Exposure to Mass Media Messages and Use of Insecticide-Treated Nets and Artemisinin Combination Therapy among Rural Residents in Three Southeast States

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Abstract

Rural areas are critical in Nigeria's drive to eliminate malaria in view of the fact that Nigeria has a large rural population. The National Malaria Elimination Programme (NMEP) uses communication extensively to persuade Nigerians to sleep under insecticide-treated nets (ITNs) and treat malaria with Artemisinin combination therapy (ACT). This study therefore examines the effect of exposure to mass media messages on the use of ITNs and ACT among rural dwellers. Data were collected with a structured questionnaire from 405 respondents across nine rural communities in three states. Data analysis was carried out using percentages and logistic regression. Exposure to radio ($p<0.000$) and television ($p<0.003$) messages were found to significantly increase the odds of ITN and ACT use, though their use is not widespread in the study areas. Secondary education ($p<0.001$) and tertiary education ($p<0.000$) were found to be positive predictors of ITN and ACT use. Although exposure to malaria messages was high the use of ITNs and ACT has not become diffuse. It is important to continue to use the media to educate the population on the need to adopt ITNs and ACT in place of ineffective practices like mixing of drugs and use of insecticide sprays.

Keywords: Exposure, Mass Media, Malaria, Insecticide-Treated Nets, Artemisinin Combination Therapy, Media Messages, Rural Areas.

Introduction

The Rollback Malaria Initiative launched in Abuja, Nigeria in 2000 has resulted in the reduction of malaria mortality from about one million in the 1990s to 435,000 in 2017 (WHO, 2018). Despite this significant reduction, malaria remains a critical health issue in Nigeria. Of the 435,000 that died of malaria globally in 2017, Nigeria, the most malaria endemic country in the world accounted for 19%, which amounted to about 83,000 deaths annually or 226 deaths daily (WHO, 2018). About three out of 10 persons having malaria live in Nigeria just as one quarter of all malaria deaths in the world occurs in Nigeria (Obinna, 2018).

In addition, malaria has a devastating impact on the economy of Nigeria, leading to an economic loss of ₦132 billion ($365m) annually (Entwistle, 2016). For a nation caught in an intractable debt burden, this could be an overwhelming distress. Some of the challenges associated with malaria control in Nigeria have to do with continual reliance on age-old, but ineffective methods of prevention and treatment. For instance, studies have shown that many still rely on insecticide sprays and mosquito coils for malaria prevention (Amaechi and Ukpai, 2013; Hogarh, Agyekum, Bempa, Owusu-Ansah, Avicor *et al*., 2018).

Drug resistance is another factor that has hobbled efforts to rein in malaria. In deed malaria has had a long history of drug resistance. The first synthetic drug used for malaria treatment was quinine. By the 1900s resistance to it began to occur. Chloroquine which became available in 1945 as the first line treatment for malaria suffered similar fate from 1957. Resistance to other drugs such as sulfadoxine/pyrimethamine combination therapy and mefloquine has also occurred (WHO, 2017; CDC, 2016; Public Engagement, 2016; Medicines for Malaria Venture, 2017). Packard (2014) submits that "the rise in chloroquine resistance contributed to a world-wide increase in malaria related mortality, particularly in sub-Saharan Africa".

The World Health Organisation approved Artemisinin-based combination therapy as the first line treatment for malaria treatment in 2001 (WHO, 2006; Akoria and Arhuidese, 2014) because of its efficacy in malaria treatment. The policy was domesticated by Nigeria in 2005 (Okoro and Jamiu, 2018). The National Malaria Elimination Programme (NMEP) which coordinates malaria control efforts in Nigeria promotes the use of ITNs and ACT for malaria prevention and treatment.

Success achieved so far in global malaria control with ITNs and ACT emboldened the WHO to set the target of malaria elimination in 35 countries by 2030. Nigeria is one of the countries working towards elimination.

With 60-70% of the Nigerian population living in the rural areas (Wilson, 2015; Aderemi, 2012), it means that for Nigeria to achieve the set goal the rural

dwellers must adopt the promoted measures. Despite accommodating a huge population, rural areas suffer infrastructural deficit, including lack of health facilities, which are disproportionately sited in favour of urban areas (Efe, 2013). In addition, there is dearth of efficient transportation and communication infrastructure, qualified medical personnel in addition to socio-economic barriers (Omonona, Obisesan and Aromolaran, 2015). This state of affairs is exacerbated by the fact that rural areas are caught in the "poverty-ill health-low productivity downward spiral" (Strasser, 2007).

The NMEP; the World Health Organisation and other organisations involved in malaria control utilise behaviour change communication, especially through the mass media, to persuade Nigerians to use insecticide-treated nets (ITNs) and Artemisinin combination therapy (ACT) for malaria prevention and treatment. These measures have been proven effective in malaria prevention and treatment. However, they compete with other control measures which Nigerians have been used to such as insecticide sprays and drugs resisted by malaria such as chloroquine and other mono-therapies. This provides a context to understand the heavy investment in behaviour change communication.

Statement of the Problem

Success recorded so far in the global effort to halt malaria has given the world the optimism that malaria can be eliminated. The World Health Organisation (WHO) has set for itself the goal of eliminating malaria in 35 countries by 2030. Nigeria is one of the countries working towards elimination. This goal cannot be met unless there is a population-wide adoption of the promoted insecticide-treated nets and Artemisinin-based combination therapy which have been proven efficacious in malaria prevention and treatment. This is especially true of the rural dwellers. While urban dwellers enjoy no immunity from malaria, it is regarded as a disease of the rural areas. This is because rural areas provide mosquito-breeding habitats like streams, stagnant and slow-moving waters and bushes (Noble and Austin, 2016; Gomez, Caicedo, Gaitan, Herrera-Varela, Arce, Vallejo, et al, 2017; Kalu, Obasi, Nduka and Otuchristian, 2012). The National Malaria Elimination Programme relies heavily on behaviour change communication via the mass media to persuade the public to use the promoted ITNs and ACT. It is important to find out if exposure to such communication has resulted in the adoption of the promoted measures in the rural areas of the selected states.

Objectives

This study seeks to determine exposure to mass media messages and the use of insecticide-treated nets and Artemisinin combination therapy among rural residents in three Southeast states of Nigeria. Specifically, this study hopes to:

1. determine the extent to which rural dwellers are exposed to mass media messages on malaria prevention and treatment;
2. ascertain if exposure to mass media messages on malaria has resulted in the adoption of insecticide-treated nets and Artemisinin combination therapy by rural dwellers; and
3. To determine the factors that affect use of insecticide-treated nets and Artemisinin combination therapy among rural dwellers.

Research Questions

1. To what extent are rural dwellers exposed to mass media messages on malaria prevention and treatment?
2. Has exposure to mass media messages on malaria resulted in the use of insecticide-treated nets and Artemisinin combination therapy among rural dwellers?
3. What factors affect the use of insecticide-treated nets and Artemisinin combination therapy among rural dwellers?

Literature Review

Health communication is a critical success factor in ensuring public health and elimination of barriers to the actualisation of public health goals (Ahmed, Hossain and Kabir, 2014). Since 2000, there has been an on-going campaign to control malaria in Nigeria, with the ultimate aim to eliminate it. The mass media have been used extensively to disseminate messages to the public. While health communicators have no guarantee that their campaign will achieve the desired goal many studies have empirically found an association between exposure to health communication and adoption of ITNs (Adjah and Panayiotu, 2014; Apo, Kwankye, and Badasu, 2015; Bowen, 2013; Kilian, Lawford, Ujuju, Abeku, Nwokolo *et al*., 2016).

The capacity of health communication to induce desirable behaviour change may be accounted for by its ability to disseminate information about a given disease resulting in increased knowledge of the disease epidemiology. Several studies in Nigeria, Tanzania and Cameroon have shown appreciable knowledge of malaria among different study populations (Killian et al, 2016; Okpoko and Aniwada, 2017; Amusan, Umar and Vantsawa, 2017, Uzochukwu and Nwuneli, 2016; Kimbi, Nkesa, Ndamukong-Nyanga, Sumbele, Atashili, et al, 2014; Edson and Kayombo, 2007).

Ankomah, Adebayo, Arogundade, Anyati, Nwokolo *et al.* (2014) found an association between knowledge that ITNs prevent malaria and people's willingness to sleep under the nets while Kilian, *et al.* found that such knowledge improved with exposure to health communication.

Notwithstanding the reported knowledge of facts on malaria, some misconceptions still exist. They include beliefs that malaria is an airborne disease, a blood virus, a disease caused by palm wine, unhygienic food, oily food, dirty and contaminated water and walking in the sun (Kimbi *et al.*, 2014; Nyirongo, 2013; Asanti *et al.,* 2010). Such misconceptions about the cause of malaria can negatively affect ITN utilisation. Arogundade *et al.* (2011) examines the relationship between caregivers' misconceptions and non-use of ITNs by under-five year-old Nigerian children. The results of the study show that misconceptions about malaria, its prevention and control, negatively influenced utilisation of ITNs. They found that caregivers who had some misconceptions about causes and prevention of malaria are about 25% less likely to own and use a net.

Exposure to health communication and knowledge of a disease may not ensure willingness to adopt promoted prevention and treatment tools. Several studies have indicated cases where despite possessing adequate knowledge of malaria and its severity and even owning some ITNs, people still refuse to sleep under them resulting in a gap between ITN possession and usage (Berkessa, Ojira, Tesfa, 2016; Birhanu, Abebe, Sudhakar, Dissanayake *et al.,* 2015; Omole, Ogunfowokan and Moses, 2017; Aderebigbe, Olatona, Sogunro, Alawole, Oluwole *et al*., 2014; Chukwuocha, Dozie, Onwuliri, Ukagu, Nwoke *et al*., 2011).

Since ITN possession by itself alone does not predict net use attention has often been paid to other intervening variables that impinge on the use of ITNs. Education for instance has been found to be a positive predictor of ITN use. It has been found that the more educated people are, the more they are willing to use ITNs (Arogundade, 2011; Astatkie and Faleke, 2009; Seyoum *et al.*, 2017; Kilian et al., 2016). There are, however, few studies showing that education is not always a predictor of net use (Ankomah *et al.,* 2014).

Furthermore, the socio-economic status of a people can have some influence on ITN use. Empirical evidence of this comes from Esse, Utsinger, Tschannen, Raso, Pfeiffer *et al.* (2008) who found an association between socio-economic status and adoption of malaria control measures. The study found that the wealthiest members of the society adopted relatively expensive control measures like insecticide sprays and bed nets while the poorest people used fumigating coils more, perceived cost being the deciding factor. This finding is consistent with another study in Mozambique (Moon, Hayes, Blevins, Lopez, Green, et al, 2016). However, there are other studies

that indicate people in the lower economic quintiles more likely to use the nets (Goesch, Schwarz, Decker, Oyakhirome, Borchet *et al.,* 2008; Apo, Kwankye and Badasu, 2015; Dako-Gyeke and Kofie, 2015; Mora-Ruiz, Penilla, Ordonez, Lopez, Solis *et al*., 2014).

Negative perceptions of ITNs can also influence attitude to the nets and often result in non-use. In a study in Tanzania, Nnko, Whyte, Geissler and Aagaard-Hansen (2012) report that some respondents, in addition to doubting the efficacy of ITNs, would not use them because of fear that insecticides would cause chronic diseases. According to them, when one is covered with ITNs "all the insecticide passes through the nose and causes lung diseases…if the bed bugs die when they ouch the treated mosquito net, it could also harm our children if they touch it". This negative perception is echoed in another study in Uganda (Taramwa, Ashaba, Ayebazibire, Omoding, Hilliard *et al*. (2017) where 41% of the respondents rejected the nets for fear that they might cause cancer. This finding is consistent with other studies in Bauchi and Enugu, Nigeria where it was assumed that the nets were laced with birth control chemicals (Onyeneho, 2013) and that the chemicals in the nets would harm unborn babies (Ugwu, Ezechukwu, Obi, Ugwu and Okeke, 2012).

Other utilisation-related impediments include complaints of extreme heat, difficulty in breathing and discomfort (Jombo, Mbaawuaga, Gyuse, Enenebeaku, Okwori, et al, 2010; Manu, Boamah-Kaaali, Febir, Anyipah, Owusu-Agyei and Asanti, 2017; Ezeama, Ezeama and Akor, 2014).

Place of residence, rural or urban, has also been found to have some influence on ITN use. Birhanu *et al.* (2015) in a study in Ethiopia found that ITN coverage was lower in urban areas than rural areas: a phenomenon the authors assumed might be connected with preference given to rural areas in ITN distribution in many African countries. Other studies in Ethiopia and Myanmar have similar results (Astatkie and Feleke, 2009; Aung, Wei, Mcfarland, Aung and Khin, 2016). However, there are studies that show higher ITN coverage and use in urban than rural areas (Inungu, Ankiba, Minelli, Mumford, Bolekale, Raji, 2017, Belay and Deressa, 2008).

Treatment is a crucial part of malaria control. Globally, Artemisinin based combination therapy (ACT) is the approved drug for malaria treatment. Studies on ACT indicate poor utilisation of the drug. Mazigo *et al.* (2010) in a study in Tanzania, found that though awareness of ACT was as high as 94.8%, only 21.2% actually used it for malaria treatment, This is consistent with other studies in Nigeria, Cameroon and Equatorial Guinea (Adeyemo, Oluwatosin, Osuala, Oladapo and Lawai-Adeyemo, 2017; Sayang, Gausseres, Vernazza-Licht, Malvy, Bley and Millet, 2009; Romay-Barja, Nkogo, Nsenga, Santana-Morales, et al, 2018; Romay-Barja, Jarrin, Nkogo, Nseng, Sagrado, Benito, 2015).

Dependence on herbal medicine may partly be the cause of the reported poor utilisation of ACT. Ekwunife, Ukwe and Awanye (2010) found that majority of their respondents in Abakaliki preferred herbal medicine for malaria treatment. This is consistent with other studies in Nigeria and Tanzania (Onyeneho, 2013; Adeyemo, 2017; Mazigo *et al*., 2010).

Another explanation for poor ACT utilisation is the tendency to "mix" drugs which refers to the practice of combining doses of various drugs to treat malaria, a practice that is discouraged in the malaria campaign. In a qualitative study that examined the role of socioeconomic factors in the development and spread of anti-malaria drug resistance, Anyanwu, Fulton, Evans and Paget (2017) found that all the respondents from rural areas engaged in mixing of medicine just as Onyeneho (2017) found that all respondents engaged in mixing of medicine as the first line treatment for malaria.

While many malaria studies have focused on the use of insecticide-treated nets, very little scholarly attention has been paid to the use of Artemisinin combination therapy, especially in the rural areas where a large proportion of the Nigerian population reside. This study addresses the gap.

Theoretical Framework

This study is undergirded by the Diffusion of Innovation theory propounded by Everett Rogers in 1962. The theory maps and describes how innovations in the form of ideas, products and practices are diffused within a community, society or from one society to another (Rimer and Glanz, 2005). In addition, it describes how such innovations are communicated over time among members of a social system through certain channels (Rogers, 1962, cited in Rimer and Glanz, 2005).

The theory recognises the importance of both the mass media and interpersonal communication in the diffusion of innovations. For instance, the early adopters are exposed to information about innovations through the mass media; they subsequently inform and influence opinion leaders through interpersonal communication. Opinion leaders equally influence others in the social system (Baran and Davis, 2012, p. 333). The Diffusion of Innovation theory identifies five categories of people with regard to their readiness to adopt promoted innovations. They include innovators, early adopters, early majority, late majority, and the laggards. This categorisation implies a difference in the level of acceptance and resistance to innovations among members of a social system (Schiavo, 2014:37) and indicates that knowledge of an innovation alone does not automatically translate into its adoption.

Methods and Data

The study was conducted across nine rural communities in Anambra, Ebonyi and Enugu states. The study made use of the survey research method. The sample size for the study was 405 respondents. The sample size, based on the population of the three states was calculated by means of the Australian Online Sample Size Calculator of the National Statistical Service using 955 confidence level and 5% error margin.

To choose the respondents, one local government area was chosen from each senatorial district through simple random sampling. From each local government council a community was chosen through simple random sampling technique. Three communities were therefore picked from each state to give a total of nine communities for the three states. From Anambra state, Azu village, Ogbunike; Nkwelle village in Umunnachi and Uzoakwa village in Ihialla were selected. From Ebonyi state, Ndiagu-Ngbo village in Okposhi; Ndiagu Ugwu in Ezillo and Mgbede in Akaeze were selected. From Enugu state, Uwelle Ukehe, in Ukehe; Amagu in Mpu and Emene, Owo in Owo were selected. The questionnaire was divided equally among the communities translating into 45 copies per community. Convenience sampling was used to select the respondents in each study area.

A structured questionnaire, containing both open-ended and closed-ended questions, was used to collect data from the 405 respondents. To overcome the barrier of illiteracy in the study areas, the questionnaire was read in the local Igbo language where necessary, with the answers coded by trained research assistants. And to make up for copies of the questionnaire which might be rendered unusable by reason of damage, being returned partially filled or filled wrongly, replacement copies were provided.

The study used two dependent/outcome variables which were use of insecticide-treated nets (ITNs) and Artemisinin Combination Therapy (ACT) for malaria prevention and treatment respectively. The respondents were asked if they slept under ITNs for malaria prevention, and if they used ACT for malaria treatment. For each of the outcome variables, their responses were coded 1=yes if they use any of ITN or ACT and 0= no if they did not use any of ITN or ACT.

The major independent variable for this study is exposure to mass media messages on malaria prevention and treatment. The sources of exposure to mass media messages were media channels such as radio, television, newspapers, magazines, billboards, and internet. Respondents who were exposed to any media channel were coded 1 (yes) while respondents not exposed to any particular medium were coded 0 (no).

The study used explanatory variables such as gender (male/female), age (18-25; 26-30; 31-40; 41-50; 51+years), education (illiterate/primary, secondary,

tertiary), marital status (never married, married, widowed/divorced), employment status (unemployed/student, farmer/businessman, civil servant).

The data were analysed by means of the Statistical Package for the Social Sciences (SPSS). Percentages were used to describe the study population, exposure to mass media malaria messages and the use of insecticide-treated nets and ACT for malaria prevention and treatment respectively. The results of these analyses were presented in tables. While logistic regression analysis was used to estimate the factors that predict respondents' use of insecticide-treated nets and Artemisinin combination therapy.

Results

Table 1: Demographic data of respondents

Variables	Anambra	Ebonyi	Enugu
Sex			
Male	59	68	45
Female	76	67	90
Age			
18-25	21	32	29
26-35	32	28	22
36-45	41	30	36
46-55	30	18	28
55+	11	27	20
Education			
Illiterate	10	19	23
Primary	22	51	18
Secondary	50	48	57
Tertiary	53	17	37
Occupation			
Unemployed	15	8	11
Student	17	27	23
Farmer/businessman	65	76	58
Civil servant	38	24	43
Marital status			
Never married	21	17	21
Married	103	118	110
Divorced/widowed	11	0	4

A total of 405 respondents comprising 172 (42.5%) males and 233 (57.5%) females were studied. The age distribution of the respondents shows that 82 (20.25%) were aged 18-25 years; 82 (20.25%), 26-35; and 107 (26.42%) fell under the 36-45 age bracket. The respondents were made up of 52(12.84%) with no formal education; 91(22.47%) with primary education; 155(38.27%) with secondary education and

107(26.42%) with tertiary education. In addition, there were 34(8.40%) unemployed respondents; 67(116.54%) students; 199 (49.14%) farmers/ businessmen and 105 (25.92%) civil servants. The marital status of the respondents shows that 59 (14.6%) fell under the never married category while 15 (3.7%) fell under the divorced/widowed category.

On the major variables that guided the study, we will use the research questions as basis to find out how far the data gathered has helped in addressing the study concerns.

To What Extent Were the Rural Dwellers Exposed to Mass Media Messages on Malaria?

A total of 364(89.9%) respondents reported being exposed to mass media messages on malaria prevention and treatment. Of this number 117 were from Anambra; 120 from Enugu and 127 from Ebonyi states. While many were exposed to the messages via multiple channels, data indicated that radio was the greatest source of exposure as 337(83.2%) reported being exposed to the messages through radio followed by 259(63.9%) who indicated television; 118 (29.1%), billboards; 23(5.7%), newspapers, 6 (1.5%), magazines and 11(2.7%) via the internet.

Use of Insecticide-treated Nets by the Respondents

Data indicate that 346 respondents (85.4%) owned ITNs while 59(4.6%) reported not owning any net. Of the number of those who owned ITNs, 115 were from Anambra state, 119 from Enugu state while 112 were from Ebonyi state. Those who owned one ITN were 114; those with two were 122 while 105 owned more than two nets. Government free ITN distribution was the major source of the nets followed by net distribution at community health centres and antenatal clinics. No respondent reported having bought their own nets in the market. Asked if they slept under the nets the night preceding the survey, a total of 241(59.5%) respondents reported that they did while 105 (25.9%) did not sleep under the net the night preceding the survey. While 34(8.4%) respondents said they did not put their nets to any kind of use, 63 (15.5%) indicated that they used theirs to protect their poultry.

Use of Artemisinin combination therapy for malaria treatment

A total of 177 (48.6%) respondents correctly identified Artemisinin combination therapy as the drug promoted in the media for malaria treatment though many could not pronounce artemisinin properly. The rest gave wrong answers. However, when asked which drug they used for malaria treatment, 150 (37%) reported that they use ACT; 105(25.9%) said they use a variety of mono-therapies`; 90(22.2%) indicated

local herbs; 33 (8.1%) indicated they treat malaria with prayers while 27(6.7%) indicated others. The local patent medicine dealers popularly called chemists were the dominant sources of drugs for the respondents as 315 (77.8%) reported purchasing anti-malaria drugs regularly from the "chemists." Asked if they usually ask the chemist to "mix" drugs for them, 232 (57.3%) respondents reported that they do not mix drugs while 150 (37%) admitted that they do. Of those that buy drugs from the chemists, 185 (45.7%) reported that they usually ask for specific drugs, instead of mixing drugs.

Table 2: Regression results for influence of mass media malaria messages on ITN and ACT use

Variables	Model 1 ITN USE Odds ratio	Model 2 ACT USE Odds ratio
Radio: No (RC)	1.000	1.000
Yes	12.632***	2.924*
Television: No(RC)	1.000	1.000
Yes	2.687**	1.207
Newspapers: NO(RC)	1.000	1.000
Yes	0.415**	0.594**
Magazines: No(RC)	1.000	1.000
Yes	0.534**	0.494**
Billboards: No (RC)	1.000	1.000
Yes	1.215	0.455*
Internet: No (RC)	1.000	1.000
Yes	0.345	0.425*

Data on Table 2 indicate the influence of mass media messages on the use of ITNs and ACT. Model 1 shows that respondents exposed to radio messages (OR=12.632; $p<0.000$) had significantly increased odds of using ITNs compared to those who did not while those exposed to television messages (OR=2.687;$p<0.003$) were 2.6 times more likely to use ITNs relative to those who were not. While exposure to malaria messages through billboards (OR=1.215) increased the odds of ITN use, exposure to newspaper messages (0.415; $p<0.006$), magazines (OR=0.534; $P<0.004$) significantly decreased the odds of ITN use. Exposure to malaria messages via the internet was also associated with decreased likelihood of ITN use.

Model 2 on Table 1 shows that exposure to radio messages on malaria control (OR=2.924; $p<0.012$) increased by 2.9 times the odds of using ACT for malaria treatment while those exposed to television messages (OR=1.207) were 1.2 times more likely to use ACT. However, exposure to newspaper, magazine, billboard and

internet messages significantly decreased the odds of ACT use for malaria treatment among the study population.

Table 3: Socio-demographic predictors of ITN/ACT use

Variables	Model 1 ITN USE Odds ratio	Model 2 ACT USE Odds ratio
Sex: Male (RC)	1.000	1.000
Female	4.448***	2.544**
Age:Less than 26 (RC)	1.000	1.000
26-35	0.678	3.542**
36-45	1.655	1.240
46-55	1.505	1.145
56 years +	0.824	0.453*
Marital status:		
Never married(RC)	1.000	1.000
Married	3.377***	2.303**
Divorced/widowed	0.534	1.189
Education		
Illiterate/Primary (RC)	1.000	1.000
Secondary	3.245**	4.072**
Tertiary	4.178***	4.396***
Employment		
Unemployed/student(RC)	1.000	1.000
Farmer/businessman	1.650	1.217
Civil servant	3.145**	3.325**
State of residence		
Enugu(RC)	1.000	1.000
Anambra	3.308***	2.426**
Ebonyi	4.315***	0.865

Model 1 on Table 3 shows the effect of socio-demographic variables on ITN use. Data indicate that females (OR=4.448; $p<0.000$) have significantly increased odds of sleeping under ITNs relative to males. In the age category it was found that while those aged 26-35 and above 56 had decreased odds of sleeping under ITNs, those in the

age brackets of 36-45 (OR=1.655) and 46-55 (OR=1.145) were associated with increased likelihood of sleeping under ITNs the night preceding the survey.

Furthermore, it was found that the married (3.377; *p<0.000*) were 3.3 times more likely to sleep under ITNs compared to the never married. However, those under the divorced/widowed category had decreased odds of sleeping under the nets relative to the never married. Data further show that education had strong influence on the use of nets. For instance, those with secondary education (OR=3.245; *p<0.001*) had significantly increased likelihood of ITN use just as those with tertiary education (OR=4.178; *p<0.000*) were associated with increased odds of ITN use.

Farmers/businessmen (OR=1.650) were found to 1.6 times more likely to sleep under ITNs relative to the students/unemployed while civil servants (OR=3.145;*p<0.000*) were associated with significantly increased odds of sleeping under ITNs. In addition being residents of Anambra (OR=3.308; *p<0.003)* and Ebonyi state (0R=4.315; *p<0.000*) had significantly increased odds of sleeping under ITNs relative to Enugu residents.

Model 2 on Table 3 depicts the influence of socio-demographic variables on the use of Artemisinin combination therapy for malaria treatment. Data show that females (OR=2.544;*p<0.004*) were significantly more likely to treat malaria with ACT compared to males. Those aged 26-35 were also found to be 3.5 times more likely to use ACT. Those in the age brackets of 36-45(OR=1.240) and 46-55(OR=1.145) had increased odds of using ACT relative to those under 26 while those aged 56 and above (OR=O.453; *p<0.013)* had decreased odds of ACT use.

The married (OR=2.303;*p<0.014),* those with secondary education (OR=4.072; *p<0.000*), tertiary education (OR=4.396;*p,0.000*) were significantly likely to use ACT relative to the illiterate and those with primary education. In occupation category, farmers/businessmen (OR=1.217) were 1.2 times more likely to use ACT while civil servants (OR=3.325; *p,0.003)* had significantly increased odds of ACT use relative to the students/unemployed. In addition, being residents of Anambra state was associated with increased odds of ACT use relative to Enugu state while being residents of Ebonyi state decreased the odds.

Table 4: Regression results of combined mass media and socio-economic predictors of ITN and ACT use

Variables	Model 1 ITN USE Odds ratio	Model 2 ACT USE Odds ratio
Mass media		
Radio**: No(RC)**	1.000	1.000
Yes	10.445***	1.935
Television: No(RC)	1.000	1.000
Yes	2.422*	1.104
Newspapers: No (RC)	1.000	1.000
Yes	0.363	0.407*
Magazines :No(RC)	1.000	1.000
Yes	0.458	0.412
Billboards: No(RC)	1.000	1.000
Yes	1.198	0.450*
Internet: No (RC)	1.000	1.000
Yes	0.340	0.414*
Sex: Male:No (RC)	1.000	1.000
Female	4.435***	1.975
Age		
Less than 26 (RC)	1.000	1.000
26-35 years	0.606	2.528*
36-45	1.445	1.225
46-55	1.365	1.104
56 years+	0.798	0.414*
Marital status		
Never married(RC)	1.000	1.000
Married	3.267***	1.375
Divorced/widowed	0.526	1.148
Education		

Illiterate/Primary (RC)	1.000	1.000
Secondary	3.232**	3.055**
Tertiary	3.986***	3.655***
Employment		
Unemployed/students(RC)	1.000	1.000
Farmer/businessman	1.585	1.165
Civil servant	3.105**	2.355**
State of residence		
Enugu(RC)	1.000	1.000
Anambra	3.135**	2.345**
Ebonyi	4.225***	0.745**

Table 4 represents the combined effects of mass media and socio-demographic variables on the use of ITNs and ACT. Model 1 shows that exposure to radio messages (OR=10.445; *p<0.000*) and television (OR=2.422; *p<0.*004) significantly increases the likelihood of ITN use. While exposure to billboard messages (OR=1.198) increases 1.9 times the likelihood of ITN use, exposure to newspaper, magazine and internet messages decreases the odds. Females (OR=4.435; *p<0.000*); the married (OR=3.267; *p<0.000*); those with secondary (OR=3.232; *p<0.003);* tertiary education (OR=3.986; *p<0.000)* and civil servants were associated with significantly increased odds of ITN use. In the same vein, being residents of Anambra state (OR=3.135; *p<0.002)* and Ebonyi state (OR=4.225; *p<0.000*) also increased the odds of ITN use relative to Enugu state.

Model 2 shows the combined effects of mass media and socio-demographic variables on ACT use. As can be seen, those exposed to radio messages (OR=1.935); television messages (OR=1.104) were associated with increased likelihood of ACT use while exposure to newspaper, magazine, billboard and internet messages decreased the odds. Females were found to be 1.9 times more likely to treat malaria with ACT just as those in the age brackets of 26-35; 36-45 and 46-55 increased the odds. However, being above 56 years decreases the odds of ACT use.

In the marital status category, the married (OR=1.375) and the divorced/widowed (OR=1.148) had increased odds of ACT use. Those with secondary education (OR=3.055; $p<0.004$) and tertiary education (OR=3.655; $p<0.000$) had significantly increased likelihood of using ACT relative to those under illiterate/primary education category. Farmers/businessmen and civil servants were 1.6 times and 2.3 times respectively more likely to treat malaria with ACT. Being residents of Anambra (OR=2.345; $p<0.004$) significantly increased the odds of ACT use, being residents of Ebonyi (OR=0.745; $p<0.005$) decreased the odds significantly.

Discussion

The study found a high level of exposure (89.9%) to mass media messages on malaria prevention and treatment. This is consistent with other studies where exposure varied from 84% to 98% (Adjah and Panayiotu, 2014; Apo, et al, 2015; Uzochukwu and Nwuneli, 2016). The dominant medium of exposure was radio, followed by television and to a lesser degree, billboards. The dominance of radio in communicating malaria information is well reported in malaria studies (Adjah and Panayiotu, 2014; Belay and Deressa, 2017; Sultana, *et al*., 2016).

The study found that while 85.4% of the respondents possessed ITNs, only 59.5% of the respondents slept under the nets the night preceding the survey. This ITN ownership/usage gap has been well documented in the literature (Birhanu, 2015; Omole, *et al*., 2017, Aderebigbe, *et al.,* 2017; Arogundade, *et al*., 2011).

There was also poor knowledge of, and low use of ACT for malaria treatment among the study population. While 48.6% of the respondents could identify ACT as the drug promoted in the mass media for malaria treatment, only 37% actually reported using it. The rest used mono-therapies and local herbs. This reported low use of ACT is consistence with other studies (Mazigo, *et al*, 2010; Adeyemo *et al*, 2017; Sayang *et al*, 2009). In addition many of the respondents reported engaging in "mixing" of medicine as reported in other studies too (Anyanwu, Evans and Paget, 2017).

The regression analyses showed a strong association between exposure to radio and television messages and use of ITNs and ACT. In addition, secondary and tertiary education were found to be positive predictors of ITN and ACT use. The influence of education on ITN use is well reported in the literature (Arogundade *et al*, 2011; Astatkie and Faleke, 2009; Seyoum, Speybroeck, Duchateau *et al*, 2017).

Analysis also indicated that farmers/civil servants had increased odds of ITN and ACT use. One plausible explanation for this might be that civil servants being

relatively educated would have the cognitive ability to grasp mass media messages and would be less inclined to have misconceptions about malaria and the nets, as well as having the resources to purchase ACT. The fact that the values changed when the mass media variables were combined with the socio-demographic variables indicates that they have some effect on the ITN ACT use.

While this study adds to the growing malaria literature, and addresses an important gap in the literature, it is noted that the study has a weakness. The small sample size used may affect the generalizability of the findings. To achieve that would require a much larger sample size.

Conclusion

The study found high exposure to malaria information disseminated through the mass media and the ability of the mass media to influence the use of ITNs and ACT. However, exposure has not resulted in wholesale use of ITNs and ACTS. There is need to, not only continue to use the mass media to raise awareness of ITNs and ACT and address misconceptions and practices that impede their use, but also to use interpersonal communication, in keeping with the Diffusion of Innovation theory to encourage population wide adoption of the measures.

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