ORIGINAL ARTICLE

Benefit incidence analysis of free insecticide treated nets distribution in urban and rural communities of Enugu state, South East Nigeria

TU Nwagha, UI Nwagha[1], CC Dim[1], UB Anyaehie[2], M Egbugara[3], C Onwasigwe[4]

Departments of Haematology and Immunology, [1]Obstetrics and Gynecology / Physiology, [2]Physiology, and [4]Community Medicine, College of Medicine, [3]Department of Obstetrics and Gynecology, Teaching Hospital, University of Nigeria, Enugu Campus, Enugu, Nigeria

Abstract

Background: Malaria is a leading cause of mortality as well as a barrier to economic and social development in developing countries. The use of insecticide-treated nets (ITNs) for malaria vector control is effective in controlling malaria attacks in pregnant women and under-5 children. The Nigerian government, in its bid to achieve the Millennium Development Goal (MDG) 4 and 5 distributes free ITNs to pregnant mothers and under-five children in the Roll Back Malaria programme (RBM).

Aim: This study compared the benefit incidence analysis of this government program between urban and rural areas.

Materials and Methods: Pretested, semi-structured questionnaires were administered to 150 pregnant women and also 150 mothers of under-5 children, who were randomly selected from each of the two communities (rural and urban) from a local government area (LGA) in Enugu state, Nigeria. The study was conducted within the rainy season periods (March–August) of 2008. The information obtained included some socio-economic variables, accessibility, usage and benefits of usage of ITNs. Data entry and analyses were done using the Statistical Package for Social Sciences (SPSS) version 15.0(Chicago IL, USA). Student's *t*-test and Chi-square were used for comparison where appropriate. Significant values were taken as *P* value. Value of less than 0.05 was considered significant.

Results: The respondents' mean monthly expenditures on food utilities and anti-malarials in the rural area and urban areas were N266.1 (74.02), range (143.3-395) and N473 (90) range (380-495.7) respectively ($P < 0.001$). Within each socio-economic stratum (SES), the average monthly expenditure in the urban community was higher than that of the rural community except for least poor SES ($P < 0.05$). For the urban community, 106 (71.6%) respondents used ITNs as against 99 (66.9%) in the rural community [$P = 0.778$, OR = 1.3 (95% CI: 0.76, 2.05)]. Also, ITNs were always accessible to 112 (75.7%) and 54 (36.5%) respondents in the urban and rural communities respectively [$P < 0.001$, OR = 5.4 (95% CI: 3.28, 8.96)]. In the urban community, 130 (87.7%) respondents expressed some benefit from ITNs as against 123 (83.1%) respondents from the rural community [$P = 0.258$, OR = 1.5 (95% CI: 0.76, 2.28)].

Conclusion: Most pregnant women and mothers of under-five children in the rural study area belong to the poorest socio-economic classes and they spend less on anti-malarial treatment. Majority of the free ITN's beneficiaries in both urban and rural study areas have used and benefitted from them

Key words: BIA, ITNs, nigeria, pregnancy

Date of Acceptance: 05-Sep-2013

Address for correspondence:
Prof. Uchenna Nwagha,
Department of Obstetrics and Gynecology / Physiology, College of Medicine, University of Nigeria, Enugu Campus,Enugu, Nigeria.
E-mail: uchenna.nwagha@unn.edu.ng,

Access this article online

Quick Response Code:

Website: www.njcponline.com

DOI: 10.4103/1119-3077.127540

PMID: 24553026

Introduction

Malaria remains one of the world's most significant health and development problems. It is a serious health problem in developing countries where it is a leading cause of mortality.[1] The disease is caused by protozoa of genus *Plasmodium*; and four species of this genera that infect humans, are: *Plasmodium falciparum*, *P. vivax*, *P. ovale,* and *P. malariae*.[2] The species *P. falciparum* causes the most severe form of the disease, often with a neurological manifestation.[3,4] Nevertheless, malaria is usually accompanied by some degree of haemolysis; and in a severe or prolonged attack, anemia may be profound. Further highlight on the complications of malaria has been described.[3]

Malaria is transmitted by female anopheles mosquitoes during a blood meal. In Nigeria, the main vector of malaria are the *Anopheles gambiae s. s.* (sensu stricto) which is predominant in a humid area and forest subtype; *An. arabiensis* which is dominant in the savannah ecotype and the cities; *An. melas* which is the salt-water species; and the *An. funestus* that is commoner in fresh waters in the dry season.[2]

The burden of malaria especially in sub-Saharan Africa is enormous; for instance, it results to about 27 million deaths per annum globally, and 20% of under-five as well as 10% of African continent's overall disease burden.[5] The disease is, therefore, a barrier to economic and social development of communities. Furthermore, malaria is ranked as the leading cause of disability-adjusted life years lost in Africa.[6] Estimates for East and West African countries have suggested a total cost of USD 10 per malaria illness taking into account collateral (loss of labor/productivity learning days lost) as well as a direct cost (drugs/hospital stay).[7] It is, therefore, obvious that the disease imposes substantial cost on households, business health systems and government budgets, as well as a major cause of poor economic performance and persistent poverty of many African countries.[7] In view of these, two global initiatives were developed to assist resource-constrained countries in the control of malaria and other endemic diseases: the RBM partnership and the Global funds for acquired immune deficiency syndrome (AIDS), tuberculosis (TB), and malaria.

Furthermore, the use of insecticide-treated nets (ITNs) for malaria vector control is one of the key elements currently employed in malaria control.[8] They are cost effective method for control of malaria especially among the under-five population. It was, therefore, not surprising that the Heads of African governments assembled in Abuja, Nigeria and called for a substantially expanded use of ITNs, which is being one of the most effective interventions for protecting children and pregnant woman against malaria.[8] For Nigeria, an estimated 27 million ITNs are required annually to effectively protect these most vulnerable groups from malaria infection.[7] Unfortunately, few people in high-risk region use ITNs which evoked the public health challenge on how to increase household demand for and access to ITNs on a scale commensurate with the size of the population at risk.[8] Also, the national malaria control strategy of Nigeria had emphasized the sale of ITNs on a user fee basis but, various social, behavioral, and economic barriers were identified including the lack of information about the benefits of ITNs, poor access to market for ITNs and insecticide treatment, cultural preferences, and low incomes.[7] In order to scale-up access to ITNs in Nigeria, mechanisms for routine distribution of free ITNs to pregnant women and under-five children were developed including the Insecticide Treated Nets Massive Promotion and Awareness Campaign (IMPAC).[8] This campaign was is in line with the report of a study in Kenya which showed that when nets and insecticides were provided free of charge, the vast majority of people were keen and motivated to sleep under a treated net.[9] The concerns are whether the distribution of the ITNs would effectively and equitably reach the targeted vulnerable groups in Nigeria. Therefore, this study aimed to compare the benefit incidence analysis of the use of ITNs amongst pregnant women and mothers of under-five children living in urban and rural areas of Enugu state of Nigeria. It is hoped that the study would drive health policy in the state through the provision of evidence about the benefits of ITNs, as well as identify inequalities in the distribution of ITNs among socio-economic groups in the study population.

Materials and Methods

This is a comparative cross-sectional survey of two communities selected randomly from the 12 communities in the Enugu East local government area (LGA) of Enugu state, Southeast Nigeria, during the rainy season periods (March–August) of 2008. The study population was pregnant women and mother-child pair receiving antenatal care or routine childhood immunization from the public health centers of the selected communities. The selection of Enugu East LGA was purposive because it consists of a mix of urban and rural communities. The 12 communities were stratified into urban and rural; the only urban community (Abakpa-Nike) was selected from the study while Ibagwa community was selected from 11 rural communities by simple random sampling technique. For each selected community, a frame was developed using the ITN distribution register of the health centers within the community. One hundred and fifty women were selected from each frame by simple random sampling. All identified respondents were counseled independently in their homes and questionnaire was administered by trained interviewers after obtaining informed consent. The questionnaire was validated using 50 matched subjects from

a neighboring community who were not included in the analysis. The Statistical Package for Social Sciences (SPSS) version 15 (Chicago IL, USA) was used for data entry and analyses. Student's *t*-test was used to compare means whereas Chi-square was used to compare proportions. A *P* value of less than 0.05 was considered significant.

The study was approved by the Institutional Review Board (IRB) of University of Nigeria Teaching Hospital (UNTH), Enugu, Nigeria. Also, permission for the study was obtained from leaders of the selected community.

For the purpose of this study, respondents' households were categorized into four socio-economic groups using Principal Component Analysis Data.[10] The variables used for the categorization include occupation and educational level of the head of family, ownership of properties such as zinc-roofed house (non-thatched roofed), television set, car, motor cycle, and refrigerator. A 7-point Likert scale was employed, and the households were categorized into socio-economic quartiles based on their scores. Thus, the score of 7 was equivalent to Least poor SES, scores of 5 and 6 = Poor SES, 3 and 4 = Very poor SES, and scores of less than 3 were equivalent to Most poor SES. The Infrastructural variables were not used to avoid 'urban bias' that could prevent comparison between rural and urban wealth indices.[10]

Accessibility of ITNs was assessed among respondents using a 3-point Likert scale thus: "Always accessible" was assigned a score of 3, "Often accessible" =2, and "Sometimes accessible" =1. The mean score per SES in the urban area was calculated and compared with the corresponding SES in a rural area.

Community mobilization for the study was ensured through advocacy to identified community gate keepers, as well as sensitization of the community members through secular and religious group meetings, and use of town criers were applicable.

A sample size of 150 women per stratum was adequate for the study, considering the ITN ownership rate of 2.4% for South eastern region, Nigeria;[11] an assumed sampling error of 5% at 95% confidence limits, and non-response rate of 5%.

Enugu state of Nigeria is one of the five Igbo speaking states that make up the South eastern region of Nigeria. It has a mixed rural and urban population of over 3.2 million and a land mass of about 8,000 km^2.[12] The average annual temperature ranges from 23.1°c to 31°C with a rainfall of 1520 to 2030 mm. There are two main seasons; rainy season (April to October) and dry season (November to February). This area is a hyper endemic area for malaria which is predominantly caused by *Plasmodium falciparium*.[13]

Enugu East LGA is one of the 17 LGAs in the state. It has a variety of urban and rural population. Ibagwa community is extremely rural, and subsistent farmers constitute over 80% of the population while Abakpa-Nike is cosmopolitan with an array of socio-economic groups such as traders, civil servants, teachers, and small business owners, forming more than 90% of the population. Abakpa-Nike has one health center and numerous maternities clinics and hospitals. There are several pharmacy stores, patent medicine shops/drug vendors, and some traditional birth attendants.

Ibagwa, on the other hand, is about five kilometers from Abakpa. It has a health center, two privately owned maternity centers, two drug vendors, five village health workers (VHW), and some traditional birth attendants. Benefits from ITNs were measured by the reduction in frequency of malaria attacks, hospitals visitations and amount spent on anti-malarial drugs

Results

Three hundred questionnaires were administered to respondents in the two selected communities, but 296 were properly completed and analyzed given a response rate of 98.7%.

For the rural community, the modal socio-economic status of respondents was the very poor SES (41.9%, 62/148) while least poor SES had the least numbers of respondents (8.1%, 12/148). For the urban community, the modal and least occurring socio-economic status were the poor SES (47.3%, 70/148) and the least poor SES (10.1%, 15/148) status respectively. The distribution of respondents according to their location and SES is shown in Table 1.

For both urban and rural communities, the expenditure on the treatment of malaria was dependent on the socio-economic status of the respondents [Table 2]. The mean monthly expenditure on food utilities and anti-malarials by respondents in the rural area was N266.1 (74.02), range (143.3-395) while that for the urban area was N473 (90) range (380-495.7) The difference between the two communities was statistically significant ($P < 0.001$). Within each socio-economic group, the mean monthly spending in the urban community was

Table 1: Respondents' socio-economic status and mean expenditure on anti-malarial

SES	Urban Mean score (S.D)	Rural Mean score (S.D)	*P* value
Most poor	2.84 (0.37)	1.07 (0.36)	<0.001
Very poor	2.89 (0.31)	2.31 (0.69)	<0.001
Poor	2.61 (0.49)	2.86 (0.54)	<0.001
Least poor	2.93 (0.26)	2.92 (0.28)	0.750

SES=Socio-economic stratum; S.D=Standard deviation

significantly higher than that of the rural community except in the least poor SES [Table 1].

For the urban community, 106 (71.6%) respondents used ITNs as against 99 (66.9%) in the rural community. The observed difference was not statistically significant [$P = 0.778$, OR = 1.3 (95% CI: 0.76, 2.05)]. Also, within each SES, there was no significant difference between the use of ITNs by the urban and rural respondents ($P > 0.05$). Details of the distribution of ITNs used within the SES are shown in Table 2.

In the urban area, 112 (75.7%) respondents reported that ITNs were always accessible as against 54 (36.5%) respondents in the rural area. The difference was statistically significant [$P < 0.001$, OR = 5.4 (95% CI: 3.28, 8.96)]. With respect to the accessibility of ITNs by respondents within the SES as assessed by the mean Likert score, there were significant differences between respondents in urban and rural areas within all SES ($P < 0.05$) except the Least poor SES ($P = 0.750$). Details of the observed differences are showed in Table 3.

For all SES, 130 (87.7%) respondents from the urban area expressed some benefit from ITNs. This was not statistically different from the 123 (83.1%) respondents that benefitted from ITN in the rural area [$P = 0.258$, OR = 1.5 (95% CI: 0.76, 2.28)]. In the urban area, all respondents from the poor and least poor SES were reportedly benefitted with the use of ITNs. Likewise, all respondents within the poorest SES in the rural area were reportedly benefitted from ITNs as evidenced by reduction in frequency of malaria attacks hospitals visitations and amount spent on anti-malarial drugs. Furthermore, within the very poor SES, 24 (63.2%) respondents from the urban community showed benefit from the use of ITNs as against 57 (82.3%) respondents from the rural community [$P = 1.0$, OR = 1.2 (95% CI: 0.34, 4.00)]. Details of benefit analysis of ITN are shown in Table 4.

Table 2: Respondents' SES versus use of ITNs and other vector control methods

SES	Frequency (%)		Mean expenditure in Naira (USD)		*P* value
	Urban	Rural	Urban	Rural	
Most poor	25 (16.9)	60 (40.5)	456.2 (88.88)	143.3 (67.31)	<0.001
Very poor	38 (25.7)	62 (41.9)	494.7 (89.13)	325 (89.51)	<0.001
Poor	70 (47.3)	14 (9.5)	495.7 (80.64)	201.4 (39.77)	<0.001
Least poor	15 (10.1)	12 (8.1)	380 (101.41)	395 (99.49)	0.703
Total	148 (100)	148 (100)	473.4	266.1	<0.001

ITNs=Insecticide-treated nets; SES=Socio-economic stratum

Discussion

This study, which aimed, to compare the benefit incidence analysis of the use of ITNs by those vulnerable to malaria in urban and rural areas has made some notable revelations. The study showed that a majority of respondents in the rural area belong to the poorest categories of SES (very poor and most poor) which supports the reports of a national population survey;[11] also, they are most unlikely to buy and own ITNs because of poverty.[7] Therefore, without the free distribution of these ITNs, efforts to bridge the inequality in the ownership of this immensely valuable malaria control tool between the urban and rural dwellers may not have been succeeded.

Also, the study showed that expenditure on malaria treatment was dependent on respondent's dwelling and socio-economic status. Though the epidemiology of the malaria does not differ between the urban and rural communities studied, the study showed a trend where respondents in the urban area spent more on malaria treatment than those in rural areas. This may imply that the morbidity and mortality due to malaria would be higher in the rural area. Therefore, an effective and sustained distribution channel for ITNs will provide a cost effective malaria preventive measure for the vulnerable group especially in rural areas.

Furthermore, the study showed that ITNs were used for malaria prevention better that other vector control methods in both urban and rural areas. This observation

Table 3: Respondents' SES versus accessibility of ITNs in urban and rural areas

SES	Location	ITN use (%)	Other vector control (%)	*P* value	OR (95% CI)
All SES	Urban	106 (71.6)	42 (28.4)	0.778	1.3 (0.76-2.05)
	Rural	99 (66.9)	49 (33.1)	-	
Most poor	Urban	18 (72.0)	7 (28.0)	0.111	2.3 (0.82-6.18)
	Rural	32 (53.3)	28 (76.7)	-	-
Very poor	Urban	29 (76.3)	9 (23.7)	0.10	0.04 (0.14-1.21)
	Rural	55 (88.7)	7 (11.3)	-	-
Poor	Urban	48 (68.6)	22 (31.4)	0.455	0.60 (0.15-2.35)
	Rural	11 (78.6)	3 (21.4)	-	-
Least poor	Urban	11 (73.3)	4 (26.7)	<0.001	30.25 (2.90-315.70)
	Rural	1 (8.3)	11 (91.7)	-	-

SES=Socio-economic stratum; CI=Confidence interval; OR=Odds ratio; ITNs=Insecticide-treated nets

Table 4: Benefits of ITN in relation to the reduction of expenditure on anti-malarial

SES	Location	Benefit from ITN (%)		*P* value	OR (95% CI)
		Yes	No		
All SES	Urban	130 (87.8)	18 (12.2)	0.258	1.5 (0.76-2.82)
	Rural	123 (83.1)	25 (16.9)		
Most poor	Urban	21 (84)	4 (16.0)	0.006	-
	Rural	60 (100)	0 (0.0)		
Very poor	Urban	24 (63.2)	4 (36.8)	1	1.2 (0.34-4.00)
	Rural	57 (82.3)	11 (17.8)		
Poor	Urban	70 (100)	0 (0.0)	<0.001	-
	Rural	7 (50)	7 (50.0)		
Least poor	Urban	15 (100)	0 (0.0)	0.001	-
	Rural	5 (41.7)	7 (58.3)		

SES=Socio-economic stratum; CI=Confidence interval; OR=Odds ratio; ITNs=Insecticide-treated nets

also holds for all the SES except the least poor SES. Nevertheless, inadequate power for sub-analysis within the later is evident in the wide confidence interval identified when use of ITN was compared between urban and rural respondents [Table 2]. Therefore, further studies on this subject should utilize a larger sample size. The finding is helpful because it suggests that the ongoing promotion for the use of ITNs for malaria prevention and control is succeeding. The ITNs promotion may be based on several studies which showed its effectiveness and/or sustainability for malaria prevention.[14-18] Furthermore, this study showed that the distribution of ITNs as a pro-poor government incentive towards prevention of malaria might not be highly accessible to respondents from the rural areas when compared to their counterparts in the urban area. The poor accessibility to ITNs would also suggest that the target vulnerable group is not being reached by the government programme. In line with this, a related study had shown that only households located in proximity to the health centers were more likely to possess and use ITNs.[19] This might be the case in Nigeria as public health facilities are used as ITN distribution centers in many areas of the country; therefore, households in villages with clinics have closer proximity to free ITNs as compared to those who would have to travel to a clinic to receive free ITNs. Other means of distributing the ITNs, especially through religious meetings, need to be developed to counter the imbalance. Furthermore, the study found that regular use of ITNs was associated with health benefit, which in this case was a reduction in respondent's expenditure on treatment of malaria. This implied that there was a reduction in the number of pregnant women and under-five children suffering from malaria and this reduction was attributable to the use of ITNs. It has been suggested that the main benefit of ITNs in pregnant women might occur after childbirth, as infants typically share sleeping space with the mother from their birth to years . [20]Some respondents that got the ITNs did not benefit from their use, which might be due to their non-use or inconsistent use. Nevertheless, further studies are required to determine the actual reasons for the non-benefit.

In conclusion, most pregnant women and mothers of under-five children in the rural study area belong to the poorest socio-economic classes, and they spend less on anti-malarial treatment. ITNs was the most used method of malaria vector prevention in both urban and rural study areas, and most of the target vulnerable group benefitted from their use irrespective of their socio-economic status and area of domicile. However, ITNs were least accessible to the most poor in the rural area.

Acknowledgements

We wish to thank Alliance for Health Policy and System Research for their financial support. We are also grateful to Professors Uzochukwu and Onwujekwe for their contributions and support. The malaria manager of Enugu State Ministry of Health Mr. Igriegbe and the matrons of Abakpa Nike and Ibagwa health centers also contributed towards this project.

References

1. Federal Ministry of Health National Malaria control Programme,Abuja.A 5-year Strategic Plan: 2006-2010.A Road Map for Impact in Nigeria.Available @ http://www.rbm.who.int/countryaction/nsp/nigeria.pdf.accessed on 26/09/2013.
2. Lucas AO, Gilles HM.A textbook of preventive medicine for the tropics. 2nd ed. London: Hodder and Stoughton; 1990.
3. Philips-Howard PA, Bradley DJ, Blaze M, Hurn M. Malaria in Britain: 1977-86. Br Med J (Clin Res Ed) 1988;296 (6617):245–8..
4. Walgate R. Quest for malaria vaccine revs up, but much work remains. Bull World Health Organ 2001;79:1002-4.
5. World Health Organization/UNICEF. African malaria report. WHO/CDS/MAL/2003; 1093.Available@http://whqlibdoc.who.int/hq/2003/WHO_CDS_MAL_2003.1093.pdf.accessed on 12/03/2012
6. World Bank.World Development Report 1993: Investing in Health. New York: Oxford University Press;19937.
7. Onwujekwe O, Hanson K, Fox-Rushby J. Inequalities in purchase of mosquito nets and willingness to pay for insecticide treated nets in Nigeria: Challenges for malaria control interventions. Malar J 2004;3:6.
8. Policy for the Implementation of Insecticides Treated Mosquito Nets (ITNs) in Nigeria. Available from: http://nmcpnigeria.org/f/itn/Policy%20for%20ITNs%20in%20Nigeria%20 (Revised,%20June%20'05).pdf [Last accessed on 2012 Dec 12].
9. Katchur SP, Philips-Howard PA, Odhacha AM, Ruebush TK, Oloo AJ, Nahlen BL. Maintenance and sustained use of insecticide-treated bed nets and curtains three years after a controlled trial in western Kenya. Trop Med Intl Health 1999;4:728-35.
10. Armitage P, Berry G. Statistical methods in medical research. 2nd ed. Oxford: Blackwell Science publication; 1987. p. 23- 48.
11. National Population Commission (NPC) and ORC Macro. Nigerian Demographic and Health Survey 2003. Calverton: National Population Commission and ORC Macro; 2004.
12. Federal Republic of Nigeria. 2006 Population Census. Available from: http://www.nigerianstat.gov.ng/nbsapps/Connections/Pop2006.pdf [Last accessed on 2012 Dec 12].
13. Federal Ministry of Health, Abuja. 2004 Annual Report of National Malaria Control Programme in Nigeria. Available from http://nmcpnigeria.org/f/2004%20Annual%20Report.pdf [Last accessed on 2013 Feb 09].
14. Egwunyenga OA. Issues in effective malaria control. J Health Med Serv 1996;1:151-8.
15. Raadt P. Focus on the patient in malaria control. TDR News 1992:6-7.

16. Rashed S, Johnson H, Dogier P, Moreau R, Lee C, Lambert J, *et al*. Economic impact of febrile morbidity and use of permethrin-Impregnated bed nets in a malarious Area Study of demographics, morbidity and household expenditure associated with febrile morbidity in the Republic of Benin. Am J Trop Med Hyg 2000;62:173-80.
17. Rashed S, Johnson H, Dongier P, Moreau R, Lee C, Lambert J, *et al*. Economic impact of febrile morbidity and use of permethrin-impregnated bed nets in a malarious area II. Determinants of febrile episodes and the cost of their treatment and malaria prevention. Am J Trop Med Hyg 2000;62:181-6.
18. Binka FN, Kubaje A, Adjuik M, Williams LA, Lengeler C, Maude GH, *et al*. Impact of permethrin impregnated bed nets on child mortality in Kassena-Nankana district, Ghana: A randomized controlled trial. Trop Med Intl Health 1996;1:147-54.
19. Macintyre K, Keating J, Okbaldt YB, Zerom M, Sosler S, Ghebremeskel T, *et al*. Rolling out insecticide treated nets in Eritrea: Examining the determinants of possession and use in malarious zones during the rainy season. Trop Med Int Health 2006;11:824-33.
20. Netmark. Baseline survey on the use of insecticide treated materials in Nigeria 2001. Available from: http://pdf.usaid.gov/pdf_docs/PNACN071.pdf [Last accessed on 2012 Dec 12].

How to cite this article: Nwagha TU, Nwagha UI, Dim CC, Anyaehie UB, Egbugara M, Onwasigwe C. Benefit incidence analysis of free insecticide treated nets distribution in urban and rural communities of Enugu state, South East Nigeria. Niger J Clin Pract 2014;17:168-73.
Source of Support: Alliance for Health Policy and System Research, Enugu,
Conflict of Interest: None declared.