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Secondary Analysis of Morbidity Data from a Rural Haitian Village.

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SECONDARY ANALYSIS OF MORBIDITY DATA FROM A RURAL HAITIAN VILLAGE

by

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Abstract

Haiti is the poorest country in the Western Hemisphere with most of the population surviving on $1 per day. Health outcomes among Haitians are poor, with a life expectancy 16 years less than the US. The majority of health research in Haiti has been narrow, focusing on specific issues like tuberculosis, HIV/AIDS, maternal health, and cholera. Unfortunately, this has resulted an incomplete understanding of health in Haiti. This study aims to fill this gap by describing the most common health complaints, how they differ by age, sex, and temporality, and if there are associations between these health issues and environmental factors. Secondary data analysis of nearly 1,200 patient reveal a high prevalence of abdominal pain, headache, fever, and hypertension. Diagnoses are likely associated with inadequate access to clean water, sanitation systems, and basic health resources. Findings from this study have great applied value, helping to aptly prepare future medical endeavors.

Keywords: Haiti, Rural, Health, Morbidity, Diagnoses, Clinic, Abdominal Pain, Headache, Fever, Hypertension

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Chapter 1

Introduction

Haiti is the poorest country in the Western Hemisphere with most of the population surviving on $1 per day (Alsan, 2011). A history of oppression, pervasive poverty, and insufficient resources has carried into contemporary life, making it difficult for Haiti to address the basic health needs of the population. This is especially true in the rural Central Plateau region of the country, where social strains are even more severe (Eberhardt & Pamuk, 2004).

The study area, the village of Layaye, is representative of the central plateau in terms of livelihood (subsistence farming), access to food, education, clean drinking water, and medical care as well as environmental factors like climate and weather. The village, with an estimated population of about 3,000, has no plumbing, electricity, reliable sources of clean water, and minimal access to health services. The area has no paved roads and the nearest hospital is 10 kilometers away in the regional capital, Hinche. The majority of the population works as subsistence farmers growing corn, millet, sugar cane, bananas, avocados, and mangos. The main water sources for the community include springs, streams, and rivers and few households have access to water filtration systems or other sources of clean water. Community medical care is limited to a once monthly clinic offered by a Haitian physician, a medical dispensary run by a retired Haitian nurse operated two to three days per week, and somewhat sparse distribution of anti-worming medication to children.

Haiti's poor health infrastructure, inadequate sanitation structure, and limited access to clean water exacerbates poor health outcomes. This situation prompted the attention of numerous international organizations interest in providing humanitarian assistance, especially medical care (PAHO & WHO, 2011c). While there is a wealth of research supporting the idea that social

factors impact health (Clouston, Rubin, Phelan, & Link, 2016; Hardoy & Satterthwaite, 2014), there is limited information about the general health of the population, making it difficult to understand the extent to which this is true.

Public health research in Haiti has spanned a great deal of topics from the structural and economic impacts on health to prevalent diseases in the population. Older studies were heavily oriented around the delivery of health care services and the impact of social factors like politics and economics on health (Brodwin, 1997; Fournier & Dodard, 1997; Gibbons & Garfield, 1999). An embargo on Haitian exports from 1991 to 1994 resulted in economic sanctions that spurred a decline in population health and left a broken health infrastructure on which to build (Fournier & Dodard, 1997). Gasoline shortages, in the early to mid-90's, produced a drastic increase in the cost of medicines and vaccinations, causing the breakdown of the national immunization program, as well as decreased transportation to and from remote areas and a lack of emergency services (Gibbons & Garfield, 1999). Even years after the embargo ended, the economy was so damaged that it prevented development and repairs and maintenance of water and sanitation systems and increased malnutrition in children and mothers who were unable to reach average calorie consumption guidelines (Gibbons & Garfield, 1999). Since the 1990s studies have been focused on addressing specific diseases and conditions that have arisen, like tuberculosis (Farmer, Robin, Ramilus, & Kim, 1991; Joseph et al., 2006), HIV/AIDS (Koenig, Leandre, & Farmer, 2004; Walton et al., 2004), maternal health (Gage, 2007; WHO & UNICEF, 2014), and cholera (Barzilay et al., 2013; De Rochars, 2011). Research on these issues in Haiti have been beneficial in helping to develop improved prevention and treatment programs (de Pee, Frede, Mehra, & Bloem, 2014; De Rochars, 2011; Koenig, Leandre, & Farmer, 2004; Joseph et al., 2015). Unfortunately, however, this disease-specific focus has resulted in a limited

understanding of general health within the country. This narrow scope has created a significant gap in our holistic understanding of health and disease morbidity in Haiti and in rural areas in particular. The focus of this study, therefore, is on bridging this gap by identifying the main health problems of women, men and children in rural Haiti.

Purpose of the Study

The purpose of this study is to investigate and describe the morbidity data collected in a convenience sample of rural Haitian villagers to understand the type and frequency of illness in this population.

Research Questions

1. What are the most common diagnoses?
2. Do diagnoses differ by age, sex, or time of year?
3. How stable are diagnoses over time?
4. Are there possible associations between environmental factors and the type of health diagnoses reported?

Significance of the Study

Findings from this study will help develop a framework for understanding health in rural Haiti. More specifically, findings will identify the leading health issues in the community and provide insight into how covariates such as age, sex, and time of year contribute to morbidity. Additionally, the study will identify epidemiologic patterns that may offer information about the origin and spread of illness, and assess how environmental factors like scarce nutritional resources, water contamination, inadequate sanitation, and limited access to health services are related to health.

Few studies exist that describe in detail the health of rural populations in Haiti. The results of this study will contribute to improved understanding of the populations' health care needs and will assist in developing an informed approach to delivery of future health services and interventions aimed at improving the quality and length of life for residents in areas facing similar problems.

Chapter 2

Literature Review

A History of Haiti and Its Significance to Health

The Republic of Haiti has a long history of oppression and poverty. In 1697 the French colonized the western third of the Caribbean island, Hispaniola, and established large coffee and sugar plantations. African slaves were imported for labor and later revolted. Although it is the only country to have gained independence from a successful slave revolt, more than a decade of war following the revolt ruined the country's infrastructure. In 1804 the French relinquished military control but demanded reparations, effectively marking the beginning of Haiti's longstanding debt burden. Since then, "instead of developing its potential, this deformed state produced a parade of nefarious leaders, most of whom gave up the insurmountable task of trying to fix the country and looted it instead" (Von Tunzelmann, 2009).

There is evidence that historical narratives can impact health outcomes, especially if salient for the population (Mohatt, Thompsom, Thai, & Tebes, 2014; Sotero, 2006). Haiti's historical narrative of trauma is striking for Haitians, as the consequences of oppression, like an inability to obtain basic levels of nutrition, education, and medical support, persist in current times (Watts, 2014). Pervasive poverty, contaminated living environments, and a gross lack of resources like healthcare, clean drinking water, adequate housing, and sanitation structure facilitate poor health outcomes. Further, the nation's history of and continued poverty hinders improvement in these areas.

The Health of the Haitian Population

Haiti's history provides a context within which contemporary social issues can be understood. It has been the poorest nation in the Western Hemisphere for decades (Sletten & Egset, 2004) and ongiong financial repression obstructed Haiti's ability to provide basic

sanitation and health resources to its population (Alsan, 2011). It is estimated that only 58% of the population has access to improved drinking water sources, and only 28% have access to adequate sanitation (UNICEF, 2015). This is particularly evident when examining the data on the health of the Haitian population. More specifically, the life expectancy among the population, exceeding 10 million, is 61 years, compared with the US life expectancy of 78.4 years (Kochanek, Xu, Murphy, Minino, & Kung, 2016), The infant mortality rate, 64 per every 1,000 births, is the highest in the western hemisphere (Anthony, 2011; WHO & UNICEF, 2014), and among children who survive past the age of 5 more than 25% suffer from malnutrition and stunted growth (Perry et al., 2007). As a result of poverty and shortcomings in healthcare infrastructure, less than half of Haitians have access to quality healthcare services (Klugman, 2009).

Poverty is arguably the greatest risk factor contributing to poor health. Evidence from all over the world supports a relationship between poverty and poor health (McIntyre, Connor, & Warren, 2000). Those living in poverty are disproportionately affected by poor health outcomes, with increased susceptibility to communicable disease and a lack of medical resources once infected (Alsan, 2011). With the majority of the Haitian population living on $1 per day (Alsan, 2011), they have little opportunity to save for health services or to acquire a baseline of good health. With that in mind, it is not surprising that many Haitians suffer from a variety of acute and chronic illness.

Focus of Past Research on Health in Haiti

The majority of research on Haitian health has been focused on specific health concerns like tuberculosis (Castro & Farmer, 2003), HIV/AIDS (Walton et al., 2004), maternal health (Gage, 2007; Jacobs, Judd, & Bhutta, 2016), and most recently, Cholera (Tappero & Tauxe,

2011). In the early 1990s tuberculosis (TB) was the leading cause of death among Haitians and there was little existing control or treatment available (Farmer, Robin, Ramilus, & Kim, 1991). A 1991 study in rural Haiti provided one group of TB positive patients with free medical care and another with free care as well as financial support, home follow-up from trained village health workers, and offered patients incentives to attend a monthly clinic. Findings revealed a significant difference in recovery rates between the two groups, suggesting a great need for consistency in treatment and support beyond basic medical care (Farmer, Robin, Ramilus, & Kim, 1991). In other words, environmental factors, like inaccessibility of care based on proximity, and social factors, like limited access to clean water and improved sanitation, can impact disease morbidity. Later studies supported this notion, suggesting that treatment must include environmental and social components, like food assistance (de Pee, Frede, Mehra, & Bloem, 2014). Findings like these made TB treatment programs more comprehensive, but poor treatment adherence and low treatment completion rates has prevented a significant decline in TB rates (de Pee, Frede, Mehra, & Bloem, 2014). In fact, Haiti showed an increase in TB prevalence with roughly 15,000 new or relapse TB diagnoses in 2014 and more than 16,000 new or relapse TB diagnoses in 2015 (WHO, 2015). In 2015, 19% of patients who were diagnosed with TB also tested positive for HIV (WHO, 2015). Patients with HIV are at an increased risk for contracting TB and between five and 10% of patients with HIV also suffer from TB (Joseph et al., 2006). The comorbidity of TB and HIV has made finding TB statistics for the general population a challenge, with most TB research now taking place in HIV/AIDS treatment facilities among HIV positive patients (Joseph et al., 2006) and centered around the relationship between the two diseases.

A little over a decade ago, over 6% of the Haitian population was HIV/AIDS positive and some speculated HIV/AIDS to be the reason for a decline in life expectancy (Koenig, Leandre, & Farmer, 2004; Walton, 2004). As of 2015, however, the infection rate has dropped to less than 2% (UNAIDS, 2016), most likely due to an increase in accessibility to antiretroviral treatment. Since 2010 Latin America and the Caribbean have seen a 25% increase in care coverage, with more than 50% of the HIV positive population able to access care (UNAIDS, 2016). With this success, in an effort to address other health priorities in Haiti, researchers have begun to tie other health matters, like TB, and maternal health, into their HIV treatment programs (Joseph et al., 2015).

Maternal health is of particular importance given Haiti's high rates of maternal mortality. According to a UNICEF report on rends in maternal mortality (2014), infant mortality, maternal mortality, and mortality rates for children under five years are the highest in the Western Hemisphere. Research on maternal health is primarily focused on access to care and the major barriers to utilization (Gage, 2007; Jacobs, Judd, & Bhutta, 2016). More specifically, geographical isolation, financial barriers, and limited transportation to services prevent mothers, infants, and young children from accessing necessary care (Jacobs, Judd, & Bhutta, 2016).

Due to financial and geographic barriers, 47% of Haitians lack access to healthcare and half of households report not having accessed health services due to the high cost (PAHO "Strengthening Health Systems and Services," 2011a). Transportation in rural areas is virtually nonexistent with most existing roads being in poor condition; only 5% of Haitians living in the mountainous country have access to paved roads (Prins, Kone, Nolan, & Thatte, 2008). A lack of health infrastructure and support for health services is contributing to poor maternal health. It is

important to note, however, that these barriers are most likely pertinent for all health services in Haiti.

Haiti's healthcare infrastructure, which was already insufficient to care for the population, suffered greatly from the earthquake in January 2010. Sixty percent of the Haitian state infrastructure, including more than 50 health institutions was destroyed, and health sector damages and losses exceeded 200% of Haiti's annual health expenditure (PAHO "Free obstetric care," 2011b). These problems, as well as damages to water and sanitation structure, were particularly challenging as Haiti faced the world's largest cholera epidemic in the last 50 years (Ryan, 2011).

Since then, most research on health in Haiti has been related to cholera surveillance and assessment of practices related to treatment and prevention (Barzilay et al., 2013; De Rochars, 2011; Ryan, 2011). One study examined the effectiveness of interventions implemented to prevent transmission of cholera and found that, while the overall knowledge of symptoms, prevention, treatment, and transmission was high, many individuals were unable to put their knowledge into practice due to structural and environmental factors, like a lack of access to safe drinking water (De Rochars, 2011). Research suggests that factors outside of individual or community level control, like malnutrition, high population density, insufficient access to clean water and sanitation, and low socioeconomic status contributed to the severity of the disease, (Barzilay et al., 2013; De Rochars, 2011), which is now endemic in the Haitian population (Ali, Nelson, Lopez, & Sack, 2015).

Conclusion

With most research focusing on specific health issues like tuberculosis, HIV/AIDS, maternal health, and cholera, our understanding of health in Haiti is somewhat narrow. To date,

there are few studies examining the comprehensive health of the rural Haitians (Niska & Sloaned, 2010). We do not know what illnesses are most prevalent in the community. Without an understanding of the common health issues in rural Haiti we cannot begin to address them. This study aims to fill the gap in our knowledge about rural Haitian health by taking a close look at a sample of clinic patients in rural Haiti.

Chapter 3

Methodology

Patients were evaluated at four medical clinics conducted between October 2011 and June 2015. Clinics were sponsored by the Cathedral of the Immaculate Conception in Memphis, TN, which developed a partnership with a parish in Layaye and surrounding villages through the Parish Twinning Program of the Americas. Detailed health and treatment information was collected to create patient records for care management to help develop health infrastructure in Layaye. Approximately 1,200 patient visits were recorded by volunteer doctors who recorded collected general metabolic measurements and information about patients' chief complaints. Although patient data were collected over a five-year period, this is the first study to analyze and draw conclusions from these data.

Research Design and Procedures

The study included all existing patient data. Participants voluntarily attended clinics held in, or nearby, their local parish. No sample strategy was implemented for this convenience sample; all patients were included in the analysis. Upon arrival at the clinic patients provided their names and were given a number. The clinic doctor saw patients in order of their arrival and collected demographic information, blood pressure, temperature, and asked about medical complaints the patients were experiencing. Data were printed on 3x5 index cards. Most notecards also report treatment prescribed. Patient data were manually entered into an Excel spreadsheet.

Each card was transformed into a row of data representing an individual patient. Entered data included unique ID, date and location of clinic, age, sex, temperature, and blood pressure of patient. For each row, columns corresponding to complaint/diagnosis were marked if the diagnosis was present, patients could have more than one diagnosis. Patient records reported a

mix of symptoms experienced by patients and diagnoses provided by the clinic doctor. In this study symptoms were considered diagnoses and treated as such during analysis. Data were reviewed by a second researcher to ensure data accuracy and integrity. Location of clinic was determined based on the date of the clinic. Each patient was given a unique ID, to maintain confidentiality, and the dataset was imported into SAS for analysis. The research protocol for this study was reviewed and approved by the University of Memphis' Institutional Review Board. A copy of this approval letter is available in the appendix.

Measurement of Covariates

Patient sex was used to assess the distribution of diagnoses throughout the population.

Patient age was used as criteria for stratification into categories to better represent the stages of life, as diagnoses appeared to change with age. Basic analysis observed differences between ten age cohorts. Children were segmented into four cohorts: Newborn to 2 years, 3 to 6 years, 7 to 12 years, and 13 to 18 years. In order to observe potential patterns in medical diagnoses correlated to age, adults were segmented into six age cohorts: 19 to 29 years, 30 to 39 years, 40 to 49 years, 50 to 59 years, 60 to 69 years, and adults 70 years of age and older.

Date of clinic data were divided into four groups: October 2011, March 2012, August 2012, and June 2015. This was done to observe any changes in symptoms based on whether clinic data were collected during rainy or dry months, as this can affect the transmission of various illnesses. June and October correspond to rainy months while March and August are typically dry.

Statistical Analysis

Descriptive analyses were conducted overall and stratified by date of clinic, sex, and age of patient. Frequency analyses were used to estimate the prevalence of each diagnosis in the

population. Some patients visit clinics multiple times so, as to not violate the assumption of independence, further analyses were run using only the initial visit. Subsequent visits were removed based on the assumption that previous treatment may have impacted their diagnoses in subsequent visits. Associations were evaluated between the prevalence of each diagnosis and age, sex, and date of clinic.

Associations between categorical variables were assessed using the chi-square test or Fishers Exact test (when expected cell counts were low). Continuous variables were compared using the t-test or Wilcoxon-Mann-Whitney test, if the normality assumption was not reasonable. All analyses used a type I error rate of 0.05 and were conducted in SAS Version 9.4 (Cary, NC).

Chapter 4

Results

Patient Demographics

There were 1,129 unique patients with a mean age of 28.04 years. Sixty-three percent of the patients were female, with a mean age of 28.76 years, and 37% were male, with an average age of 26.79 years. The largest age cohort was 19 to 29 years of age, accounting for 18.51% of all patients, followed by young children up to 3 years old (12.93%) and adults ages 30 to 39 (10.63%) and 40 to 49 (10.45%). The fewest number of patients were 70 or older (5.67%). The distribution of patients, based on age, is similar for each sex with the majority of patients being between 19 and 29 years of age for both females (19.6%) and males (16.6%). The largest age-sex cohort in the study was females, ages 19 to 29 years, accounting for 12.4% of the sample. This cohort is considerably larger than any other, regardless of sex, by 50 patients. Females also comprised the second (30 to 39 years), third (40 to 49 years), and fourth (00-02) largest age-sex cohorts in the study. The smallest age-sex cohort in the study was male patients 70 years of age or older, representing only 2.2% of the population. A detailed distribution of patients by sex and age is presented in Table 1.

Table 1

Distribution of Patients by Sex and Age

Females by Age (years)	Number	Percent	Males by Age (years)	Number	Percent
Overall	714	100	Overall	415	100.0
00-02	83	11.6	00-02	63	15.2
03-06	52	7.3	03-06	50	12.0
07-12	58	8.1	07-12	39	9.4
13-18	67	9.4	13-18	41	9.9
19-29	140	19.6	19-29	69	16.6
30-39	90	12.6	30-39	30	7.2
40-49	87	12.2	40-49	31	7.5
50-59	58	8.1	50-59	36	8.7
60-69	40	5.6	60-69	31	7.5
>E70	39	5.5	>E70	25	6.0

Diagnoses

The most common diagnoses were abdominal pain (39.91%), headache (28.05%), fever (15.58%), hypertension (12.48%), and lack of appetite (11.24%). These diagnoses include a blend of both chronic problems, like hypertension, and acute issues like fever and headache. The least common diagnoses, with less than 1% of patient diagnoses, include allergies, arthritis, asthma, burning with urination, congestion, dental or oral pain, hernia, sore throat, and upper extremity pain. Although 1.06% of patients were diagnosed with insomnia, mental health diagnoses were absent. A distribution of all diagnoses included in the analysis is available in the appendix.

Diagnoses by Sex

The most common diagnoses in females of all ages included abdominal pain (26.73%), headache (20.53%), hypertension (9.29%), and fever (9.29%). Similarly, males of all ages were most commonly diagnosed with abdominal pain (13.19%), headache (7.52%), and fever (6.28%), but also had high rates of cough complaints (4.25%). Among females and males of all ages the six most common diagnoses were identical, but distributed differently. There was a statistically significant association between headache ($p < 0.0001$), hypertension ($p = 0.0032$), lack of appetite ($p = 0.0376$), and patient sex, with a greater proportion of women than men being diagnosed with each. The 10 most common complaints and their associated P-values for sex can be found in the appendix. Table 2 offers a detailed distribution of diagnoses by sex.

Table 2

Distribution of Diagnoses by Patient Sex

Females	**Number**	**Percent**	**Males**	**Number**	**Percent**
Total	714		Total	415	
Abdominal Pain	302	26.73	Abdominal Pain	149	13.19
Headache	232	20.53	Headache	85	7.52
Hypertension	108	9.29	Fever	71	6.28
Fever	105	9.29	Cough	48	4.25
Lack of Appetite	91	8.05	Hypertension	36	3.19
Cough	73	6.46	Lack of Appetite	36	3.19
Dizziness	68	6.02	Back Pain	35	3.10
Back Pain	62	5.49	Difficulty Breathing	29	2.57
Difficulty Breathing	56	4.96	Dizziness	26	2.30
Generalized Pain/Cramps	51	4.51	Flu	24	2.12
Flu	50	4.42	Generalized Pain/Cramps	23	2.04
Acid Reflux	50	4.42	Acid Reflux	18	1.59

Diagnoses by Age

The most common diagnoses among children up to two years of age included fever (38.36%), cough (36.99%), flu (21.92%), and lack of appetite (19.18%). In children 3 to 6 years old the most common diagnoses were abdominal pain (38.24), fever (25.49%), and cough (21.57%). Children ages 7 to 12 years old showed high rates of abdominal pain (38.14%), headache (18.56%), and fever (15.46). The 13 to 18-year-old cohort had similar characteristics, with the most common diagnoses being headache (38.89%) and fever (11.11%), and nearly half being diagnosed with abdominal pain (49.07%).

Among adults 19 to 29 years of age the most common diagnoses were abdominal pain (45.95%), headache (44.98%), and dizziness (12.92%). Patients between the ages of 30 and 39 had high rates of headache (45.83%), abdominal pain (45%), back pain (15.83%), and hypertension (14.17%). The 40 to 49-year-old cohort had similar diagnoses of abdominal pain (44.07%), headache (37.49%), and back pain (19.49%), but reflected an increase in hypertension diagnoses (20.34%). Adults 50 to 59 years of age had high rates of abdominal pain (42.55%), hypertension (35.11%), headache (27.66%), as well as dizziness, back, and generalized pain (15.96%). The most common complaint among adults aged 60 to 69 years included abdominal pain (40.85%), hypertension (36.62%), and headache (23.94%). Almost half (46.88%) of adults 70 years of age and older were diagnosed with hypertension, followed by abdominal pain (37.5%), and general body pain (26.56%).

In the transition from childhood (18 years of age and younger) to adulthood (19 and older) diagnoses like flu, cough, diarrhea, and itchiness become less common while hypertension, acid reflux, difficulty breathing, and back pain become more common. Vaginal infection is common only in patients between 13 and 29 years of age. Acid reflux is most

commonly diagnosed in patients between 30 and 49 years old. Hypertension diagnoses become increasingly common with age, with a growing percentage of each cohort receiving a diagnosis of hypertension. Diagnoses like abdominal pain and headache remain common regardless of age cohort.

We found a statistically significant difference in the median age of persons with abdominal pain (Median: 26; Min-Max: 0.04-86) versus those without abdominal pain (Median: 22; Min-Max: 0.04-90) (P-Value = 0.0021). There was also a statistically significant difference in the median age of persons with a diagnosis for headache (Median: 29; Min-Max: 2-90) compared to those without a headache diagnosis (Median: 20; Min-Max: 0.04-87) (P-Value < 0.0001), those with hypertension (Median: 51; Min-Max: 18-90) versus those without a diagnosis for hypertension (Median: 20; Min-Max: 0.04-86) (P-Value < 0.0001), patients with a diagnosis for fever (Median: 9; Min-Max: 0.08-80), versus patients without fever (Median: 26; Min-Max: 0.04-90) (P-Value <0.001), as well as those with a lack of appetite (Median: 15; Min-Max: 0.50-80) and those without (Median: 24.5; Min-Max: 0.04-90) (P-Value = 0.0027). The differences in age of persons with diagnoses for back pain, dizziness, cough, flu, and generalized body pain compared to those without (all P-Values <0.0001).

A distribution of the six most common diagnoses by age cohort and a table of the 10 most common diagnoses and their associated p-values for age are available in the appendix.

Diagnoses by Covariates: Sex and Age

For both boys and girls up to 12 years of age the most common diagnoses included abdominal pain (29.57%), fever (28.12%), cough (24.35%), lack of appetite (16.81%), and flu (15.94%). Among adult men and women adults (19 years of age and older), the common

diagnoses were abdominal pain (43.64%) and headache (36.99%). The six most common diagnoses for each age and sex cohort are presented in Table 3.

Table 3 (Continued)

Most Common Diagnoses by Sex and Age Cohort

Female	**Number**	**Percent within age and sex cohort**	**Male**	**Number**	**Percent within age and sex cohort**
Age: 00-02	**83**		**Age: 00-02**	**63**	
Cough	31	37.35	Fever	25	39.68
Fever	31	37.35	Cough	23	36.51
Flu	22	26.51	Flu	10	15.87
Abdominal Pain	20	24.10	Diarrhea	9	14.29
Lack of Appetite	20	24.10	Lack of Appetite	8	12.70
Diarrhea	13	15.66	Nausea Vomiting	7	11.11
03-06	**52**		**03-06**	**50**	
Abdominal Pain	21	40.38	Abdominal Pain	18	36.00
Fever	13	25.00	Fever	13	26.00
Cough	12	23.08	Cough	10	20.00
Itchiness	9	17.31	Lack of Appetite	10	20.00
Flu	7	13.46	Flu	6	12.00
Lack of Appetite	7	13.46	Ringworm	6	12.00
07-12	**58**		**07-12**	**39**	
Abdominal Pain	22	37.93	Abdominal Pain	15	38.46
Headache	13	22.41	Ringworm	6	15.38
Fever	11	18.97	Headache	5	12.82
Lack of Appetite	11	18.97	Fever	4	10.26
Flu	6	10.34	Flu	4	10.26

Female	Number	Percent within age and sex cohort	Male	Number	Percent within age and sex cohort
Difficulty Breathing	5	8.62	Cough	4	10.26
13-18	**67**		**13-18**	**41**	
Abdominal Pain	34	50.75	Abdominal Pain	19	46.34
Headache	24	35.82	Headache	18	43.90
Vaginal Infection/Pain	10	14.93	Fever	5	12.20
Fever	7	10.45	Lack of Appetite	3	7.32
Dizziness	7	10.45	Nausea/Vomiting	2	4.88
Lack of Appetite	4	5.97	Weakness	2	4.88
Generalized Pain & Cramps	4	5.97	-	-	-
Weakness	4	5.97	-	-	-
19-29	**140**		**19-29**	**69**	
Headache	70	50.00	Abdominal Pain	30	43.48
Abdominal Pain	66	47.14	Headache	24	34.78
Vaginal Infection/Pain	21	15.00	Itchiness	9	13.04
Dizziness	19	13.57	Fever	9	13.04
Lack of Appetite	17	12.14	Dizziness	8	11.59
Fever	15	10.71	Difficulty Breathing	6	8.70
30-39	**90**		**30-39**	**30**	
Abdominal Pain	42	46.67	Abdominal Pain	12	40.00
Headache	45	50.00	Headache	10	33.33
Hypertension	17	18.89	Back Pain	6	20.00
Acid Reflux	13	14.44	Generalized Pain &	5	16.67

Female	Number	Percent within age and sex cohort	Male	Number	Percent within age and sex cohort
			Cramps		
Back Pain	13	14.44	Dizziness	4	13.33
Difficulty Breathing	11	12.22	Lack of Appetite	3	10.00
Lack of Appetite	11	12.22	-	-	-
40-49	**87**		**40-49**	**31**	
Abdominal Pain	36	41.38	Abdominal Pain	16	51.61
Headache	34	39.08	Headache	10	32.26
Hypertension	20	22.99	Back Pain	8	25.81
Back Pain	15	17.24	Dizziness	6	19.35
Generalized Pain & Cramps	13	14.94	Hypertension	4	12.90
Lack of Appetite	10	11.49	Generalized Pain & Cramps	2	6.45
50-59	**58**		**50-59**	**36**	
Abdominal Pain	29	50.00	Abdominal Pain	11	30.56
Hypertension	27	46.55	Hypertension	6	16.67
Headache	21	36.21	Back Pain	6	16.67
Dizziness	12	20.69	Cough	5	13.89
Generalized Pain & Cramps	10	17.24	Fever	5	13.89
Back Pain	9	15.52	Headache	5	13.89
-	-	-	Generalized Pain & Cramps	5	13.89
60-69	**40**		**60-69**	**31**	
Abdominal Pain	18	45.00	Hypertension	13	41.94

Female	Number	Percent within age and sex cohort	Male	Number	Percent within age and sex cohort
Hypertension	13	32.50	Abdominal Pain	11	35.48
Headache	10	25.00	Headache	7	22.58
Difficulty Breathing	9	22.50	Difficulty Breathing	6	19.35
Back Pain	8	20.00	Back Pain	5	16.13
Dizziness	8	20.00	Lower Extremity Pain	5	16.13
>E70	**39**		**>E70**	**25**	
Hypertension	20	51.28	Abdominal Pain	11	44.00
Abdominal Pain	13	33.33	Hypertension	10	40.00
Headache	11	28.21	Back Pain	6	24.00
Generalized Pain & Cramps	11	28.21	Poor Vision	6	24.00
Back Pain	7	17.95	Generalized Pain & Cramps	6	24.00
Poor Vision	6	15.38	Headache	3	12.00
Lack of Appetite	6	15.38	Itchiness	3	12.00
-	-	-	Lack of Appetite	3	12.00
-	-	-	Lower Extremity Pain	3	12.00

Diagnoses by Clinic Date

Of four separate clinics with a total of 1,223 patient visits, the largest number of patient visits was in August 2012, during the dry season, with 582 patient visits. This clinic accounted for nearly half (48%) of all visits included in this analysis. There were 333 visits in June 2015, 220 in October 2011, and 89 in March 2012. The distribution of illnesses like abdominal pain, hypertension, back pain, and headache remain somewhat consistent and common across all four

clinics. Abdominal pain, for example, remains the most common diagnosis (between 34.5% and 46.58%) across all four clinic dates. Similarly, headache is the second most common diagnosis in October (31.96%), August (29.27%), and June (25.37%), and the third most common in March, where it still accounts for 19.10% of diagnoses during that clinic date.

On the other hand, illnesses like cough, flu, diarrhea, and nausea and vomiting fluctuate across the clinic dates. For example, flu varies from 2.8% in October 2011 to 13.6% in June 2015. Cough also varies across clinic date, from 3.37% in March 2012 to 12.91% just five months later, in August 2012. Figure 1 presents the fluctuations and consistency in four diagnoses (abdominal pain, headache, flu and cough) across clinic dates.

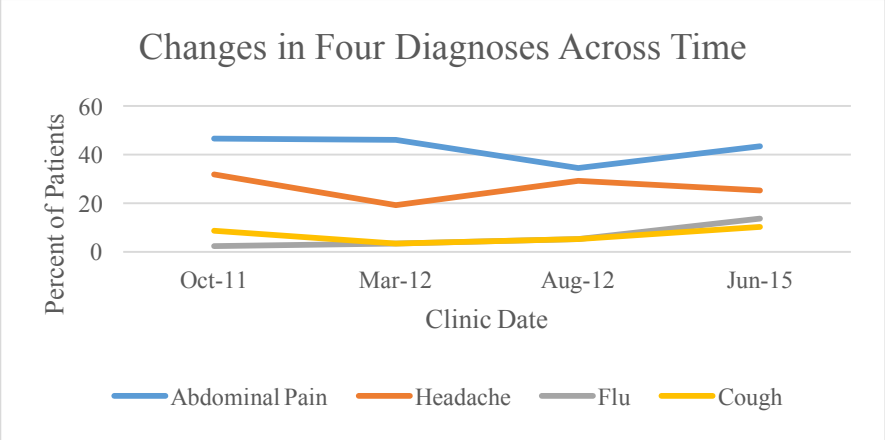

Figure 1. Distribution of Diagnoses Across Clinic Date

A distribution of the 12 most common diagnoses for each clinic date, and percentage during the clinic corresponding to each diagnoses is presented in Table 4.

Table 4

Most Common Diagnoses by Clinic Date

October 2011 (WET)	%	**March 2012 (DRY)**	%	**August 2012 (DRY)**	%	**June 2015 (WET)**	%
Abdominal Pain	46.58	Abdominal Pain	46.07	Abdominal Pain	34.55	Abdominal Pain	43.38
Headache	31.96	Fever	24.72	Headache	29.27	Headache	25.37
Hypertension	19.18	Headache	19.10	Fever	15.64	Fever	13.60
Fever	14.16	Hypertension	12.36	Hypertension	13.45	Flu	13.60
Dizziness	12.33	Dizziness	10.11	Cough	12.91	Lack of Appetite	12.13
Lack of Appetite	10.50	Diarrhea	7.87	Lack of Appetite	11.82	Dizziness	11.76
Difficulty Breathing	10.50	Back Pain	7.87	Back Pain	8.18	Cough	10.29
Back Pain	10.05	Difficulty Breathing	6.74	Difficulty Breathing	7.45	Back Pain	8.46
Cough	8.68	Lack of Appetite	6.74	Flu	5.27	Itchiness	6.25
Itchiness	5.94	Itchiness	5.62	Dizziness	4.73	Difficulty Breathing	5.51
Nausea & Vomiting	2.74	Worms/Parasites	4.49	Itchiness	3.27	Hypertension	5.15
Diarrhea	2.28	Flu	3.37	Nausea & Vomiting	2.91	Diarrhea	4.78
Flu	2.28	Cough	3.37	Diarrhea	2.18	Nausea & Vomiting	4.04
Worms/Parasites	1.37	Nausea & Vomiting	1.12	Worms/Parasites	0.55	Worms/Parasites	2.94

Blood Pressure and Hypertension

Blood pressure was measured for 98% of adult patients 19 years and older. The maximum systolic blood pressure was 254 mm Hg and the maximum diastolic blood pressure was 139 mm Hg. The mean blood pressures for men and women were similar, but women had slightly higher values than men. For women, the mean systolic blood pressure was 128.46 (SD: 28.59) and the mean diastolic blood pressure was 78.16 (SD: 15.95). For men, the mean systolic blood pressure was 128.17 (SD: 25.53) and the mean diastolic blood pressure was 76.75 (SD: 14.88). Mean systolic and diastolic blood pressures for each age cohort and hypertension cutoff categorization, based on American Heart Association guidelines (2014), is presented in Table 5.

Note that cutoff categories are based on cohort averages and does not necessarily imply that half of the patients suffer from hypertension.

Table 5

Distribution of Mean Blood Pressure by Age Cohort

Age	Mean Systolic	Standard Deviation	Mean Diastolic	Standard Deviation	Hypertension Cutoff Category (based on averages)
13-18	112.6	14.00	70.00	10.30	N/A
19-29	118.66	17.16	73.33	12.66	N/A
30-39	121.83	21.74	77.22	15.40	Prehypertension
40-49	129.99	26.77	79.36	14.87	Prehypertension
50-59	140.59	32.96	81.81	17.59	Stage 1 HTN
60-69	148.44	31.75	85.44	17.42	Stage 1 HTN
>E70	152.56	31.81	86.13	17.78	Stage 1 HTN

Hypertension diagnoses emerged in the 30 to 39-year-old cohort (14.17%) and grew increasingly prevalent with age, accounting for 20.34% of diagnoses in 40 to 49 year olds, 35.11% in 50 to 59 year olds, 36.62% in 60 to 69 year olds, and was the single most common diagnosis, 46.88%, in patients 70 years and older. Table 6 presents data for patients with a diagnosis for hypertension in each age cohort. Blood pressure was not measured in children under 13 years of age so no hypertension diagnoses could be made.

Table 6

Hypertension Diagnosis by Age Cohort

Age	Number	Percent of patients in age group with hypertension
13-18	1	0.93
19-29	10	4.78
30-39	17	14.17
40-49	24	20.34
50-59	33	35.11
60-69	26	36.62
>E70	30	46.88

Chapter 5

Discussion

The rural Central Plateau of Haiti is a geographic region in which general health has not yet been adequately investigated or described. Research conducted in rural Haiti has offered some insight into health, but the majority of published literature has been geared toward specific health concerns like tuberculosis, HIV/AIDS, maternal health, and cholera. Studies aiming to explain the overall health problems of the population are non-existent (Niska & Sloand, 2010). This study addresses the gap in our knowledge about health in rural Haiti by presenting an in-depth description of the primary medical problems and common diagnoses in the population and their distribution across age, sex, and temporality.

With our analysis we determined the most common diagnoses include abdominal pain, headache, fever, hypertension, and a lack of appetite. Abdominal pain affects the population regardless of age, gender, or time of year. Despite being this population's most common complaint, there is a scarce amount of literature discussing the prevalence of general abdominal pain in Haitians. With these data, it was not possible to determine the origin of abdominal pain, although it could be related to a number of factors such as diet, intestinal parasites, or consumption of contaminated water. Considering that only 58% of Haitians have access to clean water (UNICEF, 2015), the high incidence of abdominal pain was not surprising.

Parasitic infections are most often associated with poverty, consumption of unsafe water, and poor sanitation and hygiene (Matthys, 2011), which aptly characterize the study area. Of symptoms experienced in patients with intestinal parasites, persistent abdominal pain is one of the most common (Sheehan, Raucher, & McKitrick, 1986). Although this analysis does not report high rates of worms or parasites, it is likely that many patients diagnosed with abdominal

pain were suffering from parasitic infection. However, as clinics were not equipped with the ability to perform lab tests, the presence of parasitic worms could not be confirmed. Further, considering that children are the usual recipients of deworming medicine in this community, it is highly likely that many adults experiencing chronic abdominal pain have untreated intestinal parasites. Future research could test whether administration of an anti-helminthic drug such as albendazole to the adult population can reduce the incidence of abdominal pain.

Hypertension was another common diagnosis in this population. It was somewhat surprising to find high rates of hypertension since the population does not present many of the factors that are considered common causes like lack of physical activity, smoking, alcohol use, and obesity. Other research has reported that only 4% of the Haitian population has an increased BMI (Kenerson, 2014). One potential contributing factor is increased salt intake due to high levels of salt in traditional Haitian cooking. Haitian culture endorses the use of salt due to its protective benefits countering dehydration in hot environments and belief that it is associated with vitality and strength (Kenerson, 2014). Over time, chronic water insecurity and high salt diets may facilitate the emergence of hypertension, as research has demonstrated a link between dehydration and elevated blood pressure in late life (Manz & Wentz, 2005). This notion mirrors our findings, showing a positive correlation between age and mean systolic and diastolic blood pressure.

In their research, Niska and Sloand (2010) found that most Haitians with hypertension were unaware of their status and less than 10% who knew they were hypertensive were receiving treatment. Given the comorbidity of hypertension with other diseases like cardiovascular disease, stroke, and kidney disease there is a great need for treatment. Seeing as nearly half of Haitians choosing to forego care based on cost (PAHO “Strengthening Health Systems and Services”,

2011a) and the fact that the majority of rural Haitians' do not have reliable transportation to receive treatment anyway (Prins, Kone, Nolan, & Thatte, 2008), it is imperative to improve ongoing health services in the community. Findings from this study provides data supported evidence that hypertension is a common medical problem in the community. This evidence may be useful to doctors in future clinics to ensure they are bringing adequate amounts of hypertension medication. Additionally, with two age cohorts (30 to 39 and 40 to 49 years old) falling within the prehypertension category, preventive behavior changes are necessary to reduce the prevalence of hypertension in later adulthood. Focus groups geared toward understanding the cultural significance of salt may provide useful insight into the best way to motivate dietary changes (i.e., decreased salt consumption and increased consumption of clean water) in the community.

The analysis of diagnoses across clinic dates indicated that most common diagnoses are stable over time and do not change based on season. This held true even for acute illness like flu. These findings were unexpected, as the wet season, characterized by increased precipitation and humidity, and close proximity in closed spaces resulting from seeking shelter from rain, are often associated with increased transmission of infectious disease (Wu, Lu, Zhou, Chen, & Xu, 2016).

There seems to be a relationship between environmental issues, such as limited access to health services, scarce nutritional resources, water contamination, inadequate sanitation, and type of health complaint. For example, chronic diagnoses like hypertension require long term treatment, which, is not viable considering nearly half of Haitians lack access to general healthcare (PAHO "Strengthening Health Systems and Services," 2011a). Factors like inadequate access to clean water and sanitation structure are likely related to diagnoses including cough, fever, flu and diarrhea. In the same way that they influenced the severity of cholera

(Barzilay et al., 2013; De Rochars, 2011), these factors may also facilitate endemic diagnoses like abdominal pain.

Limitations

One limitation of the data is that it represents a convenience sample of patients attending clinics held at uneven time intervals. It is possible that some population segments, such as women and children, may be overrepresented while others, such as severely ill individuals who are unable to reach the clinic or have already been transported to hospital, may be underrepresented. Because of this, there may be biases inherent in the sample and, thus, it may not be representative of the population.

Another limitation of the data, characteristic of secondary data analysis, was a lack of control over the data collection process. This resulted in inconsistencies in data collected from clinic to clinic. For example, some temperatures were recorded in Celsius and others in Fahrenheit. In addition, there were different people collecting patient information. This sometimes resulted in different terminology or spelling for the same complaint, as data collectors' native language could have been French, Haitian Kreyol, or English. Information included on each card varied from clinic to clinic with some data collectors recording just diagnoses and patient complaints, and others providing the course of treatment, usually medication, given to each patient. Another limitation was that patients often did not know their date of birth and offered estimates, which may have caused misclassification of age groups.

Recommendations

This is the first study to assess the chief medical diagnoses in this region of rural Haiti. Based on these findings future directions could include an analysis of diagnoses based on the presence of latrines and improved water systems. Based on the observation that households are

often small, an analysis of indoor air quality and mold would be beneficial in determining if asthma could be an underlying cause of cough and headache, both of which were common diagnoses in this study. Observing consistencies or variations in diagnoses in different villages may support the generalizability of findings from this study to the rural Haitian population.

For the ease of potential analyses, future clinics would benefit from use of a standardized tool to collect patient information. Collection of additional patient demographic information like profession, education, and health behaviors (i.e., smoking, alcohol consumption, or handwashing) could provide interesting insight into how these factors relate to health. It would also be interesting to analyze variation in diagnoses based on the primary source of water (e.g., stream, river, protected or unprotected springs, well, etc.) and the method of treatment or filtration (e.g., in home filtration system, chlorine tablets, solar filtration, etc.). This may help to underscore the importance of clean water to health.

Chapter 6

Conclusion

This paper focuses on categorizing and describing the prominent medical problems diagnosed in a medical clinic in rural Haiti. The study also offers an analysis of diagnoses across covariates age, sex, and date of clinic, to observe possible patterns. An important strength of the study is the large sample size, over 1,000 patients, lending statistical power and reliability. The study explores common health problems and diagnoses in the Central Plateau of Haiti, a geographic region that has not yet been adequately described in terms of health. With one third of Haiti's healthcare coming from the private non-profit sector, including non-governmental organizations, volunteer, and religious organizations (PAHO, 2011c), findings from this analysis will be beneficial to help future organizations in their expectations, preparation, and delivery of healthcare. More specifically, future clinics may be better equipped with health information and medication suited to the health problems in rural Haiti or other similar areas.

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Appendix

Appendix 1

University of Memphis IRB Approval

Hello,

The University of Memphis Institutional Review Board, FWA00006815, has reviewed and approved your submission in accordance with all applicable statuses and regulations as well as ethical principles.
PI NAME: Emma Draluck
CO-PI:
PROJECT TITLE: Secondary Analysis of Morbidity Data from a Rural Haitian Village
FACULTY ADVISOR NAME (if applicable): Debra Bartelli
IRB ID: #4311
APPROVAL DATE: 9/1/2016
EXPIRATION DATE:
LEVEL OF REVIEW: Exempt
Please Note: Modifications do not extend the expiration of the original approval
Approval of this project is given with the following obligations:
1. If this IRB approval has an expiration date, an approved renewal must be in effect to continue the project prior to that date. If approval is not obtained, the human consent form(s) and recruiting material(s) are no longer valid and any research activities involving human subjects must stop.
2. When the project is finished or terminated, a completion form must be completed and sent to the board.
3. No change may be made in the approved protocol without prior board approval, whether the approved protocol was reviewed at the Exempt, Expedited or Full Board level.
4. Exempt approval are considered to have no expiration date and no further review is necessary unless the protocol needs modification.
Approval of this project is given with the following special obligations:
Thank you,
James P. Whelan, Ph.D.
Institutional Review Board Chair
The University of Memphis.
Note: Review outcomes will be communicated to the email address on file. This email should be considered an official communication from the UM IRB.

Appendix 2

Distribution of All Diagnoses Included in Analysis of All Patients

Diagnosis	Number	Percent
Total	1129	100
Abdominal Pain	451	39.91
Acid Reflux	68	6.02
Allergies	4	0.35
Anemia	17	1.5
Arthritis	5	0.44
Asthma	3	0.27
Back Pain	97	8.58
Burning with Urination	6	0.53
Chest Pain	20	1.77
Congestion	3	0.27
Cough	121	10.71
Dental	11	0.97
Diarrhea	37	3.27
Difficulty Breathing	85	7.52
Dizziness	94	8.32
Earache	21	1.86
Eye Pain/Itchiness	52	4.6
Fever	176	15.58
Flu	74	6.55
Gas	21	1.86
Headache	317	28.05

Diagnosis	Number	Percent
Heart Palpitations	21	1.86
Hernia	9	0.80
Hypertension	141	12.48
Insomnia	12	1.06
Itchiness	53	4.69
Lack of Appetite	127	11.24
Lower Extremity Pain	29	2.57
Nausea/Vomiting	34	3.01
Poor Vision	50	4.42
Pregnant	12	1.06
Rash	30	2.65
Ringworm	20	1.77
Scabies	10	0.88
Sore Throat	6	0.53
Urinary Tract Infection	25	2.21
Upper Extremity Pain	4	0.35
Vaginal Infection	50	4.42
Weakness	34	3.01
Weight Loss	22	1.95
Worms/Parasites	18	1.59
Generalized Body Pain/Cramps	74	6.55

Appendix 3

P-Values for the Association Between Sex and the 10 Most Common Diagnoses

Diagnosis	**Proportion of Females**	**Proportion of Males**	**P-Value**
Abdominal Pain	*42.24%*	*35.90%*	*0.0437*
Headache	*32.45%*	*20.48%*	*<0.001*
Fever	14.69%	17.11%	0.2789
Hypertension	*14.69%*	*8.67%*	*0.0032*
Lack of Appetite	*12.73%*	*8.67%*	*0.0376*
Cough	10.21%	11.57%	0.4772
Back Pain	8.67%	8.43%	0.8907
Dizziness	9.51%	6.27%	0.0569
Difficulty Breathing	7.83%	6.99%	0.6040
Generalized Body Pain	7.13%	5.54%	0.2974

*Diagnoses with significant p-values are italicized

*P-values are calculated by the Chi-Square test or Fishers Exact test

Appendix 4

P-Values for the Association Between Age and the 10 Most Common Diagnoses

Diagnosis	**Median Age (Min-Max) With Diagnosis (years)**	**Median Age (Min-Max) Without Diagnosis (years)**	**P-Value**
Abdominal Pain	*26 (0.04-86)*	*22 (0.04-90)*	*0.0021*
Headache	*29 (2-90)*	*20 (0.04-87)*	*<0.0001*
Hypertension	*51 (18-90)*	*20 (0.04-86)*	*<0.0001*
Back Pain	*46 (12-87)*	*22 (0.04-90)*	*<0.0001*
Lack of Appetite	*15 (0.50-80)*	*24.5 (0.04-90)*	*0.0027*
Fever	*9 (0.08-80)*	*26 (0.04-90)*	*<0.0001*
Dizziness	*37 (9-80)*	*22 (0.04-90)*	*<0.0001*
Cough	*3 (0.04-80)*	*25 (0.04-90)*	*<0.0001*
Flu	*4 (0.08-80)*	*25 (0.04-90)*	*<0.0001*
Generalized Body Pain	*50 (13-90)*	*22 (0.04-87)*	*<0.0001*

*Diagnoses with significant p-values are italicized

*P-Values are calculated using the Wilcoxon-Mann-Whitney test.

Appendix 5 (Continued)

Six Most Common Diagnoses for Each Age Cohort

Diagnosis	Total	Percent within age
00-02	**146**	
Fever	56	38.36
Cough	54	36.99
Flu	32	21.92
Lack of Appetite	28	19.18
Abdominal Pain	26	17.81
Diarrhea	22	15.07
03-06	**102**	
Abdominal Pain	39	38.24
Fever	26	25.49
Cough	22	21.57
Lack of Appetite	17	16.67
Flu	13	12.75
Itchiness	11	10.78
07-12	**97**	
Abdominal Pain	37	38.14
Headache	18	18.56
Fever	15	15.46
Lack of Appetite	13	13.40
Flu	10	10.31
Cough	8	8.25
13-18	**108**	
Abdominal Pain	53	49.07
Headache	42	38.89

Diagnosis	Total	Percent within age
Fever	12	11.11
Vaginal Infection	10	9.26
Lack of Appetite	7	6.48
Dizziness	7	6.48
19-29	**209**	
Abdominal Pain	96	45.93
Headache	94	44.98
Dizziness	27	12.92
Fever	24	11.48
Vaginal Infection	21	10.05
Difficulty Breathing	19	9.09
30-39	**120**	
Headache	55	45.83
Abdominal Pain	54	45.00
Back Pain	19	15.83
Hypertension	17	14.17
Lack of Appetite	14	11.67
Acid Reflux	14	11.67
40-49	**118**	
Abdominal Pain	52	44.07
Headache	44	37.29
Hypertension	24	20.34
Back Pain	23	19.49
Acid Reflux	15	12.71

Diagnosis	Total	Percent within age
General Pain	15	12.71
50-59	**94**	
Abdominal Pain	40	42.55
Hypertension	33	35.11
Headache	26	27.66
Dizziness	15	15.96
Back Pain	15	15.96
General Pain	15	15.96
60-69	**71**	
Abdominal Pain	29	40.85
Hypertension	26	36.62

Diagnosis	Total	Percent within age
Headache	17	23.94
Difficulty Breathing	15	21.13
Back Pain	13	18.31
Dizziness	11	15.49
>E70	**64**	
Hypertension	30	46.88
Abdominal Pain	24	37.50
General Pain	17	26.56
Headache	14	21.88
Back Pain	13	20.31
Poor Vision	12	18.75