

National health insurance coverage and socio-economic status in a rural district of Ghana

N. Sarpong^{1,2}, W. Loag³, J. Fobil^{3,4}, C. G. Meyer³, Y. Adu-Sarkodie⁵, J. May³ and N. G. Schwarz³

1 Agogo Presbyterian Hospital, Agogo, Ghana

2 Kumasi Centre for Collaborative Research in Tropical Medicine, Kumasi, Ghana

3 Bernhard Nocht Institute for Tropical Medicine, Hamburg, Germany

4 University of Ghana School of Public Health, Accra, Ghana

5 School of Medical Sciences, University of Science and Technology, Kumasi, Ghana

Summary

OBJECTIVE To explore the association between socio-economic status (SES) and health insurance subscription to the Ghanaian National Health Insurance Scheme (NHIS) of residents of the Asante Akim North district of the Ashanti Region, Ghana.

METHODS In the course of a community survey, data on asset variables (e.g. electricity, housing conditions and other variables) and on NHIS subscription were collected on the household level in 99 villages. Using principal components analysis, households were classified into three categories of SES (20% high, 40% middle and 40% low SES). Odds ratios of NHIS subscription were calculated for all SES categories, using the low category as the reference group and adjusting for travelling time to health facilities by public transport.

RESULTS Of the 7223 households surveyed, 38% subscribed to the NHIS, of these 21% were low, 43% middle and 60% high SES households. SES was significantly associated with NHIS subscription (high SES: OR 4.9, 95% CI 4.3–5.7; middle SES: OR 2.5, 95% CI 2.2–2.9; low SES: OR 1, reference group).

CONCLUSION Four years after its introduction, the NHIS has reached subscription rates of 38% in the district surveyed. However, to achieve the aim of assuring universal access to health care facilities for all residents of Ghana, in particular for individuals living under socio-economic constraints, increasing subscription rates are necessary.

keywords health insurance, health care disparities, Ghana

Introduction

Ghana is one of the few countries in Africa that has successfully implemented an operative health insurance system, the National Health Insurance Scheme (NHIS). Prior to 2004, patients were, in a 'cash-and-carry' structure established in 1985, required to pay for their health care, an arrangement that inherently restricted the access to health facilities for large parts of the population. The introduction of these fees had caused a decline of health facility utilization in the Asante Akim North district (Waddington & Enyimayew 1989). Adverse effects of user fees on health facility utilization have been observed in many other regions (Lagarde & Palmer 2008) and user fees for health facilities have indeed contributed to the inequality of access to health facilities and led to considerable disadvantages for poor people (Nyonator & Kutzin 1999; James *et al.* 2006). Abolition of fees led to an

increase in health facility utilization in South Africa and in Uganda (Nabyonga-Orem *et al.* 2008). Conservative estimates derived from mathematical modelling indicate that 153 000 child fatalities might safely be prevented in Africa if access to health care was free of charge (James *et al.* 2005).

Immediate payment at health facilities can be disastrous for the economic situation of poor people and may cause drastic constraints of essential means for daily needs (Mcintyre *et al.* 2006; Leive & Xu 2008). Household members with chronic diseases may constitute a tremendous financial burden (Russell 2004). Mutual health organization insurance schemes were, therefore, considered effective. Membership in community-based health insurances have, in fact, raised utilization rates of maternal health services in Mali, Senegal and Ghana. However, economic prosperity was associated with insurance membership and concurrent adherence to pre-natal consultation

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and delivery in appropriate health facilities (Smith & Sulzbach 2008).

In August 2003, Ghana passed the National Health Insurance Act, which decreed that all Ghanaian districts establish community-based health financing schemes, funded by sales taxes, contributions of formal sector worker (official employees with operative work contract) and voluntary payments by informal sector workers (Baltussen *et al.* 2006). The Ghanaian NHIS was officially launched in March 2004 with the declared objective to 'assure equitable and universal access for all residents of Ghana to an acceptable quality package of essential health care' and the policy objective that 'within the following 5 years, every resident of Ghana would belong to a health insurance scheme that adequately covered him or her against the need to pay out of pocket at the point of service delivery' (Agyepong & Adjei 2008). The NHIS covers primary care services, which constitute 95% of cases in Ghanaian health care institutions, including the costs for drugs declared on an existing NHIS list. According to the Ghanaian Health Insurance Regulations (Ministry of Health of Ghana 2004), outpatient and inpatient services including surgical and gynaecological operations, maternity care, oral health services, eye care services and emergency care are covered.

National Health Insurance Scheme fees per year were explicitly and intentionally kept low to allow subscription for poor people. Individuals <18 or ≥70 only pay a yearly registration fee of four Ghana cedis (approximately 2.70 US \$) for their subscriptions. For individuals aged 18–70, the premium is, in addition to the registration fee, between 4.90 and 32.60 US \$, depending on their economic situation. Full time students >18 years of age have to pay the registration fee and a minimum premium of 2.70 US \$. Individuals lacking visible sources of income, without permanent residence, not living with a person who is employed with permanent residence or not having enduring and consistent support from other persons are, according to the Ghanaian Health Insurance Regulations, classified as indigent and exempt from premium fees (Ministry of Health of Ghana 2004). Pregnant women are exempt from any financial contribution to NHIS.

A problem that health insurances in Africa are facing frequently is the low enrolment coverage among those who fulfil the criteria of exemption from premiums (Musango *et al.* 2004; De Allegri *et al.* 2006; Basaza *et al.* 2008). At the beginning of 2007, it was estimated that more than 7 million people in Ghana had enrolled, corresponding to a coverage of 35% of the entire population. There are, however, serious concerns that the NHIS might fail to reach the poor, in particular poor residents in rural areas. In the 2001 Abuja Declaration, African heads of state

agreed to allocate 15% of the government budget to the health sector. To date, Ghana is the only country where the share of the health sector budget has increased from 8.2% in 2004 to 15% in 2006 (Mcintyre *et al.* 2008). Ghana has now become a role model for other sub-Saharan countries. Therefore, the experience made in Ghana with its NHIS is of considerable interest.

In the Asante Akim North District of the Ashanti Region in Ghana, we conducted a community survey with the primary objective of exploring the association of the socio-economic status (SES) with NHIS subscription rates and the secondary objective of correlating distance to the nearest health facility with NHIS subscription rates. The aim of our survey was to obtain and provide to health authorities reliable facts and figures for policies and decisions.

Methods

Study site

Asante Akim North District of the Ashanti Region in Ghana has a population of approximately 140 000. The major hospital of the district is the Presbyterian Hospital in Agogo, a small town in a hilly tropical secondary forest, which emerged after forest clearing for farming and logging activities. The main occupation of inhabitants of the district is subsistence and small-scale commercial farming. The most important cash crops are cocoa, coffee and palm oil. Bananas, plantain, yam, cassava and maize are cultivated for subsistence.

Community survey, data collection

Data were collected between May and September 2008 from residents aged ≥15 years of randomly selected households within communities of the district during a survey. The sampling unit of the survey was the household, which is defined as 'a person or group of persons living together in the same house or compound, sharing the same housekeeping arrangements and being catered for as one unit' (Ghana Statistical Service and Macro International Inc. 1999). First, communities were selected using a probability proportional to size cluster-sampling method. Household lists for selected communities were obtained from the Asante Akim North District Planning Office. In the second stage of sampling, households were picked randomly from the selected communities, and the corresponding lists were prepared for the 24 fieldworkers and the supervisor who conducted the survey. The fieldworkers underwent methodical training seminars to appropriately prepare them. During these seminars, the objectives of the

study and the techniques for interviewing participants using structured questionnaires were discussed and practiced in detail. Local authorities (chiefs, assemblymen, opinion leaders) of communities were then approached to introduce the supervisor and the fieldworkers, and the purpose of the study was carefully explained to them. When permission was given to administer the questionnaire to the study subjects and make appointments for the survey, a fieldworker chose a person in a selected household who was at least 15 years of age and residential for at least 6 months prior to the interview. Information about the nature, purpose and objectives of the study was provided to the target person and his/her verbal consent was obtained. Those who agreed to participate in the survey were interviewed employing the structured questionnaire. Study participants were free to terminate their participation at any time, even after the interview had started. Only one person refused to participate. Study participants were interviewed in a private environment for a duration of approximately 15 min.

The study was approved by the Committee on Human Research Publications and Ethics of the College of Health Sciences, School of Medical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Outcome measure

The main outcome was the NHIS registration status (yes/no) as indicated by the interviewee. The secondary outcome was distance to the next functional health facility (hospital, clinics, health centres, health posts, maternity homes) measured as travelling time by public transportation.

Measurement of socio-economic inequality

To obtain a measure for the SES, proxy measures for economic well-being, e.g. water supply and dwelling characteristics such as building materials of the house, availability of electricity and others were used. Information on such asset variables was used to generate eigenvectors (weights) by principal components analysis (PCA) (Vyas & Kumaranayake 2006) using a correlation matrix: the higher the eigenvector of a variable, the stronger its association with a high SES. Assets that are unequally available to households have higher weights in the PCA. Missing values of distinct binary asset variables were replaced by the means of all summarized '0' values (asset not present) and '1' values (asset present) of this variable. Principal components are the combination of weights from each variable, whereby the first principal component explains the highest variation in the data. Using the weights

from the first principal component, a value for each household was obtained, which increased with increasing SES. Based on the per cent rank derived from these values, we categorized the households into three categories. According to the percent ranks derived from the PCA, 40%, 40% and 20% of households were classified as households of low, intermediate and high SES, respectively. Using logistic regression, we then calculated the odds ratios for having subscribed to NHIS for each of the three SES categories, whereby the low SES group was the reference group (OR = 1). The model was adjusted for distance to health facility, measured as estimated travelling time by public transportation.

Results

We approached 7226 households and interviewed 7225 households between May and September 2008. The selected interviewee of one household refused to participate. Of all interviewees, 2738 (38%) had enrolled into the NHIS.

Of the 7225 households who were analysed by the PCA (Table 1), 40% were, according to the percent ranks provided by the PCA, classified into the low, 39% into the intermediate and 21% into the high SES groups. The proportion of households that subscribed for the NHIS was 21%, 43% and 60% among the groups of low, intermediate and high SES, respectively ($P < 0.0001$, score test for trend of odds; Table 2). Among the low SES households the time required to get to the next health facility was longest. Thirty per cent only of households classified as belonging to the low SES group had access to a health facility as defined earlier that could be reached within 10 min by public transport, compared to 63% among the intermediate and 70% among the high SES groups (Table 2). Only 7% of households classified as high and 12% of those classified as intermediate, but 50% of the low SES households were living more than 20 min from the nearest health facility. Twenty-five per cent of the low SES households had even more than 45 min of public transport travel to the nearest health facility (Table 2). When stratifying by distance to health facility, the positive association between SES and insurance coverage persists in all strata, i.e. the higher the SES, the higher the insurance coverage. Likewise, when stratifying by SES, the negative association between distance to health facility and health insurance coverage persists in all strata as well, namely the shorter the distance, the higher the insurance coverage.

The means of the variables that are encoded in a binary system and correspond to the proportion of households rated positive for the respective variable are given in

N. Sarpong *et al.* **Health insurance coverage and wealth in Ghana****Table 1** Socio-economic proxy measures used for principal components analyses with their means, standard deviations and the weights from the first principal component

Variable	Mean	Standard deviation	Eigenvector (weight) Comp 1	Mean low socio-economic status (SES)	Mean intermediate SES	Mean high SES
<i>House</i>						
Stone house	0.704	0.457	0.482	0.263	0.992	1.0
Wood house	0.021	0.144	-0.082	0.051	0.002	0
Mud house	0.275	0.447	-0.466	0.686	0.006	0
Electricity	0.521	0.500	0.412	0.083	0.714	0.988
<i>Toilets</i>						
WC	0.038	0.192	0.128	0.001	0.016	0.150
Pit latrine	0.332	0.471	0.234	0.147	0.271	0.797
Public toilet	0.549	0.498	-0.160	0.679	0.686	0.053
Free range	0.080	0.271	-0.203	0.174	0.028	0
<i>Water supply</i>						
Tap water	0.025	0.155	0.066	0.006	0.024	0.061
Public pump	0.751	0.433	0.151	0.652	0.801	0.844
Well water	0.107	0.309	0.0423	0.078	0.143	0.095
River water	0.118	0.322	-0.275	0.264	0.032	0
<i>Self-estimation of economic well being</i>						
Manages well to live	0.358	0.479	0.054	0.335	0.336	0.443
Difficult to maintain live costs	0.383	0.486	-0.040	0.419	0.356	0.365
Very difficult to maintain live costs	0.259	0.438	-0.014	0.247	0.308	0.193
Relative abroad	0.154	0.361	0.112	0.093	0.145	0.284
Literacy of respondent	0.316	0.465	0.240	0.132	0.321	0.655
Literacy of partner of respondent	0.619	0.465	0.239	0.429	0.661	0.898

Table 1. The table gives the proxy measure variables (column 1) and their mean frequencies (column 2) and standard deviations (column 3) for the entire study group with their eigenvectors (column 4) that were used to classify each household into one of the three SES categories. Mean values representing the proportion of households according to the three SES categories are given in columns 5–7.

All standard housing assets that, according to common sense, would safely be attributed to a higher SES, including

Table 2 Socio-economic status (SES) and National Health Insurance Scheme (NHIS) coverage, Asante Akim North District, Ghana, 2008

	Low SES, n (%)	Intermediate SES, n (%)	High SES, n (%)	Total, N (%)
<i>NHIS subscription</i>				
Yes	594 (20.7)	1229 (43.4)	915 (60.1)	2738 (37.8)
No	2279 (79.3)	1601 (56.6)	607 (39.9)	4487 (62.1)
<i>Time to health facility by public transport, min</i>				
<10	850 (29.6)	1785 (63.1)	1063 (69.8)	3698 (51.2)
10–19	588 (20.5)	699 (24.7)	350 (23.0)	1637 (22.7)
20–44	703 (24.5)	315 (11.1)	103 (6.8)	1121 (15.5)
>45	732 (25.5)	31 (1.1)	6 (0.4)	769 (10.6)

construction materials, availability of electricity, appropriate sanitary equipment and water supply were available to high SES households rather than to low SES households. A corresponding result was obtained when assessing the self-estimation of economic well-being and comparing high SES with low SES households. The number of relatives living abroad who, most likely, contribute to the economic situation of the household on a regular basis was greater among high than low SES households. The literacy level of the respondents and their partners was also higher among the high SES group. In most cases, the intermediate SES means were between the low and high SES means.

The number of missing values for variables was mostly between 1 and 3, except for the variables 'literacy of respondent' and 'literacy of partner of respondent', for which 7 and 543 missing values, respectively, had to be imputed as the mean of the sum of all '0' and '1' values that were available. The first principal component that was according to the common PCA procedure used to derive the SES score accounted for 17.6% of the total variation.

Table 3 shows the odds ratios (OR) with the low SES group as reference (OR 1) in a logistic regression model. The odds for subscription to the NHIS increased with SES after adjustment for the time required to travel to the nearest health facility. The odds for subscription to the

Table 3 Multivariable logistic regression model of the association of the socio-economic status (SES), the time to health facility and National Health Insurance Scheme subscription

	Odds ratio	95% Confidence interval
<i>SES</i>		
Low SES	1.0	
Intermediate SES	2.5	2.2–2.9
High SES	4.9	4.3–5.7
<i>Time to health facility by public transport, minutes</i>		
<10	1.0	
10–19	0.97	0.86–1.1
20–44	0.88	0.76–1.03
>45	0.54	0.43–0.68

NHIS decreased with increasing time required to get to the nearest health facility after adjusting for the SES.

Discussion

As expected, National health insurance coverage in the Asante Akim North district of Ghana is strongly associated with economic well-being. However, statistically significant information appears to be of considerable value, as such information is essential for policy makers.

Only 21% of poor households (low SES) were enrolled into the NHIS, compared to 60% of those classified as high SES. Low SES was also associated with more extended travelling times to the closest health facility, as households who were rated as low SES were frequently located in remote areas and inhabitants of rural communities tend to have fewer economic resources. Long distance to the closest health facility was also clearly correlated with low NHIS coverage after adjusting for low SES (Table 2). People who live far from health facilities have lower hospital utilization rates (Kloos 1990). Members who are enrolled into an insurance system, but live far away from accessible health care units, will most probably use the service less. If these members have to pay identical premium fees as members living close to the services, they indirectly subsidize the insurance scheme (Criel & Kegels 1997). Distance to health facilities may, according to our findings, readily be a criterion to be included into current considerations on premium levels.

In addition to greater constraints to pay for the premiums, the lack of consistent information on the NHIS appears to contribute substantially to the low coverage among poor households. The lower degree of literacy complicates the problem. In the long run, better access to modern media such as the internet might even aggravate the disparity between rich and poor, and urban and rural populations.

Mutual Health Organizations were primarily intended to facilitate access to health facilities, particularly for the poor, and protect them from catastrophic health expenditure that may arise from unexpected necessity of health care for those who are excluded from formal insurance (Xu *et al.* 2007). Poverty is a main barrier to access health facilities (Schellenberg *et al.* 2003; Spangenberg & Mock 2006). The fact that NHIS subscription rates are higher among the households of high SES and lower among the households of low SES entails the risk that the NHIS may increase disparities between rich and poor populations, instead of effectively reducing them.

Health care interventions that target the entire population do not reach poor people to the same extent as richer people (Commission on Social Determinants of Health 2008). The fact that poor individuals consistently gain less from health services than do rich people has been addressed as ‘inverse care law’ already more than 35 years ago (Hart 1971). To overcome this equity gap, the Ghana NHIS already offers distinct levels of subscription fees according to people’s ability to pay. Although this appears to be a relevant modification, our findings clearly indicate that this effort has not succeeded to resolve the ‘inverse care law’ problem.

The shortcomings of the NHIS to reach the poor has now been recognized by the Ghanaian Ministry of Health (Asante & Aikins 2008) and strategies to efficiently overcome this drawback are currently under debate. Meanwhile, we have made available our resilient figures to the Ghanaian Ministry of Health and to the NHIS to support the endeavours to achieve the goal of equitable access to basic health care in relation to need, rather than to socio-economic or socio-cultural status. Presently, two concepts compete. One approach is to target the poor with subsidies that will allow them to access health care facilities. Disadvantages of this approach are the administrative requirements and the difficulties to unambiguously determine poverty (Schmidt *et al.* 2006). The second concept is to provide subsidies to the entire population. A modification of this concept that is currently discussed is to provide subsidies to well-defined subpopulations only. The second concept would be much easier to achieve from an administrative point of view, but bears the immanent risk of providing benefits for well-informed, educated household members who, in principle, could readily manage without additional subsidies. This, again, would significantly disadvantage poor and less-educated and less-informed families (Health Sector Advisory Office 2008).

Ghana has introduced an innovative scheme in 2008 exempting all women from payment for deliveries, in which health care providers are reimbursed by NHIS according to an agreed tariff. The great disparity

between rich and poor with regard to the health insurance coverage may be a reason to perpetuate the exemption scheme, as the cost for deliveries are likely to become catastrophic for poor people without insurance (Witter *et al.* 2007).

Conclusion

Five years after its introduction, the NHIS has reached subscription rates of 38% in a selected rural district. It is clear that a realization of the goal of the NHIS, namely to assure equitable and universal access to basic health care for all residents of Ghana, requires a subscription coverage that is by far higher than that achieved to date. All changes and modifications of the scheme that might be installed in the future must by all means refer to the fundamental constraints of the poor.

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References

- Agepong IA & Adjei S (2008) Public social policy development and implementation: a case study of the Ghana National Health Insurance scheme. *Health Policy and Planning* **23**, 150–160.
- Asante F & Aikins M (2008) *Does the NHIS Cover the Poor?* Institute of Statistical Social and Economics Research (ISSER) and School of Public Health, University of Ghana, Legon, Accra. <http://www.moh-ghana.org/moh/docs/NHIS%20issue/NHIS%20pro-poor%20research.pdf> (accessed 30 April 2009).
- Baltussen R, Bruce E, Rhodes G, Narh-Bana SA & Agepong I (2006) Management of mutual health organizations in Ghana. *Tropical Medicine and International Health* **11**, 654–659.
- Basaza R, Criel B & Van Der Stuyft P (2008) Community health insurance in Uganda: why does enrolment remain low? A view from beneath. *Health Policy* **87**, 172–184.
- Commission on Social Determinants of Health (2008) *Closing the Gap in a Generation. Health Equity Through Action on the Social Determinants of Health*. World Health Organisation (WHO), Geneva.
- Criel B & Kegels G (1997) A health insurance scheme for hospital care in Bwamanda District, Zaire: lessons and questions after 10 years of functioning. *Tropical Medicine and International Health* **2**, 654–672.
- De Allegri M, Kouyate B, Becher H *et al.* (2006) Understanding enrolment in community health insurance in sub-Saharan Africa: a population-based case-control study in rural Burkina Faso. *Bulletin of the World Health Organization* **84**, 852–858.
- Ghana Statistical Service and Macro International Inc. (1999) *Ghana Demographic and Health Survey 1998*. Ghana Statistical service, Accra, Ghana.
- Hart JT (1971) The inverse care law. *Lancet* **297**, 405–412.
- Health Sector Advisory Office (2008) *Discussion Paper: Targeting the Poor*. <http://www.moh-ghana.org/moh/docs/NHIS%20issue/Targeting%20the%20poor.pdf> (accessed 30 April 2009).
- James C, Morris SS, Keith R & Taylor A (2005) Impact on child mortality of removing user fees: simulation model. *BMJ* **331**, 747–749.
- James CD, Hanson K, Mcpake B *et al.* (2006) To retain or remove user fees?: reflections on the current debate in low- and middle-income countries. *Applied Health Economics and Health Policy* **5**, 137–153.
- Kloos H (1990) Utilization of selected hospitals, health centres and health stations in central, southern and western Ethiopia. *Social Science and Medicine* **31**, 101–114.
- Lagarde M & Palmer N (2008) The impact of user fees on health service utilization in low- and middle-income countries: how strong is the evidence? *Bulletin of the World Health Organization* **86**, 839–848.
- Leive A & Xu K (2008) Coping with out-of-pocket health payments: empirical evidence from 15 African countries. *Bulletin of the World Health Organization* **86**, 849–856.
- Mcintyre D, Thiede M, Dahlgren G & Whitehead M (2006) What are the economic consequences for households of illness and of paying for health care in low- and middle-income country contexts? *Social Science and Medicine* **62**, 858–865.
- Mcintyre D, Garshong B, Mtei G *et al.* (2008) Beyond fragmentation and towards universal coverage: insights from Ghana, South Africa and the United Republic of Tanzania. *Bulletin of the World Health Organization* **86**, 871–876.
- Ministry of Health of Ghana (2004) *National Health Insurance Regulations, 2004 (LI 1809)*. Ministry of Health of Ghana, Ghana.
- Musango L, Dujardin B, Dramaix M & Criel B (2004) [Profile of members and non members of mutual health insurance system in Rwanda: the case of the health district of Kabutare]. *Tropical Medicine and International Health* **9**, 1222–1227.
- Nabyonga-Orem J, Karamagi H, Atuyambe L *et al.* (2008) Maintaining quality of health services after abolition of user fees: a Uganda case study. *BMC Health Services Research* **8**, 102.
- Nyonator F & Kutzin J (1999) Health for some? The effects of user fees in the Volta Region of Ghana. *Health Policy and Planning* **14**, 329–341.
- Russell S (2004) The economic burden of illness for households in developing countries: a review of studies focusing on malaria,

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- tuberculosis, and human immunodeficiency virus/acquired immunodeficiency syndrome. *American Journal of Tropical Medicine and Hygiene* 71, 147–155.
- Schellenberg JA, Victora CG, Mushi A *et al.* (2003) Inequities among the very poor: health care for children in rural southern Tanzania. *Lancet* 361, 561–566.
- Schmidt JO, Mayindo JK & Kalk A (2006) Thresholds for health insurance in Rwanda: who should pay how much? *Tropical Medicine and International Health* 11, 1327–1333.
- Smith KV & Sulzbach S (2008) Community-based health insurance and access to maternal health services: evidence from three West African countries. *Social Science and Medicine* 66, 2460–2473.
- Spangenberg K & Mock C (2006) Utilization of health services by the injured residents in Kumasi, Ghana. *International Journal of Injury Control and Safety Promotion* 13, 194–196.
- Vyas S & Kumaranayake L (2006) Constructing socio-economic status indices: how to use principal components analysis. *Health Policy and Planning* 21, 459–468.
- Waddington CJE & Enyimayew KA (1989) A price to pay: the impact of user charges in Ashanti-Akim district Ghana. *The International Journal of Health Planning and Management* 4, 17–47.
- Witter S, Arhinful DK, Kusi A & Zakariah-Akoto S (2007) The experience of Ghana in implementing a user fee exemption policy to provide free delivery care. *Reproductive Health Matters* 15, 61–71.
- Xu K, Evans DB, Carrin G *et al.* (2007) Protecting households from catastrophic health spending. *Health Affairs (Millwood)* 26, 972–983.

Corresponding Author Norbert Georg Schwarz, Bernhard Nocht Institute for Tropical Medicine, Infectious Disease Epidemiology, Bernhard-Nocht Straße 74, 20359 Hamburg, Germany. Tel.: +49 40 42818 503; Fax +49 40 42818 512; E-mail: schwarznorbert@bni-hamburg.de