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Evaluating linkage to care for hypertension after community-based screening in rural Uganda

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Abstract

Objectives—To determine the frequency and predictors of hypertension linkage to care after implementation of a linkage intervention in rural Uganda.

Methods—During a multi-disease screening campaign for HIV, diabetes, and hypertension in rural Uganda, hypertensive adults received education, appointment to a local health facility and travel voucher. We measured frequency and predictors of linkage to care, defined as visiting any health facility for hypertension management within 6 months. Predictors of linkage to care were calculated using collaborative targeted maximum likelihood estimation (C-TMLE). Participants not linking were interviewed using a standardized instrument to determine barriers to care.

Results—Over 5 days, 2252 adults were screened for hypertension and 214 hypertensive adults received a linkage intervention for further management. Of these, 178 (83%) linked to care within 6 months (median = 22 days). Independent predictors of successful linkage included older age, female gender, higher education, manual employment, tobacco use, alcohol consumption, hypertension family history, and referral to local versus regional health center. Barriers for patients who did not see care included expensive transport (59%) and feeling well (59%).

Conclusions—A community health campaign that offered hypertension screening, education, referral appointment and travel voucher achieved excellent linkage to care (83%). Young adults, men, and persons with low levels of formal education were among those least likely to seek care.

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Keywords

hypertension; evaluation; community-based screening; rural; Uganda

INTRODUCTION

Community- and home-based HIV screening programs are cost-effective and successful methods to reach large numbers of previously untested individuals [1–7]. Given the high burden of other chronic diseases in sub-Saharan Africa, these innovative screening programs also are a unique opportunity to diagnose and treat individuals with diseases other than HIV, such as hypertension. This approach builds efficiency by leveraging resources invested in HIV testing campaigns as a platform to provide diagnostic services for non-communicable diseases (NCD) [8].

Hypertension is a high-burden NCD that is particularly well suited to community-based screening approaches given the ease and speed of sphygmomanometry. However, diagnosis is only the first step in the “cascade of care” that begins with diagnosis and proceeds to linkage, initiating therapy, retention, and eventual control of disease (summarized in Figure 1).

Data on retention of hypertensive patients through all steps in the care cascade in resource-limited settings are lacking. A previous study found low utilization of health care services after hypertension screening in Tanzania, but did not include a linkage intervention [9]. Only 32% follow-up was reported after hypertension and diabetes screening in Cameroon despite use of a linkage intervention [10]. Similarly, a recent study in Kenya found poor linkage to care after community-based screening (31%) but had a very small sample size (35 persons) [11]. To our knowledge, there has not been a robust assessment of hypertension linkage to care following community-based screening in sub-Saharan Africa.

The Sustainable East Africa Research in Community Health (SEARCH) collaboration has pioneered multi-disease screening that integrates HIV and NCD services through community health campaigns [8]. In a pilot campaign conducted in May 2011 in rural southwestern Uganda, we found a significant burden of untreated hypertension but inadequate follow-up after screening [8]. In an effort to understand the second step in the cascade of hypertension care, in this subsequent study we have tested a linkage strategy including education, referral appointment to a health facility and transport voucher. Using a community-based screening campaign, the primary objective of this study was to determine the frequency and predictors of hypertension linkage to care following implementation of a linkage intervention in rural Uganda. A secondary objective was to describe barriers to hypertension care in rural Uganda.

METHODS

Study design and setting

This was a prospective sub-study on hypertension linkage to care nested within a multi-disease community health campaign (CHC). The study was conducted in May 2012 in

Kakyerere parish, a community of approximately 6300 persons in Mbarara district in southwestern Uganda.

Community health campaign

This public health initiative brings rapid diagnostic services for multiple diseases to rural populations. The CHC is a high-throughput event staffed by local health personnel, offering services to all community members (approximately 1000 persons/day) at accessible community sites such as schools or churches. The campaign occurs over 5 days and each adult participant receives point-of-care screening for HIV, hypertension, and diabetes. Children are offered HIV testing, rapid diagnosis and treatment for malaria as well as deworming. The average transit time for the campaign is approximately 90 minutes. Our group previously described the implementation of a CHC in Mbarara, Uganda in 2011 [8].

Hypertension screening and study population

All community members were invited to participate in the CHC. Each adult responded to an epidemiologic survey ascertaining basic demographics, occupational and medical history, as well as substance use. Next, trained staff conducted blood pressure (BP) measurements using an electronic, automated sphygmomanometer (Honsun LD7A). Subjects were seated in a chair and rested for approximately one minute before BP was measured. High BP was defined as systolic BP ≥140 mmHg and/or diastolic BP ≥90 mmHg. Persons with high BP underwent two confirmatory measurements one minute apart. The lowest of three measurements was then used to establish a diagnosis of hypertension in order to minimize over-diagnosis (false positives) using a single BP measure. In addition, height (to the nearest 0.1 cm) and weight (to the nearest kilogram) were measured in order to calculate body mass index (BMI) for each participant. Point-of-care random plasma glucose and HIV rapid testing were also performed.

All adults at the CHC who were hypertensive on screening and self-reported not currently receiving antihypertensive therapy were invited to participate in the linkage to care sub-study.

Hypertension linkage intervention

The linkage to care intervention included education, referral appointment to a health facility and transport voucher. Each participant received an individualized counseling session with an experienced nurse which included education about the chronic nature of hypertension, possible complications of untreated disease, need for lifestyle modifications, and potential necessity for lifelong medications. Each session lasted 5–10 minutes and was performed by the same nurse for all subjects. Participants were then given a referral appointment to the nearest local health center (Bwizibwera Health Center IV) or the regional hospital (Mbarara Regional Referral Hospital) if hypertensive urgency was diagnosed (systolic BP ≥180 mmHg or diastolic BP ≥110 mmHg). Appointments were scheduled 3–30 days after screening.

The local health center was approximately 5 km away from Kakyerere parish, whereas the regional hospital was about 30 km away. The cost of a one-way journey to the local heath

center is approximately 2 United States Dollars (USD), while the cost for a one-way journey to the regional hospital is approximately 4 USD. Participants were given a travel voucher that could be reimbursed for a nominal amount upon successful linkage at the local health center or regional hospital. This amount was similar to the cost of a one-way journey: 5000 Ugandan Shillings (USh) (approximately 2 USD) for the local health center and 10000 USh (approximately 4 USD) for the regional hospital.

At either health facility, participants were treated per the Ugandan Ministry of Health guidelines. Government health facilities in Uganda are required to provide free services to all patients, including antihypertensive medication. Those with refractory hypertension or complications are usually referred to the regional hospital. However, these health facilities occasionally run out of medications, which forces patients to purchase medications from private retail pharmacies. Previously, the monthly cost of purchasing antihypertensive medicines has been estimated to be 1.1 Euros (1.4 USD) in a similar region [12].

Tracking

Linkage visits were captured using handwritten logbooks at the local health center and the referral hospital. Travel vouchers with unique study identifiers served to accurately identify participants who successfully linked to care. Participants who did not visit either health facility within 6 months were tracked to determine care status and assess barriers to care. We adapted tracking methods previously implemented in rural Uganda among patients with HIV [13].

A trained tracker conducted a standardized interview to assess care status and barriers to care. The tracker was given a list of subjects including their pertinent identifiers (name, sex, age, and occupation) and residence information (GPS coordinates and village). GPS coordinates were collected during a community-wide household census prior to the CHC. For participants who provided a cellphone number, the tracker first attempted to conduct a phone interview. If unable to conduct a phone interview or no phone number was available, the tracker visited participants at their home to determine care status. If the tracker failed to locate the participant on the first visit, at least two more attempts were made. Failing this, the tracker recorded care status information from close informants (family members, neighbors, or friends), if known.

Data analysis

Survey data at the CHC were collected via pre-programmed tablets. Tracking interview data were double entered into Microsoft Access. Stata v.12 (Stata Corporation) and R v.2.15.3 (R Core Team, 2013) were used for analyses.

Successful linkage to care was defined as visiting any clinic for hypertension care within 6 months. Factors analyzed as predictors of linkage to care were age, gender, level of education, occupation, smoking status, alcohol consumption, family history of hypertension, time to appointment, site of appointment (local health center or regional hospital), and severity of hypertension (Stage 1 or Stage 2). Stage 1 hypertension was defined as systolic BP 140–159 and/or diastolic BP 90–99 mmHg; and stage 2 hypertension was defined as systolic BP ≥160 or diastolic BP ≥100 mmHg [14].

For each predictor variable, collaborative-targeted maximum likelihood (C-TMLE) was used to estimate the marginal difference in the probability of linking, after adjusting for the other predictor variables [15]. C-TMLE was implemented instead of parametric logistic regression for several reasons. First, we wished to obtain point estimates on the additive scale, instead of estimates on the relative scale, such as odds ratios. Secondly, C-TMLE uses cross-validation and data-adaptive methods to minimize biased point estimates and inference that can arise from model misspecification. Briefly, data are split into so-called training and validation sets. Each *a priori*-specified algorithm (various parametric regressions or smoothing algorithms) is fit on the training set and its performance evaluated on the validation set. This obtains an "honest" measure of estimator performance and avoids over-fitting. The algorithm with the best performance or the best weighted combination of inputted algorithms is then used to obtain an initial estimate of the conditional probability of linking, given all the predictor variables. Next, these initial estimates are updated to further reduce bias and to obtain valid inference. This targeting step makes use of information in the so-called propensity score (the conditional probability of each predictor, given the remaining predictors). Using information in the propensity score can be especially important when the data are sparse and the outcome is rare. Consequently, C-TMLE is double-robust; it will yield a consistent estimate if either the conditional probability of linking or the propensity score is consistently estimated. Finally, C-TMLE averages over the remaining predictor variables to obtain a marginal estimate of the importance of each predictor on the probability of linking.

Ethics statement

All subjects provided written consent for participation. The study was reviewed and approved by the Makerere University School of Medicine Research and Ethics Committee, the Ugandan National Council on Science and Technology, and the UCSF Committee on Human Research.

RESULTS

4476 persons from Kakyerere parish attended the CHC; of these 2,282 were adults and 2,252 (99%) (mean/median age 48.5/45 years) were screened for hypertension and answered an epidemiologic survey at the CHC. 73 adults (3.2%) reported current use of antihypertensive medications; 281 adults had high BP on screening (12.5%) and did not report using antihypertensives. Risk factors associated with hypertension included age, gender, BMI, diabetes, alcohol consumption and family history, which have been discussed in a separate study [17].

During the CHC, 214 out of 281 participants eligible for the study received the linkage intervention, forming the study cohort. Due to lapses in staff communication to the participants, 67 persons left the campaign prior to receiving the linkage intervention.

Demographic characteristics of the study cohort are listed in Table 1. Briefly, participants were 47.2% women, mean/median age 51.2/49.5 years, 81.3% employed in manual occupations (mostly farming) and 1.9% HIV positive.

Linkage to Care

178 (83%) of the 214 participants who received the linkage intervention (the study cohort) visited a health facility for hypertension management within 6 months. Data was not available for the 67 persons who did not receive the linkage intervention; assuming none of these individuals linked to care, overall 63% (178/281) linkage was achieved.

Median time to linkage was 22 days (interquartile range: 14–24 days; n=163). Of the 36 participants in the study cohort who failed to link to care, 30 did not seek care while 6 were lost to follow-up (summarized in Figure 2).

Predictors of Linkage to Care

Among the study cohort, after multivariate adjustment, independent predictors of linkage to care included age, gender, education, occupation, tobacco use, alcohol consumption, family history, and appointment site. Adjusted risk differences (RD) along with 95% confidence intervals (CI) are given in Table 2.

Participants ≥60 years were more likely to link than those aged 18–29 years (RD = 36.9%, 95% CI 15.7, 58.2). There was no statistically significant difference in linkage between those aged 18–29 years, 30–44 years, and 45–59 years. Women had a 14.4% greater probability of linking than men (RD = 14.4%, 95% CI 5.2, 23.7). Increasing level of education was associated with an increase in the likelihood of successful linkage. Compared to those with no formal education, persons with tertiary education or beyond were the most likely to link to care (RD=19.7%, 95% CI, 8.7, 30.8) followed by those with secondary education (RD=11.1%, 95% CI 1.6, 20.5).

Manual workers, mostly farmers, were more likely to link than the unemployed (RD=18.5%, 95% CI 4.6, 32.3). Current tobacco use was associated with an increased probability of linkage to care (RD=11.4%, 95% CI 2.4, 20.4). Subjects with an alcohol consumption of ≥10 drinks per month were also more likely to link than those reporting no alcohol use (RD=11.4%, 95% CI 2.0, 20.7). Family history of hypertension was a significant predictor of linkage to care (RD=13.0%, 95% CI 5.7, 20.3). Finally, persons referred to the local health center were more likely to link than those referred to the regional hospital (RD=43.4%, 95% CI 35.9, 50.9).

In a separate secondary analysis including the 67 hypertensive persons who did not receive the linkage intervention, results were similar to the primary analysis. Independent predictors of linkage to care included age, gender, education, occupation, tobacco use, alcohol consumption, family history and receiving the linkage intervention (data not shown).

Barriers to Care

After tracking, 30 persons were confirmed to have not linked to care. Of these, 27 persons were interviewed and barriers to care assessed; 3 persons could not be interviewed and care status was determined by close informants' report. Feeling well (59%), expensive transportation (59%), transportation difficulty/inconvenience (33%), fear of being reprimanded by the clinic staff for missing a scheduled appointment (26%), family obligations (22%), and responsibilities at work (22%) were the most common barriers for

not linking to care (Table 3). Notably, no participant cited stigma as a barrier in open-ended interview questions.

DISCUSSION

High blood pressure is the leading risk factor for global disease burden and estimated to cause more than 9 million deaths per year [18]. Hypertension disproportionately affects the developing world – 80% of cardiovascular deaths occur in low- and middle-income countries [19,20]. Africa, in particular, has been noted to have the highest prevalence of hypertension among adults older than 25 years [21]. Early treatment of hypertension can reduce future complications such as heart disease, stroke, kidney disease, and retinopathy. However, a weak care cascade with inadequate screening, failure to link to care, and inability to adequately treat chronic disease leads to high morbidity, mortality, and lost economic output associated with NCDs like hypertension in developing nations [22].

We screened 2252 adults during a 5-day multi-disease screening campaign in rural Uganda and found that 63% of adults with untreated hypertension successfully linked to care within 6 months. Among the study cohort who received a linkage intervention, 83% linkage was achieved. This study provides the first sound estimate of the efficacy of a linkage to care intervention following community-based hypertension screening in sub-Saharan Africa. Our multi-disease screening approach also shows that efforts to scale up HIV testing and linkage at the community level can be successfully leveraged to identify and link persons with NCDs such as hypertension.

Within the context of a chronic care cascade for hypertension, this study illuminates the critical first steps of diagnosis and linkage-to-care. Our study identifies sub-populations most likely to be lost at the step following diagnosis. These data can inform targeted interventions to prevent loss of patients after community-based screening. Younger (18–29 years) persons were less likely to link to care than those ≥60 years. Although youth were less likely to engage in care, they represent a small percentage of the overall burden of hypertension in this community. On the other hand, men represent a large proportion of the hypertension burden, but were less likely to link to care than women. Interventions focusing on men are needed to enhance linkage from community-based screening campaigns.

Persons with little or no formal education had lower probability of linking to care than those with secondary or tertiary education. This finding emphasizes the need for increasing awareness and health literacy surrounding hypertension, perhaps through public health initiatives like the CHC. Higher linkage observed at the local health center compared to the regional hospital may be explained by their distance from Kakyerere parish. The local health center is significantly closer to the community (~5 km) than the regional hospital (~30 Km). Distance being an important consideration in a low-income setting where transport can be relatively expensive is understandable.

Interestingly, current tobacco users and persons consuming higher amounts of alcohol (≥10 drinks/month) were more likely to link to care. These persons are perhaps already at an increased risk for complications related to hypertension, such as heart disease and stroke. It

is likely that a community-based approach could be successful in reaching out to these high-risk groups. Family history also increased likelihood of linkage to care. Receiving encouragement or perhaps sharing the cost of a journey with a family member may contribute to this finding. Finally, manual laborers (mostly farmers), a large majority of this community, were more likely to link than the unemployed.

Tracking subjects who did not link allowed us to identify important barriers to care faced by rural Ugandans in our pilot study. Transportation expenses and inconvenience were prominent issues, which is consistent with expectations from a rural area with poor roads and accessibility [23]. Possible outreach could include decentralized care strategies such as home-based screening and treatment for patients living in especially remote areas. Likewise, feeling healthy or lack of symptoms was another common reason for failure to link. This has been reported previously in the HIV linkage to care literature as well [24,25]. Improving patient education surrounding asymptomatic hypertension seems essential to effectively link patients to care. Fear of being reprimanded by clinic staff was also a barrier to care and has been described as a barrier to retention in care for other diseases [26]. Sensitization efforts to promote therapeutic alliances and decrease “bad patient” labeling by health care workers are needed in this region.

We included travel vouchers in the linkage intervention, which likely boosted linkage frequency, but to an unknown extent. The amount of this voucher approximated the cost of a one-way journey to the health facilities and participants were still required to invest significant time and resources in order to link to care. Yet, this small voucher may have reinforced participants’ intrinsic motivations to seek care and substantially affected linkage frequency. It is possible that in the absence of travel vouchers linkage frequency may be reduced. Similar studies assessing linkage interventions without a travel voucher would help determine what fraction of linkage to care is attributable to transport reimbursement.

Although this study was population-based, limitations include loss of eligible subjects due to unintended operational deficiencies. Specifically, a temporal delay between receiving a diagnosis of hypertension and obtaining the linkage intervention may have confused some participants and led them to leave the CHC prematurely. Those who did not receive an appointment were more likely to be younger, though there were no significant differences by gender (data not shown). It is possible that the few subjects who did not receive the linkage intervention were also those at higher risk of failing to link. Moreover, since participation in the CHC was voluntary, it is possible that individuals with greater health-seeking tendencies came to the campaign, thereby contributing to the high frequency of linkage to care. Our pilot study included a relatively small number of hypertensive adults (n=214) and results should be interpreted cautiously. With only 36 subjects not linking to care and poor representation of certain predictor variables, estimation with standard logistic regression could result in over-fitting and biased point estimates. To minimize these risks and obtain reliable inference, we used C-TMLE with various penalized regression procedures and provide the first report on predictors of hypertension linkage to care in this region. Finally, given the need for streamlined hypertension screening during the CHC, BP measurement in our study was not in accordance with standard guidelines; however, by using the lowest of

three measurements we attempted to minimize misclassification bias resulting from using just a single BP measurement.

Despite these limitations, this study provides much needed insights into linkage to care. So far, limited studies have evaluated the care cascade for NCDs in sub-Saharan Africa. Nurse-led hypertension clinics in Cameroon retained only 14% of patients at one year with most dropouts occurring after the initial linkage visit [27]. In a similar setting, Labhardt et al. reported extremely low retention (18%) of hypertension and diabetes patients [28]. Though these few reports on retention in care have shown poor results, they also represent a key opportunity to further evaluate and improve all steps in the chronic care cascade. In fact, in a subsequent trial, Labhardt et al. reported a significant increase in retention rates at one year through low-cost interventions like treatment contracts and reminder letters for missed appointments [12].

In conclusion, a linkage strategy following community-based hypertension screening achieved excellent linkage to care (83%); identified young adults, men, and persons with low levels of formal education as least likely to link; and revealed transport costs and asymptomatic disease state as barriers to linkage in rural Uganda. However, further work is needed to elucidate the various aspects of the chronic care cascade for hypertension in this region. In the context of an ongoing community-based study in East Africa (NCT01864603) we are in the process of describing retention and re-engagement through all steps in the hypertension care cascade.

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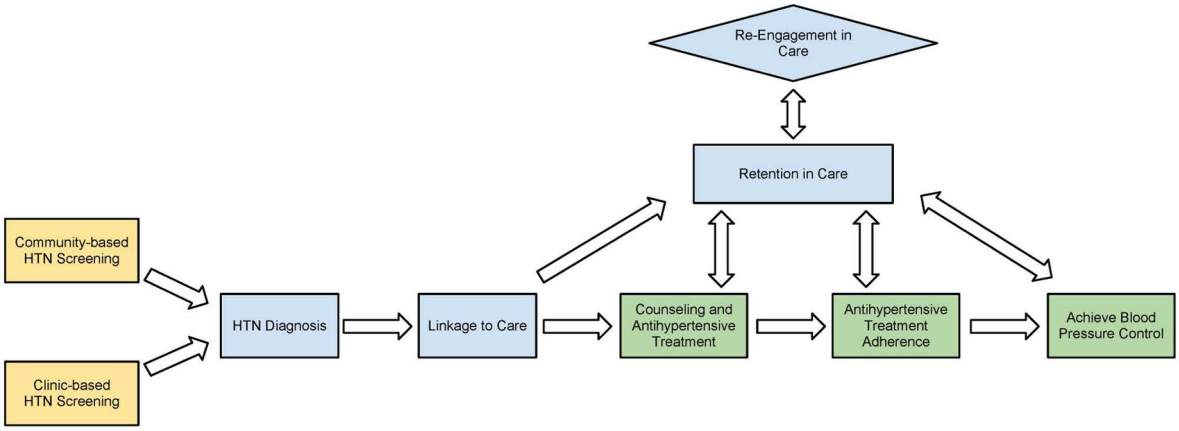

Figure 1. Hypertension care cascade

A concept map outlining each step involved in the successful treatment of hypertension. This process begins with community or clinic-based hypertension screening initiatives. Once hypertension is diagnosed, the next key steps - linkage, retention, and re-engagement - ensure continued engagement in care. These steps are crucial to retain patients in care and achieve successful blood pressure control.

HTN = hypertension.

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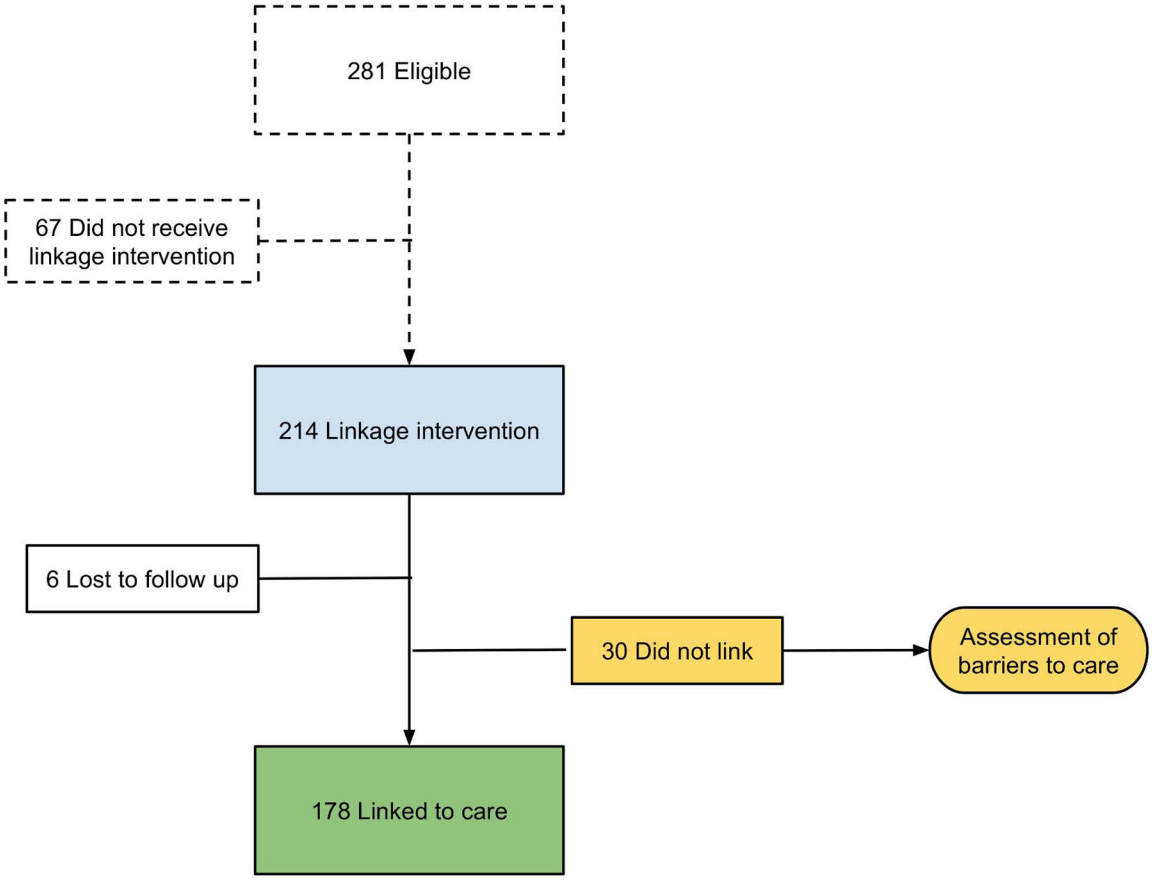

Figure 2. Study schema for the hypertension linkage to care intervention

281 adults from Kakyerere parish were eligible to participate in the study; however, 214 adults received the hypertension linkage to care intervention and formed the study cohort. 178 (83%) of these linked to care within 6 months. 30 subjects were determined to have not linked to care while 6 were lost to follow-up. Persons who did not link were tracked and interviewed to determine barriers to care.

Table 1

Demographic and clinical characteristics of study participants.

	N (%)		
	Total N=214	**Linked N=178**	**Not linked N=36**
Age (years)			
18–29	23 (10.8%)	15 (8.4%)	8 (22.2%)
30–44	63 (29.4%)	55 (30.9%)	8 (22.2%)
45–59	53 (24.8%)	46 (25.8%)	7 (19.4%)
≥60	75 (35.0%)	62 (34.8%)	13 (36.1%)
Gender			
Women	101 (47.2%)	86 (48.3%)	15 (41.7%)
Men	113 (52.8%)	92 (51.7%)	21 (58.3%)
BMI[a]			
≤25	146 (68.5%)	119 (67.2%)	27 (75.0%)
25–30	40 (18.8%)	33 (18.6%)	7 (19.4%)
≥30	27 (12.7%)	25 (14.1%)	2 (5.6%)
Blood pressure (BP, in mm Hg)			
Systolic BP Mean (SD)	154.5 (15.6)	154.9 (15.1)	152.8 (18.1)
Diastolic BP Mean (SD)	89.6 (12.5)	89.6 (12.3)	89.5 (14.0)
Severity of hypertension			
Stage 1 (140–159/90–99 mmHg)	140 (65.4%)	118 (66.3%)	22 (61.1%)
Stage 2 (≥160/≥110 mmHg)	74 (34.6%)	60 (33.7%)	14 (38.9%)
Occupation			
Unemployed	25 (11.7%)	16 (9.0%)	9 (25.0%)
Manual	174 (81.3%)	150 (84.3%)	24 (66.7%)
Sedentary	15 (7.0%)	12 (6.7%)	3 (8.3%)
Education level			
None	69 (32.2%)	55 (30.9%)	14 (38.9%)
Primary	95 (44.4%)	79 (44.4%)	16 (44.4%)
Secondary	38 (17.8%)	33 (18.5%)	5 (13.9%)
Tertiary and beyond	12 (5.6%)	11 (6.2%)	1 (2.8%)
Current tobacco user			
No	176 (82.2%)	143 (80.3%)	33 (91.7%)
Yes	38 (17.8%)	35 (19.7%)	3 (8.3%)
Alcohol use[b] (drinks per month)			
None	111 (52.1%)	91 (51.4%)	20 (55.6%)
0–10	49 (23.0%)	37 (20.9%)	12 (33.3%)
≥10	53 (24.9%)	49 (27.7%)	4 (11.1%)
HIV			
No	210 (98.1%)	175 (93.8%)	35 (97.2%)
Yes	4 (1.9%)	3 (1.7%)	1 (2.8%)

	N (%)		
	Total N=214	**Linked N=178**	**Not linked N=36**
Random blood glucose			
0–7	176 (82.2%)	145 (81.5%)	31 (86.1%)
7–11	34 (15.9%)	30 (16.8%)	4 (11.1%)
≥11.1	4 (1.9%)	3 (1.7%)	1 (2.8%)
Family history[c]			
No	160 (76.9%)	132 (75.9%)	28 (82.4%)
Yes	48 (23.1%)	42 (24.1%)	6 (17.6%)
Time to appointment			
0–2 weeks	60 (28.0%)	49 (27.5%)	11 (30.6%)
2–3 weeks	22 (10.3%)	18 (10.1%)	4 (11.1%)
3–4 weeks	132 (61.7%)	111 (62.4%)	21 (58.3%)
Appointment site			
Regional hospital	22 (10.3%)	17 (9.6%)	5 (13.9%)
Local health center	192 (89.7%)	161 (90.4%)	31 (86.1%)

[a] N=213

[b] N=213

[c] N=208

Table 2

Estimated risk differences from C-TMLE analysis. The asterisk indicates significance at the α=0.05 level (N = 207[a]).

	Proportion that linked to care (%)	Adjusted Risk Difference, RD (%)	95% CI	p-value
Age (years)				
18–29	15/23 = 65.2%	Ref	Ref	Ref
30–44	55/63 = 87.3%	19.0	(−3.4, 41.4)	0.096
45–59	46/53 = 86.8%	14.9	(−8.0, 37.8)	0.202
≥60	62/75 = 82.7%	36.9	(15.7, 58.2)	0.001*
Gender				
Men	92/113 = 81.4%	Ref	Ref	Ref
Women	86/101 = 85.2%	14.4	(5.2, 23.7)	0.002*
Education				
None	55/69 = 79.7%	Ref	Ref	Ref
Primary	79/95 = 83.2%	5.5	(−5.7, 16.7)	0.335
Secondary	33/38 = 86.8%	11.1	(1.6, 20.5)	0.021*
Tertiary and beyond	11/12 = 91.7%	19.7	(8.7, 30.8)	<0.001*
Occupation				
Unemployed	16/25 = 64.0%	Ref	Ref	Ref
Manual	150/174 = 86.2%	18.5	(4.6, 32.3)	0.009*
Sedentary	12/15 = 80.0%	1.7	(−14.6, 18.0)	0.840
Current tobacco use				
No	143/176 = 81.2%	Ref	Ref	Ref
Yes	35/38 = 92.1%	11.4	(2.4, 20.4)	0.013*
Alcohol (drinks/month)				
None	91/111=82.0%	Ref	Ref	Ref
0–10	37/49 = 75.5%	−7.0	(−20.2, 6.2)	0.299
>10	49/53 = 92.4%	11.4	(2.0, 20.7)	0.017*
Family history				
No	132/160 = 82.5%	Ref	Ref	Ref
Yes	42/48 = 87.5%	13.0	(5.7, 20.3)	0.001*
Time to appointment				
0–2 weeks	49/60 = 81.7%	Ref	Ref	Ref
2–3 weeks	18/22 = 81.8%	8.2	(−4.4, 20.7)	0.203
3–4 weeks	111/132 = 84.1%	−0.2	(−11.0, 10.6)	0.965
Appointment site				
Regional hospital	17/22 = 77.3%	Ref	Ref	Ref
Local health center	161/192 = 83.8%	43.4	(35.9, 50.9)	<0.001*
Severity of hypertension				
Stage 1	118/140 = 84.3%	Ref	Ref	Ref
Stage 2	60/74 = 81.1%	2.7	(−6.2, 11.6)	0.556

[a] Seven observations were removed due to missing data.

Table 3

Barriers to care identified during patient tracking (N=27).

Barrier	Number of responses N (%)
Medical	**19 (70%)**
I felt well and thought I didn't need care	16 (59%)
I felt too sick to come to clinic	2 (7%)
I have taken medicine for hypertension before and it did not help me feel better	2 (7%)
In the past, I have experienced side effects from antihypertensive medications	1 (4%)
I didn't want to take drugs forever	1 (4%)
I was afraid of side-effects from starting new medicines	0
I was taking too many pills a day	0
I was drinking alcohol	0
Access to Care	**17 (63%)**
Transportation was too expensive	16 (59%)
Transportation was too difficult or inconvenient	9 (33%)
Work and Family	**9 (33%)**
Work interfered with visiting clinic for review	6 (22%)
I had family obligations	6 (22%)
Clinic Factor	**8 (30%)**
I was afraid clinic staff would scold me for missing appointment	7 (26%)
The staff is not nice	1 (4%)
Inconvenient clinic hours	1 (4%)
The clinics frequently run out of medications ("stock- out")	0
The care is not good	0
It takes a long time to be seen at the clinic	0
The waiting area is not comfortable	0
Alternative Treatment and Advice	**0**
A family member or other important person told me to not go to clinic	0
Because I went to someone who tried/is trying to cure me by prayer/religious rituals	0
Because I saw/am seeing a traditional healer instead	0
Because I saw/am seeing a herbalist/nutritionist instead	0
Other	**6 (22%)**
I forgot my appointment	4 (15%)
Other	2 (7%)
Declines to answer	0