Traditionally, sub-Saharan Africa (SSA) has been affected predominantly by maternal and perinatal disease, infectious communicable conditions, and nutritional deficiencies. However, during recent years, the burden of noncommunicable diseases, such as cardiovascular disease (CVD), has been added to the challenges that health systems from this region face. In 1990, CVD and other major chronic diseases accounted for \(\approx 28\%\) of morbidity and \(35\%\) of mortality in SSA, but by 2020, it is projected that these will rise to \(60\%\) and \(65\%\), respectively.3 Although CVD is not yet the leading cause of death in SSA, age-specific CVD mortality and morbidity are already higher in some parts of the region than in many developed countries.3 Therefore, promotion of cardiovascular health and CVD prevention in an effort to mitigate the observed adverse trends in CVD is an immediate necessity.4

Background—Optimal secondary prevention is critical for the reduction of repeated cardiovascular events, and the control of cardiovascular risk factors in this context is essential. Data on secondary prevention of cardiovascular disease (CVD) in sub-Saharan Africa are needed to inform intervention strategies with a particular focus on local disparities. The aim of this study was to assess CVD management in a rural community in northeast South Africa.

Methods and Results—We recruited adults aged \(\geq 40\) years residing in the Agincourt subdistrict of Mpumalanga province. Data collection included socioeconomic and clinical data, anthropometric measures, blood pressure, human immunodeficiency virus status, and point-of-care glucose and lipid levels. CVD was defined as self-report of myocardial infarction and stroke or angina diagnosed by Rose Criteria. A linear regression model was built to identify variables independently associated with the number of cardiovascular risk factors controlled. Of 5059 subjects, 592 (11.7\%) met CVD diagnostic criteria. Angina was reported in 77.0\% of these subjects, stroke in 25.2\%, and myocardial infarction in 3.7\%. Percent controlled of the 5 individual risk factors assessed were as follows: tobacco 92.9\%; blood pressure 51.2\%; body mass index 33.8\%; low-density lipoprotein 31.4\%; and waist-to-hip ratio 29.7\%. Only 4.4\% had all 5 risk factors controlled and 42.4\% had \(\geq 3\) risk factors controlled. Male sex (\(\beta\) coefficient=0.44; 95\% confidence interval, 0.25–0.63; \(P<0.001\)), absence of physical disability (\(\beta\) coefficient=0.40; 95\% confidence interval, 0.16–0.65; \(P=0.001\)), and socioeconomic status (\(\beta\) coefficient=0.10; 95\% confidence interval, 0.01–0.19; \(P=0.035\)) were directly associated with the number of risk factors controlled.

Conclusions—Currently, CVD is not being optimally managed in this rural area of South Africa. There are significant disparities in control of CVD risk factors by sex, socioeconomic status, and level of disability. Efforts to improve secondary prevention in this population should be focused on females, subjects from lower socioeconomic status, and those with physical disabilities. (Circ Cardiovasc Qual Outcomes. 2017;10:e004094. DOI: 10.1161/CIRCOUTCOMES.117.004094.)

Key Words: aging ■ body mass index ■ cardiovascular diseases ■ secondary prevention ■ South Africa
It is well established that optimal secondary prevention is critical for the reduction of repeated cardiovascular events, and the control of cardiovascular risk factors in this context is essential.\(^5\) Many studies have assessed the prevalence of cardiovascular risk factors in sub-Saharan Africa, and the control of established cardiovascular disease, has become an increasing challenge for health systems in sub-Saharan Africa.\(^6\) The burden of noncommunicable diseases, such as cardiovascular disease, has become an increasing challenge for health systems in sub-Saharan Africa.\(^7\) For cardiovascular disease in this region, optimal secondary prevention is critical for the reduction of repeated cardiovascular events and the control of cardiovascular risk factors.\(^8\) To date, few studies have focused on the management of established cardiovascular disease in sub-Saharan Africa.

**WHAT IS KNOWN**

- The burden of noncommunicable diseases, such as cardiovascular disease, has become an increasing challenge for health systems in sub-Saharan Africa.
- For cardiovascular disease in this region, optimal secondary prevention is critical for the reduction of repeated cardiovascular events and the control of cardiovascular risk factors.
- To date, few studies have focused on the management of established cardiovascular disease in sub-Saharan Africa.

**WHAT THE STUDY ADDS**

- Despite the growing prevalence of cardiovascular disease in sub-Saharan Africa, we found that secondary prevention is currently suboptimal, especially for the outcome of control of all cardiovascular risk factors.
- Fewer than 5% of our study population had all 5 cardiovascular risk factors under control, and the majority of the group had ≤2 risk factors controlled.
- In addition, there were differences in the rates of optimal risk factor management by sex, socioeconomic status, and physical disability, suggesting potential disparities in care.

The HAALSI study is based in the Agincourt HDSS site, a subdistrict of the rural Mpumalanga province, South Africa, comprising some 115,000 people living in 21,000 households and 31 villages in an area of ≈450 km\(^2\).\(^9\) 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).

**Methods**

The HAALSI study is based in the Agincourt HDSS site, a subdistrict of the rural Mpumalanga province, South Africa, comprising some 115,000 people living in 21,000 households and 31 villages in an area of ≈450 km\(^2\).\(^9\) 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).

**WHAT THE STUDY ADDS**

- Despite the growing prevalence of cardiovascular disease in sub-Saharan Africa, we found that secondary prevention is currently suboptimal, especially for the outcome of control of all cardiovascular risk factors.
- Fewer than 5% of our study population had all 5 cardiovascular risk factors under control, and the majority of the group had ≤2 risk factors controlled.
- In addition, there were differences in the rates of optimal risk factor management by sex, socioeconomic status, and physical disability, suggesting potential disparities in care.

**Ethics Approval**

The study received ethical approvals from the Ethics Committees of 3 institutions directly involved in the project (University of the Witwatersrand Human Research Ethics Committee [ref M141159], the Harvard T.H. Chan School of Public Health, Office of Human Research Administration [ref C13-1608-02], and the Mpumalanga Provincial Research and Ethics Committee [approved on 22 October, 2014]).

**Recruitment and Follow-Up**

Before 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 (Shangaan) 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.

**Study Procedures**

Interviews lasting 2 to 3 hours were conducted in participants’ homes. The visit included a questionnaire in 2 parts: household and socioeconomic data then individual interview data; followed by anthropometric, physical, and cognitive functioning assessments plus blood sample collection in the form of capillary blood sample and dried blood spots. Data were captured on laptop computers using a Computer-Assisted Personal Interview program.

Data collected included blood pressure (Omron M6W automated cuff; Omron, Kyoto, Japan), weight (Genesis Growth Management Electronic Scale; Johannesburg, South Africa), height using a sensor with infrared measurement, and waist and hip circumferences with a flexible tape measure (SECA, Hamburg, Germany). Blood drops were used to measure glucose (Caresense N Monitor, Seoul, Korea) and individual lipid levels (Cardiocheck PA Silver version; Indianapolis, IN) in point-of-care machines. The dried blood spots were collected via finger prick on Whatman 903 paper (Whatman, Buckinghamshire, UK) and used to measure human immunodeficiency virus (HIV) status and high-sensitivity C-reactive protein. Three blood pressure readings (systolic and diastolic) were obtained with 2 minutes between each reading, and the mean blood pressure was calculated using the average between the second and third reading.\(^10\)

**Definition of Cardiovascular Disease**

Cardiovascular disease was defined by self-report of stroke and myocardial infarction or a diagnosis of angina by Rose criteria (World Health Organization Rose questionnaire is widely used in epidemiological studies and is a validated and standardized method for defining angina pectoris).\(^11\)
Control of Cardiovascular Risk Factors

Smoking status was defined by self-report of current smoking status, and the nonsmokers were considered as having this risk factor controlled. Low-density lipoprotein cholesterol was considered controlled with a value <1.8 mmol/L according to the South African Dyslipidaemia Guidelines. Body mass index in kg/m² was categorized using World Health Organization cutoffs, and values lower than 25 kg/m² were considered controlled. Waist-to-hip ratios were considered controlled if ≤0.90 for men and ≤0.85 for women. Hypertension was considered controlled if systolic blood pressure <140 mm Hg and diastolic blood pressure <90 mm Hg.

Other Covariates

Treatment of stroke, angina, and myocardial infarction was assessed by self-report. Clinical determination of HIV status was made by first using the Vironostika Uniform 11 (Biorneraix, France) screening assay. Negative results were assigned an HIV-negative status while positive results triggered a second (confirmatory) test using the Roche Elecsys (Indianapolis, IN) assay to determine the viral load. If both screening and confirmatory tests were positive, a final HIV-positive status was assigned. 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 World Health Organization guidelines. HIV-positive status was defined as a self-report of being informed of the condition by a health professional or a positive result from blood analysis. Physical disability (PD) was assessed by self-reported presence or absence of limitations in activities of daily living (excluding difficulty in dressing as an activity of daily living). Socioeconomic status (SES) was measured using the wealth asset index that is a quintile ranking of durables, such as televisions and refrigerators, as well as housing conditions. Immigrants were defined as the subjects who were born outside South Africa. Illiteracy was assessed separately from education; respondents were asked whether they could read or write.

Analyses

All analyses were conducted using STATA V14 software (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX). Continuous variables were compared using t test (expressed in mean values and SDs because they were normally distributed) and categorical variables using χ² test (expressed in absolute numbers and percentiles). The distribution of modifiable risk factors under control was assessed by HIV and immigration status because these 2 conditions were highly prevalent in this cohort, have been shown to impact on noncommunicable diseases management in the region, and yet need to be better studied. A linear regression model was built to identify factors associated with the number of cardiovascular risk factors controlled. The predictors included in this model were sex, PD, age, SES, HIV status, immigrant status, and illiteracy. These variables were included because they were previously reported as possible factors interfering with health management in this setting. The results are presented using β coefficients and 95% confidence intervals; level of significance was set as 5%.

Missing Data

Several categories had varying levels of missing data. No imputation was performed for missing height (5%), weight (7%), waist circumference (6%), glucose (9%), total cholesterol (16%), high-density lipoprotein cholesterol (16%), triglycerides (16%), and high-sensitivity C-reactive protein (15%). Descriptive statistics in Table 1 reflect the results for all people who had values for the respective variable. For the wealth index, 231 individuals were missing data, and for these individuals, the mean value for their village was imputed for this variable. In the subset of individuals with CVD, the analysis excluded subjects with missing key variables: blood pressure (3%), body mass index (7%), waist-to-hip ratio (7%), and low-density lipoprotein cholesterol (16%).

Results

Of the 5890 eligible people, 85.9% (5059) agreed to be interviewed, 7.3% refused to participate, 6.0% could not be located, and 0.8% were unable to participate. The number of subjects...
living with self-reported CVD was 592, which was 11.7% of the overall population. In this subset of CVD patients, angina was reported in 77.0% of the subjects, stroke in 25.2%, and myocardial infarction in 3.7%. The population of patients with CVD was more likely to be female, older, with higher body mass index, larger waist circumference, higher total cholesterol, and less likely to be smokers when compared with the non-CVD population. The overall population characteristics, as well as results of those with CVD compared with the non-CVD population, are summarized in Table 1.

Among the subjects with angina, 6.1% (28 of 456) were receiving treatment. In the group with stroke, 65.8% (98 of 149) were being treated and in the subset with previous myocardial infarction 86.4% (19 of 22) reported treatment of their disease. Collectively, 24% (142 of 592) of those with CVD were being treated.

To understand the impact of HIV on CVD in the community, we compared the proportion of individuals with angina, myocardial infarction, and stroke based on their HIV status. We found that 18.6% (85 of 456) of those who were HIV positive had angina compared with 22.9% (1048 of 4576) among those who were HIV negative, and this difference was statistically significant (P=0.036). The prevalence of stroke and myocardial infarction for HIV-positive people was 16.3% (24 of 147) and 9.1% (2 of 22), respectively, compared with 22.7% (1110 of 4894) and 22.5% (1132 of 5020) for HIV-negative people. These differences were not statistically significant (stroke: P=0.068; myocardial infarction: P=0.132).

The percentage of those with CVD who attained control for each of 5 modifiable risk factors was assessed, and the results are presented in Table 2. Higher proportions of control were attained for smoking, with 92.9% of the patients with history of CVD reported to be nonsmokers. Lower levels of control were attained for adiposity, as indicated by 29.7% of patients with waist-to-hip ratio below the cutoff values (0.90 for males and 0.85 for women). When these rates of modifiable risk factors were compared according to HIV and immigrant status, higher numbers of patients with controlled blood pressure were found in the HIV-positive patients, and fewer smokers were observed in the immigrant population (Table 2).

Table 2. Distribution of Modifiable Risk Factors Under Control Among the Subjects With CVD by HIV and Migration Status, Agincourt Subdistrict, South Africa, 2015

<table>
<thead>
<tr>
<th></th>
<th>Overall (%)</th>
<th>HIV Positive (%)</th>
<th>HIV Negative (%)</th>
<th>P Value</th>
<th>Immigrant (%)</th>
<th>Nonimmigrant (%)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waist-to-hip ratio*</td>
<td>29.7</td>
<td>34.9</td>
<td>28.7</td>
<td>0.207</td>
<td>29.1</td>
<td>30.1</td>
<td>0.809</td>
</tr>
<tr>
<td>LDL cholesterol‡</td>
<td>31.4</td>
<td>36.8</td>
<td>30.4</td>
<td>0.197</td>
<td>28.5</td>
<td>32.7</td>
<td>0.317</td>
</tr>
<tr>
<td>Body mass index‡</td>
<td>33.8</td>
<td>41.5</td>
<td>32.2</td>
<td>0.068</td>
<td>33.1</td>
<td>34.1</td>
<td>0.817</td>
</tr>
<tr>
<td>Blood pressure§</td>
<td>51.2</td>
<td>61.3</td>
<td>48.8</td>
<td>0.019†</td>
<td>48.8</td>
<td>52.0</td>
<td>0.480</td>
</tr>
<tr>
<td>Not smoking</td>
<td>92.9</td>
<td>88.7</td>
<td>93.8</td>
<td>0.063</td>
<td>96.5</td>
<td>91.4</td>
<td>0.028†</td>
</tr>
</tbody>
</table>

CVD indicates cardiovascular disease (self-report of Stroke/Myocardial Infarction or Angina by Rose criteria); HIV, human immunodeficiency virus; and LDL, low-density lipoprotein.

*Waist-to-hip ratio: ≤0.90 (men) or ≤0.85 (women).
†LDL cholesterol <1.8 mmol/L.
‡Body mass index <25 kg/m².
§Blood pressure <140×90 mm Hg.
††Statistically significant at α=0.05.

Figure 1 shows the cumulative number of risk factors under control in this secondary prevention population. More than 57% of the patients with CVD had only ≤2 risk factors controlled and <5% had all 5 risk factors under control. When the number of risk factors controlled was assessed by sex, 55.8% of the male subjects had ≥3 risk factors controlled compared with 34.2% of the females (P<0.001). In contrast, 28.3% of the females had only 1 risk factor controlled compared with 13.0% of the males (P<0.001).

An additional analysis was conducted to address the individual impact of each of the 5 risk factors on angina, myocardial infarction, and stroke. The only statistically significant difference we found was a higher percentage of waist-to-hip ratio in the ideal range among those with angina when compared with those with stroke (31.4% versus 22.8%; P=0.045). All other comparisons for the remaining risk factors were not statistically significantly different (Figure 2).

A multivariable linear regression model was developed to identify factors independently associated with the number of cardiovascular risk factors controlled, as shown in Table 3. Better management of CVD in this context was associated with male sex, absence of PD, and higher SES.

**Discussion**

Many different aspects of CVD have been studied in SSA, particularly the prevalence of cardiovascular risk factors and primary prevention strategies.16,7,9–12,30 However, to our knowledge, no publications have assessed the management of patients with established CVD focusing on individuals’ disparities related to cardiovascular risk factors control. Even though CVD prevalence is increasing in SSA, our results suggest that the secondary prevention of the disease is currently not being optimally managed, especially considering the need to have all cardiovascular risk factors controlled. Less than 5% of our study population had all 5 risk factors that were assessed under control, and the majority of the group had ≤2 risk factors controlled. In addition to that, sex, SES, and PD were identified as associated with CVD management in this setting.
The prevalence of CVD in our population was 13% and is similar to the 10% for combined angina, stroke, and myocardial infarction reported in the adult US population from the 2010 American Heart Association estimates. According to SANHANES, the South African National Health and Nutrition Examination Survey from 2013, the self-reported prevalence of heart disease (2.2%) and stroke (1.8%) was lower than was found in our cohort (10.7% and 3%, respectively). However, it should be noted that in both the American Heart Association and SANHANES studies, the CVD prevalence was estimated for the adult population (>18 years) while for HAALSI, only subjects >40 years were included so we would anticipate higher prevalence rates in our older population.

The overall prevalence of self-reported angina in our study was 2.35%, similar to previous findings reported for the same Agincourt population (4.02%) while the prevalence of angina as determined using the Rose criteria is 9.04%. It is likely that relying only on self-report underestimates the true prevalence of angina.

It is well established that HIV-infected individuals are at increased risk for CVD because of, among other factors, the high prevalence of cardiovascular risk factors in HIV-infected individuals. Despite the fact that prevalence of HIV positivity
was higher in the non-CVD population (23.1%) when compared with the CVD population (18%) of our study, we stratified our analysis of angina, myocardial infarction, and stroke by HIV status. This approach addresses the important interaction between stroke and HIV. Our results showed similar HIV infection numbers in individuals with and without myocardial infarction and stroke and an even lower percentage of HIV-infected subjects with angina (18.6%) when compared with those without angina (22.9%). These findings might be explained by previous findings from the same cohort that showed HIV-positive patients are more likely to receive healthcare services for diabetes mellitus and hypertension, which ultimately can lead to fewer cardiovascular events.

In the CLARIFY registry (Prospective Observational Longitudinal Registry of Patients with Stable Coronary Artery Disease) that included 33,283 outpatients (77% male, mean age: 64 years) with proven stable coronary artery disease from 45 countries, 12% of patients smoked, 78% were overweight, 71% of patients had hypertension, and the control rates ranged from 47% to 66%. Dyslipidemia was reported in 75% of patients, and low-density lipoprotein cholesterol control was between 35% and 76%. The HAALSI cohort is notably different from this study that assessed patients with CVD in its lower smoking rate (7.1%). Because we only investigated currently smoking, this lower smoking rates in the CVD group may be attributable to smoking cessation after a cardiovascular event.

Within the current study, only 4.4% of the population had all risk factors controlled, and the majority of the subjects (57.6%) had ≤2 risk factors under control. A similar analysis from the National Health and Nutrition Examination Survey showed that 10.6% of the US population (with no significant differences noted across subgroups defined by race–ethnicity) on secondary prevention had all risk factors controlled, as well as an increasing temporal trend in this result. Considering that having all risk factors under control is the most effective action in secondary prevention of CVD, we can conclude that the management of CVD in the region is far from optimal. Even more concerning is the poor level of CVD control found in women especially considering the greater effects of cardiovascular risk factors on women when compared with men.

Because each risk factor assessed in this population has a different impact as a secondary prevention strategy on angina, myocardial infarction, and stroke, we assessed the proportion of control for each the 5 risk factors individually. Once again, this stratification is of particular interest when dealing with stroke because it is already known that hypertension is the most dominant risk factor for cerebrovascular events, and additionally a focus on blood pressure and excess weight control would yield best preventive results for stroke in this population. Our results show that across all 3 CVD groups, blood pressure is better controlled than lipids, and this is consistent for what has been observed with stroke prevention in the Agincourt population. However, still only 50% of stroke sufferers have controlled blood pressure and this need to be improved.

Using the HAALSI data, we developed a multivariable linear regression model to identify the factors associated with the number of CVD risk factors controlled. Included in this model were variables previously reported as possible factors interfering with health management in this setting, including illiteracy, immigration status, PD, and SES. Male sex, absence of PD, and SES were positively associated with the number of risk factors controlled. Higher SES has been consistently associated with better risk factor control in secondary prevention of CVD, and even within the HAALSI cohort, hypertension was better managed in those individuals from higher SES. A possible explanation for the male sex and absence of PD results might be related to a better adherence to treatment in these 2 groups when compared with females and individuals with comorbidities.

A potential limitation of this particular study is the fact that the subdistrict from which the cohort was recruited has been part of an HDSS since 1992. This may create a specific environment of improved healthcare surveillance that might increase the level of risk factor control among patients with CVD when compared with subjects with CVD living in other parts of South Africa, as we previously showed in a study addressing hypertension management. The low control rates of CVD risk factors, observed in this particular area under surveillance, suggest that levels of risk factor’s control may be even worse at sites not covered by a HDSS.

Another limitation is the absence of data about specific drugs/strategies for secondary prevention. Information about antiplatelet drugs, β-blockers, blockers of the renin–angiotensin system, and statins was not obtained, limiting these specific comparisons with other epidemiological studies. However, we were able to make comparisons with another study for the number of individuals with established CVD not taking any appropriate medication. In this scenario, our results (24% not being treated) are better than the mean level observed in South Africa and other upper middle-income countries (Argentina, Brazil, Chile, Malaysia, Poland, and Turkey: 48.4%), reinforcing the hypothesis of better healthcare associated with HDSS coverage.

The strengths of this study include the investigation of variables, such as immigration and HIV status, which have not previously been assessed for their effects on CVD risk factor management. In these analyses, fewer immigrants with

| Table 3. Linear Regression Coefficients for the Number of Risk Factors Controlled Among Subjects With CVD, Agincourt Subdistrict, South Africa, 2015 |
|-----------------|-----------------|-----------------|-----------------|
| Variables       | β-Coefficient   | 95% CI          | P Value        |
| Male sex        | 0.44            | 0.25 to 0.63    | <0.001*        |
| Absence of PD   | 0.40            | 0.16 to 0.65    | 0.001*         |
| SES             | 0.10            | 0.01 to 0.19    | 0.035*         |
| Age             | 0.00            | -0.01 to 0.00   | 0.687          |
| HIV positive    | 0.20            | -0.04 to 0.44   | 0.106          |
| Immigrant       | -0.05           | -0.26 to 0.15   | 0.582          |
| Illiterate      | -0.04           | -0.24 to 0.16   | 0.675          |

CI indicates confidence interval; CVD, cardiovascular disease; self-report of stroke/myocardial infarction or angina by Rose criteria; HIV, human immunodeficiency virus; PD, physical disability—self-reported presence or absence of limitations in activities of daily living; and SES, socioeconomic status (measured using the wealth asset index).

*Statistically significant at α=0.05.
CVD were found to be smokers when compared with non-immigrants. This suppression of smoking in the immigrant population was previously shown in the literature, although not in individuals with known CVD, and may reflect more general social sanctions against personal consumption among immigrants who have taken on the responsibility of leaving home to earn money and build savings for their households.\textsuperscript{50} The better blood pressure control in HIV-positive subjects is aligned with the results of a recent meta-analysis that assessed the association between HIV and cardiometabolic diseases in SSA.\textsuperscript{51} Their results suggested that HIV-positive patients have, on average, lower blood pressure than their HIV-negative counterparts. An additional strength is the fact that this study provides relevant information on disparities in CVD management, which ultimately can be used to develop more equitable health models in a setting with limited resources.

Mortality from CVD has increased globally, particularly in the developing world from 1990 to 2013. Overall mortality from these conditions in SSA is low (ischemic heart disease 4.7%, stroke 5.0%) but South Africa’s are slightly higher (7.6% and 6.3%, respectively).\textsuperscript{52,53} Our data show that one of the reasons for these high levels of mortality from cardiovascular events may be because of the poor control of CVD risk factors. This suggests that mortality may be decreased through improvement in treatment of these risk factors coupled with greater community education on the importance of lifestyle modification. Initiatives to achieve these goals, such as population-wide screening for hypertension and diabetes mellitus, engagement of community resources and governance structures, geographic decentralization of care services, and group medical visits alone or integrated into microfinance groups, have been previously proposed in SSA,\textsuperscript{54} and some of these interventions are currently under investigation.\textsuperscript{55}

In conclusion, this analysis of the HAALSI study demonstrates that CVD is currently not being optimally managed in this rural area of South Africa and that there are significant opportunities to improve secondary prevention in this population. A particular focus should be placed on females, subjects from lower SES, and those with PD.

Acknowledgments

Sincere thanks to the Agincourt Unit field staff, quality checkers, and data team that toiled long and hard to ensure the quality of data on which this article is based. Thanks also to the Unit research management, community engagement, and administration teams; your efforts are essential. A further thank you to Mark Collinson and Carren Ginsberg for advice on how to conceptualize the health effects of migration. The Division of Clinical Pharmacology Laboratory at the University of Cape Town, South Africa, is supported by the National Institute of Allergy and Infectious Diseases of the National Institutes of Health under Award Numbers UM1 AI068634, UM1 AI068636, and UM1 AI06701, U01 AI086832, the Emunike Kennedy Shriver National Institute of Child Health and Human Development, and the National Institute of Mental Health (AI086832).

Sources of Funding

The HAALSI study (Health and Aging in Africa: Longitudinal Studies of International Network for the Demographic Evaluation of Populations and Their Health Communities), funded by the National Institute on Aging (P01 AG041710), is nested within the Agincourt Health and Demographic Surveillance System site, funded by the University of the Witwatersrand and Medical Research Council, South Africa, and the Wellcome Trust, UK (058893/A/99/A; 069683/Z/02/Z, 085477/Z08/Z). The HAALSI study has been performed through a collaboration between the Harvard Center for Population and Development Studies from the Harvard T.H. Chan School of Public Health, the MRC/Wits Rural Public Health and Health Transitions Research Unit from the School of Public Health at the University of the Witwatersrand in South Africa, and the International Network for the Demographic Evaluation of Populations and Their Health Network in Accra, Ghana. Dr Wade is supported by the Fogarty International Center of the National Institutes of Health under Award Number K43TW010698. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Disclosures

None.

References


Disparities in Management of Cardiovascular Disease in Rural South Africa: Data From the HAALSI Study (Health and Aging in Africa: Longitudinal Studies of International Network for the Demographic Evaluation of Populations and Their Health Communities)
Thiago Veiga Jardim, Sheridan Reiger, Shafika Abrahams-Gessel, Nigel J. Crowther, Alisha Wade, F. Xavier Gómez-Olivé, Joshua Salomon, Stephen Tollman and Thomas A. Gaziano