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Hypertension management in a population of older adults in rural South Africa

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Abstract

Objective—Assess awareness, treatment, and control of hypertension, as an indication of its management, in rural South Africa, especially regarding modifiers of these variables.

Methods—A population-representative sample of adults aged at least 40 years residing in the rural Agincourt subdistrict (Mpumalanga Province) covered by a long-term health and sociodemographic surveillance system was recruited. In-person interviews, physical exams, and dried blood spots were collected. Hypertension awareness, treatment, and control rates were assessed. A regression model was built to identify predictors of those outcomes.

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Conflicts of interest

There are no conflicts of interest.

Results—The mean age of the 2884 hypertensive participants was 64.1 ± 12.7 years. Hypertension awareness rate was 64.4%, treatment among those aware was 89.3 and 45.8% of those treated were controlled. Considering aware and unaware hypertensives, treatment rate was 49.7% and control 22.8%. In the multivariable regression model, awareness was predicted by female sex, age at least 60 years, higher social economic status, prior cardiovascular disease (CVD), nonimmigrant status, literacy, and physical limitation. Improved control among those treated was predicted by age at least 60 years. Blood pressure control among all hypertensive study participants was predicted by female sex, being HIV-negative, age at least 60 years, nonimmigrant status, and prior CVD.

Conclusion—High rates of awareness and treatment of hypertension as well as good levels of control were found in this population, probably explained by the long-term surveillance program conducted in the area. Considering the predictors of hypertension management, particular attention should be given to men, residents younger than 60 years, immigrants, and study participants without CVD as these characteristics were predictors of poor outcome.

Keywords

awareness; control; hypertension; rural population

INTRODUCTION

Hypertension is the leading risk factor for cardiovascular disease (CVD) and premature death globally [1]. In the United States, compared with other dietary, lifestyle, and metabolic risk factors, high blood pressure (BP) is the leading cause of death in women and the second highest in men, after smoking [2]. It was estimated that 80% of the global mortality attributable to high BP would occur in low and middle-income countries [3]. Even with these numbers, the prevalence of hypertension is increasing in these countries [4], making this condition one of the major health policy challenges.

In much of sub-Saharan Africa, and South Africa in particular, cardiovascular risk factors are increasingly common, but remain poorly characterized. As treatment and care for other communicable diseases like HIV increase and the epidemiologic transition continues to unfold, it is likely that the rates and impact of noncommunicable diseases will only increase [5]. Hypertension is one of the primary contributors to downstream events, such as stroke [6] and myocardial infarction, which can be catastrophic to both individuals and the resource-deficient health systems that provide their care [7–9]. According to a recent South African National Health and Nutrition Examination Survey (SANHANES) hypertension prevalence is estimated at 30.4% with significant regional and demographic variation and increasing prevalence by age [10,11]. Adding another level of complexity to this unique health milieu in South Africa is the high prevalence of HIV/AIDS and how it interacts with screening and caring for other diseases, particularly noncommunicable diseases [12].

In juxtaposition to this known rising threat, the medical and public health communities need more information about variations and trends regarding the prevalence and particularly modifiers of awareness, treatment, and control of hypertension.

It was with this paucity of information on the detection and management of cardiovascular risk factors, including hypertension, that the cardiometabolic disease in an Aging South African Cohort within the Health and Aging in Africa: Longitudinal Studies of an INDEPTH Community (HAALSI) Program was developed. The expressed purpose of this cohort was to understand the major forces in rural South Africa that drive changes in the prevalence, incidence, and risk factors of cardiometabolic disease with the ability to compare individual self-reported data with anthropometric and laboratory assessments. This was done by recruiting a cohort of over 5000 men and women at least 40 years of age in a robust Health and socio-Demographic Surveillance System (HDSS) setting in Agincourt subdistrict, rural South Africa. The findings from the initial, 2015, survey of this cohort are presented below as they pertain to hypertension prevalence, awareness, treatment, and control. It is hoped that our analysis of this cohort will be able to provide practical and specific recommendations in public health policy and clinical practice in South Africa and, potentially, elsewhere in sub-Saharan Africa given the rapid health transitions underway.

METHODS

The HAALSI study is based in the HDSS site, a sub-district of rural Mpumalanga Province comprising some 115 000 people living in 21 000 households and 31 villages in an area of ~450 km². An annual census update, conducted by experienced local field staff, provides up-to-date denominator data on the full population with systematic recording of all vital events (deaths, births, in/out-migrations).

Eligibility

All adults aged 40 years and older who had permanently resided in the Agincourt subdistrict (Mpumalanga Province) for at least 1 year prior to the 2013 census update were eligible.

Sampling and sample size

A total of 6281 persons were identified for recruitment from the HDSS database using random sampling based on the 2013 Agincourt sub-district census data.

Ethics approval

The study received ethical approvals from the Ethics Committees of three institutions directly involved in the project.

Recruitment and follow-up

Prior to the survey, the HAALSI study was introduced to community members across the study villages, and discussed with a representative Community Advisory Group. This facilitated community review of study objectives and contributed to the effective response achieved.

Between November 2014 and November 2015 all identified individuals were visited at home by a supervised local field worker who briefly described the study in the local language (xiTsonga), and requested permission to read and explain the relevant informed consent forms. Those who agreed to participate signed a consent form or, if not able to sign their

name, were asked to have a literate witness sign and date the informed consent on their behalf. Field workers also signed and dated the informed consent form. The first follow-up telephone call (to sustain cohort participation) was made to all participants 6 months after the interview and future follow-up calls will be made at 6-month intervals.

Data collection

Interviews lasting 2–3 h were conducted in participants' homes. The visit included a questionnaire in two parts: household and socioeconomic data then individual interview data; followed by anthropometric, physical, and cognitive functioning assessments and a blood sample collection in the form of dried blood spots and capillary samples for point of care tests. Data were captured on laptop computers using a Computer Assisted Personal Interview program. Data collected included BP (Omron M6W automated cuff; Omron, Kyoto, Japan), weight (Genesis Growth Management Electronic Scale (Johannesburg, South Africa); height using a height sensor with infrared measurement; waist and hip circumferences with a flexible tape measure (SECA, Hamburg, Germany). Blood drops were collected via finger prick on Whatman 903 paper (Whatman, Buckinghamshire, UK) and used to measure HIV status (1–3 drops), glucose in point of care machines (Caresense N Monitor, Seoul, Korea) and individual lipid levels (Cardiocheck PA Silver version; Indianapolis, Indiana, USA). Three BP readings (SBP and DBP) were obtained with 2 min between each reading and the mean BP was calculated using the average between the second and third reading [13]. Age stratification followed the SANHANES categorization, whereas BMI in kg/m^2 and obesity were categorized using WHO cutoffs [14]. Waist-to-hip ratios were considered high if more than 0.90 for men, and more than 0.85 or women, respectively [15]. Hypertension was defined as a mean SBP at least 140 mmHg or mean DBP at least 90 mmHg [16]. Fasting blood glucose required no caloric intake for at least 8 h prior to the collection of the blood sample and was calculated as the reported difference between the time of the participant's last meal and the time of the interview. Self-reported current medication use for hypertension, diabetes, dyslipidemia, angina, stroke, heart failure, and HIV (antiretroviral) was also obtained during the interview. Clinical determination of HIV status was determined by first using the Vironostika Uniform 11 (Marcy l'Etoile, France) screening assay. Negative results were assigned a HIV-negative status, whereas positive results triggered a second (confirmatory) test using the Roche Elecys (Indianapolis, Indiana, USA) assay to determine the viral load. If both screening and confirmatory tests were weak positive, a final status of HIV-positive was assigned and the viral load subsequently calculated. If the screening and confirmatory tests yielded opposing results, a third assay was run on the Siemens Centaur XP (Erlangen, Germany) immunoassay. This third test served as the tie-breaker to determine a final HIV-positive or negative status, in accordance with WHO guidelines [17,18]. HIV-positive status was defined as a self-reported history of being informed of the condition by a health professional or positive result on assay analysis. We chose this broader definition, even though a percentage of those who self-report HIV-positive were negative on testing, because the belief of being HIV-positive by the individual may have influenced health seeking behavior positively or negatively. Physical limitation was assessed by self-reported presence or absence of limitations in activities of daily living (excluding difficulty in dressing as activities of daily living) [19]. Socioeconomic status (SES) is a composite, constructed variable incorporating measures of traditional and modern

wealth captured in the computerized questionnaire, using methodology created for Demographic Health Surveys divide in five quintiles — higher SES included fourth and fifth higher quintiles [20,21]. Immigrants were defined as the study participants who were born outside South Africa. Illiteracy was defined as self-report of not being able to read or write.

‘Awareness’ was captured in persons with a self-reported history of being informed of the condition by a health professional. The subset of persons reporting medication use among those aware of their condition was defined as those being treated. Finally, those deemed as having their condition under control were defined as the subset of persons who met target levels while taking medication for the given condition; ‘total control’ included all those defined as hypertensive, whether aware or not of the condition, with their BP under control.

Analyses

All analyses were conducted using STATA V14 software (StataCorp., College Station, Texas, USA). In the bivariate analysis the χ^2 test was used to compare variables presented in absolute numbers and percentages. A multivariable regression model was built to identify predictors of awareness, treatment, and control among the treated patients; and control among all the hypertensive patients. The variables included as predictors in the model were the same as those assessed in the bivariate analysis. The results are presented using odds ratios and 95% confidence intervals; level of significance was set as 5%.

RESULTS

Among the 5890 respondents who were alive and residing in the area at the time of recruitment, 5059 (85.9%) agreed to participate, 430 refused (7.3%), 353 (6.0%) were not located, and 48 (0.8%) were unable to participate. The mean age of the population was 61.7 years with the hypertensive study participants being older (64.1 years). The mean BMI was 27.5 kg/m² and was higher in women when compared to men (29.6 versus 25.1 kg/m²). Clinical and laboratory-based characteristics of these participants are summarized in Table 1.

Collectively, 58.4% of study participants met criteria for hypertension, with women (61.6%) more likely to be hypertensive than men (54.5%). Of the 2884 hypertensive study participants identified in the sample, 64.4% were aware of their disease, 89.3% of those aware were receiving pharmacologic treatment and 45.8% of those under treatment had their BP under control (Table 2). When considering the overall hypertensive population and not only those who were aware of the condition, the number of patients receiving treatment dropped to 49.7%. The overall control rate verified among treated and untreated hypertensive subjects was 22.8%. (Figure 1)

From bivariate analysis, we found that awareness was significantly higher in study participants who were female, at least 60-year old, nonimmigrant, of higher household SES, living with CVD-associated conditions, or with physical limitations. There was no effect modification identified per bivariate analysis of engagement in treatment. The only statistically significant modifier of successful control of those being treated was age at least 60-year old. Positive modifiers of successful BP control among all hypertensive study participants included: female sex, age at least 60 years old, nonimmigrant status, of higher

household SES, and living with CVD-associated conditions. Rates of awareness, treatment, control and overall control of hypertensive participants, stratified by multiple modifiers, are displayed in Table 3.

Results from multivariable regression models are summarized in Table 4. The probability of being aware was found to be significantly higher in study participants who were female, age at least 60 years old, of higher household SES, and living with CVD-associated conditions. On the other hand, awareness was lower in people who were immigrants, those who reported being illiterate, and in participants with no physical limitation. Improved control among those treated was only predicted by being at least 60 years old. Successful BP control within all hypertensive study participants was predicted by female sex, being HIV-positive, age at least 60 years old, nonimmigrant status, and living with CVD-associated conditions.

DISCUSSION

The HAALSI cohort aids in characterizing a middle-aged and older adult population with a high burden of hypertension as having good awareness of their condition, with a moderate level of control in a low and middle-income countries setting. Our assessment included the extent of control among all participants, that is, control among both treated and untreated participants (who showed poorer control rates). None of the variables in our analysis were significant predictors of treatment, and only higher age (> 60 years) was associated with effective control. The predictors of 'awareness' were being female, older age, higher household SES, literacy, absence of physical limitations, presence of CVD, and nonimmigrant status. Hypertension control in the full cohort was predicted by being female, HIV-negative status, older age, nonmigrant status, and presence of CVD.

Awareness, treatment, and control of hypertension have been sporadically assessed in South Africa. Little progress has been demonstrated over the last two decades, with only 25–42% of patients being treated and 30–49% of those under treatment being controlled [22–24]. The rates of control of all hypertensive patients in the HAALSI cohort were similar to the 48% control rate which the Center for Disease Control and Prevention has found for patients in the United States of America in the NHANES [25]. However, overall control rates are higher in the United States because of better awareness. Another common aspect is that both cohorts demonstrate a negative effect of being immigrant as well as a protective effect from the presence of comorbid conditions including disability [25].

In 1998, a South African national survey found that awareness, treatment, and control of hypertension were higher in women (51, 36, and 18%, respectively) than men (26, 21, 10%) with ethnicity suggesting a modifying effect which was not statistically significant [26,27]. Positive determinants of awareness, treatment, and control in South Africa reported in the existing literature include higher SES, advanced age, greater contact with primary care, and female sex [28,29]. Additionally, a 2008 survey estimated national rates of awareness (38.1%), treatment (32.7%), and control (17.1%) to be fairly similar to the decade prior, with increasing awareness and treatment associated with age and contact with health care; the only modifier of control was secondary education [28]. It has also been shown that treatment adherence is directly correlated with socio-economic status by quintile, from 10% in the

lowest to 80% in the highest quintile [29]. Although some determinants of awareness, treatment and control of hypertension in our cohort are similar to previously published data, the awareness and treatment rates, and the control levels assessed are much higher. This may in part be explained by the extensive population health surveillance [30] undertaken in the Agincourt subdistrict since 1992, with an ongoing focus on stroke and hypertension for well over a decade [31], as demographic and economic characteristics of this population (that could explain these differences) are similar to other rural populations in South Africa [11]. If so, further assessment of what features of the surveillance system and related intervention–research is scalable at the national level could prove highly relevant to policy.

A particular aspect that requires focus is the sub-optimal level of control. As almost 90% of the hypertensive patients who were aware of their condition were receiving treatment, the 45.8% BP control level could be improved. Aspects related to health system deficiencies, patients' adherence to medication and physicians' inertia play a role on the African continent [32]. Limited availability of anti-hypertensive medication and distance to health facilities as reported in some studies, are common characteristics of the health systems from these areas compromising the achievement of BP control [33,34]. On the other hand, lack of time and competing priorities are classical patient and clinician factors adding to the problem [35].

Health policy addressing hypertension and its control should consider the impact of socioeconomic factors on health-seeking behaviors. First, participants who reported themselves as being unable to read or write, immigrants, and those from households with lower SES were less likely to be aware of their condition. Educational and socioeconomic conditions have been shown [28,29,32] to be directly associated with awareness of hypertension, and strategies to link these groups more effectively to the health system should be addressed. Immigrants appear especially vulnerable. This association was not a focus in prior studies [32] and warrants closer investigation of whether migrant status is related to a worse health states in South Africa, and other Sub-Saharan countries. A deeply concerning aspect is the poor outcomes observed in younger subjects (<60 years). These findings highlight the threat of premature cardiovascular events in this population and demand urgent measures to prevent and mitigate the impacts of such events [36].

An important aspect relevant to health policy is the lower chance of HIV-positive study participants having their BP under control. As the life expectancy of people living with HIV/AIDS is increasing with the use of highly active anti-retroviral therapies, the prevalence of CVD will likely increase in this population [37]. Although these patients often receive more care, either the disease itself or highly active antiretroviral therapies may lead to diminished control or adherence to hypertension treatment medications. Effectively managing cardiovascular risk factors and CVDs is vital in this subset of patients.

A limitation of this study that can also be seen as an interesting context consideration is the fact that the sub-district from which the HAALSI cohort was drawn is underpinned by a HDSS initiated in 1992. Based on an annual update of resident status and vital events, it supports multiple investigations into the causes and consequences of complex health, population, and social transitions. Observational work includes cohorts focusing on different

stages along the life course, evaluation of national policy at population, household and individual levels, and examination of household responses to shocks and stresses and the resulting pathways influencing health and well being [30]. This fact creates a specific situation of healthcare surveillance that may misrepresent the results of hypertension awareness, with overrated awareness prevalence. On the other hand, it raises the possibility that an adequate surveillance system can be effective in linking participants to the primary healthcare system and raising awareness of their condition.

Strength of this analysis is that it addresses two conditions that were not assessed in previous studies [36]: migrant status and HIV status. These conditions must be included in future work to further our understanding of their impact on hypertension and overall CVD management.

Another important point is the fact that the predictors of hypertension management were also investigated. This approach allows healthcare providers that deal with this kind of population to target their efforts on study participants with specific characteristics aiming to achieve better results when dealing with hypertensive patients in clinical practice [38].

In conclusion, in this cross-sectional baseline analysis of a rural sub-Saharan African population, 64.4% of participants with hypertension were aware of the diagnosis, treatment was initiated in 89.3% of the hypertensive population, BP was controlled among 45.8% of those being treated and in 22.8% of the overall hypertensive population. These findings, which are comparable with data from high-income countries and better than findings recorded elsewhere in the region, suggest that hypertension management may be improved by a long-term surveillance program with a particular focus on cardiovascular risk. Considering the predictors of hypertension management, particular attention should be given to males, age younger than 60 years, immigrants and study participants without CVD as these characteristics were predictors of poorer outcomes on at least two measures of effective hypertension management.

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Abbreviations

BP blood pressure

CVD	cardiovascular disease
HAALSI	Health and Aging in Africa Longitudinal Studies of INDEPTH Communities
HDSS	Health and socio-Demographic Surveillance System
hsCRP	high-sensitivity C-reactive protein
NHANES	National Health and Nutrition Examination Survey
RBG	random blood glucose
SES	socioeconomic status
SSA	sub-Saharan Africa

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FIGURE 1.

Awareness, overall treatment, and overall control of hypertension among the HAALSI hypertensive population ($n = 2884$). Hypertension defined as SBP at least 140 mmHg or DBP at least 90 mmHg or reports current use of antihypertensive medication. HAALSI, Health and Aging in Africa Longitudinal Studies of INDEPTH Communities.

Health and Aging in Africa Longitudinal Studies of INDEPTH Communities Cohort characteristics: Agincourt subdistrict, South Africa 2015

TABLE 1

Indicator	All			Male			Female			Hypertensive		
	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Age (years)	5059	61.7	13.06	2345	61.7	12.79	2714	61.7	13.30	2884	64.1	12.72
Weight (kg)	4786	71.5	18.16	2211	70.0	16.90	2575	72.7	19.09	2749	74.3	18.66
Height (m)	4685	1.61	10.12	2160	1.68	9.33	2525	1.58	8.17	2691	1.62	10.35
BMI (kg/m ²)	4680	27.5	9.97	2156	25.1	9.15	2524	29.6	10.17	2688	28.8	10.95
Average SBP (mmHg)	4895	138.0	23.34	2260	137.9	23.45	2635	138.1	23.25	2843	150.2	22.06
Average DBP (mmHg)	4895	82.1	12.71	2260	81.9	13.20	2635	82.3	12.26	2843	87.4	12.82
Lab glucose (mmol/l)	4626	6.67	3.16	2130	6.49	3.01	2496	6.83	3.28	2695	6.96	3.46
Total cholesterol (mmol/l)	4196	4.24	1.26	1886	4.03	1.18	2310	4.40	1.30	2462	4.38	1.28
High-density lipoprotein (mmol/l)	4234	1.57	0.55	1911	1.55	0.59	2323	1.59	0.50	2484	1.55	0.53
Triglycerides (mmol/l)	4223	1.76	1.57	1903	1.73	2.09	2320	1.78	0.95	2480	1.84	0.98
Low-density lipoprotein (mmol/l)	3841	2.12	1.50	1714	1.98	1.94	2127	2.23	1.02	2259	2.20	1.01

Point-of-care (random) glucose.

TABLE 2

Hypertension in rural South Africa: awareness, treatment, and control among the Treated in the Health and Aging in Africa Longitudinal Studies of INDEPTH Communities hypertensive population, Agincourt, South Africa 2015

	Number of participants (%)			
	Total	Awareness	Treatment among aware	Control among treated
Hypertension	2884	1857 (64.4)	1434 (89.3)	657 (45.8)

Hypertension is defined as SBP at least 140 mmHg or DBP at least 90 mmHg or reports current use of antihypertensive medication.

Assessment of awareness, treatment, control among all the Health and Aging in Africa Longitudinal Studies of INDEPTH Communities hypertensive population by individual predictors, Agincourt, South Africa 2015

TABLE 3

	Overall		Awareness		Treatment		Control		Total control	
	N	%	N (%)	P	N (%)	P	N (%)	P	N (%)	P
Gender	2884									
Male	1239	42.96	697 (56.30)	<0.001 ^a	514 (88.30)	0.341	222 (43.20)	0.136	222 (17.92)	<0.001 ^a
Female	1645	57.04	1160 (70.50)		920 (89.80)		435 (47.30)		435 (26.40)	
HIV status	2879									
HIV-positive	465	16.15	299 (64.30)	0.981	229 (91.60)	0.194	107 (46.72)	0.869	107 (23.01)	0.743
HIV-negative	2414	83.85	1553 (64.36)		1201 (88.83)		547 (45.55)		547 (22.66)	
Elderly	2884									
Yes	1778	61.65	1218 (68.54)	<0.001 ^a	994 (90.04)	0.152	482 (48.49)	0.002 ^a	482 (27.11)	<0.001 ^a
No	1106	38.35	639 (57.78)		440 (87.65)		175 (39.77)		175 (15.82)	
Immigrant	2882									
Yes	837	29.04	492 (58.85)	<0.001 ^a	366 (87.14)	0.100	156 (42.62)	0.156	156 (18.64)	0.001 ^a
No	2045	70.96	1363 (66.65)		1066 (90.03)		500 (46.90)		500 (24.45)	
SES	2884									
Lower	1621	56.21	994 (61.32)	<0.001 ^a	759 (88.56)	0.315	342 (45.06)	0.542	342 (21.10)	0.015 ^a
Higher	1263	43.79	863 (68.38)		675 (90.12)		315 (46.67)		315 (24.94)	
Illiterate	2884									
Yes	1246	43.20	794 (63.78)	0.533	632 (89.14)	0.862	296 (46.84)	0.492	296 (23.76)	0.276
No	1638	56.80	1063 (64.90)		802 (89.41)		361 (45.01)		361 (22.04)	
CVD	2884									
Yes	448	15.53	362 (80.80)	<0.001 ^a	295 (89.94)	0.670	134 (45.42)	0.879	134 (29.91)	<0.001 ^a
No	2436	84.47	1495 (61.40)		1139 (89.12)		523 (45.92)		523 (21.47)	
PL	2883									

	Overall		Awareness		Treatment		Control		Total control	
	N	%	N (%)	P	N (%)	P	N (%)	P	N (%)	P
Yes	283	9.81	210 (74.20)	<0.001 ^a	170 (89.95)	0.756	74 (43.53)	0.524	74 (26.15)	0.155
No	2600	90.19	1647 (63.35)		1264 (89.20)		583 (46.12)		583 (22.41)	

Hypertension defined as SBP at least 140 mmHg or DBP at least 90 mmHg or reports currents use of antihypertensive medication.

HIV status defined as self-report or positive on assay analysis.

Age at least 60 years.

Immigrants defined as the study participants who were born outside South Africa.

Variable constructed incorporating measures of wealth, using methodology created for Demographic Health Surveys divide in five quintiles — higher SES included fourth and fifth higher quintiles.

Illiterate defined as self-report of not being able to read or write.

CVD (self-report of Stroke or Myocardial Infarction or Angina or Angina by Rose criteria).

Physical limitations activities of daily living limitations.

CVD, cardiovascular disease; PL, physical limitation; SES, socioeconomic.

^aStatistically significant at $\alpha = 0.05$.

TABLE 4

Multivariable predictors of awareness, treatment, control among treated, and control among all the Health and Aging in Africa Longitudinal Studies of INDEPTH Communities hypertensive population

Variable	Awareness		Treatment		Control among treated		Control among all	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Gender (female)	2.00 (1.70–2.37)	<0.001 ^a	1.22 (0.87–1.71)	0.257	1.23 (0.98–1.54)	0.078	1.75 (1.44–2.12)	<0.001 ^a
HIV positive	0.83 (0.66–1.03)	0.091	0.64 (0.39–1.06)	0.078	0.83 (0.62–1.12)	0.226	0.76 (0.59–0.97)	0.031 ^a
Elderly	1.81 (1.52–2.15)	<0.001 ^a	1.41 (0.97–2.02)	0.059	1.51 (1.18–1.93)	0.001 ^a	2.20 (1.78–2.71)	<0.001 ^a
Immigrant	0.82 (0.68–0.98)	0.033 ^a	0.78 (0.54–1.13)	0.193	0.85 (0.66–1.09)	0.209	0.75 (0.60–0.93)	0.010 ^a
SES (higher)	1.31 (1.10–1.55)	0.002 ^a	1.12 (0.81–1.59)	0.447	1.04 (0.83–1.29)	0.721	1.19 (0.99–1.43)	0.069
Illiterate	0.74 (0.61–0.89)	0.001 ^a	0.94 (0.65–1.35)	0.741	0.99 (0.78–1.26)	0.966	0.89 (0.72–1.09)	0.263
CVD	2.39 (1.85–3.08)	<0.001 ^a	1.08 (0.72–1.61)	0.714	0.97 (0.75–1.26)	0.823	1.40 (1.11–1.77)	0.004 ^a
PL (absence)	0.65 (0.48–0.87)	0.004 ^a	0.95 (0.57–1.60)	0.859	1.21 (0.86–1.69)	0.269	0.95 (0.71–1.28)	0.755

Hypertension defined as SBP at least 140 mmHg or DBP at least 90 mmHg or reports currents use of antihypertensive medication.

HIV status defined as self-report or positive on assay analysis.

Age at least 60 years.

Immigrants defined as the study participants who were born outside South Africa.

Variable constructed incorporating measures of wealth, using methodology created for Demographic Health Surveys divide in five quintiles — higher SES included fourth and fifth higher quintiles.

Illiterate defined as self-report of not being able to read or write.

CVD (self-report of stroke or myocardial infarction or Angina or Angina by Rose criteria)

Physical limitations activities of daily living limitations.

CI, confidence interval; CVD, cardiovascular disease; OR, odd ratio; PL, physical limitation; SES, socioeconomic status.

^aStatistically significant at $\alpha = 0.05$.