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Sustained 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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ABSTRACT

Background: Hypertension is a leading risk factor for death in sub-Saharan Africa. Quality treatment is often not available nor affordable. We assessed the effect of a voluntary health insurance program, including quality improvement of healthcare facilities, on blood pressure (BP) in hypertensive adults in rural Nigeria.
Methods: We compared changes in outcomes from baseline (2009) to midline (2011) and endline (2013) between non-pregnant hypertensive adults in the insurance program area (PA) and a control area (CA), through household surveys. The primary outcome was the difference between the PA and CA in change in BP, using difference-in-differences analysis.
Results: Of 1500 eligible households, 1450 (96.7%) participated, including 559 (20.8%) hypertensive individuals, of which 332 (59.4%) had follow-up data. Insurance coverage increased from 0% at baseline to 41.8% at endline in the PA and remained under 1% in the CA. The PA showed a 4.97 mm Hg (95% CI: −0.76 to +10.71 mm Hg) greater decrease in systolic BP and a 1.81 mm Hg (−1.06 to +4.68 mm Hg) greater decrease in diastolic BP from baseline to endline compared to the CA. Respondents with stage 2 hypertension showed an 11.43 mm Hg (95% CI: 1.62 to 21.23 mm Hg) greater reduction in systolic BP and 3.15 mm Hg (−1.22 to +7.53 mm Hg) greater reduction in diastolic BP in the PA compared to the CA. Attrition did not affect the results.
Conclusion: Access to improved quality healthcare through an insurance program in rural Nigeria was associated with a significant longer-term reduction in systolic BP in subjects with moderate or severe hypertension.

1. Introduction

Hypertension is one of the main risk factors for premature death in adults in sub-Saharan Africa (SSA) due to associated cardiovascular disease (CVD) [1]. The age-standardized prevalence of hypertension in SSA increased from 19.1% in 1990 to 25.9% in 2010 [2]. Reduction of blood pressure (BP) greatly reduces the risk of CVD [3]. However, antihypertensive treatment coverage in SSA is low due to low awareness of hypertension, and poor availability of quality care for hypertension [4,5]. In addition, hypertension treatment is often not affordable for patients. In Nigeria, almost 66% of healthcare expenditures are paid out-of-pocket by patients [6]. We investigated whether a health insurance program targeted at low-income groups, which included quality improvement of health facilities, could be used to provide effective care for hypertension in rural Nigeria. We previously demonstrated that the Kwara State Health Insurance (KSHI) program (formerly known as the Hygeia Community Health Care program) resulted in a significant reduction in BP in subjects with hypertension (21% of the target population [5]), two years after the introduction of the program [7]. However,

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sustainability of such program effects is essential. Here, we report the longer-term effect of the KSHI program on BP in the hypertensive population and, in addition to our previous study, we evaluated the contribution of improved quality of care in the program clinics.

2. Methods

The KSHI program is a voluntary health insurance program that aims to improve access to affordable quality healthcare for people in rural communities of Kwara State, Nigeria. The program provides coverage for primary and limited secondary healthcare, including antihypertensive treatment. In addition, the program improves the quality of care in healthcare facilities participating in the program by upgrading of facilities, training of staff in guideline-based care, and hospital management support (see supplemental material [eMethods] for a more detailed description of the program) [7].

2.1. Study design and population

We used a quasi-experimental design to measure the effect of the KSHI program on BP in hypertensive adults. We compared changes in outcomes from baseline (pre-program) with those found at midline after 2 years of follow up (short-term) and at endline after 4 years of follow-up (longer-term), in a program area (PA) and in a control area (CA) where the program was not implemented. The difference in changes from baseline between the PA and CA represents the true program effect.

The study population of non-pregnant adults with hypertension was derived from a population-based sample of the Afon and Ajasse Ipo districts in Kwara State. Both districts were low-income rural communities with comparable availability and quality of healthcare services at baseline (see supplemental material [eMethods] for more details on the population and setting) [7]. The KSHI program has been offered to households in the Afon district (the PA) since 2009. The program was not operational in the CA, Ajasse Ipo. Consecutive population-based household surveys were conducted to measure changes in outcomes over time. Household members were interviewed and BP was measured in both areas during the baseline survey in May and June 2009, before the roll out of the insurance program [7]. Households were revisited during the same months for the midline (2011) and endline (2013) surveys. All non-pregnant adults (aged ≥18 years) among 3023 community-dwelling adults who were hypertensive at baseline were eligible for this study. Only eligible individuals with complete follow-up data were included in the analysis.

2.2. Sampling and sample size

A stratified probability sample was drawn from a random sample of enumeration areas and a random sample of households in 2009. The target sample size was 1500 households which was defined based on outcomes to measure the socioeconomic impact of the program [7]. More information about the sampling procedures is given in the supplemental material (eMethods).

2.3. Data collection

Questionnaires to collect demographic, socioeconomic, and medical information were administered by trained interviewers. BP was measured 3 times on the upper left arm in upright position after at least 5 minutes of rest using a validated automated BP device (Omron M6 Comfort; Omron Corporation). The mean value of the second and third measurement was used for analyses [7]. In both areas, respondents with systolic blood pressure (SBP) ≥140 mm Hg or diastolic blood pressure (DBP) ≥90 mm Hg were advised to see a healthcare professional and were provided with an information leaflet. A medicine cabinet survey was conducted in 2013, in which all medications present in the household were identified, each medication was linked to individual household members, and the source (formal or informal provider) was registered [8].

2.4. Ethical review

Ethical clearance was obtained from the ethical review committee of the University of Ilorin Teaching Hospital (04/08/2008, UITH/CAT/189/11/782). Informed consent was obtained from all participants by signature or by fingerprint [7].

2.5. Data analysis

Hypertension was defined as measured SBP ≥140 mm Hg, and/or DBP ≥90 mm Hg, and/or (self-reported) drug treatment for hypertension [7]. *Hypertension stages 1 and 2* were defined as SBP between 140–159 and ≥160 mm Hg respectively and/or DBP between 90–99 and ≥100 mm Hg respectively [9]. *Treatment of hypertension* was defined as individual-linked hypertension medication observed in the medicine cabinet survey, or self-reported hypertension medication use. *Control of BP* (controlled hypertension) was defined as measured SBP <140 mm Hg and DBP <90 mm Hg [7]. *Use of healthcare for hypertension* was defined as a visit to a formal healthcare provider for hypertension in the last 12 months. A *formal healthcare provider* included public and private hospitals and clinics, primary healthcare centers, private physicians and nurses, and pharmacists. *Informal providers* included patent medicine vendors and traditional medicine practitioners and vendors [7].

The difference between the PA and CA in the change in mean SBP and DBP from baseline to midline and baseline to endline was predefined as the primary outcome to measure the effect of the program on health status in the population with hypertension at baseline [7]. Additionally, a pre-defined subgroup analysis based on hypertension severity at baseline was performed. The differences in control of BP and in antihypertensive drug treatment coverage between respondents in the PA and CA over time constituted secondary outcome measures. In addition to these outcome measures, we used proxies for quality of care to evaluate differences in quality between the two areas, in the endline survey. These included the intensity of healthcare utilization for hypertension, source of hypertension medication (formal healthcare provider versus an informal provider) and association with BP reduction, and adherence to antihypertensive medication.

2.6. Statistical analysis

We analyzed the data using Stata (version 12.0; StataCorp). We analyzed population characteristics of the participants with hypertension in the PA and CA using descriptive statistics. We compared groups using bivariable analysis (Kruskal–Wallis test for continuous variables, Pearson χ^2 test or Fisher exact test for categorical variables, and nonparametric trend test for ordinal scales) [7]. Difference-in-differences analyses with fixed effects [10] were performed to compare changes in outcome over time. With this approach, all respondents in the PA were considered to be in the intervention group irrespective of whether respondents were actually insured. Such an intention-to-treat approach eliminates the bias introduced by self-selection into (or out of) the insurance program and incorporates potential spillover effects on uninsured respondents who might also benefit from the quality improvement of the healthcare facilities in the PA [7]. Biomedical and socioeconomic confounders were defined a priori and included in the models irrespective of statistical significance. The variables included were body mass index, diabetes mellitus, smoking status, assets, the value of household food consumption and expenditures on nonfood items (a socioeconomic measure that proxies a household's yearly income, hereinafter referred to as consumption), employment, household size, being the head of the household, and marital status. The common trend assumption in a difference-in-differences analysis is that the two groups compared show the same trend over time without the intervention [10]. Baseline differences between the groups being compared may influence the effect of the intervention or the effect of the baseline screening of BP and possibly undermine the common trend assumption. Therefore, we corrected for baseline differences by including an interaction between time (follow-up survey year) and a priori selected characteristics, if significant at a 0.10 significance level [11]. These included interactions between follow-up survey year and age, gender, baseline BP (primary outcomes) or baseline hypertension severity (secondary outcomes), educational level, religious affiliation and consumption. Furthermore, we performed a multivariable linear regression analysis to evaluate the association between the location where respondents obtained antihypertensive medication (source of medication) and BP reduction from baseline to endline. Confounders were selected a-priori and included in the model when statistically relevant ($P < 0.10$). All estimates were corrected for clustering at enumeration area level and lower levels of clustering such as household and individual level. To evaluate the effect of missing data (mainly because of attrition), sensitivity analyses using inverse probability weighting were performed for the main outcome measures.

3. Results

3.1. Survey response rate and attrition

Of the 1500 sampled households, 187 households could not be located and were replaced by other households to reach the sample size of 1500, at baseline. Of 1500 eligible households, 1450 (96.7%) participated in the survey, including 559 non-pregnant adults identified with hypertension at baseline (309 of 1637 non-pregnant adults in the PA [18.9%] and 250 of 1048 in the CA [23.9%]). Longitudinal data were available for 332 hypertensive adults (59.4%); 194 (62.8%) in the PA and 138 (55.2%) in the CA (Fig. 1).

Thirty-one respondents (10%) died between 2009 and 2013 in the PA compared to 19 respondents (7.6%) in the CA ($P = 0.32$). Frequently reported causes of death were infectious diseases and old age. In both the PA and CA, stroke was the cause of death for two subjects, and diabetes complications for one subject.

3.2. Population characteristics at baseline

Median age was 60 (IQR, 48–70) in the PA compared to 55 (IQR, 47–62) ($P = 0.05$) in the CA. The percentage of females was 71.6% in the PA compared to 59.4% ($P = 0.02$) in the CA. Median BMI was 22.7 (IQR, 20.3–26.2) in the PA compared to 24.2 (IQR, 21.1–27.8) ($P = 0.02$) in the CA. Median consumption was USD 655.8 (IQR, 426–1079) in the PA compared to USD 819.6 (IQR, 583–1190) ($P = 0.001$) in the CA. In