RESEARCH ARTICLE

Evaluating the cascade of care for hypertension in Sierra Leone

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Abstract

Objective: To assess the care for hypertension in Sierra Leone, by the use of a cascade-of-care approach, to identify where the need for healthcare system interventions is greatest.

Methods: Using data from a nationwide household survey on surgical conditions undertaken in 1956 participants ≥18 years from October 2019 to March 2020, a cascade of care for hypertension consisting of four categories – hypertensive population, those diagnosed, those treated and those controlled – was constructed. Hypertension was defined as having a blood pressure ≥140/90 mmHg, or self-reported use of antihypertensive medication. Logistic regression analysis was used to investigate factors associated with undiagnosed hypertension.

Results: The prevalence of hypertension was 22%. Among those with hypertension, 23% were diagnosed, 11% were treated and 5% had controlled blood pressure. The largest loss to care (77%) was between being hypertensive and receiving a diagnosis. Male sex, age and living in a rural location, were significantly associated with the odds of undiagnosed hypertension. There was no significant difference between men and women in the number of patients with controlled blood pressure. Adults aged 40 or older were observed to be better retained in care compared with those younger than 40 years of age.

Conclusion: There is a significant loss to care in the care cascade for hypertension in Sierra Leone. Our results suggest that increasing awareness of cardiovascular risk and risk factor screening for early diagnosis might have a large impact on hypertension care.

KEYWORDS
care cascade, hypertension, low resource setting, Sierra Leone, sub-Saharan Africa

INTRODUCTION

Hypertension is an increasing global health problem. According to the WHO, 1.13 billion people had hypertension in 2019 [1] with increasing prevalence in low- and middle-income countries (LMICs) in part exceeding those from high-income countries [1]. Hypertension is a major risk factor for cardiovascular disease (CVD), which is the number one cause of death globally [2]. An estimated 17.9 million people died from CVDs in 2016, with three out of four CVD deaths in LMICs [2]. The increasing trend of high blood pressure (BP) in LMICs is attributable to population ageing and changes in behavioural risk factors, including smoking, alcohol consumption, physical inactivity and unhealthy diet [3].

Despite multiple studies on the prevalence and determinants of hypertension in sub-Saharan Africa (SSA) [4], information on awareness, treatment and control of hypertension is limited. Several studies have shown that the increasing incidence of hypertension and the lack of proper care are major problems in SSA. A multi-country study on the prevalence, awareness and treatment of hypertension in Kenya, Nigeria, Uganda and Tanzania, showed that among African adults ≥18 years, nearly 25% had hypertension. Only 50% of those with hypertension were taking medication and of those treated, less than 50% had their BP under control [5]. A study examining the awareness, management and control of hypertension in Benin showed similarly high rates of unmet need for hypertension care [6].

One way to examine the care of hypertension is through a care cascade. The cascade-of-care model can be used to define the proportion of people in various healthcare stages, beginning with screening and diagnosis, followed by treatment and control [7]. This model has been widely used to assess the care for HIV in Africa [8–10] and has recently been extended to assess the care for hypertension in people living with HIV [11, 12]. To date, only a few studies have used this model solely to assess the care for hypertension [7, 13, 14]. These studies assessed the proportion of patients who reached each stage in the care cascade, allowing them to identify where the loss of patients occurs in linking hypertensive patients to appropriate care, in order to formulate improvements [7, 13, 15].

This study assessed the cascade of care for hypertension in Sierra Leone, one of the poorest countries globally with one of the most fragile healthcare systems in the world [16], partly due to the civil war 1991–2002 impacting negatively on the country's infrastructure, including its healthcare system. The West African Ebola virus disease epidemic (2013–2016) crippled the healthcare system, even more, complicating among others the response to the rising burden of NCD [17]. This study investigated where the need for healthcare system interventions for hypertension is the greatest. We further assessed possible predictors of increased risk for falling out of the care cascade for hypertension.

METHODS

This study used data from a national household-based survey to estimate surgical and maternal health conditions (PREvalence Study on Surgical COnditions (PRESSCO 2020) study) in Sierra Leone. Data were collected via individual face-to-face interviews at the homes of the respondents. Standardised data collection was undertaken by trained nurses and medical staff. Tablets with mobile internet access were used to collect data during field work. Data were subsequently uploaded to and stored in REDCap©, a secure, web-based software platform hosted at the University Medical Center Utrecht [18, 19]. Data collection took place October to November 2019 and February to March 2020.

Sampling was done through a weighted random cluster design, where the probability of cluster choice is proportional to the population size. Clusters in this context referred to enumeration areas, the smallest administrative units in Sierra Leone as per Statistics Sierra Leone. 1.875 households from 75 nationwide clusters were visited.

Information on demographic, socio-economic status (SES), medical history and physical condition was collected by questionnaire. In participants ≥18 years, systolic and diastolic BP was measured three times, preferably on the upper left arm (if this was not possible, the right arm was used), with a 3-min interval between measurements with OMRON M6 comfort machines (OMRON Healthcare, the Netherlands). The average of the second and third BP measurements was used for analysis.

Definitions of hypertension and the cascade of care

Hypertension was defined as having a mean systolic blood pressure (SBP) ≥140 mmHg and/or a mean diastolic blood pressure (DBP) ≥90 mmHg or self-reported use of antihypertensive drugs [13, 20, 21]. In order to identify gaps in the care cascade, study participants with hypertension were divided into four categories: total number of participants with hypertension based on BP measurements during the survey (Category 1); number of study participants diagnosed with hypertension (Category 2); number of participants treated (Category 3); and the number that had controlled BP (Category 4). Being diagnosed with hypertension was defined as having received a previous diagnosis by a healthcare worker or health professional. Being treated for hypertension was defined as having a diagnosis and self-reported current use of antihypertensive drugs. Being controlled for hypertension was defined as currently using antihypertensives and a mean SBP <140 mmHg [20, 21].

The proportion of study participants who reached each stage of the cascade of care was determined using the number of participants in the previous step as the denominator.

Variable definition

Age was categorised as 18–34 years, 35–44 years, 45–54 years, 55–64 years, 65+ years, respectively, as 18–39 years and 40+ years. Residential location was divided as urban and rural, following the definition of the 2015 EA census frame of Sierra Leone [22]; ethnicity differentiated between Creole, Limba, Mende, Temne and other ethnicities (including Fullah, Kissi, Kono, Koranko, Loko, Mandingo, Sherbro, Susu, Vai and Yalunka), other African and non-African. SES encompassed information on education (none, primary school, secondary school and tertiary/higher education) and occupation (employed and unemployed). Lifestyle factors included tobacco use (smoking and non-smoking) and alcohol consumption (regularly and not regularly). Medical history information included time since diagnosis of hypertension (past year or before); diabetes screening (screened or never been screened); mobility (no problems, some and confined to bed); medical history (heart problems and/or cerebral vascular accident (CVA), other (including leprosy, tuberculosis, *Wuchereria bancrofti* filariasis), none and unknown).

Statistical analysis

Frequencies and percentages were used to estimate the prevalence of hypertension. To calculate the proportions of study participants diagnosed with hypertension, treated and controlled, we obtained frequencies and percentages of study participants at each step compared with the preceding step. Multivariable logistic regression using backward elimination, with a p-value of 0.2 for variable selection, was used to investigate demographic, SES and lifestyle predictors of falling out of the care cascade. Logistic regression was conducted on the cascade step with the biggest loss to care. To extrapolate our results to the entire population, we accounted for the weighted random cluster design consisting of 16 clusters and 75 strata. Analyses were done using STATA/IC 15.1 [23].

Ethics

The study was endorsed by the Masanga Medical Research Unit's Scientific Review Committee (MMRU-SRC-009–2019). Ethical approval was obtained from the Sierra Leone National Ethics Committee and The Norwegian National Committee for Research Ethics (Ref-No 31932). Study approval was obtained from the formal head of each enumerator area, following community engagement activities contributing to the development of the study protocol. District medical officers were informed to expect referrals in case of medical diagnoses, such as undiagnosed high BP in participants of this study, depending on severity referral was within 24 hours or a week. As part of the larger PRESSCO 2020 study, referrals were arranged for patients who had serious medical problems identified during the physical examination. All participants or their guardian signed informed consent forms prior to study enrolment. Privacy and confidentiality were assured through the use of password-protected tablets, secure internet data transfer and use of anonymised data for analyses.

RESULTS

In total, 3618 individuals aged 0–100 years participated in the nationwide survey. Of those, 2007 were ≥18 years. Twenty participants had missing values for either age or sex, and 20 participants had missing values for BP measurements. Participants with implausible BP values (SBP <70 mmHg or >270 mmHg; DBP <40 mmHg or >150 mmHg) (n = 2) [13, 24] and those with a missing response on the question ever been diagnosed with hypertension (n = 9) were excluded, resulting in an analytic sample of 1956 participants (Figure S1). Thirty-seven (1.9%) participants answered yes to the question 'having ever received a diagnosis of hypertension', but did not meet the definition of hypertension, thus were excluded from our care cascade.

Table 1 presents the characteristics of the study population comprising the analytic sample. The study population was predominantly female (56%); the mean age was 39 (SD 16.5) years. Most participants were of the Mende ethnic group (34% vs. ≤28% of other ethnic groups) and lived in a rural location (67%).

Figure 1 displays the prevalence of hypertension by age groups. Of the 1956 participants, 423 had hypertension, a prevalence of 22% (95% CI: 19.8–23.5). Overall, the prevalence of hypertension was similar between men (21%; 95% CI: 18.0–23.5) and women (22%; 95% CI: 20.0–25.0). For middle-aged and older women (40+; 48%; 95% CI: 42.3–52.7), a higher prevalence of hypertension was observed than for men (40+; 35%; 95% CI: 30.0–39.5).

The prevalences of hypertension of rural (22%; 95% CI: 20.1–25.0) and urban (20%; 95% CI: 17.2–23.5 for urban) residence were similar. Overall, the percentages of patients being diagnosed, treated and controlled were higher in urban than rural participants (Table 1). The percentages of participants who were diagnosed, treated and controlled were overall higher in participants who were enrolled in or had completed a tertiary education than in participants with no formal education (Table 1). Among ethnic groups, the percentages of participants diagnosed, treated and controlled were overall higher in participants from the Limba and Creole ethnic groups than in participants from the Mende and Temne groups (Table 1).

Figures 2a–c show results of the hypertension care cascade. Figure 2a depicts the care cascade for the entire study population aged 18 and older. Of the hypertensive patients, 23% reported ever having been diagnosed; 11% of hypertensive patients were treated, and 5% of hypertensive patients were successfully retained in the cascade of care and had their BP under control. Figure 2b on the cascade of care for men and women shows that women had a higher chance of

TABLE 1 Characteristics of the PRESSCO 2020 study sample according to hypertension prevalence, diagnosis, treatment and control

	Study Sample			Hypertension			Diagnosed			Treated			Controlled		
	N	%	95% CI	N	%	95% CI	N	% of HT	95% CI	N	% of HT	95% CI	N	% of HT	95% CI
Age (years)															
18–39	1173	60.0	57.8–62.1	104	8.9	7.3–10.6	12	11.5	6.1–19.3	6	5.8	2.1–12.1	2	1.9	0.2–6.8
40+	783	40.0	37.9–42.2	319	40.7	37.3–44.3	84	26.3	21.6–31.5	41	12.9	9.4–17.0	17	5.3	3.1–8.4
Sex by age (years)															
Men															
18–39	458	52.8	49.4–56.1	37	8.1	5.8–11.0	2	5.4	0.7–18.2	0	0	-	-	-	-
40+	410	47.2	43.9–50.6	142	34.6	30.0–39.5	31	21.8	15.3–29.5	19	13.4	8.3–20.1	9	6.3	2.9–11.7
Women															
18–39	715	65.7	62.8–68.5	67	9.4	7.3–11.7	10	14.9	7.4–25.7	6	9.0	3.4–18.5	2	3.0	0.4–10.4
40+	373	34.3	31.5–37.2	177	47.5	42.3–52.7	53	29.9	23.3–37.3	22	12.4	8.0–18.2	8	4.5	2.0–8.7
Sex															
Male	868	44.4	42.2–46.6	179	20.6	18.0–23.5	33	18.4	13.0–24.9	19	10.6	6.5–16.1	9	5.0	2.3–9.3
Female	1088	55.6	53.4–57.8	244	22.4	20.0–25.0	63	25.8	20.4–31.8	28	11.5	7.8–16.2	10	4.1	2.0–7.4
Ethnicity															
Creole	34	1.7	1.2–2.4	9	26.5	12.9–44.4	4	44.4	13.7–78.8	4	44.4	13.7–78.8	2	22.2	2.8–60.0
Limba	230	11.8	10.4–13.3	56	24.3	18.9–30.4	19	33.9	21.8–47.8	9	16.1	7.6–28.3	6	10.7	4.0–21.9
Mende	662	33.8	31.7–36.0	119	18.0	15.1–21.1	18	15.1	9.2–22.8	9	7.6	3.5–13.9	3	2.5	0.5–7.2
Temne	540	27.6	25.6–29.6	123	22.8	19.3–26.6	26	21.1	14.3–29.4	11	8.9	4.5–15.4	3	2.4	0.5–7.0
Other	490	25.1	23.1–27.0	116	23.7	20.0–27.7	29	25.0	17.4–33.9	14	12.1	6.8–19.4	5	4.3	1.4–9.8
Residential location															
Rural	1312	67.1	64.9–69.2	293	22.3	20.1–24.7	43	14.7	10.8–19.3	23	7.8	5.0–11.5	6	2.0	0.8–4.4
Urban	644	32.9	30.8–35.1	130	20.2	17.2–23.5	53	40.8	32.2–49.7	24	18.5	12.2–26.2	13	10.0	5.4–16.5
Education															
None	1079	55.2	52.9–57.4	284	26.3	23.7–29.1	53	18.7	14.3–23.7	27	9.5	6.4–13.5	9	3.2	1.5–5.9
Primary school	184	9.4	8.1–10.8	36	19.6	14.1–26.0	10	27.8	14.2–45.2	3	8.3	1.8–22.5	1	2.8	0.1–14.5
Secondary school	553	28.3	26.3–30.3	68	12.3	9.7–15.3	21	30.9	20.2–43.3	8	11.8	5.2–21.9	4	5.9	1.6–14.4
Tertiary or higher	140	7.2	6.1–8.4	35	25.0	18.1–33.0	12	34.3	19.1–52.3	9	25.7	12.5–43.3	5	14.3	4.8–30.3
Mobility[a]															
Problems walking	155	8.0	6.8–9.3	76	49.0	40.9–57.2	31	40.8	29.6–52.7	16	21.1	12.5–31.9	7	9.2	3.8–18.1
No problems walking	1789	92.0	90.7–93.2	343	19.2	17.4–21.1	65	19.0	14.9–23.5	31	9.0	6.2–12.6	12	3.5	1.8–6.0

(Continues)

TABLE 1 (Continued)

	Study Sample			Hypertension			Diagnosed			Treated			Controlled		
	N	%	95% CI	N	%	95% CI	N	% of HT	95% CI	N	% of HT	95% CI	N	% of HT	95% CI
DM screening															
Yes	98	5.4	4.4–6.6	34	34.7	25.4–45.0	19	55.9	37.9–72.8	10	29.4	15.1–47.5	5	14.7	5.0–31.1
No	1712	94.6	93.4–95.6	350	20.4	18.6–22.4	74	21.1	17.0–25.8	34	9.7	6.8–13.3	12	3.4	1.8–5.9
Medical history															
CVA/heart problems	24	1.2	0.8–1.8	13	54.2	32.8–74.4	8	61.5	31.6–86.1	5	38.5	13.9–68.4	2	15.4	1.9–45.4
Other	1929	98.8	98.2–99.2	410	21.3	19.4–23.1	88	21.5	17.6–25.8	42	10.2	7.5–13.6	17	4.1	2.4–6.6

Note: % of HT = percentage of hypertensive patients, CVA = cerebral vascular accident.

[a]Mobility is defined as problems walking and no problems, redefining 3 participants that were confined to bed as problems walking.

being diagnosed than men (26% vs. 18%). This difference was less pronounced for the proportion of hypertensive patients being treated (12% women vs 11% men) and in the number of hypertensive patients with their BP under control (4% women vs. 5% of men). Figure 2c provides information on the care cascade for young adults (18–39 years) and middle-aged and older participants (≥40 years). Overall, the ≥40 year age group was better retained in the care cascade, with 26%, 13% and 5% reported ever having received a diagnosis, treatment and having their BP under control, compared to 12%, 6% and 2% for the 18–39 year age group. Differences in the care cascade for men and women categorised by age are presented in Table 1. The cascade step with the largest loss to care was between being hypertensive and receiving a diagnosis (77% for the entire study sample, 74% for women, 82% for men).

Male sex (OR = 1.91; 95%CI: 1.03–3.51) and rural residency (OR = 4.84; 95%CI: 2.53–9.25) were significantly associated with undiagnosed hypertension (Table 2). Being aged ≥45 years as compared to being aged <35 years (OR = 0.17–0.26; 95%CI: 0.06–0.70), a medical history of CVA or heart problems (OR = 0.17; 95%CI: 0.03–0.84), having problems with walking considered a proxy for disability (OR = 0.37; 95% CI: 0.19–0.73) and belonging to the ethnic group Limba, versus the Mende ethnic group (OR = 0.27; 95% CI: 0.11–0.66) were inversely associated with undiagnosed hypertension.

DISCUSSION

In this study, we report on a care cascade for hypertension in adults ≥18 years in Sierra Leone, observing high rates of unmet need for hypertension care. Only 23% of hypertensive patients were diagnosed, 11% were treated and only 5% had their BP under control. Our findings on low levels of diagnosis, treatment and control of hypertension corroborate findings from a recent study from Sierra Leone [14] and pooled individual-level population data analysis from 44 LMIC including from SSA [7].

The observed hypertension prevalence rate of 22% in the national PRESSCO household survey is considerably lower than previously reported figures for Sierra Leone with prevalences up to 50% from healthcare facility-based studies [25, 26], and a population-based study undertaken in the southern province of the country [14].

In our study, only 5% of hypertensive patients were successfully retained in the care cascade and had their BP under control, similar to the results reported from the study undertaken in the Southern Province of Sierra Leone [14]. Blood pressure control for men and women was similar in our study, even though a higher percentage of women than men were diagnosed patients. Patients aged ≥40 years were decisively better retained than patients aged 18–39 years. This aligns well with the 2019 NCD prevention and treatment protocols of the Ministry of Health, which state that BP should be measured in adults aged 40 years and older when they visit a healthcare facility [27].
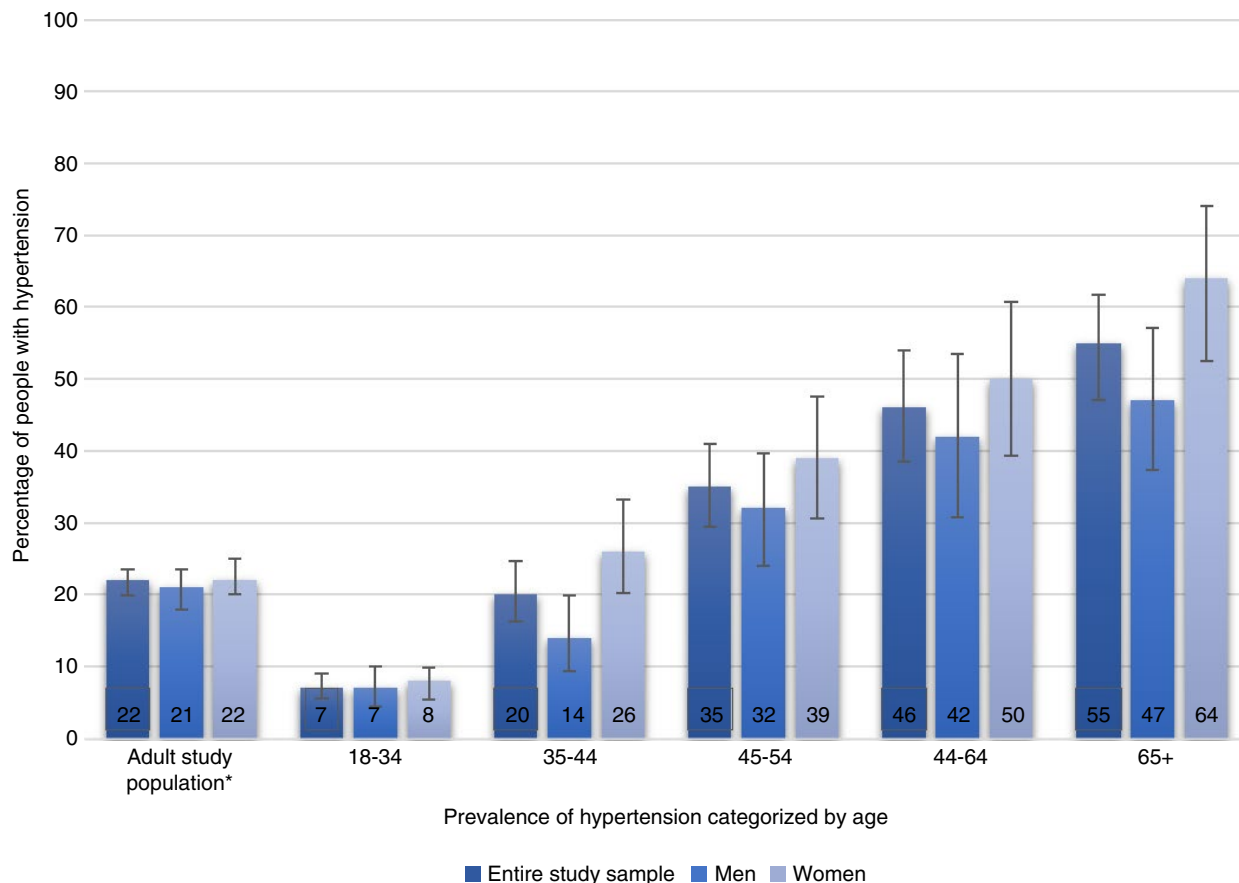
FIGURE 1 Prevalence of hypertension by age categories for the study population and for men and women separately. * All participants aged 18 and older

Across all cascade steps, the largest loss to care was found between being hypertensive and receiving a diagnosis. We observed that males had a higher risk of being undiagnosed as previously reported in several other studies [7, 13, 14]. This could be due to several factors, such as a focus on maternal and child healthcare services and gender norms concerning care-seeking and health facility opening hours [7, 14, 26, 28].

Rural participants were observed to have a higher chance of being undiagnosed compared with urban participants. A likely explanation for this difference is that people who live in rural areas encounter more care-seeking barriers [29–31]. Physical access to NCD services, principally due to distance to healthcare facilities, was reported to be a key barrier for care-seeking in Sierra Leone, [32]. The 2017 national Service Availability and Readiness Assessment (SARA) survey analysed the health facility density in Sierra Leone, an indicator of service access to outpatient consultation, observing a wide gap between rural and urban facility densities, 0.7 and 2.6 health facilities/10,000 population, respectively [33]. Not only do rural areas have fewer health facilities, but the infrastructure and transportation system in the country is also poor. Patients considering seeking care at a lower-level facility may be discouraged to access a higher level of care associated with longer travel distance and high costs for transportation [32, 33].

In addition to the poor rate of diagnosis, there was a large loss between being treated and having BP under control, which suggests a lack of effective treatment. Among those who reported the use of antihypertensive medication, only 40% had their BP under control. This might be due to poor adherence to the prescribed medication, poor monitoring by healthcare workers or ineffective medication [13]. Low adherence levels for several long-term treatment regiments have been documented in South Africa [34, 35]. Low adherence rates may in turn be caused by unavailability of medicines and the inability of patients to afford them [32]. While the free healthcare initiative in Sierra Leone has focused on providing free medicines for pregnant and lactating women and children under 5 years of age, NCD medicines for all other groups fall within the cost recovery schemes of pharmacies at health centres and hospitals, and may thus not be affordable to patients and their families [32, 36]. In 2020, the costs for a visit to one of the health facilities was about 40,000 Leones (US$4.75) and costs for antihypertensive medication for a month 50,000 Leones (US$6.00). According to recent 2021 estimates from UNDP 60% of Sierra Leoneans live on less than US$1.25 a day, illustrating how very few people can afford treatment for their hypertension [37–39]. The shortage of medicines in public facilities drives patients to purchase from private pharmacies or informal sources
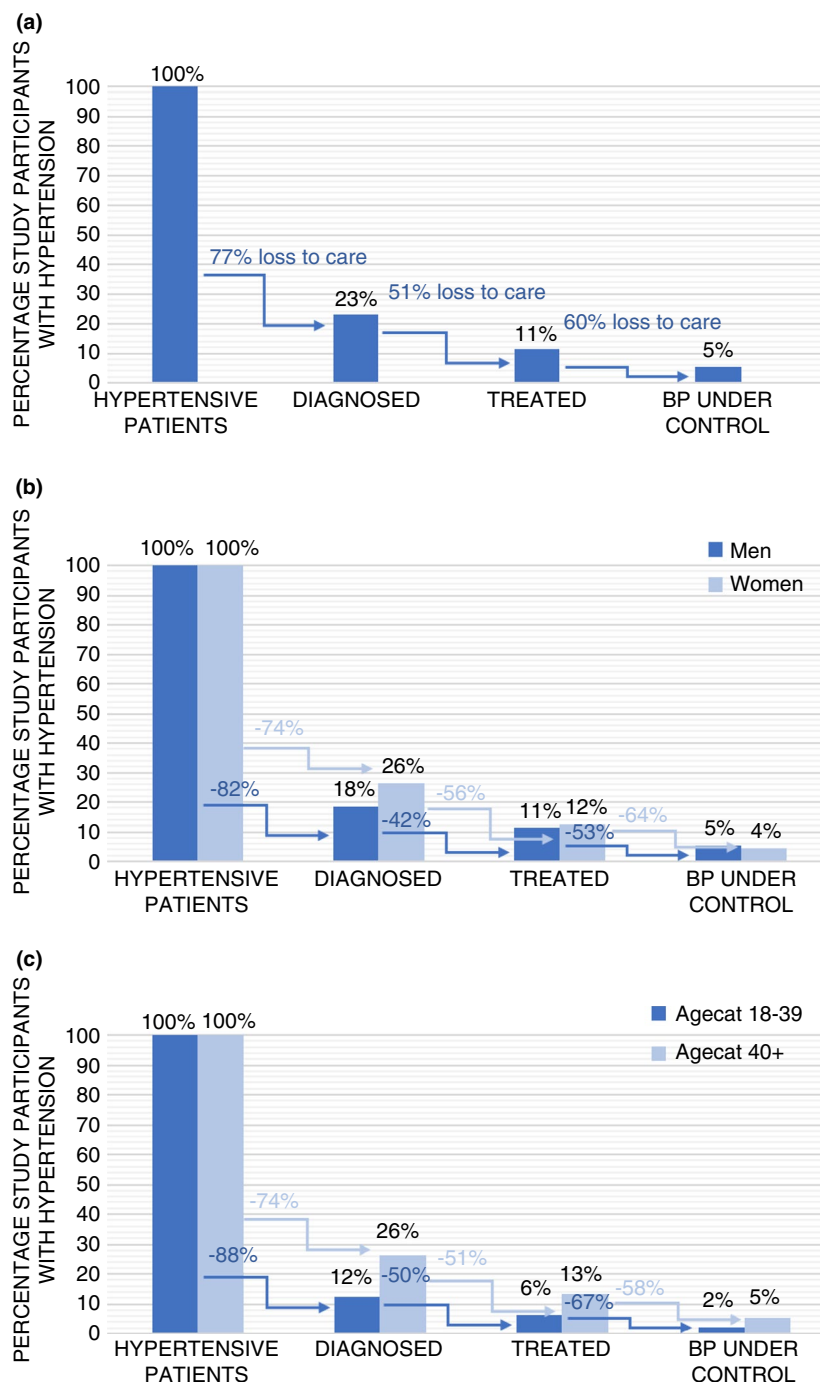
FIGURE 2 (a) Hypertension care cascade, PRESSCO 2020 study adults aged 18 years and older. The first bar represents the entire hypertensive population, each bar after this represents a percentage of that group. The arrows between bars represent the percentage of patients lost between each step of the care cascade. (b) Hypertension care cascade for men and women, PRESSCO 2020 study. The first bar represents the entire hypertensive population, each bar after this represents a percentage of that group. The arrows between bars represent the percentage of patients lost between each step for men and women separately. (c) Hypertension care cascade by age groups, PRESSCO 2020 study. The first bar represents the entire hypertensive population, each bar after this represents a percentage of that group. The arrows between bars represent the percentage of patients lost between each step for both age groups separately

associated more often with poor quality medicines, which may also result in ineffective treatment [32]. The SARA report indicated that antihypertensives were available in only 5% of healthcare facilities [40], highlighting the scarcity of essential NCD medicine medication in Sierra Leone. In addition, they reported that 19% of health facilities do not have

BP machines [40] indicating that a large part of patients cannot be properly treated or monitored.

A further reason for poor adherence to medication is personal and cultural beliefs. A study on community understanding of NCD and healthcare-seeking behaviour in Sierra Leone observed that participants hardly spoke of diseases

TABLE 2 Odds ratio for undiagnosed hypertension, PRESSCO 2020 study

Predictors	OR	95% CI	p value
Age categories (years)			
18–34	1		
35–44	0.49	0.17–1.38	0.176
45–54	0.26	0.10–0.70	0.008
55–64	0.22	0.08–0.63	0.004
65+	0.17	0.06–0.47	0.001
Sex			
Female	1		
Male	1.91	1.03–3.51	0.039
Ethnicity			
Mende	1		
Creole	0.58	0.11–3.11	0.527
Limba	0.27	0.11–0.66	0.004
Temne	0.74	0.33–1.65	0.462
Other	0.53	0.24–1.18	0.122
Education			
None	1		
Primary school	0.63	0.24–1.68	0.356
Secondary school	0.44	0.20–0.98	0.044
Tertiary or higher	1.09	0.39–3.05	0.877
Residential location			
Urban	1		
Rural	4.84	2.53–9.25	<0.001
Mobility			
No problems	1		
Problems walking	0.37	0.19–0.73	0.004
DM screening			
Yes	1		
No	2.25	0.95–5.34	0.066
Medical history			
Other	1		
CVA/ heart problems	0.17	0.03–0.84	0.030

Abbreviations: 95% CI, 95% confidence interval; DM screening, diabetes mellitus screening; OR, odds ratio.

as being chronic and generally approached healthcare services when they experienced symptoms, hoping for a quick cure and permanent solution [17]. Chronic conditions are sometimes attributed to spiritual causes such as evil spirits or witchcraft, resulting in care seeking from spiritual and traditional sources [17]. People also seek advice from family and friends with regard to which medical help should be sought, possibly resulting in seeking care from informal and traditional healers, using the formal healthcare system as a last resort [17] possibly in part due to the financial vulnerability [41].

Our results suggest that people who do not frequently visit formal healthcare facilities, either because they have no obvious medical reason to or because of care-seeking barriers, have a higher risk of being undiagnosed hypertensive. The opposite effect can be seen in our results as well; people who visit healthcare centres more often, for example people with a medical history of CVA, heart problems or problems with walking considered as a proxy of physical disability, have higher odds of being diagnosed with hypertension. This suggests that outreach care programmes focusing on cardiovascular risk factor screening and management might have the most impact on hypertension care, especially in increasing diagnosis. In some LMIC mobile health platforms show promise in promoting diagnosis, follow-up and medication adherence. However, in Sierra Leone connectivity is a problem, especially in rural areas, making this a less promising solution [42]. The use of broadcast media such as television or radio, as well as outdoor media, including print media which have been shown to disseminate health messages, could be employed in promoting NCD screening and management in these settings [43, 44]. In addition, it is important to invest in the training of community health officers (CHO's) for provision of care. This has been shown to be effective in the Bombali district in Sierra Leone, where training of CHO's on patient communication, diagnosis and management of hypertension for three months improved SBP and DBP [38]. A systematic review published in 2017 also showed that training community healthcare workers (CHW's) in prevention and control of NCDs increases favourable behaviour and impacts positively on biochemical risk factors for NCDs [45]. CHW's are present in almost every village and are, therefore, closer to the community in both distance and trust than CHO's in health facilities [45]. Other studies have shown that health workers can be effectively trained in cardiovascular risk prevention and management and that it is cost-effective for chronic disease care in LMIC [46, 47]. The sustainability of CHW programmes is a challenge [48]. Appropriate supervision, good relationship with health system management and securing adequate, and continuous funding have been suggested as ways to sustain the CHW programme [48, 49].

The implementation of CHW programmes can only improve the care for hypertension if people seek formal care. In order to increase retainment in the care cascade, improvements are needed in Sierra Leone's healthcare infrastructure and the provision of adequate equipment and antihypertensive medication at low costs in public care facilities. If patients cannot obtain or afford their medication, it becomes very difficult for them to control their hypertension, making education on prevention and lifestyle modification all the more important. Prevention in the form of population-based approaches such as health information and communication campaigns in combination with fiscal measures such as taxes on unhealthy foods have proven effective in reducing the burden of NCD in LMIC [50].

The primary strength of this analysis is the use of a care cascade approach in order to analyse the proportion of patients who reached each stage of hypertension in a national population-based survey in Sierra Leone.

Limitations of the current study relate to its cross-sectional nature and that the data, in part, relies on self-reported questions. We can, therefore, not exclude the possibility of recall bias and social acceptability bias. As we could not account for lifestyle treatment of hypertension [7, 11], underestimation of the performance of our study sample in the care cascade might have occurred. For example, there were 37 participants in our study who answered yes to the question 'having ever received a diagnosis of hypertension' but were excluded from our care cascade because they did not meet our definition of hypertension. Although this could have been pregnancy-induced hypertension or another form of temporary hypertension or a misdiagnosis, they could also have had hypertension and brought their BP under control with lifestyle modification. Another limitation of the study is that BP was measured on a single point in time, whereas hypertension is normally diagnosed based on several separate measurements [51]. Furthermore, the study did not properly account for informal urban settlements, as in our data, only three participants indicated to live in an urban slum, whereas only Freetown already has between 27 and 61 informal settlements [52]. Better consideration of this population might have narrowed the observed difference between the rural and urban population with regard to hypertension prevalence, diagnosis, treatment and control. Considering the limitations of this study, it is important that its findings are confirmed in other national cohorts including detailed information on health facility visits for screening and management of high blood pressure.

CONCLUSION

SSA countries in comparison with other LMICs have the lowest number of patients reaching each stage of the hypertension care cascade [7]. Sierra Leone is no exception; results in this study show that only 5% of hypertensive patients had their BP under control. Groups most at risk seem to be people who do not frequent a care facility, either because they have no need to or because of healthcare-seeking barriers. This suggests that increasing awareness of cardiovascular risk and risk factor screening for early diagnosis might have a large impact on hypertension care. Mass media campaigns in combination with training CHWs in prevention, diagnosis and control have proven to be effective in increasing diagnosis, follow-up and medication adherence and could assist to improve hypertension care; future studies to analyse the effect of these measures on the hypertension care cascade in Sierra Leone are recommended.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.