transmission resulted in higher rates of HIV/AIDS.
People are not the only things traveling from town to town. Mosquitos and the diseases they pass along can travel long distances, allowing vector-borne diseases such as malaria and dengue to remain an issue in the Amazon. The construction of hydro-electric dams in the tropics creates standing pools of water which can greatly increase the amount of mosquitos and the diseases they carry, which now includes the Zika virus in Brazil (Zika is not included in the model because Gurupá had not had any cases). Combined with adverse effects on an individual’s immune system from parasites/diarrhea and malnutrition people are likely to be more prone to these communicable diseases, which also have deleterious effects on one another if they become co-morbid diseases.

![Stagnant Water Syndemic Diagram](image)

Figure 8.5 Stagnant Water Syndemic

In addition to standing pools of water, Belo Monte has also affected the water quality of the river. The energy consortium has not completed its promises to the city of Altamira to upgrade the sanitation system (Barros et al. 2017), thus polluting the areas...
around where people live. There may also be substances leaking into the river from the
construction equipment and construction process, which will then travel downstream to
communities like Gurupá. As the Fundão Dam break in Minas Gerais on November of
2015 demonstrates, water that becomes polluted with construction materials and
chemicals can travel far in a short amount of time impacting many communities in its
path. According to local consultants, Gurupá has already had some increases in the cases
of childhood diarrhea thought to be coming from pollution from the Belo Monte
construction site on the Xingu River. This may also be part of the reason for the increase
in intestinal parasites in children as noted by my research assistant at her job as a health
data analyst for the community. The impact of water quality affects childhood diarrhea,
intestinal parasites, and increases the likelihood of malnutrition in children who are
especially vulnerable to poor health.

Figure 8.6 Water Quality Syndemic
River topology will affect the fauna in the area with the possibility of killing off fish that are integral to the diets of Gurupaenses. From the food survey, 64% of people responded they eat fish one or more times a week. The decrease in the amount and variety of fish likely affects nutrition intake as well as those livelihoods that depend on fishing, which in turn adds to joblessness, stress, and poverty. The changes in the levels of the Amazon River caused by the holding and releasing of water from the dam on the Xingu might also affect river transportation decreasing the amount of food, resources, people, and products that enter Gurupá and reducing the already scarce access to medicine and other healthcare needs.

Figure 8.7 River Topology Syndemic

Personal stress from breakdowns in social cohesion or increases in violence can cause negative impacts on the immune system, worsening the vulnerability to heart disease, anxiety and depression, or worsening the effects of pre-existing diseases like malaria or tuberculosis, which are in turn worsened by other conditions stemming from Belo Monte, from malnutrition from the amount of food being imported, to the quantity and quality of the fish and shrimp being consumed. In addition stress stems from the
systemic corruption the country experiences. President Dilma Rousseff has been impeached and replaced by a political party little concerned with social programs like the Bolsa Familia. The residents of Gurupá fear that they will lose this helpful income and without much of a chance for economic growth in Gurupá, these families will not be able to obtain the food necessary for their children. There have been several studies of the nutritional status of ribeirinho populations in the Brazilian Amazon, which provide a broad outline of the area. A study by Silva and Crews (2006), for example, compared child nutrition rates among three Amazonian communities in the state of Pará (Aracampina, Santana, and Caixuanã). Using the six anthropometric measurements of height, weight, upper arm circumference, triceps, subscapular and suprailiac skinfolds, the study found that children living in Aracampina and Santana were taller and heavier than those from Caixuanã. The first two communities are more integrated into a market economy and have more access to cash, Western goods, and health care, therefore resulting in a higher z-score for weight-for-height, weight-for-age, and height-for-age. This dichotomy is seen in other studies in the Amazon where the rural areas that are more reliant on subsistence farming are associated with greater numbers of undernourished children (Alencar, Yuyama and Nagahama 2000; Murrieta, Dufour and Siqueiera 1999; R. Giugliano, LG. Giugliano and Shrimpton 1981). By contrast, communities more involved in the market economy have greater access to resources, but this also includes greater access to processed foods. This too is associated with poorly nourished children as well as adults suffering from chronic diseases (Silva and Begossi 2009; Piperata, McSweeney and Murrieta 2016).
In another study conducted by Piperata (2007), researchers measured ribeirinhos ranging in age from birth to 77 years old in a total of 7 communities located in the Caxiuanã National Forest to determine the influence of subsistence strategies changes on nutritional status. Using standard anthropometric measurements and household data, Piperata’s study found the study populations to have a high degree of stunting (low height-for-age), meaning long-term nutritional stress. However, the incidence rate for under-weight adults for this population was very low with the majority of adult BMI measurements in the normal, overweight, and even obese categories. Piperata notes that men involved in wage labor had the highest propensity of being overweight and obese. This is due to factors such as less physically demanding work, being fed foods high in fat and buffet style at work, and having more money to purchase foods rather than rely on their own subsistence strategies. Similar to the findings in the Silva and Crews (2006) study above, the inclusion of communities in the market economy has had an impact on the nutritional status of Amazonian populations.

The results of this research, as indicated in the model, suggest that Gurupá’s health impacts which are most likely to occur in epidemic proportions and have deleterious affects on each other are the following: intestinal diseases and malnutrition; malaria and dengue fever; tuberculosis; sexually transmitted infections; and stress. Each of the outer boxes indicates a factor that adds to the effect of the likely impacts on the community. These factors are also affecting each other to increase their risk of becoming epidemics in the community, and should be watched in the following years. In the following chapter I will conclude this study as well as provide recommendations for the community of Gurupá to mitigate the potential impacts of the Belo Monte Dam.
As I finish writing this dissertation, a year after the end of my fieldwork, the construction of the Belo Monte Dam is nearing completion. Already there are multiple reports of devastating impacts for the surrounding areas. Violence, crime, underground prostitution rings, population displacement, and deforestation are just a few of the problems arising with the dam. For example, in a story published in *The Guardian* (2016), deforestation has increased by 24% since the dam began construction. This increase is mostly due to illegal logging linked to the greater access to the region following the initiation of dam construction. Associated violence has likewise increased, highlighted by the murder of a local Secretary of the Environment who was shot on October 13, 2016 after he tried to stop illegal logging.

The Belo Monte Dam in 2017 was now partially operating on three turbines with a total energy capacity of 2 GW. The full capacity of Belo Monte is estimated to reach 11.2 GW when all turbines are fully functional sometime around 2019 (Ingram 2016). Since more hydroelectric dams and power plants are planned for the Amazon region over the next few decades, it is important to understand the negative health impacts of the Belo Monte and to model its potential impacts, as well as explore the types of public health interventions that might be needed.
I started this dissertation by laying out the scope and the purpose of the study—which is to examine the public health system of the city of Gurupá situated downstream from Belo Monte dam, and through a syndemic framework create a predictive model of negative health impacts most likely to affect Gurupá as the Belo Monte dam is completed. Using the theory of syndemics this study seeks to identify the diseases most prone to epidemic status in Gurupá and frame them within a context where other diseases, environments, and behaviors are adding to an overall poor health status. Given the amount of knowledge that has been gleaned from numerous studies of large dam health impacts from around the world, it is possible to include the impacts of illness and other negative health impacts likely to have long-term effects on Gurupá.

Chapter Two reviews the literature on the known health and environmental impacts of dams on surrounding communities worldwide. The World Commission on Dams (2000) and the World Health Organization’s (2000) contributions to the study on dam impacts show the main areas of concern essential to this study. The possible health impacts of dams worldwide are broken up into six different categories; communicable diseases, non-communicable diseases, malnutrition, psychosocial diseases and social well-being. From these categories I pinpoint specific local health data in Gurupá from the hospital records and ask more in-depth questions in the interviews and on the questionnaires. Linking the categories together is the basis for the syndemic theory, which was also reviewed in this chapter. The syndemic theory allows the categories to be viewed as a single, community-wide process that will inevitably function to increase the adverse effects on the public health. The literature review of syndemics also shows linkages that have been previously studied and are known to interact to create even more
vulnerable public health situations. Combining the existing literature on dam impacts with known syndemic relationships, I formulated the main research questions based on a two-phase mixed method research design. The research questions are:

Phase I

(1) What is the structure of the local and regional health care system? What do the care professionals identify as the strengths and weaknesses of the system? What changes do they foresee with the dam completion?

(2) How do community members view their current health status?

(3) What changes to their health or health care do they anticipate within the coming years and what is the general opinion on, and discourse about, the Belo Monte Dam?

Phase II

(1) What are the public health impacts of the Belo Monte dam on the downstream riverine community of Gurupá? Will there be changes in infectious disease rates, nutritional status/food security, or access to healthcare? Will there be increases in malaria, dengue fever, and waterborne illnesses ranging from dysentery to diarrhea due to environmental changes and problems with water quality?

(2) Do the data collected identify syndemic relations? What is the relationship between the various health impacts?

(3) How can different stakeholders such as grassroots organizations, NGOs, and local government agencies use this information to mitigate the health care problems? How can
data on unanticipated syndemic relationships be used to “fill in” the gaps of public health care?

To better contextualize the impacts of Belo Monte, Chapters Three and Four focus on a brief history of the town of Gurupá, the research that has occurred throughout the years, and a quick overview of the history of the public health system in Brazil and the Amazon region. Both of these sections begin with the first colonization of Brazil from Portugal and detail the most impactful moments in history. It is important to note that the history of the Amazon in the North of Brazil is different from the history of the entire country, especially its southern, more populated areas. The policies of the Brazilian government have not historically been made with the best interests of Amazonian peoples in mind, but have had lasting impacts on the health and well-being of the populations who inhabit the area. In fact the planning of all large development projects has occurred with little consultation with the local populations, especially those in the most precarious and vulnerable situations.

Yet, the people in Gurupá have continued to work hard to improve their lives in multiple ways. This work documents community action, from banding together to expel corrupt members of the rural workers union to going door to door to make sure every child receives a vaccine, as an important element to maintain some degree of positive public health. The community members within the town take pride in where they live and strive to improve conditions and maintain a cohesive social atmosphere. This is one of the main strengths of Gurupá and may be useful in mediating many of the adverse health effects stemming from the dam. It might be the critical factor to maintaining a semblance of a healthy community without the needed level of aid from the government.
Chapter Five discussed the specific methods used in each phase of the research study to obtain the data collected from 2015 to 2017. Health data were collected from the local Secretary of Health as well as from the hospital to get a sense of the most serious illnesses the hospital records on an annual basis. I conducted interviews with local government employees, NGO representatives, community members, and health employees to get an understanding of how the health system works in Gurupá, some of the strengths and challenges of the current system, and what the future might bring with the knowledge of disease trends in the past couple of years. Some of these issues were brought up again during the questionnaire phase, which consisted of a health survey and a food frequency questionnaire. These methods are analyzed and the results and discussions are explained in Chapter Six as well as summarized in the following section.

The results of the health survey provided insight into how community members viewed their health and the health system of Gurupá. Along with the health data received from the hospital and Secretary of Health’s office there is a clear baseline that portrays a picture of Gurupá’s health status from 2015 and 2017. Although the majority (70 percent) of people ranked themselves as poor and had serious criticisms of the healthcare system in Gurupá, most (again 70 percent) also rated their current health status as good. Therefore, although things could always be better, from the perspective of the local population as represented in the survey sample, the community of Gurupá seems to be fairly stable in terms of health status without extreme suffering.

Food frequency questionnaires provide a snapshot of a community’s consumption patterns. Foods like rice, farinha (manioc), sugar, and coffee are consumed by over half of the sample one or more times a day—making these foods the base of the diet in
Gurupá. Meats and other proteins are consumed at least once a week when available. In town, the most available meats are beef followed by chicken. Fish is not sold commercially. There are small markets around town where local fishers sell their daily catch. The changing eco-system and the potential reduction of some fish species is something to be aware of when thinking of environmental impacts of the Belo Monte Dam and how they will affect the people of Gurupá who eat fish at least once if not more times a week. Another factor of concern is an increase in the consumption of processed foods. For 2014 alone the hospital recorded 287 new cases of hypertension and approximately 74 new cases of diabetes among adults, which indicates that chronic diseases related to nutrition, and eating habits are likely on the rise for this area. If fish and other foods native to this area are diminished as a result of a changing environment due to the dam, the potential for increased intake of processed foods could exacerbate the cases of hypertension, diabetes, and malnutrition in Gurupá.

The qualitative results are discussed in chapter 7. The information gained through interviews with community members, non-governmental organization employees, health care workers and government officials are summarized into several different themes concerning the health status of Gurupá. The main themes I encountered were: benefits of community cohesion; healthcare and outsiders; lack of structure and organization of the public health system; migration from the interior; and drugs and violence. These themes helped to form the questions for the surveys as well as help to put into context the quantitative data gathered. This chapter provides valuable information on how community cohesion is built into the fabric of Gurupá and the willingness to fight for social justice and take care of the community has worked to elevate Gurupá to a standard
above its neighbors in many different areas including health. This will be an important piece to emphasize when certain impacts of the dam begin to threaten the community cohesion such as an influx of people from other areas, increases in drugs and violence and strains on the public health system.

Finally, Chapter 8 brings together the quantitative and qualitative data collected through fieldwork and literature reviews to produce a predictive model of possible syndemic interactions stemming from the Belo Monte Dam that could impede the health and well-being of the people of Gurupá. The main purpose of the model is to elucidate the complicated manner in which diseases interact with each other and with the environment, and to help community members, law and policy makers, and health officials determine how to create interventions that will address all the illnesses interacting with each other to create an unequal burden on the most vulnerable populations.

The results of this research, as indicated in the model, suggest that Gurupá’s health impacts which are most likely to occur in epidemic proportions and have deleterious affects on each other are the following: intestinal diseases and malnutrition; malaria and dengue fever; tuberculosis; sexually transmitted infections; and stress. These factors are also affecting each other to increase their risk of becoming epidemics in the community and should be watched in the following years. The following section contains some recommendations for the community of Gurupá to mitigate the potential impacts of the Belo Monte Dam.
Recommendations

Although the tone of this section has been one of “gloom and doom,” it is safe to say that this is not the first time Gurupá has faced hardships. The intent of this dissertation is to use Gurupá and the wealth of knowledge gained throughout the years of ethnographic study as a case study for how the Belo Monte Dam might affect this particular downstream community and what steps can be taken to mitigate these effects. In doing this it is important to consider again the history of the region. When Charles Wagley first arrived in the 1940’s with SESP his observations painted Gurupá as an isolated area where epidemics were common, Western healthcare was abysmal, and the unyielding debt peonage system was keeping the lowly agro-extractivists in constant debt. Overall he described Gurupá as an underdeveloped and backwards place (Wagley 2014). In the 1980s when R. Pace began his ethnography of Gurupá, he began to notice something about the community, which he calls an esprit de corps, or a feeling of pride and loyalty shared by the members of a group (R. Pace 1998). This strong community cohesion aided in the creation of groups to help one another acquire land titles, fight for rural workers union rights, create successful public health campaigns, and even repair strained relationships between the mayor and the priest. This is how I know Gurupá today. The government, the hospital and the Catholic Church all work together to take care of the community. This has been Gurupá’s strength in maintaining a higher level of health status than its surrounding neighbors. This is also the feature most at risk from the Belo Monte Dam.

Looking back at one of the more successful attempts at mitigating negative social and health impacts exemplifies the direction I hope Gurupá can emulate. It is a successful
resettlement project due to the construction of a dam in Arenal, Costa Rica (Scudder 2006). Gurupá can consider some of the main factors contributing to this success useful since there are strong relationships in the community and the ability to organize efforts to create change. To begin, the project authorities in Arenal implemented an Inter-Institutional Task Force whose only aim was to ensure that resettled populations regained their homes, livelihoods, access to healthcare and education, and social structure. The government in Gurupá is well positioned to create an interdisciplinary task force like this through the Secretary of Health in order to watch for and anticipate public health concerns. Through this initial research and high community participation, the task force was able to identify the most important aspects required to improve the lives of those resettled. To address homelessness, cement homes that were sustainable and remained of high quality were built in the new location. Community members were able to choose which plot of land they wanted, which increased their involvement in the process and led to more willingness to move. With the amount of mobilizing that Gurupá has done with vaccination and social justice campaigns, it is well within its realm of expertise to mobilize to watch for high-risk groups, provide them with proper health education and to speak out for their needs.

To address joblessness and economics in the Costa Rica project, families were given “financial packages” that were specified to address the needs of the population based on individual family size, labor resources, and value of household assets (Scudder 2006). With the appropriate amount of compensation, coupled with good quality infrastructure and access to sanitation, water and healthcare facilities, the community was able to spend more time investing in rebuilding their community rather than worrying
about basic survival needs like shelter and water. Church groups began to emerge to begin fostering a sense of community again and through these groups came a political voice, which advocated for economic development needed to keep the community thriving. Continued support and dedication from the task force was also crucial to ensuring the sustainability of the community in the years following resettlement.

Continuing to foster the formation of organized groups within the community and facilitating communication between these groups and the government is another area in which Gurupá already excels, and can help to monitor and mitigate impacts.

One of the strengths of the syndemic model that I have proposed is that it provides the reader with all of the factors that can occur from one particular occurrence; the dam. From here multiple pathways can be created to show a syndemic relationship between the different layers. I have tried to make this model more accessible to a general audience by adding colored lines that illuminate along certain pathways so that the complexity of the model can be simplified to focus on the most important aspects while still keeping all of the other impacts in mind. Ultimately, I would like the community to use the model by adding factors important to them and then be able to draw their own pathways as they see them. Once the major issues outlined by the Syndemic model have been addressed and accounted for, structures can be put in place to successfully mitigate the known negative health impacts of dam construction. To do this, a certain degree of predicting the future must come into play.

Proper infrastructure and access to sanitation and water will solve issues concerning communicable and waterborne disease. Inclusion and organization of the community in the affairs of their health will promote political inclusion and a more
cohesive and thus sustainable health care system. Gurupá now has more knowledge of possible dam impacts and an opportunity to step in to mitigate negative health impacts that may arise in the future. It also has a responsibility to know and understand ways in which it can fill in the gaps seen time and time again in national government impact assessment plans. The community’s participation is paramount in maintaining community cohesion. It is worth noting that although there is a high level of cohesion in Gurupá compared to surrounding municipalities, there continue to be differences in opinion with regards to the Belo Monte Dam. The quantitative data show that 60% of the sample population does not think there will be any impacts from Belo Monte while 40% do believe there will be impacts. There are those in the community more aligned with the Catholic Church’s belief in social justice and then there are those that want to see progress, technology and development increase with the implementation of the dam. Therefore in order to have successful mitigations there must be a consensus met on how to tackle these issues should they arise. I would like to contribute to this conversation by presenting the data and the syndemic model to the entire public. Having a public workshop about the results of my research will encourage community members to participate in the conversation as well.

Finally, the community of Gurupá can continue to encourage the political inclusion of local groups through the facilitation of communication with policy makers and government officials with the intended goal of ensuring that the town’s living standards have been raised. One way in which NGOs and other community organizations can help is through the practice of scenario building. Matthews and Barnes (2016) address scenario building as a way to envision various potential environmental futures.
The other two ways suggested in this article are modeling and risk, disaster and uncertainty evaluation. The syndemic model I have proposed fulfills the modeling aspect of imaging potential future environments for Gurupá. A next step should be the community together with surrounding organizations and the local government to build some highly likely scenarios for the impact of Belo Monte based on the model provided. By starting the conversation with, ‘What if this should happen?’ stakeholders can prepare reasonable mitigation strategies and plans based on the resources available to them in the present. Creating an awareness of potential scenarios also enables a wide array of institutions to pool resources and share novel ideas that may not have come up in the writing of this dissertation. It is important to note, however, that scenarios are always hypothetical situations and the community will need some flexibility to deal with unexpected scenarios and planned scenarios that never occur.

**Future Research**

Based on the results of this study, I believe that creating a syndemic model with the town of Gurupá can be useful in predicting disastrous epidemics stemming from development projects in the area. However, future research would be needed to be able to truly assess the indirect impacts of Belo Monte on the community’s public health. As stressed by Søftestad and Eberhard (1991) it is of utmost importance to collect pre- and post-development data when aiming to conduct evaluation studies. Søftestad critiques a study, which looked at several thousand people that had been forcefully removed from their homes to make way for the hydroelectric dam in the Kotmale Valley, Sri Lanka. No significant evaluation studies could be carried out to assess how the quality of life of the
evacuees changed since being relocated because no baseline data existed to measure the changes of development. This research aims to provide that much needed baseline data, but still lacks the post-dam research and analysis to fully capture the effects of the dam and to be able to test the syndemic relationships that were presented in this dissertation. It would be very interesting for future research to test my predictive model to see how accurate it will be and how effective the recommendations are when examining the impacts of Belo Monte.

The continuation of ethnography and other forms of research in Gurupá provide a rich and unique understanding of a town in the Brazilian Amazon. In addition, sharing this knowledge with the local community is an integral part of the researcher/study participant relationship and provides the community with a sense of history that may not have been as preserved without the studies that have occurred in the past. I believe it is also imperative to continue an applied approach when researching Gurupá as a way to give back to the community that has opened its doors to so many researchers.

This research is significant to the advancement of the scholarly literature in that it uses syndemic theory in a new and insightful way, thereby broadening the relevance and applicability of the theory. Studying the impacts of dams and their syndemic effects on populations will help to tie previous environmental, anthropological, public health, and biological studies together showing how all factors combine and mutually impact each other, which provides the foundation for a nonlinear approach to solving public health issues. In addition, the research addresses the paucity of studies on downstream communities. In future studies after the dam has been complete and functioning for some time, I would like to see additional research combine syndemic theory with another
emerging theory of chronicity. Mendenhall and Weaver (2014) suggest using both frameworks to attain a holistic view of health and an individual’s embodied experiences of illness over time. This approach combines the strength of syndemic theory to illustrate the pathways between larger societal factors down to individual factors that interconnect to worsen health outcomes with the strength of chronicity to understand lived experiences of coping strategies for managing ill health over time. Although it is important to address issues of social injustice and its role in promoting ill health in vulnerable populations, it will also be important to understand the role that community members play in their day-to-day health management in order to create multilevel interventions for improved health.

The research, in sum, applies a syndemic framework to large-scale development projects as well as helps fill in gaps to understanding the dynamic interactions among diseases, environmental factors, and sociocultural variables. It is the hope that the information provided in this dissertation will be used to create a mitigation strategy uniquely designed for the community of Gurupá and that future research will be able to test the strength of this proposed syndemic model to further aid in the mitigation of large development projects across the Amazon region.
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APPENDIX A:

HEALTH SURVEY (PORTUGUESE)

1. No. de Identificação |_|_|_| 2. Entrevistada por ____________________________ Sector___________
3. Data __/__/__
4. Nome__________________________
5. Sexo Feminino |_| Masculino |__| 6. Idade |_|_| anos
7. Local de nascimento ____________________________________________________________
8. Local de nascimento do pai_____________________________________________________
9. Local de nascimento da mãe_____________________________________________________
10. Local de residência __________________________________________________________
11. Você tem outras residências?
   (localidade)_________________________________________________________________
12. Se tem, quantas vezes por ano você visita as outras residências: 1 vez |_,| 2-5 vezes |_,|,
    6-10 vezes |_,|, Mais de 10 vezes |__|
13. Trabalho principal_______________________________________________________________
14. Mais ou menos, o total da sua renda mensal__________________________
15. Até que nível você estudou na escola? ___________________________________________
16. Você se considera: rico |_| classe media |_,| pobre |_|?
17. Estado civil: Solteiro(a) |_,|, Vive junto |_,|, Casado |_|, Separado(a) |_|, Viúvo(a) |__|
18. Número de filhos |_|_, e filhas |_|_
19. Em geral você diria que sua saúde é: Excelente |_| Muito Boa |_| Boa |_| Ruim |__|
   Muito Ruim |__|
20. Comparada há um ano atrás, como você se classificaria sua saúde em geral agora? Muito
   Melhor |_| Um Pouco Melhor |_| Quase a Mesma |_| Um Pouco Pior |_| Muito Pior |__|
    Desidratação: |__,|, Hanseníase: |__,|, Tuberculose: |__,|, Doença de comida mal: |__|
Outras doenças você lembra:
   ____________________________________________________________________
   ____________________________________________________________________
22. História Clínica Pregressa de crianças que moram com você por o ano passado (doenças
crônicas, alergias, acidentes, hospitalizações, malformações)_______________________________________________
   ____________________________________________________________________
23. Fuma? Sim |_| Não |_| Caso sim, quantos cigarros por dia? |__|__|__|
24. Bebe? Sim |_| Não |_| Caso sim, aproximadamente quanto por semana? |__|__|__|
** Apenas para Mulheres

25. Você está grávida agora? Sim [__] Não [__]

26. Número de gravidezes anteriores [__] [__]

27. Número de filhos vivos [__] [__], e filhas vivas [__] [__]

28. Parto: Vaginal [__], Cesariana [__] (Em casa ou hospital? ____________)

29. Você está amamentando no peito agora? Sim [__] Não [__], Duração ____________

30. Número de filhos mortos [__] [__], filhas mortas [__] [__]

31. Número de abortos [__] [__]

32. Você fez pré-natal durante a última gravidez? Sim [__] Não [__], Quantas vezes? ________

33. Você já fez exame preventivo de câncer alguma vez? Sim [__] Não [__], Quando foi a última vez? ____________

**

34. O que você pensa do sistema de saúde em Gurupá? O que é bom?________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

35. O que é mal?___________________________________________________________

________________________________________________________________________

__________________________

36. Quais doenças você acha são mais graves aqui em Gurupá?________________________

________________________________________________________________________

________________________________________________________________________

37. Você acha que a barragem de Belo Monte vai impactar a saúde em Gurupá? Sim [__] Não [__].

38. Se sim, como?___________________________________________________________

________________________________________________________________________

________________________________________________________________________
APPENDIX B: HEALTH SURVEY (ENGLISH)

1. Identification # | | | 2. Interviewer: __________________________ Area: __________
3. Date __/__/____ 3. Name _______________________________________________
4. Sex: Female | | Male | | 6. Age: | | years
5. Place of birth _______________________________________________________
8. Father's place of birth ______________________________________________
9. Mother's place of birth ______________________________________________
10. Current residence __________________________________________________
11. Do you have other residences? (Where?) ________________________________
12. If yes, how many times per year do you visit your other residences? 1 time | |, 2-5 times | |
   6-10 times | |, More than 10 times | |
13. Principal Occupation: ______________________________________________
14. Approximately what is your monthly income? __________________________
15. What is the highest level of education you have completed? ______________
16. Do you consider yourself: Rich | | Middle class | | Poor | |?
17. Civil Status: Single | |, Cohabiting | |, Married | |, Separated | |, Widow | |
18. Number of sons | | | |, and daughters | | | |
19. How would you rate your health status: Excellent | | Very good | | Good | | Bad | |
   Very bad | |
20. Compared to last year, how do you rate your health status now? Much
   Better | | A little better | | Same | | A little worse | | Much worse | |
21. In the past year have you had any of the following: malaria: | |, Dengue: | |
   Pneumonia: | |, Yellow Fever: | |, Dehydration: | |, Hansen's Disease: | |
   Tuberculosis: | |, Food poisoning: | |
Have you had any other illness that you can remember?
______________________________________________________________
______________________________________________________________
22. For the past year, what has been the medical history of the children that live with you
   (chronic illnesses, allergies, accidents, hospitalizations)_______________________
   ________________________________________________________________
   ________________________________________________________________
23. Do you smoke? Yes | | No | | If yes, how many cigarettes per day? | | | |
24. Do you drink alcohol? Yes |__| No |__| If yes, approximately how many per day? |__| |__| |__|

** Only for women 
25. Are you currently pregnant? Yes |__| No |__|
26. How many times have you been pregnant? |__| |__| |__|
27. Number of live sons |__| |__|, and live daughters |__| |__|
28. Delivery: Vaginal |__|, Cesarean |__| (At home or hospital? ____________)
29. Are you breastfeeding now? Yes |__| No |__|, Duration __________
30. Number of still births? Sons |__| |__|, Daughters |__| |__|
31. Number of abortions |__| |__|
32. Did you do prenatal care during your last pregnancy? Yes |__| No |__|, How many times?________
33. Have you had an exam to prevent cancer? Yes |__| No |__|, If yes, when was the last time? __________

** 
34. What is your opinion on the health care system of Gurupá? What is good?______________________________________________________________
35. What is bad?__________________________________________________________
36. What are the most serious illnesses in Gurupá?________________________________________
37. Do you think the Belo Monte Dam will have an impact on health in Gurupá? Yes |__| No |__|.
38. If yes, how?________________________________________________________________________
### APPENDIX C:

**FOOD FREQUENCY QUESTIONNAIRE (POORTUGUESE)**

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