Profile and High Prevalence of Cardiovascular Risk Factors in an Urban Black African Population

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Abstract

Background: While cardiovascualar disease (CVD) in Africa is mostly non-ischaemic in origin, the incidence of coronary heart disease in sub-Saharan Africa is on the increase. As a subset to the much larger "Heart of Soweto" study, this study set out to raise awareness on CVD risk factors; and establish a baseline profile of CVD risk in the population of Soweto, South Africa. This paper forms the preliminary report of the 2006 Soweto "Heart Awareness Days" Programme

Methods: All participants presenting to a fixed monitoring stand in Soweto, the largest township in South Africa, were offered immediate screening. Subjects were briefly asked for their demographic status and prior history of documented CVD, diabetes, or commonly-known related diseases. In preparation for future expansions in the screening exercise, participants of the last screening day (n=190) were also asked about family history and behavioural risk factors. Blood pressure, height and weight (used to measure BMI) were measured, and blood tested for random blood glucose and cholesterol.

Results: A total of 1127 participants were screened. Three quarters of the population had at least one major risk factor for CVD, two-thirds having high BMI and 40% being severely overweight. Almost a third of screened persons had at least one component of blood pressure raised, while 13% had raised blood cholesterol levels. Being overweight was significantly associated with elevated blood pressure, and raised serum glucose and cholesterol levels.

Conclusions: The high prevalence of risk factors for CVD found in this urban black African population demonstrates the need to further raise awareness on CVD and its risk factors. More epidemiological data and thoughts towards early prevention is required for this population.

Background

Cardiovascular disease (CVD) incorporates a broad spectrum of disease affecting the heart, and central and peripheral blood vessels. The cause of CVD in Africa differs from that in the West by being predominantly non-ischaemic in origin, and comprising a majority infective causes[1]. Despite evidence to suggest that CVD-related mortality rates are increasing in the region, [2] it is only now being recognised as an important public health issue in sub-Saharan Africa, with coronary artery disease shown to rise in incidence in sub-Saharan Africa[5]. Currently, CVD is estimated to account for 7-10% of all hospital admissions [3, 4] and 10% of deaths in the region. So far, hypertension has been suggested to bear a 7-fold relative risk of coronary artery disease, making hypertension the strongest risk factor for developing cororonary heart disease [5] in sub-Saharan Africa, alongside it commonly causing heart failure. [5,6]

While the emergence of "new" forms of CVD in the region is most probably linked to its rapid urbanisation and greater affluence[7], it is now well established that socio-economic deprivation at the population level independently increases the risk of developing chronic forms of CVD (e.g. heart failure [8]). Sub-Saharan Africa is plagued with poverty, which feeds the vicious cycle of rheumatic and myopathic heart disease and poor access to health care. This is worsened by resultant chronic debilitation, and both under- and over-nourishment that now increasingly co-exist in many African settings.

Unfortunately, there is a paucity of data to describe the underlying prevalence of hypertension and other potentially important risk factors for heart disease in this region of the world.

Rationale

In South Africa, surveys on emerging CVD and associated risk factors amongst Black Africans appear to have been predominantly limited to a minority of provinces [10-17]. Still, within these areas they have already demonstrated high prevalence of obesity, hypertension, with some even showing prevalent hyperglycaemia and hypercholesterolaemia. Traditionally, CVD in the West has been a disease of the affluent older age groups, but in Less Developed Countries the onset occurs in younger age groups, overall appearing to affect women more than men, and with a productive age mortality rate that is 2.5 times that of the CVD in the USA. Being an insidious risk factor, hypertension in Black Africans is now known to occur at a younger age, being more progressive, leading to earlier damage to vital organs, and responding less well to anti-hypertensive therapy predominantly tested and proven in Caucasian cohorts [9].

Heart Awareness Days emerged as a community-based branch to the much larger "Heart of Soweto" Study[18]. The primary aim was to establish a community-oriented initiative to raise awareness on CVD in the urban Black African population of Soweto.

In addition to this, we set out to screen and estimate the prevalence of commonly-known risk factors for CVD (ie. hypertension, potential metabolic syndrome and lipid abnormalities).

Materials and Methods

The study was conducted on designated screening days spread, at monthly intervals, over a six month period from June to November 2006. For the purposes of this study, the Soweto Taxi Rank was chosen to base the surveillance monitoring stand because of its strategic position; sandwiched in between Chris Hani Baragwannath Hospital, the marketplace, the large mini-bus taxi transport station, and residential area immediately behind this whole area. To raise awareness on CVD, all screened participants were informed on the types and consequences of commonly-known risk factors for CVD and its most common manifestation heart disease. Passers by and merchants within a radius of about 200 metres from the monitoring site were also offered this information.

Ethical Considerations

Ethical approval for the study was sought from the local Ethical Committee and permission confirmed through the relevant administrative bodies. The study conformed to the principles outlined in the Declaration of Helsinki. All subjects gave written informed consent for the collection of this data. Participants were encouraged to participate but the voluntary nature of participation was emphasised. All participants with identified risk factors were given dietary counselling and other behaviour-modification advice as relevant to their situation, and referred for management when indicated.

Study Participants.

All consenting participants that presented to the monitoring stand on display were screened.

Study Data

At presentation to the stand, all participants were briefly asked for their demographic status and prior history of documented CVD (including stroke and acute myocardial

infarction), diabetes, or commonly-known related diseases. As part of a prospectively planned and staged increase in participant profiling in 2007, a subset of participants in the last screening day (n = 190) were questioned about their family history of CVD, smoking habits, alcohol use, and documented family history of CVD. All participants then followed a sequence of stations where blood pressure, height and weight (used to measure Body Mass Index [BMI]) were examined. Random blood glucose and cholesterol monitoring via finger-prick blood samples was done using Ascentia Entrust (Rouche) and Accu Chek Softclix Pro (Bayer), respectively.

Participants were addressed in the language they were most comfortable with. All participants were exposed to broad health education for CVD, in addition to any specific advice relevant to each respective participant.

Quality Assurance

The effects of any transient anxiety on blood pressure readings were minimised by our friendly staff maintaining a relaxed yet professional atmosphere, and recording repeat measures (of which the last-most was taken into consideration). For the same reason, the sequence of measures to be taken in the monitoring stand was set up so that painful measures of blood testing came well after blood pressures were recorded. Fluctuations in total cholesterol due to pre-analytical condition [20] were minimised by all participants being measured seated in same positions and applying identical strategies of obtaining blood. Intra-operator variability of measurements was virtually excluded by the use of digital measurement tools; making it relevant only to the application of blood pressure cuffs and (minimally) to reading of the height scale. However, this was anticipated and reduced by sequential training sessions prior to each screening day, by using brand new, uniform equipment serviced and checked by the same company each time and a dedicated study team. The later also helped to

minimise variation in measurement bias inherent to the equipment used, although some fixed effect of residual bias would remain.

The following threshold values were used to identify measured risk factors: systolic or diastolic blood pressure of > or = 140 and > or = 90 mm Hg, respectively; non-fasting total serum blood cholesterol level > 5mmol/L, and non-fasting blood glucose above 12mmol/L. Any BMI greater than 25kg/m^2 was considered overweight, while BMI greater than 30kg/m^2 was considered obese.

Results

Study Participants

A total of 1127 participants were screened. Almost all were Black African (99%). Approximately two-thirds of participants were female (63%), and the mean age was 45 years (SD 14 years). Blood glucose and cholesterol measurements were successfully performed in 1060 and 1017 participants, respectively. 985 participants (87% overall) had all active measurements taken as part of the full suite of screening measures.

Around one quarter of the screened cohort (n = 283) self-reported a history of CVD or the presence of a commonly known illness risk factor for heart disease. Of these 283 cases, 87% (95%CI 81 – 90%) reported being hypertensive and 1% had previously been treated for diabetes.

Profile of Common CVD Risk Factors in this Soweto Population

By far the most prevalent risk factor was obesity (40% overall), while two thirds of participants found to be overweight. Obesity was significantly less prevalent in men than in women (23% versus 51%: OR 0.28 95%CI 0.21 to 0.37, $p < 0.001$).

Next most prevalent was raised blood pressure, either systolic or diastolic (31% overall). Of those actively screened, 13% (95%CI 10-16%) had an elevated (non-fasting) blood cholesterol level (12% of males and 15% of females, respectively) and only 3% hyperglycaemia.

Overall Pattern of Commonly-Known CVD Risk Factors

A total of 439 participants (39% overall) who denied having pre-existing non-behavioural risk factor for heart disease measured positive for at least one risk factor

on active screening. Of these participants, 390 were found to be overweight (89%), 229 (52%) obese, 129 (29%) were hypertensive, while 5 (1%) were hyperglycaemic.

For measured risk factors only, a minority of 19% of the screened population had a risk factor score of zero and 76% at least one major risk factor for the future development of heart disease. Figure 1 shows the accumulated distribution of common risk factors for heart disease in the total of 985 participants who undertook all active screening measures over the six active screening days. Figure 2 shows the specific risk factors present in the 190 participants who were screened on the last "Heart Awareness Day" in 2006 and were asked about common behavioural risks and family history.

As with self-reported history of CVD risk factors, men were significantly less likely than women (68% versus 87%) to have one or more risk factor for heart disease ($p < 0.001$; OR 0.3, 95%CI 0.2-0.4). Only being overweight was significantly associated with raised blood pressure ($p=0.005$; OR 1.66, 95%CI 1.2 to 2.4). Although being overweight was significantly associated with an elevated cholesterol ($p=0.008$; OR 2.0, 95%CI 1.2 to 3.5 Morbid obesity was associated with raised cholesterol only in females ($p=0.017$). As with features of metabolic syndrome, hypercholesterolaemia was positively correlated with hyperglycaemia ($p=0.05$; OR 2.0, 95%CI 1.0 to 3.9).

Discussion

Our data suggest that, in keeping with the rapidly increasing affluence of urban dwellers throughout the country, the same highly prevalent risk factors for heart disease in Western societies are also highly prevalent in this urban population of Soweto. Of more than 1000 urban Black African adults screened, three quarters had at least one easily identifiable risk factor for heart disease; of which obesity was found to be the most prevalent of risk factor (one third of men and one half of women screened). Being overweight in our Soweto population was significantly associated with hypertension and hypercholesterolaemia.

Our study findings broadly resemble those of similar surveys undertaken in the four other provinces of South Africa where some prior data exists (Kwa-Zulu Natal, Limpopo, the North West, and Northern Provinces) [10-17], although this study showed hyperglycaemia to be less prevalent in the Soweto population. This may in part have been due to our reliance on non-fasting glucose levels and a higher cut-off point for hyperglycaemia (≥ 12mmol/L). A study in rural Black Africans found 59% of women and 29% of men to be overweight or obese, with one third of women and 57% of men using tobacco, and as many as 42% of women (29% of men) having low-density lipoprotein levels of 3mmol/L or more [10]. In the North West Province, serum lipid levels in urban Blacks increased with urbanisation and, while, overall, they remained within levels recommended for other populations they were significantly higher in urban townships/suburban housing than in rural houses, farms, and informal settlements [12]. Another study favoured an association between urbanisation and hypertension, with over 40% of Blacks in North West Province, across different levels of urbanisation, manifesting hypertension; and the highest mean blood pressure having been in the informal settlements [17]. The THUSA study

in this same region showed a 29% prevalence of obesity among black women; this being associated with higher levels of income [11]. Self-reported weight and height in the Northern Province suggested 34% of urban Blacks to be overweight and 14% obese [23]. This was much higher than their White counterparts; despite the later having reported less healthy dietary habits, and Blacks of that study population appearing to have had greater risk awareness in relation to disease [23]. Bearing in mind the potential weakness in self-reported measures and behaviour to differ from practiced routine behaviour, these data may still imply a greater role of genetic predisposition in Blacks to developing obesity.

Our data depicts the early socio-biological changes experienced by communities in sub-Saharan Africa that are in epidemiologic transition, and so more at risk of developing non-communicable disease states such as coronary heart disease. Similar evolutionary patterns of CVD have been shown in other rapidly developing societies within and outside of Africa for no less than fifteen years now [24]; the available sub-Saharan data often finding hypertension to be the strongest risk factor[25].

Another grave finding of this study was the demonstration that almost half of those who thought they were free of the common risk factors for heart disease and other forms of CVD (irrespective of previous contacts with the health care system) were now found to have at least one major risk factor for CVD. Upto 15% of the sample population were walking unknowingly with raised blood pressures. Despite knowledge or awareness on CVD risk factors not having been assessed systematically, our study team frequently noted participant surprise when the link between obesity and an increased risk of CVD was explained. Across South Africa, perceptions on obesity over the last 4 decades have been marked by gross ignorance of its potentially hazardous consequences[26]. Soweto stands to lose the most as its

relative isolation from development and health services, new pockets of wealthy individuals and fast-food centres amidst widespread poverty, and battle with the stigma of AIDS which remains highly prevalent within its growing population, all contribute towards the popular notion that "obesity is good". At industrial level, commercial food products accessible to poorer South Africans have been shown to be less healthy and to encourage obesity.

Clearly, our results suggest a significant deficit in efforts to respond to an epidemic of commonly known risk factors for CVD and early manifestations of the same in this large African population. Be this a consequence of inequitable health services in measuring, detecting, or educating the community, or persistence of a low index of suspicion of CVD in health practitioners serving this population; or whether the rapid socio-economic evolution of this community members' socio-economic status has simply overridden efforts to improve these two factors, remains unknown in the absence of more systematic studies of CVD. Such is the function of the larger "Heart of Soweto Study" [18].

Limitations

Despite our precautions to overcome measurement bias, beyond most investigators' control, some fixed effect of residual bias inherent to our equipment would remain.

While assessment of self-selected participants may contribute to the high prevalence of participants reporting prior history of CVD or its risk factors, we recall that over a third of the population (ie. almost half of those who responded on prior history of CVD) actually denied such prior history. Further still, patients attending clinics in this hospital tend to report very early (before screening hours had begun), and patients

who have just been seen in clinic may very well not feel the need to come and be re-examined. The authors suspect that prior history of CVD was, rather, underestimated. Some passers-by who looked on with interest but feared that screening would involve payment or HIV-testing drew back before they could understand the correct information.

Lastly, any selection bias from the "Healthy worker Effect" and its variants may well have cancelled out as the monitoring site hosts perhaps one of the most diverse people. Workers attending to markets and shop stalls, public transport, various ranks of hospital employees, workmen attending to neighbouring works, a wide variety of visitors to patients or offices in the hospital or vending sites, as well as passengers of public transport forced to pass by the stand merely to catch or change public transport, together would influence the magnitude of our outcomes in a way that may be difficult to define, but overall seems to favour against residual imbalances in these forms of selection bias.

Intra-subject diurnal variation in cholesterol and glucose levels may also have influenced study results; in Western populations this phenomenon in cholesterol measurement has been estimated to result in a variation of 6-11% [22].

Impact

The immediate concerns that arise from this study include the low levels of awareness of one's own CVD risk factor profile and its implications, and the devastating effects of this potential epidemic of obesity on the burden of chronic disease, health services and, as a later consequence, productivity of the society as a whole. Vulnerable groups appear to be females, half of whom bear *at least* one risk factor for CVD, and young persons. We restricted our survey to merely four common risk factors for CVD, yet

there are others. For example, peripheral vascular disease in a poor rural region of South Africa was found to occur almost as prevalently as hypertension in our study (29%), yet has been shown not only to bear the same risk of death from CVD as persons with coronary artery disease [27] but also to benefit from the same preventative strategies applied for the commonly known risk factors we measured (ie. excercise, no-smoking, etc).

The figures that have emerged from this mass screening highlight the need to address existing and emergent CVD within this urban Black African population of Soweto, to prevent Sub-Saharan communities experiencing the same fate as western societies and growing an epidemic of CVD via more affluent lifestyles. Being the largest township in South Africa and collectively comprising numerous smaller townships, the Soweto community scores high on three of the four top disease categories that burdens South Africa; namely injuries, infectious disease, and HIV/AIDS. Given that CVD in sub-Saharan Africa nowadays account for 10% of all reported deaths, full manifestation of the now nationwide "quadruple" burden of disease within this single socio-economically disadvantaged community would crippling to its health system. In the Western Cape Province of South Africa, CVD has already been shown to be the most common cause of death [2] although details of which population types were affected to which extent were not documented. Importantly, the need to institute preventative measures against CVD among non-Whites have been advocated by Seedat and colleagues: data from Durban in the early 1990's [16], indicated that coronary heart disease occurred in 2.4%, and hypertension in 28% of Black Africans [14, 15].

Beyond Soweto, similar findings from urban black populations in other societies undergoing transition have recently emphasised the growing need for more extensive,

more effective, more culturally sensitive approaches to raising awareness on CVD risk factors to the general public [28].

Individual health care professionals attending to this urban Black African population would need to adopt far higher index of suspicion of CVD and its risk factors. Barriers to routine and objective risk stratification arise from health practitioners (eg. demonstrated inertia among health care professional to initiating and modifying treatment in persons with hypertension, poor adherence to national guidelines, health care services (waiting times, drug availability, etc) [29] and from the lack of evidence-based resources for this population.

Medical and public health training institutions are thus encouraged to take their own leading role in ensuring graduates comprehend the profile and implications of CVD among our urban Black populations, as well as in the supervision of preventive strategies that span across all age groups. Lessons learnt from US surveys on missed opportunities for the primary prevention of CVD and diabetes warn us that the common practice of offering preventative advice only to persons already manifesting risk factors or CVD or diabetes [30] is a wait longer than we can afford.

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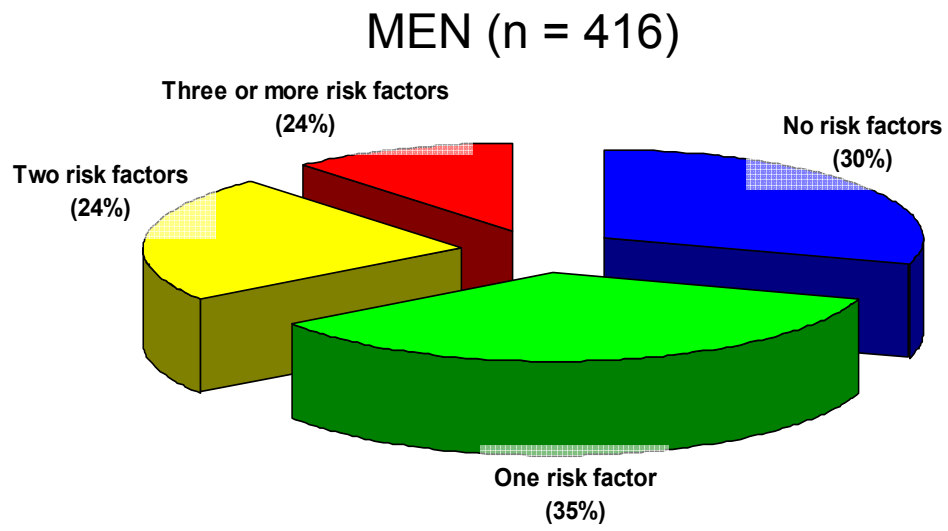
Table I. Blood Pressure and BMI Characteristics of Screened Participants

Risk Factor	Total (N=1127)		Males (N=416)		Females (N=701)		p-value
	No.	%	No.	%	No.	%	
Age	45 (44-46)	N/A	43 (42-45)	N/A	46 (45-47)	N/A	0.003
Prior history of documented Hypertension (N=905)	246	27	63	19	183	32	<0.001
Prior history of CVD / diabetes/other (N=905)	283	25	76	23	207	36	<0.001
History of smoking (N=190)	46	24	31	44	15	13	0.049
BMI (kg/m2)	29.5 (29.1-30.0)		26.4 (25.8-30.0)	N/A	31.4 (30.8-31.9)	N/A	<0.001
Blood pressure: - Systolic -Diastolic	132 (130-132) 82 (81-83)	N/A	131 (130-133) 81 (80-83)	N/A	132 (130-133) 83 (82-84)	N/A	0.834 0.108
Raised blood pressure: - Systolic (>140mmHg) - Diastolic (>90mmHg) - Both systolic and diastolic - At least one raised	280 237 179 338	25 21 16 31	99 86 62 123	24 21 15 30 (95%CI 26-35)	181 151 117 215	26 22 17 31 (95%CI 27-34)	0.492 0.787 0.468 0.756
"Newly diagnosed" raised blood pressure (N=905)	146	51*	67	61*	79	44*	-

*Figures represent the percentage of those with raised blood pressure (either systolic or diastolic) that denied prior documentation of hypertension, within each sub-group shown; hence implying these raised values found on screening are newly found

Figure 1 Number of Detected Risk Factors for Heart Disease in the 1,072 Men and Women who Underwent Full Screening as Part of the Heart Awareness Days in Soweto



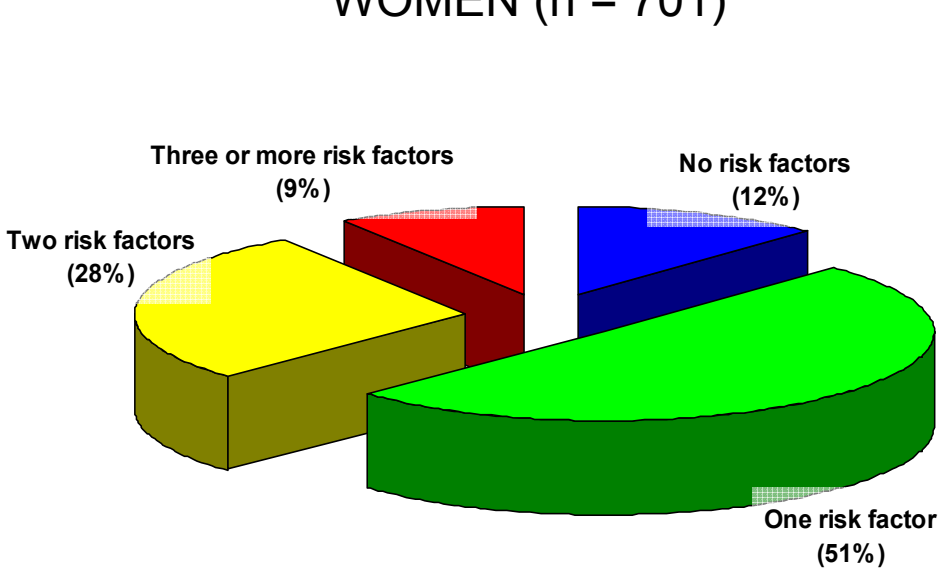


Figure 2 Risk Profile of the 190 Men and Women Screened on the last Heart Awareness Day in 2006

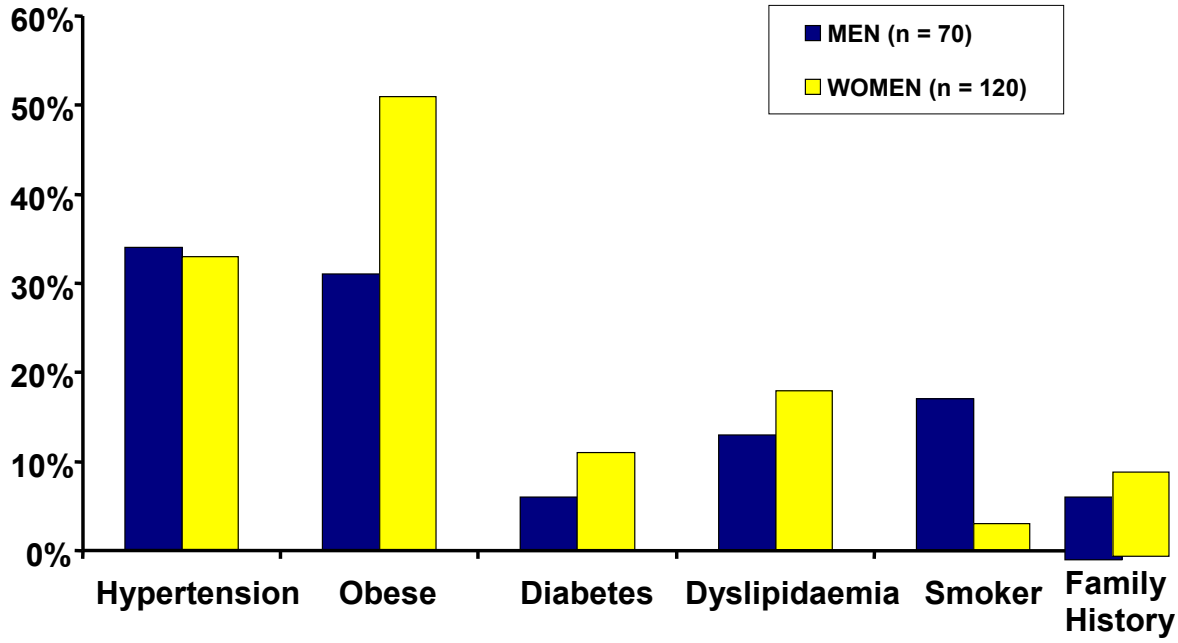


Figure 3a

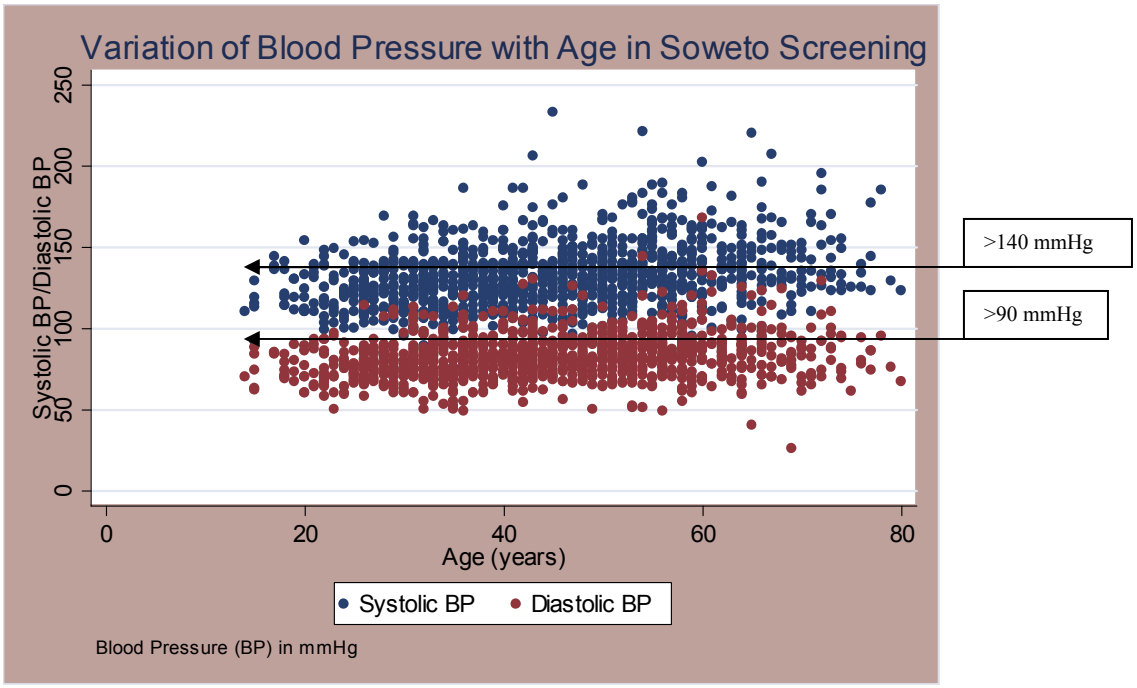


Figure 3b