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This supplementary material has been provided by the authors to give readers additional information about their work.
eMethods.

The Hygeia Community Health Care program
The Health Insurance Fund (HIF) is an international development organization committed to providing access to quality health care for low- and middle-income groups in several African countries through innovative financing mechanisms and improvement of health care quality. The HIF is developing and implementing community-based health insurance (CBHI) programs, which focus on the informal sector. The key elements on the demand side of the HIF’s program are the focus on organized groups in the informal sector and their dependents; the provision of (subsidized) insurance premiums reflecting the ability to pay; payment of co-premium by enrollees to promote ownership and encourage the groups to demand quality care; and voluntary enrollment. On the supply side, the key elements include capacity building, quality assurance, involvement of the private sector, focusing on performance and results-based financing, information gathering and management. Other models of health insurance include national health insurance programs that are state-funded and government managed and social health insurance programs that are generally designed for the working population and financed by payroll taxes collected from employers and employees. The HIF program uses a public-private partnership model and is implemented by PharmAccess International and private African Health Maintenance Organizations (HMOs) or health insurance companies. The HMOs are responsible for execution of the program and for contracting a network of health care providers to provide the care for the enrollees. The program started in Nigeria in Lagos and Kwara State in Nigeria in 2007 in collaboration with the HMO Hygeia Limited under the name of Hygeia Community Health Care (HCHC).

The aim of the HIF program is 2-fold: improving the demand for health care by introducing CBHI for individuals with low and middle incomes and improving the quality of care provided in these communities. To achieve this, the program addresses challenges on both the supply and demand side of the health care system. Donor money from both international and local sources is used to develop and set up the insurance program and to upgrade the medical and administrative capacity of the insurers and health care providers contracted under the program. Payment of insurers and providers is performance-based, as it relates payment of providers to their performance.

Quality assurance within HCHC program
Quality and efficiency of care are monitored through independent audits of an international quality improvement and assessment body called SafeCare, a partnership of PharmAccess International, the American Joint Commission International, and the South-African Council for Health Services Accreditation of Southern Africa. When a health care provider is contracted by the HMO, a baseline assessment in the clinic is conducted by SafeCare and a quality improvement plan is formulated. The provider specific improvement plans consist of specific targets in 13 different domains including management and leadership, human resource management, patients rights and access to care, management of information, risk management, primary health care services, inpatient care, operating theatre, laboratory, diagnostic imaging, medication management, facility management and support services. The improvement plans are implemented by the health care providers with support from the HMO, SafeCare monitors the progress on quality improvement through annual follow-up assessments with the SafeCare Quality Standards. Examples of quality improvement interventions include implementation of treatment guidelines (for example for hypertension), training of staff in guideline-based care, upgrading of laboratory equipment and training of laboratory staff to enable basic laboratory testing, assurance of continuous essential drug supplies, adequate medical file keeping, waste management protocols and hospital infection control protocols.

The HCHC program in Kwara
Since 2007, the HCHC program is rolled out in 3 regions in Kwara Sate, Nigeria: Kwara North (Shonga, Bacita, Lafiagi, Tsaragi), Kwara Central (Afon, Owode, Onire), and Kwara South (Oyun, Odo-Ogun, Oke-Ogun). The details and advantages of the health insurance program were communicated by the HMO through several channels. Activities included face-to-face information sharing (through outreach activities to the communities, house-to-house visits by enrollment officers, health education and advocacy visits to community opinion leaders) and large-scale communication and marketing activities in the target communities (through billboards, comics, brochures, flyers and elaborate announcements and information sharing on the radio). All households living in the districts in which the program is operational are eligible for enrollment. There is no preenrollment screening for chronic diseases. Over 72,000 people were enrolled in the HCHC program in September 2013 in all 3 regions in Kwara State. The HMO has contracted 14 public and private clinics to provide the care for their enrollees. Most clinics are primary and secondary care facilities that provide outpatient services and have admission capacity. Referral to 2 tertiary care clinics in Ilorin (the Kwara State capital) is possible if needed. Beneficiaries are enrolled individually (as opposed to household enrollment) on an annual basis and pay a co-premium of 300
NAIRA or approximately US $2 per person per year. Currently, individuals are responsible for about 7% of the premium, while the remaining share is covered by the subsidy of which Kwara State Government pays about 60%. The co-premium ranges from 0.96% of the average annual per capita consumption for the lowest wealth quintile to 0.16% for the highest wealth quintile (data from baseline survey 2009). The scheme’s beneficiaries do not incur out-of-pocket costs for the services covered since the clinics are paid directly by the insurance scheme.

Coverage within the HCHC program in Kwara
The insurance package provides coverage for consultations, diagnostic tests, and drugs for all disease categories (including hypertension) that can be managed at a primary care level, and limited coverage of secondary care services. Secondary care services provided include radiological and laboratory diagnostic tests and hospital admissions for different disease categories, minor and intermediate surgery, antenatal care and delivery care, neonatal care, immunizations, annual check-ups and HIV/AIDS treatment care and support. Excluded from the program are high technology investigations (computed tomography and magnetic resonance imaging), major surgeries and complex eye surgeries, family planning commodities, treatment for substance abuse/addiction, cancer care requiring chemotherapy and radiation therapy, provision of spectacles, contact lenses and hearing aids, dental care, management of acute cardiovascular events other than admission to a hospital (eg, trombolysis for stroke, coronary events), intensive care treatment and dialyses. There is no limit to the number of visits to the clinics for patients but as a large share of the payment from the insurer to the health care provider is paid trough capitation, providers are encouraged to prevent overutilization of services.

Study area and population
Kwara State is located in western Nigeria and is the fourth poorest state of the country (eFigure 1). The majority of the population lives in rural areas. The program and control areas included in this study are both rural, low income farming communities. The baseline survey conducted in 2009 demonstrated that Yoruba was the dominant ethnic group in both the program (67.8%) and control (89.2%) area. Nupe was another large ethnic group in the program area (9.9%). Islam and Christianity were the main religions, trading and farming the main occupations. The baseline survey showed that 20% of the population lived below the poverty line of US $2 (PPP adjusted) per day. The population of both areas was relatively homogenous in terms of wealth with average per capita consumption ranging from 31.261 Naira (US $210) to 190.006 Naira (US $1273) in the lowest to highest quintile in the program area and 32.651 (US $219) in the lowest and 226.196 (US $1515) in the highest quintile in the control area. Forty percent of the population completed primary school, and a further 25% completed senior secondary school. Literacy rates ranged from 45.7% in the program area compared to 51.4% in the control area.

Nigeria has among the highest out-of-pocket health spending and poorest health indicators in the world. Similar to the rest of the country, Kwara State has a weak health system with inadequate government funding for health, weak governance and legislation, inadequate health infrastructure and poor service quality. Kwara State is participating in the federally funded National Health Insurance Scheme (NHIS). The majority of the enrollees, however, are individuals working in the formal sector. NHIS started a rural community-based social health insurance program in 2010 but access to the scheme is limited. The baseline survey in 2009 showed that less than 1% of the population in the program and control area was enrolled in a health insurance scheme.

In both the program and control area, there were few functional health care facilities before the start of the program. Most clinics were primary care clinics; some provide limited secondary care (such as surgery, inpatient care). The implementing organisation of the insurance program performed an assessment in the program area of potential health care providers that could be contracted under the HCHC program. Most facilities were poorly maintained, essential equipment was lacking and patient numbers were low. A similar situation was observed in clinics in the control area (clinic assessment done by the research team). The program area included three public and three private clinics. Two clinics were selected for the provider network of the Afon Program: the General Hospital (primary and secondary care, State Government facility) in Afon community and Ilera Layo (primary care, private facility) in Aboto Oja community (eFigure 1). The control area included three public and two private clinics. The populations of the program area and control area included in this study all had similar geographical access to care as sampling was done within 15 kilometres distance of towns with comparable health facilities (eFigure 1).

* Conversion rate 15 may 2009, oanda.com US $1 = 149.28 NGN
Sampling and sample size

Sampling
Sampling of households was done in the program area and the control area. The control area was selected because of its similarity with the program area in terms of language, main economic activities, distribution of health care facilities, urban/rural composition and population size. A stratified two-stage random probability sample was drawn in 2009. The first stage consisted of a random selection of 100 out of 300 enumeration areas (EAs) from the 2005 National Population Census. These 300 EAs were located within 15 kilometres distance from two towns in the program area in Afon district (Afon and Aboto Oja) and from a third town in the control area in Ajasse Ipo district (Ajasse Ipo). The three towns had similar health care facilities at baseline. As part of the intervention, quality improvement (facility improvement, training of staff) took place in the two health care facilities in Afon district. The sample was stratified by EAs in and outside the towns to allow for sufficient households from remote areas, where patients have more difficult access to services provided by the health care facilities, in both areas. In the second stage, the research team conducted a pre-survey to list all households in these EAs. Households were randomly sampled from this list with a probability proportional to EA size. This second stage sampling was done for each of the four strata separately, such that the sample within a stratum represented the population density. Finally, a number of replacement households were sampled within each EA, in anticipation of household migration in the period between the pre-survey and the baseline survey. If a sampled household could not be found, a replacement household was approached.

Sample size
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 general population. These outcome measures were defined to study the socioeconomic impact of the insurance program in the general population. The specific health outcomes of the impact evaluation were defined after the baseline survey (but before the follow-up survey) after which data on the burden of disease in the study population became available. Therefore, no formal sample size calculations were performed using blood pressure changes as main outcome measure. However, with a fixed sample size of 1500 households, we expected to be able to measure an impact on blood pressure given the prevalence of hypertension of over 20% in adults in the study population and an expected insurance uptake of 50%.
eReferences


**Nigeria**

*Kwara State*

Program area: Afon and Aboto Oja

Control area: Ajasse Ipo

- State capital
- Community with (potential) program clinic*
- Sampling area (max 15 km around community)

*The two Hygeia Community Health Care (HCHC) health care clinics in which the insurance program was operational after the baseline survey are located in Afon community and Abota Oja community. In Ajasse Ipo, the HCHC program is not operational but there are health care clinics in this community that are comparable with the clinics in the program area at baseline (before upgrading by the HMO).*
eTable 1. Baseline characteristics of respondents with complete data and with missing data and baseline characteristics of respondents with missing data in the program and control areas

<table>
<thead>
<tr>
<th>Variable</th>
<th>Respondents with complete data N=413</th>
<th>Respondents with missing data N=151</th>
<th>p-value*</th>
<th>Respondents with missing data program area N=76</th>
<th>Respondents with missing data control area N=75</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, median (IQR)</td>
<td>60.0 (48.0-70.0)</td>
<td>55.0 (42.0-70.0)</td>
<td>0.28</td>
<td>59.0 (40.0-70.0)</td>
<td>55.0 (45.0-70.0)</td>
<td>0.69</td>
</tr>
<tr>
<td>Male, n (%)</td>
<td>141 (34.1)</td>
<td>65 (43.9)</td>
<td>0.034</td>
<td>28 (36.8)</td>
<td>37 (51.4)</td>
<td>0.075</td>
</tr>
<tr>
<td>Annual per capita consumption^, median (IQR)</td>
<td>73925 (48340-117900)</td>
<td>71967 (50222-117405)</td>
<td>0.87</td>
<td>66162 (42493-101326)</td>
<td>76497 (57530-123583)</td>
<td>0.11</td>
</tr>
<tr>
<td>Baseline systolic blood pressure, median (IQR)</td>
<td>150.5 (141.5-168.5)</td>
<td>148.5 (139.0-166.0)</td>
<td>0.36</td>
<td>147.5 (138.3-166.3)</td>
<td>148.5 (140.5-166.0)</td>
<td>0.41</td>
</tr>
<tr>
<td>Baseline diastolic blood pressure, median (IQR)</td>
<td>95.0 (90.0-103.0)</td>
<td>93.5 (90.0-104.5)</td>
<td>1.00</td>
<td>94.3 (90.0-104.5)</td>
<td>93.5 (90.0-103.0)</td>
<td>0.67</td>
</tr>
</tbody>
</table>

*Chi² test used for categorical variables, Kruskal Wallis for continuous variables
^n=148, n=72, in Nigerian Naira
### eTable 2. Association between hypertension status at baseline and insurance status in 2011, corrected for confounders

<table>
<thead>
<tr>
<th>Insured in 2011</th>
<th>Logistic regression*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td>Hypertension grade 1 at baseline†</td>
<td>0.76</td>
</tr>
<tr>
<td>Hypertension grade 2 at baseline†</td>
<td>3.40</td>
</tr>
</tbody>
</table>

#### Confounding baseline characteristics

- **Female**: 1.21 (0.49 - 2.97) 0.68
- **Age, divided by 10**: 0.46 (0.16 - 1.33) 0.15
- **Age, squared**: 1.09 (0.98 - 1.20) 0.10
- **Being household head**: 0.95 (0.35 - 2.61) 0.92
- **Married**: 2.92 (1.20 - 7.08) 0.02
- **Individual has worked in past year**: 1.31 (0.54 - 3.18) 0.54
- **Households head highest completed education level: primary**: 0.59 (0.19 - 1.85) 0.37
- **Households head highest completed education level: secondary**: 0.64 (0.17 - 2.41) 0.51
- **Religion: Islam**: 1.31 (0.24 - 7.34) 0.76
- **Ethnicity: Yoruba**: 1.49 (0.29 - 7.50) 0.63
- **Program clinic in community = Ilera Layo**: 2.49 (0.83 - 7.44) 0.10
- **(Potential) program clinic in the community**: 9.51 (2.69 - 33.6) <0.001
- **Household size**: 0.82 (0.67 - 1.00) 0.045
- **Normalized wealth indicator**: 2.04 (1.21 - 3.45) 0.008
- **Household with functional toilet facility**: 8.79 (0.41 - 188) 0.16
- **Household with good quality drinking water**: 0.46 (0.16 - 1.34) 0.15
- **Individual has diabetes**: 0.87 (0.070 - 10.7) 0.91
- **Missing diabetes status**: 0.63 (0.33 - 1.21) 0.17
- **Individual smokes**: 0.31 (0.094 - 1.00) 0.049

#### Observations

1,137

*Mixed model corrected for clustering at enumeration area level and household level. OR: Odds ratio. CI: Confidence Interval.

†Compared to respondents without hypertension at baseline. Grade 1 hypertension: systolic blood pressure between 140-159 mmHg and diastolic blood pressure between 90-99 mmHg. Grade 2 hypertension: systolic blood pressure ≥ 160 mmHg or diastolic blood pressure ≥ 100 mmHg. 

‡Compared to no education or secondary education household head. 

§Compared to primary or no education household head. 

‖Compared to other education levels. 

¶Compared to other religions. 

ǁCompared to other ethnic groups. 

**Compared to the other (potential) program clinics. The word potential refers to the clinics in Ajasse Ipo community in the control area. In this community the insurance program was not operational but the community has clinics comparable to the clinics in the program area at baseline (before upgrading by the HMO) and is therefore classified as a potential program clinic if the program would roll out in this area. 

## Compared to remote areas without a (potential) program clinic in community. 

### Based on asset score 2009. 

### OR increase in self-reported health status per category, 0=worst, 4=best.