

Determinants of Voluntary National Health Insurance Drop-Out in Eastern Sudan

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Abstract

Background Low enrolment and high drop-out rates are common problems in voluntary health insurance schemes. Yet, most studies in this research area focus on community-based health insurance and enrolment, rather than drop-out. **Objective** This study examines what causes informal sector families not to renew their voluntary National Health Insurance Fund (NHIF) health insurance membership in Eastern Sudan.

Methods Primary data from about 600 informal sector households that dropped out or remained insured, collected through a household survey conducted in March 2014, were used. Logistic regressions were employed to examine what determines drop-out of the voluntary NHIF scheme.

Results The logistic regression results are consistent with the existing literature and confirm the importance of household head, household and community characteristics. Notably, worse family health status and higher health care utilization decrease the probability of drop-out, which requires further analysis as it may indicate the problem of adverse selection and insufficient risk management. Most importantly, the results consistently show that household heads who are satisfied with health services and those who understand the main features of the voluntary NHIF scheme are less likely to drop out. Also, 30 % of drop-out households hold a social support card and reported that the social support scheme is the main reason for not renewing

their voluntary NHIF health insurance membership as they qualify for sponsored NHIF health insurance membership. **Conclusions** This study shows that satisfaction with health services and knowledge of the health insurance scheme are important factors explaining drop-out of a national health insurance programme. The results suggest that education and information campaigns should be developed further to raise understanding of the NHIF voluntary scheme. In addition, information systems and coordination between the main agencies should be strengthened to reduce administrative costs and ensure policy coherence.

Key Points for Decision Makers

High drop-out rates threaten the sustainability of health insurance schemes.

This study finds that satisfaction with health services and good knowledge of the health insurance scheme reduce national health insurance drop-out, and underlines the importance of conducting effective education and information campaigns.

In addition, the findings suggest that close coordination among the main agencies involved is needed to reduce administrative costs and ensure that people have continuous health insurance coverage.

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1 Introduction

There are many paths that lead to universal health coverage. Possible financing mechanisms that have worked to advance universal health coverage include tax financing,

social health insurance and community-based health insurance (CBHI) [1, 2]. CBHI has been introduced in low- and middle-income countries as a transitional mechanism to achieve universal health coverage [3]. However, country experiences have shown that CBHI schemes face several challenges, most notably in terms of scaling up and sustainability, given the absence of a large risk pool [4]. As an alternative to the bottom-up approach, a top-down national health service or social health insurance can be developed [4]. Given the limited tax base in low- and middle-income countries and the need to generate revenues, several countries opted for the latter, namely the introduction of a social health insurance, and adapted it to also include the informal sector. While the formal sector generally pays income-related contributions, the informal sector sometimes simply pays flat rate premiums as it is extremely difficult to reliably assess income earned, and/or has its premiums subsidized by the government, given widespread poverty [2]. Ghana, Kenya, Tanzania and Sudan are examples of countries that adopted social health insurance. Yet, these social health insurance schemes have also failed to operate at a large scale. For example, 38 % of Ghana's population were active members of the National Health Insurance Scheme in 2013 [5], while Kenya's National Hospital Insurance Fund covered 18 % [6] and Tanzania's National Health Insurance Fund schemes covered 22.7 % of the population in 2015 [7]. These countries have sought to expand their existing social health insurance schemes to achieve universal health coverage.

One of these countries is Sudan, a lower middle-income country in Northeast Africa. Sudan's National Health Insurance Fund (NHIF) was set up in 1994, following the announcement of the *National Insurance Corporation Act 1994* (amended in 2001 and 2004), with the objective of covering at least 80 % of the entire population by 2031 [8]. However, only 37.3 % of the population were covered in 2011, of which 30.2 % were from the formal sector, 22.5 % from the informal sector and the remaining 47.2 % special groups such as retirees and people covered by the social support scheme or private health insurance [8]. Regional as well as rural-urban disparities exist, and coverage ratios ranged from 19 % in conflict-affected South Kordofan to 55 % in the Northern state in 2009 [9]. While NHIF membership is compulsory for the formal sector, it is voluntary for the informal sector. Low enrolment rates are a common problem of CBHI. Mebratie et al. report an unweighted average CBHI uptake rate of 37 % in low- and middle-income countries [10], while De Allegri et al. refer to enrolment rates between 1 and 10 % in sub-Saharan Africa [11]. One of the factors contributing to the low participation in the NHIF is the high number of drop-outs among informal sector members. It is estimated that about 40 % of members from the informal sector decide

not to renew their membership. Comparable drop-out rates have been reported in the case of the Nouna district scheme in the northwest of Burkina Faso [12]. High drop-out rates, in turn, threaten the sustainability of the health insurance scheme [11, 12].

Although the high level of drop-outs from voluntary health insurance is a common problem, only a few studies have investigated the determinants of this phenomenon and most of these studies focus on CBHI, not national health insurance programmes. There is, however, a large body of literature on the determinants of voluntary health insurance enrolment rather than drop-out per se. The determinants of voluntary health insurance enrolment have thus been well established [13–19]. Voluntary health insurance enrolment is typically associated with household head characteristics (e.g. age, gender, ethnicity, religion, higher education, formal sector employment, member in other group), household characteristics (e.g. higher socioeconomic status, worse household health status, more dependents, greater distance to health facility) and community characteristics [e.g. lower socioeconomic inequality, respondents' perceptions of solidarity (i.e. perceived solidarity)] as discussed in Jütting, De Allegri et al., Kimani et al. and Mladovsky et al. [13–18]. In addition, Jehu-Appiah et al. found that perceived scheme characteristics (e.g. benefit package and enrolment process) are important, while perceived health care provider characteristics (e.g. health care quality and attitude of health professionals) turned out to be mostly insignificant, although the authors argue that perceived health care provider characteristics seem to matter for the rich rather than the poor [19].

The determinants of CBHI drop-out, on the other hand, are often thought to be the opposite of those factors that explain voluntary health insurance enrolment. Yet, studies on enrolment focus on the insured versus those who have never been insured, while studies that analyse drop-out look at the insured versus previously insured who opted for non-renewal. In a qualitative study, using information obtained in 2000 from focus group discussions conducted in Conakry, Guinea, Criel and Waelkens explained that poor perceived health care quality is a major reason for health insurance drop-out [20]. In addition, the authors found the lack of affordability of the health insurance premium to be another important reason explaining drop-out. The results of the qualitative study by De Allegri et al. of drop-out of a CBHI in the Nouna health district in the northwest of Burkina Faso confirm that poor perceived health care quality and affordability (as well as payment modality) of the health insurance premium are major issues [21]. In addition, their results suggest that scepticism towards the scheme is another important problem, which is *inter alia* caused by inadequate knowledge and understanding of the scheme. The importance of knowledge and

understanding of the health insurance scheme is also confirmed by Basaza et al. and Mathauer et al. [22, 23]. Dong et al. also specifically ask why people drop out of CBHI in the Nouna health district in the northwest of Burkina Faso, but employ a quantitative approach [12]. The results from the logistic regression, using 122 observations from a household survey conducted in 2006, indicate that drop-out is associated with household head characteristics (female, higher age, lower education), household characteristics (fewer illness episodes in the past 3 months, less health care seeking, fewer dependents, higher household expenditures, shorter distance to health facility, the latter two results being contrary to expectations), as well as perceived poor health care quality. Mebratie et al. confirm the importance of socioeconomic status, including membership in a social support programme, and illness events in their study on drop-out of the Ethiopian CBHI scheme, using data from a large longitudinal household survey collected in 2012 and 2013 [24]. Their analyses further show that understanding of health insurance and experience with and knowledge of the CBHI scheme decrease the probability of drop-out. Two quantitative studies examine the determinants of dropping out of a national health insurance, namely the National Health Insurance Scheme in Ghana, and also found that household head, household and community characteristics, as well as perceived scheme and health care provider characteristics are associated with drop-out [25, 26].

Given the relative scarcity of voluntary health insurance drop-out analyses, this study focuses on the informal sector in Sudan's eastern Kassala state and seeks to explain what causes NHIF informal sector members not to renew their voluntary health insurance membership. In contrast to most previous studies, this study looks at a national health insurance programme that offers a comprehensive benefit package with a wide range of health care services. National health insurance programmes can overcome some of the problems that have threatened CBHI such as an unclear legislative and regulatory framework, dissimilar and limited benefit packages and a lack of financial support from the central government [27]. Understanding health insurance drop-out is important for policy-makers as high drop-out rates impose administrative costs on the scheme, and may reflect poor performance of the health insurance scheme, as well as adverse selection [28]. The focus is on Kassala state in Sudan's Eastern region, which comprises Kassala, Al Gadaref and Red Sea states, as the security situation has remained relatively calm there when compared with conflict-affected areas. The region has faced a multitude of serious development challenges, yet, NHIF health insurance coverage in Kassala stood at the national average in 2009, which is the reason why the state of Kassala was purposively selected for the fieldwork.

1.1 Local Context

Two rounds of civil war in Sudan and the 2011 separation of South Sudan left the country in a difficult position to deal with its manifold development challenges. In addition, conflicts are ongoing in some areas. In Sudan, total life expectancy at birth was only 63 years in 2012. Under-5 mortality stood at 73 per 1000 live births in 2012 and maternal mortality at 730 per 100,000 live births in 2010 [29]. Primary, secondary and tertiary health care is provided by the ministries of health at all levels, armed forces, parastatal organizations, the NHIF and the private sector [29]. Free care programmes exist for emergency care, health care and medicines for children under 5 years as well as pregnant women, renal dialysis, immunosuppressant drugs for renal transplants, chemotherapy and radiotherapy, and haemophilia [8]. On average, 71 % of the population lives within a 5-km distance from a health facility, but rural-urban disparities exist, especially also in terms of the distribution of health personnel [8]. In addition, many health care facilities are poorly equipped and are often unable to provide basic services.

While the total expenditure on health reached 6.4 % of gross domestic product (GDP) in 2011,¹ the social sector is considered underfunded [8]. Recent increases in the ratio of total expenditure on health to GDP are mainly due to decreases in GDP, given low oil prices and the substantial loss of oil production caused by the secession of South Sudan [29]. About 73 % of total health expenditures are private expenditures, indicating that household out-of-pocket expenditures, which stood at 70 % of total health expenditures, are extremely high, and far above the average of comparable countries. These large out-of-pocket payments impede financial access to health care. Health insurance schemes, including the NHIF, only contribute about 7 % to total health expenditure [8]. The NHIF, together with the Sudanese Zakat Fund and the Social Insurance for Pensioners, belongs to the Ministry of Welfare and Social Security. The Sudanese Zakat Chamber is in charge of managing the compulsory charity contributions levied on Muslims and non-Muslims under Islamic law. Its institutional infrastructure spans all levels, from the national level down to the village level [30]. 37.3 % of the population were covered by the NHIF in 2011, while another 5.5 % were covered by other health insurance schemes such as the police and military health insurance schemes, health insurance schemes of parastatal organizations (e.g. Sudan Air and Bank of Sudan) and private insurance programmes [8], indicating that about three-fifths

¹ The World Health Organization (WHO), however, reported that the total expenditure on health as a percentage of GDP stood at 8.4 in 2011 [29].

of the country's population were not covered. NHIF membership is compulsory for the formal sector, but voluntary for the informal sector and small companies with less than ten employees [8]. Membership in the NHIF is family based (household head and dependents, i.e. spouse, children and parents), and the informal sector pays a flat rate per month, which varies across states. In 2011, the premium was 20 Sudanese Pounds (SDG) [3.4 US dollars (USD)] in Khartoum and 15 SDG (2.5 USD) in other states [8]. Upon enrolment, members have to pay the premium for 3 months upfront. These premiums can either be paid through agents or directly to NHIF offices. The NHIF benefit package is comprehensive, with a tendency towards secondary and tertiary care [31]. Services excluded from the NHIF benefit package are plastic surgery, teeth rooting, open heart surgery, chemotherapy, and implants and transplantation [32]. A co-payment of 25 % for prescribed medicines and full payment for medicines out of the essential drug list are required. The benefit package is essentially non-costed, and the premiums are considered insufficient, which in turn has implications for sustainability [31]. Providers are paid on a fee-for-service basis [8]. Some health facilities belong to the NHIF as the NHIF has remained involved in the direct provision of health services. As part of a social support scheme, "free" health insurance coverage is provided for targeted poor and needy families. The social support scheme is administered by the Ministry of Welfare and Social Security together with implementing agencies such as the NHIF. The health insurance premiums are paid for by the Ministry of Finance and National Economy, the Sudanese Zakat Chamber, not-for-profit organizations and wealthy individuals. Poor families are identified by the Sudanese Zakat Chamber on the basis of several criteria, which are related to employment status, income, expenditures and assets of family members [33]. The total number of poor to be supported in a year is decided upon by the Federal High Council, and the allocation is done on the basis of poverty registries maintained and updated by the Sudanese Zakat Chamber. Once selected, families receive a social support card. Retirees and students have their premiums paid for by the Ministry of Finance and National Economy, National Pensioners Fund and the National Social Security Fund, as well as the National Students' Fund [8].

The state of Kassala in Eastern Sudan, in which about 5.8 % of the total Sudanese population lived in 2009 [9], shares many of the development challenges that Sudan is facing. About one-third of the population in Kassala are living below the national poverty line of 148 SDG or about 25 USD per person per month [34] and key health indicators such as the under-5 mortality rate and maternal mortality ratio are above country averages. Also, health care delivery indicators are worse in Kassala state

Table 1 Health care delivery Data source: World Bank Development Indicators and Federal Ministry of Health of the Republic of Sudan

Indicator	Sudan	Kassala state
Physicians (per 100,000 people)	35.8 (2010)	9.9 (2010)
Nurses (per 100,000 people)	46.6 (2010)	39.5 (2010)
Midwives (per 100,000 people)	35 (2010)	28.6 (2010)
Hospital beds (per 100,000 people)	73.8 (2010)	54.8 (2010)

compared with country averages, as shown for the year 2010 in Table 1, reflecting severe infrastructure and resource shortages that are likely to impede adequate health service provision and, thus, may spur health insurance drop-out.

In 2012, NHIF health insurance coverage in Kassala was only 21.7 % of the total population compared with about 30 % in 2009 [9, 34], indicating that health insurance drop-out seems to be a major problem. Of those individuals covered, 48 % were in the formal sector, 15 % in the informal sector and 37 % in various other sectors [35]. The NHIF flat rate premium that families had to pay in 2014 was 30 SDG per month, or about 20 % of the 2009 poverty line.

2 Methods

A household survey was conducted in March 2014 to collect primary data about the factors that determine participation in and drop-out of the voluntary health insurance scheme of the NHIF.² The target population of the survey was informal sector households in Kassala state; that is 171,308 households in total [37]. Disproportionate sampling was used to ensure a sufficient number of members for each of the three health insurance statuses, namely, regular member (initial enrolment before 2011 and continuously enrolled thereafter), newly enrolled (initial enrolment in or after 2011 and continuously enrolled thereafter) and drop-out (initially enrolled, but premium not paid for 12 consecutive months). Health insurance statuses were defined on the basis of the authors' knowledge of the local context. Dong et al. refer to drop-outs as those "who discontinue membership after enrolling one year" [12]. However, it is unclear how this discontinuation happens. Similarly, the definitions in Mebratie et al., Atinga et al. and Jehu-Appiah et al. are debatable [24–26]. The sample size, n , was calculated as follows [38]:

² A combined dataset, comprising the dataset used in this study and additional data collected from never-insured individuals using convenience sampling, was used in Fakihammed [36].

$$n = \frac{Nz^2pq}{Ne^2 + z^2pq},$$

where N denotes the population size (171,308 informal sector households), e the margin of error (5 %), z the statistic that defines the desired level of confidence (1.96 for the 95 % level of confidence), and p the proportion of the population that has the particular attribute (0.15, assuming that out of the 171,308 informal sector households, 15 % are covered by voluntary NHIF health insurance in 2011 [37]); q equals $1 - p$. The calculated sample size of 196 informal sector households was subsequently used for each health insurance status, i.e. 196 regular members, 196 newly enrolled members and 196 drop-outs were sampled. Enrolled households were separated into regular members and newly enrolled members to see if major statistically significant differences exist between these two groups, as suggested by Sommers [39]. Existing studies often only look at current members, irrespective of whether these people have been enrolled for a long period of time or have only recently been enrolled. Hence, a total of 588 households from seven localities (out of 11 localities) were surveyed using a multi-stage sampling design. Four localities were excluded because the NHIF scheme had not been implemented (two localities) or because they were too remote and thus difficult to access from Kassala City (two localities). The most chronic food insecure localities, Hamashkoreeb, Telkok and North Delta, as identified by the UN World Food Programme and Kassala State Ministry of Agriculture [40], as well as the remote locality Seteet were thus excluded. Forty blocks/villages³ from rural and urban areas in seven localities were selected systematically, using lists from the fifth national census, conducted in 2007, and were proportional to the size of the informal sector in each locality. The number of households per locality was also determined on the basis of the size of the informal sector in the locality, and the 588 regular, newly enrolled and drop-out informal sector households were subsequently selected systematically from the NHIF membership records. Survey weights were created to adjust the sample in terms of the key variable, drop-out. A comprehensive, administered questionnaire was used to elicit socio-demographic, economic, illness and health care-related information about the household head and the household. Detailed questions were also asked about the health insurance status, health insurance knowledge and the social support scheme. Based on the authors' knowledge of the local context and in line with Dong et al., it is assumed that the household head decides

whether to drop out or not and therefore only household heads (aged 18 or older) were questioned [12].

The survey started on March 1, 2014 and was completed on March 17, 2014 by a fieldwork team consisting of 15 members, of which five were NHIF staff. In addition, community leaders and other key people from within the communities were extensively involved and helped to locate the households. Absent households were repeatedly visited until the household head could be interviewed. Therefore, all households could be located and none of the households refused to participate, resulting in a non-response rate of zero. In a few households (about 4 %), the household head could not be interviewed as he was away. In these cases, a representative was invited to participate on behalf of the household head.

The data analysis consists of two steps. First, a descriptive analysis was done to see if there are differences among members of the three health insurance statuses. Second, a logistic regression was used to examine what determines drop-out of the NHIF voluntary scheme. For this purpose, following Mladovsky et al., a model of the following form was specified [16]:

$$\begin{aligned} \text{Logit } [p(y = 1)] &= \log\left(\frac{p}{1-p}\right) \\ &= \alpha + \beta_1 X_{1,i} + \dots + \beta_n X_{n,i} \end{aligned}$$

where y denotes the drop-out ($y = 1$) or not ($y = 0$) conditional upon prior enrolment, X_1 to X_n are variables for household head, household and community characteristics, including satisfaction with health services (used to account for perceived quality of care, as perceived quality of care is an important driver of patient satisfaction) and knowledge of health insurance, p is the probability of dropping out, α is the constant, and β values are the model parameters. The variables used and their expected signs are shown in Table 2 below.

It is hypothesized that in line with the literature, household head, household and community characteristics determine drop-out of the voluntary NHIF health insurance scheme. Older household heads are expected to be more likely to drop out as they may not feel comfortable with the modalities of the scheme, while poor households are likely to drop out due to their inability to pay the flat rate premium, as suggested in Jütting [13]. On the other hand, the following factors are assumed to decrease the probability of drop-out: younger household head, male household head, better educated household head, household head who is satisfied with the health services provided at the nearest health facility, high household expenditures, household located far away from the nearest health facility or in a rural area, and worse health status and higher health care utilization of family members [12, 24, 26]. In light of the insights gained from the qualitative studies of De Allegri et al. and Basaza et al. [21, 22] and the quantitative study

³ The Sudan Technical and Ethical Review Committee, whose approval was obtained, set a range of 30–40 for the total number of blocks/villages.

Table 2 Variables included in the study: household head, household and community characteristics

Variable	Description	Expected sign
Age	Age of household head	+
Male	Male household head (yes = 1)	-
Higher education	Household head completed secondary school or higher (yes = 1)	-
Expenditure quantile 1	Lowest quantile of average monthly household expenditures (below 800 SDG) (yes = 1)	+
Expenditure quantile 5	Highest quantile of average monthly household expenditures (1500 SDG or higher) (yes = 1)	-
Per capita household expenditure	Log household expenditure per family member	-
Distance to health facility	Distance of household to nearest health facility more than 5 km (yes = 1)	-
Satisfaction with health services	Household head satisfied with the services of the nearest health facility (yes = 1)	-
Chronic illness	One or more family members have a chronic illness (yes = 1)	-
Illness ratio	Average number of times per month family members sought health services over the past 3 months over number of family members	-
Good knowledge of health insurance	Household head answered at least 5 out of 7 questions ^a about health insurance correctly (yes = 1)	-
Location	Household located in rural area (yes = 1)	-

NHIF National Health Insurance Fund, SDG Sudanese Pounds

^a The following 7 questions were asked to test respondents' knowledge about the voluntary NHIF health insurance scheme and health insurance in general: What is the purpose of enrolling in the NHIF? How can you enrol in the NHIF? For how many months do you have to pay the premium upfront when enrolling? How high is the NHIF premium? What benefits do you get? Your family? How high is the co-payment for drugs? Why would you agree to pay a monthly amount of money although you may not be sick all the time?

by Mebratie et al. [24], it is expected that knowledge of the voluntary NHIF health insurance scheme would decrease the probability of drop-out.

3 Results

Table 3 shows descriptive statistics for the full sample and the sub-samples, i.e. regular members, newly enrolled members and drop-outs. The average age of the household head is 45 years. The majority of households (86 %) are headed by a male household head, and the average family size is six persons. About half of the household heads (49 %) completed secondary school or higher education. Average household expenditures stood at 1255 SDG per month, while average per capita household expenditures were 241 SDG per month. These data are consistent with the averages reported by the UN World Food Programme and Kassala State Ministry of Agriculture [40] (which use survey data collected from all 11 localities in December 2011 and January 2012), except the higher level of education of the household head in this study. The latter may be due to the fact that this study excludes the poorest localities and requires household heads to be at least 18 years old to be eligible for inclusion.

The results in Table 3 also show that the respondents differed across many of the explanatory variables.

Household heads who opted to drop out were the least educated. Only 39 % had completed secondary school or higher, compared with 53 % of the regular members and 56 % of the newly enrolled members. The drop-outs had a relatively lower proportion belonging to the highest expenditure quantile, reporting being satisfied with the health services of the nearest health facility, having at least one chronically ill family member and possessing good knowledge of health insurance. In addition, drop-outs stated the lowest illness ratios and a higher proportion of the drop-outs lived in rural areas. The newly enrolled, on the other hand, were relatively younger than regular members and those who dropped out, and a lower proportion lived more than 5 km away from the nearest health facility.

The regression results are reported in Table 4. Models 1 and 2 use per capita household expenditures as a proxy for socioeconomic status, while in models 3 and 4, dummy variables that capture if the household belongs to expenditure quantiles 1 or 5 are included to see if it matters whether the household belongs to the poorest or richest household expenditure group. In models 1 and 3, standard household head, household and community characteristics are used as explanatory variables. As several quantitative studies do not explicitly control for knowledge of the health insurance scheme [12, 25, 26], separate regressions were run, and the variable to take into account the

Table 3 Descriptive statistics: household head, household and community characteristics by health insurance status

Variable	Total (<i>n</i> = 588)	Health insurance status			<i>p</i> values ^a
		Regular members (<i>n</i> = 196)	Newly enrolled (<i>n</i> = 196)	Drop-outs (<i>n</i> = 196)	
Mean age (years)	45.49	47.02	43.24	46.20	0.00***
Male (%)	85.88	87.24	82.65	87.76	0.28
Higher education (%)	49.15	52.55	56.12	38.78	0.00***
Expenditure quantile 1 (%)	12.59	10.71	12.24	14.80	0.47
Expenditure quantile 5 (%)	31.29	39.29	30.10	24.49	0.01**
Mean expenditures per family member (SDG)	240.50	255.97	236.35	229.17	0.17
Mean family size (persons)	5.98	6.23	5.95	5.75	0.19
Mean log expenditures per family member	2.32	2.34	2.31	2.30	0.17
Distance to health facility (%)	11.73	18.37	7.65	9.18	0.00***
Satisfaction with health services (%)	59.18	59.69	64.80	53.06	0.06*
Chronic illness (%)	41.67	53.06	42.86	29.08	0.00***
Mean illness ratio	0.44	0.45	0.48	0.39	0.00***
Good knowledge of health insurance (%)	65.14	82.14	68.88	44.39	0.00***
Location (%)	23.13	18.37	18.88	32.14	0.00***

Test of statistical significance: * significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level

^a *F* test for continuous variables and Chi-square test for categorical variables

household head's knowledge of the voluntary NHIF health insurance scheme is only included in models 2 and 4.

The results suggest that more educated household heads are less likely to drop out, which is as expected and is consistent with the findings in Dong et al. and Mebratie et al. [12, 24]. More educated household heads better understand the financial protection health insurance offers. Contrary to the literature [20, 21, 25], affordability does not seem to be an issue, which may be due to the existence of the social support scheme for targeted poor and needy families. In the case of Ethiopia's CBHI, Mebratie et al. found that households in the second quintile, but not the poorest quintile, were more likely to drop out, as the poorest households receive social support [24]. However, the results in Table 4 show that neither the expenditure per family member nor belonging to the first expenditure quantile are statistically significant. This is surprising as a large number of the poor, i.e. about 2.3 million families [8], were not covered despite the social support scheme. The former result may be driven by the fact that the expenditure per family member variable fails to adequately account for the composition of the household, especially in terms of the number of dependents.⁴

The results from models 3 and 4, however, reveal that households belonging to the highest income quantile are

less likely to drop out. Households that are located more than 5 km away from the nearest health facility are also less likely to drop out as expected, which is consistent with the findings in De Allegri et al., who found that enrolment is associated with greater distance to the health facility [14], and Dong et al. [12]. Although counterintuitive, more distant households seem to appreciate provided services more, as suggested in De Allegri et al. [14]. The results also confirm the finding in the literature that perceived quality of care is important [12, 20, 21]. If the household head is satisfied with the services provided at the nearest health facility, s/he is less likely to drop out as expected. Also in line with expectations, households that have at least one family member who suffers from a chronic illness and households with higher illness ratios are less likely to drop out, which may indicate adverse selection problems, as discussed in Dong et al., Mebratie et al. and Atinga et al. [12, 24, 25]. As suggested in the studies by De Allegri et al., Basaza et al., Mathauer et al. and Mebratie et al. [21–24], household heads that have a good understanding of the voluntary NHIF scheme are less likely to drop out. Also, as to be expected, the explanatory power of the models increases with inclusion of this additional variable. The coefficients of the variables age and gender are not significant. The latter may be due to the fact that most household heads in the sample are male. The coefficient of the location variable is statistically significant, but enters with an unexpected positive sign, which may reflect that

⁴ The authors are grateful to an anonymous referee for suggesting this.

Table 4 Estimated logistic regression coefficients and odds ratios (full sample)

	Model 1 coefficients (odds ratios)	Model 2 coefficients (odds ratios)	Model 3 coefficients (odds ratios)	Model 4 coefficients (odds ratios)
Age	0.011 (1.011)	0.016 (1.016)	0.010 (1.010)	0.014 (1.014)
Gender (1 = male)	0.142 (1.152)	0.053 (1.054)	0.141 (1.152)	0.048 (1.049)
Higher education (1 = secondary school or higher)	-0.691 (0.501)***	-0.640 (0.528)***	-0.615 (0.540)***	-0.570 (0.565)***
Expenditure quantile 1 (1 = lowest quantile)			0.229 (1.257)	0.132 (1.141)
Expenditure quantile 5 (1 = highest quantile)			-0.456 (0.634)**	-0.370 (0.691)*
Log expenditure per family member	0.521 (1.684)	0.698 (2.011)		
Distance to health facility (1 = more than 5 km)	-0.742 (0.476)**	-0.963 (0.382)***	-0.740 (0.477)**	-0.958 (0.384)***
Satisfaction with health services (1 = satisfied)	-0.496 (0.609)**	-0.398 (0.672)**	-0.470 (0.625)**	-0.376 (0.687)*
Chronic illness (1 = at least one family member has chronic illness)	-0.849 (0.428)***	-0.853 (0.426)***	-0.798 (0.450)***	-0.810 (0.445)***
Illness ratio	-2.242 (0.106)***	-2.259 (0.104)***	-2.211 (0.110)***	-2.094 (0.123)***
Location (1 = rural area)	0.625 (1.868)***	0.828 (2.289)***	0.655 (1.925)***	0.849 (2.337)***
Good knowledge of health insurance (1 = good knowledge)		-1.463 (0.231)***		-1.415 (0.243)***
<i>n</i>	588	588	588	588
<i>R</i> ²	0.097	0.169	0.104	0.171

* Significant at 0.1 level

** Significant at 0.05 level

*** Significant at 0.01 level

more and better equipped health facilities are available in urban areas.

As a robustness check, sub-sample analyses were subsequently done. Instead of including all NHIF voluntary scheme members in the dependent variable reference group, only regular members (initial enrolment before 2011 and continuously enrolled thereafter) and, alternatively, newly enrolled members (initial enrolment in or after 2011 and continuously enrolled thereafter) were considered. Only models 2 and 4 are used for the sub-sample analyses as the full sample analysis confirmed the importance of using knowledge of the health insurance scheme as an explanatory variable. These results are shown in Table 5. The sub-sample analyses, using 392 observations each, broadly confirmed the key results, the main exceptions being age and expenditure per family member in the sub-sample analysis that used newly enrolled members as the dependent variable reference group. Both age and expenditure per family member are statistically significant and were found to increase the probability of drop-out. The coefficient on age is positive as expected, but the result with respect to expenditure per family member is contrary to expectations, but consistent with Dong et al., and may be due to the ability and willingness to afford alternative providers [12]. In addition, distance to the health facility

and belonging to the fifth expenditure quantile turned out to be insignificant. In the sub-sample analysis that used regular members as the dependent variable reference group, satisfaction with the services provided at the nearest health facility was insignificant although the coefficient entered with the expected negative sign in all regressions. Regular members had a lower proportion of household heads who reported being satisfied with the health services of the nearest health facility compared with newly enrolled, as shown in Table 3. Regular members may have developed higher expectations over time. As pointed out by Asadi-Lari et al., patient satisfaction does not only depend on actual treatment experiences, but also personal expectations [41].

3.1 Social Support Scheme

Of the 588 households, 60 households (all of which are drop-outs) reported that the family has a social support card. Interestingly, however, only seven of the households with a social support card fall into expenditure quantile 1, while 11 households with a social support card fall into expenditure quantile 5. This seems to suggest that the social support scheme, which aims at providing financial assistance to the poor, may suffer from targeting problems, as reported by the

Table 5 Estimated logistic regression coefficients and odds ratios (subsamples)

	Drop-outs and regular members (newly enrolled members dropped from the sample)		Drop-outs and newly enrolled members (regular members dropped from the sample)		Families with a social support card dropped from the sample	
	Model 2 Coef. (OR)	Model 4 Coef. (OR)	Model 2 Coef. (OR)	Model 4 Coef. (OR)	Model 2 Coef. (OR)	Model 4 Coef. (OR)
Age	-0.002 (0.998)	-0.004 (0.996)	0.030 (1.030)**	0.028 (1.029)**	0.012 (1.012)	0.010 (1.010)
Gender (1 = male)	0.031 (1.032)	0.078 (1.081)	0.223 (1.250)	0.177 (1.194)	0.285 (1.330)	0.247 (1.281)
Higher education (1 = secondary school or higher)	-0.639 (0.528)**	-0.604 (0.547)**	-0.682 (0.506)***	-0.602 (0.548)***	-0.365 (0.694)	-0.293 (0.746)
Expenditure quantile 1 (1 = lowest quantile)		0.129 (1.137)		0.196 (1.217)		0.363 (1.438)
Expenditure quantile 5 (1 = highest quantile)		-0.574 (0.563)**		-0.242 (0.785)		-0.249 (0.779)
Log expenditure per family member	-0.060 (0.941)		1.404 (4.072)**		0.676 (1.966)	
Distance to health facility (1 = more than 5 km)	-1.620 (0.198)***	-1.613 (0.199)***	-0.172 (0.842)	-0.251 (0.778)	-1.325 (0.266)***	-1.299 (0.273)***
Satisfaction with health services (1 = satisfied)	-0.152 (0.859)	-0.140 (0.869)	-0.611 (0.543)**	-0.550 (0.577)**	-0.698 (0.498)***	-0.691 (0.501)***
Chronic illness (1 = at least one family member has chronic illness)	-0.959 (0.383)***	-0.900 (0.407)***	-0.725 (0.484)***	-0.687 (0.503)***	-0.978 (0.376)***	-0.944 (0.389)***
Illness ratio						
Location (1 = rural area)	-1.445 (0.236)*	-1.656 (0.191)**	-2.758 (0.063)***	-2.230 (0.108)***	-2.107 (0.122)***	-2.062 (0.127)***
Good knowledge of health insurance (1 = good knowledge)	1.113 (3.043)***	1.139 (3.124)***	0.634 (1.885)**	0.663 (1.941)**	0.786 (2.194)***	0.837 (2.308)***
<i>n</i>	392	392	392	392	528	528
<i>R</i> ²	0.231	0.240	0.153	0.145	0.173	0.175

Coef. coefficients, OR odds ratios

* Significant at 0.1 level

** Significant at 0.05 level

*** Significant at 0.01 level

Sudan Federal Ministry of Health [8]. All but one of these 60 households also reported that “benefitting from the social support scheme” is the main reason for dropping out of the voluntary NHIF health insurance scheme. The regression analysis was subsequently redone without these 60 households, using 528 observations, as shown in Table 5. All results were confirmed, with the exception of expenditure quantile 5 and higher education, which showed the expected sign, but were insignificant.

4 Discussion and Policy Implications

Voluntary health insurance schemes typically suffer from high drop-out rates, which endanger their sustainability. While a common problem, only a few studies have investigated the determinants of this phenomenon, and most of these studies focus on bottom-up CBHI initiatives, not top-down created national health insurance programmes. In addition, most of the quantitative studies are interested in the determinants of voluntary health insurance enrolment rather than drop-out per se, and, therefore, focus on the insured versus those who have never been insured. Studies that analyse health insurance drop-out, on the other hand, look at those formerly insured, who opted for non-renewal, versus the insured, where typically no distinction is made between long-term and newly insureds.

This study, therefore, seeks to explain what causes NHIF informal sector members not to renew their voluntary health insurance membership. In contrast to most previous studies, this study looks at national health insurance programme drop-out and provides sub-sample analyses that separate long-term and newly insureds. Primary data from 588 households were collected in March 2014 and analysed using descriptive statistics and logistic regressions.

The descriptive analysis compared regular members, newly enrolled members and those who dropped out. The data revealed significant differences in terms of age, education, expenditure quantile, distance to the nearest health facility, satisfaction with health services, having at least one chronically ill family member, illness ratio, knowledge of health insurance and living in the rural areas.

The regression results are mostly consistent with the existing literature and confirm the importance of household head, household and community characteristics [12–26]. Higher education of the household head and living more than 5 km away from the nearest health facility decrease the probability of dropping out. Households that belong to the richest household expenditure group and households located in urban areas are also less likely to drop out. The latter is contrary to expectations, but may be explained by the fact that there are more and better equipped health

facilities in urban areas. Worse family health status and higher health care utilization decrease the probability of drop-out. The observed importance of family health status and health care utilization may indicate the problem of adverse selection and insufficient risk management. However, family-based membership helps to reduce the problem of adverse selection as all family members are enrolled, not only those who are sick [42]. Whether to consider additional measures to deal with adverse selection requires further analysis to ensure that poor and needy families remain covered.

Turning to our key variables of interest, this study confirms that perceived health care quality and knowledge of the health insurance scheme are important factors explaining drop-out of a top-down national health insurance programme. Satisfaction of the household head with health services decreases the probability of drop-out. This is contrary to Jehu-Appiah et al., whose results with respect to perceived technical quality of care (elicited through responses to five statements, including, e.g. “I can get immediate care if I need it.”), service adequacy (four statements, including, e.g. “The rooms are adequate.”) and provider attitude (two statements, including, e.g. “Availability of drugs should be improved.”) are mostly not as expected and insignificant [26]. We also asked respondents about the reasons for being dissatisfied with the health services provided, and most dissatisfied respondents (55 %) stated the lack of drugs at the health facility as the main reason, followed by long waiting times (25 %) and unclean health facilities (7 %). Most respondents (almost 70 %) reported waiting times of between 30 and 60 min, while 15 % said that they had to wait for more than 1 h. The results further consistently show that household heads that have knowledge of the main features of the voluntary NHIF scheme are less likely to drop out. This finding is very important given that several quantitative studies do not explicitly control for knowledge of the health insurance scheme, but implicitly assume that household heads with a higher educational attainment also have a better understanding of the health insurance scheme [12, 25, 26].

The results of the sub-sample analyses suggest that future studies should distinguish regular and newly enrolled voluntary health insurance members. The key finding here is that in the sub-sample analysis that used regular members as the dependent variable reference group, satisfaction with the services provided at the nearest health facility turned out to be insignificant. Regular members may have developed higher expectations over time, resulting in lower satisfaction with the health services of the nearest health facility compared with the newly enrolled. Another key finding of the sub-sample analyses is that the main results are confirmed when the 60 households that reported having a social support card are removed

from the sample. As 30 % of drop-out households have a social support card, the social support scheme is found to be an important reason for informal sector families not renewing their voluntary NHIF health insurance membership, as they qualify for sponsored NHIF health insurance membership.

This study has some limitations that are important to understand. First, disproportionate sampling was used to obtain a better representation of drop-outs. This, however, can bias the results, although adjustments were made during the analysis. Second, as this study uses cross-sectional data, the direction of causality cannot be established. Third, while the definition of regular members, newly enrolled members and drop-outs are based on the authors' knowledge of the local context, these are of course open to question. Another limitation is that information about the timing of drop-out after initial enrolment could not be accessed. Had this information been accessible, a survival analysis could have been conducted. Despite these limitations, the results of this study are important, especially since there are ongoing initiatives that are exploring the introduction of CBHI schemes in Eastern Sudan and ultimately linking these with the NHIF.

Our findings, therefore, have important policy implications. As the results consistently show that knowledge of the main features of the voluntary NHIF scheme is important, improving people's understanding of the health insurance scheme, and especially its benefits, through continued and participatory education and information campaigns is crucial. The findings from the sub-sample analysis suggest that the voluntary NHIF scheme has to become more responsive to its members and deal with the lack of health care resources to ensure continued satisfaction with health services. Efforts to tackle the problem of high voluntary health insurance drop-out through education and information campaigns should be accompanied by improvements in the quality of health services, most notably by dealing with the problem of drug non-availability at health facilities, which was identified as a major cause of dissatisfaction. The results further show that the social support scheme is an important reason for informal sector families not renewing their voluntary NHIF health insurance membership, which implies that information systems and coordination among the main agencies should be improved to ensure policy coherence and lower administrative expenses. As only about 12 % of the sampled households that had a social support card fall into expenditure quantile 1, the current targeting criteria of the social support scheme should be reconsidered. This in turn could help safeguard poor and needy families and ensure that they remain covered by health insurance.

5 Conclusion

Satisfaction with health services and good knowledge of the health insurance scheme reduce the probability of members dropping out of the voluntary national health insurance scheme, which suggests that education and information campaigns should be developed further to raise understanding of the NHIF voluntary scheme. In addition, the results show that health insurance drop-out analyses should distinguish regular and newly enrolled health insurance members, as these have different characteristics. Finally, the findings in this study reveal that close coordination among the agencies involved in providing social protection is important.

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Compliance with Ethical Standards

Chantal Herberholz and Wael Ahmed Fakihammed confirm that no funding has been received for the conduct of this study and/or preparation of this research article. Chantal Herberholz declares that she has no conflicts of interest. Wael Ahmed Fakihammed was working with the NHIF, Kassala state, Sudan, when the data were collected, and he is still working there today, serving as SSHS/CBHI State Coordinator, BMB Mott MacDonald. Permission to collect the data was obtained by Wael Ahmed Fakihammed from the Sudan Technical and Ethical Review Committee. Informed consent was obtained from all individual participants included in the study.

Author contributions Chantal Herberholz is the principal investigator and bears the ultimate responsibility for this research article. She was responsible for study conception and research design, conducting the research (excluding data collection), and writing, as well as revising, the first and final versions of this research article. The data were collected and entered into a database by Wael Ahmed Fakihammed, who was also responsible for questionnaire and sampling design. Wael Ahmed Fakihammed further contributed to conducting the research by providing vital information about the local contexts and helping to analyze the data, as well as sending comments on the drafts.

References

1. Carrin G, James C. Reaching universal coverage via social health insurance: key design features in the transition period. Geneva: World Health Organization; 2004.
2. Doetinchem O, Carrin G, Evans D. Thinking of introducing social health insurance? 2010. http://www.who.int/healthsystems/topics/financing/healthreport/26_10Q.pdf. Accessed 1 July 2016.
3. Gottret P, Schieber G. Health financing revisited: a practitioner's guide. Washington DC: The World Bank; 2006.
4. Wang H, Pielemeier N. Community-based health insurance: an evolutionary approach to achieving universal coverage in low-income countries. *J Life Sci.* 2012;6:320–9.

5. National Health Insurance Authority (Ghana). National Health Insurance Authority 2013 Annual Report. 2014. <http://www.nhis.gov.gh>. Accessed 1 July 2016.
6. Mwaura RN, et al. The path to universal health coverage in Kenya: repositioning the role of the national hospital insurance fund. 2015. <http://documents.worldbank.org/curated/en/2015/08/24943477/path-universal-health-coverage-kenya-repositioning-role-national-hospital-insurance-fund>. Accessed 1 July 2016.
7. National Health Insurance Fund (Tanzania). National Health Insurance Fund profile. 2016. <http://www.nhif.or.tz/index.php/about-us/profile>. Accessed 1 July 2016.
8. Sudan Federal Ministry of Health. Health system financing review report. Khartoum: Public Health Institute, Federal Ministry of Health; 2014.
9. Central Bureau of Statistics, The Republic of Sudan. Statistical year book for the year 2009. Khartoum: Central Bureau of Statistics, The Republic of Sudan; 2010.
10. Mebratie AD, Sparrow R, Alemu G, Bedi AS. Community-based health insurance schemes: a systematic review. The Hague: Institute of Social Studies; 2013.
11. De Allegri M, Sauerborn R, Kouyate B, Flessa S. Community health insurance in sub-Saharan Africa: what operational difficulties hamper its successful development? *Trop Med Int Health*. 2009;14(5):586–96.
12. Dong H, et al. Drop-out analysis of community-based health insurance membership at Nouna, Burkina Faso. *Health Policy*. 2009;92:174–9.
13. Jütting J. Health insurance for the poor? Determinants of participation in community-based health insurance schemes in rural Senegal. Paris: OECD Development Center; 2003.
14. De Allegri M, et al. Understanding enrolment in community health insurance in sub-Saharan Africa: a population-based case-control study in rural Burkina Faso. *Bull World Health Organ*. 2006;84(11):852–8.
15. Kimani JK, et al. Determinants for participation in a public health insurance program among residents of urban slums in Nairobi, Kenya: results from a cross-sectional survey. *BMC Health Serv Res*. 2012;12(66):1.
16. Mladovsky P, et al. Can social capital help explain enrolment (or lack thereof) in community-based health insurance? Results of an exploratory mixed methods study from Senegal. *Soc Sci Med*. 2014;101:18–27.
17. Adebayo EF, et al. A systematic review of factors that affect uptake of community-based health insurance in low-income and middle-income countries. *BMC Health Serv Res*. 2015;15(543):1.
18. Baloul I, Dahlui M. Determinants of health insurance enrolment in Sudan: evidence from Health Utilisation and Expenditure Household Survey 2009. London, BMC Health Services Research 14 (Suppl 2: O17): Evidence-based practice conference, Meeting abstracts; 2014.
19. Jehu-Appiah C, et al. Household perceptions and their implications for enrolment in the National Health Insurance Scheme in Ghana. *Health Policy Plan*. 2011;27(3):222–33.
20. Criel B, Waelkens MP. Declining subscriptions to the Maliando Mutual Health Organisation in Guinea-Conakry (West Africa): what is going wrong? *Soc Sci Med*. 2003;57:1205–19.
21. De Allegri M, Sanon M, Sauerborn R. “To enrol or not to enrol?” A qualitative investigation of demand for health insurance in rural West Africa. *Soc Sci Med*. 2006;62:1520–7.
22. Basaza R, Criel B, Van der Stuyft P. Low enrolment in Ugandan community health insurance schemes: underlying causes and policy implications. *BMC Health Serv Res*. 2007;7(105):1.
23. Mathauer I, Schmidt J-O, Wenyaa M. Extending social health insurance to the informal sector in Kenya. An assessment of factors affecting demand. *Int J Health Plan Manag*. 2008;23:51–68.
24. Mebratie AD, et al. Dropping out of Ethiopia’s community-based health insurance scheme. *Health Policy Plan*. 2015;30(10):1296–306.
25. Atinga RA, Abiiro GA, Kuganab-Lem RB. Factors influencing the decision to drop out of health insurance enrolment among urban slum dwellers in Ghana. *Trop Med Int Health*. 2015;20(3):312–21.
26. Jehu-Appiah C, et al. Equity aspects of the National Health Insurance Scheme in Ghana: who is enrolling, who is not and why? *Soc Sci Med*. 2011;72:157–65.
27. Odeyemi IA. Community-based health insurance programmes and the national health insurance scheme of Nigeria: challenges to uptake and integration. *Int J Equity Health*. 2014;13(20):1.
28. Buchmueller TC, Gilmer T, Harris K. Health plan disenrollment in a choice-based Medicaid managed care program. *Inquiry*, 41(Winter 2004/2005); 2004. p. 447–460.
29. WH. Sudan—Country cooperation strategy at a glance. 2014. http://www.who.int/countryfocus/cooperation_strategy/ccsbrief_sdn_en.pdf. Accessed 23 Dec 2015.
30. Kjellgren A, et al. Sudan social safety net assessment. Washington DC: The World Bank; 2014.
31. Public Health Institute. The evidence—Issue 10. [Online]. 2014. <http://www.phi.edu.sd/Newsletter/TheEvidence10.pdf>. Accessed 7 July 2016.
32. Ahmed MY, Panda A. Could a new law revolutionize Sudan’s health care system? [Online]. 2016. <http://www.jointlearningnetwork.org/news/could-a-new-law-revolutionize-sudans-health-care-system>. Accessed 3 July 2016.
33. Sudanese Zakat Chamber. The role of SZC in social development. [Online]. 2015. <http://www.zakat-chamber.gov.sd>. Accessed 27 Feb 2016.
34. UNDP Sudan. MDG profile of Eastern Sudan-2010. [Online]. 2010. <http://www.sd.undp.org/content/dam/sudan/docs/MDG%20Summery%20East%20Sudan2010.pdf>. Accessed 14 Jan 2016.
35. NHIF. NHIF report—Kassala state. Khartoum: NHIF; 2012.
36. Fakihammed WA. Determinants of informal sector participation in the National Health Insurance Fund in Kassala State (Eastern Sudan), unpublished MSc thesis, Chulalongkorn University, Bangkok; 2014.
37. NHIF. Annual statistical report—Kassala. Khartoum: NHIF; 2011.
38. Yamane T. Statistics: an introductory analysis. 2nd ed. New York: Harper and Row; 1967.
39. Sommers BD. Loss of health insurance among non-elderly adults in Medicaid. *J Gen Intern Med*. 2008;24(1):1–7.
40. UN World Food Programme and Kassala State Ministry of Agriculture. A comprehensive food security assessment in Kassala State, Sudan. 2012. <http://documents.wfp.org/stellent/groups/public/documents/ena/wfp258759.pdf?iframe>. Accessed 24 Dec 2015.
41. Asadi-Lari M, Tamburini M, Gray D. Patients’ needs, satisfaction, and health related quality of life: towards a comprehensive model. *Health Qual Life Outcomes*. 2004;2(32):1.
42. Rajkotia Y, Frick K. Does household enrolment reduce adverse selection in a voluntary health insurance system? Evidence from the Ghanaian National Health Insurance System. *Health Policy Plan*. 2011;27(5):1–9.