

Feasibility of Community-based Hypertension Screening and Referral by Village Health Teams in Eastern Uganda: a Quasi-experimental Study

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Abstract

Background

Hypertension (HTN) is a significant public health challenge in Uganda, with a high prevalence and low diagnosis rate due to healthcare system deficiencies, like scarce diagnostic resources and a shortage of medical professionals. Task-shifting roles for community health workers (CHWs) could potentially fill gaps in the control of HTN, but this is still underexplored. This study determined the feasibility of leveraging CHWs, called Village Health Teams (VHTs), for HTN screening and referral in Eastern Uganda.

Methods

We conducted a quasi-experimental study from June to November 2023 in Jinja City and Bugembe town council, Eastern Uganda. Twelve VHTs were trained and deployed to screen and refer hypertensive patients in their communities. The training covered hypertension basics, blood pressure measurement, and referral protocols. Over four months, VHTs screened adults aged 18 and above using automatic blood pressure machines. Participants with elevated blood pressure ($\geq 140/90$ mmHg) on two different occasions at least 15 minutes apart were referred to a local health center for diagnosis and management. Data were collected on participant demographics, blood pressure readings, and referral outcomes and analyzed using descriptive statistics, paired t-tests, and reliability assessments in STATA version 15. A p-value < 0.05 was considered statistically significant.

Results

The VHTs screened 5,215 individuals, surpassing the target by 48%. The prevalence of HTN was 22.4% ($n = 1167$). Factors associated with HTN were older age, being male, having had previous blood pressure measurements, and alcohol use. The blood pressure measurements taken by VHTs compared to health professionals showed a high agreement (95.65%; 95% CI: 90.72% – 100%). However, of the hypertensive individuals identified, only 278 (23.8%) accepted referral to the health center. The monthly average number of new patients at the health center significantly increased from 4.6 ± 0.9 to 12.7 ± 1.4 four months before and after the intervention ($t = 4.37$, $p = 0.0014$).

Conclusion

VHTs can reliably screen for HTN, comparable to qualified health professionals. However, to improve the VHT-led screening and referral intervention, community trust in blood pressure measurements taken by VHTs must be enhanced to address the low referral rates.

BACKGROUND

Hypertension (HTN) is a significant global public health issue, affecting approximately one billion individuals worldwide.[1] While the global prevalence of HTN stabilized from 1999 to 2019, it continued to rise in low—and middle-income countries (LMICs), with sub-Saharan Africa (SSA) experiencing particularly sharp increases—reaching 48% among women and 34% among men by 2019.[2] In Uganda, a national survey reported that 26.4% of the population suffers from HTN, yet 76.1% are unaware of their condition.[3]

In Uganda, effective control of hypertension is hampered by systemic deficiencies within the primary healthcare system.[4–6] A needs assessment across 53 health facilities revealed that fewer than half were equipped with essential diagnostic tools such as blood pressure (BP) machines, and only a minority had established guidelines for HTN management.[7] In addition, the country faces a critical shortage of healthcare professionals, with a doctor-patient ratio of 1:25 000 and a nurse-patient ratio of 1:11 000 falling well below the World Health Organization’s (WHO) recommended thresholds of 1:1000 and 1:11 000, respectively.[8] This shortage creates a gap in the human resources needed to screen, diagnose, and manage HTN effectively.

Given these challenges, task shifting specific healthcare roles to community health workers (CHWs)—Public health workers selected by community members who live in their communities—emerges as a viable and cost-effective strategy.[9] The WHO supports task shifting to expand health service coverage, particularly in resource-limited settings like Uganda.[9] This approach has shown positive results in controlling infectious diseases, such as HIV and tuberculosis.[10, 11] Furthermore, in Ethiopia, adequately trained CHWs effectively detected and diagnosed HTN, demonstrating comparable proficiency to qualified health professionals.[12] This evidence, coupled with the fact that early diagnosis and control of hypertension is a mainstay in reducing cardiovascular deaths[13, 14] underpin the importance of utilizing CHWs to combat the burden of HTN.

In Uganda, Village Health Teams (VHTs), a group of CHWs, have been engaged in many public health initiatives to enhance community health, such as effectively improving maternal and child health outcomes and helping reduce the burden of malaria and tuberculosis.[15, 16] With the epidemiological shift towards NCDs, VHTs could be crucial in community-based HTN-related initiatives. Although studies done in rural Uganda have demonstrated that VHTs can effectively screen and manage hypertensive patients, their full potential remains largely underexplored.[17–19] The studies have focused on VHT-led community HTN management, including follow-up home visits. However, none have explored the feasibility of post-screening referrals and the potential challenges. While direct VHT involvement in HTN management is important, the referral process is vital to VHT’s role in the primary healthcare system. In this study, we trained and deployed VHTs to actively screen and refer hypertensive patients in their community to a health center for diagnosis and further management in Eastern Uganda. We determined the feasibility of VHTs in screening and referring hypertensive patients. Furthermore, we compared the blood pressure values measured by VHTs against those of qualified health workers to determine their reliability in measuring blood pressure.

METHODS AND MATERIALS

Study Design

We used quantitative techniques for a quasi-experimental study with a pre-and post-intervention evaluation design without a comparison group from June 2023 to November 2023. VHTs were trained to actively screen and refer patients with hypertension in their communities to the health center to confirm the diagnosis and further manage the condition.

Study Setting

The study was conducted in Jinja City, Bugembe town council in Eastern Uganda. Jinja is a rapidly urbanizing area in Uganda due to its tourist attractions, mainly the source of the River Nile, where NCDs are on the rise. Bugembe town council comprises seven villages with an estimated population of 45,600. Four villages were purposively selected based on their proximity to Bugembe Health Center (HC) IV, the referral facility for the participants identified with HTN. Bugembe HC IV has been operating a weekly HTN and DM clinic since 2021, with 261 registered patients before the initiation of this intervention. Health Center IVs in Uganda's health system lie in the health sub-district, with in-patient and outpatient facilities, operating theatres, and general doctors able to provide the first level of comprehensive care.

Study Population

This study included VHTs of Bugembe town council, Jinja City, Eastern Uganda. Each village in Bugembe has three designated VHTs, and twelve from four selected villages were included in the study. The VHTs were permanent residents of these villages and affiliated with Bugembe HC IV, a public health facility. The study population for screening was adults ≥ 18 years old who were permanent residents in their community and willing to participate. These were found either at home or in trading centers at their places of work.

VHTs are the first point of contact with Uganda's health system, bridging communities with the larger healthcare system by raising awareness or assisting referrals. Their communities select them through a process facilitated by local councils. The selection criteria emphasize that VHTs should be exemplary, trustworthy, and respected within their communities. They should also be able to fluently read and write in their local language, facilitating effective communication and participation in training programs. They undergo training provided by the Ministry of Health to equip them with the necessary skills for delivering primary healthcare services. Their roles include health education, mobilizing communities for health service utilization, managing common health conditions, and following up on patients.[20]

Study Procedures and Data Collection

Baseline

A comprehensive training program was developed in consultation with a multidisciplinary team, including a physician, two general medical doctors, two nurses, a health inspection officer, and two

VHTs. We developed materials, including a training booklet, PowerPoint slides, and data collection tools (e.g., referral forms). A three-day workshop was conducted to train VHTs using didactic and practical sessions covering HTN definition, signs, symptoms, risk factors, BP measurement techniques, interpretation of BP values, health lifestyle counseling, and referral criteria delivered by a bilingual team familiar with Lusoga (the local language) and English. On the first day, they learned about the fundamental concepts of HTN. On the second day, they covered the procedures for measuring and interpreting BP values. The third day focused on practical sessions with an automatic BP machine. Each VHT measured the BP of three colleagues and received feedback. Pre- and post-training multiple-choice tests assessed the VHTs' knowledge of trained topics. There was a significant change in the mean percentage knowledge scores before and after the training ($59.2 \pm 3.4\%$ Vs. $80.6 \pm 2.4\%$, $t = 5.59$, $p < 0.001$). The post-test scores showed marked improvement in almost all questions covered in the training. We also conducted a retrospective analysis of all HTN clinic health records at Bugembe HCIV to determine the previous diagnosis rates of HTN and enrollment into care.

Intervention

Each VHT was given a well-calibrated automatic BP machine and deployed into their communities to educate, screen, and refer people with hypertension to the health center. Each VHT was required to screen at least 14 people per week for the four months, making 224 people per VHT and at least 2,688 people. These numbers were agreed upon as feasible during the training. For each screened person, the VHTs recorded the BP readings, their demographics (Age and sex), risk factors (Smoking, alcohol use, and family history of hypertension), and if their BP had been measured before in their lifetime. Every participant with elevated BP ($\geq 140/90$ mmHg) on two different occasions at least 15 minutes apart was considered a suspected case of HTN and referred to the participating health center (Bugembe HC IV). HTN was categorized into stage 1 (systolic BP ≥ 140 -159mmHg or Diastolic BP ≥ 90 -99mmHg) and stage 2 (systolic BP ≥ 160 mmHg or Diastolic BP ≥ 100 mmHg).

Upon referral, the VHTs retained a carbon copy of the referral form and were required to do a follow-up to ensure the referred patients reached the facility. If the identified patient declined to be referred, they would probe and record why they declined to visit the facility. Qualified health workers double-check BP measurements twice for diagnosis confirmation at the health facility and appropriate enrollment into care, either starting on antihypertensives or lifestyle counseling and monitoring. The health workers completed the referral forms by recording their measured values. The VHT screening activities were supervised once every week. Monthly evaluation meetings were held with the VHTs to assess screening progress and identify challenges and best practices to optimize the interventional outcomes.

Endline

Trained research assistants (RAs) collected the completed referral forms with BP values recorded by the VHTs and qualified health workers from the health center NCD clinic. The RAs also reviewed the clinic records to extract the number of newly diagnosed hypertension patients enrolled in treatment during the intervention period.

Standard of Care

Health workers (general practitioners, clinical officers, and nurses) usually detect HTN when patients come to the health facility seeking medical care or for other reasons. The Ministry of Health in Uganda requires screening for HTN in all patients visiting the hospitals as part of routine care.[21]

Study Outcomes

The study outcomes included the number of individuals screened and the proportion who were hypertensive; referral cascade efficacy (how many were referred, arrived, enrolled, and started on treatment); reliability of VHT blood pressure measurements; and enrollment rates pre-and post-intervention.

Data Analysis

The data were entered into Microsoft Excel, cleaned, coded, and imported into STATA version 15 for analysis. The data was described using frequency, percentages, and means with standard deviations and presented as text, tables, and graphs. The prevalence of hypertension was calculated as a percentage proportion of those with HTN out of the total number screened. The screening and referral cascades were analyzed descriptively to determine the proportions and percentages of those with HTN who were referred, reached the hospital, and enrolled in care. To calculate the reliability of the VHTs' hypertension screening, the BP classifications of VHTs and qualified health workers were cross-tabulated using a two-by-two contingency table and assessed using the Kappa statistic. A cumulative frequency curve was plotted to demonstrate the change in the number of newly diagnosed patients at the facility before and after the intervention. An independent t-test was used to evaluate the significance of the changes in HTN diagnosis pre- and post-intervention. A p-value of less than 0.05 was used to determine statistical significance.

RESULTS

Characteristics of participants screened by VHTs

Over four months of active screening, 5,215 individuals were screened beyond the targeted 2,688 community members. Their mean age was 34 (SD: 12.3) years, with the range of 26–39 years (n = 2282, 43.8%). The majority were females (n = 3584, 68.7%), had never had their blood pressure measured before (n = 2827, 54.2%), and had no known family history of hypertension (n = 3196, 61.3%). About 14% (752) were alcohol users, and only 5.7% (298) were cigarette smokers (Table 1).

Table 1
Sociodemographic characteristics of participants that were screened by VHTs (N = 5215)

Variable	Frequency	Percentage
Age (Mean ± SD)	34.7 ± 12.3	
18–25	1338	25.7
26–39	2282	43.8
40–64	1446	27.7
≥ 65	149	2.9
Sex		
Female	3584	68.7
Male	1631	31.3
Ever Had Blood Pressure Measured		
Yes	2388	45.8
No	2827	54.2
Alcohol Use		
Yes	752	14.4
No	4463	85.6
Cigarette Smoker		
Yes	298	5.7
No	4917	94.3
Known Family History of Hypertension		
Yes	2019	38.7
No	3196	61.3

Prevalence of HTN and associated factors among participants screened by VHTs

Of the screened community members, 1167 (22.4%) were found to have HTN. They had a mean age of 41 (SD: 14.2) years, most in the age range of 40–64 years (n = 520, 44.6%). The mean systolic and diastolic BP were 146 (SD: 19.2) mmHg and 95 (SD: 11.6) mmHg respectively. Most were categorized under stage 1 HTN (n = 784, 67.2%). Only 83 (7.1%) were smokers, 223 (19.1%) alcohol users, and 502 (43.0%) had a family history of HTN (Table 2).

With increasing age, there was a progressive increase in the risk of having HTN. Compared to individuals aged 18–25 years old, the adjusted prevalence ratios were 1.71 (95% CI: 1.39–2.10) for 26–39 years, 3.89 (95% CI: 3.15–4.80) for 40–64 years, and peaked at 8.67 (95% CI: 5.95–12.63) for ≥ 65 years. Other factors associated with HTN were being male (aPR: 1.29, 95% CI: 1.10–1.51), using alcohol (aPR: 1.38, 95% CI: 1.14–1.66), and having had prior blood pressure measurements (aPR: 1.58, 95% CI: 1.36–1.84) (Table 2).

Table 2
Social demographic distribution of participants identified with HTN (N = 1167)

Variable	Hypertension Yes n (%)	Unadjusted PR (95% CI)	Unadjusted PR (95% CI)
Overall	1,167 (22.4)		
Mean ± SD Systolic Bp (mmHg)	146.8 ± 19.2		
Mean ± SD Diastolic BP (mmHg)	95.3 ± 11.6		
Age (Mean ± SD)	41.6 ± 14.2		
18–25	142 (12.2)	1.00	1.00
26–39	420 (36.0)	1.89 (1.54–2.32)	1.71 (1.39–2.10) *
40–64	520 (44.6)	4.72 (3.85–5.80)	3.89 (3.15–4.80) *
≥ 65	85 (7.2)	11.18 (7.74–16.16)	8.67 (5.95–12.63) *
Sex			
Female	759 (65.0)	1.00	1.00
Male	408 (35.0)	1.24 (1.08–1.42)	1.29 (1.10–1.51) *
Ever Had Blood Pressure Measured			
Yes	678 (58.1)	1.89 (1.66–2.16)	1.58 (1.36–1.84) *
No	489 (41.9)	1.00	1.00
Alcohol Use			
Yes	223 (19.1)	1.57 (1.32–1.86)	1.38 (1.14–1.66) *
No	944 (80.9)	1.00	1.00
Cigarette Smoker			
Yes	83 (7.1)	1.36 (1.05–1.77)	1.16 (0.87–1.53)
No	1,084 (92.9)	1.00	1.00
Family History of Hypertension			
Yes	502 (43.0)	1.25 (1.10–1.43)	1.15 (1.00–1.32)
No	665 (57.0)	1.00	1.00
Blood Pressure Categories			
Stage 1_ Hypertension	784 (67.2)		

Variable	Hypertension Yes n (%)	Unadjusted PR (95% CI)	Unadjusted PR (95% CI)
Stage 2_Hypertension	383 (32.8)		
* Statistically significant at $p < 0.05$			

Referral and diagnosis of hypertension at the health Center.

Of the 1167 individuals identified with HTN, only 278 (23.8%) agreed to be referred to Bugembe HC IV by the VHTs for further assessment and potential enrollment in care. Among those referred, a minority (n = 69, 24.8%) made it to Bugembe HC IV. Within this group, a majority (n = 39, 56.5%) were promptly enrolled in care and started on antihypertensive treatment, while 26 participants (37.7%) were initiated first on non-pharmacological management (counseled on lifestyle modifications and scheduled for follow-up). Only four individuals (5.8%) had normal blood pressure readings upon reassessment at the health facility, as shown in Fig. 2.

Figure 3 shows an exponential cumulative increase in new HTN patients monthly at the health center during the intervention. Furthermore, compared to the preceding four months, the average number of new HTN patients after the intervention increased significantly (4.6 ± 0.9 versus 12.7 ± 1.4 , $t = 4.37$, $p = 0.0014$).

Reliability of VHT's blood pressure values

We assessed how well and correctly the VHTs screened for blood pressure. Of the 69 participants whose records of the referral paper we accessed, 65 (94.2%) were also found to be hypertensive by health workers at the health center. On assessing inter-rater reliability using Cohen's Kappa, the percentage agreement of BPs measured between VHTs and qualified health workers was 95.65% (SE = 2.47%, $t = 38.68$, $p < 0.001$, 95% CI: 90.72% – 100%), indicating a high level of agreement. Despite the high agreement, the kappa value was zero, contradictory to the agreement above, mainly due to a lack of variance in the blood pressure categories taken by VHTs as they were all hypertensive compared to those by health workers, for which some turned out normal. These statistics express that VHTs' screenings could be relied on as correct.

DISCUSSION

This study demonstrates the feasibility of VHTs conducting HTN screening and referrals. The VHT screening exceeded the target by 48%, showing their potential to extensively conduct HTN screening with a wider community reach. The VHTs also effectively screened participants, with a high level of agreement between their BP values and those of qualified health workers. This aligns with a study from Ethiopia, where trained CHWs detected high BPs as effectively as trained health workers.[12] This success could be attributed to increased knowledge following the training ($59.2 \pm 3.4\%$ Vs. $80.6 \pm 2.4\%$, $t = 5.59$, $p < 0.001$), translating into field practice, consistent with other studies that have also trained

CHWs.[12, 17] In addition, studies conducted in rural areas of Uganda have shown that VHTs can effectively screen and manage hypertensive patients.[17–19] Therefore, with proper training, VHTs can significantly help screen for HTN in Uganda and similar low-resource settings.[19, 22]

This study revealed that 22.4% of those screened had HTN, similar to the HTN rates (22%) reported in a rural area of Kisoro in Western Uganda.[18] Another study in rural Islands in Uganda found a higher proportion of HTN (28%). The studies indicate a high prevalence of HTN in Ugandan communities that needs urgent attention. The differences in HTN prevalence could be explained by the differences in urbanization and lifestyle adaptations that drive the risks of HTN, as reflected in the 2014 national survey.[23] In addition, this study revealed that more than half (54.2%) of the participants had never had blood pressure measurements in their lifetime, and 41.9% of those found with HTN had also never screened and were unaware. Similar studies in Western Uganda (84%) and rural Islands of Uganda (89%) reported higher prevalences of unawareness.[12, 18] These studies were conducted in more rural areas than our study, which could explain the differences in unawareness rates. People in rural areas often live far from health facilities and have poor health-seeking behaviors.[17] However, health facilities in rural areas are also not well equipped to screen and manage HTN.[7] Efforts to reduce HTN need reinforcement across individual factors and the entire health system in Uganda. Empowering and motivating CHWs to screen and provide education on HTN could improve awareness, as they have extensive reach to the last mile in their communities.[24]

Furthermore, efforts to address HTN should be informed by understanding the demographic and behavioral risk factors associated with the condition. In our study, we found that increasing age, male gender, alcohol use, and a family history of HTN are significant factors linked to HTN. A similar study utilizing VHTs for HTN screening reported older age as a factor associated with having high blood pressure. [17] Therefore, tailored community education programs could effectively target older adults and men at higher risk, providing them with better information on the risks and management of HTN.

Despite successful screening, there were challenges in referring individuals with HTN for further assessment and treatment. Only 23.8% of patients found with HTN accepted referral. This is similar to a large community study conducted in Uganda and Kenya, where of the 92% of participants who screened hypertensive, only 42% were subsequently linked to care.[25] Upon following up with the participants in this study, reasons noted for referral decline and failure to reach the health facility included lack of transport and financial constraints, feeling well (asymptomatic), concerns about poor service delivery at the health center (particularly long waiting times and drug unavailability), and doubts about the competence of VHTs in screening blood pressure. Other Uganda studies further confirm community members' low confidence in VHTs regarding their competence in screening and managing NCDs such as HTN.[22, 26] Similar concerns have been reported in other countries in sub-Saharan Africa, such as South Africa and Swaziland, affecting the performance and acceptability of CHW services despite their credibility and effectiveness.[27–29] Further empowering VHTs to build greater community trust in fighting NCDs is important to improving VHT-led HTN screening and referral activities in Uganda and other LMICs.

Strengths and Limitations

This study's strength lies in the comprehensive training of VHTs and well-calibrated automatic blood pressure machines used in the screening. The VHTs also screened many individuals, providing reliable findings and relatively generalizable data for similar settings in Uganda. However, the study has some limitations. The absence of a control group limits the ability to attribute observed changes directly to the intervention, as external factors could have influenced the outcomes. The study was conducted over a relatively short period (four months), which may not capture long-term adherence to VHT-led referral advice. These factors should be considered when interpreting the findings and planning future research. In addition, we only followed up with patients referred to Bugembe Health Center IV. The lack of strategies to include participants who visited private facilities limited the comprehensive evaluation of post-referral assessments. The reliability of blood pressure measurements between VHTs and health workers could have been better assessed if both parties screened all patients, not just those referred with high blood pressure. Although logistical issues prevented this, the current analysis offers valuable insights into the reliability of VHT measurements. Future studies in Uganda could build on these findings.

Conclusion

The VHTs can effectively screen for HTN with high reliability in blood pressure measurements comparable to those by health professionals. However, significant enhancements are needed to ensure an effective post-screening referral process. Only a small fraction of those identified with HTN followed through with referrals to healthcare facilities, citing skepticism about the quality of screening provided by VHTs and logistical and financial barriers. There is a need to enhance community trust in the potential of VHTs to participate in HTN and other NCD screening and management competently. Also, broadening the training of VHTs to make them more confident and competent is crucial. High levels of HTN and unawareness in the community could be addressed by leveraging the far-reaching capabilities of VHTs to sensitize the communities on HTN and screening. Additionally, there is a need to improve service delivery and equip especially public health facilities, with the resources and medications needed to manage HTN to encourage the community to seek their services. These improvements will support the scalability and sustainability of VHT-led HTN control activities, contributing to better community health outcomes related to HTN prevention and management.

Abbreviations

HTN
Hypertension
CHW
Community Health Worker
VHT
Village Health Team
LMIC

Low–and Middle–Income Country

SSA

Sub–Saharan Africa

BP

Blood Pressure

WHO

World Health Organization

NCD

Non–communicable Disease

HC

Health Center

Declarations

Ethics approval and consent to participate

The study was approved by the Busitema University Faculty of Health Sciences Research Ethics Committee (BUFHS-REC) under number BUFHS-2023-75. Additional permission was obtained from the Jinja City health offices and the administration of Bugembe Health Center IV. All participants were enrolled in the study after informed consent was obtained. They were told that participation was voluntary and that they could withdraw anytime.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

All authors made substantial contributions to the manuscript. AMK, RBK, and TMK conceptualized the study. AMK, RBK, TMK, and RK designed the study protocol. AWN, KA, AMK, and RBK participated in data

collection. RBK, and TMK analyzed the data. RK, SL, AMK, RBK, AWN and TMK drafted the original manuscript. All authors reviewed and approved the final manuscript.

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Figures

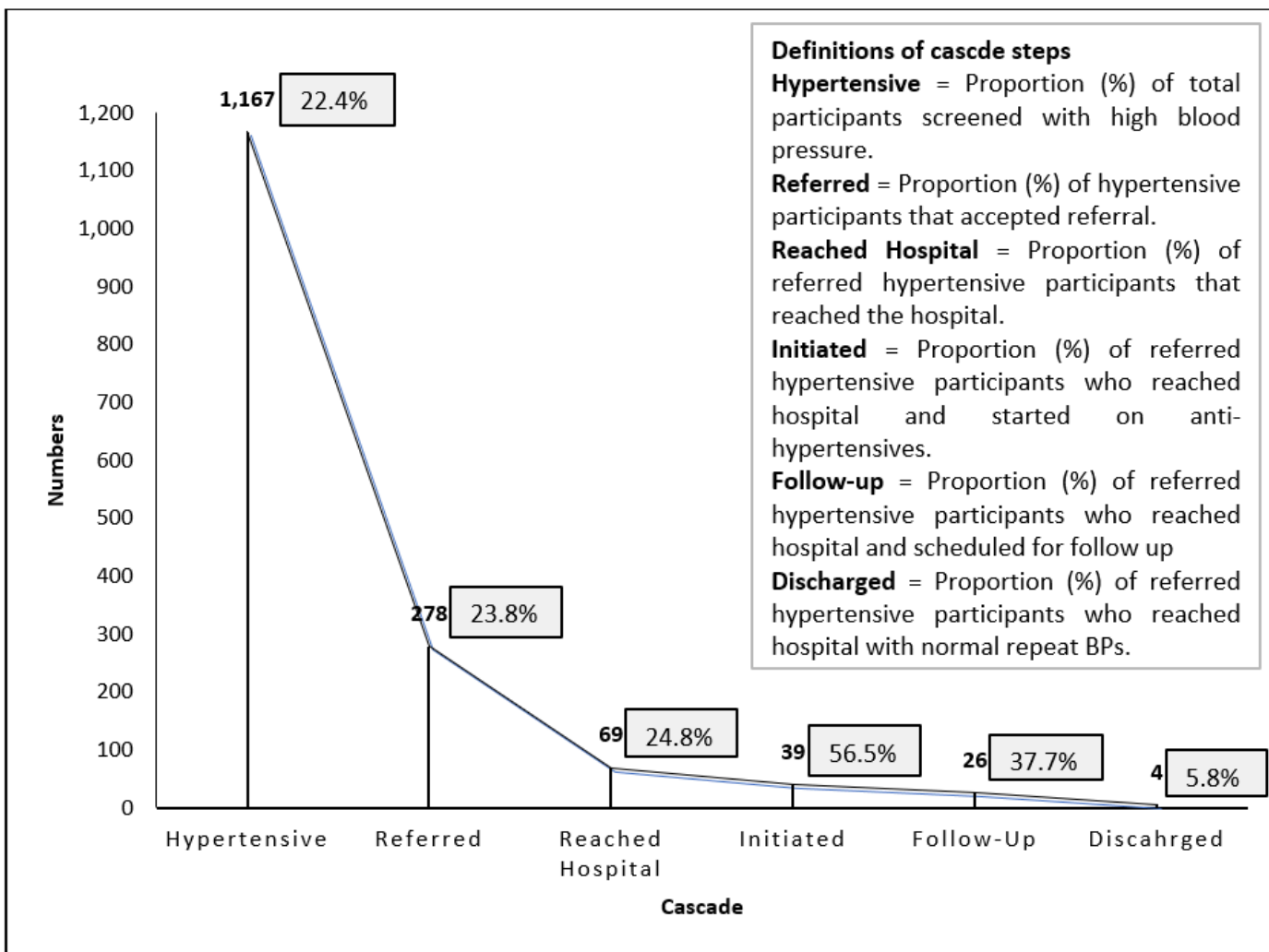


Figure 1

Figure 2: Cascade of the screening and referral steps by VHTs and diagnosis and enrollment into care at the facility by health workers

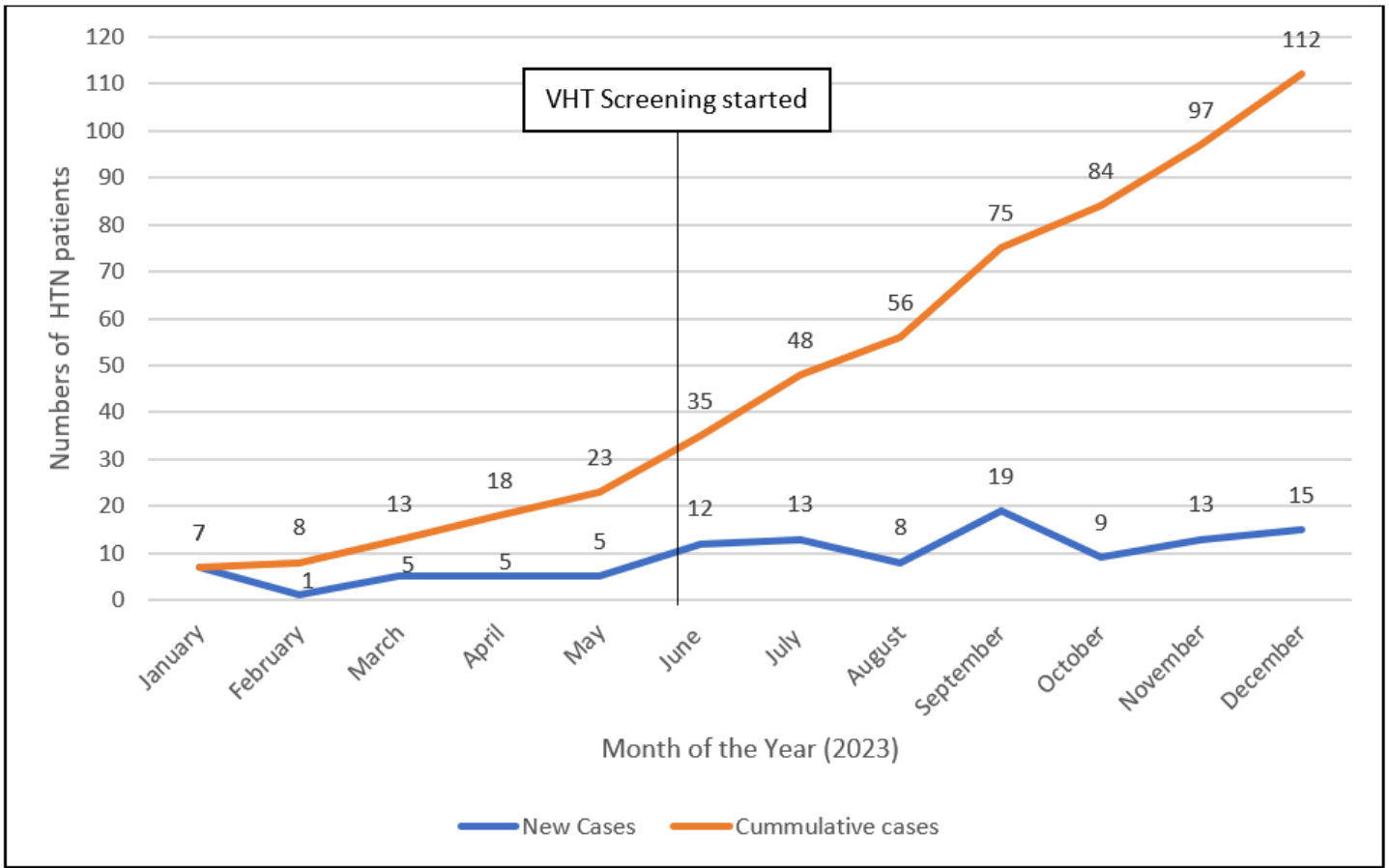


Figure 2

Figure 3: Line graph showing number of new and cumulative hypertension patients at the health center before and after the VHTs commenced screening.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [STROBEchecklistcrosssectionalVHTHTN.docx](#)