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A Survey of Household Practices for the Prevention of Malaria in Benin City, Nigeria: Public Health Challenges One Decade after 'Roll Back Malaria'

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KEYWORDS

Malaria, prevention, households, under-fives, pregnant women, Benin-City

ABSTRACT

Background: By targets set when 'Roll Back Malaria' (RBM) was launched in 2000, 60% of children younger than 5 years (U5s) and pregnant women (PW) in Nigeria should have been sleeping under insecticide treated nets by 2005. The benchmark was raised to 80% in 2006.

Objectives: To present demographics and practices for the prevention of malaria in households in Benin City, especially among U5s and PW, with a view to assessing levels of attainment of the 'Abuja Targets' for malaria prevention.

Methods: Households were selected from each of the 3 Local Government Areas which make up Benin-City, Edo State, by multi-stage sampling. Data were obtained by interviews with adult household members from December 2009 to February 2010 and analyzed using SPSS version 16. Relationships between categorical variables were explored using Pearson's chi-square test. A 2-sided p value equal to or less than 0.05 was considered significant.

Results: There were 10 times as many mothers without any education as there were fathers (217 households). Insecticides were chief among malaria preventive measures, some available in potentially hazardous forms. Only 2.8% of U5s and 3.3% of PW slept under insecticide treated nets the night before interviews; only 6.7% of PW had received malaria prophylaxis with sulfadoxine/pyrimethamine. Parental education was not significantly associated with household ownership of bed nets.

Conclusions: One decade after the historic RBM launch in Abuja, Nigeria, malaria preventive practices in households in Benin City were far from the set targets. National malaria prevention programmes have apparently not been successfully integrated into household practices in Benin City.

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INTRODUCTION

The depressing statistics regarding the prevalence, incidence and morbidity/mortality associated with malaria need not be re-stated. Suffice it to say that Nigeria contributes the most to the worldwide burden of malaria. At the Roll Back Malaria (RBM) launch in Abuja in 2000, laudable targets were set, now widely known as the 'Abuja Targets'. Among these were that by 2005 at least 60% of pregnant women and children younger than 5 years would be sleeping under insecticide treated bed nets (ITNs), and at least 60% of pregnant women would have access to intermittent prophylactic antimalarial therapy[1]. The year for evaluation of the level of attainment of the 'Abuja Targets' which was initially set at 2005 was shifted to 2010 by consensus between the World Health Organization (WHO) and other RBM partners with good reason[2]- many affected countries lacked reference data and credible data for many countries only became available from 2005[2].

The WHO recommends intermittent prophylactic

therapy (IPTp) given at least twice in pregnancy, at least one month apart, after quickening is experienced in women receiving antenatal care. This, along with sleeping under ITNs is expected to provide protection against malaria (and its complications) in pregnancy[3]. Sadly, the low weighted average coverage for IPTp in 2010 was accounted for by low coverage in Nigeria[4].

Vector control and case management are key approaches to malaria control in the current efforts to eliminate or control malaria[4]. Sustained and high vector control coverage is critical. Nigeria has adopted the Integrated Vector Management (IVM) recommended by the WHO: use of long lasting insecticidal nets (LLINs), protective clothing and repellents; larviciding, in/outdoor spraying, as well as biological and environmental control measures[5]. These are expected to be used as "multiple control measures in a compatible manner"[5]. Available evidence regarding insecticide treated net distribution in Nigeria is not impressive. Worse still, utilization of treated bed nets has been shown to be low in parts of the country where they have been distributed[6].

Current recommendations by the WHO have gone beyond the Abuja targets of 2000[1]. The target now is one LLIN for every two households in Nigeria. The Abuja Summit of 2006 reviewed the initial Year 2000 targets, raising the bar from 60% to 80%: by 2010 80% of pregnant women and children younger than 5 years were targeted to be sleeping under ITNs or LLINs[7]. Further, the New Partnership for Africa's Development (NEPAD) had among its goals that by 2010 suffering and death due to malaria should have been reduced by 50%, in line with Millennium Development Goal 6, target 8[8, 9]. Nigeria's five-year programme to scale up interventions for malaria control should have been concluded by 2010[7]. It is therefore timely to evaluate the extent to which the RBM targets have been achieved. This survey explored household practices for the prevention of malaria in Benin City, Nigeria, with particular attention on malaria prevention practices among the most vulnerable subsets of the population - pregnant women, and children younger than 5 years.

METHODS

Sample sizes were calculated using Epi Info software for population survey. Households were randomly selected from the three Local Government Areas (LGAs) in Benin City (Egor, Ikpoba-Okha and Oredo LGAs, respectively), using a multi-stage sampling process. Enumeration lists[10] obtained from State Office of the National Population Commission were used to develop sampling frames for households in the respective LGAs. The estimated household sample size at 99% confidence level was 159 and giving a 50% allowance for anticipated non-consents the sample size was rounded up to 240. The estimated sample sizes were similar for under-fives and pregnant women.

Eighty random numbers were generated electronically for each of the 3 LGAs and marked off on the respective household lists. In order to achieve the required sample sizes of pregnant women and children younger than 5 years an additional 20 random numbers had to be generated for 2 LGAs (Egor and Ikpoba-Okha) at the completion of the initial round of survey. These were marked off on the sampling frame for the respective LGAs as in the first round.

Questionnaires were pretested in a sample of residents living in the University of Benin Teaching Hospital vicinity and pilot tested in a convenience sample of residents living in an Enumeration Area (EA) adjacent to one of those selected for study. The physician-researcher conducted interviews between December, 2009 and February, 2010. Data were obtained by interviewing consenting adults in the respective households - parents or their designated adult representatives. The details required were household demographics and practices for the prevention of malaria among household members.

Household reference persons (HRPs) were assigned based on whose occupation ('father' or 'mother') was considered to provide the higher income[11] and were classified using the International Labour Organization (ILO) classification[12]. Household possession of bed nets was calculated as the percentage of households surveyed in which there were bed nets; bed net use was calculated as the r an

percentage of households surveyed in which members had slept under an untreated or insecticide treated bed net, respectively, the previous night. Data were analysed using the Statistical Package for the Social Sciences (SPSS) version 16. Categorical variables were explored using contingency tables; Pearson chi-square test to detect differences. Where the expected count in any cell was less than 5, Fisher's exact test was employed. Significance level was placed at a p value (2-sided) less than 0.05.

Ethical Considerations:

Ethical clearance was obtained from the Ethics and Research Committee of the University of Benin Teaching Hospital and from the University of Liverpool Committee on Research Ethics. Written consent was obtained from responsible adult household members prior to conducting interviews. Information regarding children less than 5 years was obtained only after their parents or guardians provided written consent on their behalves.

RESULTS

Consent for interviews was refused in 4 households; in 19 there was no adult available to give informed consent after repeated visits, thus two hundred and seventeen households were surveyed in the first round. There were 1,067 household members, 1-14 members in individual households with a bi-modal frequency of 3 and 6 members per household, respectively; 517 (48.5%) were males, 156 (14.6%) were younger than 5 years and 24 were pregnant. An additional 18 under-fives and 6 pregnant women were recruited in the second round of household surveys (Table 1).

Table 1: Numerical characteristics of the study sample

LGA*	Selected households	Non-consents	No adult	Surveyed households	U5*	P*
First Round of Household Surveys						
Egor	80	1	10	69	39	6
Ikpoba-okha	80	2	5	73	63	8
Oredo	80	1	4	75	54	10
Total	**240**	**4**	**19**	**217**	**156**	**24**
Second Round of Household Surveys						
Egor	20	0	0	11**	18	2
Ikpoba-okha	20	0	0	4***	0	4
Oredo	Nil	0	0	0	0	0
Total	**40**	**0**	**0**	**15**	**18**	**6**
Grand Total	**280**	**4**	**19**	**232**	**174**	**30**

* LGA: Local Government Area; P: pregnant women; U5: under-fives
, * Only under-fives and pregnant women were interviewed

The majority (68.2%) of survey respondents were females. Service and sales workers constituted the largest proportion of household reference persons (Figure 1).

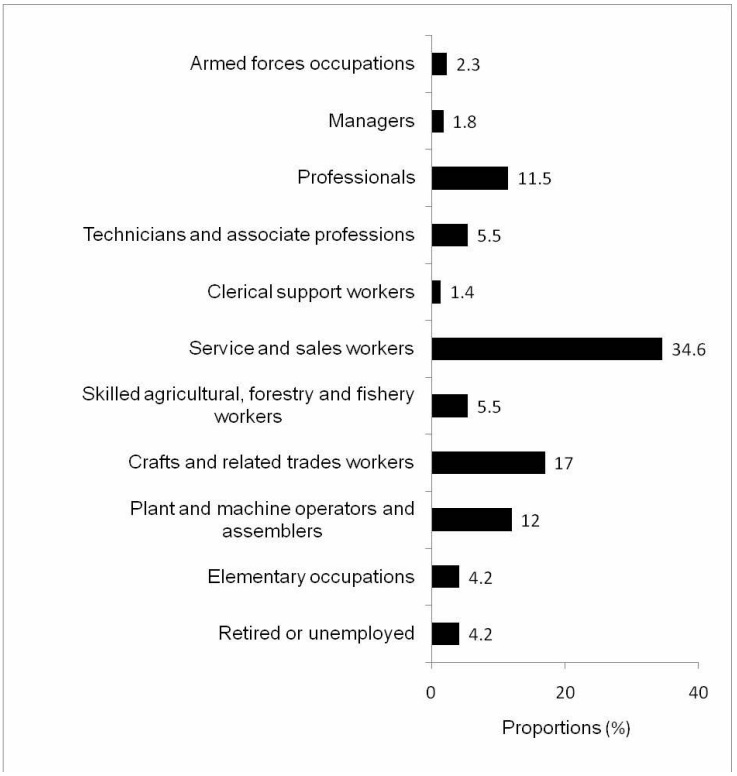

Figure 1: Bar chart showing the proportions of household reference persons in various occupational categories

There were 10 times as many mothers without any education as there were fathers; more fathers had postgraduate education than mothers (Figure 2).

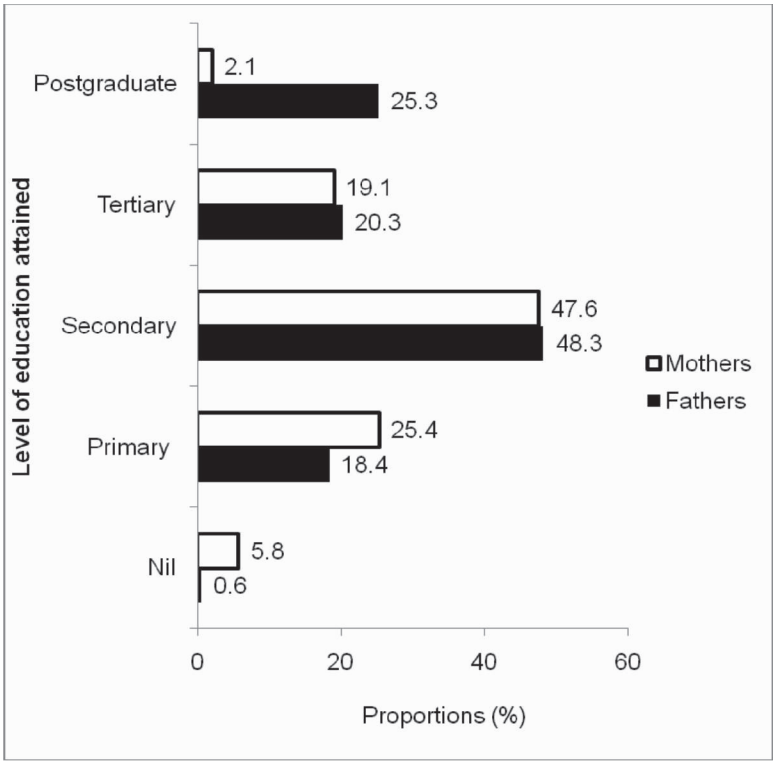

Figure 2: Bar chart showing proportions of 'fathers' and 'mothers' with different levels of educational attainment

All household members were Nigerians; 93.5% Christians, 3.7% African traditionalists, 1.8% Muslims and 0.9% mixed religions.

Multiple interventions for the prevention of malaria were employed in most households (Table 2), chief among them insecticides. The latter were used in various forms papers (called 'recharge cards') which were burned in rooms, locally made sprays, well packaged aerosols, and liquids in small bottles (popularly called 'angle 90'). The latter contained dichlorvos (2, 2-dichlorovinyl dimethyl phosphate DDAVP) as the active ingredient.

Table 2: Malaria preventive measures undertaken in households in Benin-City

Measures	**Frequency**	**Percent**
Insecticides plus window/door screens ± environmental measures	99	45.6
Other combinations excluding treated bed nets	43	19.8
Insecticide coils, drops, paper or sprays	36	16.6
Other combinations including treated bed nets	9	4.1
None	9	4.1
Window and/or door screens	7	3.2
Environmental measures	4	1.8
Combinations of insecticides, screens and orthodox medicines with or without environmental measures	4	1.8
Combinations of screens, insecticides and traditional medicines with or without environmental measures	3	1.4
Orthodox medicines	1	0.5
Untreated bed nets	1	0.5
Treated bed nets	1	0.5
Total	**217**	**100.0**

Environmental measures included sweeping and cleaning within/outside houses, bush/grass clearing, cleaning of drains and disposal of stagnant water. These were employed in various combinations and to various degrees in the respective households. A large number of window/door screens were in disrepair.

Nine households (4.2%) possessed untreated bed nets; 16 (7.4%) had insecticide treated bed nets (ITNs). Of the latter, 7 had purchased their ITNs at prices ranging between 2,000 and 2,700 Naira (13-17 US Dollars at the prevailing Exchange Rate); others obtained theirs from government programmes within and outside Edo State. Household use of ITNs, alone or in combination with other measures was 2.8% (Table 3). The chief reason given for non-use of bed nets was heat, especially when power supply was interrupted. One household could not set up their ITN; in another the ITN was used exclusively by the parents. There was no significant association between parental levels of education and household ownership of bed nets (Table 4). Insecticides were also the most popular malaria preventive measure used by pregnant women, alone or in combination with other measures. Only 2 women (6.7%) had received prophylaxis with sulfadoxine/pyrimethamine in pregnancy (Table 5); 3.3% slept under insecticide treated nets. Less than half of children younger than 5 years had any specific protection against malaria the night

Table 3: Specific measures undertaken in households to prevent malaria 'last night' outside window/door screens and environmental measures

Measures	**Frequency**	**Percent**
None	145	66.8
Insecticide coils, drops, paper or sprays	54	24.9
Treated bed nets ± insecticides	6	2.8
Untreated bed nets ± insecticides	6	2.7
Combinations with orthodox or traditional medicines excluding treated bed nets	2	0.9
Combinations with orthodox or traditional medicines excluding treated bed nets	2	0.9
Orthodox medicines	1	0.5
Cloth cover	1	0.5
Total	**217**	**100.0**

Table 4: Parental educational levels and household possession of bed nets in Benin-City

		Levels of Education					
		Secondary and below		Tertiary and above		Total	
		F*	M**	F*	M**	F*	M**
Treated bed nets in household ?	No	109	142	55	38	164	180
	Yes	9	8	1	2	10	10
Total		118	150	56	40	174	190
* Fathers: Pearson chi-square statistic: 2.392; Fisher's exact significance: 0.171 ** Mothers: Pearson chi-square statistic: 0.007; Fisher's exact significance: 1.000							
Untreated bed nets in household?	No	112	144	53	36	165	180
	Yes	6	6	3	4	9	10
Total		118	150	56	40	174	190
* Fathers: Pearson chi-square statistic: 0.006; Fisher's exact significance: 1.000 ** Mothers: Pearson chi-square statistic: 2.280; Fisher's exact significance: 0.222							

Table 5: Malaria preventive measures among pregnant women in households in Benin-City

Reported Measures	**Frequency**	**Percent**
Insecticides plus window/door screens	9	30.0
Insecticide coils, drops, paper or sprays	6	20.0
Window/door screens plus insecticides and environmental measures	4	13.3
Other combinations excluding treated bed nets	4	13.3
Orthodox medicines	2	6.7
Other combinations including treated bed nets	2	6.7
Window or door screens only	2	6.7
Combinations of screens, insecticides and orthodox medicines with or without environmental measures	1	3.3
Total	**30**	**100.0**
Actual measures undertaken 'last night'		
None	22	73.3
Insecticide coils, drops, paper or sprays	6	20.0
Orthodox medicines	1	3.3
Treated bed nets	1	3.3
Total	**30**	**100.0**

Table 6 Measures undertaken to prevent malaria in under-fives 'last night'

Measures	Frequency	Percent
None	100	57.5
Insecticides	54	31.0
Other combinations excluding treated bed nets	6	3.4
Untreated bed nets	4	2.3
Insecticide treated bed nets	3	1.7
Covered with cloth	2	1.1
Other combinations including treated bed nets	2	1.1
Untreated bed nets plus insecticides	2	1.1
Orthodox medicines	1	0.6
Total	**174**	**100.0**

DISCUSSION

In assessing attainment of the RBM targets related to malaria prevention it is important that study samples are representative of the general population in focus. Thus, randomly selected household samples are ideal. This study ensured scientific rigour with a view to providing results that are generalizable to the population living in Benin City, Nigeria.

In a multi-national survey[13] which purposively sampled households with women in the reproductive age group and children younger than 5 years, a household bed net ownership of 26.7% was reported in Nigeria in 2004. Notably, the authors of the study conceded that their findings might have been higher than what would have been obtained if the samples had been randomly selected[13]. In a national survey conducted in Nigeria's six geo-political zones[6] bed net ownership was found to be 11.5% and use among children younger than 5 years was 1.7%[6]. Randomly selected samples were used in this survey but the representativeness of the samples is doubtful: the authors reported wealth distribution (as measured by wealth index) that was mainly in the upper quartiles[6], whereas we know that two-thirds of Nigerians live on less than one dollar a day[14].

In a hospital-based survey of pregnant attendees at antenatal clinics in Edo State in 2004, 8.5% of pregnant women were reported to have used ITNs[15]. These data were obtained by self-administered questionnaires in a semi-urban community and the assessment of ITN use was not referred to the previous night as recommended by the WHO[16]. Another hospital-based study from south-west Nigeria which was conducted between May 2003 and October 2004 reported that 1.1% of pregnant respondents used ITNs[17]. These findings underscore the heterogeneity that may exist between studies conducted in different parts of Nigeria (even within the same period), stressing the need for sub-national studies.

This study has demonstrated low levels of achievement of the Abuja targets with respect to malaria prevention in Benin City. The disparity between household possession of treated nets and use (7.4% and 2.8%, respectively) is also highlighted.

The need for investigators to distinguish between bed net ownership and use[18] cannot be over-emphasized. This distinction may be obscured if studies do not distinguish between ITN use *at anytime* and use the previous night. In a survey of semi-urban communities in Etsako area of Edo State, Nigeria, ITN possession was reported as 9.3% and use 8.0%[19], but the unit of measurement was ITN use during pregnancy, rather than the previous night.

Household usage of ITNs in this study was 2.8%. A high-profile study reported a household bed net usage of 91% in Nigeria in 2000, and 56% in 2004[18]. The calculations were done using net-owning households as denominator rather than the total number of households surveyed. It is important to use uniform numerators and /or denominators in assessments of uptake of malaria interventions in order that findings are comparable within and between regions. Adherence to the RBM guidelines for malaria research would help in this regard.

It has been demonstrated in this study that there was no statistically significant relationship between parental education (maternal or paternal) and household ownership of bed nets. This is at variance with findings from the national survey [6]. However 'household education' in that survey was described using criteria that were not explicit. Besides, while the authors stated that there was a 30% increase in the odds of owning a bed net in households with an educated woman[6], no odds ratios or confidence intervals were provided.

The prominence of insecticides as malaria control measures in Benin City is similar to findings reported in another study[17]. The unregulated use of locally packaged dichlorvos in medicine-like bottles and without safety caps is worrisome because of the potential hazard of poisoning. Animal studies suggest that dichlorvos may have oncogenic and mutagenic effects[20]. The public health concerns therefore relate to the propriety of use as well as long-term risks.

Would we consider the proverbial 'glass' as half empty or half full[21] at this point in the journey towards malaria control in Nigeria? Only 3.3% of pregnant women and 2.8% of under-fives respectively, slept under treated bed nets as reported in this study. Thus, the 'glass' can be said to be just beginning to fill up! The link between malaria and poverty is very well established[22, 23]: Malaria is a key driver of poverty in many of the world's poorest countries. If the malaria eradication efforts of the mid-60s and 1970s failed because of lack of political will and economic power, history should not be allowed to repeat itself. Current efforts are clearly not lacking in political mobilization[24] although funding challenges are evident[25].

This study suggests that new approaches to achieve the RBM targets in Nigeria may be required. The present interventions typify a top-down approach and do not seem to have been successful in achieving the set targets. Securing commitment for malaria control at the grassroots should become a prime consideration. The 'roll back malaria' challenge could become more manageable if State and Local Governments in Nigeria would be adequately empowered, mobilized and monitored to drive interventions at the grassroots rather than concentrating resources at the Federal Government. The onus is on indigenous researchers to provide policy makers in Nigeria with credible data quantifying malaria's contribution to our poverty challenge in a language that is understandable. The success story of guinea worm eradication highlights the potential power of credible data to induce change[24]. Hopefully, the same feat can be achieved with respect to malaria control/eradication.

CONCLUSIONS

As at May 2010 the level of attainment of the 'Abuja Targets' assessed in this study were a far cry from those set in 2000. Among the most vulnerable members of the population in Benin City children younger than 5 years and pregnant women the uptake of ITNs/LLINs was low just as the uptake of IPTp was low among pregnant women. Some vector control practices evoke concern as they may constitute public health risks.

LIMITATIONS

This study did not compare household practices on the basis of relative household wealth. This would

have required principal component analysis which the study was not designed for. It was also not possible to examine the bed nets owned by individual households.

Pregnant respondents were recruited on their admission of pregnancy which (especially in early pregnancy) could be taboo. Household recruitment rates of pregnant women may not be representative of the numbers that were actually pregnant. Assessment of malaria preventive measures among pregnant women did not also take into consideration their gestational ages.

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