Original Investigation

Effect of Health Insurance and Facility Quality Improvement on Blood Pressure in Adults With Hypertension in Nigeria
A Population-Based Study

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IMPORTANCE Hypertension is a major public health problem in sub-Saharan Africa, but the lack of affordable treatment and the poor quality of health care compromise antihypertensive treatment coverage and outcomes.

OBJECTIVE To report the effect of a community-based health insurance (CBHI) program on blood pressure in adults with hypertension in rural Nigeria.

DESIGN, SETTING, AND PARTICIPANTS We compared changes in outcomes from baseline (2009) between the CBHI program area and a control area in 2011 through consecutive household surveys. Households were selected from a stratified random sample of geographic areas. Among 3023 community-dwelling adults, all nonpregnant adults (aged ≥18 years) with hypertension at baseline were eligible for this study.

INTERVENTION Voluntary CBHI covering primary and secondary health care and quality improvement of health care facilities.

MAIN OUTCOMES AND MEASURES The difference in change in blood pressure from baseline between the program and the control areas in 2011, which was estimated using difference-in-differences regression analysis.

RESULTS Of 1500 eligible households, 1450 (96.7%) participated, including 564 adults with hypertension at baseline (313 in the program area and 251 in the control area). Longitudinal data were available for 413 adults (73.2%) (237 in the program area and 176 in the control area). Baseline blood pressure in respondents with hypertension who had incomplete data did not differ between areas. Insurance coverage in the hypertensive population increased from 0% to 40.1% in the program area (n = 237) and remained less than 1% in the control area (n = 176) from 2009 to 2011. Systolic blood pressure decreased by 10.41 (95% CI, −13.28 to −7.54) mm Hg in the program area, constituting a 5.24 (−9.46 to −1.02)–mm Hg greater reduction compared with the control area ($P = .02$), where systolic blood pressure decreased by 5.17 (−8.29 to −2.05) mm Hg. Diastolic blood pressure decreased by 4.27 (95% CI, −5.74 to −2.80) mm Hg in the program area, a 2.16 (−4.27 to −0.05)–mm Hg greater reduction compared with the control area, where diastolic blood pressure decreased by 2.11 (−3.80 to −0.42) mm Hg ($P = .04$).

CONCLUSIONS AND RELEVANCE Increased access to and improved quality of health care through a CBHI program was associated with a significant decrease in blood pressure in a hypertensive population in rural Nigeria. Community-based health insurance programs should be included in strategies to combat cardiovascular disease in sub-Saharan Africa.

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Hypertension is the leading risk factor for death in sub-Saharan Africa.[1] The age-standardized prevalence of hypertension in the adult population (aged ≥25 years) in sub-Saharan Africa ranged from 38% to 56% in 2008 compared with 30% in the United States and 26% to 44% in Western Europe.[2,3] In Nigeria, the age-standardized prevalence of hypertension was 49% in the adult population in 2008.[3] As a consequence, the burden of cardiovascular disease (CVD) and stroke in particular is rising in sub-Saharan Africa.[1] Disability-adjusted life-years resulting from stroke range from 1163 to 2453 in most sub-Saharan African countries, including Nigeria, compared with 50 and 484 in Western Europe and the United States, respectively.[2] Reduction of blood pressure greatly reduces mortality due to CVD.[4] However, the level of antihypertensive treatment coverage in sub-Saharan Africa is low.[5-7] Hypertension has been identified as an important health problem in rural Kwara State, Nigeria, with a prevalence of 21% in the adult population (aged ≥18 years), with low levels of awareness (8%), antihypertensive treatment coverage (5%), and blood pressure control (3%) among those with hypertension.[6]

Almost 50% of total health care expenditures in low- and middle-income countries are paid out of pocket by the patients.[8] As a result, the ability to pay for health care has become a critical issue in these countries.[9] Interventions to increase the ability to pay for health care, such as health insurance programs, provide financial protection, thereby increasing use of health care resources.[10] Health insurance programs may be particularly useful for patients with chronic conditions, such as hypertension, because long-term treatment is unaffordable for many patients. However, studies that evaluate the relation between interventions to increase the ability to pay for health care and health status in low- and middle-income countries are scarce and have provided conflicting results,[10-12] possibly because most of these studies were retrospective and used cross-sectional data or because of the poor quality of the health care provided.[10]

Community-based health insurance (CBHI) programs (also called *health insurance for the informal sector* or *micro–health insurance*) are health insurance programs that share the following 3 characteristics: not-for-profit prepayment plans, community empowerment, and voluntary enrollment. The Health Insurance Fund is an international development organization committed to promoting access to quality health care for low- and middle-income groups in several African countries through innovative financing mechanisms and quality improvement.[13] The first 2 Health Insurance Fund programs were started in 2007 in Lagos and in Kwara State, Nigeria, under the name of Hygeia Community Health Care. The insurance package provides coverage for primary and limited secondary health care, including antihypertensive treatment. In addition, the program improves the quality of care in the health care facilities participating in the program by upgrading of facilities, training of staff in guideline-based care, and hospital management support. Further details of the Hygeia Community Health Care program are described in the Supplement (eMethods). In this study, we evaluated the effect of a CBHI program on blood pressure in a hypertensive population in rural Nigeria.

Methods

Study Design and Population

We used a quasi-experimental design to measure the effect of implementing the CBHI program (the intervention) on blood pressure in adults (aged ≥18 years) diagnosed as having hypertension. We compared changes in outcomes from baseline (preintervention) with those found after 2 years of follow-up in an intervention area and in a control area where the CBHI program was not implemented. We consider the difference in changes from baseline between the intervention and control areas to represent the intervention effect.

The study population of adults with hypertension was derived from a population-based sample of the Afon and Ajasse Ipo districts in Kwara State (Supplement [eFigure]). Both districts are low-income rural communities with comparable availability and quality of health care services at baseline (a description of the population and the setting is found in the Supplement [eMethods]). The Hygeia Community Health Care insurance program offered voluntary enrollment to the inhabitants of the Afon district from 2009 (the intervention or program area). The program was not operational in Ajasse Ipo, which is therefore considered the control area. Consecutive population-based household surveys were conducted to measure changes in outcomes from 2009 to 2011. All households located in the study areas were eligible for inclusion in the survey. Household members were interviewed and blood pressure was measured in both areas before the rollout of the CBHI program and the upgrading of participating health care facilities in the program area in May and June 2009. Households were revisited during the same months in 2011, when the insurance program had been available in the program area for 2 years. All nonpregnant adults (aged ≥18 years) among 3023 community-dwelling adults who were classified as hypertensive at baseline were eligible for this study (**Figure**).

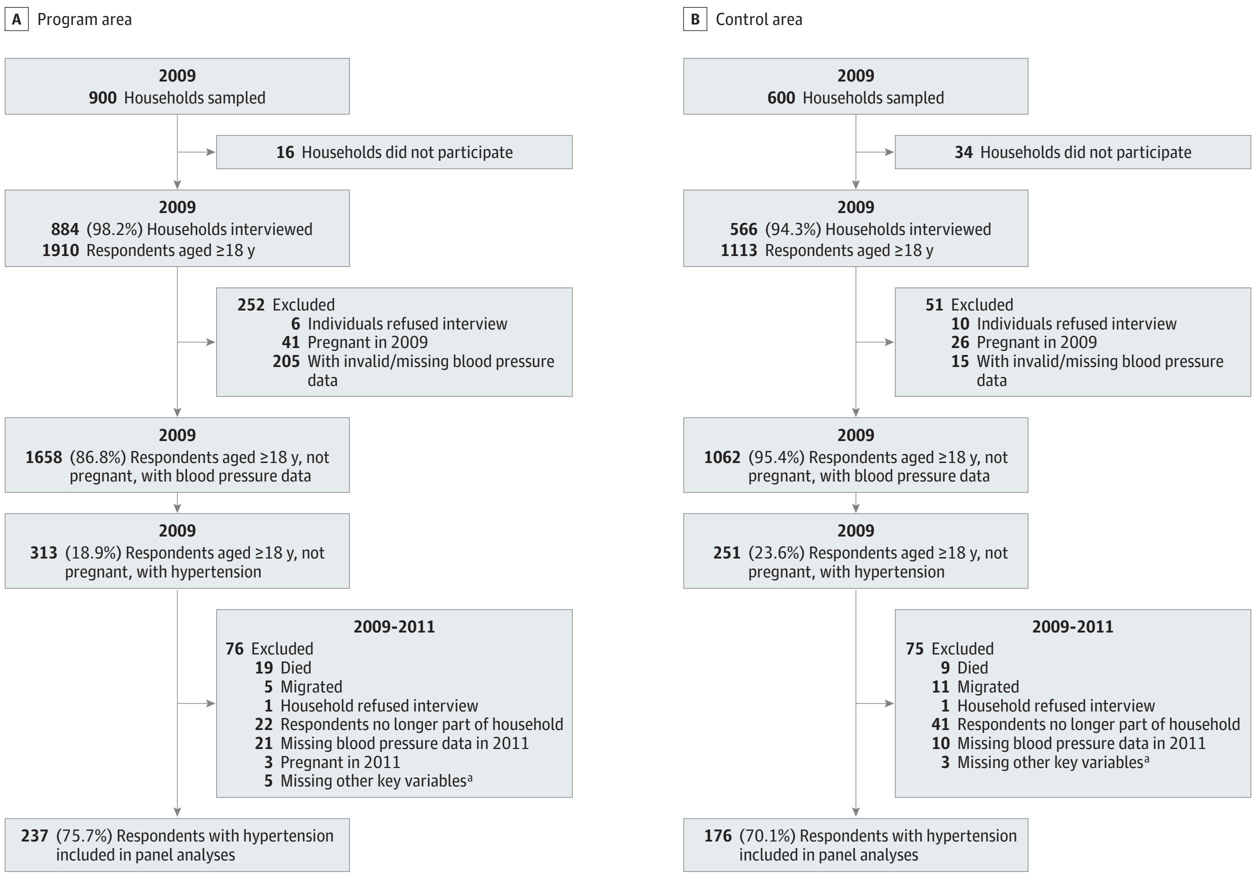
Sampling and Sample Size

A stratified, 2-stage, random-probability sample was drawn from a random sample of geographic areas in 2009 and a random sample of households. The target sample size was 1500 households and was based on sample size estimates required to study use of health care resources and financial protection in the overall population, which were the outcome measures defined to study the socioeconomic impact of the CBHI program. More information about the sampling procedures is described in the Supplement (eMethods).

Data Collection

Questionnaires to collect demographic, socioeconomic, and medical information were administered by trained interviewers. Blood pressure was measured 3 times on the upper left arm after at least 5 minutes of rest using a validated automated blood pressure device (Omron M6 Comfort; Omron Corporation). The mean value of the second and third measurements was used for analyses. All respondents with systolic blood pressure of at least 140 mm Hg or diastolic blood pressure of at least 90 mm Hg were advised to see a health care professional in both

Figure. Participation in the 2009 and 2011 Surveys and Reasons for Attrition



[a]Key variables include age, sex, consumption (measured in per capita US dollars), and/or wealth indicator.

areas. In addition, an information leaflet with general information about hypertension was provided. Households were revisited at least once in case household members were not present during the first visit.

Ethical Review

Ethical clearance was obtained from the ethical review committee of the University of Ilorin Teaching Hospital. Informed consent was obtained from all participants by signature or by fingerprint.

Data Analysis

Hypertension was defined as measured systolic blood pressure of at least 140 mm Hg, diastolic blood pressure of at least 90 mm Hg, and/or self-reported drug treatment for hypertension. *Control of blood pressure* (controlled hypertension) was defined as measured systolic blood pressure of less than 140 mm Hg and diastolic blood pressure of less than 90 mm Hg. *Use of health care resources* was defined as a visit to a modern health care provider in the last 12 months. A modern health care provider included hospitals, primary health care centers, private physicians, nurses, pharmacists, and other nontraditional medicine vendors. The definition excluded traditional medicine practitioners and vendors.

The difference in change in systolic and diastolic blood pressure from 2009 to 2011 between the program and control areas in the population with hypertension at baseline was predefined as the outcome to measure the effect of the program on health status before the follow-up survey. This primary outcome was defined because of the high prevalence of hypertension observed in the study population during the baseline survey, the observed high level of use of health care resources for hypertension in the program clinics, and our predefined hypotheses about which components of health status could be influenced by an insurance program within 2 years. The differences in control of blood pressure, antihypertensive drug treatment coverage, and general use of health care resources between respondents with hypertension in the program and control areas over time constituted secondary outcome measures.

Statistical Analysis

We analyzed the data using commercially available statistical software (Stata, version 12.1; StataCorp). We explored population characteristics of the participants with hypertension in the program and control areas using descriptive statistics; we compared the statistics using bivariable analysis (Kruskal-Wallis test for continuous variables, Pearson χ^2 test or Fisher exact test for categorical variables, and trend test for ordinal scales). Multivariable mixed linear regression models corrected for clustering at the enumeration area level, household level, and individual level were used to measure the effect of the CBHI program on blood pressure and the secondary outcomes. Difference-in-differences analysis[14] was performed to measure changes in outcomes over time, including all respondents in the program and control areas. With this approach, all respondents in the program area were considered to be in the intervention group irrespective of whether respondents decided to enroll in the CBHI program or not, similar to an intention-to-treat analysis. Such an approach eliminated the bias introduced by self-selection into (or out of) the insurance program and incorporated potential spillover effects on uninsured respondents who might also benefit from the quality improvement of the health care facilities in the program area. Confounders were defined a priori and included in the models irrespective of statistical significance. Biomedical confounders included were CVD risk factors (age, sex, body mass index [calculated as weight in kilograms divided by height in meters squared], presence of diabetes mellitus, and smoking status) that may affect hypertension severity or the decision to start or to intensify treatment. Socioeconomic confounders reflecting health care–seeking behavior were included to correct for respondent characteristics that may lead to better health outcomes through increased health care–seeking behavior independent of the CBHI program. The variables included were socioeconomic status (educational level, assets, household expenditures on food and nonfood items [a socioeconomic measure of wealth hereinafter referred to as consumption], employment, and household size), being the head of the household, being a female head of the household, marital status, religious affiliation, ethnicity, and access to health care facilities (program and nonprogram clinics). For the primary outcome, we performed a sensitivity analysis with imputation of missing covariates. Furthermore, we performed a multivariable mixed logistic regression analysis corrected for clustering at the enumeration area and household level to evaluate whether hypertension status at baseline was associated with insurance enrollment in 2011. For the latter analysis, we included the hypertensive and nonhypertensive adult nonpregnant population. In addition to the variables included in the effect models, this analysis also included variables reflecting recent illness, recent use of health care resources, and recent health care expenditures because these factors may influence the decision to enroll in the program.

Results

Survey Response Rate and Attrition

Of the sampled households, 187 households could not be located and were replaced by other households to reach the sample size of 1500. Of 1500 eligible households, 1450 (96.7%) participated in the survey, resulting in 564 nonpregnant adults with hypertension at baseline (313 of 1658 respondents in the program area [18.9%] and 251 of 1062 in the control area [23.6%]). Longitudinal data were available for 413 hypertensive adults (73.2%) (237 [75.7%] in the program area and 176 [70.1%] in the control area) (Figure).

Age, blood pressure, and consumption at baseline did not differ significantly between the 413 respondents with longitudinal data and the 151 respondents whose follow-up data were not available because of missing data or attrition (owing to death or loss to and unavailability for follow-up). Respondents with incomplete data were more often male compared with those with complete data (Supplement [eTable 1]). Age, blood pressure, consumption, and the proportion of men among respondents with incomplete data in the program and control areas were similar at baseline (Supplement [eTable 1]).

The number of respondents who died during the time from 2009 to 2011 was higher in the program area compared with the control area, but this difference was not statistically significant (19 deaths [6.1%] in the program area vs 9 [3.6%] in the control area [*P* = .18]). One respondent in the program area died of complications of diabetes mellitus, and other reported causes of death included infectious diseases and old age. No CVD-related deaths were reported.

Population Characteristics

Use of health care resources and health care expenditures at baseline were similar between areas (**Table 1**). Socioeconomic status was lower in the program area compared with the control area. Median consumption was US $562 (interquartile range [IQR] $381-$889) per capita per year in the program area and US $679 ($485-$1046) per capita per year in the control area (*P* < .001). In the program area, 191 respondents (82.7%) had no education compared to 97 (56.4%) in the control area (*P* < .001). Median age was higher in the program area (60.0 [IQR, 50.0-70.0] years) compared with the control area (55.0 [47.0-65.0] years) (*P* = .02) (Table 1). Baseline blood pressure was similar between areas (Table 1). Baseline median body mass index was lower in the program area (22.7 [IQR, 20.2-26.3]) compared with the control area (24.3 [21.1-27.9]) (*P* = .01). Eight respondents (3.4%) reported any alcohol use in the program area compared with 15 (8.5%) in the control area (*P* = .02) (Table 1).

Insurance Enrollment

One respondent in the control area (0.6%) and none in the program area were insured at baseline (Table 1) (enrolled in the National Health Insurance Scheme). In 2011, 95 (40.1%) respondents with hypertension were insured in the program area and none in the control area. The presence of stage 2 hypertension at baseline was significantly associated with being insured in 2011 (odds ratio [OR], 3.40 [95% CI, 1.22-9.46]; *P* = .02) (Supplement [eTable 2]).

Insurance Effect

Effect on Blood Pressure

Systolic blood pressure decreased by 10.41 mm Hg (95% CI, −13.28 to −7.54 mm Hg; *P* < .001) from 2009 to 2011 in the program area. This reduction was 5.24 mm Hg (95% CI, −9.46 to −1.02 mm Hg; *P* = .02) greater compared with the control area,

Table 1. Characteristics of Respondents With Hypertension at Baseline in 2009

	Area					Insurance Status in Program Area in 2011			
	Control		Program			Insured		Uninsured	
Characteristic	No. of Respondents	Data	No. of Respondents	Data	*P* Value[a]	No. of Respondents	Data	No. of Respondents	Data
Age, median (IQR), y	176	55.0 (47.0-65.0)	237	60.0 (50.0-70.0)	.02	95	60 (50.0-70.0)	142	60 (48.0-70.0)
Male sex, No. (%)	176	72 (40.9)	237	69 (29.1)	.01	95	27 (28.4)	142	42 (29.6)
Hypertension status, No. (%)									
Awareness	176	13 (7.4)	237	23 (9.7)	.41	95	12 (12.6)	142	11 (7.7)
Treatment	176	9 (5.1)	237	11 (4.6)	.25	95	5 (5.3)	142	6 (4.2)
Controlled	176	7 (4.0)	237	7 (3.0)	.57	95	2 (2.1)	142	5 (3.5)
SBP, median (IQR), mm Hg	176	151.5 (140.5-170.0)	237	150.0 (142.0-166.5)	.72	95	153.0 (141.0-173.0)	142	149.5 (142.5-163.0)
DBP, median (IQR), mm Hg	176	95.5 (90.5-105.3)	237	95.0 (89.0-101.5)	.20	95	95.5 (90.0-104.5)	142	94.8 (89.0-100.0)
BMI, median (IQR)	172	24.3 (21.1-27.9)	233	22.7 (20.2-26.3)	.01	95	23.4 (20.7-27.3)	138	22.3 (19.7-26.2)
Waist circumference, median (IQR), cm	171	85.0 (75.0-94.0)	231	84.0 (76.0-93.0)	.50	94	83.5 (76.0-94.0)	137	84.0 (76.0-92.0)
Diabetes mellitus, No. (%)	150	10 (6.7)	161	7 (4.3)	.37	68	1 (1.5)	93	6 (6.5)
Smoker, No. (%)	176	7 (4.0)	237	13 (5.5)	.48	95	4 (4.2)	142	9 (6.3)
Alcohol use, No. (%)	176	15 (8.5)	237	8 (3.4)	.02	95	3 (3.2)	142	5 (3.5)
Consumption per capita, median (IQR), US $[b]	176	679 (485-1046)	237	562 (381-889)	<.001	95	603 (391-1000)	142	534 (331-849)
Educational level, No. (%)[c]									
None	172	97 (56.4)	231	191 (82.7)	<.001	89	72 (80.9)	142	119 (83.8)
Primary	172	30 (17.4)	231	22 (9.5)		89	9 (10.1)	142	13 (9.2)
Secondary	172	22 (12.8)	231	12 (5.2)		89	5 (5.6)	142	7 (4.9)
Tertiary	172	23 (13.4)	231	6 (2.6)		89	3 (3.4)	142	3 (2.1)
Insured, No. (%)	176	1 (0.6)	237	0	.25	95	0	142	0
Visited modern health care professional in last 12 mo, No. (%)	173	93 (53.8)	236	110 (46.6)	.15	95	38 (40.0)	141	50 (35.5)
Annual health care expenditures, median (IQR), US $[d]	176	5.5 (2.3-12.2)	237	5.0 (1.7-12.4)	.22	95	5.7 (2.1-14.5)	142	4.8 (1.1-11.9)

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); DBP, diastolic blood pressure; IQR, interquartile range; SBP, systolic blood pressure.

[a] Indicates differences between control vs program areas (χ^2 test or Fisher exact test for categorical variables, Kruskal-Wallis test for continuous variables, and trend test for educational level).

[b] Indicates household expenditures on food and nonfood items (a socioeconomic measure of wealth), corrected for inflation.

[c] Percentages have been rounded and may not total 100.

[d] Excludes premium, corrected for inflation.

where systolic blood pressured decreased by 5.17 mm Hg (95% CI, −8.29 to −2.05 mm Hg; *P* = .001) (**Table 2**). Diastolic blood pressure decreased by 4.27 mm Hg (95% CI, −5.74 to −2.80 mm Hg; *P* < .001) in the program area, 2.16 mm Hg (−4.27 to −0.05 mm Hg; *P* = .04) greater reduction compared with the reduction in the control area, where diastolic blood pressure decreased by 2.11 mm Hg (−3.80 to −0.42 mm Hg; *P* = .01) (Table 2). When missing values for covariates of 46 respondents were imputed, the difference in the decrease in systolic blood pressure between the program and control area was 4.39 mm Hg (95% CI, −8.39 to −0.38 mm Hg; *P* = .03) and the difference in the decrease in diastolic blood pressure was 1.74 mm Hg (−3.74 to −0.26 mm Hg; *P* = .09).

Hypertension Treatment and Blood Pressure Control

Awareness of hypertension, antihypertensive treatment coverage, and blood pressure control were similar between the program and control areas at baseline (Table 1). Most of the respondents with hypertension were unaware of their status during the baseline survey. In the program and control areas, respondents with newly detected hypertension were advised to contact a health care professional. Coverage of antihypertensive drug treatment increased from 11 (4.6%) to 31 (13.1%) respondents in the program area and from 9 (5.1%) to 20 (11.4%) respondents in the control area (Table 1 and **Table 3**). We found no difference in the increase in drug treatment coverage between areas when corrected for confounders (OR,

Table 2. Effect of the Insurance Program on Respondents With Hypertension at Baseline[a]

	Difference-in-Differences			
	Unadjusted Analysis		Adjusted Analysis	
	Effect (95% CI)	*P* Value	Effect (95% CI)	*P* Value
SBP, coefficient (95% CI)[b]				
Difference in outcome between program and control areas at baseline	−0.77 (−5.19 to 3.65)	.73	−3.89 (−9.25 to 1.46)	.15
Difference between 2009 and 2011 in program area	−9.04 (−11.49 to −6.58)	<.001	−10.41 (−13.28 to −7.54)	<.001
Difference between 2009 and 2011 in control area	−4.90 (−7.90 to −1.89)	.001	−5.17 (−8.29 to −2.05)	.001
Difference in change from baseline between areas (program effect)[c]	−4.14 (−8.03 to −0.26)	.04	−5.24 (−9.46 to −1.02)	.02
DBP, coefficient (95% CI)[b]				
Difference in outcome between program and control areas at baseline	−1.66 (−3.86 to 0.55)	.14	−3.22 (−6.13 to −0.31)	.03
Difference between 2009 and 2011 in program area	−4.28 (−5.45 to −3.11)	<.001	−4.27 (−5.74 to −2.80)	<.001
Difference between 2009 and 2011 in control area	−2.56 (−4.31 to −0.81)	.004	−2.11 (−3.80 to −0.42)	.01
Difference in change from baseline between areas (program effect)[c]	−1.72 (−3.82 to 0.39)	.11	−2.16 (−4.27 to −0.05)	.04
Drug treatment for hypertension, OR (95% CI)[d]				
Difference in outcome between program and control areas at baseline	0.71 (0.17 to 2.96)	.64	5.02 (0.81 to 31.33)	.08
Difference between 2009 and 2011 in program area	6.04 (2.26 to 16.13)	<.001	5.43 (1.87 to 15.78)	.002
Difference between 2009 and 2011 in control area	3.78 (1.31 to 10.92)	.01	3.95 (1.11 to 14.06)	.03
Difference in change from baseline between areas (program effect)[c]	1.60 (0.41 to 6.27)	.50	1.37 (0.29 to 6.47)	.69
Controlled hypertension, OR (95% CI)[d]				
Difference in outcome between program and control areas at baseline	0.62 (0.18 to 2.08)	.44	1.06 (0.25 to 4.46)	.94
Difference between 2009 and 2011 in program area	45.43 (14.15 to 145.91)	<.001	50.10 (13.93 to 180.12)	<.001
Difference between 2009 and 2011 in control area	13.27 (4.71 to 37.35)	<.001	15.87 (4.69 to 53.74)	<.001
Difference in change from baseline between areas (program effect)[c]	3.42 (0.94 to 12.52)	.06	3.16 (0.78 to 12.79)	.11
Consulted modern HCP in last 12 mo, OR (95% CI)[d,e]				
Difference in outcome between program and control areas at baseline	0.67 (0.40 to 1.14)	.14	0.89 (0.49 to 1.65)	.72
Difference between 2009 and 2011 in program area	1.90 (1.27 to 2.85)	.002	2.00 (1.28 to 3.11)	.002
Difference between 2009 and 2011 in control area	0.78 (0.49 to 1.23)	.28	0.81 (0.50 to 1.32)	.40
Difference in change from baseline between areas (program effect)[c]	2.45 (1.32 to 4.55)	.005	2.47 (1.29 to 4.71)	.006

Abbreviations: DBP, diastolic blood pressure; HCP, health care provider; OR, odds ratio; SBP, systolic blood pressure.

[a] Unless otherwise indicated, sample size for unadjusted analysis was 822 respondents; for adjusted, 754 respondents.

[b] Adjusted estimates are corrected for sex, age, age squared, being the head of household, marital status, work in the past year, educational level of the head of household, religion, ethnic group, program clinic in the community is Ilera Layo (as opposed to other clinics), a potential program clinic in the area, distance to the nearest clinic, having a female head of household, household size, yearly per capita consumption excluding health care expenditures corrected for inflation, wealth indicator based on asset score in 2009, household with functional toilet facility, household with good-quality drinking water, diabetes mellitus, smoking, and body mass index (BMI). All estimates were corrected for clustering at enumeration area level, household level, and individual level using mixed models.

[c] Reflects the true effect of the intervention.

[d] Corrected for sex, age, age squared, being the head of household, marital status, work in the past year, educational level of the head of household, religion, ethnic group, program clinic in the community is Ilera Layo (as opposed to other clinics), a potential program clinic in the area, household size, yearly per capita consumption excluding health care expenditures corrected for inflation, wealth indicator based on asset score 2009, household with a functional toilet facility, household with good-quality drinking water, diabetes mellitus, smoking, and BMI. Distance to the nearest clinic and having a female head of household were excluded because of nonconvergence of the model. All estimates were corrected for clustering at the enumeration area level, household level, and individual level using mixed models.

[e] Sample size for unadjusted analysis was 792 respondents; for adjusted, 726 respondents.

1.37 [95% CI, 0.29-6.47]; *P* = .69) (Table 2). The number of respondents with controlled blood pressure increased from 7 (3.0%) to 92 (38.8%) in the program area and from 7 (4.0%) to 46 (26.1%) in the control area (Tables 1 and 3). This difference in increase in controlled blood pressure compared with baseline between areas did not reach statistical significance when corrected for confounders (OR, 3.16 [95% CI, 0.78-12.79]; *P* = .11) (Table 2).

Use of Health Care Resources

Self-reported general use of health care resources increased in the program area and decreased in the control area (Tables 1 and 3). The change in use of health care resources from baseline was significantly different between areas when corrected for confounders (OR, 2.47 [95% CI, 1.29-4.71; *P* = .006) (Table 2).

Discussion

Our study showed that the availability of a CBHI program that provided access to improved quality health care was associated with a significant decrease in blood pressure in a hypertensive population in rural Nigeria. Estimates of health risks suggest that, in particular, reduction in systolic blood pressure leads to major health benefits. Each decrease of 10 mm

Table 3. Characteristics of Respondents With Hypertension at Basline, Follow-up in 2011

Characteristic	Area: Control, No. of Respondents	Area: Control, Data	Area: Program, No. of Respondents	Area: Program, Data	*P* Value[a]	Insurance Status in Program Area in 2011: Insured, No. of Respondents	Insured, Data	Uninsured, No. of Respondents	Uninsured, Data
Age, median (IQR), y	176	57.0 (49.0-67.0)	237	62.0 (52.0-72.0)	.02	95	62.0 (52.0-72.0)	142	62.0 (50.0-72.0)
Male sex, No. (%)	176	72 (40.9)	237	69 (29.1)	.01	95	27 (28.4)	142	42 (29.6)
Hypertension status, No. (%)									
Awareness	176	47 (26.7)	237	74 (31.2)	.32	95	45 (47.4)	142	29 (20.4)
Treatment	176	20 (11.4)	237	31 (13.1)	.49	95	24 (25.3)	142	7 (4.9)
Treatment, including lifestyle intervention	176	46 (26.1)	237	64 (27.0)	.28	95	44 (46.3)	142	20 (14.1)
Controlled	176	46 (26.1)	237	92 (38.8)	.007	95	38 (40.0)	142	54 (38.0)
SBP, median (IQR), mm Hg	176	147.8 (135.5-167.5)	237	144.0 (126.5-162.0)	.03	95	144.0 (124.5-162.0)	142	143.0 (128.0-165.5)
DBP, median (IQR), mm Hg	176	94.5 (87.0-102.5)	237	90.0 (81.5-101.5)	.004	95	90.0 (78.0-101.5)	142	90.3 (82.0-101.5)
BMI, median (IQR)	171	24.2 (21.2-28.2)	232	22.5 (20.2-26.3)	.008	94	23.3 (20.6-27.9)	138	22.2 (19.8-26.0)
Waist circumference, median (IQR), cm	176	88.0 (78.0-96.0)	235	86.0 (79.0-94.0)	.45	94	89.0 (80.3-98.0)	141	84.0 (78.0-91.0)
Diabetes mellitus, No. (%)	133	12 (9.0)	147	6 (4.1)	.09	66	4 (6.1)	81	2 (2.5)
Smoker, No. (%)	176	7 (4.0)	237	14 (5.9)	.38	95	5 (5.3)	142	9 (6.3)
Alcohol use, No. (%)	176	23 (13.1)	237	9 (3.8)	<.001	95	3 (3.2)	142	6 (4.2)
Consumption per capita, median (IQR), US $[b]	176	659 (448-950)	237	511 (347-780)	<.001	95	559 (364-789)	142	476 (337-773)
Educational level, No. (%)[c]									
None	173	94 (54.3)	235	196 (83.4)	<.001	94	75 (79.8)	141	121 (85.8)
Primary	173	27 (15.6)	235	17 (7.2)		94	4 (4.3)	141	13 (9.2)
Secondary	173	27 (15.6)	235	10 (4.3)		94	7 (7.4)	141	3 (2.1)
Tertiary	173	25 (14.5)	235	12 (5.1)		94	8 (8.5)	141	4 (2.8)
Insured, No. (%)	175	0	237	95 (40.1)	<.001	95	95 (100.0)	142	0
Visited modern health care professional in last 12 mo, No. (%)	167	83 (49.7)	234	140 (59.8)	.04	94	67 (71.3)	140	52 (37.1)
Annual health care expenditures, median (IQR), US $[d]	176	4.9 (1.6-16.1)	237	2.2 (0.8-6.5)	.001	95	2.2 (0.9-7.4)	142	2.2 (0.7-5.9)

Abbreviations: Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); DBP, diastolic blood pressure; IQR, interquartile range; SBP, systolic blood pressure.

[a] Indicates difference between control vs program areas (χ^2 test or Fisher exact test for categorical variables, Kruskal-Wallis test for continuous variables, and trend test for educational level).

[b] Indicates household expenditures on food and nonfood items (a socioeconomic measure of wealth), corrected for inflation.

[c] Percentages have been rounded and may not total 100.

[d] Excludes premium, corrected for inflation.

Hg in systolic blood pressure at the population level is associated with a 38% reduction in the risk of stroke and a 26% reduction in the risk of ischemic heart disease.[15] Therefore, a 10.41-mm Hg reduction in blood pressure would translate into a significant decrease in CVD events if sustained over time.

Early identification and treatment of people with hypertension is vital for prevention of CVD, in particular in an African population, among whom end-organ damage and mortality are known to occur at a younger age compared with white populations.[16] Awareness of hypertension and antihypertensive treatment coverage were very low at baseline and in line with the findings of other studies from sub-Saharan Africa.[17] All respondents with hypertension at baseline were advised to visit a health care professional. This recommendation has likely resulted in increased awareness and antihypertensive treatment coverage in 2011 in the program and control areas and has contributed to the blood pressure reduction observed in both areas. These findings suggest that simple screening interventions could help to raise hypertension awareness and antihypertensive treatment coverage. However, antihypertensive medication use was self-reported, and no information about the quality and continuity of the treatment was available. Sustained reductions in blood pressure require access to quality care, retention in care with frequent monitoring, a continuous supply of guideline-based drugs, and adherence to treatment regimens.[18] Our study showed that the CBHI program resulted in increased use of formal health care services, indicating better access to care for patients. We hypothesize that the quality improvement component of the CBHI program in the health care facilities resulted in better-quality (ie, guideline-based) care and has contributed to the larger blood pressure reduction in the program area compared with the control area despite similar reported antihypertensive treatment coverage. To the best of our knowledge, this study is the first from a low-income setting that finds an effect of health insurance on blood pressure using longitudinal data.

The World Health Organization and other experts have advocated universal health care coverage through prepaid insurance programs to reduce catastrophic health expenditures and to increase access to health services, which should ultimately lead to an improvement in population health.[19-22] Several studies that evaluated prepaid insurance programs in low- and middle-income countries showed an increase in the use of health care resources and a decrease in out-of-pocket expenditures.[10,11] However, studies from low- and middle-income countries[10-12,23] that show an effect on population health are scarce and the results are conflicting. A study that evaluated the effect of the Seguro Popular insurance program in Mexico on hypertension treatment and control[23] found that being insured was associated with greater use of antihypertensive treatment and better blood pressure control. However, cross-sectional data from a single survey were used to compare the insured with the uninsured populations. In addition, a selection bias was likely in the voluntarily insured group, which limits the value of a comparison of insured with uninsured groups. Patients with better health literacy, more health-seeking behavior, and more severe hypertension may be more likely to enroll in an insurance program and may be more likely to start and adhere to an antihypertensive treatment regimen, independent of their insurance status. Our own data support this notion because treatment coverage for hypertension in the uninsured population in the program area was lower compared with treatment coverage in the (equally uninsured) control area, and patients with more severe hypertension were more likely to enroll in the program. The strength of our study is the elimination of selection bias by using difference-in-differences analysis with longitudinal data from repeated surveys. This analysis compares changes in outcomes over time in a program area and a control area irrespective of insurance status in the program area.

Our study has several limitations. First, the rollout of the CBHI program was not randomized. Very few settings exist where health insurance programs can be rolled out in a (cluster) randomized fashion given the complexity of such programs with multiple parties and stakeholders, including local insurance companies, implementing parties, and national and local governments. We used an alternative approach by including a control group and by analyzing the data using difference-in-differences analysis. Second, the relatively small number of patients with hypertension in any unselected population is a limitation for population-based impact studies of insurance programs. Healthy individuals clearly constitute most of the population, making it exceedingly difficult to measure any effect of insurance on population health outcomes. Given this limitation, the effect on systolic blood pressure observed in our study was striking. Finally, longitudinal data were not available for 26.8% of the study population. However, the relevant baseline characteristics of respondents with incomplete data did not differ significantly between the program and control areas. Therefore, the lack of data did not affect the validity of our impact analysis, which is measured as the difference in change in outcomes over time between the program and control areas.

Several respondents with uncontrolled hypertension at baseline had controlled blood pressure in 2011 without reporting any drug treatment or lifestyle intervention for hypertension. This observation can be explained by regression to the mean, which is known to occur in hypertension.[24] However, regression to the mean is likely to occur in the program and control areas. Therefore, this phenomenon does not affect the validity of the observed effect of insurance on blood pressure. In addition, some respondents may have been unaware of their treatment for hypertension, in particular if they were also treated for other comorbidities. Of the 237 respondents in the program area, 142 (59.9%) decided not to enroll in the insurance program, limiting the power of the difference-in-differences analysis, as the strongest effect on the outcome measures is expected in those who obtained insurance. However, this finding reflects a real-world situation in which not all eligible subjects choose to enroll in a health insurance program.

Conclusions

Increased access to and improved quality of health care through a CBHI program is associated with a decrease in blood pressure in a hypertensive population in rural Nigeria. Our study highlights the potential of health insurance programs that cover the costs of care for patients and improve the quality of health care facilities for long-term disease management in low- and middle-income countries. The CBHI programs should be included in strategies designed to combat the increasing burden of CVD in low- and middle-income countries.

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