Determinants of Enrolment and Renewing of Community-Based Health Insurance in Households With Under-5 Children in Rural South-Western Uganda

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Abstract

Background: The desire for universal health coverage in developing countries has brought attention to community-based health insurance (CBHI) schemes in developing countries. The government of Uganda is currently debating policy for the national health insurance programme, targeting the integration of existing CBHI schemes into a larger national risk pool. However, while enrolment has been largely studied in other countries, it remains a generally under-covered issue from a Ugandan perspective. Using a large CBHI scheme, this study, therefore, aims at shedding more light on the determinants of households’ decisions to enrol and renew membership in these schemes.

Methods: We collected household data from 464 households in 14 villages served by a large CBHI scheme in south-western Uganda. We then estimated logistic and zero-inflated negative binomial (ZINB) regressions to understand the determinants of enrolment and renewing membership in CBHI, respectively.

Results: Results revealed that household’s socioeconomic status, husband’s employment in rural casual work (odds ratio [OR]: 2.581, CI: 1.104-6.032) and knowledge of health insurance premiums (OR: 17.072, CI: 7.027-41.477) were significant predictors of enrolment. Social capital and connectivity, assessed by the number of voluntary groups a household belonged to, was also positively associated with CBHI participation (OR: 5.664, CI: 2.927-10.963). More positive perceptions on insurance (OR: 2.991, CI: 1.273-7.029), access to information were also associated with enrolment and renewing among others. Burial group size and number of burial groups in a village, were all significantly associated with increased the likelihood of renewing CBHI.

Conclusion: While socioeconomic factors remain important predictors of participation in insurance, mechanisms to promote inclusion should be devised. Improving the participation of communities can enhance trust in insurance and eventual coverage. Moreover, for households already insured, access to correct information and strengthening their social network information pathways enhances their chances of renewing.

Keywords: Community-Based Health Insurance, Enrolment, Renewing, Perceptions, Rural Uganda

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Citation: Nshakira-Rukundo E, Chanie EM, Nshakira N, Gerber N, von Braun J. Determinants of enrolment and renewing of community-based health insurance in households with under-5 children in rural south-western Uganda. Int J Health Policy Manag. 2019;x(x):x–x. doi:10.15171/ijhpm.2019.49

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Original Article

Implications for policy makers

- Households’ socioeconomic welfare is strongly associated with While community-based health insurance (CBHI) enrolment and renewing decisions in rural Uganda.
- Social connectivity and access to information also predict household insurance status.
- It is important to consider community perceptions on health insurance to improve trust in insurance, enrolment and renewing.
- Burial groups in rural Uganda can act as critical entry points for formalising health insurance.

Implications for the public

While community-based health insurance (CBHI) is expanding in many developing countries, with the targets of universal health coverage, enrolment remains low where programmes are voluntary in nature. Moreover, for those who enrol, dropping out is high. Understanding why households enrol and continue to renew their membership is central to achieving higher insurance coverage and ultimately universal coverage. Governments interested in reaching rural poor people with health insurance should consider maximising the potential of existing social support and informal insurance systems such as burial groups. Our research adds to a small body of literature on health insurance in Uganda and more broadly on renewing membership in insurance in developing countries.
Background

The 2010 World Health Report suggested that apart from the availability and equitable use of resources, reliance on direct payments for health was another barrier to universal health coverage, leading to increased catastrophic health expenditures. Xu et al estimated that about 150 million people faced catastrophic health expenditures and 100 million people were pushed into poverty annually due to catastrophic health payments. Moreover, poor households are more likely to borrow and or sell their household productive assets when faced with such health payments.

To protect households from eminent deprivation due to health expenditures and encouraging policies for universal health coverage, the World Health Organization (WHO) has recognised the role of community-based health insurance (CBHI) schemes. In addition to previous pronouncements in support of CBHI (such as Resolution 58.33 of the 2005 World Health Assembly), the 2010 WHO has stated that countries need “longer-term plans for expanding prepayment and incorporating community and micro-insurance into the broader pool” including “voluntary schemes, such as community health insurance or micro-insurance.”

The contributions of CBHI schemes to health systems financing and broader pathways to universal health coverage in developing countries are well-documented. In detail, substantial research has explored questions of enrolment and renewing. Nonetheless, in Uganda, a country with a long history of CBHI, very little is known about these questions, especially from a quantitative perspective. Previous work has only used qualitative methods, identifying various issues such as lack of trust, limited understanding from both policy-makers and clients, and limited community involvement, among the factors inhibiting enrolment. Only 3 studies try to address these questions quantitatively. Biggeri et al study the feasibility of CBHI in a region without prior experience in a willingness to pay exercise. Cecchi et al, using a public good experiment, study the dynamics of social capital when third-party run CBHI is introduced in villages. They reveal that social capital suffers when insurance is formalised through CBHI schemes. None of these studies directly addresses the main questions, why households join and why households remain in CBHI schemes. The closest to our study is who use mixed methods to investigate why rural households choose to enrol in insurance over free health services. This study is also in a similar area like ours. They find that overall poor quality services, drug stock-outs as well as poor human resourcing pushed households from free government health services while easier access to healthcare, financial protection, the perception of the quality of care and the intrinsic benefits of mutual assistance attracted individuals to CBHI. Our main objective here is to contribute to this body of work by directly addressing these questions.

Overall, the literature on enrolment, as elaborated in several systematic reviews can be summarised in 2 dimensions. Firstly, the legal, institutional and policy environment in which insurance operates is important. Countries with stronger laws also have the political will to facilitate higher enrolment. However, major bottlenecks to voluntary enrolment are associated with households’ socioeconomic capacities to demand. Wealthier, better educated and people with positive perceptions about insurance and more informed individuals are more likely to enrol. Moreover, specific groups such as women in reproductive age and children face distinct barriers to enrolment in comparison to the general population.

While enrolling in insurance remains of pertinent interest, dropping out of insurance is high. A handful of papers have looked into this issue. The other purpose of this research is to add to this thin literature. Moreover, for Uganda, this analysis is of further policy interest. After many years of a slow policy process, the government is in the process of starting a national health insurance scheme. The scheme will aim to build on and integrate existing community insurance schemes into a larger risk pool. These results will, therefore, feed into the policy process, in a timely fashion, to give a better understanding of what influences rural households’ decisions to participate and renew participation.

The Landscape of Health Insurance in Uganda

Uganda does not have any public insurance programme. The current health financing policy provides that general health services are free at public health facilities. Private non-profit health facilities receive grants to subsidise services but also charge user fees. However, there has been a long-standing process of starting a public health insurance programme. Coverage of private insurance schemes is lean, available mainly to urban formal sector employed individuals and estimated at only about 460,000 people in 2012. CBHI is, therefore, the remaining option for rural, informal and poor households. Musau profiled the first CBHI scheme in Uganda, the Kisiizi Hospital CBHI scheme, and since then, the schemes have grown to 21 schemes covering over 140,000 people in 2014. The schemes are mainly in central and western Uganda, especially in regions that have been known to have burial societies which provide informal mutual insurance. While enrolling in insurance remains of pertinent interest, previous studies have shown a low demand for CBHI in Uganda. recent studies have shown increasing interest. It is understood that in the financial year 2018/2019, the revised National Health Insurance Bill will be approved into law for the establishment of a national health insurance scheme.

The Kisiizi Hospital Community-Based Health Insurance Scheme

The Kisiizi Hospital CBHI scheme is the largest CBHI scheme in Uganda, providing insurance coverage to over 42,000 individuals. Households pay premiums ranging from UGX (Uganda Shilling; Uganda currency) 11,000 per person for a household of 8-11 members to UGX 28,000 per person for a 2-person household. In US dollar terms, at the time of data collection in August 2015, this was equivalent to US$3 for 8-11 member household and US$8 for the 2-person households. Accordingly, these premiums were equivalent to 1%-2% of the annual income in south-western Uganda.
in 2015. Enrolment in insurance is group based in that households that participate organise themselves in groups. However, the scheme does not operate as group insurance since there is no joint liability in the group. Majority of the groups (about 95%) were traditional funeral groups which have existed in the area for very many decades. However, the unit of enrolment is a household and groups are only used as marketing and coordination platforms. Currently, about 210 groups belong to the scheme. Households are required to enrol as a full unit and not partial enrolment as observed in other schemes such as in Ghana. An important feature of the scheme is the waiting time for full coverage. Newly enrolled households typically wait for about 12 months to be fully covered. Newly enrolled members pay 90% of the medical costs when they are hospitalised within the first 12 months of enrolment. This waiting time is significantly longer than what is observed in other schemes such as in Nigeria. These conditions are aimed to control moral hazard. The scheme covers basic primary care, maternity care, surgeries, and outpatient and inpatient services and excludes outpatient services for chronic illnesses and substance abuse related illnesses and injuries.

Methods
The Data
Data used in this study comes from a cross-sectional survey conducted between August and December 2015, in Kabale and Rukungiri districts in south-western Uganda. A multi-stage simple random sampling criterion was applied to select a population representative sample of 464 households in 14 villages. The first stage was the selection of villages from 3 sub-counties of Nyakishenyi and Nyarushanje in Rukungiri district and Kashamba sub-county in Kabale district, which have the highest coverage of Kisiizi CBHI scheme. The 3 sub-counties represented a population of 106,000 people in 23,500 households as of the 2014 national census. We invited leaders from 23 parishes in the 3 sub-counties for a first stage sampling workshop. Fifteen of the 23 parish leaders attended in person or were represented by a committee member. Eight parishes that did not have a representative were excluded. All parish leaders were requested to list all the villages in their area. In addition, they were requested to classify the villages into rich and poor, using access to road, school or health facility or market as a criterion. Altogether, 174 villages were listed, 104 as poor and 70 as rich villages. All the listed villages’ names were put in a raffle box according to their categorisation and a leader randomly selected 7 villages from each box in the presence of other leaders and the research team. Leaders who attended the village sampling workshop provided the contacts of lower level leaders in the selected villages for household listing.

The second stage of sampling was household listing and selection of households for the survey. Fourteen lower level leaders were invited for a household listing workshop and requested to generate a list of households in their villages who had a child between 6 months and less than 59 months (5 years). A total of 511 households were listed and 464 were interviewed.

A data collection tool was developed by the first and fourth authors and was duly assessed by the respective ethical committees in Germany and Uganda. The tool included a household demographic module collecting data on household occupancy; a child and maternal health module recording data on healthcare seeking behaviour for mothers and children and a nutrition module recording household food availability and intake data. Data on durable assets holdings and other endowments in agriculture, water and sanitation, and housing was recorded as an indicator for household social and economic welfare. The health insurance and social connectivity modules collected data regarding household insurance status, group membership and participation, and knowledge of insurance such as premiums and benefits package. In line with, data on various perceptions on insurance were collected. Moreover, village level information is also collected and used to control for village heterogeneity.

Data were collected using Open Data Kit, a computer-assisted personal interviewing platform. Open Data Kit and other platforms of similar fashion are becoming increasingly suggested for their overall cost-effectiveness and reducing of common survey errors. Data analysis was conducted in Stata version 14.

Empirical Approach
We employ 2 models to understand the determinants of enrolment and renewing CBHI. Since the outcome for CBHI participation (1 if CBHI member and 0 otherwise), the suitable model is a binary logistic model to estimate the determinants of household’s CBHI status. The model is given as:

\[
\Pr(\text{Insure}=1) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \epsilon_i
\]

Where the probability that a household \( i \) was enrolled depends on \( X_{1i} \), a vector of household socioeconomic and demographic variables, \( X_{2i} \) a vector of household enabling variables and \( X_{3i} \) is a vector of village level variables and an error term \( \epsilon_i \). All household socioeconomic variables, household enabling variables and village level variables are shown in Table 1. We show odds ratios of the association between the covariates and the decision to enrol in CBHI. To ascertain that the model is well fit, we first re-center some variables to overcome multi-collinearity. We then show the Variance Inflation Factor statistic.

The decision to renew membership in CBHI is modelled in the form of the length of time households are insured. The more the years a household was in CBHI implies the number of annual renewing decisions taken by the households. As seen in the Figure, majority households (56%) are not in CBHI. These are therefore coded as zeros regarding the decision the renew insurance.

Because the outcome is a non-negative count outcome – years of participation in CBHI, a suitable model would be of a Poisson distribution, such as Poisson, Tobit, or negative binomial model. However, as the Figure shows, we are worried about excess zeros (over-dispersion) since more than half the sample does not renew participation. To model the determinants of renewing CBHI, we, therefore, use a zero-
inflated negative binomial (ZINB) model. The ZINB model facilitates the estimation of a non-negative count outcome with possible over-dispersion better than other models for count outcomes. The ZINB model performs the inflation equation and an outcome equation. The inflation equation is a logistic estimation of the probability that the outcome is observed as a zero. After accounting for the excess zero in the model estimates the probability of the outcome. In order to show that the ZINB is the appropriate model over negative binomial model and other models of count outcomes, we show the Vuong test, which shows a significantly positive test statistic if the data is suitable for zero-inflated models. The basic model is then given as follows.

\[
\text{Years}_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \epsilon_i
\]

Similar to determinants of CBHI enrolment status, renewing (Years) is a function of vectors for household socioeconomic and demographic variables, household enabling variables and village covariates. In the results, we report incident rate ratios (IRRs) for renewing CBHI.

**Results**

**Descriptive Results**

Overall, 44% of the respondents were enrolled in CBHI and the average number of years of enrolment was 5 years. In Table 2, we detail summary statistics and the mean differences between CBHI and non-CBHI households, obtained through t tests. The average age for under-fives was 30.2 months while the average age for mothers was 30.2 years. 55.4% of the mothers had delivered their youngest child in a health facility. On average, birth weight was 3.1 kilograms but we observe substantial differences between CBHI and non-CBHI children.

Birth weight was significantly lower in households with CBHI than those without. This might raise questions of adverse selection into insurance. However, as enrolment is group based and groups are independent of individual household preferences, it is highly doubted that households with low birth weight enrolled more than the rest. We also observe substantial differences in parental education and religion. CBHI households are more likely to be Catholic, which is the dominant religion in the area but are less likely to have secondary education. Men in insured households are likely to be employed in casual labour while only 5% of mothers in CBHI were casual labourers.

Socioeconomic welfare was assessed using principal components analysis (PCA) and combined 41 variables representing household asset holding, water and sanitation, agriculture and livestock assets and housing quality into a single index. On average, in terms of socioeconomic welfare, households in the richest quintile were almost 3 times better off than the poorest (bottom quintile) households. There is no substantial difference between the CBHI and non-CBHI in the richer households. Only in the poorest households, do observe substantial differences between the insured and non-insured households. Using PCA again, we follow Jehu-Appiah et al to develop a perception index. The perception index combines 42 Likert scale questions (see Supplementary file 1, Table S1) that elicit perceptions of 6 dimensions, namely; social influence, financial protection, premiums, health beliefs, management of schemes, the convenience of the scheme processes (such as enrolment requirements) and quality of care. A second PCA is then executed on these 7 indices to generate the first principal component as the perception index. To ascertain internal consistency of the indices developed, we provide the Cronbach's alpha for the overall perceptions index and the 6 dimensions of perceptions in Table S2 in Supplementary file 1. Overall, we observe that households in CBHI have more positive perceptions than households not in CBHI.

As stated earlier, CBHI is accessed through burial groups. In principle, every household belongs to a burial group. Katabarwa has stated about their historical presence and Musau found that over 90% in south-western Uganda belonged to one. In this survey, virtually every household belonged to a burial group. We find that households in CHBI belonged to burial groups with an average of 60 households. Households that were not in CBHI were in generally larger burial groups averaging 80 households.

Villages can have several burial groups. We find households in CBHI belonged to villages with about 3.6 burial groups while non-CBHI belonged to villages with an average of 2.1 groups. We further indicate the differences in voluntary group membership, access to information and neighbourhood effects. Overall, households in CBHI belonged to more groups, had more access to information and had at least one neighbour in CBHI. We provide more descriptive results in Table 2.

**Empirical Results**

**Determinants of Enrolment in Community-Based Health Insurance Scheme**

Table 3 presents the results of a logistic regressions model for the determinants of enrolment in CBHI. We present the results in 3 models. Model one presents only household socioeconomic and demographic variables. Model 2 includes household enabling factors. These variables are not in direct control of a household but enhance the household's capacity to participate in CBHI. The full model, Model 3 includes...
village covariates. First, we explore factors associated with reducing the odds of enrolment. We observe that households with older children are less likely to enrol as their odds of enrolment are lower by about 3% (odds ratio [OR]: 0.969, CI: 0.940-0.999) in the full model. The coefficient of the child’s age in months square is not statistically significant, implying that, as there is no evidence to suggest that, as children in households become older, household enrolment behaviour changes. Secondly, we observe that parental education is negatively associated with enrolment. Odds were low by slightly over 7% (OR: 0.926, CI: 0.896-0.958).

We then turn to factors that enhance enrolment of households. As would be expected, there is a strong correlation between household wealth and enrolment status. Holding the poorest households as a comparison group, we find that as households improve in wealth, so do their odds of enrolment in CBHI. Average, richer and richest households were 2 to 4 times more likely to participate in CBHI. Once we control for household enabling variables we observed that households in average and richest classification were 2 to 4 times more likely to participate in CBHI. As would be expected, there is a strong correlation between household wealth and enrolment status. In the full model, we observe that richest households were still close to 4 times more likely to enrol in CBHI than the poorest households.

Table 1. Variable Type and Description

| Variable                           | Type and Variable Coding                                                                 |
|------------------------------------|-----------------------------------------------------------------------------------------|
| CBHI enrolment                     | Dummy: 1 = if a household was enrolled in CBHI, 0 = otherwise                           |
| Years in CBHI                      | Continuous: number of years in CBHI, ranging from 0 for the uninsured to 11 years       |
| Child’s age (months)               | Continuous: age in months                                                               |
| Mother’s age                       | Continuous: age in years                                                                |
| Birth weight                       | Continuous: weight in kilos                                                            |
| Household size                     | Continuous: number of people residing in the household                                  |
| Parental (secondary) education     | Dummy: 1 = if at least of the parents has a secondary education, 0 = none of the parents has a secondary education |
| Food adequacy                      | Dummy: 1 = if household states had enough food, 0 = if household states that food was not enough in the last 7 days |
| Household diet diversity score     | Continuous: number of foods groups consumed in the last 7 days out of 12 food groups   |
| Father employment = casual labourer| Dummy: 1 = father/husband's employment is casual labour, 0 = father/husband's employment not casual labour |
| Mother employment = casual labourer| Dummy: 1 = mother's employment is casual labour, 0 = mother's employment not casual labour |
| Health facility delivery           | Dummy: 1 = if child delivered from a health facility, 0 = child not delivered in a health facility |
| Village altitude                   | Continuous: distance from village to commonly used health facility                      |
| Quintile 1 (poorest)               | Categorical: divides a social economic wealth index into 5 categories: 1 = quintile 1 – poorest, 2 = quintile 2 – poorer, 3 = quintile 3 – average, 4 = quintile 4 – richer, 5 = quintile 5 – richest |
| Quintile 2 (poor)                  |                                                                                         |
| Quintile 3 (average)               |                                                                                         |
| Quintile 4 (rich)                  |                                                                                         |
| Quintile 5 (richest)               |                                                                                         |
| Has a neighbour in CBHI            | Dummy: 1 = if one of the four immediate neighbours of a household is in CBHI, 0 = none of the neighbours is in CBHI |
| Access to information              | Dummy: 1 = if the household had a television, or listened to radio daily or read a newspaper, 0 = household does not own a television, read a newspaper or listen to radio daily |
| Voluntary groups membership        | Continuous: number of voluntary groups a household belongs/participates in               |
| Perception index                   | Continuous: PCA generated index (first principal component) from 7 indices about perceptions on health insurance The index is made of 6 individual indices for premiums (5 questions), convenience of CBHI scheme (8 questions), benefits/financial protection (7 questions), quality of care (7 questions), management of the scheme (4 questions) and health beliefs (4 questions) and social influence (5 questions). Altogether, 42 questions in the index |
| Village health team                 | Dummy: 1 = if respondent has received any health advice from a community health worker in the last 12 months, 0 = otherwise |
| Know premiums                      | Dummy: 1 = if respondent knows insurance premiums per individual, 0 = otherwise          |
| Health facility waiting time       | Continuous: waiting time at health facility recorded in minutes                         |
| Size of burial groups              | Continuous: number of households in a burial group a household belongs to                |
| Number of burial groups in village | Continuous: number of burial groups in the village                                       |
| Village has a school               | Dummy: 1 = if village has a school, 0 = otherwise                                       |
| Village has a health centre        | Dummy: 1 = village has a health centre, 0 = otherwise                                    |
| Trading trade                      | Dummy: 1 = if village main economic activity is retail trade, 0 = otherwise               |
| Banana cultivating village         | Dummy: 1 = if village main economic activity is banana cultivation, 0 = otherwise       |
| Distance to health facility        | Continuous: distance from village to commonly used health facility                      |
| Village altitude                   | Continuous: village altitude measured in metres above sea level                           |

Abbreviations: CBHI, community-based health insurance; PCA, principal components analysis.
Table 2. Descriptive Statistics – T Tests With Mean Differences in the Subgroups

| Overall Mean | Mean Non-CBHI | Mean CBHI | Mean Difference | T Statistic |
|--------------|---------------|-----------|----------------|-------------|
| Child’s age (months) | 30.202 | 30.822 | 29.404 | 1.418 | .318 |
| Mother’s age | 30.204 | 30.132 | 30.296 | -0.164 | .807 |
| Birth weight | 3.157 | 3.202 | 3.099 | 0.103 | .026** |
| Household size | 5.679 | 5.659 | 5.704 | -0.045 | .824 |
| Catholic | 0.504 | 0.383 | 0.660 | -0.277 | .001*** |
| Parental (secondary) education | 0.304 | 0.356 | 0.236 | 0.120 | .005*** |
| Food adequacy | 0.534 | 0.510 | 0.567 | -0.057 | .224 |
| Household diet diversity score | 4.097 | 4.027 | 4.187 | -0.160 | .173 |
| Father employment = casual labourer | 0.356 | 0.299 | 0.414 | -0.115 | .010** |
| Mother employment = casual labourer | 0.101 | 0.138 | 0.054 | 0.084 | .003** |
| Health facility delivery | 0.554 | 0.529 | 0.586 | -0.057 | .218 |
| Wealth index (poorest) | -1.262 | -1.291 (64) | -1.199 (30) | -0.092 | .023** |
| Poorer | -0.777 | -0.790 (53) | -0.759 (40) | -0.030 | .231 |
| Average | -0.299 | -0.326 (48) | -0.273 (48) | -0.052 | .077* |
| Richer | 0.310 | 0.311 (42) | 0.309 (53) | 0.003 | .961 |
| Richest | 2.211 | 2.370 (54) | 1.943 (32) | 0.427 | .187 |
| Access to information | 0.599 | 0.548 | 0.665 | -0.117 | .011** |
| Has a neighbour in CBHI | 0.692 | 0.521 | 0.911 | -0.390 | .001*** |
| Voluntary groups membership | 1.911 | 1.516 | 2.420 | -0.904 | .001*** |
| Perception index | -0.000 | -0.546 | 0.712 | -1.247 | .001*** |
| Village health team | 0.466 | 0.421 | 0.522 | -0.101 | .031** |
| Know premiums | 0.528 | 0.241 | 0.897 | -0.655 | .001*** |
| Health facility waiting time | 88.621 | 71.540 | 110.581 | -39.041 | .001*** |
| Size of burial groups | 71.366 | 80.100 | 60.140 | 19.962 | .001*** |
| Number of burial groups in village | 2.778 | 2.130 | 3.611 | -1.481 | .001*** |
| Village has a school | 0.528 | 0.628 | 0.399 | 0.229 | .001*** |
| Village has a health centre | 0.401 | 0.460 | 0.325 | 0.135 | .003*** |
| Trading trade | 0.366 | 0.391 | 0.335 | 0.056 | .217 |
| Banana cultivating village | 0.261 | 0.249 | 0.276 | -0.027 | .515 |
| Distance to health facility | 11.239 | 12.646 | 9.429 | 3.217 | .001*** |
| Village altitude | 1720.235 | 1671.336 | 1783.105 | -111.769 | .001*** |

N: 464

Abbreviation: CBHI, community-based health insurance.
Significance levels for * .10, ** .05, *** .01. For wealth index, the numbers of observations are 94, 92, 97, 95 and 86 for the poorest, poorer, average, richer and richest households, respectively. Observations for CBHI and non-CBHI households in parenthesis.

We find that households with higher access to information had higher odds of enrolment (OR: 1.643; 95% CI: 1.030-2.620). However, while the coefficient generally increases, it is not significant when we control for group level enabling factors and village level covariates.

Model 2 includes several household enabling factors. These variables give us a host of social network and social connectivity proxies. We find that most of these indeed are associated with increased odds of enrolment. First, we observe that having a neighbour in CBHI increased odds of enrolment by 3.5 times (OR: 3.509, CI: 1.514-8.133). This association vanishes when we control for other community level variables. We find that belonging for more voluntary groups was associated with increasing enrolment by over 5 times (OR: 5.664, CI: 2.927-10.963). However, the relationship is non-linear in that enrolment reduces as a household participated in more voluntary groups. We find that what households know and what they perceive about insurance matters. Knowing premiums is a proxy of knowledge about CBHI processes, benefits, requirements and expectations. We find that knowing premiums was associated with increasing the odds of enrolment by up to between 20 times and 17...
| Variables                              | Model 1 |          |          | Model 2 |          |          | Model 3 |          |          |
|---------------------------------------|---------|----------|----------|---------|----------|----------|---------|----------|----------|
|                                      | OR      | P Value  | 95 % CI  | OR      | P Value  | 95 % CI  | OR      | P Value  | 95 % CI  |
| Child age (months)                    | 0.997   | .653     | 0.981-1.012 | 0.973** | .041     | 0.947-0.999 | 0.969** | .040     | 0.940-0.999 |
| Child age square                      | 1.000   | .474     | 0.999-1.001 | 1.000   | .952     | 0.998-1.002 | 1.000   | .606     | 0.998-1.001 |
| Mother’s age                          | 1.009   | .665     | 0.969-1.051 | 0.999   | .980     | 0.921-1.084 | 1.045   | .367     | 0.949-1.151 |
| Mother’s age square                   | 1.000   | .878     | 0.996-1.003 | 0.998   | .566     | 0.993-1.004 | 0.997   | .358     | 0.991-1.003 |
| Birth weight                          | 0.647*  | .051     | 0.418-1.002 | 0.975   | .924     | 0.573-1.659 | 0.746   | .353     | 0.402-1.385 |
| Household size                        | 1.060   | .363     | 0.935-1.203 | 0.978   | .817     | 0.807-1.184 | 0.914   | .456     | 0.721-1.158 |
| Catholic                              | 3.366***| .001     | 2.202-5.146 | 2.784***| .002     | 1.463-5.298 | 2.991** | .012     | 1.273-2.079 |
| Parental (secondary) education        | 0.425***| .001     | 0.259-0.698 | 0.401** | .040     | 0.168-0.957 | 0.544   | .223     | 0.205-1.447 |
| Food adequacy                         | 1.106   | .671     | 0.695-1.759 | 1.131   | .734     | 0.556-2.299 | 1.424   | .414     | 0.610-3.324 |
| Household diet diversity score        | 1.113   | .277     | 0.918-1.349 | 0.984   | .916     | 0.723-1.338 | 0.955   | .786     | 0.684-1.333 |
| Husband employment = casual           | 2.302***| .001     | 1.410-3.758 | 3.341***| .003     | 1.498-7.448 | 2.581** | .029     | 1.104-6.032 |
| Mother employment = casual            | 0.281***| .001     | 0.138-0.574 | 0.273** | .012     | 0.099-0.749 | 0.286** | .047     | 0.083-0.985 |
| Health facility delivery              | 1.342   | .182     | 0.871-2.065 | 1.138   | .718     | 0.565-2.292 | 1.097   | .808     | 0.520-3.134 |
| Wealth index (base: poorest)          |         |          |          |         |          |          |         |          |          |
| Poorer                                | 1.371   | .354     | 0.703-2.674 | 0.847   | .748     | 0.307-2.336 | 0.742   | .611     | 0.235-2.343 |
| Average                               | 2.075** | .043     | 1.022-4.212 | 3.533** | .023     | 1.194-10.455 | 2.615   | .111     | 0.802-8.522 |
| Rich                                  | 2.398** | .018     | 1.164-4.943 | 1.998   | .248     | 0.618-6.463 | 1.301   | .655     | 0.410-1.266 |
| Richest                               | 1.428   | .373     | 0.652-3.126 | 4.102*  | .059     | 0.948-17.762 | 3.790*  | .081     | 0.847-16.950 |
| Access to information                 | 1.643***| .037     | 1.030-2.620 | 1.750   | .152     | 0.813-3.768 | 1.880   | .117     | 0.854-1.138 |
| Has neighbour in CBHI                 | 3.509***| .003     | 1.518-8.133 | 1.472   | .508     | 0.468-4.625 |
| Voluntary groups (number)             | 5.907***| .001     | 3.197-10.915 | 5.664***| .001     | 2.927-10.963 |
| Voluntary groups square               | 0.528***| .001     | 0.380-0.734 | 0.612** | .012     | 0.416-0.899 |
| Perception index                      | 1.295** | .033     | 1.020-1.642 | 1.263*  | .086     | 0.968-1.649 |
| Village health team                   | 1.896*  | .079     | 0.929-3.871 | 1.440   | .415     | 0.600-3.460 |
| Know premiums                         | 20.167***| .001   | 9.106-44.663 | 17.072***| .001     | 7.027-41.477 |
| Waiting time                          | 0.999   | .683     | 0.996-1.003 | 0.999   | .720     | 0.996-1.003 |
| Burial group size                     | 0.971***| .001     | 0.957-0.985 | 0.960***| .003     | 0.949-0.990 |
| Burial groups in village (number)     |         |          |          | 1.208   | .508     | 0.691-2.113 |
| Village has school                    | 0.653   | .534     | 0.170-2.504 |
| Village has health centre             | 1.197   | .843     | 0.202-7.082 |
| Trading village                       | 0.314*  | .092     | 0.082-1.208 |
| Banana cultivating village            | 0.693   | .768     | 0.061-7.910 |
| Distance to health facility           | 0.826   | .248     | 0.596-1.143 |
| Distance square                       | 1.033   | .586     | 0.918-1.162 |
| Village altitude                      | 0.989-1.015| .015   | 0.880-1.888 |
| Constant                              | 0.185***| .000     | 0.090-0.378 | 0.007***| .000     | 0.002-0.046 | 0.026** | .016     | 0.001-0.501 |
| Pseudo r-squared                      | 0.147   | .615     | 0.662 |
| Variance inflation factor             | 1.92    | 2.06     | 3.02 |
| Observations                          | 458     | 458      | 458 |

Abbreviations: CBHI, community-based health insurance; OR, odds ratio.
*** P < .01, ** P < .05, * P < .1.
* Outcome variable: CBHI status, 1 if insured, 0 otherwise.
Determmants of Staying in Community-Based Health Insurance Scheme

The second major interest of this paper is to understand what influences households to renew participation in CBHI, especially in view of high dropouts recorded in similar CBHI schemes. After implementing ZINB models, we show results in Table 4, in 3 models for household socioeconomic and demographic variables, plus additional household enabling factors and the full model includes additional village covariates.

First, we observe that parental age plays an important role in renewing decisions. Households with older mothers are more likely to renew CBHI by an additional year (IRR: 1.045, CI: 1.021-1.069) however; renewing is less likely when as mothers get older as shown by the quadratic term of mother's age. We find the households with older children were more likely to renew (IRR: 1.007, CI: 1.001-1.012), though the effect general reduced when we control for additional enabling and village covariates. Like the enrolment decisions, enrolled catholic households were more likely to renew CBHI, with an incident rate ranging from 45% to 53% (IRR: 1.445, CI: 1.138-1.837). Regarding socioeconomic status, we observe that richer households were more likely to renew membership. Controlling for socioeconomic and household enabling factors, average, rich and richest households were 1.5 to 1.9 times more likely to renew membership. Once we controlled for additional village covariates, we observed that the richest households were 1.6 times more likely to renew (IRR: 1.640, CI: 1.050-2.562).

The battery of enabling factors revealed similar effects on renewing as on enrolment. We observe that having a neighbour in CBHI was associated with increasing the likelihood of renewing CBHI by 2 times (IRR: 1.786, CI: 1.217-2.621) while belonging in an additional voluntary group was associated with an increased likelihood of renewing by up to 2.3 times (IRR: 2.260, CI: 1.835-2.783). However, households reduce renewing as they participate in more voluntary groups. Like enrolling decisions, households who knew the correct premiums levied were about 3 times (IRR: 2.968, CI: 2.090-4.216) more likely to renew CBHI membership. Belonging to a large burial group increased the likelihood of an insured household to renew membership by 0.7% (IRR: 1.007, CI: 1.000-1.014).

Regarding access to information, we find that households with more access to information had a higher likelihood of renewing membership, improved by close to 50% (IRR: 1.486; 95% CI: 1.167-1.892) in the full model. We find that like enrolment, households having a woman employed in casual labour were less likely to renew. In particular, the likelihood is reduced by between 53% and 64% (IRR: 0.641, CI: 0.417-0.985).

Many village level variables dampen renewing decisions. However, we find the households in villages with more burial groups were more likely to renew membership by 36% (IRR: 1.358, CI: 1.126-1.639). Likewise, residing in a village with a school as associated with a higher likelihood of renewing by up to 53% (IRR: 1.527, CI: 0.929-2.508). Finally, we highlight the influence of distance from health facilities. We find that an extra kilometre further from a health facility was associated with reducing enrolment likelihood by 29% (IRR: 0.718-0.916) and this association is linearly significant as shown by the quadratic term of distance from health facilities.

Effect of Perceptions on Enrolment and Staying Insured

Because behavioural change is embedded in community social structures, perceptions and beliefs are generally influential in the adoption of health behaviours. Perceptions about different aspects of health insurance generally play an important role in how individuals make decisions to enrol and utilise services. The perceptions presented here follow the classification of Jehu-Appiah and colleagues. In particular, we explore perceptions regarding management of the scheme, financial protection, health beliefs, social influence, the convenience of scheme processes, quality of health services and premiums. Due to collinearity in the indices, perceptions on scheme management and convenience of CBHI processes are not included in the regressions. As Jehu-Appiah et al have also done, we reverse the coding of premiums perceptions.

Table 5 shows the results of a logistic regression of the association of perceptions and enrolment decisions. In general, having more positive perceptions was associated with increasing the odds of enrolling in CBHI by 57% (OR: 1.568, CI: 1.390-1.769). Moreover, we were also interested in identifying which perceptions were more influential in decisions to enrol. All individual perceptions have a significant association with enrolment with perceptions on health beliefs having a negative association with enrolment behaviour (results are available upon request).

Model 2 of Table 5 shows the association of individual perceptions and enrolment in a combined model. We observe that perceptions regarding the quality of care were associated with increasing the odds of enrolment by 15% (OR: 1.151, CI: 0.986-1.3459). Respondents who believed that the premiums were value for money and generally agreed with the ongoing premiums policy were more likely to be enrolled, having 69% higher odds of enrolment (OR: 1.689, CI: 1.402-2.034). Finally, we observe that enrolment decisions are not only a household choice but also households are influenced by people in their networks. We observe that feeling the social influence of leaders and relatives was associated with increasing the odds of enrolment by 27% (OR: 1.271, CI: 1.110-1.456). This finding makes important sense in view of how CBHI in south-
Table 4. ZINB Results of Determinants of Renewing CBHI

| Variables                                      | Model 1 |        |         | Model 2 |        |         | Model 3 |        |
|------------------------------------------------|---------|--------|---------|---------|--------|---------|---------|--------|
|                                                 | IRR     | P Value| 95 % CI | IRR     | P Value| 95 % CI | IRR     | P Value|
| Child age (months)                              | 1.007** | .013   | 1.001-1.012 | 1.007** | .092   | 0.999-1.014 | 1.006   | .124   |
| Child age square                                | 1.000   | .718   | 1.000-1.000 | 1.000   | .677   | 0.999-1.000 | 1.000   | .888   |
| Mother’s age                                    | 1.049***| .001   | 1.032-1.066 | 1.042***| .001   | 1.019-1.065 | 1.045***| .001   |
| Mother’s age square                             | 0.997***| .001   | 0.996-0.998 | 0.996***| .001   | 0.994-0.998 | 0.996***| .001   |
| Birth weight                                    | 1.067   | .434   | 0.907-1.254 | 1.144   | .235   | 0.916-1.427 | 1.103   | .404   |
| Household size                                  | 1.058** | .013   | 1.012-1.106 | 1.052   | .131   | 0.985-1.125 | 1.034   | .334   |
| Catholic                                        | 1.134   | .116   | 0.969-1.327 | 1.532***| .001   | 1.222-1.921 | 1.445***| .001   |
| Parental (secondary) education                  | 0.984   | .916   | 0.801-1.178 | 0.960   | .425   | 0.712-1.154 | 0.966   | .790   |
| Food adequacy                                   | 0.995   | .890   | 0.931-1.064 | 0.981   | .687   | 0.896-1.075 | 0.964   | .451   |
| Household diet diversity score                  | 1.026   | .758   | 0.870-1.210 | 1.141   | .294   | 0.891-1.461 | 1.048   | .711   |
| Husband employment = casual                     | 0.877   | .397   | 0.646-1.189 | 0.532***| .003   | 0.351-0.806 | 0.641** | .042   |
| Health facility delivery                        | 0.995   | .948   | 0.852-1.161 | 1.033   | .771   | 0.829-1.288 | 1.024   | .838   |
| Wealth index (base: poorest)                    | 1.017   | .781   | 0.802-1.341 | 0.978   | .906   | 0.679-1.409 | 0.854   | .401   |
| Access to information                           | 1.201   | .149   | 0.937-1.539 | 1.480** | .028   | 1.042-2.101 | 1.246   | .229   |
| Rich                                            | 1.108   | .432   | 0.858-1.432 | 1.572** | .015   | 1.094-2.260 | 1.198   | .344   |
| Rich                                            | 1.199   | .222   | 0.896-1.604 | 1.948***| .002   | 1.272-2.983 | 1.640** | .030   |
| Voluntary groups (number)                       | 2.139***| .001   | 1.435-3.190 | 1.786***| .003   | 1.217-2.621 | 1.835-2.783 | .001   |
| Voluntary groups square                         | 2.180***| .001   | 1.776-2.699 | 2.260***| .001   | 1.835-2.783 | 2.260***| .001   |
| Perception index                                | 0.705***| .001   | 0.630-0.790 | 0.738***| .001   | 0.659-0.827 | 0.738***| .001   |
| Village health team                             | 1.136   | .234   | 0.921-1.401 | 1.088   | .946   | 0.800-1.270 | 1.086   | .946   |
| Know premiums                                   | 2.908***| .001   | 2.043-4.139 | 2.968***| .001   | 2.090-4.216 | 2.968***| .001   |
| Waiting time                                    | 1.000   | .708   | 0.999-1.001 | 1.000   | .701   | 0.999-1.001 | 1.000   | .701   |
| Burial group size                               | 1.002   | .396   | 0.997-1.007 | 1.007*  | .066   | 1.000-1.014 | 1.000   | .001   |
| Burial groups in village (number)               | 1.358***| .001   | 1.126-1.639 | 1.527***| .095   | 0.929-2.508 | 1.527***| .095   |
| Village has school                              | 1.117   | .697   | 0.641-1.945 | 0.347***| .001   | 0.210-0.574 | 0.347***| .001   |
| Village has a health centre                     | 0.485*  | .072   | 0.220-1.068 | 0.811***| .001   | 0.718-0.916 | 0.811***| .001   |
| Distance to a health facility                   | 0.953** | .030   | 0.913-0.995 | 0.997*  | .095   | 0.993-1.001 | 0.997*  | .095   |
| Village altitude                                | 4.883***| .000   | 3.738-6.377 | 0.415***| .009   | 0.215-0.799 | 0.864   | .774   |
| Vuong (P value)                                 | 8.77 (0.001) | 3.34 (0.001) | 2.98 (0.001) | 8.77 (0.001) | 3.34 (0.001) | 2.98 (0.001) |
| Observations                                    | 458     | 458    | 458      | 458     | 458    | 458      | 458     | 458    |

Abbreviations: CBHI, community-based health insurance; ZINB, zero-inflated negative binomial; IRR, incident rate ratio. ** P < .01, * P < .05, * P < .1. * Outcome variable: number of years in CBHI.
widespread in western Uganda is linked with kin-associated burial groups.\(^{37}\)

Furthermore, our analysis is interested in studying how perceptions influence decisions to renew CBHI membership. We implement a ZINB model due to the nature of our outcome – the number of years in CBHI. Results in Model 1 of Table 6 show that overall perceptions are not significant predictors of renewing decision, as seen in the main renewing model (in Table 4). More granular analysis of individual perceptions indicates that perceptions regarding social influence were significant predictors of renewing CBHI membership. In particular, respondents who had more influence from other people were 8.7% more likely to renew (OR: 1.087, CI: 1.002-1.178).

The finding regarding other individual and overall perceptions might not imply that perceptions do not influence decisions of renewing CBHI but could rather indicate that once perceptions have been formed and initial enrolment decisions have been taken, households are more likely to keep in CBHI rather than update their perceptions in a way that negatively affects their enrolment status.

**Discussion and Policy Implications**

**The Usefulness of Rural Employment Cash Flows**

We find different effects regarding the employment of men and women in casual labour. Non-farm employment, similar to casual labour in our study has been integral to rural employment and poverty reduction in Uganda.\(^{37}\) However, women and men participate in it differently. While only 10% of women in our sample were employed in this type of work, close to 36% of men were in casually employed. Casual employment is essential for village economies because it provides the type of cash flow required for burial groups in CBHI. Generally, all burial groups in the region and beyond exist to provide basic funeral insurance, however, they often go beyond only funeral insurance to provide credit services.\(^{49,50}\) Households with higher cash flows are therefore able to involve in lending, borrowing and saving to accumulate enough for premiums. Casual work, with higher cash flow, is appropriate for these demands. Moreover, the dynamics of casual work for women and men are different. While casual work might favour men due to mobility and opportunity to search for employment, women’s gender roles might imply that increasing their mobility (job search process) and uncertainty of employment in addition to traditional gender roles in rural areas can limit health utilisation behaviour. For instance, Morgan et al\(^{58}\) found that women’s workload limits the sustainable utilisation of maternal health services.

**Presence and Persistence of Socioeconomic Exclusion**

The first one is that even in the presence of informal insurance systems which are supposedly inclusive,\(^{36}\) poorest households are still excluded. Rich households were 4 times more likely to enrol and 2 times more likely to renew CBHI than their poorest counterparts. The results are of pertinent interest to the government of Uganda, which is in the process of establishing a national health insurance programme. For
the future of CBHI in particular and the national health insurance in general, it is recommended appropriate measures for inclusion are taken into consideration in the current planning processes. These measures might include premium waivers for the poor and progressive premiums for the better-off households as has been recently introduced in Rwanda.\(^5\) Another possible avenue of including the vulnerable population is taking CBHI within the broader spectrum of social protection programmes for the poor. In this case, social protection instruments such as cash transfers can supplement CBHI. Studies in Ethiopia have indicated that combining CBHI with other social protection programmes is beneficial for both health and socioeconomic outcomes.\(^6\) In addition, it might be important for development organisations supporting health insurance interventions to consider supporting the extremely poor households, either at a macro level through providing additional funds to insurance programmes\(^5,8\) or through direct identification and subsidising of the poor.\(^5\)

**Social Connectivity and Access to Information Enhance Membership and Renewing**

The influence of household enabling factors is noted. These factors are important proxies of social connectivity and social learning that takes place in health insurance programmes\(^4\) and other health interventions.\(^15,45\) In line with Liu et al.,\(^45\) our findings suggest that households adopt and renew insurance through their social networks. An important network diffusion point in this study is burial societies in rural areas.\(^46\) Their usefulness in diffusing health information has been widely elaborated\(^22,47\) and it is our recommendation and CBHI promotion programme utilise them even more. Moreover, it is even important that the introduction of formal health insurance aims to build on existing informal risk management mechanism rather than bypass them. Bypassing them might erode social capital and eventual failure of the formalisation goals.\(^15\)

The finding regarding the negative association of large burial groups can be explained by relating our case study scheme with the wider literature of group behaviour. A two-tailed condition for enrolment in this scheme is that for smaller burial groups of 30 or fewer households, all households are required to enrol while on the other tail, for larger burial groups, 60% of the households, which has to be higher than 30 households, are required for a group to enrol its members. With this condition in mind, the finding regarding burial group size aligns with other literature that large groups might portray less cooperation and more free-riding\(^46\) but also members might enjoy a higher utility from the wider risk-sharing networks,\(^7\) which might, in turn, reduce the propensity to formalise insurance by enrolling in CBHI.

Turning to access to information, we find that access to information increases the odds of enrolment as well as renewing membership in CBHI. Availability of information has been previously studied before in Ghana\(^15\) and Burkina Faso.\(^42,43\) In Burkina Faso, access to information was studied through an information, education and communication campaign while in Ghana it was studied through listening to radio, television or newspapers. Our findings. The findings are by and large mixed. The studies in Burkina Faso found that while insurance knowledge generally improved through access to information, it did not improve enrolment. However, the study in Ghana finds that exposure to all either radio or television or print media were all associated with increasing the odds of enrolment. Our findings are in line with this later Ghanaian study. However, while the current studies are focused on traditional media, there could be opportunities to utilising new types of media such as social media to spread information about insurance. Future studies could look into this issue.

**Perceptions Are Associated With Enrolment but not Renewing**

Regarding the influence of perceptions, the study finds that households care about how the CBHI schemes are managed and this influences the decisions to enrol. Nevertheless, negative perceptions about premiums reduce the likelihood of both enrolling and renewing. These findings touch on the issue of trust, an underlying cause of failure in most CBHI schemes. Earlier work in Uganda found that low trust in schemes' management was a major factor inhibiting enrolment. From a policy and implementation dimension, it is important to understand and consider how communities perceive CBHI. Trust and local buy-in might be achieved for instance by promoting more participation. Premiums and benefits packages, for instance, could be designed in more participatory ways. Understanding the importance of these perceptions is important for policy-makers and scheme managers in facilitating the development of easily saleable insurance interventions and benefits packages.

**Exploring the Potential of Faith-Based Health Providers in Insurance Expansion**

Finally, we would like to expound on the finding regarding higher enrolment and renewing of Catholic households. On average, just about half the households in our sample subscribed to the Catholic faith but over 66% of CBHI, households were Catholic. We do not have detailed data to look into why these households seem to insure more than others. However, we believe 2 mechanisms might be explored to increase future enrolment. First, larger group association through religious gatherings, helps in getting messages across to prospective insurance clients. Moreover, individuals might be more inclined to absorbing and acting of health messages from people of community respect such as religious leaders.\(^45,47\)

Secondly, faith-based associations already play an important role in health service delivery in Uganda as well as providing health insurance options, especially to rural people. The scheme subject to this study is itself run under the auspices of the Uganda Protestant Medical Bureau and other faith-based medical bureaus run multiple facilities and insurance programmes.\(^7\) In establishing the national health insurance scheme, we recommend that policy-makers utilise these faith-based platforms in both marketing the scheme...
as well as maximising on their wide health infrastructure. Studies have shown that faith-based health providers in Uganda are intrinsically motivated to serve the poor\textsuperscript{27,28} hence inclusiveness might be achieved through these channels.

Conclusion
We use a case study of a large CBHI scheme in south-western Uganda to shed more light on the reasons for enrolment and renewing of CBHI in rural Uganda. After logistic and ZIP regression analyses, we find that wealthier households were more likely to enrol in CBHI. Moreover, access to information and better social connectivity and husband’s employment in casual rural work were positively associated with enrolment decisions. In addition, wealthier households, household’s informal social support system assessed through membership burial groups and number of burial groups in the village was associated with renewing CBHI. Knowledge of CBHI assessed through questionnaire fully influenced both enrolment and renewing decisions. Moreover, improving perceptions about CBHI increases enrolment chances. Overall, by using this case study, the paper makes credible contributions to understanding why households choose to enrol and renew in CBHI participation in rural Uganda. This is very crucial especially for the ongoing policy debates about a national health insurance programme.

Acknowledgements
The authors acknowledge the support of all four research assistants that helped in household data collection. The support of the staff of Kisizi hospital administration and the health insurance scheme, especially Dr. Francis Banya and Mr. Moses Mugume, is highly appreciated. The authors also highly appreciate assistance of the 5 research assistants that were involved in data collection.

Ethical issues
The initial ethical review was carried out by the Center for Development Research (ZEF) research ethics committee at the University of Bonn, Bonn, Germany. Further reviews were conducted by the Mengo Hospital Research and Ethics Review Committee in Uganda. An ethical clearance certificate (Reference Number SS-39369) was issued by the Uganda National Council for Science and Technology. Informed verbal consent was obtained from all the survey respondents and the respective administrative leaders.

Competing interests
Authors declare that they have no competing interests.

Authors’ contributions
ENR led the conceptualisation of the study, design and acquisition of the data, statistical analysis, writing the manuscript, and interpretation of the results. EMC supported drafting of the manuscript and data analysis. JvB critically reviewed the manuscript. JvB and NG provided overall guidance and EMc supported drafting of the manuscript and data analysis. NN, NG, and JvB were involved in statistical analysis, drafting the manuscript, and interpretation of the results.

ENR led the conceptualisation of the study, design and acquisition of the data, statistical analysis, writing the manuscript, and interpretation of the results. EMC supported drafting of the manuscript and data analysis. JvB critically reviewed the manuscript. JvB and NG provided overall guidance and EMc supported drafting of the manuscript and data analysis. NN, NG, and JvB were involved in statistical analysis, drafting the manuscript, and interpretation of the results.

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Supplementary files
Supplementary file 1 contains Tables S1-S2.

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