

SEVERE HYPERTENSION IN TWO EMERGENCY DEPARTMENTS
OF NETCARE MANAGEMENT (PTY) LIMITED HOSPITALS,
JOHANNESBURG, SOUTH AFRICA

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A research report submitted at the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Medicine in Emergency Medicine

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DECLARATION

I, Diulu Kabongo declare that this research report is my own work. It is being submitted for the degree of Master of Science in Medicine in Emergency Medicine in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

----- Diulu Kabongo

-----day of-----2013

I confirm that this work has been granted permission by the Human Research Ethics Committee of the University of the Witwatersrand, Johannesburg. The clearance number is M10516. It has also received approval from the Research committee of the Netcare Management (Pty) Limited.

Diulu Kabongo

-----day of -----2013

Supervisor: Professor Elena Neustadt Libhaber

DEDICATION

To my wife, Doctor Cathy Ngandu Kande, and my daughter, Gloria Dinanga Kabongo, I wish to celebrate this work with you as it reflects your support and your many days of sacrifices.

To my father, Christophore Mulumba Kabongo, and my mother, Margueritte Mbuaya Walenga, I simply bow down, thankful for the value of perseverance you instilled in me.

To the many hypertensive patients whose data were used in the present study, you may have opened our eyes to your plight.

ABSTRACT

Hypertension is the major cause of cardio-vascular diseases and contributes to 13.5% of premature deaths worldwide. With a 10–year risk to develop organ damages estimated at 30%, severe hypertension exposes even more patients to premature death. Severe hypertension is a type of hypertension with systolic blood pressure ≥ 180 mmHg and/or diastolic blood pressure ≥ 110 mmHg that may present with or without symptoms/signs or target organ damages, and may be classified accordingly as asymptomatic (without symptoms/signs) severe hypertension, hypertension urgency (with symptoms/signs, no target organ damage) or hypertension emergency (with target organ damage). Hypertension urgency and hypertension emergency are considered hypertension crisis.

This study aimed to establish the socio-demographic and clinical characteristics of the patients who presented with severe hypertension at the Emergency Departments of two private hospitals of the Netcare Management (Pty) Limited in Johannesburg during the period from the 1st of January 2010 to 30th April 2011. These patients presumably receive quality health care and may not be expected to develop severe hypertension. Therefore, this study would contribute to efforts to identify patients at risk and those who may benefit from preventive measures.

The methodology of this study was a retrospective, transversal and comparative study. One thousand and forty-two patients were included in the study. All of these participants had a medical aid cover or were able to pay for medical consultation at a private hospital. Data were collected from an electronic database, the Medibank™, and from manual patients' registers kept in each hospital's Emergency Department.

Severe hypertension was found among 1.7% of all patients who presented to the studied emergency departments. Only 817 patients were classified in the different subtypes of SH. Asymptomatic severe hypertension was the most common (83.4%) type of severe hypertension and hypertension emergency was the least common (4.8%). At Mulbarton Hospital, 50.2% of severe hypertension patients were male and at Linksfield Hospital, 60.3% were female. Male patients were younger than female patients. White patients and elderly were mostly affected by severe hypertension in the studied population.

Systolic blood pressures were similar among the different races and genders. Black patients had higher diastolic blood pressure compared to white patients. White patients were older and may have had a tendency of isolated systolic hypertension.

Overall, the most common symptoms/signs in hypertension urgency were chest pains (46.4%), headache (34.0%) and epistaxis (11.3%). The most common target organ damages in hypertension emergency were stroke (58.9%), left ventricular failure/congestive cardiac failure (28.2%) and seizures (12.8%). None of the studied characteristics could be claimed predictors of hypertension crisis. Also, there was no association between seasons and days of presentation and onset of severe hypertension in each hospitals.

Further studies are required to include other factors that are known to affect the occurrence of severe hypertension, such as co-morbidities, smoking, alcohol intake and poor adherence to medication by known hypertensive patients. Also, risk factors contributing to the occurrence of SH among younger black patients need to be analysed.

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LIST OF ABBREVIATIONS

AMI:	Acute Myocardial Infarction
ASH:	Asymptomatic severe hypertension
BP:	Blood Pressure
CAD:	Coronary Artery Disease
CCF:	Congestive Cardiac Failure
CVD:	Cardiovascular Disease
DBP:	Diastolic Blood Pressure
DOH:	Department of Health
ED:	Emergency Department
HIV:	Human Immuno-deficiency Virus
HT:	Hypertension
HTE:	Hypertension Emergency
HTU:	Hypertension Urgency
ICU:	Intensive Care Unit
IHD:	Ischemic Heart Disease
JNC 7:	Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure
LMIC:	Low and Middle Income Countries
LVF:	Left Ventricular Failure
NCD:	Non-Communicable Disease
NPCD:	National Patients Care Database
SADHS:	South African Demographic and Health Survey
SAHS:	Southern African Hypertension Society
SBP:	Systolic Blood Pressure
SH:	Severe Hypertension
SSA:	Sub-Sahara Africa
TB:	Tuberculosis
TOD:	Target Organ Damage
VA:	Veteran Health Administration

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CHAPTER 1

1.0. INTRODUCTION

1.1. Introduction

Worldwide, hypertension (HT) contributes to 13.5% of premature deaths and imposes a burden on health care systems (1, 2). HT is a key contributor to the occurrence of cardio-vascular diseases (CVDs) (2). Globally, HT related CVDs are responsible of more deaths than CVDs due to smoking, obesity and lipid disorders. In general, CVDs affect an increasing number of individuals around the world and without interventions, non-communicable CVDs are predicted to be the leading cause of death and disability by 2020. Presently, the burden of CVDs is carried by countries with low and middle income communities (3). These communities, particularly the low income population, already battle against poverty in an environment that faces other health burdens like tuberculosis (TB) and Human Immunodeficiency Virus (HIV) infection (4, 5, 6). The capacity to respond to all of these mixed outbreaks is therefore limited in this environment. In addition, in low and middle income communities, deaths due to CVDs occur mainly in the middle-aged and economically active section of the population, further impacting negatively on already fragile economies (5). Currently, two thirds of stroke and half of ischemic heart diseases (IHD) are worldwide related to hypertension and, these facts underscore the importance of HT in the occurrence of CVDs (7). Similarly and further underscoring the importance of HT among CVDs factors, hypertensive

heart failure is the most common cause of chronic heart failure (3). In South Africa, HT, dyslipidemia, cigarette smoking and diabetes mellitus are major contributors to CVDs (1).

In 1998 the South African Demographic and Health Survey (SADHS) found that 25% of men and 26% of women were hypertensive, when using a cut-off point systolic blood pressure (SBP) of 140 mmHg and/or diastolic blood pressure (DBP) of 90 mmHg (8). In South Africa, like in all sub-Saharan African (SSA) countries, the prevalence of HT is 2 to 3 times lower in rural areas compared to urban areas (3, 9). The epidemiological transition, i.e. social and nutritional changes due to migration from rural to urban areas, contributes to this difference (2, 5). The prevalence of HT in urban South Africa has increased to levels reported in developed countries (6, 9). In South Africa, all cardio-vascular diseases (including hypertension related CVDs) contribute considerably to mortality of adults (1).

Prevention of CVDs and management of established CVDs may be hypothesised as important steps to reducing mortality and morbidity due to CVDs. Indeed, the efficient management of HT contributes positively to the reduction of CVDs and may prolong the life of hypertensive patients (2, 10, 11).

In a historic landmark decision in 2006, the South African Hypertension Society (SAHS) and the Department of Health (DOH) published a joint HT Guideline. This guideline aimed at improving HT management (1). Approximately 4 years after the release of the 2006-Guideline, improvements in the management of hypertension

were already described in the 2010-cohort study in Soweto. This study analysed a randomly selected population of normotensive (53.8%) and hypertensive (46.2%) black individuals. It found that among black hypertensive patients, 51% of individuals were on anti-hypertensive medication, levels that have increased to become almost similar to the South African white population (55%) and are approaching levels reported in developed countries (60.4%). However, there were still concerns about the management of HT. The same study found that 22.6% of study participants were known hypertensive patients and were not on any anti-hypertensive medication. Furthermore, 6.7% of study participants had untreated hypertension though they had high or very high added cardiovascular risk (11).

Indeed, the SAHS recommends taking into account cardiovascular risk factors, the existence of target organ damage and the associated specific clinical conditions during the initiation of anti-hypertensive medication. These parameters accompanying hypertension determine risks of cardiovascular complications that need to be prevented (1). Considering the absolute 10-year risk of CVD, the untreated hypertensive patients with high and very high risks would have respectively 20-30% and more than 30% probability of developing CVD complications over a 10-year period. In the same 2010 Soweto cohort study, only 35.9% of treated hypertensive patients had a controlled BP. Therefore the potential for complications due to HT still exists as blood pressure (BP) in untreated or uncontrolled hypertensive patients may severely increase and, may affect vital organs. In the Soweto study, about 52% of untreated hypertensive patients with high or very high added cardiovascular risk had severe hypertension (11). The

latter group of patients may consequently present to the Emergency Department (ED) with HT related symptoms/signs or even target organ damages (TODs) (1). Severe BP elevation accompanied with related symptoms/signs or TOD is called HT crisis (12).

Cases of HT crises, i.e. episodes of severe BP elevation with subsequent impending or established damage to organs such as the brain, the eyes, the heart and the kidneys, contribute to the mortality and morbidity of hypertensive patients. Reasons for the occurrence of HT crises, i.e. HT urgency and HT emergency, include the ineffective management of HT and the inability to recognise secondary causes of hypertension (1, 12, 13). Approximately 1% to 2% of hypertensive patients will present with a HT crisis (13, 14). The vast majority of SH patients presenting at the ED are known chronic HT with poor BP control and are asymptomatic (15). Therefore, they require no specific aggressive treatment (1). However, the management of the remaining HT crises has considerable financial implications due to the need for expert human resource and special medications/equipment as shown in private healthcare institutions of USA (16).

1.2. Classification of severe hypertension

Severe hypertension (SH) is defined as a type of HT with or without target organ dysfunction due to an abnormally elevated BP corresponding to a systolic BP (SBP) ≥ 180 mmHg and/or a diastolic BP (DBP) ≥ 110 mmHg (1, 12). Severe BP

elevation may induce hypoperfusion and ischemia resulting in dysfunction of organs such as the brain, heart, kidney and eye (17).

The SAHS (1) classification considers the presence or absence of symptoms/signs or TOD to group SH into:

1. Asymptomatic severe hypertension (ASH);
2. Hypertension urgencies (HTU); and
3. Hypertension emergencies (THE) and are presented in Figure 1.

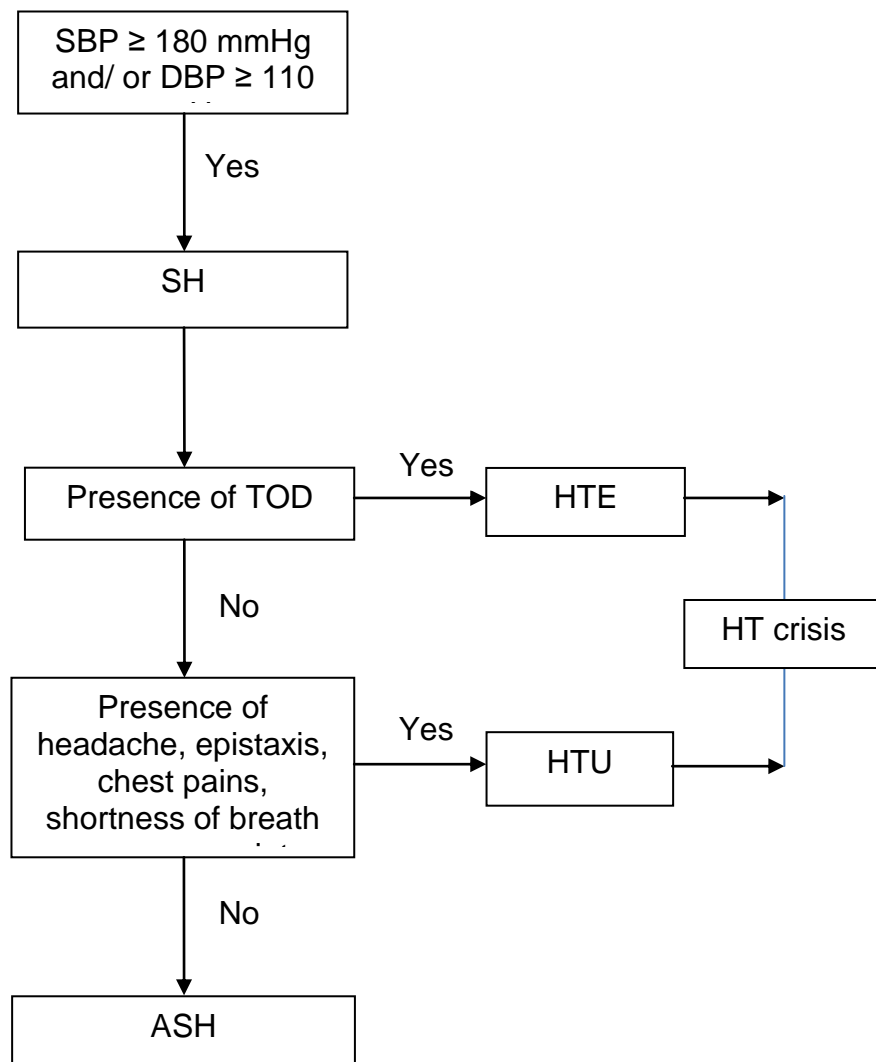
Previously, literature described malignant HT among the severe complications of HT (14, 18, 19). There are authors who still refer to this terminology (13, 17, 20, 21). Currently, SAHS has likened malignant hypertension to hypertensive encephalopathy and considers it as a form of HT emergency (1). Malignant HT is a sudden elevation of BP (usually DBP > 120 mmHg) accompanied by bilateral fundus haemorrhages and/or exudates or papilloedema (15, 19, 20). There is also a risk of renal failure in malignant HT (19).

Recently, Kotliar described another classification that did not include the expressions “urgency” and “emergency”. The primary aim of this classification was to avoid the urge for a rapid reduction of BP during the management of the SH patients. This approach also highlighted the need to consider organ damages pre-existing to the severe elevation of BP in the classification of SH (22). However, BP levels for the definition of SH remained SBP \geq 180mmHg and/or DBP \geq 110mmHg

similarly to the SAHS classification (1, 22). This classification has two subgroups of severe HT (22):

1. SH without acute target organ damage (this group includes patients with pre-existing cardiac, renal and cerebrovascular diseases).
2. SH with acute target organ damage.

Figure 1: Types of severe hypertension



SBP: systolic blood pressure, DBP: diastolic blood pressure, SH: severe hypertension, TOD: target organ damage, HTE: hypertension emergency, HTU: hypertension urgency, ASH: asymptomatic severe hypertension

The SAHS classification and the terms ASH, HTU and HTE will be used in the present study.

BP levels remain a central component in the definition of SH in both the above stated classifications (1, 22). Nevertheless, another study conversely suggests the importance of the clinical presentation rather than the level of BP to determine HT crisis (23). According to the SAHS Guideline, BP measurement is essential to ascertain HT and must be performed correctly with an adequate BP cuff size and after rest (1). The level of BP and the accompanying signs/symptoms will thereafter define the type of SH (1, 24). Moreover, Borzecki et al describe an association between BP levels and the development of TOD (24).

Indeed, the likelihood of damage to target organs increases with the level of BP and the presence of co-morbidities (24). Co-morbidities are clinical conditions associated with HT and increase the risk for CVD complications; they include diabetes mellitus, chronic kidney disease (CKD), dyslipidemia and obesity (1). The probability of developing complications due to HT may be expressed as the 10-year risk of developing TODs. In the case of SH, this probability is calculated to be 20-30% (high risk); it increases to more than 30% if co-morbidities are associated to SH (very high risk) (1, 24). Also, the short-term or immediate risk of developing TODs is higher in SH compared to other levels of BP and has a correlation with the degree and the speed of BP elevation (24). Furthermore, the odds of developing HT crisis were found to increase by 30% for every 10mmHg increase in SBP (25).

1.3. Epidemiology of severe hypertension

In 2004, a quarter of mortality in sub-Saharan Africa (SSA) was related to non-communicable diseases (NCDs). Currently, projections reveal that NCDs will contribute to 46% of deaths by 2030. NCDs mainly include CVD, cancer and metabolic diseases. In SSA, research mainly focused onto issues related to maternal and child health and infectious diseases (26). Hypertension is a major risk factor for CVD (2). Also worldwide, it is predicted that 1% of hypertensive patients will develop HT crises in their lives (13, 14, 27).

1.3.1. Severe hypertension in the general population

Worldwide, limited information exists about the prevalence of SH in the general population (24). Preston et al recalled a projection that set the prevalence of SH at 11% among the USA hypertensive patients (28).

Borzecki et al concurred about the difficulties to set a definite prevalence of SH in the general population, but acknowledged the existence of limited cross-sectional studies that set the prevalence of SH in the ranges of 8 to 19% in the USA. Borzecki et al also noted that patients with SH were older, mainly female, commonly African American and with co-morbidities like obesity and dyslipidemia (24).

1.3.2. Severe hypertension in hospitals

There exist several attempts to determine the magnitude of the problem “severe hypertension” in public and private health institutions (24, 28, 29). The prevalence of SH may be considered in different populations, such as all patients presenting to the ED or all medical emergencies at ED or hypertensive patients presenting to the ED.

Lalljie et al assessed specialist, private practices in Jamaica and found a prevalence of SH of 19% among hypertensive patients of mixed ethnicities but predominantly black; also 62% of patients with SH were ≤ 65 years of age (29). On the other hand, in a prospective study at a tertiary hospital in the USA, Preston et al recorded a prevalence of SH of 4.9% among all medical ED patients (28). The latter prevalence appears lower as it considered all medical patients that presented at ED.

In a study of individuals of mixed ethnicities in USA, Borzecki et al showed an association between older age and SH. The SH patients' mean age was 67.0 ± 18.2 years old (24) and they were predominantly black (24, 29).

In case of ASH, the primary reason for consultation is not usually HT (1). The primary reason for consultation is surgical or trauma related and attracts more the attention of clinicians (1).

1.3.3. Asymptomatic severe hypertension

ASH appears the commonest type of SH at the ED (15, 28). In the USA, using the data from the ED of three teaching hospitals serving largely uninsured and economically disadvantaged patients, Karras et al found ASH to be more common among African American women (54.0%) with a mean age of 56.5 ± 12.7 years (30). Also at yet another public teaching hospital in USA, without determining if patients were insured, Preston et al found that ASH was more common among men (51.7%) and African American patients with a mean age of 54.3 ± 12.5 years (28).

Finally, the average SBP and DBP in ASH were estimated to be 199 mmHg and 110 mmHg respectively (30), whilst the average BP in case of HT crisis was estimated at 197/108 mmHg (25). The level of BP suggests that BP elevation alone may not explain the occurrence of complications due to SH.

1.3.4. Hypertension crisis

Risk factors for HT crises are: poor adherence or sub-optimal treatment of known hypertensive patients, poor access to healthcare and presence of co-morbidities, such as diabetes mellitus and kidney failure (1, 13, 27, 29, 31). HT crises also occur in normotensive patients, such as in the case of pre-eclampsia and acute nephritis (27, 32, 33). The rate of HT crisis in the general population remains unknown (27). However, the distribution of HT crisis parallels the one for essential HT, i.e. high incidence among elderly and African American in USA (14). Studies from 1991-1995 have estimated the prevalence of HT crisis in the ED (34, 35).

Zampaglione et al conducted a study in a tertiary public hospital and found a rate of HT crisis equivalent to 4% of Caucasian patients presenting to the ED (34). However, in Malaysia, Lim et al found the rate of HT crisis to be 10% of Malaysian medical patients presenting to ED. Both studies were conducted at public institutions (34, 35).

1.3.4.1. Hypertension emergency

In case of HTE, literature always suggests a search for secondary causes of HT. Indeed, the presence of pheochromocytoma, primary aldosteronism, illicit drugs use, thyroid diseases and systemic erythematous lupus may explain the occurrence of HTE (20, 33). However, most HTE are known hypertensive patients with poor BP control (14).

Worldwide, the incidence of HTE is below 5% of all patients presenting to the ED (1). In terms of TODs associated to HTE, Zampaglione et al described cerebral infarction as the most common TOD (24%), followed by acute pulmonary oedema (23%), hypertensive encephalopathy (16%) and cerebral haemorrhage (4.5%) (34). Rodriguez et al concurred that ischemic stroke is the most common TOD in HTE (13). On the other hand, hypertension remains a major risk factor for stroke worldwide. Indeed, Choi et al after assessing patients presenting at Korean private clinics and tertiary hospitals, found that an appropriate treatment of HT reduces stroke risk by 40% and each increase of BP by 20/10 mmHg above 115/75 mmHg doubles the stroke risk. Choi et al also noted an average 10-year probability to

develop stroke among Korean hypertensive patients to be higher in public hospital (24%) compared to private clinics (16%). The better outcome in private clinics may have been because more hypertensive patients in private clinics (79%) were on antihypertensive medication compared to public hospital (76%). However, other factors like co-morbidities may have influenced this outlook since patients at the public hospital were older and had more stroke risk factors (36).

Similarly, in a retrospective study in Pakistan, Vohra et al showed that 50% of stroke patients in the medical wards of a community and private hospitals were hypertensive. Also hypertensive patients had the worst mortality (37.8%) compared to non-hypertensive patients (30.8%). In general, mortality due to a stroke was higher in community hospitals (33.1%) compared to private hospitals (13.1%). This difference in mortality might be due to distinct care and/or a lack of facilities in the community hospital (37).

A number of studies in SSA, and particularly South Africa, have described aspects of the epidemiology of hypertension crises (19, 38, 39). Indeed, prior to the use of the current classification of severe hypertension, an analysis of the South African Dialysis and Transplantation registry (1982 to 1987) showed that malignant HT was more prevalent in black patients than in white patients. Black patients were relatively younger (mid-40s) and, still economically active. Also, as malignant HT seemed to follow a distribution similar to essential HT, it may be hypothesised that poor adherence to medication and sub-optimal management of hypertensive patients may have therefore been significant factors determining the occurrence of

HT crisis in South Africa similarly to elsewhere in the world (19). Worldwide, malignant HT is described as occurring more commonly among black patients (13, 15)

Similarly, poor BP control appeared as contributing factor among patients admitted with stroke to two teaching hospitals between 1984 and 1985 in Zimbabwe. Indeed 89.8% of these patients were unknown hypertensive or had defaulted their anti – hypertensive medication and their mean age was 52 years old (40).

Recently, in a study conducted at private clinics in South Africa, Rayner et al found that black ethnicity and SH were independent predictors of left ventricular hypertrophy (LVH). Whilst LVH has a 20% 10–year risk of CVD in South Africa, and is considered as a marker of TOD occurrence (38). Hence, Opie et al described a rate of stroke twice higher in black patients compared to white patients (39).

1.3.4.2. Hypertension urgency

HTUs are more frequent than HTEs worldwide (76% vs 24% respectively) (34). In a study by Vlcek et al, patients with HTU more frequently developed cardiovascular events (88%) in comparison to other hypertensive patients (42%) (41).

Rodriguez et al described the common presenting signs and symptoms of HTU as headache (22%), epistaxis (17%), severe anxiety (10%), chest pains (9%) and

dyspnoea (9%) (13). However, compared to HTU, HTE presented with chest pains (27%), dyspnoea (21%), neurologic deficits (21%) and headache (3%) (13).

1.3.5. Survival after hypertension crisis

Finally, the survival after an attack of hypertensive crisis, i.e. HTE and HTU, has globally improved throughout the years. Indeed before 1950, the year that marked the advent of potent anti-hypertensive medication, the 1-year survival rate after HTE was 20-30%; but since 1985 the 1-year survival rate has become 90-95%. Currently, the survival after HT crisis worsens with older age and the presence of co-morbidities such as diabetes mellitus and obesity. Also, the quality of life after an episode of HTE seems to be better: the only target organs to have persistent damage after adequate treatment are the eyes and the central nervous system (42).

1.4. Aspects of pathogenesis, pathophysiology and principles of management of severe hypertension

It appears generally accepted that suboptimal management or poor adherence to medication as well as secondary causes of HT explain the severe elevation of BP among hypertensive patients. This process may be worsened by co-morbidities, and may simply result in established or impeding TOD (1).

However, there are several pathogenetic mechanisms to explain the occurrence of a hypertensive crisis. These mechanisms may be viewed as a cascade of changes that may lead to TOD, in which case, there will be an HTE episode (1). Otherwise, if TOD does not occur and only symptoms are present, it is an HTU episode.

Indeed, mechanical stress due to BP elevation may result in vascular wall damage with increased vascular permeability, cell proliferation, activation of coagulation cascade and release of vasoconstrictors (13, 14). Vasoconstriction is further explained by the activation of the renin-angiotensin-aldosterone system (13, 14, 23). Frequently, the ultimate consequence of this cascade of changes is a hypo-perfusion and ischemia in vital organs (13, 14).

Nonetheless, mechanisms of development of HTE generally remain poorly understood and the above explanations are simply hypotheses (13, 14). As the development of HTE follows the distribution of essential HT, the lack of a consistent primary health care provider and the poor adherence to treatment are considered determinants to episodes of HTEs (1). Indeed, inadequate management of blood pressure will result in BP elevation and vascular stress thereafter, which if followed by a cascade of reactions as described above, results in HTE (13, 14). Otherwise, intuitively, if the vascular stress does not result in the cascade of reactions with ultimate organ hypo-perfusion, the episode will be called ASH or HTU in cases where symptoms such as headache, epistaxis, chest pains and shortness of breath are present.

Treatment of SH depends on the presenting symptoms (1). ASH requires offering a relaxed position to the patient for an hour before repeating BP measurement, and if the second BP measurement is still elevated at the same level of BP, the patient should be treated with oral antihypertensive medication (1, 12). Further investigations may be needed if ASH patients still have elevated BP after 2 weeks of antihypertensive medication (1, 12). Treatment of hypertensive crisis requires immediate reduction of BP, though not necessarily aiming to reach normal BP in a short period of time (1, 12, 13, 14).

The initial goal of management of HTEs is to reduce the mean arterial pressure (MAP) by no more than 25% of the initial BP within minutes to one hour (usually to be maintained at $MAP > 130$ mmHg, but depends on initial BP) (13, 14, 23). Thereafter, BP reduction may aim to 160/100 mmHg in the next 2 to 6 hours (1, 12, 13). This cautious reduction of BP is justified to avoid renal, cerebral or coronary ischemia (14). Further reduction of BP to reach normal BP may follow in the next 24 to 48 hours (12, 13, 10). However, in cases of ischemic stroke, there are strong suggestions to delay the use of antihypertensive drugs unless $SBP > 220$ mmHg or $DBP > 120$ mmHg (1, 12). Conversely, BP should be dropped fast in case of aortic dissection to prevent the immediate threat of aortic tearing (12, 13, 14). HTEs should preferably be treated in intensive care units (ICU) with parenteral antihypertensive medication (1, 12, 13, 14, 17). HTUs may simply require oral antihypertensive medication under observation for several hours (12, 13, 17). Management of HTU does not require admission to hospital (1). The aim of treatment is to reduce the DBP to 100mmHg (1).

1.5. Prevention of severe hypertension

Severe hypertension carries a high risk of cardiovascular damage (11). Its efficient management has contributed to the reduction of morbidity and mortality (10). However, *sequelae* due to TODs involving the eyes and the CNS in HTE may be persistent and debilitating. Prevention of the occurrence of SH is therefore paramount and may be part of the general strategies to prevent HT and its complications (1).

Preventive measures of SH include strategies to avoid the occurrence of HT as well as to control BP elevation in case of established HT (1, 12). Also, co-morbidities require efficient control. These strategies address social, cultural and economic determinants of HT in the general population (1). In cases of established HT, strategies include early detection, early management and efficient control of BP elevation (1, 12).

Generally, management of HT should be based on the following principles: communication to build up partnership with patients, continuity to maintain BP control, coordination to have skilled professionals always offering services to patients, comprehensiveness for fast delivery of services by offering different activities at a single point in hospitals, keeping in mind health promotion and offering quality care with competence (1, 12).

Finally, the search for secondary causes of HT should be prompt and proper management of HTU and HTE may curb the occurrence of persistent complications (1).

In summary, efforts to prevent severe HT, and particularly HT crisis, are important. Intuitively, the identification of patients likely to develop severe HT may be the first step in attempting to prevent severe HT. The present study aims to profile the patients who present with severe HT at the ED. It focuses on patients who presented to private hospitals in urban, densely populated and cosmopolitan areas. Presumably, these patients have easy access to quality health care and adequate BP control. Also, some of these patients are undergoing social and nutritional changes that expose them to HT. This study contribution may increase awareness and may be used to further project the cost incurred by the health-care system in South Africa.

1.6. Study objectives

1.6.1 Aim of the study

The aim of the present study is to review socio-demographic and clinical characteristics of the patients who presented with SH at the ED of private hospitals in an urban area. Two private hospitals, namely Mulbarton and Linksfield Netcare Hospitals allowed data collection at their hospitals for the purpose of this study.

1.6.2 Specific objectives of the study

1. To determine the frequency of SH in general, ASH, HTU and HTE among patients presenting to the ED at Mulbarton and Linksfield Netcare Hospitals
2. To determine the characteristics of patients presenting with all types of SH at ED of the above mentioned hospitals in terms of:
 - i. age
 - ii. gender
 - iii. race
 - iv. Level of SBP and DBP
3. To determine the frequency of the organ dysfunction accompanying HTE in patients who presented to the ED of the above mentioned hospitals
4. To compare the frequencies of patients presented at above stated ED with different types of SH among:
 - i. Males and females
 - ii. Age groups
 - iii. Race.
5. To compare the frequencies of patients who presented at above stated ED with different types of SH during different days of the week and different seasons.
6. To compare systolic and diastolic blood pressure levels among the different types of SH presented at the above mentioned ED.
7. To compared the demographic data (age, gender and race), the days and seasons of presentation and the clinical characteristics (level of BP,

presenting signs and symptoms) of patients with SH between Mulbarton and Linksfield Netcare hospitals.

8. To determine any independent factors to predict HT crises.

CHAPTER 2

2.0. MATERIALS AND METHODS

2.1. Study methodology

2.1.1. Study design

This study was retrospective, transversal and comparative.

2.1.2. Study setting

Data were obtained from Mulbarton and Linksfield Netcare Hospitals based in Johannesburg, South Africa. Both hospitals offer 24-hour emergency services.

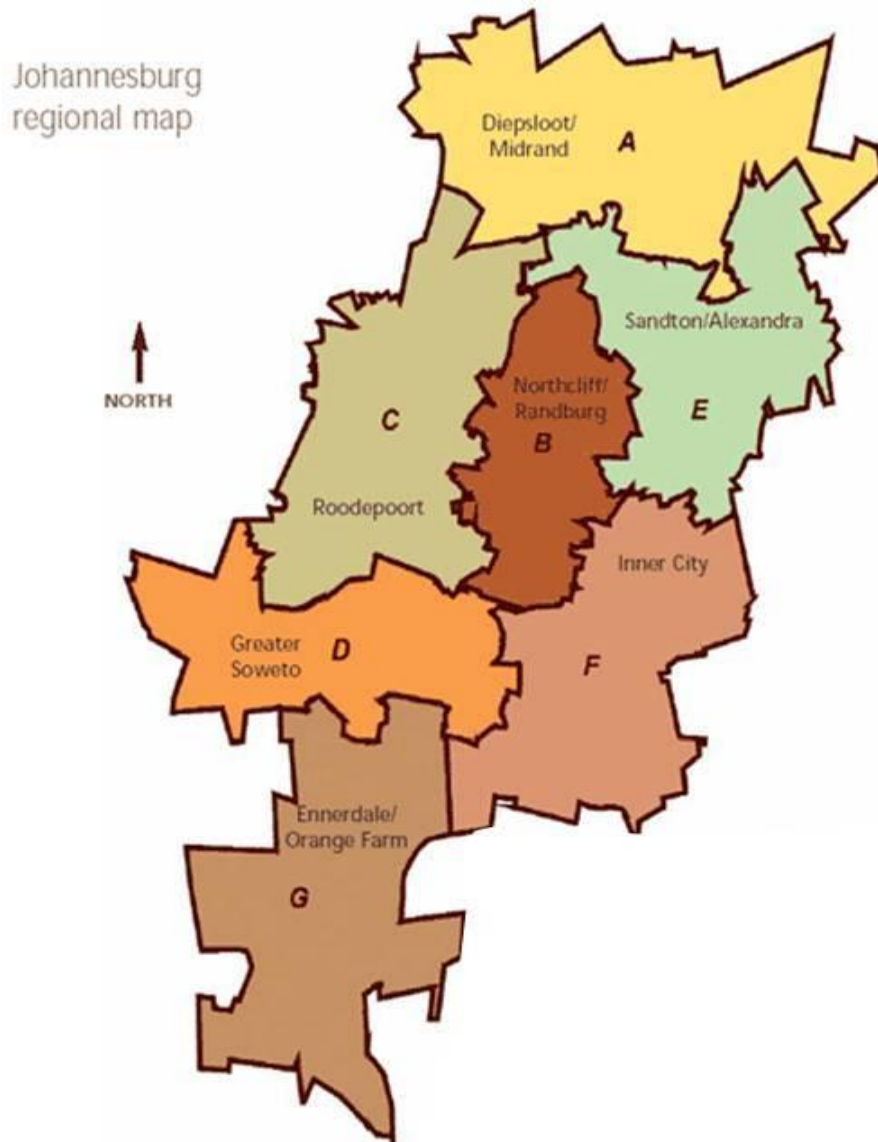
Mulbarton Hospital is situated south of Johannesburg, in Mulbarton suburb of Region F (Figure 1). Region F of Gauteng Province has a population that is estimated at 433 054 individuals. However, this population figure might be underestimated as many temporary residents are found in Region F. The inner city and the southern part of Region F have different demographics. Indeed, high-income residents and white residents have moved away from the inner city. Currently, mainly low income black population have replaced them. On the contrary, the southern area of region F, that includes Mulbarton, is populated with middle and high-income population. The population of Mulbarton comprises 52.7% female. In terms of race, the white population represents 68.7%, followed by the

black population (22.6%), the Indian or Asian (5.5%) and the coloured population (3.1%) (43).

Linksfeld Hospital is situated north-east (Region E) of Johannesburg, in the middle-class suburb of Linksfeld (Region E) (Figure 1). Region E has a population of 394 000 people, among whom 87% are black, 11% white, 1% indian and 1% coloured individuals. In Linksfeld, the female subgroup represents 49.8% of the population. Regarding race, the white population represents 68.9%, followed by the black population (29.7%), the Indian or Asian (1.3%) and the coloured population (0.1%) (43).

Generally, these private hospitals are visited by patients holding medical aid or able to pay for private consultation.

Figure 2: Map of Johannesburg subdivided into regions (43)



Source: The official website of the City of Johannesburg. Available at <http://www.joburg.org.za>

Netcare Management (Pty) Limited comprises 53 hospitals that are located in different areas in South Africa, among which 40 are linked to the Medibank™. Medibank™ is an electronic database and captures the demographic and clinical

characteristics of patients. Medibank™ data capturing is performed in each networked ED using a stand-alone computer. Mulbarton and Linksfield are linked to Medibank™. Medibank™ has a search engine that allows retrieval of information about routinely captured patients.

2.1.3. Study population

Study participants included all patients, regardless of their reasons of consultation, with SH, i.e. SBP \geq 180 mmHg and/or DBP \geq 110 mmHg who presented to the EDs of the above-stated hospitals from the 1st of January 2010 to 30th April 2011. Excluded from this study are individuals less than 13 years of age who had no systematic BP checking at ED.

2.1.4. Data collection

All of the data were retrieved from the Netcare Group electronic database (Medibank™) and manual patients' registers. The following steps were taken during data collection:

- **Step 1:** Identification of all patients who presented at ED with SBP \geq 180 mmHg and/or DBP \geq 110 mmHg. This identification made use of the Medibank™. The Medibank™ manager forwarded an electronic copy of all patients who presented to the ED during the period under review. Data on each patient showed: date of admission, Netcare reference number, gender, race, SBP, DBP. From this list of patients, a search of those with SBP \geq 180

mmHg and/or DBP \geq 110mmHg was performed and a list of the SH patients that are included in this study was established.

- **Step 2:** Collecting following information for each selected patient: date seen at ED, age, gender, race, level of BP. The search was performed in the Medibank™ database. This information was recorded in a manual data sheet (Microsoft Word) (Appendix 1).

- **Step 3:** Collecting information about presenting symptoms/signs or diagnosis at ED of all selected patients in a manual patient's register held at each emergency department. This information was added into the manual data sheet (Appendix 1). Also, information about the date seen at ED, the age, the gender and the race obtained from the Medibank™ were validated in the manual patients' registers. Each patient was then classified as: ASH or HTU or HTE.

- **Step 4:** Establishing an electronic data sheet in Microsoft Excel (Appendix 2). Appendix 1 and appendix 2 contained the same information.

2.2. Data analysis

Data were analysed with STATISTICA 10.0. Descriptive results were presented as means and standard deviations (SD) for continuous variables and as frequency or percentage for categorical variables. To assess the differences between different continuous variables (that were not normally distributed) by the different categorical variables, the Kruskal-Wallis test was used, followed by the Bonferroni correction for two-by-two comparisons. To compare frequencies of different

categorical variables among the three diagnosis of severe HT (AHT, HTU and HTE), the Chi-square test was used. Univariate and multiple logistic regressions were performed to determine possible independent predictors of HT crisis. The independent variables included in the model were: age, gender, race, SBP and DBP. Significance was assumed at $p < 0.05$ on a two-sided test.

2.3. Ethical considerations

As the study was retrospective, no informed consent was needed from each study participant. Confidentiality was upheld by using the following measures: no name was specified on collection tools; only reference numbers (codes) appeared on these tools; once the final electronic database was edited, all other data collection tools were destroyed and access to the Microsoft Excel database was password restricted to the main investigator.

Permission to conduct research was sought and granted from the Human Research and Ethics Committee of the University of Witwatersrand (Appendix 3), as well as from the Netcare Management (PTY) Limited Hospitals (Appendix 4).

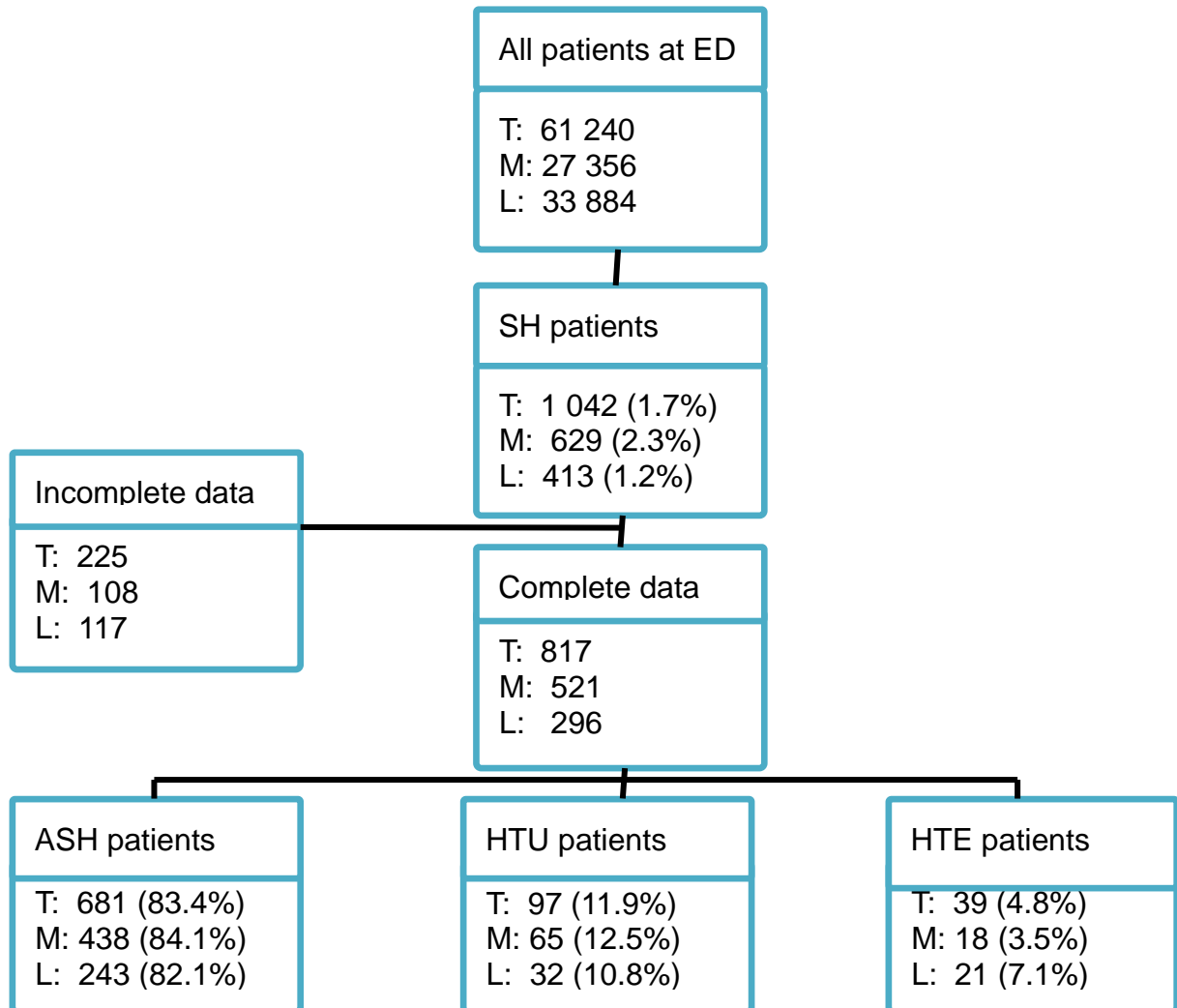
CHAPTER 3

3.0. RESULTS

3.1. Clinical and demographic description of severe hypertension patients

During the period from 1st January 2010 to 30 April 2011, 61 240 patients visited the EDs of Mulbarton and Linksfield hospitals (27 356 patients at Mulbarton Hospital and 33 884 patients at Linksfield Hospital). Of all the patients seen at these EDs, 1 042 patients, i.e. 1.7% (2.3% at Mulbarton and 1.2% at Linksfield) met the criteria for SH (SBP \geq 180mmHg and/or DBP \geq 110mmHg) and were included in this study. However, 225 SH patients (from 1 042 SH patients) could not be classified into the different types of SH due to incomplete clinical information. Thus, 817 SH patients were classified as ASH (N=681), HTU (N=97) and HTE (N=39) (Figure 3).

Figure 3: Flow diagram of patients presenting to the ED of Mulbarton and Linksfield hospitals



T: Total (including M and L), M: Mulbarton Hospital, L: Linksfield Hospital, ASH:asymptomatic severe HT, HTU: HT urgency, HTE: HT emergency, SH: severe HT

The demographic characteristics and clinical aspects of patients with SH are presented in Table 1 below. Also, patients with incomplete clinical data were included only in the analysis of all SH, but not classified into the different types of SH as their signs/symptoms were unavailable. The analysis of their demographic and clinical characteristics is presented in Table 2.

Table 1: Demographic and clinical characteristics of patients with severe hypertension

	Total N= 1042	Mulbarton N= 629	Linksfield N= 413	p-value*
GENDER (Male) n (%)	479 (45.9)	316 (50.2)	163 (39.7)	0.0008
AGE (years) Mean \pm SD	56.8 \pm 18.4	52.5 \pm 16.2	63.2 \pm 19.6	<0.0001
RACE n(%)				
White	646 (62.0)	327 (52.0)	319 (77.2)	<0.0001
Black	262 (25.1)	190 (30.2)	72 (17.4)	
Other	134 (12.8)	112 (17.8)	22 (5.3)	
BP (mmHg)				
Mean SBP	186.2 \pm 20.6	187.8 \pm 21.2	183.8 \pm 19.6	0.0006
Mean DBP	107.9 \pm 16.1	109.4 \pm 16.8	105.8 \pm 14.9	0.004
DAY OF WEEK n(%)				
Weekdays	715 (68.6)	432 (68.7)	282 (68.6)	0.9818**
Weekends	327 (31.4)	197 (31.3)	129 (31.4)	
SEASON n(%)				
Summer	376 (36.1)	217 (34.5)	159 (38.5)	0.1382***
Autumn	272 (26.1)	168 (26.7)	104 (25.2)	
Winter	217 (20.8)	125 (19.9)	92 (22.3)	
Spring	177 (17.0)	119 (18.9)	58 (14.0)	
DIAGNOSIS n (%)				
HTE	39 (3.7)	18 (2.9)	21 (5.1)	0.0298****
HTU	97 (9.3)	65 (10.3)	32 (7.8)	
ASH	681 (65.4)	438 (69.6)	243 (58.8)	
Unknown	225 (21.6)	108 (17.2)	117 (28.3)	

SD: standard deviation, BP: blood pressure, SBP: systolic BP, DBP: diastolic BP, HTE: hypertension emergency, HTU: hypertension urgency, ASH: asymptomatic severe hypertension, *: comparison between Mulbarton and Linksfield Hospitals, **: comparison of distribution in days of week, ***: comparison of distribution in seasons, ****: comparison of distribution of different types of SH

Gender distribution of SH patients was different between Mulbarton and Linksfield Hospitals (p=0.0008) with a predominance of male patients at Mulbarton Hospital and female patients at Linksfield Hospital (Table 1). The overall mean age of SH patients was 56.8 \pm 18.4 years, and there was a difference in mean ages between

the two hospitals ($p < 0.0001$) with Linksfield Hospital having older cohort of patients. Race distribution of SH patients were also different between the two hospitals ($p < 0.0001$). Linksfield Hospital had more predominantly white SH patients. BP levels of SH patients were different between the two hospitals ($p = 0.0006$ for SBP and $p = 0.004$ for DBP). SH patients presented similarly according to seasons and days of week between the two hospitals. Finally, the subdivision of SH patients into different types showed a difference between the two hospitals ($p = 0.0298$). Linksfield Hospital had more HTE patients (5.1%) than Mulbarton Hospital (2.9%) (Table1).

Among the SH patients with incomplete clinical data, seasonal presentation and presentation during days of week remained similar between the two hospitals (Table 2). However, there were differences between the two hospitals in mean ages, race distribution and levels of SBP ($p = 0.0034$, $p = 0.0006$, $p = 0.0006$ respectively) (Table 2). DBP and gender distribution were similar (Table 2). Also, among the 225 SH patients with incomplete clinical data, 108 were found at Mulbarton Hospital. The latter patients were similar to those with complete clinical data at Mulbarton Hospital. At Linksfield Hospital, there were 117 SH patients with incomplete data and, compared to those with complete clinical data at Linksfield Hospital, they had differences in mean ages, SBP levels, DBP levels and gender distribution ($p = 0.02$, $p < 0.0001$, $p < 0.0001$, $p = 0.01$ respectively).

Table 2: Demographic and clinical characteristics in severe HT (patients with incomplete data)

	Mulbarton N= 108*	Linksfield N= 117§	p-value
GENDER (Male) n (%)	61 (56.5)	58 (49.6)	0.2996
AGE(years) Mean ±SD	52.1 ±17.1	59.8 ±19.7	0.0034
RACE n (%)			
White	57 (52.8)	84 (71.8)	
Black	30 (27.8)	28 (23.9)	0.0006**
Other	21 (19.4)	5 (4.3)	
B P(mmHg)			
Mean SBP	185.5 ±24.1	174.2 ±24.3	0.0006
Mean DBP	109.9 ±23.2	112.1 ±11.1	0.0604
DAY OF WEEK n (%)			
Weekdays	75 (69.4)	88 (75.2)	0.3332***
Weekends	33 (30.6)	29 (24.8)	
SEASON n (%)			
Summer	38 (35.2)	44 (37.6)	
Autumn	31 (28.7)	25 (21.4)	0.1931****
Winter	17 (15.7)	30 (25.6)	
Spring	22 (20.4)	18 (15.4)	

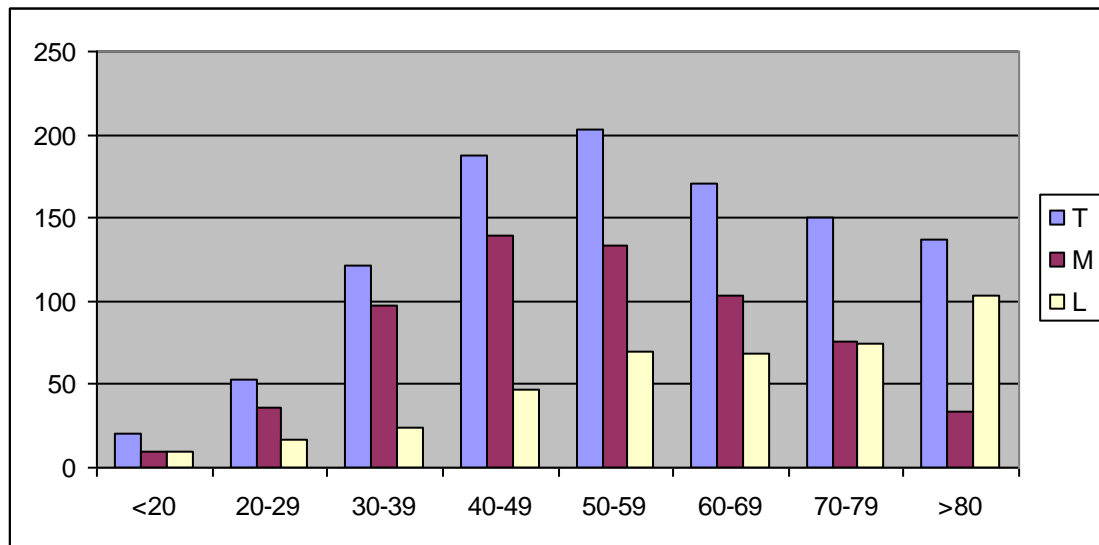
BP: blood pressure, SBP: systolic blood pressure, DBP: diastolic blood pressure, SD: standard deviation

*: Comparison between SH patients with complete clinical data and those with incomplete clinical data (Gender: p=0.19, Mean age: p=0.94, Race distribution: p=0.79, SBP: p=0.23, DBP: p=0.99, Days of week: p=0.94 and Seasons: p=0.69)

§: Comparison between SH patients with complete clinical data and those with incomplete clinical data (Gender: p=0.01, Mean age: p=0.02, Race distribution: p=0.1, SBP: p<0.0001, DBP: p<0.0001, Days of week: p=0.08, Seasons: p=0.57), **: comparison of race distribution, ***: comparison of distribution in days of presentation, ****: comparison of seasonal presentation

The mean ages of SH patients are presented as distribution in different age-groups in Figure 4.

Figure 4: Age distribution among severe HT patients



Legend: T: Both hospitals, M: Mulbarton Hospital, L: Linksfield Hospital

Generally, SH was most common in the age-group 50-59 years old, followed by the 40-49 age-group. Although the most common age-group was SH was most in 40-49 years old, followed by 50-59 age-group at Mulbarton Hospital, SH was most common in the above 80 age-group, followed by 70-79 age-group at Linksfield Hospital.

Finally, race distribution was also detailed to outline the composition of the category “other races”. Other races were minority in both hospitals (Figures 5, 6 and 7). Other races included Coloureds, Indians and Asians non-Indians.

Figure 5: Overall race distribution of severe hypertensive patients

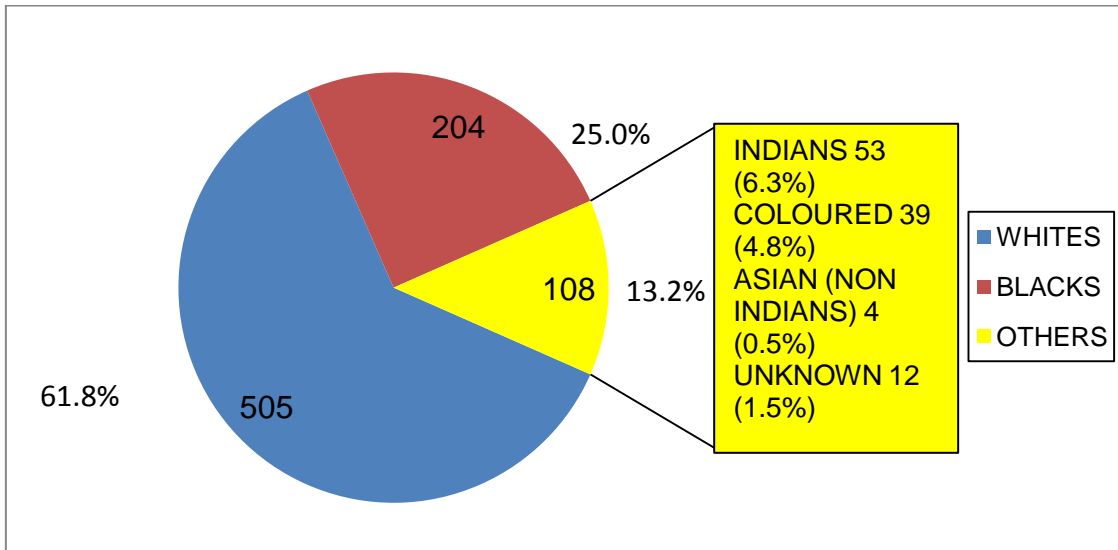


Figure 6: Race distribution of severe hypertensive patients at Mulbarton Hospital

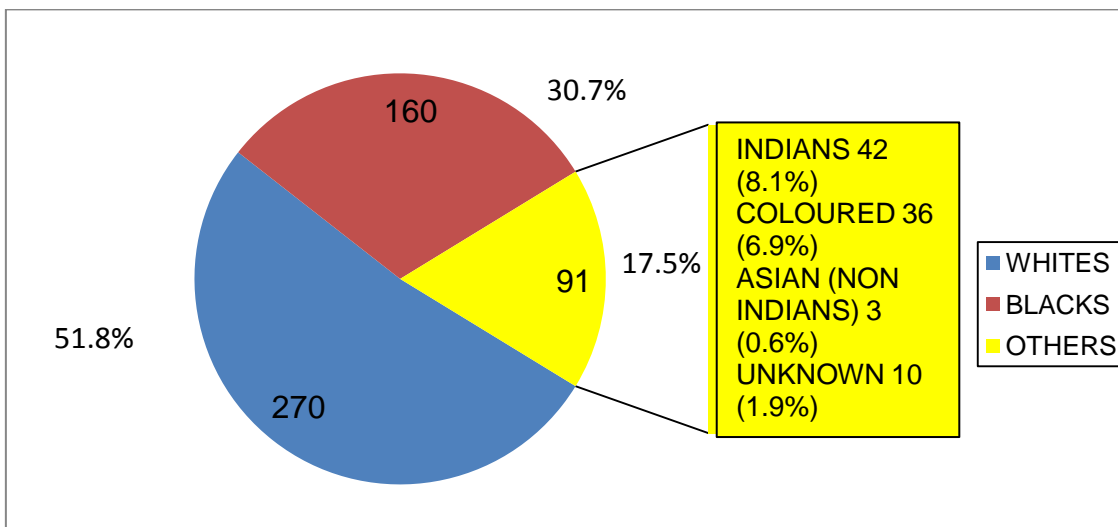
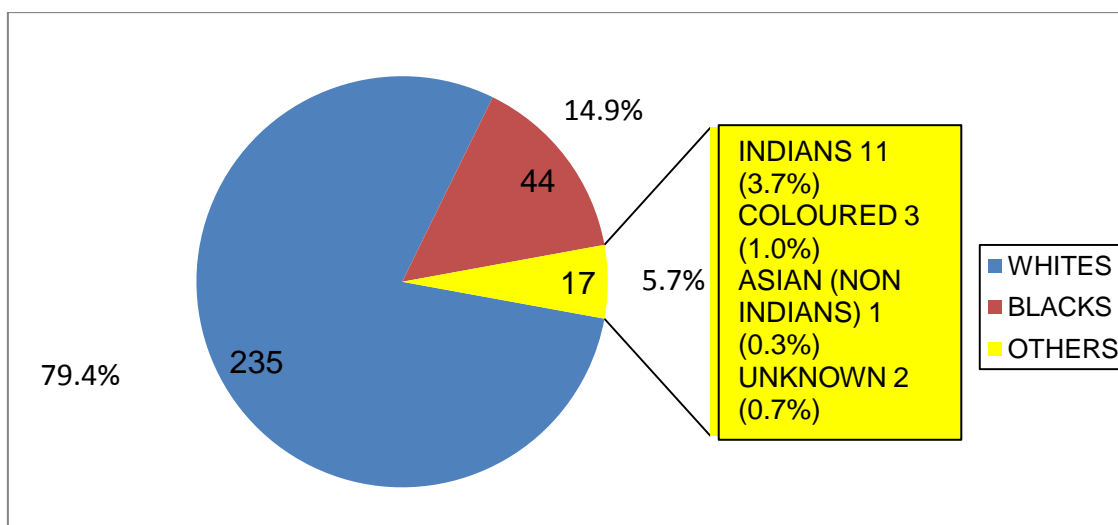


Figure 7: Race distribution of severe hypertensive patients at Linksfield Hospital



3.2. Types of severe hypertension

Further analysis of Table 3 shows the differences among the different types of SH. Overall, ASH patients had a mean age of 57.3 ± 18.3 years, a mean SBP of 187.9 ± 18.5 mmHg and a mean DBP of 106.8 ± 15.2 mmHg (Table 3). By comparing Mulbarton and Linksfield Hospitals, ASH patients were older (65.3 ± 19.4 years) at Linksfield Hospital than those at Mulbarton Hospital (52.9 ± 16.1 years) ($p < 0.0001$) (Table 3). The age distribution of ASH patients is shown in Figure 8. Linksfield hospital ASH patients were mostly white (80.2%). At Mulbarton hospital, ASH patients comprised of 53.2% white and 29.9% Black patients ($p < 0.0001$) (Table 3). DBP were also different with Linksfield Hospital ASH patients having a lower DBP than Mulbarton Hospital ASH patients ($p < 0.0001$) (Table 3). The SBP remained similar between the two hospitals. Also the days and seasonal presentation of

ASH patients remained the same between the two hospitals. Days and seasonal presentations of the other types of SH remained similar as well (Table 3).

Regarding the HTU, the overall mean age was 51.9 ± 18.0 years (Table 3). The average BP of HTU was $187.8 \pm 20.1/110.0 \pm 15.5$ mmHg. Comparison of HTU patients at Mulbarton and Linksfield Hospitals showed a significant difference in mean age, with Linksfield Hospital patients being older (58.4 ± 20.5 years) than Mulbarton Hospital patients (48.6 ± 15.8 years) ($p=0.0244$) (Table 3). The age distribution of HTU patients at the two hospitals is represented in Figure 9.

Table 3: Demographic and clinical characteristics of patients with different types of severe hypertension

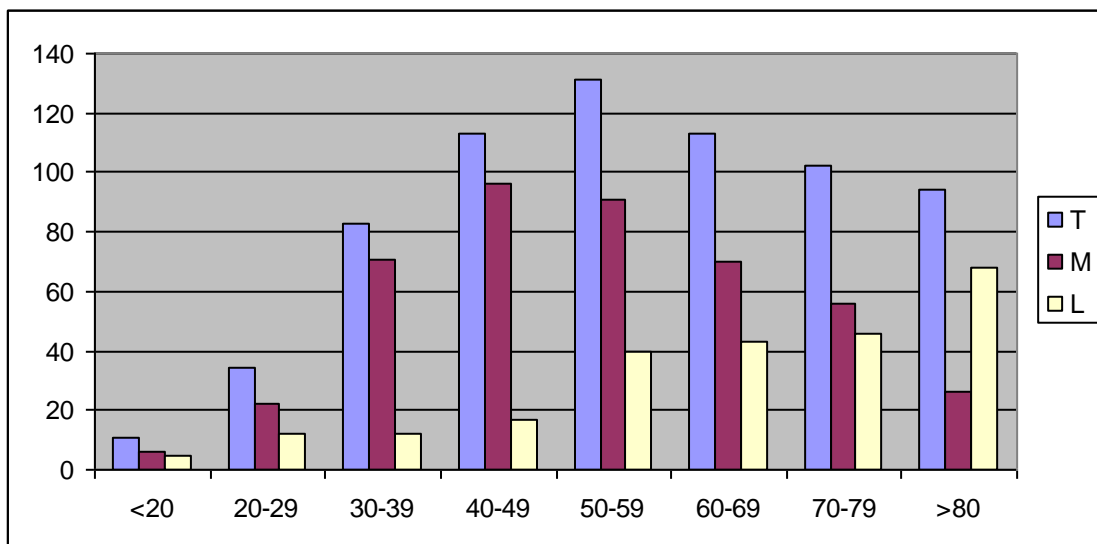
	ASYMPTOMATIC SEVERE HYPERTENSION				HYPERTENSION URGENCY				HYPERTENSION EMERGENCY			
	T N= 681	M N= 438	L N= 243	p value*	T N= 97	M N= 65	L N= 32	p value*	T N= 39	M N= 18	L N= 21	p value*
GENDER (Ma) n (%)	295 (43.3)	216 (49.3)	79 (32.5)	<0.0001	52 (53.6)	33 (50.8)	19 (59.40)	0.4242	13 (33.3)	6 (33.3)	7 (33.3)	1.000
AGE (years)	57.3 ±18.3	52.9 ±16.1	65.3 ±19.4	<0.0001	51.9 ±18.0	48.6 ±15.8	58.4 ±20.5	0.0244	63.4±14.8	59.9 ±14.0	66.4 ±15.1	0.1884
RACE n(%)												
White	428 (62.8)	233 (53.2)	195 (80.2)	<0.0001	48 (49.5)	26 (40.0)	22 (68.8)	0.0248	29 (74.3)	11 (61.1)	18 (85.7)	0.1756
Black	166 (24.4)	131 (29.9)	35 (14.4)		30 (30.9)	23 (35.4)	7 (21.9)		8 (20.6)	6 (33.3)	2 (9.5)	
Other	87 (12.8)	74 (16.9)	13 (5.4)		19 (19.6)	16 (24.6)	3 (9.3)		2 (5.1)	1 (5.6)	1 (4.8)	
BP (mmHg)												
Mean SBP	187.9 ±18.5	188.4 ±20.5	187.2 ±14.3	0.1064	187.8 ±22.2	188.8 ±20.1	185.8 ±20.7	0.2919	189.0 ±22.2	182.1 ±21.1	194.9 ±21.1	0.2119
Mean DBP	106.8 ±15.2	107.8 ±19.0	102.9 ±14.5	<0.0001	110.0 ±15.5	111.1 ±14.1	108.0 ±18.0	0.5481	103.6 ±18.9	107.1 ±16.3	180.7 ±20.9	0.3300
D W n(%)												
Weekdays	457 (67.1)	299 (68.3)	158 (65.0)	0.3880	67 (69.1)	44 (67.7)	23 (71.9)	0.6752	28 (71.8)	14 (77.8)	14 (66.7)	0.4421
Weekends	224 (32.9)	139 (31.7)	85 (35.0)		30 (30.9)	21 (32.3)	9 (28.1)		11 (28.2)	4 (22.2)	7 (33.3)	
SEASON n (%)												
Summer	241 (35.4)	151 (34.5)	90 (37.0)	0.3845	38 (39.2)	21 (32.3)	17 (53.1)	0.1015	15 (38.5)	7 (38.9)	8 (38.1)	0.6173
Autumn	186 (27.3)	120 (27.4)	66 (27.2)		25 (25.8)	16 (24.6)	9 (28.1)		5 (12.8)	1 (5.6)	4 (19.1)	
Winter	143 (21.0)	88 (20.1)	55 (22.6)		20 (20.6)	16 (24.6)	4 (12.5)		7 (17.9)	4 (22.2)	3 (14.3)	
Spring	111 (16.3)	79 (18.0)	32 (13.2)		14 (14.4)	12 (18.5)	2 (6.3)		12 (30.8)	6 (33.3)	6 (28.5)	

T: Both hospitals, M: Mulbarton, L: Linkfield, Ma: Male, DW: Day of week, BP: Blood pressure, SBP: systolic BP, DBP: Diastolic BP
p-value*: Comparison between Mulbarton and Linkfield Hospitals, NA: analysis not done due to small sample

Also, the race distribution among HTU patients was different between the two hospitals ($p=0.0248$) (Table 3). Patients with HTU at Linksville Hospital were mostly white (68.8%). At Mulbarton Hospital, white patients represented 40.0% and black patients 35.5% (Table 3).

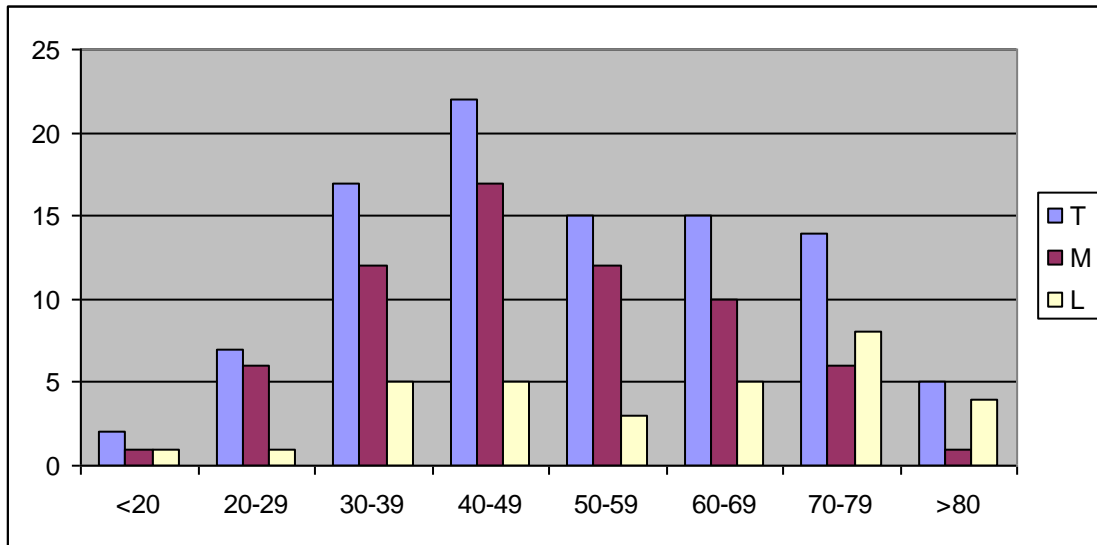
Lastly, there was no difference in mean age, gender distribution, levels of BP, days of ED presentation and seasonal ED presentation between HTE patients at Mulbarton and Linksville Hospitals (Table 3). In general, the mean age of HTE patients was 63.4 ± 14.8 years (Table 3). Age distribution is represented in Figure 10. The mean SBP was 189.0 ± 22.1 mmHg and the mean DBP was 107.1 ± 16.3 mmHg (Table 3).

Figure 8: Age distribution among asymptomatic severe hypertensive patients



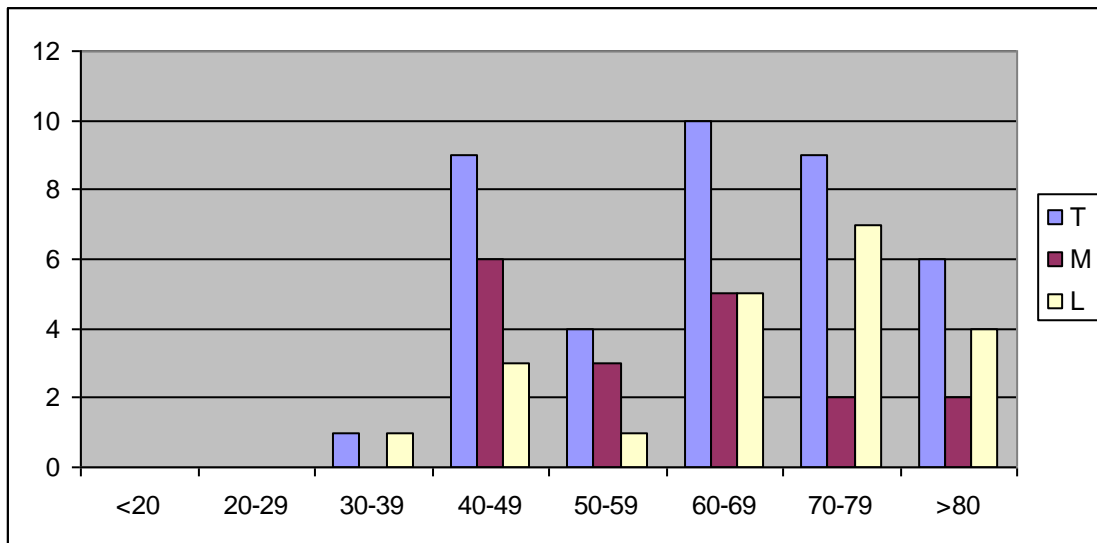
Legend: T: Both hospitals, M: Mulbarton Hospital, L: Linksville Hospital

Figure 9: Age distribution among hypertensive urgency patients



Legend: T: Both hospitals, M: Mulbarton Hospital, L: Linkfield Hospital

Figure 10: Age distribution among hypertensive emergency patients



Legend: T: Both hospitals, M: Mulbarton Hospital, L: Linkfield Hospital

Clinical and demographic characteristics of the patients with ASH were compared to HTU and HTE within each hospital. Table 4 shows this comparison.

Gender distribution showed a difference among the different types of severe HT at Linksfield Hospital ($p=0.0125$) (Table 4). Also, the mean ages were different among the different types of SH at Mulbarton Hospital ($p=0.0261$) (Table 4); HTE patients were older (59.9 ± 14.0 years), followed by ASH patients (52.9 ± 16.1 years) and HTU (48.6 ± 15.8 years). Linksfield Hospital patients with different types of SH did not show any difference in mean age ($p=0.1912$) (Table 4).

Distribution of races, levels of BP, days of presentation as well as seasonal presentations of the patients did not show any difference among the different types of SH both at Mulbarton and Linksfield Hospitals (Table 4).

Table 4: Comparison of clinical and demographic characteristics of patients with different types of severe HT within hospitals

	MULBARTON				LINKSFIELD			
	ASH N=438	HTU N=65	HTE N=18	p value	ASH N=243	HTU N=32	HTE N=21	p value
GENDER (M) n (%)	216 (49.7)	33 (50.8)	6 (35.3)	0.3933	79 (32.5)	19 (59.4)	7 (33.3)	0.0125
AGE (years)	52.9 ±16.1	48.6 ±15.8	59.9 ±14.0	0.0261	65.3 ±19.4	58.4±20.5	66.4 ±15.1	0.1912
RACE n(%)								
White	233 (53.2)	26 (40.0)	11 (61.1)	0.1811	195 (80.2)	22 (68.8)	18 (85.7)	0.5001*
Black	131 (29.9)	23 (35.4)	6 (33.3)		35 (14.4)	7 (21.9)	2 (9.5)	
Other	74 (16.9)	16 (24.6)	1 (5.6)		13 (5.4)	3 (9.3)	1 (4.8)	
BP (mmHg)								
Mean SBP	188.4 ±20.5	188.8 ±20.1	182.1 ±21.1	0.5210	187.2 ±14.3	185.8 ±20.7	194.9 ±21.9	0.2040
Mean DBP	107.8 ±19.0	111.1 ±14.1	107.1 ±16.3	0.5687	102.9 ±14.5	108.0 ±18.0	100.7 ±20.9	0.1477
DW n(%)								
Weekdays	299 (68.3)	44 (67.7)	14 (77.8)	0.6876	158 (65.0)	23 (71.9)	14 (66.7)	0.7418**
Weekends	139 (31.7)	21 (32.3)	4 (22.2)		85 (35.0)	9 (28.1)	7 (33.3)	
SEASON n(%)								
Summer	151 (34.5)	21 (32.3)	7 (38.9)	0.4057	90 (37.0)	17 (53.1)	8 (38.1)	0.2236***
Autumn	120 (27.4)	16 (24.6)	1 (5.6)		66 (27.2)	9 (28.1)	4 (19.1)	
Winter	88 (20.1)	16 (24.6)	4 (22.2)		55 (22.6)	4 (12.5)	3 (14.3)	
Spring	79 (18.0)	12 (18.5)	6 (33.3)		32 (13.2)	2 (6.3)	6 (28.5)	

DW: days of week, ASH: asymptomatic severe HT, HU: HT urgency, HE: HT emergency, M: Male, *: comparison of race distribution, **: comparison of days of presentation, ***: comparison of seasonal distribution

The age and level of BP were compared among the different races in SH and in all its types. Table 5 presents these comparisons.

The levels of BP and the mean ages of patients with ASH and HTU were also compared among different races (Table 5).

Overall, SBPs were similar among all the races with ASH and HTU. However, DBPs were different among all races with ASH and HTU ($p < 0.0001$, $p = 0.0002$, $p = 0.0064$ respectively) (Table 5). In ASH and HTU, black patients had a higher DBP compared to white patients (Table 5).

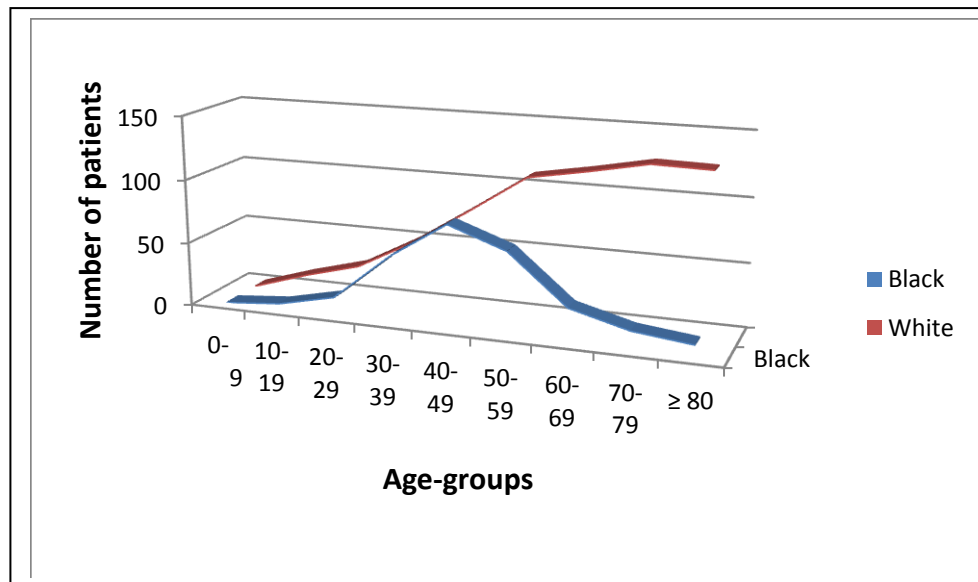
Overall, mean ages were different among all races with SH, ASH and HTU ($p < 0.0001$, $p < 0.0001$, $p = 0.0105$ respectively) (Table 5). In these cases, black patients were younger than white patients. Figure 11 also shows the age distribution of SH among the different races.

Table 5: Race according to types of severe HT

	OVERALL			p value
	White	Black	Other	
SH	N= 505	N= 204	N= 108	
SBP	186.2 ±20.4	185.8 ±21.4	187.2 ±20.4	0.3675
DBP	106.1 ±15.3	111.5 ±13.1	111.7 ±18.4	<0.0001
AGE	61.6 ±18.7	48.5 ±13.9	50.4 ±16.3	<0.0001
ASH	N= 428	N= 166	N= 87	
SBP	188.2 ±17.2	187.2 ±21.3	187.1 ±19.9	0.6183
DBP	105.2 ±15.6	109.6 ±13.3	109.7 ±15.9	0.0002
AGE	61.9 ±18.6	48.9 ±14.3	50.6 ±16.0	<0.0001
HTU	N= 48	N= 30	N= 19	
SBP	187.1 ±19.6	185.9 ±21.7	192.5 ±19.9	0.8189
DBP	106.0 ±13.9	116.5 ±13.3	110.1 ±19.4	0.0064
AGE	56.6 ±19.5	45.4 ±12.3	50.1 ±19.0	0.0105
HTE	N= 29	N= 8	N= 2	
SBP	188.4 ±24.8	191.1 ±13.5	189.0 ±15.5	0.5299*
DBP	102.1 ±20.9	108.4 ±12.9	107.5 ±3.5	0.6712*
AGE	66.7 ±14.5	54.0 ±10.8	53.0 ±18.4	0.0267*

SH: severe HT, ASH: asymptomatic severe HT, HTU: HT urgency, HTE: HT emergency, *: p value between black And white patients. Distribution of different types of SH among black and white patients showed no difference (p=0.097)

Figure 11: Age distribution among different races with SH



Finally, the age and level of BP were compared between male and female patients with SH and all its types as showed in Table 6.

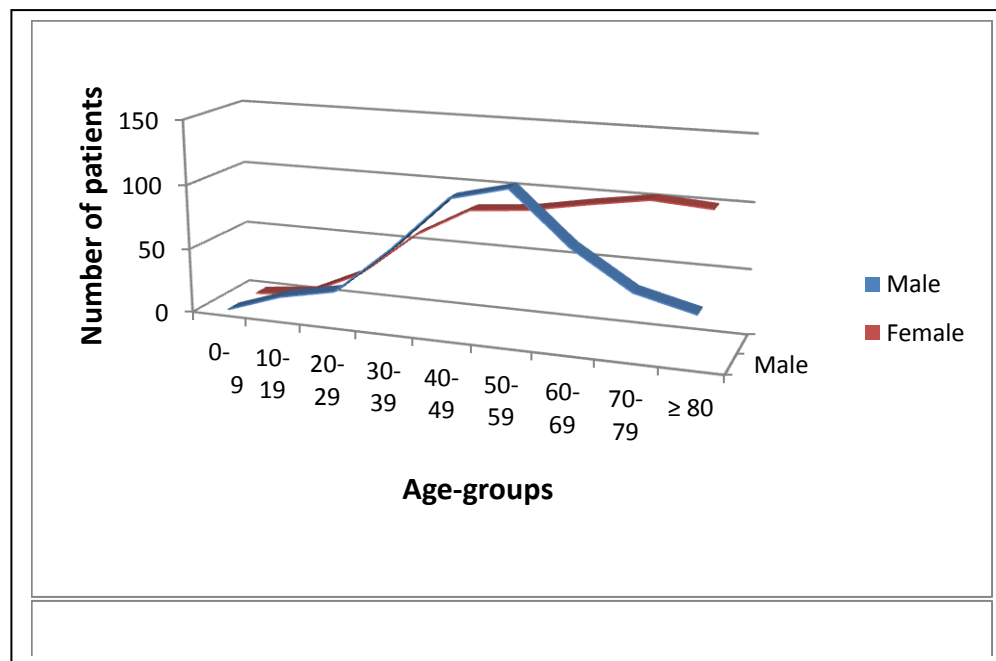
Overall, different types of SH had similar SBPs between female and male patients (Table 6). However the DBPs of patients with ASH and HTU were different between the different genders ($p < 0.0001$, $p = 0.0307$ respectively) (Table 6). Males had a higher DBP compared to female patients. The mean age of patients with ASH was statistically different significantly between the different genders ($p < 0.0001$ respectively) (Table 6). Male patients with ASH were younger (52.8 ± 17.0 years) than female patients (60.7 ± 18.5 years) (Table 6). In the contrary, patients with HTE had similar SBP, DBP and mean ages between the different genders (Table 6). Mean ages of SH patients were between female and male patients. Male SH patients were younger (52.7 ± 16.8 years) than female SH patients (60.2 ± 18.8 years). The age distributions of SH patients of different genders are represented in Figure 12.

Table 6: Gender according to types of severe HT

	OVERALL*		
	Female	Male	p value
SH	N=455	N=360	
SBP	186.6 ±19.3	185.7 ±22.0	0.4611
DBP	105.6 ±15.5	111.2 ±14.9	<0.0001
AGE	60.2 ±18.8	52.7 ±16.8	<0.0001
ASH	N=386	N=295	
SBP	188.3 ±17.4	187.5 ±20.0	0.4505
DBP	104.3 ±15.4	110.2 ±14.3	<0.0001
AGE	60.7 ±18.5	52.8 ±17.0	<0.0001
HTU	N=45	N=52	
SBP	183.5 ±18.6	191.5 ±21.1	0.1612
DBP	106.2 ±15.8	113.4 ±14.5	0.0307
AGE	53.5 ±20.1	50.4 ±16.1	0.5578
HTE	N=26	N=13	
SBP	187.8 ±26.9	191.4 ±7.6	0.3322
DBP	105.6 ±17.3	99.7 ±22.0	0.4295
AGE	63.2 ±14.8	63.8 ±15.3	0.9051

SH: severe HT, ASH: asymptomatic severe HT, HTU: HT urgency, HTE: HT emergency, SBP: systolic BP, DBP: diastolic BP, *: 2 patients with gender not recorded at Linkfield

Figure 12: Age distribution among different genders with SH



3.3. Target organ damages and symptoms/signs

Among patients with HTU, chest pains were generally the most frequent symptom (46.4%), followed by headache (34.0%), epistaxis (10.3%), severe anxiety (8.2%) and, lastly SOB (1.0%) (Table 7). There was only one patient with SOB who was found at Linksfield Hospital. No association between symptoms according to gender or race was found among patients with HTU (Table 8).

Table 7: Distribution of signs/symptoms of HT urgency at Mulbarton and Linksfield Hospitals

	OVERALL (n=97)	MULBARTON (n=65)	LINKSFIELD (n=32)
Headache	33 (34.0)	22 (33.8)	11 (34.4)
Epistaxis	10 (10.3)	8 (12.3)	2 (6.3)
Chest pain	45 (46.4)	29 (44.6)	16 (50.0)
Severe Anxiety	8 (8.2)	6 (9.2)	2 (6.3)
SOB	1 (1.0)	0 (0.0)	1 (3.1)

SOB: shortness of breath

Table 8: Gender, race and symptoms/signs in HT urgency

		OVERALL		
GENDER	Female	Male		p value
n (%)	N=45	N=52		
Chest pains	20 (44.4)	25 (48.1)		
Headache	16 (35.6)	17 (32.7)		
Epistaxis	2 (4.4)	8 (15.3)		0.1517
Anxiety	6 (13.3)	2 (3.9)		
SOB	1 (2.2)	0 (0.0)		
RACE n (%)	White	Black		p value
	N=48	N=30		
Chest pains	25 (52.0)	13 (43.3)		
Headache	14 (29.2)	10 (33.3)		
Epistaxis	3 (6.3)	5 (16.7)		0.3978
Anxiety	6 (12.5)	2 (6.7)		

SOB: shortness of breath

Among patients with HTE, stroke was generally the most frequent TOD, followed by LVF/CCF and seizures (Table 9). However, there was no difference in TOD distribution between the different genders or between white and black patients (Table 10).

Table 9: Distribution of target organ damages among hypertension emergency at Mulbarton and Linksfield Hospitals

	OVERALL (n=39)	MULBARTON (n=18)	LINKSFIELD (n=21)
LVF/ CCF n (%)	11 (28.2)	5 (27.8)	6 (28.6)
Stroke n (%)	23 (58.9)	10 (55.6)	13 (61.9)
Seizures n (%)	5 (12.8)	3 (16.6)	2 (9.5)
Renal failure n (%)	1 (2.6)*	0	0

*patient with renal failure had also LVF/CCF

CCF: congestive cardiac failure, LVF: left ventricular failure

Table 10: Gender, race and target organ damages in hypertension emergency

		OVERALL		
GENDER n (%)	Female N=26	Male N=13		p value
CCF/LVF	5 (19.2)	6 (46.2)		
Stroke	18 (69.2)	5 (38.5)		0.1558
Seizures	3 (11.6)	2 (15.3)		
		OVERALL		
RACE n (%)	White N=29	Black N=8		p value
CCF/LVF	9 (31.0)	2 (25.0)		
Stroke	16 (55.2)	5 (62.5)		0.9476
Seizures	4 (13.8)	1 (12.5)		

CCF: congestive cardiac failure, LVF: left ventricular failure

3.4. Prediction of hypertension crisis

Using univariate or multiple logistic regressions, neither age, gender, race, SBP or DBP showed any independent association with HT crisis (Table 11).

Table 11: Logistic regression of hypertension crisis

	UNIVARIATE			MULTIVARIATE		
	OR	95% CI	p-value	OR	95% CI	p-value
Race	0.973	0.718-1.318	0.8590	0.997	0.738-1.347	0.9630
Age	0.994	0.984-1.004	0.2205	0.996	0.984-1.007	0.4605
Gender*	1.192	0.824-1.724	0.3517	1.121	0.767-1.639	0.5540
DBP	1.005	0.996-1.019	0.1919	1.005	0.993-1.017	0.4152
SBP	1.002	0.991-1.010	0.9026	1.002	0.992-1.012	0.7635

OR: odds ratio, 95% CI: 95% confidence interval *Gender = male

CHAPTER 4

4.0. DISCUSSION

4.1. Study findings and comparison to existing literature

The main finding of this study showed that SH represented 1.7% of all patients who presented in the assessed Emergency Departments. This prevalence was hospital-based and did not reflect the prevalence of SH in the general populations of Mulbarton and Linksfield where the two hospitals are situated. Also, the patients presenting to the study sites were not necessarily and exclusively from Mulbarton and Linksfield areas. Indeed, private patients may follow their preferred health - care provider and not necessarily seek medical care from the nearest hospital. They may also be guided by preferences or recommendations from friends or family members. Lalljie et al found in selected Jamaican private specialist clinics that there was a 19% prevalence of SH amongst all medical patients (29). Although, comparison may not be easy due to the study designs, the apparent difference between the prevalence of SH in the Jamaican study and the present study may be explained by the inclusion of all patients presenting to the ED, i.e. medical, surgical and trauma patients and not only medical patients in the present study as well as the use of specialist clinics that would probably receive referral of more complicated cases. Lastly, Preston et al found a SH prevalence of 11% among hypertensive patients who presented at the ED of a USA public tertiary hospital that was accessed mainly by underprivileged communities. However, this prevalence dropped to 4.9% when Preston et al considered all acute medical

emergencies (28); it may have dropped even lower if all ED patients, not only medical patients were considered and may have joined SH prevalence levels similar to the present study. SH prevalence in ED among private patients at the study site showed levels close to the prevalence in developed countries.

Also, in a public hospital in South Africa, Nkombua noted a prevalence of HT of 3.8%. This prevalence placed HT 9th among the 10 most common reasons to visit the ED. Nkombua did not specify if these cases were SH (43). However, this finding may imply that the prevalence of SH (a subset of HT) in the ED was even lower than 3.8%. At least we can note a low prevalence of SH in a public hospital despite the predictable poor access and the inadequate BP control. As the populations in Nkombua study (public hospital) and in the present study (private hospital) were different (not insured versus insured) and living in different environment, there might be other factors contributing to SH occurrence, not only the poor access to health care.

The mean age of SH patients was 56.8 ± 18.4 years. In this study population, black SH patients were relatively younger than white SH patients. Black patients affected by SH were most likely still economically active. Similarly, Lalljie et al studying a mixed ethnic population (mainly of black African ancestry) attending Jamaican private clinics found that 62% of SH patients were below 65 years old (29). Also, in the present study, the peak age group with SH was between 50 and 59 years. The particular presence of SH among relatively young black patients raised considerable concerns due to its negative impact on individual and national productivity. Indeed, SH carries a 20-30%-risk of CVD occurrence (11) and

therefore exposes particularly the young individuals to disabling illnesses later in life. Gersh et al had already warned about a worldwide growing CVD epidemic with HT as the main cause (5). Moreover, in sub-Saharan Africa, CVDs occur where communicable diseases like TB and HIV are already a burden on the health care system (5). This mixture of complex epidemics financially burdens the health-care system of SSA countries even more.

Also, in the present study, white patients with SH were generally older than black patients. The occurrence of SH among white patients may be explained by the reluctance to aggressively manage HT among elderly patients. Indeed, clinicians avoid reducing BP considerably in individuals who are already prone to orthostatic hypotension and subsequent falls (12). The SAHS recommends a target BP of 160/90 mmHg among elderly patients whilst in younger patients, the target BP is 140/90 mmHg or even lower at 130/80 mmHg if there is association of co-morbidities like DM and renal diseases (1).

The age difference between white and black patients with SH was found in the subtypes ASH and HTU as well. However, both white and black patients with HTE had similar mean ages and therefore had the same susceptibility of elderly and frail patients to severe BP elevation.

If younger patients with SH seemed to be protected against TOD occurrence, their exposure to severe BP elevation was worrying even in cases of episodes of ASH or HTU. Indeed, any severe BP elevation carries an estimated 20-30%-risk of CVD occurrence (24). In addition, among the patients attending an Austrian tertiary

hospital, Vlcek (2008) demonstrated that those with HTU had a higher likelihood of developing subsequent cardiovascular events compared to mild and moderate hypertensive patients (41).

Furthermore, the significantly older mean age of SH patients at Linksfield Hospital compared to Mulbarton Hospital may be explained by the exclusion from this study of relatively younger individuals that were not classified into SH subtypes at Linksfield Hospital. Despite the difference of peak ages of SH patients between the two hospitals, SH still seemed to affect the oldest group at each hospital. Hence, the presence of SH among relatively younger individuals may be hypothesised as an artefact influenced by the average age of the population considered. Indeed, Gersh et al attributed the presence of SH among younger patients in low and middle income communities (LMIC) to an artefact as the population is generally young in LMIC (5)

Elderly patients who presented with SH also carried a CVD risk that may even have been higher than 30% as they most probably had co-morbidities (11). Even if elderly patients may not be economically active, CVD occurrence may add a burden to their respective families that may need a re-adjustment to assure home-based care and, thereof, impact on the national productivity. Also, elderly SH patients may impact negatively on their family by straining their family finances to provide for their special needs.

Patients with HTE were older than those with ASH who were in turn older than those with HTU. Hence, on one side, older age and frailty may contribute to TOD

occurrence in HTE. However, older patients with ASH may have consulted for other medical condition and were found to have a severely elevated BP due to probable pain and anxiety (15).

The linking of age to target organ damage was also supported by the constant presence of elderly patients with HTE at both hospitals, whilst patients with ASH and HTU were relatively younger at Mulbarton Hospital compared to Linksfield Hospital. Moreover, Linksfield Hospital had proportionally more patients with HTE and also older patients compared to Mulbarton Hospital. Similarly, Zampaglione et al found that HTE patients were older than HTU patients among Caucasian individuals (34). Though Italians are different from the white community in SA, Zampaglione study may re-enforce the link between HTE and advanced age among particularly white patients. On the other hand, Rayner et al studied a mixed ethnic population presenting to rural and urban private clinics in South Africa and found that the only independent predictors of LVH were black ethnicity and SH, these predictors were subsequently linked to CVD occurrence as LVH is a good indicator of CVD risk. In other words, there was a higher proportion of LVH among black hypertensive patients compared to white hypertensive patients. Thus, black patients would be more exposed to CVD than white patients even if, in total, white patients with LVH were more than black patients (38). This may have been similar to the present study that had more white patients presenting with TOD (74.3 %) than black patients (20.6%) at a site visited more by the white population.

Lastly, and supporting the artefact role of the racial distribution of the population attending a particular ED, Borzecki et al found among American military veterans

that SH was most likely among black individuals in a population with almost equal black and white individuals (24).

Regarding gender, there was a difference in the gender predominance among patients with SH at the study sites. Indeed, Mulbarton Hospital had almost equal male and female SH patients (50.2% male and 49.8% female), whilst they were mostly female (60.3%) at Linksfeld Hospital. Like at Linksfeld Hospital, Borzecki et al also showed a predominance of female patients among American military veterans with SH (24), fact that could be understood in USA as in a nation-wide survey, female hypertensive had less likely a control of BP (45). Also, in USA, the JNC 7 pointed to post-menopausal hormonal changes and common obesity among women as probable reasons of poor control of BP (1). Female predominance at Linksfeld Hospital may also have been due to probable post-menopausal hormonal changes among an older population (mean age of SH patients at Linksfeld Hospital: 63.2 ± 19.6 years old). However, female and male patients with HTU had similar distribution of symptoms and those with HTE had similar distribution of TODs.

Generally, the most common symptom in HTU was chest pain, followed by headache, epistaxis and severe anxiety in the present study. Instead, Rodriguez et al showed that headache was the most common symptom of HTU, followed by epistaxis, faintness, psychomotor agitation, dyspnoea and chest pains (13). However, this difference did not take into account the discharge diagnosis at the study site.

Also, TOD distribution was similar among black and white patients with HTE. Stroke was generally the most common TOD, followed by CCF/LVF and seizures (not otherwise specified). Zampaglione et al found similar distribution of TOD in Italy (32), confirming the importance of stroke among TOD due to SH.

Regarding BP and similarly of the levels of BP of different genders with SH, patients of different races with SH and all its types had a similar SBP in the present study. However, DBPs were either similar or different among patients of different races with SH. Where there was a difference in DBPs, black patients who were younger had always a higher DBP. This follows the pattern of a predominantly systolic hypertension among elderly patients (1).

Overall, BP levels did not show any association to the occurrence of TOD. Indeed, all types of SH had similar BP levels. Conversely, Zampaglione et al found a higher DBP among HTE patients compared to HTU patients presenting at the ED in Italy (34). Also, during the evaluation of a nation-wide USA database, Tisdale et al found that for every increase of 10mmHg of SBP the chance of HT crisis increased by 30% and for every increase of 10mmHg of DBP the chance of developing HT crisis increased by 21% (25). Choi et al found similar results in South Korea as they noted that an increase of BP by 20/10mmHg doubles the risk of developing stroke among Korean hypertensive patients (36).

4.2. Limitations of the present study

Information used in the present study was routinely collected by the ED of Mulbarton and Linksfield Hospitals. The study was retrospective and relied on the quality of data in the Netcare Medibank™. Also, many socio-demographic characteristics discussed in other studies were not captured in the Netcare Medibank™ like: smoking habits and alcohol consumption (1). Moreover, some clinical characteristics related to the occurrence of severe HT and its types were not also included. There are: the presence of co-morbidities, a known history of hypertension, the type of medication used and the level of adherence and obesity (1).

Although the age, gender, race, level of SBP/DBP were obtained from Netcare Medibank™ and were together with symptoms/signs and diagnosis validated against the information in the manual register, information about performed investigations was not obtained. There was a no access policy on the patients' files.

Lastly, the present study was limited to the small population of two private hospitals and, therefore, the results are not to be generalised to other populations.

CHAPTER 5

5.0. Conclusion and recommendations

5.1. Conclusion

Study was conducted at two private hospitals in Johannesburg among patients who have medical insurance or are able to pay for medical consultation. Patients presenting at these hospitals are assumed to have easy access to quality health-care. The findings of this study are summarised as follows:

- SH was found among 1.7% of all patients presenting to ED.
- SH affected mostly adult middle aged individuals at study sites. Black SH patients were relatively younger and still economically active. Any prevention efforts need to pay particular attention to this subgroup of patients.
- Male patients and black patients were younger than other patients with severe HT.
- Black patients had a higher DBP compared to white patients. This was due to the older age of white patients who showed a common tendency of isolated systolic hypertension.
- No association to weekdays or seasonal presentation were found among different types of SH or between hospitals.
- Stroke and CCF/LVF were the most common TODs; chest pains, headache and epistaxis were the commonest symptoms in HTU.

Taking into account the findings and the limitations of this study, further studies may wish to elaborate on the work of this study in the following areas of research:

- A prospective study at public and private hospitals that include information about co-morbidities like diabetes, obesity and dyslipidemia and histories of smoking as well as alcohol consumption.
- From the above recommendation, there may be value in identifying the risk factors of relatively younger black patients who are affected by severe hypertension.
- Further research may choose to interview health workers to find out the reasons why the classification of SH as described in the SAHS guideline is not referred to in the ED diagnosis of SH.

APPENDICES

Appendix 1 and 2: Data collection tool (appendix 1: Microsoft work and appendix 2: Microsoft Excel)

Ref No	Date seen at ED	Age	Gender	Race	SBP	DBP	Signs/symptoms/TOD	Diagnosis

Ref: reference, ED: emergency department, TOD: target organ damage, SBP: systolic blood pressure, DBP: diastolic blood pressure

Appendix 2: Approval by the University of Witwatersrand

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Dr D Kabongo

CLEARANCE CERTIFICATE

M10516

PROJECT

Hypertension Emergency at netcare Group
Hospitals in Johannesburg South Africa

INVESTIGATORS

Dr D Kabongo.

DEPARTMENT

Department of Family Medicine

DATE CONSIDERED

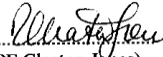
28/05/2010

DECISION OF THE COMMITTEE*

Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 31/05/2010

CHAIRPERSON 
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Dr E Liebhaber

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

Appendix 3: Consent by Netcare Management (Pty) Limited



Tel: +27 (0)11 301 0000 Fax: +27 (0)11 217 9669
76 Maude Street, Corner West Street, Sandton, South Africa
Private Bag X34, Benmore, 2010, South Africa

17 March 2011

Dr D Kabongo
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LICHTENBURG
2740

E mail: diuluk@yahoo.com

Dear Dr Kabongo

HYPERTENSION EMERGENCY AT NETCARE GROUP HOSPITALS, JOHANNESBURG, SOUTH AFRICA

It is with pleasure that we inform you that your application to conduct research on; Hypertension emergency at Netcare group hospitals, Johannesburg, South Africa, at Netcare Mulbarton & Linksfiled Hospitals, has been successful, subject to the following:

- i) All information with regards to Netcare will be treated as confidential.
- ii) Netcare's name will not be mentioned without written consent from the Academic Board of Netcare.
- iii) Where Netcare's name is mentioned, the research will not be published without written consent from the Academic Board of Netcare.
- iv) A copy of the research will be provided to Netcare once it is finally approved by the tertiary institution, or once complete.
- v) All legal requirements with regards to patient rights and confidentiality will be complied with.

A handwritten signature in black ink, appearing to be "EJ".

Directors: EJ Brannigan, MSF de Costa, IM Davis, J du Plessis, VE Firman, RH Friedland, VLJ Lithakanyane, IMB Nkosi, C Pailman, P Warrenner
Company Secretary: L Kok Reg. No. 1995/012717/07

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