

# Malaria Finance, Household Mosquito Net Ownership & Use, Intermittent Preventive Treatment in Pregnancy (IPTp) in Ghana; A Socioeconomic Comparative Analysis

Akim Tafadzwa Lukwa (✉ [tafadzwalukwa@gmail.com](mailto:tafadzwalukwa@gmail.com))

University of Cape Town School of Public Health and Family Medicine <https://orcid.org/0000-0003-2534-3731>

Christian Atta-Obeng

National Malaria Control Programme Ghana

Tinashe Warren Kaseke

Teesside University School of Health and Life Sciences

Siya Aggrey

Stellenbosch University Department of Botany and Zoology

Olufunke Alaba

University of Cape Town School of Public Health and Family Medicine

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## Research

**Keywords:** Malaria finance, Insecticide Treated Bed-Net (ITN), Insecticide Treated Bed-Net (ITN) ownership, IPTp, National health insurance, Socioeconomic inequalities, Wagstaff normalised concentration index, Insecticide-treated nets

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## Abstract

### Background

Malaria to date remains one of the top five killer diseases in sub-Saharan Africa (SSA), the malaria burden is skewed towards pregnant women and children under five. Insecticide Treated Bed-Net (ITN) usage and intermittent preventive treatment has been credited to be among the most cost-effective, preventive interventions against malaria.

### Methods

The study used Ghana's Malaria Indicator Surveys (GMIS) of 2016 and 2019. Socioeconomic status was assessed using the wealth index reported in both surveys. Household mosquito net ownership, mosquito net use among under 5's and women, IPTp coverage, health insurance and awareness of malaria covered by national health insurance were binary variable, therefore the study adopted the Wagstaff normalized index. Concentration curves were computed to present a graphical picture of the concentration indices.

### Results

Treated household net ownership and use among under-5s' and pregnant women for both time periods was highest in among poor literate rural women, as well as the Intermittent Preventive Treatment in pregnancy coverage. However, even though poor households were more likely to have health insurance, wealth household were more likely to be aware that malaria treatment is finance by the National Health Insurance Scheme in Ghana.

### Conclusion

In conclusion for the period under-review the concentration indices for; household net ownership, usage of treated nets among under-5s and pregnant women increased reflecting widening socioeconomic inequalities in net ownership and usage in Ghana. While, health insurance ownership and awareness of malaria finance under NHIS showed socioeconomic gaps to be contracting.

## Background

Malaria has been argued to be among the leading causes of morbidity and mortality, especially in Africa [1]. However, even though malaria is preventable and curable, sub-Saharan Africa still reports malaria as one of the major causes of death in children under-five and pregnant women [2]. Malaria has been argued to affect economic growth in Africa, perpetuating a vicious cycle of poverty, costing the continent an estimated USD\$10 billion to \$12 billion annually in lost gross domestic product (GDP) [3]. The treatment costs associated with malaria in Africa in the recent decade accounted for about 1.3% annual reduction in economic growth [4]. Productivity lost due to malaria in an adults in endemic areas of Africa ranges from 1 to 6 days [4,5], resulting in considerable losses of productive time.

The economic cost associated with malaria treatment is overwhelming in Ghana [1], and it significantly affects productivity and wealth of households. In Ghana, the economic burden of malaria accounted for a loss of about 10.6% Disability Adjusted Life Years (DALYs) and 6% loss of gross domestic product (GDP) annually [6], while Northern Ghana, estimated the average cost of treating a malaria case to be between US\$6.39 to 15.79 [7].

The global community has continuously shown immense efforts in controlling malaria and set an ultimate objective of eliminating malaria transmission [8]. Insecticide-treated nets (ITNs) have been cited as an important component of malaria control and elimination strategies [9], with reductions in malaria episodes by 50% and under-five mortality by 17% attributed to ITNs use [10]. With all the benefits associated with ITN use, ITN use has been reported to be below universal coverage [9] and ITN ownership has been cited as a significant determinant of ITN use [11].

Ghana has realised significant strides in the mass and continuous of insecticide-treated nets (ITNs), however, despite these gains, a gap remains between ITN access and use [12]. For Ghana, at an estimated cost about US\$1.2 per person protected per year, ITNs are considered to be one of the most cost-effective health interventions [2]. The socioeconomic component plays an important role in mosquito net ownership, as study done in the Hohoe Municipality in Ghana reported financial constraints accounting for about 12% of reasons why people did not have a mosquito net in Ghana [2].

It is alarming that without appropriate control interventions, about 45% of pregnancies in malaria-endemic areas in sub-Saharan Africa are at risk of *Plasmodium falciparum* malaria [13]. Malaria in pregnancy (MIP) has been argued to account for a significant proportion of morbidity and mortality among pregnant women and their new-borns, especially in sub-Saharan Africa (SSA) [14]. Globally, malaria in pregnancy is a known cause of stillbirths and neonatal deaths [15], especially in malaria endemic regions. Ghana has been reported as malaria endemic country with almost 50% of pregnant women at term (36–40 weeks gestation) and 12–36% of women at 32 weeks gestation and above, having asymptomatic malaria parasitaemia [16,17]. The World Health Organisation (WHO) recommends three main strategies in the treatment and prevention of malaria during pregnancy; intermittent preventive treatment in pregnancy (IPTp) with sulfadoxine-pyrimethamine (SP), using long lasting insecticidal nets (LLINs/ITNs), and early diagnosis and treatment of malaria cases [18,19].

Ghana's health systems history has been characterised with challenges in financing of health services [6]. When Ghana attained her independence in 1957, public health services were financed through tax revenue and provided free [20]. This was however not sustainable. This consequently led to the introduction of use fees by the government, where individuals paid out-of-pocket (OOP) for health services. Due to socioeconomic disparities in Ghana, user fees brought about challenges of equity in access to health care especially for the poor [21] and the end result was declining utilization of health care services at the public health facilities [20,21].

This then led Ghana to consider community-based health insurance schemes (CBHIS) as an option for financing health care, which later informed the inception of the National Health Insurance Scheme (NHIS) in October 2003 under Act 650 [22]. The sole mandate the NHIS is to improve access to and quality of basic health care services in Ghana by eradicating the OOP payments for health services thus providing financial protection against high costs of health care or catastrophic spending. Ghana's NHIS covers about 95% of diseases including malaria and children below 18 years, the aged (70+) in the informal sector, and indigents are exempted from paying premiums [6].

Given the detailed background on malaria in Africa as well as the status of mosquito net usage, IPTp coverage and malaria financing in Ghana. This study therefore assessed socioeconomic inequality trends in Ghana on mosquito net ownership & use among under-fives and pregnant women, as well as IPTp coverage in pregnant women and malaria finance in Ghana comparing two time periods 2016 and 2019.

## Methods

### Sources of Data

The study used Ghana's Malaria Indicator Surveys (GMIS) of 2016 and 2019, whose main objective was to estimate key malaria indicators [23,24]. Both surveys had main objectives of; measuring extent of ownership and mosquito bed nets, coverage of intermittent preventive treatment to protect pregnant women, identifying practices and specific medications used for treating malaria among children under age 5, measuring of indicators of behaviour change communication messages, knowledge regarding malaria, and practices and assessing the measure the prevalence of malaria and severe anaemia among children age 6-59 months.

The samples for both GMIS's 2016 and 2019 were designed to provide estimates of key malaria indicators for the country as a whole, for urban and rural areas separately, and for each of the 10 administrative regions (Western, Central, Greater Accra, Volta, Eastern, Ashanti, Brong Ahafo, Northern, Upper East, and Upper West) as defined in the Ghana 2010 Population and Housing Census (PHC) [23,24]. Both surveys used the 2010 Population and Housing Census, however in 2019, Ghana created six new regions, resulting in a total of 16 regions and 260 administrative districts but the new administrative boundaries were not available during the survey hence were not included. Therefore, both surveys were based on 10 regional boundaries defined according to the 2010 Population and Housing Census [23,24].

### Socioeconomic status

Socioeconomic status was assessed using the wealth index reported in both surveys. The wealth was based on household scores based on the number and kinds of consumer goods they own, ranging from a television to a bicycle or car, and housing characteristics such as source of drinking water, toilet facilities, and flooring materials [23,24]. The scores were derived using principal component analysis however, national wealth quintiles were compiled by assigning the household score to each usual (de jure) household member, ranking each person in the household population by their score, and then dividing the distribution into five equal categories (poorest, poorer, middle, richer, richest), each with 20% of the population. However, for this study the wealth index was categorised in to three categories (poor, middle and rich).

### Wagstaff Normalised Concentration index

Household mosquito net ownership, mosquito net use among under 5's and women, IPTp coverage, health insurance and awareness of malaria covered by national health insurance were binary variable, therefore the study adopted the Wagstaff normalized index ( $W(h)$ ). The study opted to use the normalised formulae as, Wagstaff, (2005) argued that normalization of the health concentration index formula ensures remedying the bounds issue for a binary cardinal health variable. The Wagstaff normalized index ( $W(h)$ ) can be expressed as:

$$W(h) = \frac{\mu_n(b_n - a_n)}{(b_n - \mu_n)(\mu_n - a_n)} C(h)$$

$C(h)$  is denoted by;

$$C(h) = 1 - \frac{\sum_{i=1}^n (2\gamma_i - 1)h_i}{n^2 \mu_n}$$

$\gamma_i$  denotes socioeconomic position, with the best well-off individual ranked first and the least well-off individual ranked last

$h_i$  denotes real number which measures the health status

$\mu_n$  denotes the average health of the population

$a_n, b_n$  denotes defined lower and upper limits

$n$  denotes a given individual in a population N

The Wagstaff health concentration index ( $W(h)$ ) measures socioeconomic inequalities in health based upon information on the socioeconomic ranks and the health levels of all individuals in the population [26]. The  $W(h)$  values range from -1 and +1 and tackle the bounds issue by stretching the index in such a way

that it always has a uniform range. A positive value of  $W(h)$  indicates that health is distributed in favour of the rich (+1), and a negative one reflects it is distributed in favour of the poor (-1). The higher the absolute value of the index, the more extreme the pro-rich or pro-poor character of the distribution is supposed to be. Concentration curves were computed to present a graphical picture of the concentration indices. Concentration curves are derivatives of concentration indices and they rank the variable of interest by socioeconomic status [27].

## Results

### Descriptive statistics

This study analysed 7,154 and 6,981 pregnant women for 2016 and 2019, respectively. Literate secondary educated women aged between 15-34 years accounted for the biggest proportion of the study participants in both surveys (Table 1).

Treated household net ownership for both time periods was highest in among poor literate rural women aged between 25-34 years who had attained at least secondary education and resided in the Ashanti region (Table 2). While treated net usage for both time periods among under-fives was highest among rural children from poor households whose mothers were not literate but had attained at least secondary education aged between 25-34 years and residing in the Ashanti region (Table 2). Treated net usage among pregnant women for both time periods was highest in 25-34 year rural poor from Ashanti, who are not literate but have attained at least secondary education (Table 2). Intermittent Preventive Treatment in pregnancy (IPTp) coverage for the time periods under review was highest among 24-34 year old women who had at least secondary education (Table 2). Health insurance coverage was highest among literate women from wealthy households and had attained at least secondary education residing in the urban areas thus in 2016, while for 2019 everything else was the same except that it was highest for women residing in rural areas (Table 2). Even though health insurance coverage was highest among women from wealth household, poor women were more aware that malaria was covered under the National Health Insurance Scheme (Table 2).

### Concentration curves and indices

Concentration indices for household net ownership for both time periods were all positive, reflecting that mosquito net ownership among households was pro-rich [2016(0.2694);2019(0.2772)] meaning wealthy households were more likely to own a mosquito net (Table 3). Mosquito net use among under-five children was pro-poor [2016(-0.2751);2019(-0.3780)], thus children from poor household were more likely to sleep under a mosquito net. However, women from wealthy households were more likely to sleep under mosquito nets as the concentration indices were pro-rich [2016(0.3404);2019(0.4328)] (Table 3). Poor women were more likely to receive intermittent preventive treatment (IPTp) as the concentration indices were pro-poor [2016(-0.0577);2019(-0.1274)] (Table 3).

Poor women were likely to have health insurance [2016(-0.1247);2019(-0.0098)] however, women from wealthy household were more likely to be aware that malaria treatment is covered in the National Health Insurance (NHIS) (Table 3). The study reported widening socioeconomic inequality gaps in; household mosquito net ownership, mosquito net use in under-fives, mosquito net use among women and intermittent preventive treatment use (Table 3). However, socioeconomic inequality gaps in health insurance acquisition and awareness that malaria treatment is covered by NHIS contracted (Table3).

## Discussion

The objective of the study was to observe changes in; household mosquito net ownership, mosquito net usage, intermittent preventive treatment coverage and awareness coverage of malaria finance under national health insurance across socioeconomic classes in Ghana between 2016 and 2019. Ghana has reported significant increased access to insecticide-treated nets (ITNs), which has been mainly attributed to the mass and continuous distribution channels [2,10–12]. However, despite these gains, a gap remains between ITN access and use [12].

Study findings showed treated net usage and ownership at; household level, among pregnant women and under-fives to be dominant among women and children from poor households. This shows great strides by Ghana as a report using previous data sets showed Ghana being part of four countries (Ghana, Nigeria, Senegal, and Zimbabwe) with below-target treated net use and access ratios when viewed by wealth quintile [11]. Study results also reported a significant increase treated net household ownership and usage among under-fives and pregnant women from poor households in Ghana between the two time periods. However, computed concentration indices revealed that wealthy households were more likely to own a treated mosquito net, this in contrary to findings of other studies [1,2,9,10,12,16]. While children under-5 from poor households were more likely to sleep under a treated mosquito net, thus concurring with findings of the PMI multi-country report that treated net usage is better among the poor in Ghana than the rich [11].

In the previous study on net usage in Ghana it was concluded that urban households consistently had lower use and access ratios compared to rural households [11]. Likewise, in our study findings poor households reported higher proportions of net ownership and use compared to wealthy households. However, they were some variations in the figures by region, concurring with findings also observed in Hohoe municipality [2]. The latter observed differences by region has been alluded to environmental factors associated with Malaria which vary disproportionately by region.

It has been observed in literature that malaria during pregnancy increases maternal anaemia and low birth weight especially among women living in rural communities [13,16,28]. Our study findings showed that intermittent preventive treatment in pregnancy coverage was high among educated women, concurring with findings observed in literature which argued that education empowers women with knowledge which in turn enables women to make informed choices in this case, choice of IPTp use [18]. However, IPTp coverage favoured women from poor households concurring with findings observed in other studies in literature [1,3,28,4,7,12,13,15–18].

A study done earlier revealed that most malaria patients do not self-treat but rather seek care from formal health facilities such as government and private health facilities [6]. The increase in seeking of formal health care as a result of the National Health Insurance Scheme (NHIS) in Ghana has been reported in other studies [6,20,29]. The NHIS in Ghana provides free consultations, laboratory diagnoses, and drugs for patients who are enrolled into the scheme for malaria treatment [6]. However, in our findings we observed that poor households were more likely to have health insurance but, surprisingly it is the wealthy that were more likely to be aware that malaria was covered in the National Health Insurance Scheme.

## Conclusion

In conclusion for the period under-review the concentration indices for; household net ownership, usage of treated nets among under-5s and pregnant women increased reflecting widening socioeconomic inequalities in net ownership and usage in Ghana. While, health insurance ownership and awareness of malaria finance under NHIS showed socioeconomic gaps to be contracting.

## Abbreviations

CBHIS - community-based health insurance schemes

DALYs - Disability Adjusted Life Years

GDP - gross domestic product

GMIS - Ghana's Malaria Indicator Surveys

ITN – insecticide treated net

IPTp - Intermittent Preventive Treatment in pregnancy

LLINs - long lasting insecticidal nets

National Health Insurance Scheme

NHIS – National Health Insurance Scheme

OOP – Out of Pocket Payment

PHC - Population and Housing Census

SSA – Sub-Saharan Africa

WHO - World Health Organisation

(W(h)) - Wagstaff normalized index

## Declarations

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No research funding was received, all the authors just dedicated their time to write manuscript.

### *Availability of data and materials*

All data sets are publicly available on the Demographic Health Survey website and can be accessed upon request from the Demographic Health Survey team.

### *Authors' contributions*

ATL designed the study, wrote the paper, analysed data, reviewed the paper and submitted it for publication, CAO reviewed the paper in preparation for publication, TWK reviewed the paper in preparation for publication, SA reviewed the paper in preparation for publication and OA analysed data wrote the paper and reviewed the paper in preparation for publication.

### *Ethics approval and consent to participate*

No ethical approval was sought as the parent studies DHS were cleared on ethics also this is a secondary data analysis hence data sets are publicly available.

### *Competing interests*

No competing interests between the authors

## Consent for publication

Consent from all co-authors was obtained.

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## Tables

**Table 1:** Women demographic characteristics across socioeconomic groups for 2016 and 2019

	(N) Col %		Poor		Middle		Rich	
	2016	2019	2016	2019	2016	2019	2016	2019
<b>N</b>	7,154	6,981	2,728	2,693	1,451	1,441	2,974	2,846
<b>Women Age groups</b>								
15-24yrs	30.20	31.26	31.39	31.17	34.78	34.55	26.88	29.67
25-34yrs	39.30	37.26	36.40	36.09	38.24	38.07	42.47	37.95
34-44yrs	24.37	24.42	25.53	24.75	21.53	21.46	24.70	25.60
45-49yrs	6.13	7.07	6.68	7.98	5.44	5.93	5.95	6.77
<b>Women's education level</b>								
No education	20.96	18.46	40.24	35.46	14.69	13.59	6.32	4.85
Primary	18.14	19.57	22.52	24.63	19.71	21.24	13.35	13.95
Secondary	53.64	54.73	36.85	39.12	63.46	62.91	64.27	65.37
Tertiary	7.26	7.23	0.39	0.79	2.14	2.26	16.07	15.83
<b>Women's literacy</b>								
Not literate	48.29	45.13	69.73	68.08	50.83	47.07	27.36	22.42
Partially literate	9.52	8.53	8.55	7.10	9.89	9.79	10.23	9.25
Literate	42.18	46.34	21.72	24.82	39.28	43.14	62.41	68.33
<b>Residence status</b>								
Rural	53.67	47.25	77.89	15.75	76.54	48.77	56.28	76.28
Urban	46.33	52.75	22.11	84.25	23.46	51.23	43.71	23.72
<b>Religion</b>								
Christian	77.67	79.11	69.44	70.03	76.10	80.74	86.00	86.88
Islam	20.46	19.64	26.15	27.65	23.46	18.23	13.77	12.78
Traditional	1.87	1.25	4.41	2.32	0.45	1.03	0.23	0.34
<b>Regions</b>								
Western	7.83	10.00	8.41	8.24	8.25	14.73	7.10	9.26
Central	10.82	7.19	14.85	5.89	13.98	11.83	5.56	6.08
Greater Accra	17.78	15.88	2.22	1.90	12.54	6.48	34.63	33.84
Volta	8.10	11.07	9.10	14.09	9.82	13.69	6.33	6.89
Eastern	8.85	11.69	9.45	6.99	9.57	14.83	7.93	14.55
Ashanti	19.54	17.75	9.25	12.91	23.79	18.48	26.93	21.96
Brong Ahafo	8.69	8.09	10.97	11.31	9.24	10.63	6.34	3.76
Northern	11.78	10.99	22.37	23.16	9.31	5.87	3.26	2.07
Upper East	4.02	4.37	8.28	9.28	1.70	1.92	1.24	0.97
Upper West	2.59	2.97	5.09	6.23	1.79	1.54	0.69	0.61

**Table 2:** Household net ownership, health insurance coverage, awareness of malaria covered in NHIS, net usage among under-fives and women, IPTp coverage across demographic characteristics for 2016 and 2019

Household Treated Net Ownership			Treated Net usage <5			Treated Net use pregnant women			Treated Net Use			IPTp	
	2016	2019	Change	2016	2019	Change	2016	2019	Change	2016	2019	Change	2016
<b>Socioeconomic status</b>													
Poor	41.28	41.86	0.58↑	49.75	55.26	5.51↑	50.25	53.46	3.21↑	48.66	53.55	4.89↑	47.1
Middle	20.23	21.22	0.99↑	20.16	20.77	0.61↑	19.66	21.67	2.01↑	21.38	21.97	0.59↑	21.4
Rich	38.49	36.92	1.57↓	30.08	23.97	6.11↓	30.08	24.87	5.21↓	29.96	24.48	5.48↓	31.4
<i>Chi-square</i>	<b>0.00</b>	<b>0.00</b>		<b>0.00</b>	<b>0.00</b>		<b>0.00</b>	<b>0.00</b>		<b>0.01</b>	<b>0.09</b>		<b>0.30</b>
<b>Women age groups</b>													
15-24yrs	30.02	30.13	0.11↑	25.33	27.05	1.72↑	26.15	26.79	0.64↑	21.14	22.09	0.95↑	21.7
25-34yrs	39.34	37.81	1.53↓	46.99	44.16	2.83↓	42.07	39.93	2.14↓	50.23	47.39	2.84↓	50.2
34-44yrs	24.77	24.88	0.11↑	25.30	24.70	0.60↓	26.37	26.68	0.31↑	27.02	27.62	0.60↑	26.3
45-49yrs	5.88	7.19	1.31↑	2.38	4.08	1.7↑	5.41	6.61	1.2↑	1.62	2.90	1.28↑	1.69
<i>Chi-square</i>	<b>0.01</b>	<b>0.00</b>		<b>0.00</b>	<b>0.20</b>		<b>0.00</b>	<b>0.00</b>		<b>0.40</b>	<b>0.76</b>		<b>0.00</b>
<b>Religion</b>													
Christian	77.43	79.27	1.84↑	74.87	74.88	0.01↑	76.14	77.35	1.21↑	75.64	76.14	0.50↑	76.0
Islam	20.69	19.32	1.37↓	22.31	23.37	1.06↑	21.19	20.73	0.46↓	21.69	21.96	0.27↑	21.2
Traditional	1.88	1.41	0.47↓	2.83	1.76	1.07↓	2.68	1.92	0.76↓	2.67	1.89	0.78↓	2.66
<i>Chi-square</i>	<b>0.32</b>	<b>0.00</b>		<b>0.06</b>	<b>0.01</b>		<b>0.00</b>	<b>0.00</b>		<b>0.05</b>	<b>0.59</b>		<b>0.50</b>
<b>Women's education</b>													
No education	21.81	19.20	2.61↓	27.09	24.59	2.50↓	26.46	23.30	3.16↓	14.43	23.60	9.17↑	25.1
Primary	18.60	20.02	1.42↑	20.43	22.01	1.58↑	19.70	22.24	2.54↑	15.69	22.52	6.83↑	20.1
Secondary	52.88	54.26	1.38↑	46.99	49.37	2.38↑	49.22	50.49	1.27↑	65.59	49.50	16.09↓	48.7
Tertiary	6.70	6.53	0.17↓	5.48	4.03	1.45↓	4.62	3.97	0.65↓	4.29	4.38	0.09↑	5.92
<i>Chi-square</i>	<b>0.00</b>	<b>0.00</b>		<b>0.00</b>	<b>0.00</b>		<b>0.00</b>	<b>0.00</b>		<b>0.10</b>	<b>0.30</b>		<b>0.72</b>
<b>Women's literacy</b>													
Not literate	49.34	46.57	2.77↓	56.24	55.43	0.81↓	56.30	54.02	2.28↓	57.26	55.78	1.48↓	55.5
Partially literate	9.51	8.23	1.28↓	9.34	7.55	1.79↓	9.40	7.46	1.94↓	9.48	7.80	1.68↓	9.64
Literate	41.15	45.21	4.06↑	34.42	37.01	2.59↑	34.29	38.52	4.23↑	33.26	36.42	3.16↑	34.8
<i>Chi-square</i>	<b>0.00</b>	<b>0.00</b>		<b>0.00</b>	<b>0.00</b>		<b>0.00</b>	<b>0.00</b>		<b>0.04</b>	<b>0.05</b>		<b>0.21</b>
<b>Residence status</b>													
Urban	46.04	42.95	3.09↓	37.37	30.31	7.06↓	36.68	31.54	5.14↓	45.17	31.08	14.09↓	39.1
Rural	53.96	57.05	3.54↑	62.63	69.69	7.06↑	63.32	68.46	5.14↑	54.83	68.92	14.09↑	60.8
<i>Chi-square</i>	<b>0.00</b>	<b>0.00</b>		<b>0.00</b>	<b>0.00</b>		<b>0.00</b>	<b>0.00</b>		<b>0.31</b>	<b>0.14</b>		<b>0.50</b>
<b>Regions</b>													
Western	7.29	10.41	3.12↑	6.66	11.45	4.79↑	7.20	10.24	3.04↑	6.85	12.66	5.81↑	6.96
Central	11.85	7.21	4.64↓	11.23	7.29	3.94↓	11.95	7.33	4.62↓	11.11	7.56	3.55↓	11.1
Greater Accra	15.80	12.58	3.22↓	10.88	6.35	4.53↓	9.55	7.42	2.13↓	11.01	6.68	4.33↓	11.4
Volta	8.13	12.02	3.89↑	8.80	13.05	4.25↑	9.04	13.96	4.92↑	8.63	13.03	4.4↑	8.98
Eastern	8.48	11.68	3.2↑	7.73	8.51	0.78↑	8.22	9.17	0.95↑	8.09	7.95	0.14↓	8.67
Ashanti	18.80	17.50	1.3↓	19.06	15.53	3.53↓	19.99	16.30	3.69↓	19.12	16.16	2.96↓	17.8
Brong Ahafo	9.15	8.93	0.22↓	10.65	11.51	0.86↑	10.60	11.25	0.65↑	11.14	11.01	0.13↓	11.5

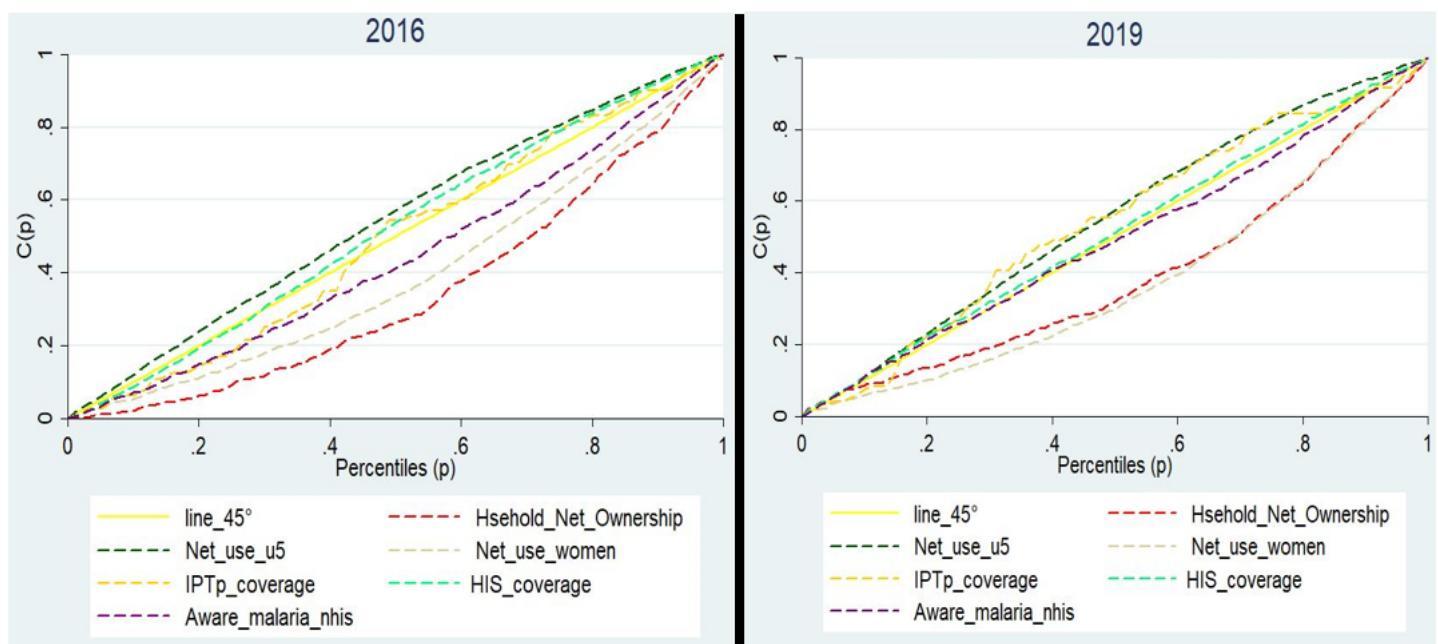
Northern	12.85	11.90	0.95↓	16.02	16.49	0.47↑	14.42	14.18	0.24↓	14.56	14.83	0.27↑	14.0
Upper East	4.71	4.81	0.1↑	5.91	5.83	0.08↓	5.68	6.08	0.4↑	6.07	5.77	0.3↓	6.01
Upper West	2.94	2.96	0.02↑	3.06	3.99	0.93↑	3.34	4.05	0.71↑	3.41	4.35	0.94↑	3.34
<b>Chi-square</b>	<b>0.00</b>	<b>0.00</b>		<b>0.00</b>	<b>0.00</b>		<b>0.00</b>	<b>0.00</b>		<b>0.00</b>	<b>0.16</b>		<b>0.04</b>

**Table 3:** Wagstaff normalised indices of household net ownership, net usage among women & under 5's, IPTp coverage, Health insurance coverage and awareness on malaria coverage in NHIS for 2016 and 2019

	2016	2019	Concentration Indices Absolute difference
<i>Household treated mosquito net ownership</i>	0.2694*** (0.0182)	0.2772*** (0.0182)	0.0078↑
<i>Treated mosquito net use among under 5's</i>	-0.2751*** (0.0167)	-0.3780*** (0.0171)	0.1029↑
<i>Treated mosquito net use among pregnant women</i>	0.3404 *** (0.0130)	0.4328*** (0.0127)	0.0924↑
<i>IPTp coverage in pregnancy</i>	-0.0577 (0.0517)	-0.1274* (0.0632)	0.0697↑
<i>Health insurance coverage</i>	-0.1247*** (0.0138)	-0.0098 (0.0150)	0.1149↓
<i>Aware malaria is covered by NHIS</i>	0.1054*** (0.0165)	0.0173 (0.0154)	0.0881↓

Note: Concentration index andd standard errors in parenthesis; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## Figures



**Figure 1**

Concentration curves of household net ownership, net usage among women & under 5's, IPTp coverage, Health insurance coverage and awareness on malaria coverage in NHIS for 2016 and 2019 Note: Concentration index andd standard errors in parenthesis; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1