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Community Based Management, Environmental Factors and Ecological Patterns Associated with Malaria Parasites Transmission in the Communities of Children Treated with Rectal Artesunate in Ogun State, South-Western Nigeria

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ABSTRACT

Community-based case management of malaria has been shown to be effective in reducing mortality and morbidity. Overall total of 183 communities comprising 36(19.7%) communities in Egba Goe-Political Zone (GPZ), 56(30.6%) in Yewa-Awori GPZ, 43(23.5%) in Remo GPZ, and 48(26.2%) in Ijebu GPZ. There was a significant (p = 0.011) difference between preventive measures against malaria adopted for children across LGAs. Involvement in environmental management /sanitation as part of control measure (78.0%) can mostly help in tackling the adverse effects of malaria parasites transmission. They also agreed that mosquitoes breed majorly in stagnant water (77%) and Ponds (74.6%) and they did not always use (54.4%) their ITN/LLITN and their family mostly used ITN/LLITN during rainy season (84.4%). Fresh-water Rain Forest (44.3%) and Lowland Rain Forest (43.2%) are common forest vegetation types. Communities having plains topographical structure were more (91.3%) with close/compact (54.6%) type of settlement and are more densely populated (51.9%). Water bodies present are small rivers (100%). House type common in the communities was mud with iron sheets (100%) and drainage system (36.2%) was not common.

Communities Involvement in environmental management/sanitation as part of control measure will reduce malaria parasite transmission.

***Keywords*:** Community-based management, malaria, mosquitoes vegetation topographic environmental management, Ogun State, South-western Nigeria

1. INTRODUCTION

As malaria transmission decreases, the responsibility for malaria control should increasingly be taken on at more peripheral administrative levels, even with communities. A community-based approach could ensure that the remaining affected communities take a more aggressive and appropriately tailored approach to lowering and ultimately eliminating transmission in active foci (WHO, 2009 and Lemma, *et al.*, 2010).

Since 2001, community-based case management of malaria, a strategy formerly known as 'home management of malaria', in which antimalarial treatment is made available close to the home by community health workers has been a cornerstone of the WHO-recommended strategy to improve access to prompt, effective malaria treatment, especially in remote, underserved areas with high malaria transmission. Community-based case management of malaria has been shown to be effective in reducing mortality and morbidity (WHO, 2009 and Lemma, *et al.*, 2010).

In sub-Saharan Africa, several preventive and curative malaria control activities are already conducted at community level. Community case management of malaria, a strategy that was originally based on presumptive treatment of all cases of suspected malaria, is widely practiced. On the basis of results of pilot studies in Ethiopia (Lemma, *et al.*, 2010), Zambia (Chanda, *et al.*, 2011), Burkina Faso (Tiono, *et al.*, 2010), and Ghana (Anyorigiya, *et al.*, 2010), community case management of malaria is now being redefined to include the use of malaria rapid diagnostic tests (RDTs) by community health workers to confirm a diagnosis of malaria before dispensing treatment. In some countries, this has led to adoption of a strategy that includes management of acute respiratory infections, diarrhoea, and malaria in a package known as 'integrated community case management' or ICCM. Other countries have adopted community-directed interventions for neglected tropical diseases (Remme, *et al.*, 2010).

Community-based case management of malaria could be a useful addition to achieve and improve sustained malaria control, a prerequisite for malaria elimination. In addition, rapid malaria elimination in areas of high transmission potential will require large-scale, innovative preventive and curative interventions that will reach all populations at risk.

2. MATERIALS AND METHODS

Study Areas

The study was conducted in Ogun State, Nigeria; a Tropical Rain Forest Zone, lies approximately between Longitude 2°31'W and 4°31' E, and Latitude 6°31 S and 8°N, its bounded in the south partly by the Atlantic Ocean, and sharing common boundaries with Oyo, Osun, Ondo, Lagos States and Republic of Benin (Plate 5).The state is made up of three Senatorial Zones i.e. Ogun Central, Ogun East and Ogun West) and four Geo-Political Zones

(GPZs) i.e. Yewa-Awori, Egba, Ijebu and Remo) with five main ethnic groups namely, Egba, Ijebu, Egbado, Awori and Egun. The main occupations are Farming, Textile production (tie and dye), Fishing, Trading, Civil Servant, Public Servant and Pottering.

It has an area of 16,980.55 Square Kilometres (km^2) of the 196,000 km^2 land area of the South-West Zone of the 192,803.07 km^2 of the Southern Nigeria in overall land area of 937,052.16 km^2 of Nigeria. It has a population of 3,751,140, (1,864,907 Males and 1,886,233 Females).

Selection of Study Sites

Grid Systematic Method was employed in selecting sixteen (16) study centres which comprised two Primary Health Centres (PHCs) from each eight Local Government Areas (LGA) namely, Ado-Odo-Ota (ADT), Imeko-Afon (IMA), Ewekoro (EWK), Odeda (ODD), Ijebu-East (IJE), Ijebu-North (IJN), Odogbolu (ODG) and Remo-North (RMN).

GIS instrument was used to obtained co-ordinates of the PHCs and map was drawn using ArcGIS 9.3 software (Figure 1).

3. CONSENT AND ETHICAL APPROVALS

Ethical approval was obtained from Ethics Committee of Department of Biological Sciences, and Federal Medical Centre Idi-Aba Abeokuta, Ogun State, Nigeria. Permission for study was obtained from Ogun State Ministry of Health and Local Government Service Commission, Abeokuta Ogun State, Nigeria.

A Certificate of approval was obtained from National Agency for Food and Drug Administration and Control (NAFDAC) for import permission for the Plasmotrim-50/200mg (produced by Acino Pharma Ltd Dornacherstrasse 114/ch-4147 Aesch Switzerland) used for the study and multi-centre clinical trial permission to carry out the research.

Communities Ecological and Topographical Patterns Promoting Parasites Transmission Reports

Environmental factors of the communities of participated children were observed and recorded through interview/discussion. The information obtained include environmental/ ecological profiles, settlement, topographic structure, population structure, sewage system, occupation, housing type, sources of information on health care, preventive measure against mosquito, source of drug to the community, factors that worsen malaria problem in the community and role of community in control of malaria.

Data Analysis

The questionnaire were entered in MS excel (MS Excel 2007) and analyzed using SPSS version 20 (IBM SPSS Incorporation). Frequencies and percentages were used to compare number of participants associated with a study variable. Averages and 95% confidence interval (CI) were used for summarizing of results.

Pearson's Chi-square test, Pearson's R and Spearman correlation (r) were used to test for an association. A *p*-value of < 0.05 was regarded as significant association between the

variables. Maps of communities of participated children were drawn using ArcGIS 9.3 software.

4. RESULT

GIS Map of Communities of Participated Children across the GPZs

The co-ordinates of communities of participated children (Figure 2-5) showed an overall total of 183 communities comprising 36(19.7%) communities in Egba GPZ, [19(10.4%) communities from Ewekoro LGA {PHC, Itori- 11(6.0%) and PHC, Elere-Adubi- 8(4.4%)} and 17(9.3%) communities from Odeda LGA {PHC, Ilugun- 8(4.4%) and PHC, Alabata-9(4.9%)}]. In yewa-awori GPZ, a total of 56(30.6%) communities participated, comprising 27(14.8%) communities from Ado-Odo-Otta LGA [PHC, Alapoti- 14(7.7%) and PHC, Ado-Odo- 13(7.1%)] and 29(15.8%) communities from Imeko-Afon LGA [PHC, Imeko- 16(8.7%) and PHC, ilara- 9(7.1%)]. In Remo GPZ, a total of 43(23.5%) communities participated, comprising 14(7.7%) communities from Odogbolu LGA [PHC, Ososa- 8(4.4%) and PHC, Mobalufon- 6(3.3%)] and 29(15.8%) communities from Remo-North LGA [PHC, Ipara- 14(7.7%) and PHC, Ajana- 15(8.1%)]. In Ijebu GPZ, a total of 48(26.2%) communities participated, comprising 28(15.3%) communities from Ijebu-North LGA [PHC, Obada- 16(8.7%) and PHC, Ibipe- 13(6.6%)] and 20(10.9%) communities from Ijebu-East LGA [PHC, Odoladalepo- 9(4.9%) and PHC, tonigbo- 11(6.0%)].

Preventive Measures Adopted Against Malaria Disease in the Communities

On preventive measures adopted against malaria disease for children under study (Figure 6), analysis of data showed that the use of herbs (87.1%) were more with least result obtained with environmental/personal hygine (34.5%) across all the LGAs.

There was a significant (p = 0.011) difference between preventive measures against malaria adopted for children across LGAs.

Physical Environmental Practices Promoting Malaria Parasites Transmission in the Study Areas

Malaria (73.4%) and Chill and Cold (72.9%) were common illnesses in their family and they mostly received information from government and private organisations about treatment and prevention of malaria disease through their Hospital/Clinic (93.3%) and Radio (84.6%).

They confirmed that malaria parasites could be transmitted (90.4%) through bites from infected mosquitoes (98.6%).

Parents believed that malaria can be prevented (78.1%) if people adopted weeding of surroundings regularly (85.0%) and use of insecticide sprays (76.4%), since bushes/uncultivated land (76.4%) and stagnant water (78.2%) are found around their houses/environments.

Bushes, presence of broken or unused bottles and cans around house (84.9%) and impact of dams, construction, and irrigation (79.2%) commonly worsen malaria parasites transmission in the communities.

Involvement in environmental management/sanitation as part of control measure (78.0%), can mostly help in tackling the adverse effects of malaria parasites transmission (Table 1).

Parents Knowledge on Vector (Mosquitoe) and use of ITN/LLITN

Analysis of data on parents knowledge on vector (mosquitoe) (Table 2) showed that they had experience mosquito bites (98.8%) in their areas, mostly at night (97.3%), outdoor (86.9%) and indoor (86.4%) and described mosquito bites harmful (100%). They also agreed that mosquitoes breed majorly in stagnant water (77%) and Ponds (74.6%).

The windows and doors of theirs houses were not screened with the mosquito wire gauze (69.9%). Dispose of all containers likely to hold water (78.9%) and clearing of bushes along water banks (70.7%) were described as main actions to inhibit mosquito breeding.

Some of the participated parents have heard, own and use (59.9%) ITN/LLITN at home and 59.6% of their children who are less than five years old slept under ITN/LLITN. The most advantage of children sleeping under the ITN/LLITN was that it reduces the burden of malaria on them (74.6%).

Parents revealed that they did not always use (54.4%) their ITN/LLITN and their family mostly used ITN/LLITN during rainy season (84.4%).

Communities Ecological and Topographical Patterns Promoting Parasites Transmission Observed

Fresh-water Rain Forest (44.3%) and Lowland Rain Forest (43.2%) are common forest vegetation types. Communities having plains topographical structure were more (91.3%).

Communities have close/compact (54.6%) type of settlement and are more densely populated (51.9%). Water bodies present are small rivers (100%).

House type common in the communities was mud with iron sheets (100%) and drainage system (36.2%) was not common (Table 3).

5. DISCUSSION AND CONCLUSIONS

Participated parents have observed the impact of environment in malaria parasites infection with need to adopt necessary preventive measures. This result was in line with previous reports on preventive measures and environment factors associated with malaria parasite transmission in the rural and urban communities of Ogun State (Adeneye *et al.,* 2013; Atulomah *et al.,* 2014), other state of Nigeria (Okwa *et al.,* 2013; Adeyemo *et al.,* 2014; Adebayo *et al.,* 2015) and Africa countries (Kassile, 2012; Dhawan *et al.,* 2014).

The participated communities' member revealed previous knowledge on vectors (mosquitoes) and environmental practices in preventing vectors. Correspond results on preventive measures among people of Ogun State had been reported (Adeneye *et al.,* 2013; Atulomah *et al.,* 2014) and in other parts of Nigeria (Bawa and Auta 2014; Adebayo *et al.,* 2015) and Africa (Dhawan *et al.,* 2014; Sikala *et al.,* 2014).

Participated communities member have heard, own and use of ITN/LLITN at home for their. The obtained result is an indication of awareness on the use of ITN/LLITN. The correspond results of the use, ownership and andvantage of ITN/LLITN among people of Ogun State had been reported previously (Atulomah *et al.,* 2014; Runsewe-Abiodun and Adekunle, 2014) and in other parts of Nigeria (Awosan *et al.,* 2013; Adeyemo *et al.,* 2014; Adebayo *et al.,* 2015), Africa (West *et al.,* 2012; Desrocher *et al.,* 2014) and other parts of the world (Burgert *et al.,* 2014; Noriko *et al.,* 2014; Sikala *et al.,* 2014).

The result on communities' ecological and topographical patterns aiding parasites transmission observed is an evidence of Ogun State in tropical rain forest zone of Nigeria (Dery *et al.*, 2010; Omonijo and Matzarakis, 2011) and an evidence of proximity to malaria vector which may lead to transmission of malaria parasites and this had been reported previously (Ayeni, 2011; Ominijo *et al.*, 2011).

References

[1] Adebayo, A.M., Akinyemi, O.O. and Cadmus, E.O. (2015). Knowledge of Malaria Prevention among Pregnant Women and Female Caregivers of under-five Children in Rural Southwest Nigeria. *PeerJ*, 3: e792.

[2] Adeneye, A.K., Jegede, A.S., Mafe, M.A. and Nwokocha, E. E. (2013). Community Perceptions and Home Management of Malaria in Selected Rural Communities of Ogun State, Nigeria. *International Journal of Malaria Research and Reviews*, 1(3): 22-34.

[3] Adeyemo, M.O.A, Oluwatosin, O.A., Amodu, O.K. and Taofeeq, Y.O. (2014). Home Management and Prevention of Malaria among Under-Five Children: Experiences of Mothers in a Nigerian Local Government Area. *African Journal Biomedical Research*, 17: 83-91.

[4] Ajayi, I.O., Afonne, C., Dada-Adegbola, H. and Falade, C.O. (2015). Prevalence of Asymptomatic Malaria and Intestinal Helminthiasis Co-infection among Children Living in Selected Rural Communities in Ibadan Nigeria. *American Journal of Epidemiology and Infectious Disease*, 3(1): 15-20.

[5] Ajayi, I.O., Jegede, A.S., Falade, C.O. Sommerfeld, J. (2013). Assessing Resources for Implementing a Community Directed Intervention (CDI) Strategy in Delivering Multiple Health Interventions in Urban Poor Communities in Southwestern Nigeria: a Qualitative Study. *Infectious Diseases Poverty* 2(1): 25

[6] Amoran, O.E. (2013). Impact of health education intervention on malaria prevention practices among nurses mothers in rural communities in Nigeria. *Nigeria Medical Journal*, 54(2): 115-122.

[7] Anyorigiya, T. (2010). Home Management of Acute Febrile Illnesses in Northern Ghana using Artesunate-Amodiaquine Combination: the Role of Rapid Malaria Diagnostic Testing and Respiratory Rate Counting. In: 59th American Society of Tropical Medicine and Hygiene Congress, Atlanta, Georgia.

[8] Atulomah, B.C. and Atulomah, N.O. (2012). Health Literacy, Perceived-Information Needs and Preventive-Health Practices among Individuals in a Rural Community of Ikenne Local Government Area, Nigeria. *Ozean Journal of Social Sciences* 5(3): 95-104.

[9] Atulomah, E.T., Farotimi, A.A. and Atulomah, N.O. (2014). Knowledge, Attitude and Practice of Malaria Prevention among Expectant Mothers attending Ante-Natal Clinic at OOUTH Sagamu, Ogun State. *ActaSATECH*, 5(1): 9-25.

[10] Awosan, K.J., Ibrahim, M.T.O., Alayande, M.O., Isah, B. A., Yunusa, E. and Mahmud, M.B. (2013). Prevalence and Barriers to the Use of Insecticide Treated Nets among Pregnant Women attending Ante-Natal Clinic at Specialist Hospital Sokoto, Nigeria. *Journal of Public Health and Epidemiology*, 5(10): 416-420.

[11] Ayeni, A.O. 92011). Malaria Morbidity in Akure, Southwest Nigeria: A Temporal Observation in a Climate Change Scenario. *Trends in Applied Sciences Research,* 6: 488-494.

[12] Bawa, J.A. and Auta, T. (2014). Prevalence of Malaria: Knowledge, Attitude and Cultural Practices of Pregnant Women in Katsina Metropolis, Nigeria. *European Scientific Journal*, 10: 21.

[13] Burgert, C.R.S., Bradley, E.K., Arnold, F. and Eckert, E. (2014). Improving Estimates of Insecticide Treated Mosquito Net Coverage from Household Surveys: using Geographic Coordinates to Account for Endemicity. *Malaria Journal,* 13: 254.

[14] Chanda, E., Hemingway, J., Kleinschmidt, I., Rehman, A.M., Ramdeen, V., Phiri, F.N., Coetzer, S., Mthembu, D., Shinondo, C.J., Chizema-Kawesha, E., Kamuliwo, M., Mukonka, V., Baboo, K.S. and Coleman, M. (2011). Insecticide Resistance and the Future of Malaria Control in Zambia. *PLoS One*, 6: e24336.

[15] Dery, D. B., Brown, C., Asante, K.P., Adams, M., Dosoo, D. and Amenga-Etego, S. (2010). Patterns and Seasonality of Malaria Transmission in the Forest-Savannah Transitional Zones of Ghana, *Malaria Journal*, 9: 314-321.

[16] Desrochers, R. Kendra Siekmans, E., Berti, P.R., Bramhill, K., Buchan, S.A.W., Battah, G.K., Gbetoglo, D., Vignikin, K. and Sabino, A. (2014). Effectiveness of Post-Campaign, Door-To-Door, Hang-Up, and Communication Interventions to Increase Long-Lasting, Insecticidal Bed Net Utilization in Togo (2011–2012): A Cluster Randomized, Control Trial. *Malaria Journal*, 13: 260.

[17] Dhawan, G. Joseph, N., Pekow, P.S., Rogers, C.A., Poudel, K.C. and Bulzacchelli, M.T. (2014). Malaria-related Knowledge and Prevention Practices in Four Neighbourhoods in and around Mumbai, India: A Cross-Sectional Study. *Malaria Journal*, 13: 303.

[18] Kassile, T. (2012). Prevention and Management of Malaria in Under-Five Children in Tanzania: A Review. *Tanzania Journal of Health Research,* 14: 14.

[19] Lemma, H. et al. (2010). Deploying Artemether-Lumefantrine with Rapid Testing In Ethiopian Communities: Impact on Malaria Morbidity, Mortality and Healthcare Resources. *Tropical Medicine and International Health*, 15: 241-250.

[20] Noriko, W.A., Kaneko, S.Y., Hope, L.G., Taleo T., Tanihata J., Koji, L. and Peter, S.L. (2014). Determinants of the Use of Insecticide-Treated Bed Nets on Islands of Pre and Post-Malaria Elimination: An Application of the Health Belief Model in Vanuatu. *Malaria Journal*, 13: 441.

[21] Okwa, O.O. (2013). The Current Trends in Integrated Prevention and Control of Malaria. A Case Study of Some Nigerian Communities. *Global Advanced Research Journal of Medicine and Medical Sciences*, 2(5): 104-107.

[22] Omonijo, A.G. and Matzarakis, A. (2011a). Climate and Bioclimate Analysis of Ondo State, Nigeria, *Meteorologische Zeitschrift-Accepted for Publication*.

[23] Omonijo, A.G., Matzarakis, A., Oguntoke, O. and Adeofun, C.O. (2011b). Influence of Weather and Climate on Malaria Occurrence Based on Human-Biometeorological Methods in Ondo State. *Nigeria Journal of Environmental Science and Engineering*, 5: 1215-1228.

[24] Remme, J.H. et al. (2010). Community-Directed Interventions for Priority Health Problems in Africa: Results of a Multicountry Study. *Bulletin of the World Health Organization*, 88: 509-518.

[25] Runsewe-Abiodun, I.T. and Adekunle, D.A. (2014). Ownership of Bed Nets and Use by Children below 5 Years in Sagamu Local Government Area of Ogun State, Nigeria. *International Journal of Tropical Disease and Health*, 4 (9).

[26] Sikaala, C.H. Chinula, D., Chanda, J., Hamainza, B., Mwenda, M., Mukali, I., Kamuliwo, M., Lobo, N.F., Seyoum, A. and Killeen, G.F. (2014). A Cost-Effective, Community-Based, Mosquito-Trapping Scheme that Captures Spatial and Temporal Heterogeneities of Malaria Transmission in Rural Zambia. *Malaria Journal*, 13: 225.

[27] Tiono, A. et al. (2010). Role of Rapid Diagnostic Testing for Malaria in the Context of Home Management of Childhood Fevers: An Open Randomized Controlled Trial in a Rural and Seasonal Malaria Transmission Area of Burkina Faso. In: 59th American Society of Tropical Medicine and Hygiene Congress, Atlanta, Georgia.

[28] World Health Organization, (2009). Parasitological Confirmation of Malaria Diagnosis. Geneva, World Health Organization.

[29] Anil Pawar, Sandeep Kumar. An Analytical Review on Inter-relationships Between Climate Change and Malaria Transmission. *World News of Natural Sciences* 11 (2017) 1-4

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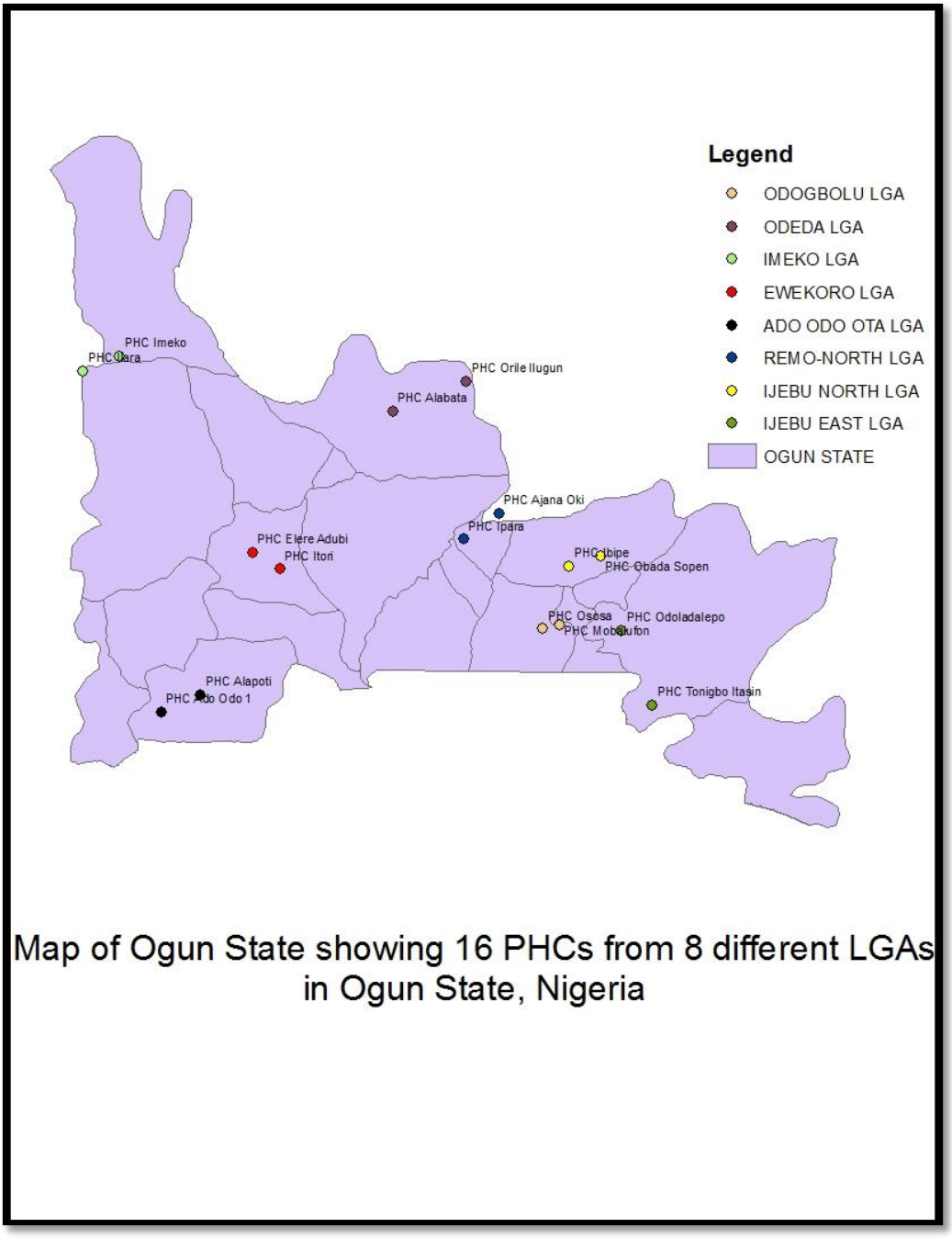

Figure 1. Map of Ogun State Showing the Selected LGAs and their PHCs Used for the Study.

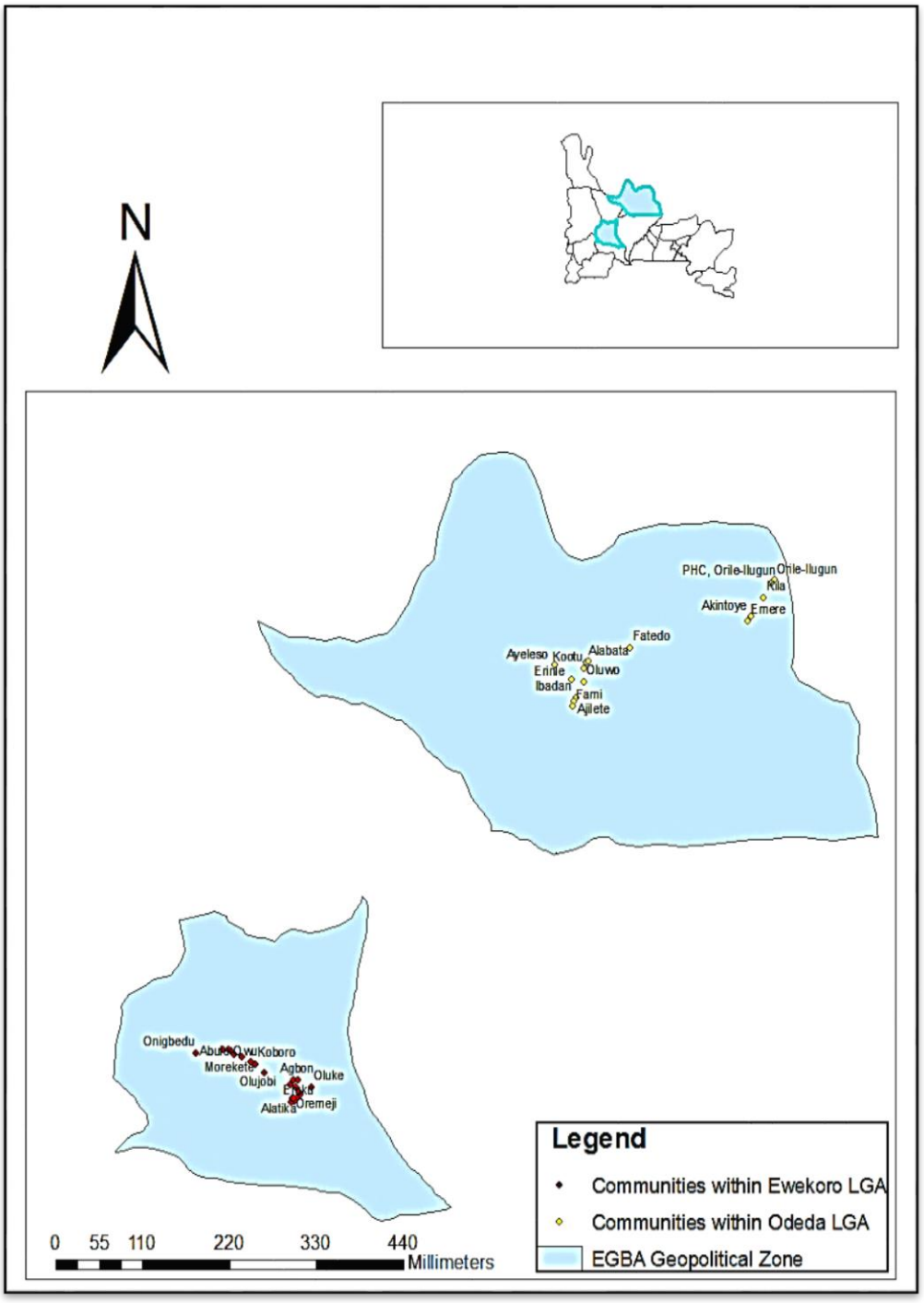

Figure 2. GIS Map of Communities of Participated Children in Egba Geo-Political Zone (Ewekoro and Odeda LGAs).

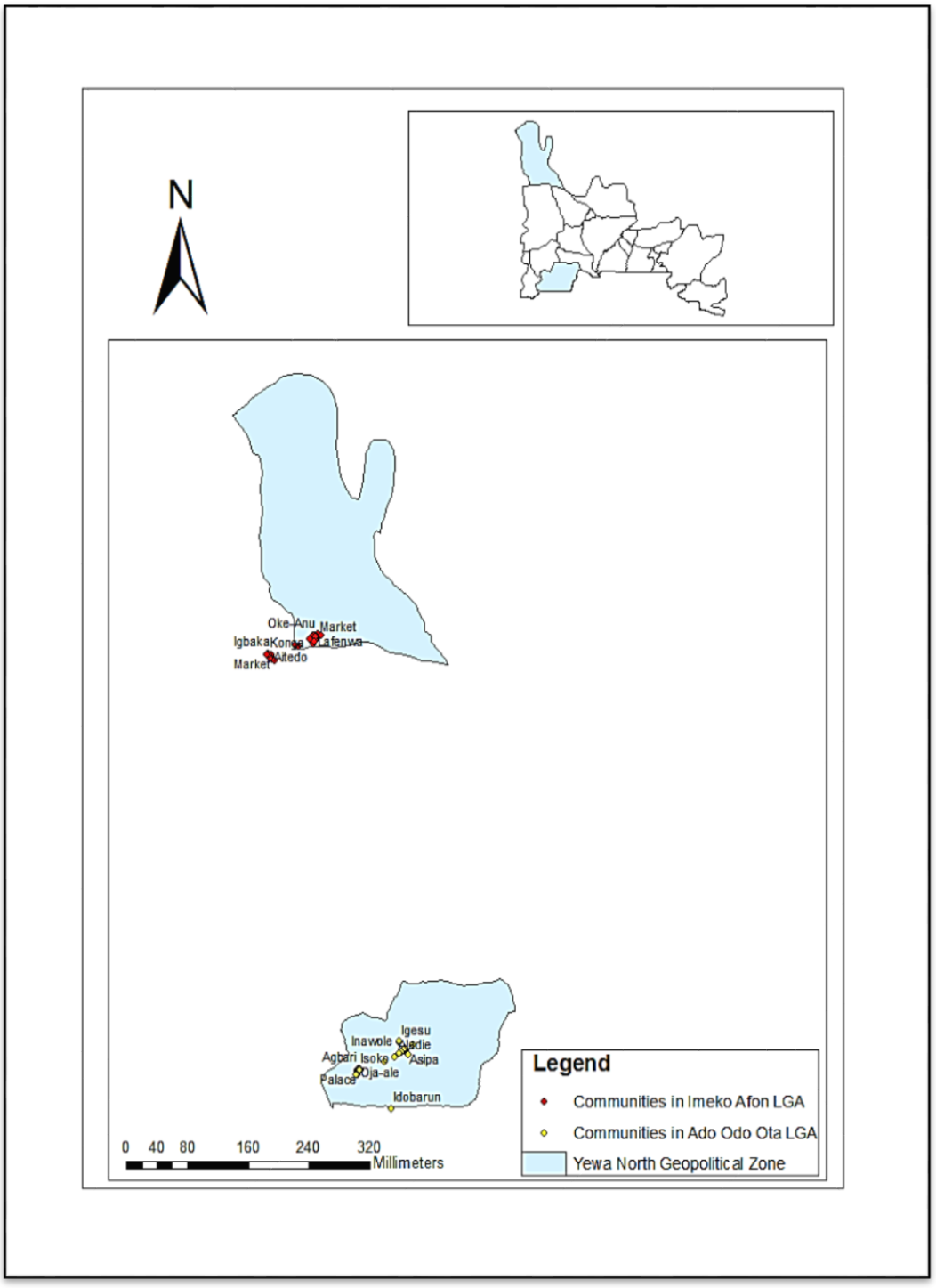

Figure 3. GIS Map of Communities of Participated Children in Yewa-Awori Geo-Political Zone (Imeko-Afon and Ado-Odo-Otta LGAs).

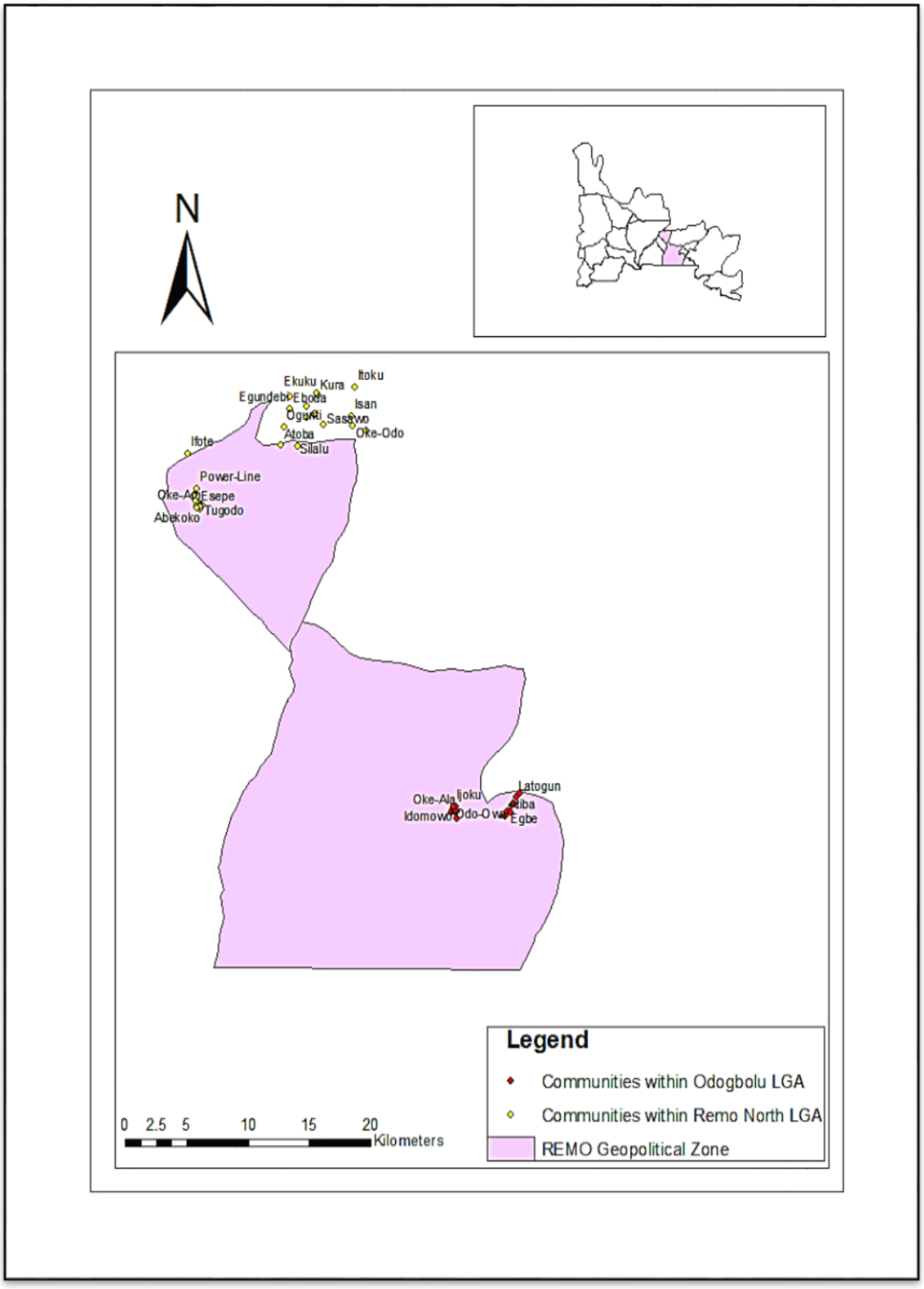

Figure 4. GIS Map of Communities of Participated Children in Remo Geo-Political Zone (Odogbolu and Remo-North LGAs).

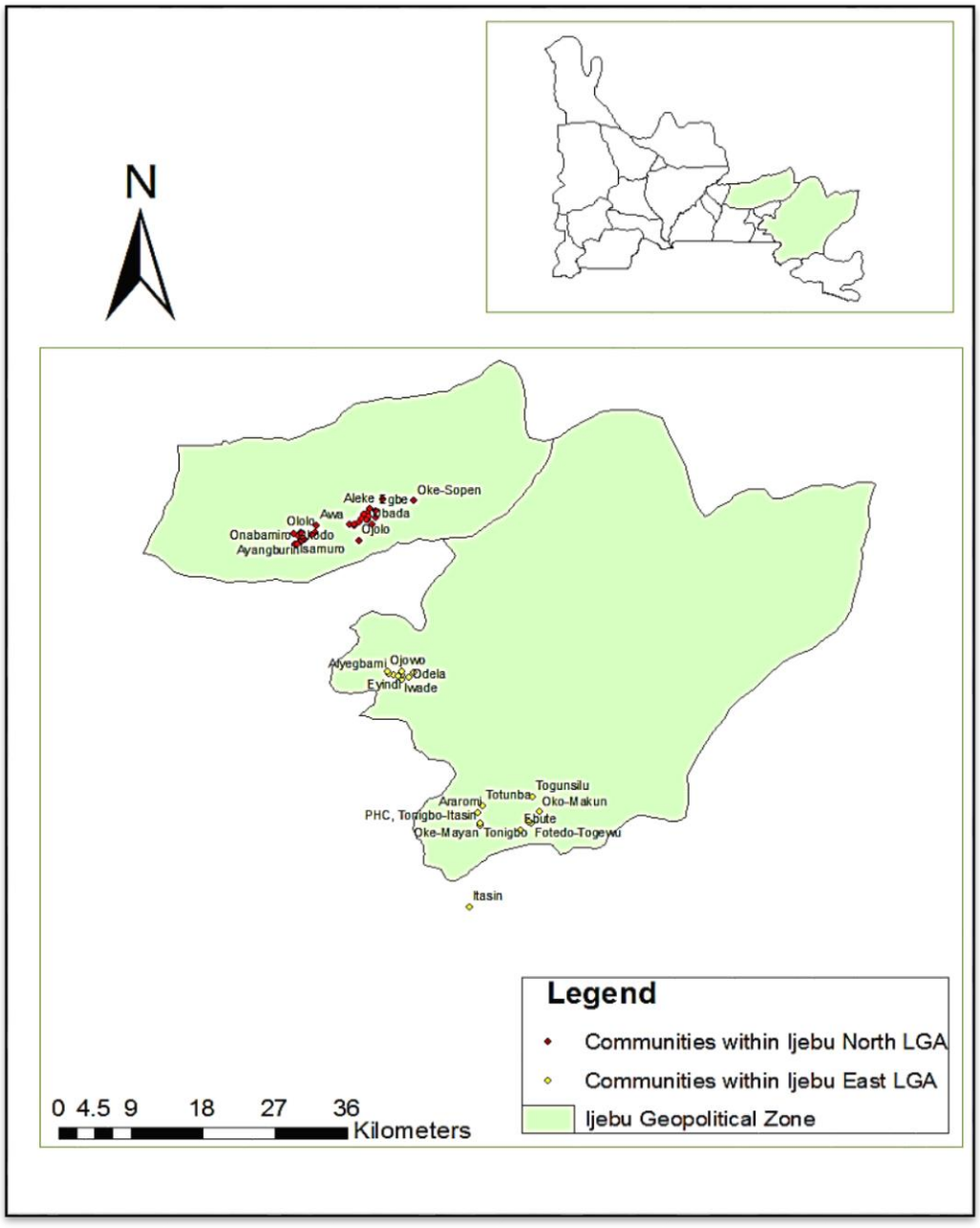

Figure 5. GIS Map of Communities of Participated Children in Ijebu Geo-Political Zone (Ijebu-North and Ijebu-East LGAs)

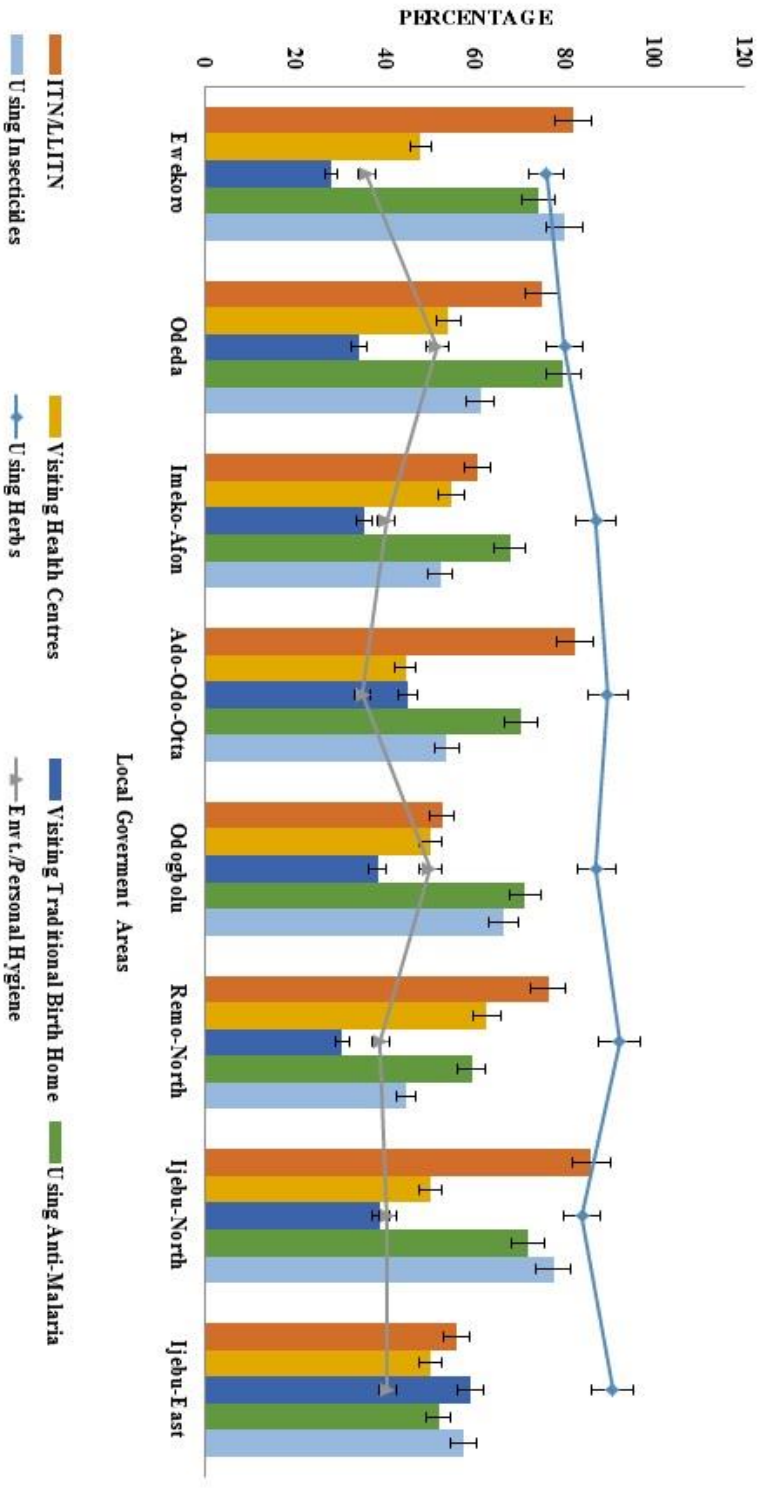

Figure 6. Preventive Measures of Malaria adopted for Children in the Study Areas

Table 1. Physical Environmental Factors Promoting Malaria Parasites Transmission in the Study Areas

Parameters		Total (%)
What is/are common illness (es) in your family?		
Malaria		664(73.4)
Diarrhoea		216(23.9)
Fever		802(88.6)
Yellow urine		259(28.6)
Chill and cold		660(72.9)
How did you received information on treatment and prevention of malaria		
Radio/Television		766(84.6)
Hospital/Clinic		844(93.3)
Magazine		318(35.1)
Community health worker		485(53.6)
Market		308(34.0)
Did you think malaria can be transmitted?	Yes	818(90.4)
	No	87(9.6)
How is malaria disease been transmitted?		
Bite from infected mosquitoes		892(98.6)
Contact between two people		0(0)
Drinking contaminated water		13(1.4)
Can malaria be prevented?	Yes	707(78.1)
	No	198(21.9)
How can you prevent malaria parasites transmission in your community?		
Draining and cleaning of choked gutters/cans		612(67.6)
Using of insecticide sprays		691(76.4)
Weeding surroundings regularly		769(85.0)
Which of the following is/are found around your house/environment?		
Old tires, Containers, and Ponds		52(47.3)
Farming activities		62(56.4)
Stagnant water		86(78.2)
Sewage/Pit		70(63.6)
Drainages		76(69.1)
Bushes/uncultivated land		84(76.4)
What do you think is/are the potential factors which worsen malaria disease in your community?		
Poverty		613(67.7)
Lack of proper sanitation		658(72.7)
Impact dams, construction, and irrigation		717(79.2)
Poor drainage/sewage system		513(56.6)

Bush, presence of broken or unused bottles cans around house	769(84.9)
What is/are the role(s) of community in controlling of malaria parasites transmission	
Involvement in environmental management	706(78.0)
Supporting the role of health workers	498(55.0)
Fund control programs	497(54.9)

Table 2. Parents Attitude and Practices on Vectors (Mosquitoes), Environmental Practices and Vector Preventive Measures (ITN/LLITN)

Parameters		Total N(%)
ATTITUDE AND PRACTICES ON VECTOR		
Do you experience mosquito bite in your area?	Yes	894(98.8)
	No	11(1.2)
If yes, when		
Morning		568(62.8)
Afternoon		72(8.0)
Night		881(97.3)
Indoor		782(86.4)
Outdoor		786(86.9)
Do you find mosquito bite harmful?	Yes	905(100)
	No	0(0)
Where do you think mosquitoes breed?		
Stagnant water		96((87.3)
Ponds		86(78.2)
Drainages		52(47.3)
Bushes		72(65.5)
Are the windows and doors of your house screened with the mosquito wire gauze	Yes	24(21.8)
	No	86(78.2)
Which of the following actions do you perform to inhibit mosquito breeding around your house?		
Drain any accumulation of water around the house.		76(69.1)
Clear bushes along water banks		80(72.7)
Dispose of all containers likely to hold water		80(72.7)
Keep water containers covered		42(38.2)
ATTITUDE AND PRACTICES ON USE OF ITN/LLITN		
Have you heard, own and use of Insecticide Treated bed Net (ITN/LLITN)?	Yes	542(59.9)
	No	363(40.1)
Did your child/Children who is/are >5 years Age slept under ITN?	Yes	366(40.4)
	No	539(59.6)

What do you think are the advantages of children sleeping in the ITN/LLITN? It:	
reduce the burden of malaria on them	675(74.6)
help save money for other purposes	566(62.5)
child sleeps better	647(71.5)
saves time from visiting the hospital	545(60.2)
Do you personally use your ITN/LLITN?	
Always	413(45.6)
Not always	492(54.4)
In which season of the year does the family use the ITN/LLITN	
Rainy	764(84.4)
Dry	183(20.2)
Throughout	614(67.8)

Table 3. Ecological and Topographical patterns aiding parasites transmission.

Ecological and Topographical patterns	Total (%)
Forest vegetation type	
Woodland forest	1(0.5)
Lowland rain forest	79(43.2)
Freshwater rain forest	81(44.3)
Mangrove forest	0(0)
Mountain forest	17(9.3)
Plantation forest	2(1.2)
Topographical structure present	
Mountain	0(0)
Hill	16(8.7)
Plains	167(91.3)
Type of settlement present in the community	
Close/Compact	100(54.6)
Scattered/Dispersed	2(1.2)
Cluster/Nucleated	45(24.6)
Linear	29(15.8)
Ring	0(0)
Hamlet	8(4.4)
Population structure	

Densely	95(51.9)
Scattered	45(24.6)
Fewer	43(23.5)
Type of water body present	
Big river	13(7.1)
Small river	183(100)
Pond	1(1.1)
Lake	0(0)
Swamp	0(0)
Drainage system present in the community	
Gutter	64(34.9)
House Drainage	51(27.9)
None	66(36.2)
House type present in the community	
Mud with thatch	68(37.2)
Mud with iron sheets	183(100)
Bricks with thatch	3(1.6)
Bricks with iron sheets	179(97.8)