

The prevalence of hypertension in Haiti : A retrospective study[†]

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Abstract

The purpose of this study was to explore the prevalence of hypertension in Haiti and to describe regional characteristics, and thus to speculate Haitian specific regional risk factors. This is a descriptive and comparative study. Subjects were 145 male/female Haitians, who aged between 30 and 59 and have lived in rural areas, had their hypertension indicators being screened. Data were analyzed with descriptive statistics, t-test and ANOVA. More than four fifth of the subjects (82.8%) showed pre-hypertensive or moderate to severe hypertensive condition. 65.5% of the total had abnormal pulse pressure ($PP \geq 50$) and 13.8% of the sample showed tachycardia ($Heart\ Rate \geq 100$). Female Haitian tended to have higher diastolic blood pressure and faster heart rate than male Haitian. The residents who lived in Part 5-1 area with less accessibility to drinking water tended to have higher systolic and diastolic pressure. Hydration status of Haitians was highly considered as an affecting factor on the distribution of hypertension as evidenced by different level of accessibility to drinking water.

Keywords: Dehydration, hypertension, Haitian, tachycardia.

1. Introduction

Hypertension (HTN) has been an overarching concept studied over the past several decades (Cooper and Gosnel, 2014). Research has indicated how broadly HTN can compromise multiple organs, causing multiple complications in physical health. For example, HTN causes coronary artery disease (CAD), pulmonary/respiratory disease, and kidney disease if proper treatment does not intervene. In addition, studies on HTN have focused on race specific odd ratios, showing African-Americans are to be the most at risk. A few studies have even compared the odd ratio between African-Americans and Haitians. The results showed that Haitians are at a higher risk of developing HTN than African-Americans are (Niska and Sloand, 2010; Saint-Jean and Crandall, 2005; Singh-Franco *et al.*, 2013). Although there are vast amount of studies focused on the ethnic related risk factors of hypertension, only a few studies have focused on HTN among the Haitian population. However, studies of HTN limiting to Haitian population cannot be overemphasized, since Haitians are considered as

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the most vulnerable population in developing hypertension. Further, this topic is directly related to the broader topic of international health disparity. This study is a preliminary study conducted based on this motive. Thus, the purpose of this study is to inform the aspects of the prevalence of hypertension in Haiti and to describe regional features, and thus to determine Haitian specific regional risk factors of hypertension developed in rural areas of Haiti.

2. Review of Literature

2.1. Hypertension in general

Hypertension is a leading cause of death worldwide (World Health Organization, 2013). In addition, HTN is a primary reason that individuals seek medical attention (WHO, 2013). If HTN is untreated and moves into a chronic phase, it compromises health conditions, causing varied complications. It is well known that HTN is a significant risk factor for coronary heart disease, congestive heart failure, chronic lung diseases, and brain stroke (Deshmukh *et al.*, 2011; Koch *et al.*, 2005). U.S. statistics show that HTN and related diseases are the most common diseases among Americans (WHO, 2013). Thus, it has been studied broadly for over a few decades with governmental financial support provided to researchers.

2.2. Hypertension by ethnicity

Lately, studies conducted on HTN have been limited to specific ethnicities. African-Americans are well known to be at risk HTN and many studies have validated this. Affecting factors are mostly related to socio-economic conditions (Franklin *et al.*, 2009; Franklin *et al.*, 2005). Also, many intervention studies have been conducted focusing on African-Americans since they are known to be at the highest risk for HTN. In addition to African-Americans, recent studies have studied Hispanic-Americans as a focused group with high risk of HTN (Singh-Franco *et al.*, 2013). However, few studies have focused on the Haitian population.

2.3. Hypertension in Haiti

Hypertension is the one of the two most prevalent health conditions in Haiti (Saint-Jean and Crandall, 2005; Singh-Franco *et al.*, 2013). In addition, the odd ratio of hypertension among Haitians is much greater than among African-Americans (Odell *et al.*, 2006). Singh-Franco and his colleagues compared Haitian and non-Haitian populations in their study to see which population is at the most risk in relation to hypertensive condition. Surprisingly, 80% of Haitian participants were hypertensive at significant risk of hypertension. Further, few of the subjects were under appropriate treatments such as anti-hypertensive medications or had received health education. Some studies have compared the ratio of low birth weight between Haitian women and African-American women (Odell *et al.*, 2006; The common wealth of Massachusetts, 2002) and reported that Haitian women tend to have more children with low birth weight than African-American women due to their hypertensive condition (Odell *et al.*, 2006).

2.4. Risk factors for hypertension in general

There are two main factors contributing to hypertension: genetic factors, which are the non-modifiable, and environmental factors, which are modifiable (Cooper and Gosnel, 2014). Family history, gender, age, and ethnicity are considered to be non-modifiable factors; while weight, high sodium diets, sedentary life styles, alcohol, stress, and certain chronic conditions, are considered to be modifiable environmental factors. Health professionals are more interested in the modifiable factors and this authors, as health professionals, would like to focus more on the environment factors surrounding hypertensive conditions among Haitians.

2.5. Haitian specific risk factors of HTN

Dehydration has not been adequately studied as one of environmental risk factors of hypertension. Only a few references indicate mild dehydration as a modifiable risk factor of hypertension (Bouby and Fernades, 2003; Manz and Wentz, 2005) and these are discussed only in relation to experimental studies with animals. For example, Manz and Wentz (2005) confirmed that mildly dehydrated rats secreted vasopressin and vasopressin effected urine output: the vasopressin stimulated kidneys did not eliminate water and thus increased recirculating/returning fluid volume into vessels. This mechanism can be the consequence of mild hypertensive condition if it is not corrected in a proper manner. 75% of Haitians are poor and 67% lives in rural areas where there is no electricity, sewer, or safe drinking water (Lluberas *et al.*, 2000). In fact, only 58% of the population has access to a safe drinking water system (Niska and Sloand, 2010). It is difficult to think separately for two factors, mild dehydration and hypertensive condition, for Haitian population.

2.6. Significance of this study

This study is innovative because it is one of the first studies to determine Haitian specific risk factors for hypertension. A few studies have included Haiti in comparisons of the prevalence of hypertension among different countries (Lluberas *et al.*, 2000; Saint-Jean and Crandall, 2005; Singh-Franco *et al.*, 2013). However, they have not reported specific reasons why Haiti has a high volume of people with hypertensive conditions. Also, the results of this research will provide a framework for developing tailored interventions for specific ethnic groups, specifically African-Americans and Haitians, since both groups are considered as African populations. Moreover, this study endeavors to decrease health disparity by reporting and drawing attention to about this developing county: appropriate help given to the people and country will then improve their current health condition.

3. Methods

The Institutional Research Board (IRB) at an University approved this study on April 22nd, 2014 and there is no potential ethical issue going on within this study. This study was a quantitative, non-experimental, cross-sectional, correlational, descriptive, and predictive study. 145 Haitians aged between 30 and 59 living in rural areas, both male and female, were included. The sampling was convenience sampling. They voluntarily walked into a free dental clinic operated by a medical mission team dispatched by one mission organization in Philadelphia, USA. Thus, a potential sampling bias exist. Study variables were SBP, DBP,

HR, Pulse pressure, gender, age, and place of residence (Part 4, Part 5-1, Part 5-2, and Cafu). Part 5-1 is most isolated from water streams among all four living places. Likewise, Part 5-2 is the second most isolated place from water stream.

Terms of hypertension (abnormal SBP and DBP), tachycardia, and abnormal pulse pressure were used using definitions from the Joint National Committee (James *et al.*, 2014): Prehypertension is systolic pressure from 120 to 139mmHg or a diastolic pressure from 80 to 89mmHg. Mild hypertension is systolic pressure from 140 to 159 mmHg, diastolic from 90 to 99mmHg. Likewise, severe hypertension is systolic pressure 160mmHg or greater or diastolic 100mmHg or greater. Tachycardia is heart rater greater than 100 beats per minute. Also, high pulse pressure is difference of systole and diastole blood pressure greater than 50mmHg.

An auto inflate digital blood pressure monitor was used to measure systolic and diastolic blood pressure. Test-retest reliability for the machine has been firmly constructed and it is considered to be a reliable tool to measure blood pressure (model name: Relion BP300 Auto Inflate Digital Blood Pressure Monitor). Heart rate was measured by a stethoscope made by 3MTM (3MTM Littmann Lightweight II S. E.). Pulse pressure is the difference between systolic and diastolic pressure readings. The data was analyzed by using the most recent version of SPSS (V.22) (IBM corp., 2013). Central tendencies (mean, standard deviation, and range) and descriptive statistics were used to describe the sample. Also, t-test, ANOVA and post-hoc (Tukey test) were used to compare among 4 rural areas, there was a difference of accessibility to drinking water among the four areas and genders.

4. Results

4.1. General characteristics of subjects

101 female patients (69.7%) and 44 males (30.3%) walked into the clinic and participated in this study. Their average age was 46.10 years old with a range from 30 to 59. Four rural areas (Part 4, Part 5-1, Part 5-2 and Cafu) were included and the number of participants from each area was normally distributed (26.9%, 25.5%, 23.4%, and 24.2% respectively) (Table 4.1).

Table 4.1 General characteristics of subjects (N=145)

| Variable | Category | n (%) | M±SD | Range |
|-----------|----------|------------|------------|-------|
| Age (yrs) | 30~39 | 36 (24.8) | 46.10±8.15 | 30-59 |
| | 40~49 | 44 (30.4) | | |
| | 50~59 | 65 (44.8) | | |
| Gender | Male | 44 (30.3) | | |
| | Female | 101 (69.7) | | |
| Residence | Part 4 | 39 (26.9) | | |
| | Part 5-1 | 37 (25.5) | | |
| | Part 5-2 | 34 (23.4) | | |
| | Cafu | 35 (24.2) | | |

4.2. Hypertension indicators

The average systolic blood pressure (SBP) was 144.20 mmHg while diastolic blood pressure (DBP) was 87.63 mmHg. 17.2% of subjects showed SBP less than 120mmHg and 36.6% of

subjects' SBP stayed between 120 and 139mmHg. Still, 46.2% of the sample displayed their SBP greater than 140mmHg. For DBP of 36.6% of the subjects were less than 80mmHg, 27.5% were between DBP 80 and 89mmHg, and 35.9% of them possessed DBP greater than 90mmHg. The mean heart rate was 82.66 for the entire sample. 86.2% of the sample (125 subjects) had normal heart rates ($HR < 100$). However, 13.8% of the sample (20 subjects) demonstrated tachycardic conditions ($HR \geq 100$). The average Pulse Pressure (PP) was 56.57mmHg, PP less than 50mmHg found from 34.5% of the sample and 65.5% of them demonstrated PP greater than 50mmHg (Table 4.2).

Table 4.2 Hypertension indicators (N=145)

| Variable | n (%) | M±SD | Range |
|---------------------------------|------------|--------------|--------|
| Systolic blood pressure (mmHg) | | 144.20±26.32 | 89-218 |
| SBP<120 | 25 (17.2) | | |
| 120≤SBP<140 | 53 (36.6) | | |
| SBP≥140 | 67 (46.2) | | |
| Diastolic blood pressure (mmHg) | | 87.63±14.53 | 62-159 |
| DBP<80 | 53 (36.6) | | |
| 80≤DBP<90 | 40 (27.5) | | |
| DBP≥90 | 52 (35.9) | | |
| Heart rate (bpm) | | 82.66±14.68 | 54-141 |
| HR<100 | 125 (86.2) | | |
| HR≥100 | 20 (13.8) | | |
| Pulse pressure (mmHg) | | 56.57±17.40 | 14-117 |
| PP<50 | 50 (34.5) | | |
| PP≥50 | 95 (65.5) | | |

SBP: systolic blood pressure, DBP: diastolic blood pressure, HR: heart rate, PP: pulse pressure

4.3. Difference of hypertension indicators by gender

The analysis of group difference by gender showed that DBP ($p=.027$) and heart rate ($p < .001$) were differed significantly between male and female patients. Female patients tended to have higher diastolic blood pressure and heart rate compared to men participants. Systolic blood pressure and pulse pressure were not found to be different between genders (Table 4.3).

Table 4.3 Difference of hypertension indicators by gender (N=145)

| Variable | Male (n=44) | Female (n=101) | t | p |
|------------|--------------|----------------|------|-------|
| | M±SD | | | |
| SBP (mmHg) | 142.86±17.95 | 144.78±29.30 | 0.42 | .688 |
| DBP (mmHg) | 83.61±10.99 | 89.39±15.55 | 2.23 | .027 |
| HR (bpm) | 74.27±11.72 | 86.32±14.39 | 4.89 | <.001 |
| PP (mmHg) | 59.25±12.56 | 55.40±19.06 | 1.23 | .221 |

SBP: systolic blood pressure, DBP: diastolic blood pressure, HR: heart rate, PP: pulse pressure

4.4. Difference of hypertension indicators by living places

The analysis of group differences by place of residence showed that SBP ($p=.044$) and DBP ($p=.004$) was significantly different among the four different locations. Post-hoc comparison test was completed and the result revealed that the rural area named Part 5-1 tended to have higher diastolic blood pressure compare to the rest of two areas (Part4 and Cafu). However, heart rate and pulse pressure did not differ by living places (Table 4.4).

Table 4.4 Difference of hypertension indicators by living places (N=145)

| Variable | Part 4 (n=39) | Part 5-1 (n=37) | Part 5-2 (n=34) | Cafu (n=35) | F | p |
|--------------|---------------------------|---------------------------|---------------------------|---------------------------|------|--------|
| | M±SD | | | | | |
| SBP (mmHg) | 135.41±20.52 ^a | 151.49±27.84 ^b | 148.00±28.74 ^c | 142.60±20.25 ^d | 2.77 | .044* |
| DBP (mmHg) | 82.97±9.45 ^a | 94.30±17.31 ^b | 88.26±14.97 ^c | 85.17±13.43 ^d | 4.61 | .004** |
| HR (bpm/min) | 82.03±13.48 | 85.73±16.99 | 80.35±15.49 | 82.37±12.47 | 0.85 | .472 |
| PP (mmHg) | 52.44±14.12 | 57.19±16.30 | 59.74±19.26 | 57.43±19.67 | 1.16 | .328 |

SBP: systolic blood pressure, DBP: diastolic blood pressure, HR: heart rate, PP: pulse pressure

*post-hoc comparison by Tukey test ($b > a, d$)

**post-hoc comparison by Tukey test ($b > a$)

5. Discussion

Compare to other countries, a significantly large portion of the Haitian population has hypertension. 82.8% of the total study sample were either pre-hypertensive or had mild to severe hypertensive conditions based upon SBP. These statistics are non-comparable to other studies, which report only 45% of the population as hypertensive (Niska and Sloand, 2010) and under 10% of their sample (Odell *et al.*, 2006). Although Singh-Franco *et al.* (2013) reported a significant hypertensive population in their study, the analysis from this study showed a higher number of hypertensive participants than the one from Singh-Franco and colleagues' study.

67.4% of the study subjects in this sample showed abnormal diastolic blood pressure. DBP conveys beyond that of SBP in cardiovascular risk stratification. A few studies, report that DBP is considered to be a risk factor for cardiovascular disease (Franklin *et al.*, 2009; Kelly *et al.*, 2008). Also, 14.2% of the participants showed tachycardia in this study. Tachycardia prevents the hearts' filling time and thus can lead to an ischemic heart condition. In addition, 68.9% of the total sample had abnormal pulse pressure. Pulse pressure is a significant sign of coronary artery calcification. In other words, high pulse pressure means that the patient's heart is calcified and that its ability to contract has been decreased. This signifies that they are in danger of developing coronary vessel disease (Kelly *et al.*, 2008). Some have stated that elevated pulse pressure is the most significant factor in determining the degree of risk for developing ischemic heart disease (Domanski *et al.*, 2002; Freundlich and Ludwig, 2005; Malone and Reddan, 2010; Russo *et al.*, 2009). Considering the factors consequences stated above, the participants in this study are at considerably high risk for developing coronary heart disease.

In all four locations, women tended to have more tachycardic conditions and higher DBP than men. There is no known reason about this phenomena but one hypothesis is that women work more in the kitchen, where ventilation systems are almost non-existent, meaning that they breathe smoke into their lungs as they cook. Chronic lung conditions affects the cardiac vascular system and thus, tachycardic conditions developed. In addition, women is the main workforce in each family to bring water to home and they may more reluctant to drink water, since they know how difficult to convey water from the water stream to home. They might have decided not to drink rather than carrying that heavy water jars or containers. However, this is a preliminary hypothesis and should be carefully analyzed with more studies focused on this topic. Considering this preliminary study results, more studies need to be repeated to determine the reasons focusing qualitative research on social life style and gender differences. However, women's tachycardic condition could be one of multiple explanations for this phenomenon. In addition, there was a trend toward higher pulse pressure for men to

have, although the difference was not so significant. Since pulse pressure is considered as the most significant indicator for coronary heart disease, researchers need to further investigate why Haitian men tend to have higher PP than Haitian women. More studies in a similar vein are therefore warranted.

Further, people who lived in the area with less accessibility to drinking water tend to have higher diastolic blood pressure: Part 5-1 was the area where people experience most difficulty to carrying water to home from water stream, since this area is most isolated from water streams among all four living places. Likewise, Part 5-2 is the second most isolated place from water stream, since Part 5-1 and Part 5-2 were located closely each other, and thus residents in 5-2 tend to have higher blood pressure than Part 4 and Cafu (refer to Table 4.4). We deliberately searched for the reason why this study's samples had serious hypertensive conditions. The first author in this study stayed in the four rural areas in Haiti for about two weeks and ate the same food Haitians normally eat. According to the author's knowledge, their diet is not high in fat, calories, or salt. Through close observation, however, the author learned that they rarely drink water. They tend to avoid drinking water because water fountains are too far from their homes: it takes about an hour by walk to get water and come back. This discourages Haitians from regularly drinking water. Beside genetic factor, this authors found the condition of chronic mild dehydration as the only potential risk factor for them developing hypertension.

There is increasing evidence that mild dehydration plays a role in developing various complications, including hypertension (Bouby and Fernades, 2003; The common wealth of Massachusetts, 2002). Experimentation on animals have confirmed this theoretical hypothesis: in such studies, rats with sustained high level of vasopressin failed to excrete sodium to kidneys. In turn, water which is supposed to be eliminated via the renal system, is backed up in the systematic vascular system, causing the heart to be burdened with overload. This then contributes to hypertensive conditions (Bouby and Fernades, 2003; Freundlich and Ludwig, 2005; Malone and Reddan, 2010; Manz and Wentz, 2005). This theory supports the hypertensive condition among Haitians who live in rural area unreached by the drinking water system.

6. Limitations

This is a preliminary study and meant to answer the research question of what the most reasonable factor is for the significant number of Haitians with hypertension. Therefore, it is required that this study be replicated in order to confirm the study's results. In addition, the sample size was too small to do path-analysis in order to confirm causality and sampling method, the convenience sampling, might have missed some significant people to include to this study. Also, the sample distribution between female and male was not even. This bias may affect study results. Thus, more studies should be conducted with bigger samples and random sampling. Further, this study was a retrospective study and the research plan was written in the aftermath of a medical mission trip. Hence, it lacked a systematic methodology in conduction of a research. Larger and more systematic studies should be conducted in order to determine whether chronic mild dehydration is a predictor. Repeating this study in the future must be planned beforehand with and established rigor of study design and methods. Further, this study's results can only be generalized to Haitians who living in rural areas. Still, the advantages of this study outweigh its disadvantages.

7. Conclusion

Haitians who lives in rural areas suffer from malignant hypertensive condition, yet few studies have been performed to investigate Haitian specific risk factors for hypertensive conditions. More studies should be conducted targeting Haitians in order to determine Haitian specific risk factors for hypertension. There are many studies conducted in regard to hypertension among African-Americans, but studies among Haitians are rare.

Considering the fact that 82.8% of Haitians, more like women, living in rural areas are at risk for developing coronary artery disease, more studies should be replicated to confirm the results of this study: that for Haitians from rural areas, mild chronic dehydration is a specific risk factor for hypertensive conditions. Attention from world health organization and systems should be given to this population who are at high risk for HTN and further coronary heart disease.

This study is significant and innovative because this is one of the first studies to seek out Haitian specific risk factors for hypertensive conditions. Also, this study constructs a foundation for future direct intervention studies: the intervention study is not only for Haitians of African descent, but also for other ethnicities of African descent, such as African-Americans. Further, the results of this study can be applied to experimental studies in the future, such as hydrating groups at risk for hypertension in order see if this is an effective intervention. In summary, this study is a foundation for future intervention studies.

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