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Universal health coverage in the context of population ageing: spatial analysis of the enrolment in the National Health Insurance scheme in Ghana

Nele van der Wielen*, Dr. Amos Channon, Prof. Jane Falkingham
Division of Social Statistics and Demography, University of Southampton, Southampton, SO17 1BJ, United Kingdom
**Email: n.van-der-wielen@soton.ac.uk*

Abstract

Population ageing advances considerable challenges to universal health coverage. Ghana presents a crucial case study of geospatial influences on the implementation of policies aimed at universal health coverage in the context of population ageing in low and middle-income countries. Ghana has witnessed profound demographic transitions including large increases in the number of older adults when implementing policies aimed at universal health coverage. Using the Ghanaian Living Standards Survey from 2012-2013 spatial and aspatial determinants of National Health Insurance Scheme (NHIS) enrolment for individuals over the age of 50 are examined through the application of multilevel regression and spatial cluster analysis. While previous studies have mainly focused on demographic and socio-economic factors, analysis of spatial barriers show that NHIS enrolment is a matter of geographical accessibility. Overall results show that there are great inequalities in enrolment, by wealth and travel time to health care services.

Introduction

The concept of universal health coverage has been described as "the single most powerful concept that public health has to offer" (Margaret Chan, 2012). The aim of universal health coverage is to ensure that everyone in a population has equal access to healthcare services of good quality without fearing financial hardship. Efforts to meet this aim will be influenced to a great extent by the global population ageing phenomenon. Today, two-thirds of the 868 million people aged 60 and over are living in low and middle income countries. By 2050 it is projected that 8 in 10 people that are classified as older adults will live in countries that are less developed (Falkingham, 2015, United Nations, 2013). In Sub-Saharan Africa alone, the number of people aged 60 and over is expected to rise from 46 million in 2014 to 694 million people by 2050, accounting for 10% of the population of the region (Aboderin, 2015). The increase in the proportion of older adults is associated with an increasing demand for healthcare due to greater prevalence of disabilities and morbidity in older age (United Nations, 2013). Especially in low and middle income countries the rapid increase in the proportion and number of older adults provides challenges in the adequate provision of healthcare services for them (Channon et al., 2012). Yet, population ageing in Africa is yet to receive considerable attention from policymakers or researchers. This marginalization has up to now been explained by a proclivity among policymakers and researchers to prioritize the needs of younger groups who account for the greater share of the population. Africa is considered a youthful continent with 40% of the population below 15 years of age (Pillay and Maharaj, 2013). Further the Millennium Development Goals (MDGs) helped to frame the discussion on public health in many low and middle income countries around the reduction of maternal and child mortality. This is seen to have contributed to the marginalisation of other important groups, such as older adults (Lloyd-Sherlock, 2010). As a result, the healthcare needs of older adults are less salient when policies are formulated at the national level in these countries (Pillay and Maharaj, 2013, Parmar et al., 2014).

In countries without social security systems it is left to the individual to finance healthcare expenditures (United Nations, 2013). Progress towards universal health coverage is of great importance to help individuals avoid catastrophic expenditures in times of unforeseen serious illness. Different countries have experimented with different approaches to achieving universal health coverage. The design of healthcare systems plays a crucial role. Social healthcare systems can protect people by improving their financial protection when seeking care (World Health Organization, 2000). Universal health *insurance* can be viewed as an important driver to achieve universal health coverage as it aims to make healthcare affordable and accessible to all citizens. Pooled funding through health insurance can be seen as a redistribution of income resulting in better access to services among the poorest groups by equalizing the ability to pay for services. Only 17% of older adults in Sub-Saharan Africa benefit from social security and receive a pension, while many older adults are left without a regular income (Parmar et al., 2014). Thus older adults struggle to make a healthcare payment which

makes it important to examine health insurance coverage as an approach to achieving universal health coverage.

Ghana presents a timely opportunity for a crucial case study of geospatial and policy influences on health in the context of population ageing. By 2030, it is estimated that Ghana will have the largest share of older adults among all low and middle income countries in Sub-Saharan Africa (Pillay and Maharaj, 2013). In 2005 Ghana implemented a national health insurance scheme (NHIS) aimed at achieving universal health coverage. There is a substantial lack of studies that examine the correlates of insurance coverage specifically among older adults in Ghana, however, due to the fast pace at which population ageing occurs, the windows of opportunity to react and implement reforms are limited (United Nations, 2013). Evidenced-based research is needed to inform the nascent policy dialogue in Ghana on the challenges and opportunities of a globally ageing society.

Previous studies in Ghana like Dixon et al. (2011) and Mensah et al. (2009) have mainly focused on insurance enrolment and healthcare utilisation of young and middle-aged adults or women. Using the Ghanaian Living Standards Survey from 2012-2013 the determinants of NHIS enrolment for individuals over the age of 50 are here examined through the application of multilevel regression and spatial cluster analysis. This study benefits from using a recently published dataset and can be seen to provide build on and update previous studies in this field (Ayitey et al., 2013, Dixon et al., 2011, Osei-Akoto and Fenny, 2013) which used data from the year 2005 up to 2008. Over 10 years after the launch of the NHIS the system has had time to develop and has increased in both its awareness and uptake (National Health Insurance Authority, 2013, Kusi et al., 2015). The use of timely data can help evaluate whether these trends are signifiers of underlying changes in motivations to enroll.

This paper puts a special emphasis on spatial and aspatial barriers to health insurance enrolment. If healthcare services are not available or accessible, health insurance affiliation becomes void of value for the individual as desired care cannot be attained. Aspatial barriers are also important to consider as the social context people live in can help inform their decision about whether to join the NHIS or not.

The Ghanaian National Health Insurance Scheme

The NHIS is an ambitious model to move towards universal health coverage and has been described as "the only one in sub-Saharan Africa that aims to provide a standardized, nearly comprehensive and portable package of health benefits to all residents" (Blanchet and Acheampong, 2013, p. 2). The NHIS scheme is grounded on the 2003 National Health Insurance Act, specifically on the ACT 650 (Salisu and Prinz, 2009). This act protects every citizen against financial hardship if they decide to seek basic healthcare (Ministry of Health Ghana, 2013). The NHIS operates under a vision "to be a model of a sustainable, progressive and equitable social health insurance scheme in Africa and beyond" (National Health Insurance Authority, 2015).

Overall three insurance schemes are available under the Health Insurance Act in Ghana:

- The District-Wide Mutual Health Insurance Scheme (DMHIS)
- The Private Mutual Health Insurance Scheme
- The Private Commercial Health Insurance Scheme.

The District Mutual Insurance Scheme, however, is the only system that receives governmental support from the National Health Insurance Fund and that is available in all 170 districts (Gobah and Liang, 2011).

Although in Ghana it is mandatory to be part of an insurance scheme, in practice enrolment in the NHIS is seen as voluntary (Blanchet et al., 2012, Osei-Akoto and Adamba, 2011). No penalties apply for not being a member of any insurance scheme and citizens, apart from those working in the formal sector, are not enrolled by default (Blanchet et al., 2012, Osei-Akoto and Adamba, 2011). In order to become a member of the NHIS individuals need to sign a registration form at their DMHIS office and pay a registration fee and a premium. The health insurance membership ID card, which provides evidence of enrolment, will then be provided for participants after a waiting period which can take up to several months (Blanchet et al., 2012). Biometric registration has been launched only recently in selected districts to speed up the enrolment process. However, a waiting period before benefiting from healthcare insurance is seen as a way to reduce adverse selection as it reduces the likelihood of self-enrolment only when ill (Osei-Akoto and Adamba, 2011).

On reaching 70 years of age people are exempted from the NHIS premium payment. Other groups that are exempt from paying the premium include all children under 18 when both of their parents are enrolled in the NHIS, the core poor, and pregnant women. All people who cannot show a source of income and have no fixed residence are classified as the core poor (Blanchet et al, 2012). In addition individuals who either contribute to or receive a pension from the Social Security and National Insurance Trust (SSNIT) are exempt from the premium (Blanchet et al, 2012). Overall the financing

of the current healthcare system in Ghana is classified as progressive. The principal of the NHIS is that wealthier members contribute a higher share of their income than members with less means. The premium is based proportionally on people's income with the poorest being exempt from any fees (McIntyre et al., 2008). The minimum payment amounts to GH¢7.2 and the upper limit is not allowed to exceed GH¢48.00 (National Health Insurance Authority, 2015). In reality this is difficult to achieve as it is problematic to define which are the poorest in a population, and it is challenging to determine the exact income of a household as household members do not necessarily state all of their income sources. To avoid these difficulties most individuals that want to join the NHIS pay a fixed rate on average of GH¢ 7.2 per annum (McIntyre et al., 2008).
Apart from the premium and registration fees, the NHIS is financed by means of a 2.5% value added tax (VAT), contribution to the SSNIT made by workers, the national insurance council and government and donor funds (Owusu-Sekyere and Chiaraah, 2014).

The enrolment in any public or private insurance scheme in Ghana has to offer a minimum benefit package recognised by the Minister of Health (Hsiao and Shaw, 2006). This NHIS package includes outpatient services, inpatient services, oral health, eye care, maternity care and emergencies (National Health Insurance Scheme Authority, 2014). Officially the NHIS covers 95% of the common disease burden in its insurance package (Owusu-Sekyere and Chiaraah, 2014).

Spatial and aspatial barriers of health insurance enrolment

Several factors determine the uptake of health insurance. Barriers that can influence the decision to enrol in a health insurance scheme can be divided between spatial and aspatial characteristics. To being with spatial barriers are discussed before moving on to aspatial barriers.

When looking at spatial barriers the literature distinguishes between the availability and accessibility of healthcare services as the availability of services does not necessarily mean that these services are physically accessible. It is expected that only when healthcare services are avaible and accessible health insurance uptake can be improved. If healthcare services are not accessible, health insurance membership is of little worth as the desired care cannot be attained. Previous research has found that older adults are disadvantaged in their access to healthcare as they predominately live in rural areas where the provision of healthcare services is limited (McIntyre, 2004). In addition, older adults are less mobile than younger age groups, and are more likely to be bed-ridden, which makes it more difficult for them to reach healthcare facilities. In Ghana specifically, previous research showed that long distances as well as increasing travel time to healthcare facilities reduces healthcare utilisation and NHIS enrolment (Osei-Akoto and Fenny, 2013, Osei-Akoto and Adamba, 2011).

The most common measures of service availability are the provider to population ratios which are also known as supply ratios (Guagliardo, 2004). Although provider to population ratios (like doctor to patient ratio or nurse to patient ratio) are suitable for the comparison of supply across regions, these ratios have their limitations. They do not account for border crossing of patients and they do not measure accessibility limitations like poor public transport (Guagliardo, 2004). In addition, the average distance to facilities can increase depending on location and clustering (Guagliardo, 2004). When using population ratios, facilities on the border of the set area carry the same weight as facilities close to a participant place of residence.

To account for these accessibility limitations, travel time, and distance to facilities seem to provide a more accurate measurement of the concept. The most common accessibility measurements in this vein are straight line distance, travel distance or actual travel time. The straight line distance is classified as the closest distance between two points on a map. Travel distance refers to the distance from a patient's place of residence to the closest healthcare provider travelling along roads or other infrastructure systems like railway. The weaknesses of the travel distance and straight line distance indicators is that neither provides any information on the actual time it takes to get to a healthcare facility. Understandings can vary between regions as a result of differences in infrastructure and land cover (like rivers or vegetation) (Møller-Jensen and Kofie, 2001). Thus average travel impedance to a healthcare provider is sometimes preferred as a more actuate measurement (Guagliardo, 2004). Travel time estimates the time to get to a healthcare facility via different transportation networks including driving, walking or using public transport (Guagliardo, 2004). Travel cost is found to be closely related to geographical distance in the sense that greater distance implicates higher transportation costs (Buor, 2003).

Beside spatial factors, aspatial factors are expected to influence NHIS enrolment. Spatial characteristics refer to geographical access (described above) while aspatial dimensions are also known as social access (Khan and Bhardwaj, 1994). The latter are barriers to healthcare that are of non-geographic character which includes political, economic and cultural factors (Khan and Bhardwaj, 1994, Mobley et al., 2006). The social context people live in can help inform their decision about whether to join the NHIS or not. Social interaction of individuals is expected to pass on information about the NHIS which can contribute to a spatial and social diffusion pattern in uptake. Positive or negative experience with the NHIS of one person can influence the decision of another person to be part of the scheme or not. This phenomenon of social interaction has gained importance in the literature (Mobley et al., 2006). Behaviour patterns among more proximate neighbourhoods are expected to be similar which is also described as 'peer-effect' (Mobley et al., 2006). This peer effect can lead to clustering which needs to be controlled for in the analysis. Osei-Akoto and Adamba (2011)

argue that especially in Africa community health insurance coverage is a challenge due to the country's cultural diversity.

Method

Data

The data for the analysis carried out here is taken from the Ghanaian Living Standards Survey (GLSS) round 6 (2012-2013) – a national representative survey. The latest (2012/1013) GLSS sampled 18000 households within 1200 Enumeration Areas (EA). The Primary Sampling Units (PSU) were stratified by 10 different regions proportional to the population size. In round six a response rate over 93% led to 16772 households being interviewed (Ghana Statistical Service, 2014). For the analysis people aged 50 and above are classified as older adults hence only older household members aged 50 plus were taken into account. This is an unusual cut off point as most studies focusing on elderly populations restrict their study to a population aged 65 and above (McIntyre, 2004). Here it is argued that the chronological definition of 65 is not appropriate when doing research in an African context. In many low and middle income countries the official retirement age of 60 is used to define an older adult, however, World Health Organization (2006) argues that in an African context a chronological age of 50 or 55 serves as a more appropriate cutoff point when defining an older adult. In Ghana the life expectancy at birth is 62 years and the healthy life expectancy at birth 54 years which shows that not many people actually survive beyond the age of 60 (World Health Organization, 2015). Using age 50 as a cutoff point seems therefore more suitable in a Ghanaian context. Further the population aged 50 plus is under-represented in surveys carried out in low and middle-income countries as health surveys commonly set their focus on adults up to age of 49 (World Health Organization, 2000). Focusing on adults aged 50 plus will make sure to fill this gap in the literature and can inform a wide range of policymakers about the needs of this age group.

Further data for the construction of district level control variables were taken from a 10% sample of the Ghanaian 2010 census. For descriptive purposes the straight-line distance to healthcare facilities was created using data taken from the ESRC Centre for Population Change in Southampton who previously produced a detailed list of healthcare facilities in Ghana based on data from the Ministry of Health, the Centre for Remote Sensing and Geographic Information Service and the University of Ghana (Gething et al., 2012). The attribute data and shape files were exported to the statistical program R and the district polygon map was linked to the healthcare facility dataset, the GLSS data and the census data.

Variables and hypothesis

Spatial factors

Spatial characteristics are hypothesised to affect the demand for health insurance. Place of residence and region were included in the anlysis to capture geographical differences. Here it is hypothesised that living in an urban area increases the likelihood of health insurance enrolment due to the greater availablity of services. Based on the argument made earlier, on measuring the accessablity of healthcare, the use of reported travel time seemed most appopripriate. Straight-line distance was only taken into account for descriptive statistics with a view to a better understanding of the geographial provision of services. For this study the average district travel time to a healthcare facility was computed using the in the survey reported individual travel time to and from a healthcare facility. Here, not only travel time to public facilities was included, but also to private and faith-based facilities. This was done because the NHIS expanded the role for the private healthcare sector to include public, faith-based and an increasing number of private providers (National Health Insurance Authority, 2013). Please note that seeking alternative care like homeopathy or consulting a traditional healer was not taken into account.

When looking at travel time to healthcare, *access* is usually defined as "a measure of distance to care, with 30 minutes generally being viewed as the accepted maximum time to access healthcare" (Janke, 2009, p. 437). Although 30 minutes of travel time is viewed as a common measurement of access to healthcare (Health and Places Initiative, 2014) this standard has been mainly applied by researchers conducting studies on high-income countries (Bosanac et al., 1976, Luo and Wang, 2003). Nevertheless, there is also evidence that in low and middle-income countries the 30 minutes travel time standard is appropriate. Schoeps et al. (2011) provide evidence that in Burkina Faso the estimated survival for children under the age of five is greater for those living within 30 minutes travel time of a healthcare facility compared to those living further than 30 minutes from a healthcare facility. Further Campbell and Abu Sham (1995) analysed the decision to seek health care in Sudan and found that women wish to not travel further than 30 minutes to reach a healthcare facility unless the quality of a facility is considered as particularly good. While these studies give evidence that support the 30 minute travel time standard the Health and Places Initiative (2014) argues that in rural areas especially this standard does not hold. These findings are supported when looking at Ghana. While 78.6% of the population that reside in urban areas have quick access to a health care facility, less than half of the population living in rural areas have access to health care services within 30 minutes (Ghana Statistical Service, 2005). Therefore for this analysis the travel time has been coded as followed: up to 15 minutes, 16-30 minutes, 31-45, 46-60 minutes, over and hour.

To measure availability of healthcare the existence of a hospital in the district was included in the model. It was hypothesised that having a hospital in the district will increase insurance coverage due to the greater benefit of actually using insurance in the case of illness. Because of potential multicollinearity problems between the travel time and hospital availability variables, the correlation

between both variables was checked. Only a weak correlation was found which indicated that multicollinearity is not a problem.

Demographic and other aspatial factors

The variable *age* has been transformed from a continuous into a categorical variable (50-59, 60-69, 70 plus) in order to control for changes in the demand for healthcare insurance among different age groups. 10 year intervals were chosen to compare different groups of older adults. These categories make theoretical sense as operationalisations of groups differentially related to the scheme through regulations governing exemptions from payments. Age 60 is the official retirement age in Ghana and all pensioners under the Social Security Pension Scheme are exempted from premium payments (Apoya and Marriott, 2011). Those age 60-69 years who do not receive pensions and work in the informal sector would still be liable for premium payments on the NHIS. It is expected that due to the exemptions on premiums from age 70 and for pensioners under the Social Security Pension Scheme, insurance membership rises sharply among older adults. Also the model fit for all models improved when treating age as a categorical instead of a continuous variable.

Based on previous findings like Dixon et al. (2011) and Ayitey et al. (2013), living standards were hypothesised to have the strongest effect on health insurance enrolment. In this paper expenditure was used as a measurement of living standards. To account for differences in regional prices, per capita household expenditure was adjusted to the regional cost of living in the year 2012 (Ghana Statistical Service, 2014). It ought to be noted that per capita expenditure simplifies the resource allocation in a household and assumes equal access to resources among all household members. The interpretation of per capita expenditure therefore needs to be treated with caution. The different needs of household members are not captured using this approach and no economies of size are controlled for (Falkingham et al., 2009, Barrientos et al., 2003). The level of material poverty among older adults could be underestimated using a simple per capita approach (Falkingham et al., 2009, Barrientos et al., 2003).

Following Juetting (2001), in order that sample selection bias is avoided, (in the sense that people of ill health are more likely to self-select into insurance membership), healthy and non-healthy individuals were included in the analysis. Participants in the GLSS were asked whether they have any disabilities that limit their full participation in life activities which was used as an indication of health status.

The variable *marital status* was included as married people were found in previous studies to be more likely than singles to enrol in a health insurance scheme. The variable marital status distinguishes between married/cohabiting, never married, separated/divorced and widowed. Being widowed was

included as an extra category as older adults often face being left without their partner due to death. Married people in developed as well as developing countries are found to be more likely to hold a health insurance as they may feel increased responsibility to mitigate effects of their potential ill-health on their partner (Asenso-Okyere et al., 1997, Cameron and McCallum, 1995). In addition married couples have the opportunity to pool financial recourse making it easier to afford insurance membership (Dixon et al., 2011).

Level of education was grouped into three categories ranging from primary (or less) to tertiary based on the Ghanaian education system standard (US Embassy, 2015). A growing body of the literature also debates whether higher internet coverage in an area increases the overall awareness of the NHIS which is why internet usage was controlled for.

The social context people live in can help inform their decision about whether to join the NHIS or not. Osei-Akoto and Adamba (2011) argue that in an African context ethnic and religious diversity determines enrolment in health insurance. This argument is based on the hypothesis that ethnically diverse societies experience a lower level of trust and face less support for collective action (Osei-Akoto and Adamba, 2011). A recent study by Fenenga (2015) gives evidence that community trust is the key to success for the NHIS. The calculation of ethnic and religious diversity is obtained using the fractionaization index (Alesina et al., 1999). It measures the probablity that two radomly selected people form the same district will be ethnically or religiously different, meaning that they belong to different ethnic groups or religious domains (Osei-Akoto and Adamba, 2011, Alesina et al., 1999). A higher index indicates a higher diversity in a defined area.
The fractionization index F was calculated as (Fearon, 2003):

$$F = 1 - (\sum_{i=N}^{n} p_i^2)$$

Where:
$p_1, \ldots, p_n$ = share of religious / ethnic group as a proportion of the total population of a defined area

-Table 1 about here-

Method

Pearson's Chi-squared test was used to assess whether there is a significant association between the categorical explanatory variables and NHIS enrolment in the population. Here the significance level was set to 0.05 (5%). To examine the correlates of NHIS enrolment, binary logistic multilevel modelling was used. The binary outcome variable equals 1 if an individual is enrolled in the NHIS and 0 otherwise. Multilevel modelling allows controlling for variances in the structure of the data (Johnson et al., 2015). The NHIS operates on a district level which makes the use of a multilevel model appropriate, thereby allowing the distinguishing of individual and contextual effects on health insurance enrolment (Ko and Bindman, 2014). A conventional regression model would underestimate the standard errors, as it fails to take the clustered structure into account, thereby increasing the risk of incorrectly assuming that a result is significant (Park and Lake, 2005). The model here consists of two levels. The multilevel model assumes that 9492 individuals (level 1) are nested within 170 districts (level 2). A sequential model-building process was applied to understand the extent to which user characteristics, aspatial, and spatial access barriers influence participation in the NHIS.

A local Moran's test for the residuals was carried out in order to test whether there is evidence for spatial autocorrelation or whether insurance enrolment is distributed randomly. This is important as the review of the literature emphasized the impact of social interaction on health insurance enrolment. As a consequence of social interaction it is expected that neighborhoods demonstrate similar behavior patterns potentially resulting in spatial clustering (Mobley et al., 2006) and misleading estimates (Mobley et al., 2006). A queen contiguity criterion has been applied for the test which defines neighbourhoods that share borders or corners (Mobley et al., 2006).

The complete analysis has been carried out with the data software STATA, R and GeoDa. For the descriptive statistics sample weights were applied throughout to adjust for unequal probability of selection.

Results

Descriptive results

The analysis revealed that they are spatial differences in the NHIS coverage. Figure 1 illustrates the distribution of NHIS coverage by region and residence. In the Upper West, Upper East and Brong-Ahafo region the insurance coverage is particularly high. A lower coverage was found in the Central region and in Greater Accra while in all regions the coverage in urban areas was higher compared to

rural areas. Overall the enrolment rate in urban areas among older adults was 67% and in rural areas 59%. The hypothesis that NHIS uptake is equal across place of residence and region was rejected at a 95% confidence level.

-Figure 1 about here-

Looking at the healthcare facility availability and hospital provision, the coverage tends to be greater in the South compared to the North of Ghana. The Ghana Health Service policy framework defines easy access to healthcare as being located within 8 kilometres reach of a healthcare facility (Johnson et al., 2015, Apoya and Marriott, 2011, Luginaah and Kerr, 2015). Figure 2 visualises the distance to healthcare facilities and hospitals, respectively, within the recommended 8 kilometres radius. The majority of Ghanaians live within an 8 kilometres distance of a healthcare facility but nearly 73% of the Ghanaian population do not live within the 8 kilometre radius of a hospital.

-Figure 2 about here-

When looking at the average reported travel time geographical differences were confirmed. The average travel time to a health care facility in an urban area was just over 30 minutes and over 40 minutes in rural areas. Figure 3 indicates a negative relationship between NHIS coverage and travel time to healthcare facility.

-Figure 3 about here-

Moving on to demographic characteristics NHIS enrolment was found to increase with age. A significant relationship ($p<0.05$) was found between age and NHIS enrolment. NHIS enrolment increased from 58% among older adults aged 50-59 to over 70% among people aged 70 plus. This relationship was expected due to the premium exemption afforded those who reach the age of 70 (see figure 4).

-Figure 4 about here-

In figure 5 the distribution of NHIS uptake by expenditure is visualised. Results indicate that expenditure significantly ($p<0.05$) influences NHIS enrolment. An increase in wealth was associated with a higher NHIS uptake from 59% among the poorest to 66% among the richest.
Bivariate analysis further showed significant differences with respect to gender, occupation, marital status, education, internet usage and disability.

-Figure 5 about here-

Spatial results

The Moran's I test resulted in invalidation of the hypothesis that the residuals are randomly distributed (Moran I statistic = 0.36, p-value <0.01). This result is visualised in figure 6. The map indicated significant regionalization in NHIS enrolment among older adults. This means that NHIS coverage among adjacent districts is spatially correlated[1]. Strong positive autocorrelation is shown by the darker shaded red and blue colours. The locations with positive spatial autocorrelation are clusters that have a high local and a high neighbourhood rate, or low neighbourhood and low local rate. Non-significant clusters are presented in grey. Depending on place of residence, a model that does not account for spatial autocorrelation is liable to under-predict or over-predict the likelihood of NHIS enrolment. Thus the aim of the model-building process was to include factors in the model that can adjust for spatial correlation.

-Figure 6 about here-

Multi-level regression results

Table 2 illustrates the odds ratio from the multilevel regression analysis which examined the correlates of NHIS enrolment for older adults. Overall, three models were built. The first model controls the physical accessibility of services in terms of travel time to healthcare facilities. The second model expands the first model and adds other demographic characteristics. Contextual factors were controlled for in model three.

Model 1 supports the findings of the descriptive statistics and indicates that travel time to the nearest healthcare facility influences insurance enrolment negatively. A greater travel time to a healthcare facility was associated with a smaller likelihood of enrolment in the NHIS.

When adding user characteristics it was revealed that an increase in expenditure is associated with an increase in NHIS enrolment. Expenditure has been included in the model as a fixed effect. The variance of expenditure across districts was tested by including a random slope for the differences in wealth expenditure in the model. However, this revealed that the effect of expenditure did not vary across districts. Further it was shown that NHIS insurance coverage increases with age confirming the results of the bivariate analysis. Model 2 also found that household internet usage increases NHIS membership but this variable does not remain significant when adding contextual factors. It was

[1] The GLSS is not representative at district level, therefore it has to be acknowledged that the sample used might not be representative.

expected that in urban areas internet availability is superior, but an interaction between place of residence and internet usage was found not to be significant.
The analysis here showed an effect of marriage on insurance affiliation. Married older adults were more likely to be enrolled in the NHIS compared to those never married, separated or widowed. Furthermore, the likelihood of being insured increased when being employed in the public sector compared to being self-employed. In addition, an increase education significantly increased NHIS enrolment.

In model 3 it was revealed that place of residence significantly influences the decision to enrol in the NHIS when controlling for demographic and socioeconomic characteristics as well as travel time to healthcare facilities. The finding that living in an urban area increases the likelihood of being enrolled in the NHIS, irrespective of region is significant. This can hinder older adult's access to services most especially, as the proportion of older adults living in rural areas is particularly high. The likelihood of enrolling in the NHIS for older adults not living in the Greater Accra Region was greater than for individual's living Accra. This reflects the enrolment patterns found in figure 1. The availability of a hospital in a district was found to have no significant effect on insurance coverage.

Looking at ethnic and religious diversity it can be seen that only the variable *religious diversity* was found to be significant. When looking at the direction of the effect of both variables indicated decreasing NHIS enrolment with increasing diversity.

-Table 2 about here-

Overall travel time to healthcare facilities explained 10.8% of the between-community variance compared to an intercept-only model. When controlling for spatial and aspatial barriers (model 3), the between community variations in NHIS enrolment was reduced by 49% but it does remain significant. This indicates that the model was unable to explain all the between community differences in NHIS enrolment. When, however, applying the local Moran's I test to model 3, it was seen that the model successfully controls for spatial clustering (Moran I statistic standard deviate = 0.156, p-value = 0.438).

Discussion

The analysis presented in this paper examines spatial and aspatial factors to determine key barriers to insurance enrolment among older adults in Ghana. The results of this analysis have both research and political relevance. The analysis combined demographic and geographical methods to examine NHIS coverage in Ghana. The use of geographic information systems gave an insight into the geographical

distribution of NHIS enrolment. The multilevel model allowed determination of which individual-level and area-level characteristics influence participation in the NHIS.
These findings are important for healthcare authorities and policymakers who would wish to create target-orientated policies to increase the NHIS enrolment rate.

Despite scaled-to-income fees, that in theory should mitigate skewed enrolment according to wealth, the findings imply that insurance enrolment increases with wealth. This was also found by other research, including Ayitey et al. (2013) and Dixon et al. (2011). Health insurance is argued to be a way to improve access to healthcare. However, low enrolments among the poorest indicate failure to reach the objective of equal access. These findings can be explained by the 'inverse equity hypothesis'. This hypothesis suggests that "new health interventions will initially benefit higher socioeconomic groups and widen health inequities, but if coverage increases overtime, the poor can eventually catch up and health inequities can be narrowed" (Lee et al., 2014, p. 1).
There is evidence that poorer people are increasingly benefitting from the system. Further analysis of the GLSS showed that 93% of the poorest NHIS members reported that they benefitted from the system which is slightly but significantly ($p<0.05$) higher compared to richest members (89%). This could be due to the greater need of healthcare among the poorest. 32% in the lowest income quantile reported that they have serious illnesses or disabilities compared to only 14.2% in the richest quantile. Further, poorer people usually do not have the financial means to seek healthcare which is why the NHIS is their only access to healthcare, whereas richer individuals often have the means to afford cash payments when care is needed. Government subsidies or donor funding are seen as one way to stabilize the health finance system in the long run. Efforts need to be undertaken to ensure that all people that fall below the poverty line are aware of the premium exemption in the NHIS to increase enrolment among the poor.

Social and regional differences presented in this study indicate that NHIS affiliation is influenced by factors that go beyond wealth. An increase in education was found to significantly increase insurance affiliation for older adults. This finding underlines those of Ayitey et al. (2013) who showed that with rising education NHIS enrolment increases. Ayitey et al. (2013) study was based on data gathered in the year 2005 when the general knowledge of the NHIS was low due to its then recent implementation. More up to date research indicates a high general awareness of the system. In the GLSS round 6 (2012/2013) less than 1% of respondents reported that they did not know about the system. A recent randomized control trial by Schultz et al. (2013) examined whether health education increases NHIS enrolment or re-enrolment by delivering health education sessions. Their experiment showed that education was not a barrier. No significant differences between the clients that received education and those who did not were found. Moreover it is doubtful that higher education alone increases NHIS awareness of older adults. Formal education of older adults generally occurred in the earlier part of

their lives and therefore those people would not have received direct mention of the health insurance system during their schooling. It is likely that the variable education serves as a proxy for a set of capacities, confidences and behavioural norms that allow individuals to overcome psychological and social-norm barriers to exploiting opportunities provided by the state.

The likelihood of being insured also increased among older adults when being employed in the public sector compared to being self-employed. Although the National Health Insurance Bill made NHIS enrolment mandatory for the formal and informal sector (Owusu-Sekyere and Bagah, 2014), the large informal sector in Ghana whose average income is often too low to significantly contribute to the NHIS makes sustainable funding of the scheme problematic (Owusu-Sekyere and Bagah, 2014). It is challenging to increase NHIS membership in the informal sector. While in the public sectors employers are obligated to ensure NHIS enrolment among their employees, there are no formal operators that can check insurance status among the self-employed.

When looking at gender, the results show older females were more likely than males to be enrolled in the NHIS. These results of are in line with findings of Dixon et al. (2011) and Ayitey et al. (2013) who also found that females are more likely to enroll in the NHIS than males. Further explanation as to why women are more likely to enrol could be attributed to gender cultural roles. Dixon et al. (2013) argue that women in Ghana tend to take responsibility for the health and wellbeing of the family and thus are more likely to be aware of the benefits provided by health insurance coverage. Other researchers discuss whether the opportunity for women to enrol in the NHIS contributed to a broader debate about women's empowerment in Ghana (Dixon et al., 2011). NHIS enrolment can act as a tool to narrow gender-related discrimination in access to healthcare. In Ghana the decision-making power of spending money for seeking healthcare often lies with the male household head who tends to control access to and allocation of household resources (Tolhurst et al., 2008). If required services are covered be the insurance system the NHIS enables women to seek healthcare when needed after the regular premium is paid without asking to use household resources more irregularly. This augments women’s decision making power in seeking healthcare.

Furthermore, it is well known that religion and culture have a significant impact on beliefs and health practices (Dwumoh et al., 2014). Religion influences the choice of provider and the decision to seek formal care. People tend to be more likely to learn from people of their own religious beliefs than from individuals that are socially more distant. This study indicated that religious diversity influences the decision to enrol in the NHIS negatively. Parmar et al. (2014) showed that a greater social community network increases the likelihood of NHIS enrolment. Osei-Akoto and Adamba (2011) gave evidence that ethnic diversity reduces the uptake of the NHIS. In this study here the ethnic diversity variable, however, was found to have a non-significant effect. Dwumoh et al. (2014) showed

that the variable *ethnicity* does not influence NHIS enrolment but *religion* does. Religious diversity was expected to have a great influence on the uptake of NHIS in particular among older adults as studies found that religious activities influences the well-being of older adults (Lawler-Row and Elliott, 2009). For the promotion of public health, faith-based institutions in Africa were found to carry an important role at community level (de-Graft Aikins et al., 2010). Hence, great religious diversity makes the promotion of the NHIS in communities through churches more difficult.

Moving on to spatial barriers of NHIS enrolment, the multilevel analysis of this paper found evidence that travel time to healthcare facilities reduces the likelihood of NHIS membership among older adults. For older adults especially, health services need to be physically accessible, as older adults tend to be less mobile than younger adults and are more likely to be bed-ridden making it impossible to travel long distances to seek care. Policymakers need to become more attuned to these risks and Vice President of Help Age Ghana, Edward Ameyibor, has urged the NHIS to react better to the needs of older adults by proving home treatment (Ghana news Agency, 2013).
Furthermore, differences in the provision of services in the geographic regions of Ghana were proven. It was found that urban dwellers were more likely to join the NHIS compared to rural dwellers, even when controlling for travel time to healthcare facilities. This could be due to poorer medication stocks, poorer quality of care, and long waiting periods in rural areas (McLaren et al., 2014). Also the poverty rate in rural areas was found to be significantly higher than in urban parts of Ghana (Duku et al., 2013). This again is a particular problem for older adults as they tend to live in rural areas.

Limitations

One of the limitations of this work is that it was not possible to control for all factors that potentially influence insurance enrolment. The major limitation of the analysis carried out here was the limited opportunities to control for the quality of healthcare service. Omitted variable bias can occur by omitting variables that potentially influence NHIS affiliation (Jehu-Appiah et al., 2000). With this case of omitted variable bias, it is expected that the effect of other explanatory variables is overestimated (Jehu-Appiah et al., 2000). A positive association between the quality of service and healthcare utilisation is expected. Although there is a common agreement in studies focused on an African context that wealth is the main driver of insurance enrolment (Mills et al., 2012), in Guinea it was found that not wealth, but poor quality of services forms the main explanation of low enrolment in the Mutual Health Organisation community insurance scheme (Criel and Waelkens, 2003). Furthermore, people are expected to travel longer distances to obtain specialist and higher quality treatment (Buor, 2003). Poor healthcare quality could lead to a scenario where wealthy people self-select themselves into a private insurance system instead of choosing to be part of the NHIS as they

expect better services if they go private. Other factors that were not controlled for include the availability of drugs. Gobah and Liang (2011) argue that low coverage of drugs in the NHIS reduces the likelihood of joining the system.

Conclusion

The NHIS in Ghana has been described is the most important driver towards universal health coverage in the country (Blanchet and Acheampong, 2013). The goal of the NHIS was to improve access to and utilisation of healthcare in order to provide affordable healthcare for Ghanaian citizens. While other studies evaluated demand for the NHIS and its benefits on healthcare usage among adults, the implication of the NHIS for older adults remained up to now under-researched. There is limited evidence analysing whether the NHIS was successful in enrolling older adults (Parmar et al., 2014). Increasing population ageing combined with an increasing demand for healthcare due to the greater occurrence of disabilities in older age, created an imperative for this research agenda as a means to inform policymaking.

This study showed that spatial and aspatial barriers in the decision to enrol in the NHIS exist. These barriers need to be removed in order to make further progress in the direction of universal health coverage. Travel time to healthcare facilities was found to have a negative effect on NHIS enrolment. This finding calls for greater advertising of the scheme and information on how it could benefit these in remote areas. For older adults health services need to be physically accessible as they tend to be less mobile and distance to health care facility has a particularly negative effect on their usage of healthcare (Buor, 2003).

There are still regional differences in the uptake of the NHIS. Living in rural areas reduces the likelihood of enrolment in the system which shows that NHIS uptake is also a matter of geographical accessibility. Residential differences in NHIS coverage require a targeted policy response and innovative insurance devices be considered within schemes including reimbursed transport for those who live in remote areas. In rural areas especially, the NHIS enrolment rates need to be improved. In many lower and middle-income countries older adults rely on traditional institutions like their family as caregivers due to a lack of institutional frameworks that successfully manage and define health care needs of older adults (Saeed et al., 2015). However, due to the rural-urban migration of younger adults in Ghana, many older adults are left behind in rural areas. In urban areas the restrictions on physical space provides challenges to living in households with different generations (Beales, 2000).

The pro-rich bias in NHIS enrolment shows that the NHIS failed to meet the needs of the poorest and is not a financially affordable option for the poor, although in theory, scaled-to-income fees exists. So far there is no evidence that indigent status protects the poorest members of society. Without interventions to ensure that the poorest people can access the NHIS they will continue face a trade-off between financing needed healthcare and the allocation of recourses for other essentials like food (Blanchet and Acheampong, 2013).

To ensure equal access to healthcare among older adults a lowering of the premium exemption of older adults to an age of 60, the authorised retirement age, is proposed (Mba, 2006). It is unclear whether older adults are aware of the premium exemption at 70 years of age as no studies have examined this issue (Parmar et al., 2014) and further research on this aspect is needed. Awareness of the NHIS premium exemptions could be improved through increased publicity of the system, potentially at markets or community hubs. Further community trust in the system can lead to the encouragement of community members to join the NHIS.

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References

ABODERIN, I. 2015. Older people and the future of sub-Saharan Africa. *Facing the facts: The truth about ageing and development.* London: Age International

ALESINA, A., BAQIR, R. & EASTERLY, W. 1999. Public Goods and Ethnic Divisions. *Quarterly Journal of Economics,* 114**,** 1234-1284.

APOYA, P. & MARRIOTT, A. 2011. Achieving a shared goal: Free universal health care in Ghana. Oxford: Alliance for Reproductive Health Rights, Essential Services Platform of Ghana, ISODEC, Oxfam.

ASENSO-OKYERE, W. K., OSEI-AKOTO, I., ANUM, A. & APPIAH, E. N. 1997. Willingness to pay for health insurance in a developing economy. A pilot study of the informal sector of Ghana using contingent valuation. *Health Policy,* 42**,** 223-237.

AYITEY, A. M., NKETIAH-AMPONSAH, E. & BARIMAH, A. 2013. Determinats of Insurance Enrolment Among Ghanaian Adults: The Case of the National Health Insurance Scheme (NHIS). *Economics, Management, and Financial Markets,* 8**,** 37-57.

BARRIENTOS, A., GORMAN, M. & HESLOP, A. 2003. Old Age Poverty in Developing Countries: Contributions and Dependence in Later Life. *World Development,* 31**,** 555–570.

BEALES, S. 2000. Why we should invest in older women and men: The experience of HelpAge International. *Gender & Development,,* 8**,** 9-18.

BLANCHET, N. J. & ACHEAMPONG, O. B. 2013. Building on Community-based Health Insurance to Expand National Coverage: The Case of Ghana. Bethesda: USAID's Office of Health Systems.

BLANCHET, N. J., FINK, G. & OSEI-AKOTO, I. 2012. The Effect of Ghana's National Health Insurance Scheme on Health Care Utilisation. *Ghana Medical Journal,* 46**,** 76-84.

BOSANAC, E. M., PARKINSON, R. C. & HALL, D. S. 1976. Geographic Access to Hospital Care: A 30-Minute Travel Time Standard. *Medical Care,* 14**,** 616-624.

BUOR, D. 2003. Analysing the primacy of distance in the utilization of health services in the Ahafo-Ano South district, Ghana. *International Journal of Health Planning and Management,* 18**,** 293–311.

CAMERON, A. C. & MCCALLUM, J. 1995. *Private Health Insurance Choice in Australia: The role of long-term utilisation of health service,* New South Wales Economics and Health.

CAMPBELL, M. & ABU SHAM, Z. 1995. Sudan: situational analysis of maternal health in Bara District, North Kordo. *World Health Statistics Quarterly,* 48**,** 1.

CHANNON, A. A., ANDRADE, M. V., NORONHA, K., LEONE, T. & DILIP, T. 2012. Inpatient care of the elderly in Brazil and India: Assessing social inequalities. *Social Science and Medicine,* 75**,** 2394-2402.

CRIEL, B. & WAELKENS, M. P. 2003. Declining subscriptions to the Maliando Mutual Health Organisation in Guinea-Conakry (West Africa): what is going wrong? *Social Science & Medicine,* 57**,** 1205–1219.

DE-GRAFT AIKINS, A., BOYNTON, P. & ATANGA, L. L. 2010. Review Developing effective chronic disease interventions in Africa: insights from Ghana and Cameroon. *Globalization and Health* 6**,** http://www.globalizationandhealth.com/content/6/1/6.

DIXON, J., TENKORANG, E. Y. & LUGINAAH, I. 2011. Ghana's National Health Insurance Scheme: helping the poor or leaving them behind? *Environment and Planning C: Government and Policy,* 29**,** 1102-115.

DIXON, J., TENKORANG, E. Y. & LUGINAAH, I. 2013. Ghana's National Health Insurance Scheme: a national level investigation of members' perceptions of service provision. *BMC International Health and Human Rights,* 13**,** doi:10.1186/1472-698X-13-35.

DUKU, S. K. O., FENEGA, C. J., ALHASSAN, R. K. & NKETIAH-AMPONSAH, E. 2013. Rural-Urban differences in the determinants of enrolment in health insurance in Ghana. *IUSSP International Population Conference.* Busan.

DWUMOH, D., ESSUMAN, E. E. & AFAGBEDZI, S. K. 2014. Determinant of factors associated with child health outcomes and service utilization in Ghana: multiple indicator cluster survey conducted in 2011. *Archives of Public Health,* 72**,** http://www.archpublichealth.com/content/72/1/42.

FALKINGHAM, J. 2015. The changing shape of society. *Facing the facts: The truth abut ageing and development.* London Age International.

FALKINGHAM, J., BASCHIERI, A., EVANDROU, M. & GRANT, G. 2009. Left behind in transition? The well-being of older people in Tajikistan. *CRA discussion paper, 0901, Centre for Research on Ageing, Southampton*.

FEARON, J. D. 2003. Ethnic and Cultural Diversity by Country. *Journal of Economic Growth,* 8**,** 195-222.

FENENGA, C. 2015. *A matter of trust: clients' perspective on health and health insurance services in Ghana.* University of Groningen.

GETHING, P. W., JOHNSON, F. A., FREMPONG-AINGUAH, F., NYARKO, P., BASCHIERI, A., ABOAGYE, P., FALKINGHAM, J., MATTHEWS, Z. & ATKINSON, P. M. 2012. Geographical access to care at birth in Ghana: a barrier to safe motherhood. *BMC Public Health,* 12**,** 1-13.

GHANA NEWS AGENCY. 2013. *NHIS neglecting health needs of older people- HelpAge Ghana* [Online]. http://www.ghananewsagency.org/health/nhis-neglecting-health-needs-of-older-people-helpage-ghana--59117: Ghana news Agency [Accessed 20/08 2015].

GHANA STATISTICAL SERVICE 2005. Ghana 2003 Core Welfare Indicators Questionnaire (CWIQ II) Survey Report. Accra: Ghana Statistical Service.

GHANA STATISTICAL SERVICE 2014. Ghana Living Standards Survey Round 6: Main Report. Accra: Ghana Statistical Service.
GOBAH, F. & LIANG, Z. 2011. The National Health Insurance Scheme in Ghana: Prospects and Challenges: a Cross-Sectional Evidence. *Global Journal of Health Science,* 3**,** 90-101.
GUAGLIARDO, M. F. 2004. Spatial accessibility of primary care: concepts, methods and challenges. *International Journal of Health Geographics,* 3**,** doi:10.1186/1476-072X-3-3.
HEALTH AND PLACES INITIATIVE 2014. Geographic Healthcare Access and Place. A Research Brief. Version 1.0. http://research.gsd.harvard.edu/hapi/: Health and Places Initiative.
HSIAO, W. C. & SHAW, P. R. 2006. *Social Health Insurance for Developing Nations,* Washington D. C., The World Bank.
JANKE, R. A. 2009. *Encyclopedia of Health Services Research,* California, SAGE Publications.
JEHU-APPIAH, C., ARYEETEY, G., DE HOOP, T., AGYEPONG, I. & BALTUSSEN, R. 2000. Equity aspects of the National Health Insurance Scheme in Ghana: Who is enrolling, who is not and why? *Social Science & Medicine,* 72**,** 157-165.
JOHNSON, F. A., FREMPONG-AINGUAH, F., MATTHEWS, Z., HARFOOT, A. J. P., NYARKO, P., BASCHIERI, A., GETHING, P. W., FALKINGHAM, J. & ATKINSON, P. M. 2015. Evaluating the Impact of the Community-Based Health Planning and Services Initiative on Uptake of Skilled Birth Care in Ghana. *PLOS ONE,* 10**,** e0120556. doi:10.1371/journal.pone.0120556.
JUETTING, J. P. 2001. The Impact of Health Insurance on the Access to Health Care and Financial Protection in Rural Developing Countries. Washington DC: The International Bank for Reconstruction and Development/ The world Bank
KHAN, A. A. & BHARDWAJ, S. M. 1994. Access to Health Care: A Conceptual Framework and Its Relevance to Health Care Planning. *Evaluation & The Health Professions,* 17**,** 60-76.
KO, M. & BINDMAN, A. B. 2014. No man is an island: disentangling multilevel effects in health service reseach *BMJ Qual Saf,* 23**,** 177-179.
KUSI, A., ENEMARK, U., HANSEN, K. S. & ASANTE, F. A. 2015. Refusal to enrol in Ghana's National Health Insurance Scheme: is affordability the problem? *International Journal for Equity in Health,* 14**,** DOI 10.1186/s12939-014-0130-2.
LAWLER-ROW, K. & ELLIOTT, J. 2009. The Role of Religious Activity and Spirituality in the Health and Well-being of Older Adults. *Journal of Health Psychology,* 14**,** 43-54.
LEE, T. J., HUANG, Z., BASU, S. & MILLETT, C. 2014. The inverse equity hypothesis: Does it apply to coverage of cancer screening in middle-income countries? *Journal of Epidemiology and Community Health***,** doi:10.1136/jech-2014-204355.
LLOYD-SHERLOCK, P. 2010. *Population ageing and international development,* Bristol, The Policy Press.
LUGINAAH, I. & KERR, R. B. 2015. *Geographies of Health and Development,* Farnham, Ashgate
LUO, W. & WANG, F. 2003. Measures of spatial accessibility to health care in a GIS environment: synthesis and a case study in the Chicago region. *Environment and Planning B: Planning and Design,* 30**,** 865-884.
MBA, C. J. 2006. The Health Condition of Older Women in Ghana: A Case Study of Accra City. *Journal of International Women's Studies,* 8**,** 171-184.
MCINTYRE, D. 2004. Health Policy and Older People in Africa. *In:* LLOYD-SHERLOCK, P. (ed.) *Living Longer: Ageing, Development and Social Protection* London: United Nations Reseach Instiute for Social Development
MCINTYRE, D., GARSHONG, B., MTEI, G., MEHEUS, F., THIEDE, M., AKAZILI, J., ALLY, M., AIKINS, M., MULLIGAN, J.-A. & GOUDGE, J. 2008. Beyond fragmentation and towards universal coverage: insights from Ghana, South Africa and the United Republic of Tanzania. *Bulletin of the Wrold Health Organization,* 86**,** 871-876.
MCLAREN, Z. M., ARDINGTON, C. & LEIBBRANDT, M. 2014. Distance decay and persistent health care disparities in South Africa. *BMC Health Services Research* 14**,** doi:10.1186/s12913-014-0541-1.

MENSAH, J., OPPONG, J. & SCHMIDT, C. M. 2009. Ghana's National Health Insurance Scheme in the Context of the Health MDGs. *Ruhr Economic Papers,* 157**,** 4-20.

MILLS, A., ATAGUBA, J., E, BORGHI, J., GARSHONG, B., MAKAWIA, S., MTEI, G., HARRIS, B., MACHA, J., MEHEUS, F. & MCINTYRE, D. 2012. Equity in financing and use of health care in Ghana, South Africa, and Tanzania: implications for paths to universal coverage *The Lancet,* 380**,** 126-133.

MINISTRY OF HEALTH GHANA. Towards Universal Health Coverage: Increasing Enrolment Whilst Ensuring Sustainability. *In:* NATIONAL HEALTH INSURANCE SCHEME, R. F., ed. NHIS 10TH Anniversary International Conference on UHC, 2013 Accra. Ministry of Health Republic of Ghana.

MOBLEY, L. R., ROOT, E., ANSELIN, L., LOZANO-GRACIA, N. & J., K. 2006. Spatial analysis of elderly access to primary care services. *International Journal of Health Geographics,* 5**,** doi:10.1186/1476-072X-5-19.

MØLLER-JENSEN, J. & KOFIE, R. Y. 2001. Exploiting available data sources: location/allocation modeling for health service planning in rural Ghana *Danish Journal of Geography* 101**,** 145-153.

NATIONAL HEALTH INSURANCE AUTHORITY 2013. National Health Insurance Scheme 10th Anniversary International Conference Report. *In:* AUTHORITY, N. H. I. (ed.) *National Health Insurance Scheme 10th Anniversary International Conference.* International Conference Centre, Accra.

NATIONAL HEALTH INSURANCE AUTHORITY. 2015. *National Health Insurance Scheme* [Online]. http://www.nhis.gov.gh: National Health Insurance Authority,. [Accessed 14/07 2015].

NATIONAL HEALTH INSURANCE SCHEME AUTHORITY. 2014. *National Health Insurance Scheme* [Online]. http://www.nhis.gov.gh/. [Accessed 05/02 2014].

OSEI-AKOTO, I. & ADAMBA, C. 2011. Ethnic and Religious Diversity as Determinants of Health Insurance Uptake in Ghana. *4th European Conference on African Studies* Uppsala.

OSEI-AKOTO, I. & FENNY, A. P. 2013. Client Power and Access to Quality Health Care: An Assessment of Ghana's Health Insurance Scheme. *Journal of African Development,* 15**,** 73-97.

OWUSU-SEKYERE, E. & BAGAH, D. A. 2014. Towards a Sustainable Health Care Financing in Ghana: Is the National Health Insurance the Solution? *Public Health Research,* 4**,** 185-194.

OWUSU-SEKYERE, E. & CHIARAAH, A. 2014. Demand for Health Insurance in Ghana: What Factors Influence Enrollment? *American Journal of Public Health,* 2**,** 27-35.

PARK, S. & LAKE, E. T. 2005. Multilevel modeling of a clustered continuous outcome: nurses' work hours and burnout. *Nursing Research,* 54**,** 406-413.

PARMAR, D., WILLIAMS, G., DKHIMI, F., NDIAYE, F., ASANTE, F. A., ARHINFUL, D. K. & MLADOVSKY, P. 2014. Enrolment of older people in social health protection programs in West Africa – Does social exclusion play a part? *Social Science & Medicine,* 119**,** 36-44.

PILLAY, N. K. & MAHARAJ, P. 2013. Population Ageing in Africa *In:* MAHARAJ, P. (ed.) *Aging and Health in Africa.* New York: Springer Science+Business Media.

SAEED, B. I. I., XICANG, Z., YAWSON, A., NGUAH, S. B. & NSOWAH-NUAMAH, N. N. N. 2015. Impact of socioeconomic status and medical conditions on health and healthcare utilization among aging Ghanaians. *BMC Public Health,* 15**,** DOI 10.1186/s12889-015-1603-y.

SALISU, A. & PRINZ, V. 2009. Health Care in Ghana. Wien: ACCORD

SCHOEPS, A., GABRYSCH, S., NIAMBA, L., SIE, A. & BECHER, H. 2011. The Effect of Distance to Health-Care Facilities on Childhood Mortality in Rural Burkina Faso. *American Journal of Epidemiology,* 173**,** 492-498.

SCHULTZ, E., METCALFE, M. & GRAY, B. 2013. The impact of health insurance education on enrollment of microfinance institution clients in the Ghana National Health Insurance Scheme, Northern region of Ghana. *International Labour Organization's Social Finance Programme, the Microinsurance Innovation Facility* Research Paper No.33.

TOLHURST, R., AMEKUDZI, Y. P., NYONATOR, F. K., SQUIRE, S. B. & THEOBALD, S. 2008. "He will ask why the child gets sick so often": The gendered dynamics of intra-household bargaining over

healthcare for children with fever in the Volta Region of Ghana. *Social Science & Medicine,* 65**,** 1106-1117.
UNITED NATIONS 2013. World Population Ageing 2013. New York: Department of Economic and Social Affairs Population Division.
US EMBASSY. 2015. *Educational system Ghana* [Online]. http://ghana.usembassy.gov/root/pdfs/wwwfeducationofghana.pdf. [Accessed 16/08 2015].
WORLD HEALTH ORGANIZATION 2000. Information Needs for Research, Policy and Action on Ageing and Older Adults. *In:* ORGANIZATION, W. H., INTERNATIONAL, H. A. & AGING, U. S. N. I. O. (eds.) *WORKSHOP ON CREATING A MINIMUM DATA SET (MDS) FOR RESEARCH, POLICY AND ACTION ON AGEING AND THE AGED IN AFRICA.* Harare, Zimbabwe: World Health Organization.
WORLD HEALTH ORGANIZATION 2006. *WHO SAGE Survey Manual: The WHO Study on Global AGEing and Adult Health (SAGE),* Geneva, World Health Organization.
WORLD HEALTH ORGANIZATION. 2015. *Country statistics and global health estimates by WHO and UN partner* [Online]. http://www.who.int/gho/countries/gha.pdf?ua=1: World Health Organization. [Accessed 26/10 2015].

Appendix

Table 1: Coding of used variables

Variable	Coding
Travel time	Was treated as a categorical variable (up to 15 minutes, 16-30 minutes, 31-45, 46-60 minutes, over and hour) , with ≥ 15 used as reference category
Sex	Coded dichotomously using the category male as reference
Age	Was treated as a categorical variable (50-59, 60-69, 70+) with 50-59 used as reference category
Disability	Coded dichotomously into yes -suffering from disabilities- and no – not suffering from disabilities. Latter was used as the reference category
Marital status	Grouped into 3 categories: married/cohabiting, never married, separated/divorced and widowed. Reference category: married/cohabiting
Internet usage	Coded dichotomously using the category no usage as reference
Occupation	Converted into 4 categories with self-employment as reference category
Education	Converted into 3 categories from primary to tertiary education with primary education as reference category
Standard of living	Expenditure tertile. Reference category: Poorest (1st tertile)
Region	Included the 10 regions in Ghana with Greater Accra used as reference
Place of residence	Coded dichotomously. Reference: Urban

Figure 1: Distribution of NHIS enrolment by residence and region with 95% confidence interval

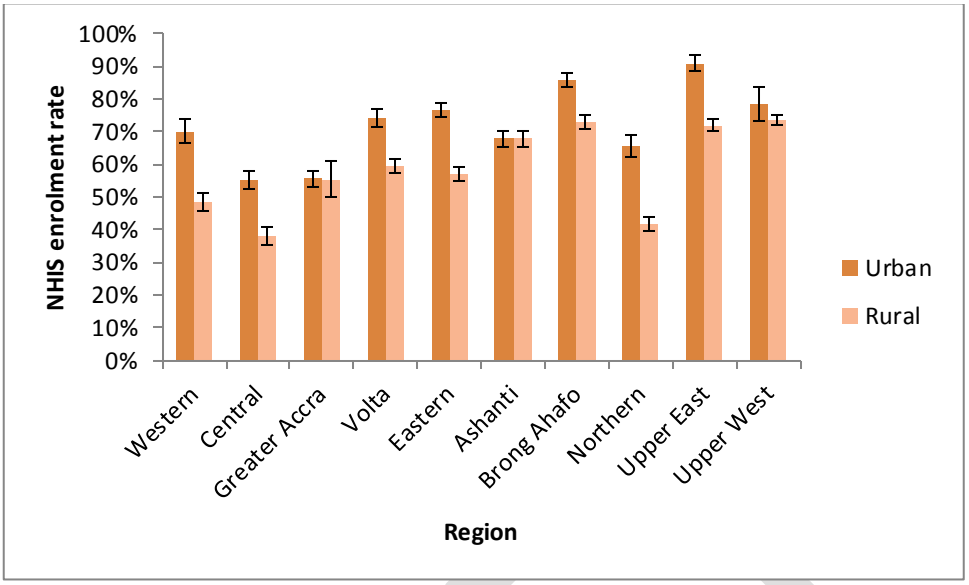

Figure 2: Distance to a) health care facility b) hospital

a) b)

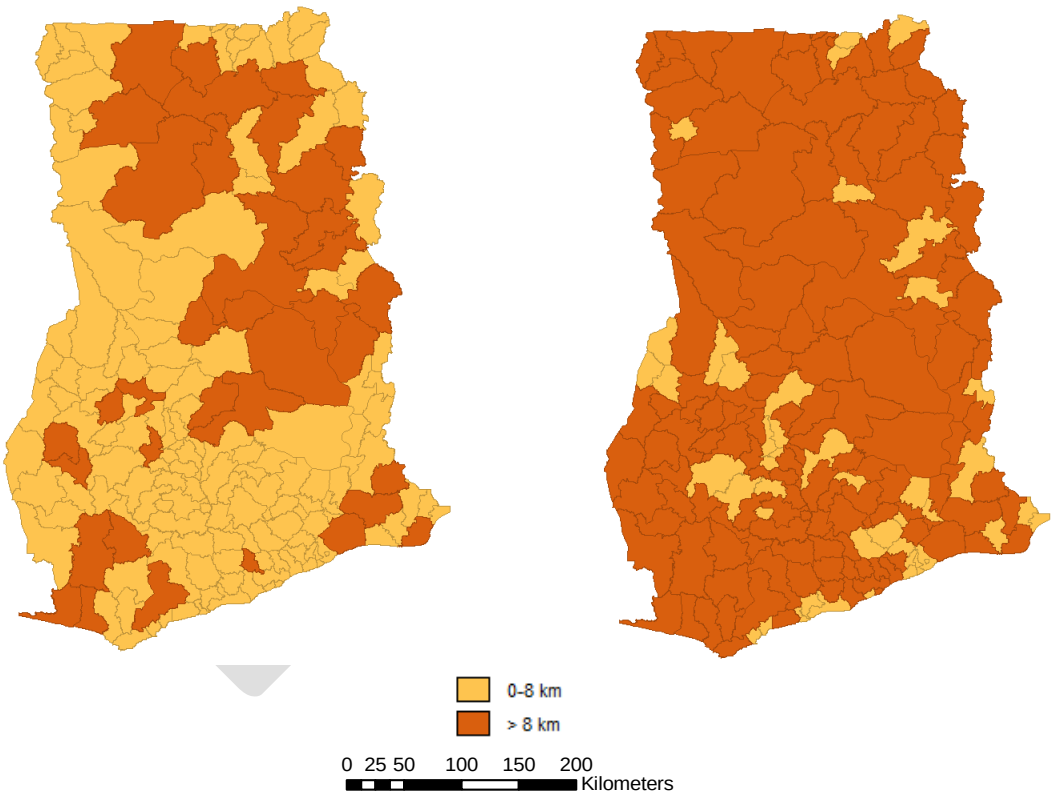

Figure 3: NHIS coverage rate and average travel time to healthcare facility

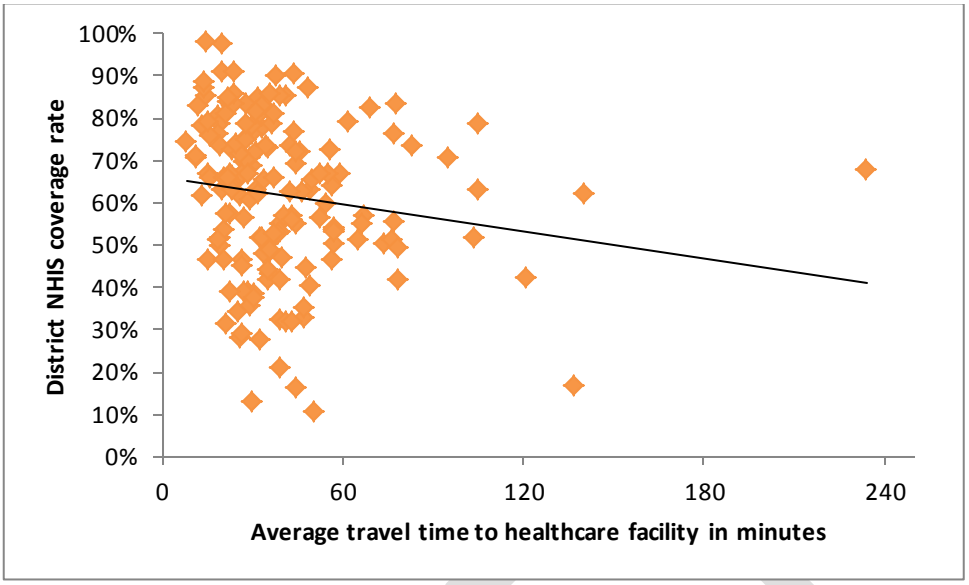

Figure 4: Distribution of NHIS enrolment by age group with 95% confidence interval

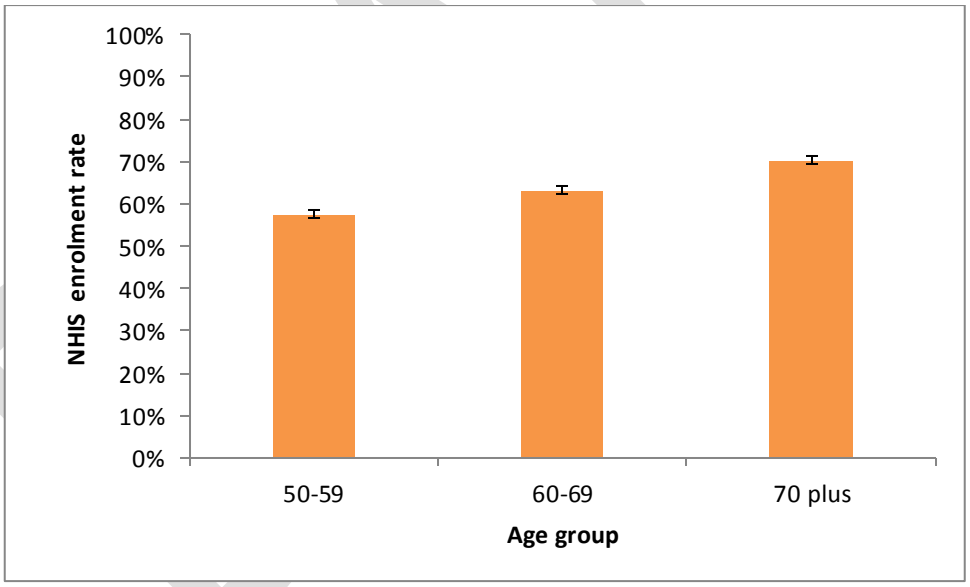

Figure 5: Distribution of NHIS enrolment by expenditure with 95% confidence interval

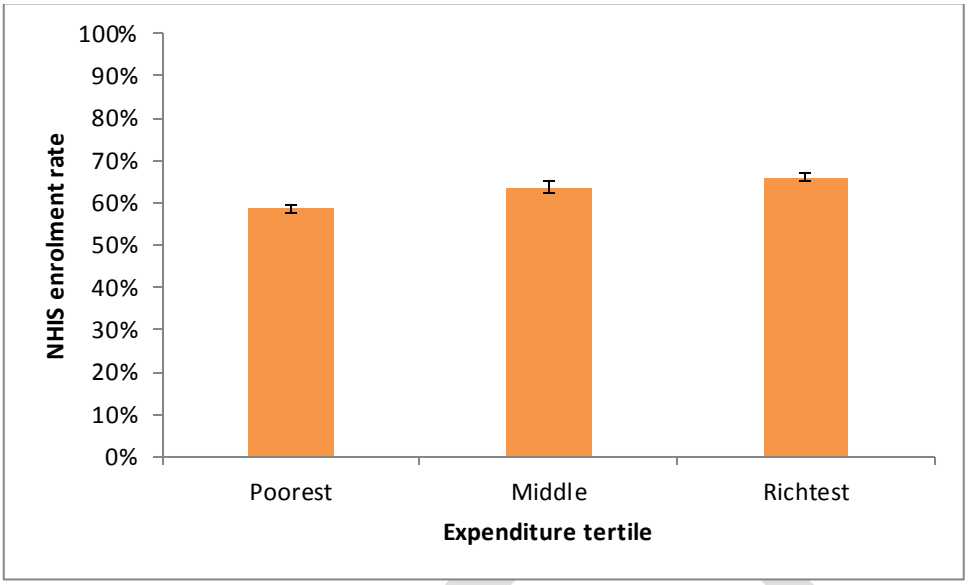

Figure 6: Spatial clustering in NHIS enrolment rate

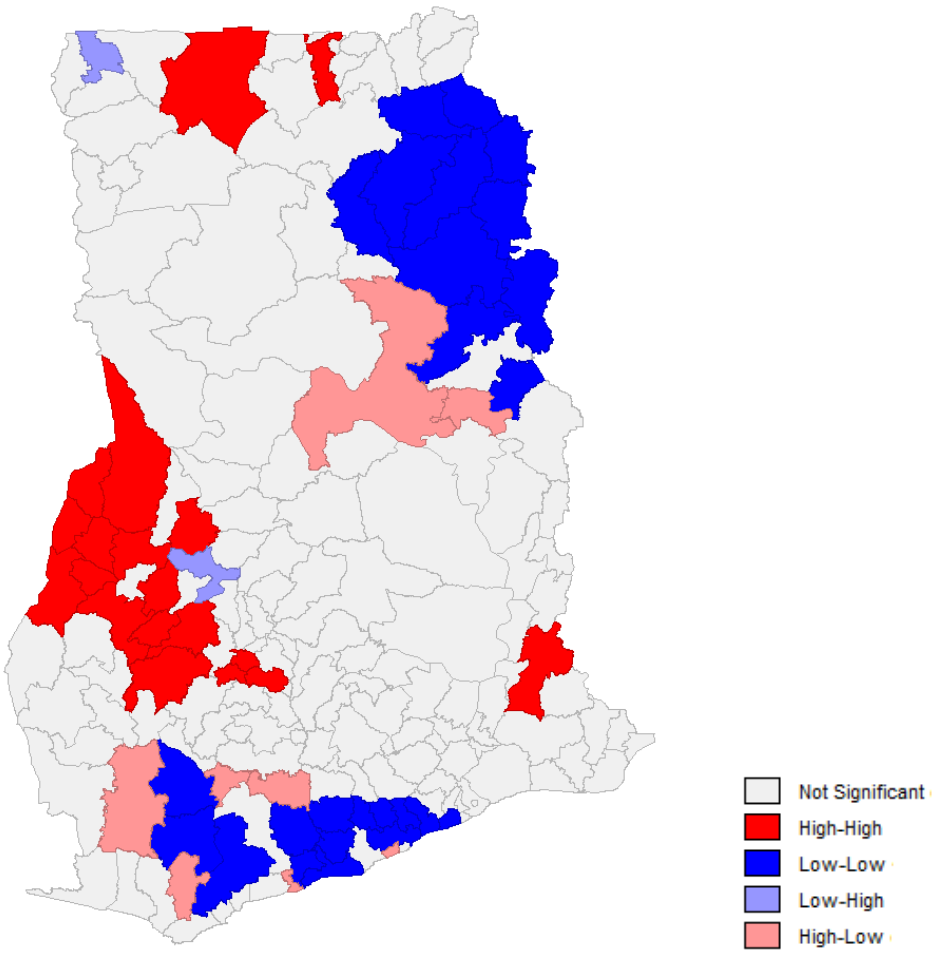

Table 2: Odds Ratio of NHIS enrolment

Variable	Characteristics	Model 1	Model 2	Model 3
Travel time	≥ 15 min	**1.000**	**1.000**	**1.000**
	16 -30 min	0.416 **	0.414 **	0.557 *
	31 – 45 min	0.329 ***	0.382 **	0.486 **
	46 – 60 min	0.276 ***	0.319 **	0.545 *
	> 1 hour	0.333 **	0.357 **	0.607
Sex	**Male**		**1.000**	**1.000**
	Female		1.738 ***	1.700 ***
Age	**50-59**		**1.000**	**1.000**
	60-69		**1.396** ***	1.400 ***
	70plus		**2.187** ***	2.265 ***
Disability	**No**		**1.000**	**1.000**
	Yes		0.982	0.967
Marital Status	**Married**		**1.000**	**1.000**
	Separated/Divorced		0.637 ***	0.622 ***
	Widowed		0.800 **	0.776 ***
	Never married		0.413 ***	0.420 ***
Household size	**Log**		**1.046**	**1.064**
Internet usage	**No**		**1.000**	**1.000**
	Yes		1.335 **	1.183
Occupation	Self-employed		**1.000**	1.000
	Private		2.960 ***	2.580 ***
	Public		1.459 ***	1.342 **
	Inactive		1.370 ***	1.322 ***
Education	**None**		**1.000**	**1.000**
	Low		1.381 ***	1.342 ***
	Medium		2.061 ***	1.831 ***
	High		2.186 ***	1.967 ***
Expenditure	**Poorest**		**1.000**	**1.000**
	Middle		1.420 ***	1.548 ***
	Richest		1.593 ***	1.902 ***
Region	**Greater Accra**			**1.000**
	Western			1.869 *
	Central			1.128
	Volta			2.931 ***
	Eastern			2.794 ***
	Ashanti			3.220 ***
	Brong Ahafo			7.485 ***
	Northern			2.710 **
	Upper East			9.804 ***
	Upper West			9.382 ***
Residence	**Urban**			**1.000**
	Rural			0.469 ***
Diversity	**Religious**			0.258 *
	Ethnic			0.819
Hospital in district	**No**			**1.000**
	Yes			1.143