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CHARACTERISTICS OF UNCONTROLLED HYPERTENSION PATIENTS IN BAHATI SUBCOUNTY HOSPITAL IN NAKURU COUNTY, KENYA: A STUDY UTILIZING SPICE PLATFORM (2020–2023)

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ABSTRACT

Background: Uncontrolled hypertension represents a substantial global health challenge, markedly elevating the risk of cardiovascular diseases, cerebrovascular accidents (strokes), renal failure, and premature mortality. This study investigates the socio-demographic, clinical and behavioural characteristics of hypertensive patients at Bahati sub-county hospital in Nakuru, Kenya, employing SPICE digital Platform. The primary objective of this research is to determine the critical factors contributing to insufficient blood pressure control. The findings derived from this analysis are pivotal in shaping national health policies as Kenya endeavors to achieve universal health coverage. This initiative is anticipated to enhance hypertension management and improve patient outcomes across the region.

Method: This study employed cross sectional study design using data from the SPICE digital health platform, focusing on hypertensive patients enrolled between 2020 and 2023 with at least six months of follow-up. Descriptive analysis summarized socio-demographic, clinical and behavioral characteristics, and chi-square tests assessed factors of controlled and uncontrolled hypertension patients after six months of follow up. Logistic regression identified factors influencing uncontrolled hypertension, with odds ratios and 95% confidence intervals reported. All analyses, conducted using IBM SPSS version 25, applied a significance level of $p < 0.05$.

Results: The study of 1,199 hypertension patients revealed a significant gender difference,

with 81.6% being female, a majority aged 70 and above, and 56.1% unemployed. Additionally, a separate study of 755 participants indicated that 76.47% had uncontrolled hypertension, particularly in the 50-59 age group, with many lacking formal education and insurance. Males were 21.1% less likely to control their hypertension compared to females, while risk of uncontrolled hypertension was lower in insured and employed group. Community Health Promoters follow-ups effectively enhanced hypertension control.

Conclusion: Addressing gender and ensuring equitable access to health insurance and employment are crucial for managing hypertension. Socioeconomic factors significantly impact health outcomes, emphasizing the need for community health promoters. These individuals enhance patient care by connecting healthcare providers with communities, delivering tailored interventions, and promoting health literacy, highlighting the importance of comprehensive approaches in hypertension management.

KEYWORDS: Cardiovascular Diseases, Uncontrolled Hypertension, SPICE Platform.

I. INTRODUCTION

Uncontrolled hypertension is a major global health issue, significantly contributing to the increasing rates of cardiovascular diseases (CVD), stroke, kidney failure, and premature death (Ahuja et al., 2018). Hypertension, defined as a persistently elevated systolic and diastolic blood pressure (DBP) of 140/90 mmHg or higher in adults, is a key modifiable risk factor for these conditions (Mills, Stefanescu and He, 2020). However, despite advancements in hypertension management, uncontrolled hypertension remains a serious challenge, particularly in low- and middle-income countries (LMICs), where access to healthcare is limited and adherence to treatment regimens is often poor (Mills, Stefanescu and He, 2020).

Globally, hypertension contributes to approximately 9.4% of disability-adjusted life years, emphasizing its significant role in the global disease burden (Safiri et al., 2022). Patients with uncontrolled hypertension face a higher risk of severe complications. For instance, research shows that reducing systolic blood pressure (SBP) by just 5 mmHg can lower the risk of major cardiovascular events by 10% (Canoy et al., 2022). Moreover, a reduction of 10 mmHg in SBP has been linked to a 13% decrease in all-cause mortality and a 27% reduction in the incidence of stroke (Ettehad et al., 2016). Despite these clear benefits, achieving adequate control remains elusive for many individuals globally.

The situation is even more concerning in Sub-Saharan Africa (SSA). Approximately 46% of individuals with hypertension are unaware of their condition, and fewer than 10% of those

diagnosed achieve effective blood pressure control (Mogaka et al., 2022). The region faces numerous barriers to hypertension management, including inadequate healthcare infrastructure, limited access to medications, and a focus on infectious diseases within the health system (Oleribe et al., 2019).

In Kenya, hypertension continues to be a major contributor to the country's rising burden of non-communicable diseases (NCDs), accounting for about 27% of annual deaths (Ortiz et al., 2022). Poor healthcare access, inconsistent follow-up, and low treatment adherence are significant factors contributing to the high prevalence of uncontrolled hypertension in rural areas like Nakuru County (Mohamed et al., 2018). In Nakuru County, approximately 50% of the population suffers from hypertension, with a mortality rate of 31.6% due to complications related to uncontrolled hypertension (Mohamed et al., 2021).

Recent studies in SSA further underscore the need for effective hypertension interventions. The SEARCH trial in Kenya and Uganda demonstrated that combining community health interventions with digital platforms significantly reducedSBP and improved survival rates among patients with uncontrolled hypertension (Natale et al., 2024). Such approaches hold promise for improving hypertension control in underserved areas like Nakuru, thereby reducing the burden of CVD.

At Bahati Subcounty Hospital in Nakuru County, uncontrolled hypertension is a critical health issue, with many patients presenting poorly controlled blood pressure despite ongoing treatment. This situation significantly increases their risk of life-threatening complications, such as heart disease and stroke. To address this challenge, the integrated digital health system (IDHS), incorporating Medtronic’s SPICE platform, was introduced in 2018.

Given the pressing nature of uncontrolled hypertension, this study aimed to investigate the characteristics of uncontrolled hypertension patients in Bahati Subcounty Hospital in Nakuru County, Kenya. By focusing on individuals who have not achieved blood pressure control, the research seeks to provide valuable insights into the factors contributing to uncontrolled hypertension and to inform future interventions aimed at enhancing patient outcomes. The findings may also guide national health strategies as Kenya strives to achieve Universal Health Coverage (UHC), ensuring effective management of chronic conditions like hypertension (Londono Agudelo et al., 2021).

Statement of the Problem

Globally, hypertension affects over 1.4 billion adults, making it a leading cause of morbidity and mortality, contributing to approximately 7.5 million deaths annually (Wang et al., 2023).

In the African region, the prevalence of uncontrolled hypertension is alarmingly high. Current epidemiological data indicate that approximately 50% of individuals diagnosed with hypertension remain either undiagnosed or inadequately treated. Alarmingly, effective blood pressure control is achieved in less than 10% of these cases (Ongewe, Mung'ayi and Bal, 2019). In East Africa, specifically in Kenya, the management of hypertension presents complex challenges due to intricate factors, including significant socio-economic barriers. These barriers lead to a high number of uncontrolled hypertension cases, ultimately contributing to the escalating healthcare costs. Data from Bahati Subcounty Hospital reveal that 45% of patients with hypertension exhibit uncontrolled blood pressure levels, significantly elevating their risk of severe health complications such as stroke and heart disease (Oyando, Barasa and Ataguba, 2022).

Despite the concerning increase in uncontrolled hypertension cases in Kenya, primarily attributable to limited health education, unhealthy lifestyle choices and inadequate access to healthcare resources, Nakuru county lacks comprehensive data on the characteristics of individuals with uncontrolled hypertension, despite its high prevalence. This scarcity of detailed and consistent health facility information significantly hinders the development of focused interventions and policies to effectively tackle this issue. Although digital health solutions promise proven successful in addressing various health issues in Kenya, their potential in managing non-communicable diseases like hypertension is an emerging field that is starting to gain recognition and offers promise for improving the overall health outcomes in the region.

This study aimed to describe the characteristics of uncontrolled hypertension patients in Bahati Subcounty Hospital. The research focused on identifying various factors contributing to this issue by conducting a detailed analysis of electronic health data. Through this study, valuable insights were aimed to understand the underlying characteristics of uncontrolled hypertension in this specific population. The goal was to use this information to inform the development of future interventions and improve patient outcomes, aligning with Kenya's broader public health objective to achieve UHC.

Significance of the Study

Hypertension represents a significant health challenge in Kenya, with a prevalence rate of approximately 30-40% among adults, and about 50% of these individuals experiencing uncontrolled hypertension (Ruchman et al., 2021). This condition contributes to nearly 25% of cardiovascular-related deaths, reflecting its severe impact on public health. Uncontrolled

hypertension causes 20% of hospital admissions due to complications like stroke and heart failure, with nearly 30% of hypertensive patients developing serious health issues over time. Uncontrolled hypertension is on the rise, especially among younger populations, due to lifestyle factors like high salt intake, obesity, and sedentary behavior. The annual incidence of newly diagnosed hypertension is about 10%, with many cases becoming uncontrolled due to inadequate management and poor healthcare access (Mohamed et al., 2018).

In Nakuru County, where NCDs accounted for 58% of deaths in 2017/2018 (Onyango and Onyango, 2018). The region's hypertension prevalence is around 35%, with 50% of affected individuals experiencing uncontrolled hypertension. This condition significantly contributes to mortality, with hypertension-related complications leading to about 30% of NCDs deaths. Hospital admissions for hypertension-related issues account for roughly 15% of total admissions, highlighting the burden on healthcare facilities. Additionally, inadequate routine data collection and reporting exacerbate the challenge, as the national reporting rate for hypertension data stands at only 54.1% (Njoki et al., 2024).

The study aimed to address uncontrolled hypertension management gaps by examining patient characteristics using SPICE platform. The study aimed to analyze socio-demographic, clinical and behavioural characteristics to enhance the development of effective preventive and management strategies. The research findings are expected to significantly influence policy decisions and improve healthcare worker training programs, ultimately leading to enhanced care quality for patients with uncontrolled hypertension. Understanding these characteristics is crucial for developing effective interventions for uncontrolled hypertension, leading to improved health outcomes and alleviating the burden.

II.LITERATURE REVIEW

Socio-demographic Characteristics of Uncontrolled Hypertension Patients

Uncontrolled hypertension poses a significant challenge worldwide, leading to a surge in CVD like heart attacks and strokes, along with complications such as kidney failure that can result in premature death. According to the NCD Risk Factor Collaboration (NCD-RisC, 2021), only about 20% of hypertensive patients worldwide achieve adequate control of their blood pressure. Age is a major socio-demographic component in the control of hypertension, with older people more likely to have uncontrolled hypertension because of age-related changes in their arteries and the prevalence of concomitant conditions including diabetes and chronic kidney disease (Oliveros et al., 2020)

Furthermore, recent research through meta-analyses has shed light on the significance of gender regarding cardiovascular issues linked to hypertension. It has been observed that women face a higher likelihood of developing uncontrollable high blood pressure post-menopause as opposed to men. This disparity in hypertension patterns between genders suggests that various biological factors exclusive to each gender, such as hormonal changes and other gender-specific physiological aspects, may influence the differing control levels observed in these populations (Connelly, Currie and Delles, 2022).

Research study done by (Ukoha-Kalu et al., 2023) found a strong association between education attainment and effective management of blood pressure. Specifically, it showed that individuals who completed secondary education or higher were able to achieve an optimal blood pressure control rate of 70%, in contrast to the 60% uncontrolled hypertension rate observed among patients with lower educational levels. Global research by (Yao et al., 2019) revealed that among individuals diagnosed with hypertension, those covered by national health insurance exhibited a considerable advantage with a 25% reduction in the incidence of cardiovascular events compared to the 75% of uninsured individuals grappling with uncontrolled hypertension who faced increased risks. This disparity can be attributed to the insurance's provision of comprehensive medical benefits and regular health check-ups, which played a pivotal role in early risk detection, effective risk mitigation strategies, thereby significantly enhancing the cardiac well-being of insured individuals.

In SSA, hypertension management faces challenges due to socioeconomic disparities and limited healthcare access. One important factor to consider is age, as research has shown that older individuals tend to have higher instances of uncontrolled high blood pressure. A study in Nigeria found 76% of hypertensive individuals aged 60 and above had uncontrolled blood pressure levels, primarily due to age-related physiological changes and health challenges (Shakil et al., 2022).

In Kenya, a notable finding from a recent study conducted by(Misgana et al., 2023) revealed that individuals and with hypertension who were unemployed faced a 35% higher likelihood of experiencing uncontrolled hypertension. This increased risk was primarily attributed to the combination of factors including financial stress, lack of access to healthcare, and potentially erratic lifestyle habits. Additionally, Older adults, particularly those over 60, are more susceptible to uncontrolled hypertension due to higher rates of comorbid conditions like diabetes and kidney disease, as per global and regional trends (Ma et al., 2024).However, there reported data may introduce bias. Furthermore, the study did not account for potential

confounding variables such as dietary habits, physical activity levels, and medication adherence, which could influence the outcomes.

Clinical Characteristics of Uncontrolled Hypertension Patients

Managing hypertension is a global challenge for millions, with comorbidities and medication adherence significantly affecting the prognosis. Research shows up to 70% of uncontrolled hypertension patients struggle with medication adherence. On a global scale, clinical characteristics like obesity, smoking, and alcohol are widely acknowledged as major risk factors for uncontrolled hypertension. It's important to note that a systematic review revealed that a significant 64% of individuals with both diabetes and hypertension struggle to manage their hypertension effectively. This particular finding vividly underscores the complexities associated with controlling hypertension when dealing with concurrent health conditions (Abdelbagi et al., 2021). Additionally, research by (Lin et al., 2021) showed that individuals with hypertension who smoke face a significantly higher risk, with a 40% increase compared to non-smokers, of developing comorbidities such as renal damage and retinopathy. In addition, they are more likely to experience uncontrolled hypertension.

Additionally, a study by (Carey, Moran and Whelton, 2022) conducted in the United States found that individuals with a higher body mass index (BMI) were more likely to have uncontrolled hypertension, defined as SBP ≥140 mmHg and DBP ≥90 mmHg. The study highlighted that as BMI increased, the likelihood of uncontrolled hypertension also rose, indicating a clear relationship between BMI and blood pressure control.

In a study conducted in SSA by (Mills, Stefanescu and He, 2020) it was uncovered through the research findings that individuals at various stages of hypertension were all susceptible to an increased risk of uncontrolled blood pressure levels. The study specifically highlighted that individual diagnosed with stage 1 hypertension faced a notable 20% escalation in the likelihood of experiencing uncontrolled hypertension, in contrast to individuals with healthy blood pressure readings. Similarly, those identified with stage 2 hypertension were determined to have a significantly higher 45% risk of developing uncontrolled hypertension when juxtaposed with individuals with normal blood pressure levels.

Common comorbidities, such as diabetes, present formidable obstacles in the effective management of hypertension. In SSA, over 90% of patients struggle to control their blood pressure due to various factors like inadequate access to healthcare services, lack of awareness about their conditions, and the intricate nature of managing multiple health issues simultaneously (Ndejjo et al., 2021).

Uncontrolled hypertension is a significant global health issue, particularly in LMICs like Uganda. The lack of follow-up by Community Health Practitioners (CHP) exacerbates this problem, leading to poor management of hypertension and its associated complications. A study by (Ozemek et al., 2020) highlighted the prevalence of uncontrolled hypertension among patients in Uganda due to inadequate follow-up by CHP. The research revealed that only a small percentage of hypertensive patients received regular follow-up care, leading to suboptimal blood pressure control and increased risk of cardiovascular events.

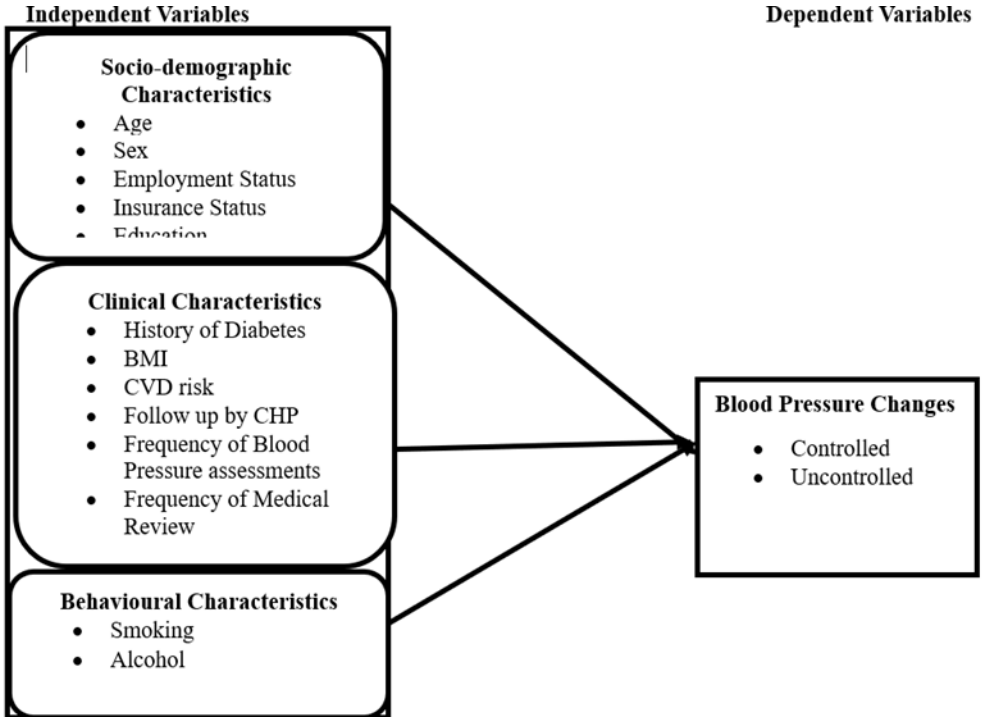
In Kenya, there is a significant challenge with the low frequency of blood pressure assessment and uncontrolled hypertension. This issue is part of a global trend where limited access to healthcare services, inadequate resources, and poor awareness contribute to suboptimal management of hypertension. A study by (van de Vijver et al., 2016) highlighted the prevalence of uncontrolled hypertension in Kenya, with only a small proportion of hypertensive individuals having their blood pressure adequately managed. The study attributed this to various factors, including insufficient screening programs, lack of awareness about hypertension, and limited access to affordable antihypertensive medications and regular healthcare services.

Behavioural Characteristics of Uncontrolled Hypertension Patients

Globally, research indicates that the lack of adherence to medication, unhealthy lifestyle habits, and insufficient medical oversight collectively contribute to 70% of uncontrolled hypertension cases. This underscores the critical need for improved patient education, lifestyle modification, and enhanced healthcare monitoring to effectively manage hypertension (Ojangba et al., 2023). People who do not regularly seek medical evaluations are at a higher risk of developing uncontrolled hypertension, with statistics indicating that up to 80–90% of individuals in this category may be affected by this condition. Maintaining regular check-ups and monitoring blood pressure levels can help in early detection and effective management of hypertension (Fernandez-Lazaro et al., 2019). Moreover, individuals who have a 30–50% higher likelihood of experiencing uncontrolled high blood pressure are typically those who seldom pay attention to monitoring their blood pressure levels. Failing to keep track of blood pressure readings can lead to an increased risk of serious health complications. The risk of experiencing severe consequences like heart disease, stroke, and renal issues significantly rises by 25–40% when individuals fail to consistently monitor their hypertension and receive regular follow-up care (Mahmood et al., 2020).

Studies conducted in SSA have revealed that behavioral risk factors, like alcohol and tobacco use, are likely seriously hinder hypertension patients' ability to recover. Patients with hypertension who drink alcohol have a 30% lower chance of recovery than those who do not. Drinking too much alcohol can raise blood pressure and negate the advantages of medication and lifestyle modifications. The recovery rate is 25% lower in smokers with hypertension than in non-smokers. Smoking can narrow blood arteries, raising blood pressure and decreasing the efficacy of hypertension medications (Moloro, Seid and Jaleta, 2023). The absence of Community-based follow-up programs in SSA has led to detrimental treatment outcomes for hypertension. This lack of support has resulted in a significant decrease in control rates, with studies showing a decrease of 20–30% compared to standard therapy. These negative effects are primarily due to challenges such as limited access to care, insufficient patient education and support services, and infrequent monitoring and feedback mechanisms. Consequently, these factors contribute to the rise in uncontrolled hypertension rates within the region (Fernandez et al., 2022).

Conceptual Framework



III. METHODOLOGY

Study Design

This study employed cross sectional study design to evaluate the Characteristics of uncontrolled Hypertension Patients at Bahati Subcounty Hospital in Nakuru County, Kenya,

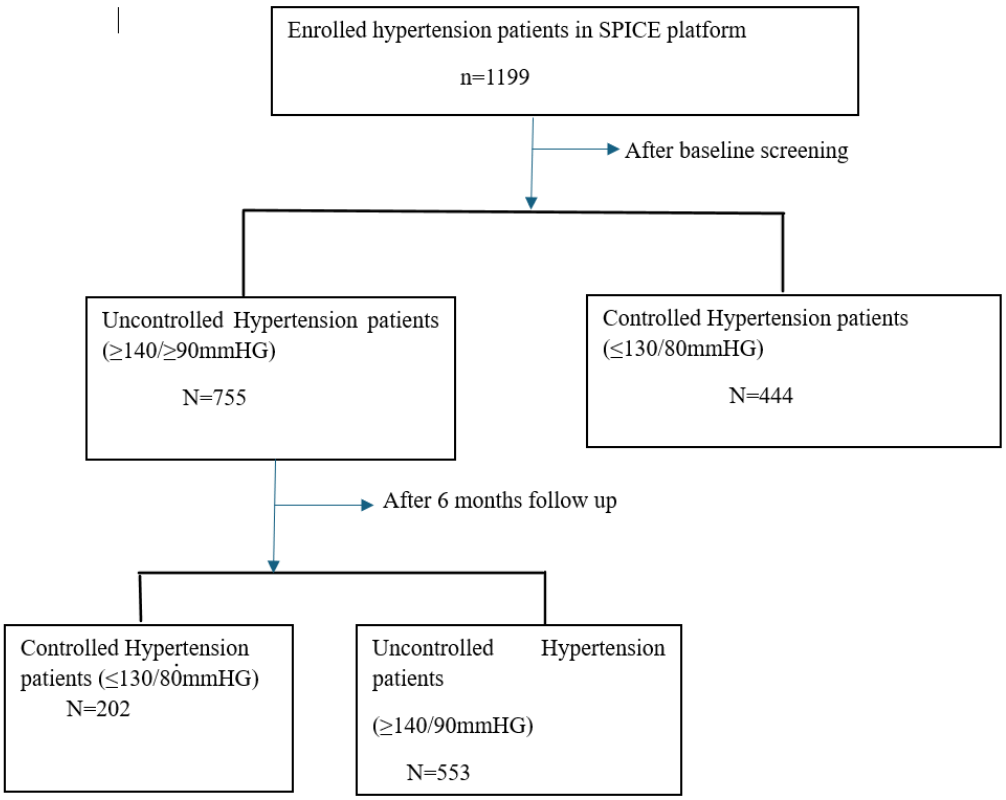
using SPICE digital Platform from 2020 to 2023. Data was collected at two points: at baseline (during enrollment) and after a 6-month follow-up, assessing both the dependent variable and independent variables.

Study Participants, Sampling, and Sample Size

The study included all hypertensive patients enrolled in the SPICE digital health platform at Bahati Subcounty Hospital between January 2020 and December 2023. Purposive sampling was used to include all patients who met the inclusion criteria and had informed consent. The sample consisted of all eligible hypertensive patients with complete records and at least 6 months of follow-up data.

Inclusion and Exclusion criteria

Inclusion criteria were patients diagnosed with hypertension, enrolled in the SPICE platform between 2020 and 2023, with informed consent and at least 6 months of follow-up data. Exclusion criteria included patients with incomplete records, those lost to follow-up or transferred out before 6 months, and patients with controlled blood pressure at baseline.



Study Subjects Screening and Selection.

Variables

The table below provides specific information on each variable utilized in this study. Blood pressure changes was the dependent variable, whereas socio-demographic clinical and behavioural characteristics were the independent variables.

Table 1Study Variables.

Variable	Categories	Classification	Definition
Dependent	BP changes	0.Controlled 1.Uncontrolled	Controlled/Uncontrolled hypertension at enrollment and after 6 months follow up
Independent	Age	1.< 40 2.40-49 3.50-59 4.60-69 5.70+	Age of patients
	Sex	1. Female 2. Male	Gender of patients
	Employment Status	1. Employed 2.Self-employed 3.Unemployed	Employment Status of the patient.
	Insurance status	0.No 1.Yes	Insurance status of the patients
	Education	0.No Formal Schooling 1.Primary School Completed 2.Secondary School +	Education level achieved by the patients
	BMI	0.Normal 1.Obese 2.Overweight 3.Underweight	Measure of body fat based on height and weight that applies to adult
	CVD Risk score	0.Low risk 1.Medium risk 2.Medium high risk	The non-lab-based WHO CVD risk score
	Follow up by CHP	0.No 1.Yes	Patients with at least one Blood Pressure follow up done by Community Health Care Promoter.
	Tobacco	0.No 1.Yes	Whether the patient has ever smoked cigarette or is currently smoking
	Alcohol	0.No 1.Yes	Whether the patient has ever drunk alcohol or is currently drinking
	Frequency of Blood Pressure	0.2-3 1.4-7	Frequency of BP measurement done within 6 months after being enrolled

Variable	Categories	Classification	Definition
	Assessments		in care
	Hypertension grading	0.Normal 1.Grade 1 2.Grade 2 3.Grade 3	The severity of the hypertension at the time when the patient was enrolled in care for monitoring.

BMI; body mass index, CVD; cardiovascular disease, CHP; community health promoter

Data Collection

Data was collected retrospectively from SPICE digital platform for hypertensive patients enrolled in the program at Bahati Subcounty Hospital between January 2020 and December 2023. Information on socio-demographic and clinical characteristics was gathered. The data was then extracted into a Microsoft Excel spreadsheet for analysis.

Data Analysis

In this study, data was extracted from the SPICE database and transferred to an Excel sheet for thorough scrutiny. Descriptive analysis was employed to outline the general characteristics of the study population of hypertensive patients. Percentages were used to summarize categorical variables, such as socio-demographic and clinical characteristics, providing a comprehensive overview of the participants' profiles. Chi-square was used to assess the relationships between controlled and uncontrolled hypertension cases following the 6-month assessment follow up. Furthermore, logistic regression analysis was conducted to analyze predictors of Uncontrolled hypertension control, providing estimates of odds ratios and 95% confidence intervals. A significance level of $p < 0.05$ was established for all analyses, and all statistical procedures were carried out using IBM SPSS version 25.

IV. RESULTS

4.1 Socio-demographic, clinical and behavioural characteristics of all patients assessed for Hypertension at enrollment

A comprehensive overview of the hypertension patients' study is presented in Table 2. Out of the 1,199 patients studied, a clear gender difference was observed, with a significant 81.6% being female, while 18.4% were male. An examination of the age demographics depicted a broad spectrum, with the largest segment aged 70 and above, accounting for 33.4%, while those below 40 constituted a smaller 5.1%. The educational background varied considerably, as indicated by 45.0% of individuals having no formal education 27.3% completing primary school and secondary school and higher accounted for 27.7%. Notably, the majority of

hypertension patients lacked insurance coverage, totaling 88.4%. Regarding employment status, 56.1% were unemployed, in contrast to the 6.6% who were employed. Moreover, a significant portion of patients had a history of diabetes, representing 74.1%, while the remaining 25.9% had no such medical record. An analysis of BMI revealed that 36.0% fell within the normal range, 42.0% were classified as overweight, 20.5% as obese and 1.5% as underweight.

In terms of CVD risk distribution among the patients, 57.5% were classified as low risk, 38.2% as medium risk and 4.3% as medium-high risk. Interestingly, almost all patients, totaling 98.9%, reported not using tobacco, with only a small 1.1% using it. Additionally, it was found that 98.8% of patients did not use alcohol, while 1.2% did. The majority of patients, 75.4%, had their blood pressure checked 2 to 3 times, while 24.6% had it checked more frequently, between 4 and 7 times. At the first assessment, 37.0% of patients were classified as having normal blood pressure, while 33.5% had Grade 1, 19.3% had Grade 2, and 10.1% had Grade 3. Regarding follow-up, 93.8% of patients did not receive follow-up care from Community Health Promoters (CHP), leaving only 6.2% who were followed up by CHP.

Table 2.Socio-demographic, clinical and behavioural characteristics of all patients assessed for Hypertension at enrollment. (N=1199*)*

Variable	Category	n (%)
Age (Years)	<40	61(5.1)
	40-49	121(10.1)
	50-59	305(25.4)
	60-69	311(25.9)
	70+	401(33.4)
Gender	Female	978(81.6)
	Male	221(18.4)
Education	No formal schooling	540(45.0)
	Primary School completed	327(27.3)
	Secondary+	332(27.7)
Insurance	No	1060(88.4)
	Yes	139(11.6)
Employment	Employed	79(6.6)
	Self employed	447(37.3)
	Unemployed	673(56.1)
Diabetes	No	888(74.1)
	Yes	311(25.9)
BMI	Normal	432(36.0)
	Obese	246(20.5)
	Overweight	503(42.0)

	Underweight	18(1.5)
CVD Risk	Low	689(57.5)
	Medium Risk	458(38.2)
	Medium high Risk	52(4.3)
Tobacco	No	1186(98.9)
	Yes	13(1.1)
Alcohol	No	1185(98.8)
	Yes	14(1.2)
Frequency of BP check	2 to 3	904(75.4)
	4 to 7	295(24.6)
First assessment grade	Normal	444(37.0)
	Grade 1	402(33.5)
	Grade 2	232(19.3)
	Grade 3	121(10.1)
Follow up by CHP	No	1125(93.8)
	Yes	74(6.2)

N; sample size, MI; body mass index, BP;blood pressure,CVD; cardiovascular disease, CHP;community health promoters, N; sample size

4.2 Socio-demographic, clinical, behavioural characteristics of uncontrolled and controlled hypertension patients after 6 months follow up

From the Chi-Square results presented in Table 3, the data set excluded 444 controlled hypertension cases after baseline screening; thus, 755 participants were used for analysis. It is evident that the percentage of patients with uncontrolled hypertension after a 6-month assessment varies across different age groups. Specifically, the data shows that the highest percentage of uncontrolled hypertension occurs in the 50-59 age bracket (76.47%), followed by those aged 70 and above (75.56%), patients under 40 years (74.36%), individuals between 40-49 years (71.43%), and those in the 60-69 age group (67.20%). This indicates that there is a noticeable trend of higher uncontrolled hypertension rates within the middle-aged and older population.

Additionally, the data in Table 3 indicates that a significant percentage of both females (73.05%) and males (74.10%) experienced uncontrolled instances of hypertension after a six-month assessment. This suggests that most individuals, regardless of gender, struggled to effectively manage their high blood pressure. Among hypertensive patients with uncontrolled cases after 6 months of assessment for hypertension, it was found that 73.62% had no formal schooling, 74.29% had completed primary school, and 71.69% had completed secondary education and higher.

It was also observed that 74.63% of patients without insurance coverage had uncontrolled cases. This finding highlighted the significance of insurance coverage in managing hypertension, with a p-value of 0.016 indicating a strong association.

After a 6-month assessment for hypertension, it was observed that 74.63% of patients without insurance coverage had uncontrolled cases. This finding highlighted the significance of insurance coverage in managing hypertension, with a p-value of 0.016 indicating a strong association.

After conducting a detailed and extensive six-month assessment focusing specifically on the prevalence of hypertension patients, it was discovered that a noteworthy 73.83% of cases were linked to non-tobacco users, highlighting a stark contrast with the 30.00% attributed to tobacco users who grappled with effective hypertension management. These findings were further emphasized by a statistically significant p-value of 0.0019, indicating a robust association between tobacco consumption and the challenges faced in controlling hypertension effectively.

Moreover, during the comprehensive assessment spanning six months to monitor hypertension, researchers identified a notably higher proportion, specifically 73.66%, of patients who refrained from alcohol consumption as experiencing uncontrolled hypertension, in contrast to the 45.45% of patients who did consume alcohol. The statistical analysis lent further weight to these results, revealing a significant association with a p-value of 0.036, shining a light on the impact of alcohol intake on hypertension control.

Delving into the initial assessment grades, it was evident that 67.91% of Grade 1 patients, 80.17% of Grade 2 patients, and 77.69% of Grade 3 patients were struggling with uncontrolled hypertension after the six-month follow-up period. This notable observation, supported by a statistically significant p-value of 0.0017, underscores the formidable challenge posed by hypertension management within these subgroups.

Further investigation uncovered that 74.86% of individuals followed up by CHP failed to achieve hypertension control, with 52.73% of these patients continuing to exhibit uncontrolled hypertension following the six-month assessment. The calculated significance level of p=0.0017 underscores the concerning prevalence of uncontrolled hypertension within the scope of this study, demanding urgent attention and intervention.

Table 3.Socio-demographic, clinical and behavioural characteristics of uncontrolled and controlled hypertension patients after 6 months of follow up.

		Uncontrolled cases		Controlled cases		p-value
Variable	**Category**	**(N=553) (%)**		**(N=202) (%)**		
Age (Years)	<40	29 (74.36)		10 (25.64)		0.2541
	40-49	55 (71.43)		22 (28.57)		
	50-59	143 (76.47)		44 (23.53)		
	60-69	125 (67.20)		61 (32.80)		
	70+	201 (75.56)		65 (24.44)		
Gender	Female	450 (73.05)		166 (26.95)		0.8008
	Male	103 (74.10)		36 (25.90)		
Education	No formal schooling	240 (73.62)		86 (26.38)		0.8147
	Primary School completed	156 (74.29)		54 (25.71)		
	Secondary+	157 (71.69)		62 (28.31)		
Insurance	No	500 (74.63)		170 (25.37)		0.016
	Yes	53 (62.35)		32 (37.65)		
Employment	Unemployed	304 (75.25)		100 (24.75)		0.1037
	Self employed	217 (72.58)		82 (27.42)		
	Employed	32 (61.54)		20 (38.46)		
Diabetes	No	403 (72.74)		151 (27.26)		0.6054
	Yes	150 (74.63)		51 (25.37)		
BMI	Normal	189 (73.83)		67 (26.17)		0.8633
	Obese	126 (16.69)		42 (25.00)		
	Overweight	232 (72.05)		90 (27.95)		
	Underweight	6 (66.67)		3 (33.33)		
CVD Risk	Low	262 (71.58)		104 (28.42)		0.4726
	Medium Risk	250 (74.18)		87 (25.82)		
	Medium high Risk	41 (45.21)		11 (21.15)		
Tobacco	No	550 (73.83)		195 (26.17)		0.0019
	Yes	3 (30.00)		7 (70.00)		
Alcohol	No	548 (73.66)		196 (26.34)		0.036
	Yes	5 (45.45)		6 (54.55)		
First assessment grade						
	Grade 1	273 (67.91)		129 (32.09)		0.0017
	Grade 2	186 (80.17)		46 (19.83)		
	Grade 3	94 (77.69)		27 (22.31)		
Follow up by CHP	No	524 (74.86)		176 (25.14)		0.0004
	Yes	29 (52.73)		26 (47.27)		

*N; sample size; BMI; body mass index, CVD; cardiovascular disease, BP; blood pressure, CHP; community health promoters.

4.3 Logistic regression analysis of predictors of Uncontrolled Hypertension

The logistic regression analysis presented in Table 4 identifies key predictors of uncontrolled hypertension patients, emphasizing the significance of insurance coverage, tobacco use, alcohol consumption, initial hypertension severity, and follow-up care. Each variable uniquely contributes to the efficacy of blood pressure management, illustrating their critical roles in enhancing patient outcomes over time.

Insurance is a significant positive predictor of blood pressure control, with an adjusted odds ratio of 1.749, meaning insured patients are 1.749 times more likely to achieve controlled hypertension compared to uninsured patients (95% CI: 1.087–2.816, p = 0.021). The 95% confidence interval (1.087–2.816) reinforces the reliability of these results, suggesting that the true odds ratio is likely to fall within this range. A p-value of 0.021 indicates statistical significance, highlighting the critical role of insurance in improving hypertension management outcomes.

Conversely, tobacco use is significantly associated with uncontrolled hypertension, as indicated by an adjusted odds ratio of 6.374. This means that smokers are over six times more likely to experience difficulties in managing their blood pressure compared to non-smokers (95% CI: 1.622–25.045, p = 0.008). The 95% confidence interval (1.622–25.045) indicates that this relationship is robust, suggesting that the true odds ratio lies within this range. A p-value of 0.008 confirms the statistical significance of these findings, highlighting the serious negative impact of tobacco on cardiovascular health and blood pressure control.

Although the analysis indicates an increased risk of uncontrolled hypertension among alcohol users, with an adjusted odds ratio of 3.101 (95% CI: 0.927–10.377, p = 0.066). This suggests that alcohol consumption may be associated with poorer blood pressure control; however, the association is not statistically significant, as reflected by a p-value of 0.066. The 95% confidence interval (0.927–10.377) further illustrates the uncertainty of this relationship, as it includes values below 1. While a trend exists linking alcohol use to hypertension control issues, the evidence is insufficient for definitive conclusions. Future research should explore potential dose-dependent effects and variations by alcohol type and consumption frequency, which could lead to more tailored guidelines for hypertensive patients.

The severity of hypertension at initial assessment significantly predicts control outcomes over time. Patients with Grade 2 hypertension have an adjusted odds ratio (OR) of 0.515, indicating they are less likely to achieve controlled blood pressure compared to those with Grade 1 hypertension (95% CI: 0.350–0.759, p < 0.001). The 95% confidence interval (0.350–0.759) and a p-value of less than 0.001 confirm the statistical significance of this

finding. Similarly, patients with Grade 3 hypertension show an OR of 0.581 (95% CI: 0.358–0.943, p = 0.028), also indicating lower odds of control. These results suggest that more severe hypertension at diagnosis correlates with greater challenges in management. Therefore, implementing targeted interventions for patients with higher initial grades may improve outcomes, underscoring the importance of early intervention to prevent disease progression.

Follow-up care provided by community health promoters (CHPs) significantly enhances the likelihood of achieving controlled hypertension, as indicated by an adjusted odds ratio (OR) of 2.491. This means that patients who receive follow-up care are nearly 2.5 times more likely to attain controlled blood pressure compared to those who do not (95% CI: 1.419–4.373, p = 0.001). The 95% confidence interval (1.419–4.373) suggests that this finding is robust, with a p-value of 0.001 confirming statistical significance. These results highlight the crucial role of ongoing support from healthcare promoters, which can facilitate medication adherence, regular blood pressure monitoring, and overall better management of hypertension, ultimately leading to improved health outcomes for patients.

Table 4.Logistic regression analysis of predictors of hypertension control.

Predictor		**Crude Odd Ratio (95 % CI)**	**P-value**	**Adjusted Odd Ratio (95%CI)**	**P-value**
Insurance	No	Ref			
	Yes	1.776 (1.108,2.847)	0.02	1.749 (1.087,2.816)	0.021
Tobacco	No	Ref			
	Yes	6.581 (1.685,25.701)	0.007	6.374 (1.622,25.045)	0.008
Alcohol	No				
	Yes	3.355 (1.013,11.117)	0.048	3.101 (0.927,10.377)	0.066
First assessment grade					
	Grade 1	Ref			
	Grade 2	0.523 (0.356,0.769)	<.001	0.515 (0.350,0.759)	<.001
	Grade 3	0.608 (0.377,0.979)	0.041	0.581 (0.358,0.943)	0.028
Follow up done by CHP	No	Ref			
	Yes	2.669 (1.531,4.655)	<.001	2.491 (1.419,4.373)	0.001

*CI;confidence interval; BMI;body mass index, CVD; cardiovascular disease

V.DISCUSSION

5.1 Socio-demographic, Clinical, Behavioural Characteristics of All Patients Assessed for Hypertension at enrollment

The study's demographic analysis revealed significant gender differences, with a predominance of female patients (81.6%) compared to males (18.4%). This trend may be linked to several causes such as genetic predispositions and lifestyle variations between the genders. This finding aligns with previous research, which indicates that hypertension often manifests differently across genders, with women generally experiencing higher rates of uncontrol hypertension post-menopause (Connelly, Currie and Delles, 2022). Age also played a crucial role, as the largest cohort was aged 70 and above (33.4%), This is probably because aging brings with it more risk factors, like decreased blood vessel function and reduced blood pressure regulation capabilities. This is consistent with the finding that age is a major socio-demographic component in the control of hypertension, with older people more likely to have uncontrolled hypertension because of age-related changes in their arteries and the prevalence of comorbid conditions including diabetes and chronic kidney disease (Oliveros et al., 2020).

Given that 45% of people with hypertension have never attended formal school. This could result in a lack of awareness of the significance of lifestyle changes and medication adherence, which would be detrimental to health and raise the risk of complications. The correlation between education attainment and effective management of blood pressure. Specifically, the individuals who completed secondary education or higher were able to achieve an optimal blood pressure control rate of 70%, in contrast to the 60% uncontrolled hypertension rate observed among patients with lower educational levels (Ukoha-Kalu et al., 2023). The fact that 88.4% of patients do not have insurance highlights a major obstacle to receiving healthcare services since it restricts their ability to pay for necessary medical procedures and preventive care, which results in unmet healthcare needs and perhaps worse health outcomes. The statistics are consistent with earlier studies showing a link between not having health insurance and uncontrol high blood pressure (Yao et al., 2019).

Additionally, 56.1% of hypertension patients were unemployed, which further emphasized discrepancies in employment status and may imply difficulty in obtaining healthcare and treatment due to inadequate resources and financial constraints, which could worsen their health outcomes. This result is consistent with earlier studies showing that individuals with hypertension who were unemployed faced a 35% higher likelihood of experiencing uncontrolled hypertension. This increased risk was primarily attributed to the combination of factors including financial stress, lack of access to healthcare, and potentially erratic lifestyle

habits (Misgana et al., 2023). The high rate of diabetes (74.1%) among patients with hypertension is mainly caused by a combination of factors, including genetic predisposition, unhealthy lifestyle choices like inadequate diet and exercise, and potential complications from long-term hypertension management. This aligns with the well-established link between these two conditions, emphasizing the need for integrated care approaches (Ma et al., 2024).

5.2 Socio-demographic, Clinical, Behavioural Characteristics of Uncontrolled Cases After 6 Months Assessment for Hypertension

The six-month follow-up demonstrated a concerning characteristic of uncontrolled hypertension, with 755 participants analyzed after excluding those who had achieved control. The highest rates of uncontrolled hypertension were observed in the 50-59 age group (76.47%) and those aged 70 and above (75.56%), Older persons have difficulties with medication compliance and uncontrolled hypertension rates due to age-related changes in blood vessels and bad lifestyle choices that enhance risk factors for hypertension. This is consistent with the literature that identifies middle-aged and older adults as high-risk groups for hypertension-related complications (Shakil et al., 2022).

Among those without a formal education, the high percentage of uncontrolled cases (73.62%) raises serious concerns. The lack of understanding regarding the management of hypertension is one of the many factors contributing to this high prevalence. Financial obstacles may also have a major influence on the capacity to successfully manage hypertension, as seen by the correlation between the absence of insurance coverage and hypertension control ($p=0.016$), this is in line with the study by (Yao et al., 2019) which found that among individuals diagnosed with hypertension, those covered by national health insurance exhibited a considerable advantage with a 25% reduction in the incidence of cardiovascular events compared to the 75% of uninsured individuals grappling with uncontrolled hypertension who faced increased risks. This disparity can be attributed to the insurance's provision of comprehensive medical benefits and regular health check-ups, which played a pivotal role in early risk detection, effective risk mitigation strategies, thereby significantly enhancing the cardiac well-being of insured individuals.The link between tobacco uses and hypertension control was also apparent, with non-tobacco users exhibiting higher rates of uncontrolled hypertension (73.83%). This can be explained by the negative effects of tobacco on blood pressure regulation and general cardiovascular health, which makes it harder for tobacco users than non-users to achieve adequate hypertension control. This finding aligns with existing research that indicates individuals with hypertension who smoke face a significantly higher risk, with a 40% increase compared to non-smokers, of developing comorbidities such

as renal damage and retinopathy. In addition, they are more likely to experience uncontrolled hypertension (Lin et al., 2021).

It's interesting to note that non-alcoholics (73.66%) had worse difficulty controlling their hypertension than alcoholics (45.45%). This is in contrast with various research that indicates certain behaviors, such as alcohol and tobacco use, may significantly impair the prognosis of hypertension patients. Alcoholic patients with hypertension showed a 30% decreased likelihood of recovery compared to alcoholic patients. Excessive alcohol consumption can increase blood pressure and counteract the benefits of medication and lifestyle changes (Moloro, Seid and Jaleta, 2023).

The follow-up care from CHP showed that those who received follow-up had lower rates of uncontrolled hypertension (52.73%). Regular monitoring and support by CHP have led to better adherence to treatment plans and lifestyle modifications for effective blood pressure control and prevention of complications, supporting evidence that proactive health engagement can significantly enhance patient outcomes (Fernandez et al., 2022).

5.3 Logistic Regression Analysis of Predictors of Uncontrolled Hypertension

Insurance emerged as a vital predictor of blood pressure control, reflected in an adjusted odds ratio of 1.749. This indicates that insured patients were 1.749 times more likely to achieve controlled hypertension than their uninsured counterparts. This is because insurance offers access to regular healthcare services, medications, monitoring, and early detection of health issues. These factors collectively enhance blood pressure management and contribute to improved overall health outcomes, leading to better long-term health for insured individuals. This reinforces findings that healthcare access significantly impacts chronic disease management (Yao et al., 2019).

Tobacco use was significantly linked to uncontrolled hypertension, with an adjusted odds ratio of 6.374. This indicates that smokers were over six times more likely to struggle with managing their blood pressure compared to non-smokers. The harmful effects of tobacco, including increased vascular resistance and impaired blood flow, contribute to poor blood pressure control. These factors not only hinder effective hypertension management but also lead to adverse overall health outcomes. Consequently, individuals who use tobacco face a higher risk of long-term health complications. These findings align with research indicating that hypertensive patients who smoke are more likely to experience uncontrolled hypertension (Lin et al., 2021).

This study presents a notable divergence from existing research, finding that alcohol use was not statistically significant in hypertension control, with a p-value of 0.066. This contrasts

with previous studies emphasizing alcohol's negative impact on recovery in hypertensive patients. Specifically, those with hypertension who consume alcohol have a significantly lower chance of recovery compared to non-drinkers (p=0.001)(Moloro, Seid and Jaleta, 2023). Excessive alcohol intake can raise blood pressure and diminish the effectiveness of medications and lifestyle changes. This emphasizes the need for further research to clarify the relationship between alcohol consumption and hypertension management.

The study found that patients with Grade 2 and Grade 3 hypertension have significantly lower odds (0.515 and 0.581, respectively) of achieving controlled blood pressure compared to those with Grade 1. This trend indicates that as hypertension severity increases, the likelihood of successful management decreases. Severe hypertension often involves greater vascular damage, complicating control efforts. Additionally, patients with higher-grade hypertension may have more comorbidities, further complicating treatment. Medication adherence can decline due to the complexity of their health needs, and lifestyle changes may be harder to implement. This is in line with the findings by (Mills, Stefanescu and He, 2020), which indicated that individuals at different stages of hypertension face an increased risk of uncontrolled blood pressure. Specifically, those with stage 1 hypertension have a 20% higher likelihood of uncontrolled hypertension compared to individuals with healthy blood pressure, while those with stage 2 hypertension have a significantly higher 45% risk compared to those with normal levels.

Lastly, follow-up by CHP significantly improved hypertension control (AOR: 2.491), CHP provide personalized care, monitoring blood pressure, adjusting medication, and offering lifestyle advice, leading to improved health outcomes and reduced risks associated with uncontrolled high blood pressure. This is in line with the findings that Community-based follow-up programs in SSA have shown positive treatment outcomes for hypertension, improving control rates by 20-30% compared to standard therapy (Fernandez et al., 2022).

VI.CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The study highlights significant gender and age differences among hypertension patients, with a predominance of female patients and older individuals. Factors such as educational level, employment status, and lack of insurance further challenge hypertension management. Additionally, the analysis reveals a concerning prevalence of uncontrolled hypertension across demographics, especially among middle-aged and older individuals and those without insurance coverage.

The findings indicate that having insurance significantly improves blood pressure control, while tobacco use worsens it. Higher grades of hypertension are associated with lower management success. Community Health Promoters contribute to improved hypertension control through personalized care and monitoring.

6.2Recommendations

Enhance Access to Health Insurance: Implement policies to expand health insurance coverage among vulnerable populations, especially middle-aged and older individuals. This may include expanding public insurance options or providing subsidies to help uninsured individuals access necessary healthcare services, thereby improving hypertension management.

Develop Targeted Educational Programs: Create and promote community-based educational initiatives focused on hypertension management, emphasizing lifestyle changes, medication adherence, and the risks associated with tobacco use. Tailoring these programs to address the specific needs of different demographics, particularly women and older adults, can enhance awareness and improve hypertension management.

Strengthen Community Health Programs: Invest in and expand Community Health Programs that offer personalized care and monitoring for hypertension patients. These programs should prioritize regular follow-ups, support for lifestyle modifications, and resources for managing comorbid conditions, thereby enhancing blood pressure control and overall health outcomes in the community.

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