



# Hypertension and Diabetes Mellitus in Rural Haiti

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## Abstract

**Introduction:** The problem of the prevailing occurrence of hypertension and diabetes cases quickly took the world by storm. Rural areas became even more exposed to the negative issues associated with these health conditions due to the lack of a skilled workforce and educational programs for patients. Within the framework of the current paper, the researcher utilized the data from two mission trips in Thomonde, Haiti, to gain more insight into chronic health issues among rural Haitian residents.

**Methods:** This study employed a retrospective analytical cross-sectional retrospective, descriptive design utilizing data obtained from two mission trips in Thomonde, Haiti in the areas of Palmay, Savane Plate, and La Hoye. The information was analyzed with the help of the SPSS software. A total of 403 adult patient visits across the three sites and two visits were included in the analysis.

**Results:** *Gastroesophageal reflux disease* (GERD) (25.8%) was the most common diagnosis found in the rural Haitian communes among adults in the total sample (N=403), followed by Hypertension (16.8%) and Dehydration (13.9%). Among women, significant differences were found by location for pregnancy. The greatest number of pregnancies were observed in La Hoye (19.0%).

**Conclusion:** The core implication of these findings was the significance of disseminating knowledge across rural areas while conducting similar retrospective studies to check progress. Real-life application of relevant knowledge could be beneficial for both patients and care providers operating in rural locations that are the hardest to reach.

**Keywords:** Chronic Disease, Prevalence, Primary Health Care, Rural Population

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## Introduction

Cardiovascular disease (CVD) is a major cause of morbidity and mortality across the world. According to the World Health Organization (WHO) report, 80% of all CVD-related deaths occur in developing countries.<sup>1,2</sup> Moreover, CVD was responsible for 24% of total deaths in Haiti (WHO, 2014). Haiti is a country located on the island of Hispaniola in the Greater Antilles archipelago of the Caribbean Sea, to the east of Cuba and Jamaica and south of The Bahamas and the Turks and Caicos Islands (Figure 1). In the western hemisphere, Haiti has one of the highest rates of non-communicable diseases (e.g., CVD and stroke), and associated risk factors, including hypertension and diabetes, are among the leading cause of death.<sup>3</sup> However, data regarding the prevalence of diseases and associated risk factors in rural Haiti are sparse, limiting our ability to address the health needs of the Haitian people.

Hypertension is a major risk factor for CVD and stroke and the most prevalent CVD risk factor affecting Haitians.<sup>4,5</sup> The Haiti Ministry of Health finds hypertension as being the leading cause of mortality among adults in Haiti with 5.4% of all deaths are directly attributed to hypertension.<sup>6</sup> Diabetes mellitus is also an important risk factor for CVD. In Haiti, the prevalence of diabetes is estimated to be around 10% in the general population.<sup>4</sup> Based on the WHO,<sup>7</sup> diabetes mellitus

was responsible for 5% of total deaths in Haiti. Similar to hypertension, the prevalence of diabetes has continued to rise over the past several decades, and it is thought to be the acquisition of a more westernized diet and lifestyle. It is prudent that prevention and management programs be developed to target those people who have diabetes and hypertension, as these are the most important and prevalent risk factors for CVD affecting Haitians. Research regarding health issues in Thomonde is scant.

This study aimed to describe the prevalence of hypertension and diabetes mellitus, as well as other health-related issues in three specific communes of the Central Plateau: Palmay, Savane Plate, and La Hoye.

## Methods

### Design and Sample

This study employed a retrospective analytical cross-sectional design utilizing data obtained from two mission trips in Thomonde, Haiti. The [Blinded for Review] has partnered with Project Medishare, a non-governmental organization since 2010 to provide primary care health services to the rural population of the Central Plateau in Haiti.<sup>8</sup> The data for this study was collected from six mobile clinics conducted in collaboration with local nurses, pharmacists, and physicians



Figure 1. Haiti Map.

in 2016 and 2017. During the clinic visits, nurse practitioner students and faculty members performed physical exams and prescribed treatment regimens. While adults (18 years old or greater) and pediatric (<18 years old) were seen at the clinics, only adults are reported in this manuscript. A total of 403 adult patient visits across the three sites and two visits were included in the analysis. The analysis described below included the entire population of patients assessed. Moreover, the statistics reported in this study were descriptive and nonparametric. Therefore, a sample size calculation was not conducted.

### Physical Exams

Physical exams included the overall constitution of the patient. An external and internal exam of the eyes and ears, nose, and pharynx was performed using a Welch Allyn otoscope and ophthalmoscope diagnostic set (97250). Additionally, inspection, palpation, and auscultation of the neck, cardiovascular, pulmonary, and gastrointestinal/abdominal system was performed. When appropriate or related to the chief complaint, the exam included the genitourinary system. Following a cephalocaudal approach, the students examined the lower back and extremities. The students assessed the extremities for tenderness, edema, deformities, cyanosis, palpated peripheral pulses, and capillary refill.

### Measures

Hypertension was diagnosed based on two separate readings above 140/90.<sup>9</sup> To obtain the readings, an electronic Welch Allyn blood pressure monitor (Pro BP 2000) was used with an appropriate cuff based on arm circumference. Elevated values were confirmed manually with a Welch Allyn DS44-11C Durashock Aneroid sphygmomanometer adult cuff. Diabetes Mellitus was diagnosed following the American Diabetes Association<sup>10</sup> based on a random plasma glucose test greater

than or equal to 200mg/dl plus symptoms of diabetes such as polyuria, polydipsia, and polyphagia. To obtain the reading, a Stat Strip Nova biomedical glucometer was utilized. Prior to performing exams for the day, control for low glucose and high was passed by each glucometer. A presumptive diagnosis of gastroesophageal reflux disease (GERD) was made based on the patient's symptoms (heartburn, regurgitation) and physical examination.<sup>11</sup> The diagnosis of Tinea infections was made based on physical examination.<sup>12</sup> The diagnosis of dehydration was made according to clinical manifestations (diarrhea, vomiting, decreased urine output), physical exam (dry mucous membrane), and viral signs (tachycardia, tachypnea).<sup>13,14</sup> A diagnosis of upper Respiratory Infections was made based on clinical manifestation and physical exam.<sup>15</sup>

### Prescribed Treatments

Prescribed treatments included over-the-counter medications brought by the research team. Examples of drugs brought by the team included acetaminophen, ibuprofen, famotidine, diphenhydramine, clotrimazole topical, triple antibiotic (bacitracin/neomycin/polymyxin b sulfate), multivitamins, and selenium shampoo. Additionally, medications from the Medishare formulary were used to treat various ailments encountered during the visit. The formulary had a limited list of medicines based on donations. Medications were separated by category and included dosages available. Classes available included antibiotics, antihypertensives, respiratory, gastrointestinal, anti-malaria, analgesics, antidiabetics, and topical medications for skin disorders. The availability of the medications would vary by day, and faculty with students would have to check with the local pharmacist if the medications or substitutions are available. Treatment protocols from the USA, such as the American Heart Association, were used to select pharmacological agents as well as the availability of first-line agents from the formulary list. Because of the high propensity for dehydration in the area, the study team avoided using diuretics to manage hypertension and used alternative medications such as calcium channel blockers when available. When patients were noted to have a history of renal disease, angiotensin-converting enzyme inhibitors were used per Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood (JNC 8) recommendations. Nurse practitioner students were required to verify the diagnosis and treatment plan with a faculty member.

### Standardized Documentation

The standardized documentation sheet used in the study was divided into seven different sections. The top portion included demographics, name, age, gender, and chief complaint information. The second portion contained vital signs, height, weight, waist circumference, and head circumference (used in pediatrics only). The third portion of the form included information about any tests performed during the visits and the results. Examples of tests available to perform were urine dipstick, point of care glucose, point of care cholesterol, and 12 lead ECG. Dipstick findings recorded on the sheet included blood, glucose, nitrite, and leukocyte

esterase. The recorded cholesterol information included total cholesterol, high-density lipoprotein, low-density lipoprotein, triglyceride, and cholesterol ratio. The fourth portion of the form allowed students to document past medical, family, and social history. Social history included smoking tobacco, alcohol consumption, and drug use. Students noted the list of home medications and allergies to any medications in this portion. The fifth portion is the physical exam described in detail above. Below the physical exam, a section was included to document the patient's diagnosis. Below the diagnosis, a list of the medications prescribed to the patient depending on the given diagnosis was included. The list was created to match the usual drugs available from the formulary and over-the-counter medicines customarily brought by the research team. The students could circle the drugs selected or document any other medication under 'other,' not on the list.

### Data Analysis

Data were manually entered into SPSS Statistics® (IBM, version 24). Data were double-checked for verification. Descriptive statistics and frequencies were generated and reported. Frequency distributions were reported for categorical variables. In addition, chi-Square tests of Association were used to examine differences in the prevalence of specific diagnoses by site and by gender. Additionally, one-way analysis of variance (ANOVA) was used to determine whether age differed by the site. Significance was determined using  $\alpha=0.05$ .

### Results

Table 1 displays the frequency counts for age, sex, visit (first or second), and totals by commune and for the total adult sample. Among adults in the total sample ( $N=403$ ), GERD (25.8%) was the most common diagnosis, followed by hypertension (16.8%) and dehydration (13.9%).

#### Differences Between Communes (Both Visits Combined)

Across both visits (Table 2), 136 (34%) adult patients were seen in Palmay, 141 (35%) were seen in Savane Plate, and 126 (31%) were seen in La Hoye. Significant differences by location were found on new diagnoses of hypertension ( $P=0.037$ ) with fewer cases of hypertension in Savane Plate (15.7%) compared to Palmay (12.5%) and La Hoye (15.1%). Among women, significant differences by location were found for pregnancy ( $P<0.001$ ), where the fewest pregnancy diagnoses were seen in Savane Plate (2.2%) compared to Palmay (7.7%), and the greatest number of pregnancies were observed in La Hoye (19.0%). Finally, differences between locations on vaginal yeast infections were also noted ( $P=0.009$ ) with fewer cases of vaginal yeast infections diagnosed in Savane Plate (1.1%) and Palmay (0.0%) than in La Hoye (6.7%). No significant differences by location were found on any other diagnosis.

#### Differences Between Communes: First Visit Only

When we examined the data from the first visit only (Table 3), 59 adult patients were seen in Palmay, 60 were seen in Savane Plate, and 60 were seen in La Hoye. Among adult women,

**Table 1.** Frequency Counts by Age, Gender, and Visit Across Communes

Characteristic	Palmay No. (%)	Savane Plate No. (%)	La Hoye No. (%)	Total Sample
Males	40 (30)	47 (33)	20 (16)	107
Females	91 (67)	90 (64)	105 (83)	286
First visit	59 (43)	60 (43)	60 (47)	179
Second visit	77 (57)	81 (57)	66 (53)	224
Total adults	136 (34)	141 (35)	126 (31)	403

**Table 2.** Differences in Diagnoses by Communes (Both Visits Combined)

Diagnosis	Palmay N	Savane Plate N	La Hoye N	P Value
Diabetes	3	0	0	0.049
Hypertension (new diagnosis)	17	8	19	0.037
Hypertension (established)	30	16	21	0.113
Urinary tract infection	11	12	13	0.800
GERD	39	41	24	0.112
Dehydration	17	16	23	0.225
Upper respiratory infection	6	4	3	0.616
Acute otitis	2	1	0	0.384
Tinea	4	2	1	0.387
Scabies	0	1	0	0.394
Pregnancy	7	2	20	<0.001
Bacterial vaginosis	0	0	0	-
Vaginal yeast infection	0	1	7	0.002

**Table 3.** Differences in Diagnoses by Commune (First Visit Only)

Diagnosis	Palmay N	Savane Plate N	La Hoye N	P Value
Diabetes	2	0	0	0.126
Hypertension (new diagnosis)	7	4	10	0.235
Hypertension (established)	15	11	12	0.575
Urinary tract infection	9	9	9	0.999
GERD	18	17	8	0.057
Dehydration	7	4	3	0.348
Upper respiratory infection	3	2	1	.585
Acute otitis	2	0	0	0.128
Tinea	3	2	1	0.585
Scabies	0	0	0	-
Pregnancy	1	1	11	<0.001
Bacterial vaginosis	0	0	0	-
Vaginal yeast infection	0	0	2	0.135

significant differences by location were found on pregnancy ( $P=0.002$ ) where Savane Plate and Palmay each had one diagnosed pregnancy, but 11 cases were diagnosed in La Hoye. No other significant differences by location were found on any other diagnosis.

#### Differences between Communes: Second Visit Only

When we examined data from the second visit only (Table 4), 77 adult patients were seen in Palmay, 81 were seen in Savane Plate, and 66 were seen in La Hoye. Significant differences by

**Table 4.** Differences in Diagnoses by Commune (Second Visit Only)

Diagnosis	Palmay N	Savane Plate N	La Hoye N	P Value
Diabetes	1	0	0	0.376
Hypertension (new diagnosis)	10	4	9	0.140
Hypertension (established)	15	5	9	0.044
Urinary tract infection	2	3	4	0.566
GERD	21	24	16	.766
Dehydration	10	12	20	0.016
Upper respiratory infection	3	2	2	0.874
Acute otitis	0	1	0	0.407
Tinea	1	0	0	0.383
Scabies	0	1	0	0.412
Pregnancy	6	1	9	0.014
Bacterial vaginosis	0	0	0	-
Vaginal yeast infection	0	1	5	0.012

location were found on established hypertension ( $P=0.044$ ) with fewer cases of hypertension in Savane Plate ( $n=5$ ) and La Hoye ( $n=9$ ) compared to Palmay ( $n=15$ ). Among adult women, significant differences were found on pregnancy ( $P=0.045$ ) where Savane Plate had one diagnosed pregnancy, Palmay had 6, and La Hoye had 9. Significant differences were also found on vaginal yeast infections ( $P=0.036$ ), where La Hoye had five cases, Savane Plate had zero, and Palmay had one. Significant differences by location were also found on dehydration ( $P=0.016$ ) with more cases of dehydration in La Hoye ( $n=20$ ) than in Savane Plate ( $n=12$ ) or Palmay ( $n=10$ ).

#### Demographic Information and Diagnoses

During the first visit, the proportion of males and females did not differ by location, ( $P=0.127$ ). However, the average age of the patients was significantly different with patients in Palmay being slightly older ( $M=52.58$ ) than patients in Savane Plate ( $M=42.92$ ) and La Hoye ( $M=42.17$ ), ( $P=0.004$ ). During the second visit, the proportion of males and females did differ by location ( $P=0.011$ ), with La Hoye having a higher proportion of females than Palmay and Savane Plate. In addition, similar to the first visit, patients from Palmay were slightly older ( $M=48.42$ ) than patients from Savane Plate ( $M=39.64$ ) or La Hoye ( $M=40.32$ ). When examining whether gender was associated with diagnoses, we found only significant differences in the proportion of males and females diagnosed with GERD ( $P=0.022$ ) with more males being diagnosed with GERD (33.6%) compared to females (22.4%). When examining whether age was associated with diagnoses, older adult patients were more likely to be diagnosed with hyperglycemia/diabetes ( $P=0.017$ ), hypertension (new diagnosis) ( $P=0.002$ ), and hypertension (established or out of control) ( $P<0.001$ ). Younger adult patients were more likely to be diagnosed with urinary tract infections ( $P=0.017$ ), and younger female patients were more likely to be diagnosed with pregnancy ( $P=0.001$ ) and vaginal yeast infections ( $P=0.036$ ). No other diagnoses were found to be associated with age.

#### Discussion

Health care professionals, policymakers, and stakeholders must be aware of the prevalence of chronic diseases that are major CVD risk factors in poor, underdeveloped areas such as the Central Plateau in Haiti to facilitate implementation campaigns to achieve the cardiovascular reduction target dictated by WHO in 2025. This retrospective, descriptive study provides the prevalence of hypertension, and Diabetes Mellitus, and other health-related issues in three specific communes of the Central Plateau, Palmary, Savane Plate, and La Hoye communes.

In previous studies conducted in Haiti,<sup>8,9</sup> the prevalence of hypertension was found to be close to 50% of the population. The prevalence of hypertension in our study is lower (16.8%) than the one reported in previous studies. The Haitian Demographic and Health Survey<sup>16</sup> reported that the hypertension prevalence (2016-2017) in Port au Prince among women 35 to 69 years old was 49% and among men within the same age group was 38%. No recent data have been published about the prevalence of hypertension in the rural population of Haiti.

One of the important proportions that have to be considered when dwelling on high-risk patients across rural Haiti is the prevalence of CVDs and the lack of prevention measures. The current study dwelled on an exceptionally high level of variation among different patients, meaning that treatment recommendations have to be aligned against personalized health predictions. From the point of view of public health, this is a crucial implication for Haitians because of the increased exposure to risks associated with hypertension and diabetes. The existing risk models have to be altered to allow for improved approaches to categorizing cardiovascular issues and promoting wellness among rural Haiti regions. The accuracy of these findings is reinforced by the literature on the subject, as precise predictions can be made only in the case where all proportional hazards have been covered.

With newer statistical techniques, researchers could foresee at least some of the outcomes of CVDs while recording all the underlying data. The validation of new tools is also essential since rural Haiti struggles with the majority of cases of hypertension and diabetes, especially when compared to developed regions across the globe that are exposed to fewer instances of hypertensive heart disease and nonischemic cardiomyopathies. Hence, there is a need for new risk models reading CVDs in rural Haitians to improve calculations and reduce the workflow to an acceptable minimum. With the current evidence suggesting that quite a few actions to reduce the prevalence of hypertension and diabetes remain unsuccessful, more attention has to be paid to multisector initiatives. Both patients and providers have to join forces to transform the public health sector and introduce approaches to cardiovascular issues that are not as expensive but effective enough to reduce comorbidities and negative patient outcomes.

Even without uniform methods of coping with hypertension, diabetes, and other related cardiovascular issues, the author believes that risk prediction models represent a fundamental

opportunity for all patients. The current variations in the data obtained from rural Haiti prove that only a locally relevant program would lead to positive outcomes. The vital factor that has to be viewed as central is treatment availability, as Haitians from rural areas could have a problem with the affordability of required services.

### **Limitations**

This retrospective, descriptive study was limited in several ways. First, limited demographic data were collected. Second, the data were collected from a range of individuals living in three regions at two different time points. Diagnoses were made primarily based on physical exam findings and clinical manifestations due to limited diagnostics and no laboratory capabilities to confirm the diagnoses. Further, the sample was limited to those who were well enough to attend the mobile clinic and could potentially exclude individuals with more serious illnesses. However, by providing a starting point, this study contributes to providing insight into the current health status and common chronic conditions affecting the rural Haitian community. One of the particular elements that have been overlooked by the researcher was the multitude of opportunities linked to care provider learning, especially in the light of natural calamities that tend to occur rather often across Haitian rural communes. There has to be a better balance between evidence-based approaches and the potential availability of resources.

More effective communication strategies have to be implemented by researchers conducting similar studies to collect valuable feedback from locals and establish a true reality-based medicine. Yet, the lack of resources across rural Haiti should be considered to recognize the need for collaboration and the essential influence of organizational and human learning systems on the ability to alter the status quo. The author of the current paper only reviewed a limited number of insights, while the study could have been improved significantly with the aid of transcultural bridges and more interviews with local citizens and healthcare professionals. Cardiovascular issues require care providers to engage in the expansion of the delivery system to have better control over patient conditions and learn the most important lessons from the past. A much more task-oriented approach could be appropriate in this situation, allowing for a reasonable change of model of care. The latter could be problematic with the existing findings, as these only signify the need for improved communication and care affordability across several Haitian rural communes.

### **Conclusion**

The core conclusion that can be made in connection to the current study is that intervention programs to prevent and manage diabetes and hypertension are imperative in rural Haiti. The reason why this outlook has to become the new truth for local Haitians is that resource-poor settings represent one of the biggest contributors to the growth of occurrence of hypertension, diabetes, and numerous other conditions. Various determinants of health – from social

and environmental to laboratory and clinical – have to be considered when developing new educational programs for care providers and patients. Additional insight would help Haitian care providers from rural communes to compare their practices to American analogs, and build a platform to revise their care provision methods. The initial assessment of information from Palmay, Savane Plate, and La Hoyo shows that most risk factors associated with cardiovascular issues are relatively unmanageable. Therefore, efforts should be exerted to replicate the success of American care providers and translate their knowledge into practical benefits across the Haitian rural areas.

Diabetes, hypertension, and numerous other cardiovascular conditions have to be monitored across Palmay, Savane Plate, and La Hoyo because these three communes are in greater need of more approved documented standards and a quality-based review of outreach.

Challenges related to diagnosing and screening patients in rural Haiti have to be resolved with the help of community health workers, nursing assistants, and public health educators. These stakeholders will be responsible for dwelling on how healthcare leadership could ease access to necessary models of care and training opportunities. Most likely, systems of upper-level clinical management will have to be altered as well, paving the way for updated community guidelines and motivating more care providers to engage in basic science review and collaborative development of medical coalitions where the ultimate objective would be to improve the quality of care and help patients gain access to relevant information on hypertension and diabetes.

### **Implications**

The study results are relevant to clinical practice. For global and community health practitioners interested in serving low-income countries, these results provide insight into the struggles and common chronic illnesses of Haitians living in rural areas. Through the identification of common chronic conditions, practitioners will be better able to prepare for service-learning and mission experiences. The information obtained from this study can be utilized to plan education efforts for health care workers in Haiti, prepare student and nurse volunteers, as well as steer efforts to obtain the selected supplies and medications for this population. Throughout the healthcare system, more attempts should be made to boost management competence regarding hypertension, diabetes, and a variety of other cardiovascular issues. The clinical experience obtained during such activities would make it easier for Haitian citizens from the given communes to keep in touch with care providers. Healthcare workers, on the other hand, would achieve proper certification and a continuing education intended to aid them in terms of establishing a multi-tiered health management team.

The review of existing evidence allowed for a much more detailed outlook on how the aforementioned communities could reduce the occurrence of hypertension and diabetes. Despite the presence of national standards, stronger approaches to training should be implemented to prevent healthcare

## Research Highlights

### What Is Already Known?

Haiti has one of the highest rates of non-communicable diseases (e.g., CVD and stroke), and associated risk factors, including hypertension and diabetes that are among the leading cause of death.

### What Does This Study Add?

Data regarding the prevalence of diseases and associated risk factors for CVD in rural Haiti are sparse, limiting our ability to address the health requirements of the Haitian people. This study provides the prevalence of chronic diseases from three rural communes in Haiti.

workers from rural Haiti from losing motivation or lacking vital information regarding the process of providing care to high-risk patients with cardiovascular issues. In a sense, there is going to be a roadmap built for Haitian care providers in the nearest future, helping them receive comprehensive education and then apply their knowledge to real-life situations. Patients with cardiovascular conditions are going to participate in the data collection process as well, keeping up their aspirations and ensuring that care remains relevant and affordable. Either way, knowledge acquisition is going to remain the key implication of the current study because educational efforts will benefit rural Haitian communes in many ways.

### Authors' Contributions

JO is the corresponding author. His contributions include the conception and design of the study, data collection, analysis and interpretation of data, and writing the manuscript. JMG's contributions include data collection and writing the manuscript. KS's contributions include data collection and writing the manuscript. AQ's contributions include data collection and writing the manuscript. KG's contributions include analysis and interpretation of data, writing the manuscript, and statistical expertise.

### Conflict of Interest Disclosures

This manuscript has not been published and it is not under consideration for publication in any other journal.

### Ethical Approval

This study was approved by the University of Miami Institutional Review Board, IRB ID: 20150555.

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