Insecticide-Treated Net Utilization And Associated Factors Among First-Time Young Pregnant Women Attending Antenatal Care In Kwale County, Kenya

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Abstract

Background: Malaria remains an indirect leading cause of maternal, perinatal and neonatal morbidity and mortality in sub-Saharan Africa. According to WHO, 2015 (1)" Insecticide-treated nets (ITNs) are a proven preventive intervention, yet their utilization among vulnerable groups such as first-time young pregnant women is often suboptimal. Primigravid, adolescent' women are most susceptible to malaria because they do not possess natural immunity malaria. In the absence of pregnancy-specific interventions, approximately 45% would be exposed to malaria facing higher risks of eclampsia, puerperal endometritis, infections and children of young mothers face increased risks of low birth weight, preterm birth and severe or serious neonatal conditions.

Methodology: Descriptive research design was used as it was appropriate; it allows for generalization to larger populations, it provided an opportunity to probe and give an in-depth comprehension of ITN utilization at a point in time. The study population was first-time pregnant women attending antenatal care in Lunga Lunga and Msambweni sub-counties. The expected number of pregnant women in this cohort is 7,309, The actual number of pregnant women aged 10-24 years offered antenatal services in the last quarter in the selected facilities was 455 KHIS, 2024 (2) data cumulative for the 6 facilities this will be the target population (N) since this is a reducing indicator.

Sample size determination was conducted through Fisher's et al. formulae according to Kothari CR, 2004 (3) giving a sample size of 126 respondents. Six public health facilities were purposively selected from Lungalunga and Msambweni sub counties. The 126 first time young pregnant women were randomly and conveniently selected to participate in the study as they were attending their antenatal clinic during the study. The data collection was carried out using a structured interviewer-administered questionnaire. A randomly selected number of the young pregnant women based on proximity to their homes were followed to their homes to complement the responses of the structured interview administered questionnaire.

Data was collected using an ODK tool – kobo tool box to manage interface and quality checks. Responses were summarized and computed in percentages, determining the rate of ITN use under demographic and health system factors. In data analysis, descriptive statistical tools like frequency distribution and data visualization tools like bar graphs and pie charts were employed to analyze quantitative data where R for both Chi-Square and fisher's exact test was employed to determine relationships, test association and multivariable logistic regression model was applied to analyze quanlitative data.

Results: the study showed that only 58% of the first time young mothers utilize ITN. A large portion of the ITN users were aged 20–24 years (68.5%), with lower utilization observed among young age groups 3.5% in 10-19 years. Urban residents made up a significant portion (82.2%) of users compared to rural dwellers. On the level of education, the ones with secondary education accounted for the highest usage (68.5%), followed by tertiary (17.8%) and primary levels (13.7%). For Chi-square and exact Fisher's, the age, educational level, income level and residence emerged as one of the most influential variables with a p value of (P< 0.0001). This substantial association suggests that ITN usage pattern differ markedly across age cohorts, educational attainment, financial capacity and different geographical factors. In a logistic regression model age, education level and socioeconomic status (SES) were linked with an increase in ITN usage.

In health system factors; most respondents (93.2%) reported ITNs were very available at health facilities. A majority (84.9%) received community education on ITNs, and 84.9% were engaged in community health activities. Access barriers to ITNs were low (12.3%), and cost was split fairly between free and paid (49.3% vs. 50.7%). The results from chi-square and Fisher's exact analysis revealed that availability of ITN (p<0.0001)

and access barriers (p<0.0001) demonstrated near-identical strength, highlighting supply-chain and affordability as critical bottlenecks. Healthcare providers (HCP) advice (p<0.0001) and cost (p<0.0001) were also pivotal, while community engagement (p<0.0001) had a smaller but significant effect. Conversely, general ITN information campaigns (p>0.05) and health system approaches (p>0.05) showed negligible impact.

In logistic regression, the strongest candidates are ITN availability, access barriers HCP advice cost and community education. These variables were selected due to their extreme statistical significance (p<0.001), and direct relevance to health system interventions

Discussion

The study found moderate ITN utilization among first time young pregnant women in Kwale County. Age, income, education and area of residence were strong predictors, highlighting the importance of youth responsive services, community sensitizations and education on importance of pregnant women sleeping under treated mosquito nets, community outreaches focusing on adolescents to reach the hard to reach areas, the findings were similar to Kenya malaria indicators survey 2020 (4).

Conclusions:

This paper reveals that ITN utilization among young first time pregnant women is still low at 58% below the WHO recommendation of above 80%. Key in the influencers identified included age, area of residence (urban and rural setting), socio-economic status, education attainment, family status, number of people in the household in the demographic realm, and presence of access barriers to ITNs from varied sources, cost, presence of qualified health care providers to address ITN concerns and community education under the health system realm were in the final statistical model influencing ITN utilization.

Recommendations: *Future research to build up this study and address the limitations in this study, intensify malaria prevention education, and appropriate mechanisms be put in place to improve accessibility and availability of ITNs to pregnant women.*

Key Words

Adolescence *refers to ages from 10 to 19. It is a stage of human being development and an important time for laying the foundations of good health RH policy, 2022 (5).*

Teenage *Age between 13 and 19 Years old.*

Young People *cover the age range 10-24 years.*

Primgravida *refers to a woman who is pregnant for the first time*

Placental malaria *primary approach through which malaria in pregnancy causes adverse perinatal outcomes.*

I. Introduction

There are 11,617,890 (22.2%) adolescents' ages 10-19 years in Kenya. Adolescents in Kenya experience severe challenges in life and their general health particularly in relation to their sexual and reproductive health (5). Poor SRH outcomes in adolescents lead to long-term adverse effects on health, wellness and productivity (6). Although adolescence is considered a period when an individual should enjoy a healthy life, many teenagers die prematurely while others suffer long-term health complications because of preventable or treatable causes, such as teenage pregnancies and HIV/AIDS. Worldwide, adolescent pregnancy, also referred to as teenage pregnancy, is inclusive of teenage girls who become pregnant before reaching 20 years of age, whether they are single or married (6).

Nearly 12 million young girls aged 15-19 years and at least 777 000 girls under the age of 15 years get pregnant and as a results giving birth each year in developing countries. Health problems related to pregnancy and childbirth are among the leading causes of death for girls aged 15–19 years globally. One of the specific targets of the health Sustainable Development Goal (SDG 3) is that by 2030, the world needs to ensure universal access to proper sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programs. Malaria is a component of interest in the SDG 3.3 target to combat epidemics like malaria by 2030, (7).

Insecticide-treated nets (ITNs) are the most powerful and high impact interventions which prevent bites while people sleep and aimed at killing mosquitoes as they try to feed. (7). The ITN was developed in the year 1940, and as such it has been an important aspect of global and national malaria control policies since the mid-1990s. Despite these efforts, coverage is still unacceptably low within the implementing countries, one decade down the line; only about 20% of pregnant women. Malaria in pregnancy is still high, and maternal and fetal mortalities from its complications are still high. (8). Insecticide-treated nets (ITNs) are widely used tools that have been proven to be very effective in preventing and controlling malaria. However, usage varies across households and can greatly impact the benefits of ITNs.

According to Schantz-Dunn J, 2021(9) Primigravid women are highly susceptible to malaria since they do not possess natural immunity malaria. It is assumed that in the nonexistence of pregnancy specific interventions, nearly 45% of pregnant women in Africa would be exposed to malaria, and almost half would develop placental malaria. Adolescent mothers (aged 10–19 years) face higher risks of puerperal endometritis, eclampsia and systemic infections than women aged 20–24 years, and babies of young adolescent mothers often face higher risks of low birth weight, preterm birth and severe neonatal condition (10,11,12,13,14)

According to WHO, 2015 (15), Malaria in pregnancy accounts for up to 900,000 Low Birth Weight deliveries annually and over 100,000 infant deaths in Africa. Research has demonstrated that ITN usage in malaria endemic areas can reduce malaria-related deaths by about 20% preventing the adverse outcome of malaria during pregnancy.

According to (15) globally, around 228 million incidences and 405,000 malaria attributed deaths were reported, with Africa accounting to 93% of cases and 94% of deaths. The proportion of pregnant women sleeping under ITN has increased considerably between 2000 and 2021, from 3 to 53%. However, overall use of ITNs has continued to decline in Sub Saharan Africa at 64%. According to DHS data 2011-2022(16), the overall usage of ITN by pregnant mothers in East Africa was about 47.05%

In Kenya, according to the KMIS 2020 (4), the number of pregnant mothers who slept under ITN increased from 41% in 2010 to 58% in 2015 before decreasing to 40% in 2020. According to KDHS 2022, 45 % of pregnant mothers slept under an ITN the night before the survey. The use of ITN in coastal endemics counties is at 57% while Kwale County the use of ITN among pregnant women was at 51%, KMIS 2020 (4). Despite issuing ITNs to pregnant women and mass net distribution, the ITN use among pregnant women is still low with cases of pregnancy related malaria and its complications still being reported.

II. Methods

Study design and target population: Descriptive research design was adopted as it was appropriate, it allows for generalization to larger populations, it provided an opportunity to probe and give an in-depth comprehension of ITN utilization at a point in time. The target population was all first-time young pregnant women in Kwale County, Kenya while the study population was all the first time young pregnancy women attending antenatal care in lungalunga and msambweni sub counties, Kwale County during the study period which was 455, based on the previous quarter attendance for first antenatal care of the same cohort.

Study area: The study was carried out in lungalunga and msambweni sub-counties, Kwale county, Kenya. The county has an estimated population projection of 1, 085,750 2023/2024 with 50.50%: 49.50% male: female ratio (17). Major diseases in the county include: NCDs, HIV, and malaria, it being a malaria endemic region. Service provision status is quite acceptable to the county has 6 hospitals, 12 health centers and 159 dispensaries with an annual estimated pregnant women of 38,888. Lungalunga and msambweni sub counties were selected because they are bordering waters sources, 100% electronic community health information system, 100% community units' coverage and also records highest numbers of malaria in pregnancy cases in the county 16% and 26% respectively. KHIS, 2024 (4)

Variable: The independent variables, which were demographic characteristics such as; age, gender, occupation, and residence and health care system factors such as availability of ITNs, number of health care providers and health education. The dependent variable was the utilization of insecticide treated nets.

Sampling, Data Collection, and Data Analysis. The two sub counties were conveniently selected because of their characteristics; Msambweni is urban and has a high number of malaria cases and has good accessibility. While Lungalunga is rural, has high number of malaria cases and has 100% community units' coverage and primary care networks. The 6 public health facilities were purposively selected since they are the only public facilities in the two sub counties that provide daily uninterrupted antenatal care.

The first-time young women who are pregnant attending antenatal care in the data collection days were conveniently selected as they came in for antenatal care services and also randomly selected using their ANC numbers for those who were in the group of ANC- young pregnant women group did participate in the study until the sample size was achieved per facility. A sample size of 126 was calculated using the fisher's formula (3), structured interviewer-administered questionnaires were used during data collection.

The inclusion criteria included all young first-time pregnant women were attending antenatal care and had consented to the study, exclusion criteria was those in their second pregnancy and above and those who did not consent to the study.

Data was collected using an ODK tool – kobo tool box and responses were summarized and computed in percentages to determine the rate of ITN use under socio cultural factors, demographic factors, and health system factors. Software used in data analysis; Descriptive statistical tools like, frequency distribution and data

visualization tools like bar graphs and pie charts were employed to analyze quantitative data where R for both CHI-Square and fisher's exact test was used to determine the relationships, test association and multivariable logistic regression model was applied to analyze quanlitative data. Descriptive statistics with chi square at a 95% confidence interval were used to test the association of independent and dependent variables. The variables that had statistically significant association using chi square and Fisher's exact test were subjected to logistic regression to generate the odds ratios. All results were interpreted as significant at a *P* < 0.05.

Ethical and logistical approval: Approval to undertake the research was sought from Kenyatta University Graduate School. Ethical approval was obtained from Kenyatta University Ethics Review Committee. Research Authorization was granted by National Commission for Science, Technology, and Innovation ((NACOSTI/ 9/ 25/ 414661)). Clearance and approval to access health facilities and conduct research was provided by CECM Health and research coordinator Kwale county (KWL/6/5/CEC/39/VOL.1/56). Informed consent to take part in the study was obtained from study respondents. Community entry also included linkage and regular communication with the sub-counties reproductive health coordinators and the research assistants were recruited from the same community to ensure they understand the language and culture dynamics.

III.   Results And Discussion

Proportion of first-time young pregnant women who utilize insecticide treated nets

Out of the 126 participants, 58% reported consisted use of ITN, Higher utilization was observed among the age cohort of 20-24 years at 68.5%.
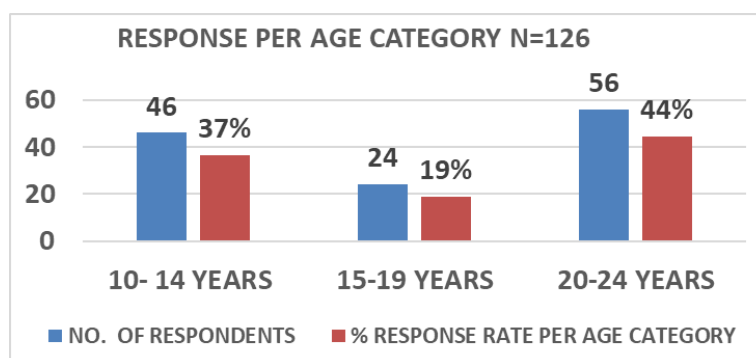

Figure 1 response rate by age category

Figure 1: shows the response rate by age category among the first-time young pregnant women 44% of the respondents were 20-24, 37% were 10-14 and 19% were between 15-19 years.
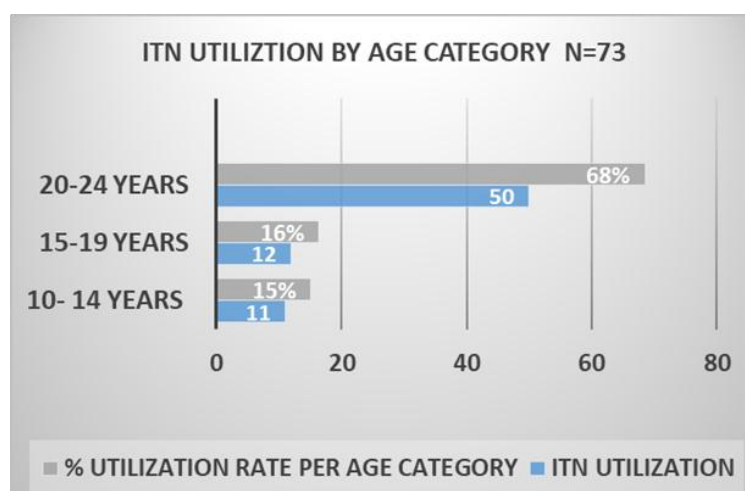

Figure 2 ITN utilization by age category

Figure 2 shows Overall, 73 participants reported ITN use out the 126 participants interviewed 58 % (CI: 49 % - 67 %). (95% CI 48.82, 66.67) of the first-time pregnant mothers confirmed using ITNs during their pregnancy with 80.8% confirming having used an ITN a night before their respective interviews date. In utilization by age 68% were between 20-24 years, 16% 15-19 and 15% were between 10-14 years.

Demographic characteristics influencing the utilization of insecticide treated nets

In demographic characteristics, a large portion of the ITN users were aged 20–24 years (68.5%), with lower utilization observed among younger age groups. Kwale's urban residents made up a significant portion (82.2%) of users compared to rural dwellers at 17.8% (95% CI 18.08, 48.09). On the level of education, the ones with secondary education accounted for the highest usage (68.5%) also influenced due to the highest attained level of education, followed by tertiary (17.8%) and primary levels (13.7%).

The dominant ethnic groups among users were Duruma (41.1%) and Digo (38.4%). Households with 4 people had the highest ITN usage (34.2%), while both smaller and larger households showed lower usage. Most users earned KES 26,000–50,000 (53.4%), and housewives were the largest group by income source (35.6%).

Chi-square and fishers exact tests were used to test for the associations between demographic covariates (such as residence, age, marital status, income level, education level and household size) and ITN utilization.

Table 1 Fishers exact and Chi square test on demographic factors

FACTOR	LEVEL	NO	YES	CHI/FISHERS TEST
AGE	1	35 (76.1%)	11(23.9%)	
	2	12 (50%)	12 (50%)	
	3	6 (10.7%)	50 (89.3%)	45.05(2), P<0.0001*
MARITAL STATUS	1	22(53.7%)	19 (46.3%)	
	2	11 (40.7%)	16 (49.3%)	
	3	11 (29.7%)	26(70.3%	
	4	9(42.9%)	12(57.1%)	4.6(3). P=0.2039
EDUCATIONAL LEVEL	1	4(100%)	0(0%)	
	2	45(81.8%)	10(18.2%)	
	3	3 (5.7%)	50(94.3%)	
	4	1(7.1%)	13 (92.9%)	P<0.0001"*
INCOME SOURCE	1	11(50%)	11(50%)	
	2	6(33.3%)	12(66.7%)	
	3	4(23.5%)	13976.5%)	
	4	10(83.3%)	2(16.7%)	
	5	16(38.1%)	26(61.9%)	
	6	6(40%)	9(60%)	12.21(5),P=0.032
INCOME LEVEL	1	13(68.4%)	6(31.6%)	
	2	28(75.7%	9(24.3%)	
	3	5(11.4%)	39(88.6%	
	4	7(26.9%)	19(73.1%)	42.03(3), P<0.0001*
AREA OF RESIDENCE	1	28(68.3%)	13(331.7%)	
	2	25(29.4%)	60(70.6%)	15.6(1), P<0.0001*
RESIDENCE DURATION	1	8(36.4%)	14(63.6%)	
	2	17(37.8%)	28(62.2%)	
	3	21(44.7%)	26(55.3%)	
	4	7(58.3%)	5(41.7%)	2.07(3), P=0.5584
ETHNICITY	1	18(39.1%)	28(60.9%)	
	2	22(42.3%)	30(57.7%)	
	3	13(46.4%)	15(53.6%)	0.38(2), P=0.8259
RELIGION	1	6(60%)	4(40%)	
	2	29(41.4%)	41(58.6%)	
	3	14(34.1%)	27(65.9%)	
	4	4(80%)	1(40%)	P=0.1486"
MOBILE PHONE ACCESS	1	7(50%)	7(50%)	
	2	46(41.1%)	66(58.9%)	0.12(1), P=0.7257

Nb: Where P Value Is Reported With Symbol (") It Denotes Fishers Exact Test Was Used

Table 1 shows age, income level, and educational level are of residence emerged as the most influential variables with a p value of (P< 0.0001) this substantial association suggests that ITN usage patterns differ markedly across age cohorts, educational attainment, financial capacity and different geographical factors.

A logistic regression model that incorporates these predictors would allow for: (1) quantification of each factor's independent contribution to ITN usage when controlling other variables, (2) calculation of precise odds ratios to estimate effect magnitudes, and (3) identification of potential interactions with the effects between variables (e.g., whether education modifies the income-usage relationship). Such an analysis would provide actionable insights for targeted intervention strategies, such as focusing educational campaigns on less-educated groups or tailoring distribution programs to specific age cohorts.

The non-significant variables, with their small effect sizes (all V < 0.30), can reasonably be excluded from further modeling to maintain parsimony and enhance model interpretability. This selective approach ensures analytical resources focus on factors that demonstrably influence ITN usage while avoiding overfitting with irrelevant variables. The findings collectively suggest that interventions addressing educational disparities, economic barriers, and age-specific needs in rural areas may prove most effective in improving ITN adoption rates.

Table 2 logistic regression Demographic Factors in ITN Use

Variable	Odds Ratio(95% CI)	P.-value	Significance	Odds Ratio 95_CI	P. value
Intercepts	0.01(0.00-1.30)	0.084		NA	NA
Age	4.80 (1.77-16.62)	0.005	*	NA	NA
Marital status	0.97 (0.42-2.15)	0.932		NA	NA
Education level	8.57 (2.15-48.34)	0.006	*	NA	NA
Income level	3.12 (1.31-9.03)	0.018	*	NA	NA
Area of residence	4.49 (0.63-41.20)	0.145		NA	NA
Duration of residence	2.20 (0.05-0.61)	0.011	*	NA	NA
People in household	0.34 (0.15.062)	0.002	*	NA	NA
ITN use before pregnancy	6.31 (0.86-63.47)	0.082		N/A	N/A
A/C	NA	NA		58.8	
B/C	NA	NA		84.3	
Nagelkerke RA^2	NA	NA		0.646	

Table 2 shows that demographic factors age, marital status, education level, income level, area of residence, number people in a household, duration of residence and ITN use before pregnancy all influence on ITN use. Age, education level and level of income were associated with an increase in ITN usage. On the contrary, an increasing number of people in the household negatively affected ITN usage. ITN use prior to pregnancy positively affected the ITN utilization rate but there was no significant association (p>0.05)

Healthcare systems factors influencing utilization of insecticide treated nets
In health system factors most respondents (93.2%) reported ITNs were very available at health facilities. A majority (84.9%) received community education on ITNs, and 84.9% were engaged in community health activities. Access barriers to ITNs were low (12.3%), and costs were evenly distributed between free and paid (49.3% vs. 50.7%).

ITN usage was high, with 74.0% using them every night and 80.8% using them the previous night. Information on ITNs came mainly from healthcare professionals (83.6%), with social media/radio/TV also key sources. Most ITNs were received as gifts (23.3%) or from health facilities (20.5%).

Health system strengthening approaches, including community meetings and door-to-door campaigns, were seen as sufficient (79.5%). Health education in facilities and mobile/social media platforms were the top sources of information.

These health system summaries suggest that high ITN usage is driven by good availability in health facilities, strong community engagement, and access to free or subsidized ITNs.

Table 3 Fishers exact and Chi square test on health system factors

FACTOR	LEVEL	NO	YES	CHI/FISHERS TEST
MALARIA INFORMATION	1	22(42.3%)	30(57.7%)	
	2	31(41.9%)	43(58.1%)	P=1"
INT PREVIOUS NIGHT	1	0(0%)	14(100%)	
	2	0(0%)	59(100%)	
	3	53(100%)	0(0%)	P<0.0001"*
FREQUENCY USAGE	1	53(100%)	0(0%)	
	2	0(0%)	54(100%)	
	3	0(0%)	13(100%)	
	4	0(0%)	6(100%)	P<0.0001"*
SOURCE OF ITN	1	53(100%)	0(0%)	
	2	0(0%)	15(100%)	
	3	0(0%)	13(100%)	
	4	0(0%)	12(100%)	
	5	0(0%)	17(100%)	
	6	0(0%)	16(100%)	P<0.0001"*
COST OF ITN	1	53(58.9%)	37(41.1%)	
	2	0(0%)	36(100%)	P<0.0001"*
SOURCE OF INFORMATION	1	5(26.3%)	14(73.7%)	
	2	3(27.35)	8(72.7%)	
	3	26(50%)	26(50%)	
	4	19(43.2%)	25(56.8%)	4.29(3), P=0.232

HSS COMMUNITY ENGAGEMENT	1	25(69.4%)	11(30.6%)	
	2	28(31.1%)	62(68.9%)	P<0.0001"*
ITN INFORMATION HCP	1	45(78.9%)	12(21.1%)	
	2	811.6%)	61(88.4%)	P<0.0001"*
ITN INFORMATION HCP FREQUENCY	1	0(0%)	2(100%)	
	2	1(9.1%)	10(90.9%)	
	3	714.3%)	42(85.7%)	
	4	0(0%)	3(100%)	
	5	0(0%)	4(100%)	P=0.8099
ITN HSS APPROACH SUFFICIENT	1	17(53.1%)	15(46.9%)	
	2	36(38.3%)	58(61.7%)	P=0.2076"
AVAILABILITY OF ITN	1	7(100%)	0(0%)	
	2	8(10.5%)	68(89.5%)	
	3	7(70%)	3(30%)	
	4	31(93.9%)	2(6.1%)	P<0.0001"*
ITN ACCESS BARIERS	1	8(11.1%)	64(88.9%)	
	2	45(83.3%)	9(16.7%)	P<0.0001"*
COMMUNITY EDUCATION	1	35(76.1%)	11(23.9%)	
	2	18(22.5%)	62(77.5%)	P<0.0001"*

Nb: Where P Value Is Reported With Symbol (") It Denotes Fishers Exact Test Was Used

Table 3 showing Chi-square and Fisher's exact test analysis, were used in establishing association between health system components (such as ITN availability within health facilities, community education, and antenatal care attendance, ITN costs, presence of ITN access barriers) and ITN utilization.

The Chi-square, and fishers exact test results reveal several strong health system predictors of ITN use. Usage behavior (*ITN Previous Night*, *Frequency Usage*, and *Source of ITN*) showed perfect associations (p<0.001), indicating these are direct from the Fishers exact test chose variables that are significant and subject them to the logistic regression

Availability of ITN (p<0.0001) and access barriers (p<0.0001) demonstrated near-identical strength, highlighting supply-chain and affordability as critical bottlenecks. Healthcare providers (HCP) advice (p<0.0001) and cost (p<0.0001) were also pivotal, while community engagement (p<0.0001) had a smaller but significant effect. Conversely, general *ITN information* campaigns (p>0.05) and *health system approaches* (p>0.05) showed negligible impact.

Table 4 Healthcare System in ITN Use

Variable	Odds Ratio (95%.Cl)	P. - value	Significance	OddsRatio 95.Cl	P. value
Intercepts	0.00 (0.00-0.09)	0.007	*	NA	NA
Availability at facility	98.27 (7.46-4618.63)	0.004	*	NA	NA
Health system community engagement	3.50 (0.40-33.83)	0.247		NA	NA
ITN information from CHPs	17733.15 (1.02-499079386.83)	0.038	*	NA	NA
Frequency of ITN information from CHPs	0.23 (0.03-2.39)	0.143		NA	NA
Sufficiency of health system approach to ITN	1.05 (0.08-13.00)	0.968	*	NA	NA
ITN access barriers	0.02 (0.00-0.13)	<0.001		NA	NA
Community education on ITNs	4.54 (0.62-41.87)	0.143		NA	NA
A/C	NA	NA		48.6	
B/C	NA	NA		71.3	
Nagelkerke RA^2	NA	NA		0.668	

Table 4 showing logistic regression, the strongest candidates are ITN availability, access barriers HCP advice cost and community education. The variables were identified based on to their extreme statistical significance (p<0.001), and direct relevance to health system interventions. They represent three critical dimensions: (1) supply-side factors (availability/access), (2) healthcare delivery (HCP advice), and (3) community-level engagement. Variables with weak effects like general ITN information campaigns were excluded as they showed no meaningful association with usage patterns.

IV.   Study Limitation:
The study encountered challenges in interviewing the teenagers less than 18 years who required parental consent to participate in any research. This was mitigated by ensuring that those accompanied by parents, spouses or teachers the consent is sought, those not accompanied will be treated as mature minors, the health professional is required to be involved to act as their advocate.

V.   Discussion

The study found moderate ITN utilization among first time young pregnant women in Kwale County. Age, income, education and area of residence were strong predictors, highlighting the importance of youth responsive services, community sensitizations and education on importance of pregnant women sleeping under treated mosquito nets, community outreaches focusing on adolescents to reach the hard to reach areas.

Barriers such as cost and availability require health system issues of timely ordering and quantification to ensure continuous availability of cost free treated nets, these findings are similar to the results in a similar study in Ghana by Asumah MN. 2021 (19), meta-analysis study in East Africa (20) and Ghana malaria indicator survey 2019 (21).

## VI.	Conclusions

This paper reveals that ITN utilization among young first time pregnant women is still low at 58% below the WHO recommendation of above 80%. Key in the influencers identified included age, area of residence (urban and rural setting), income levels, education levels, marital status, numbers of people in the households in the demographic realm, and access barriers to ITNs from varied sources, presence of qualified health care providers to address ITN concerns and questions under the health system realm were in the final statistical model influencing ITN utilization. The data model designed for the aforementioned factors illustrate that demographic and healthcare systems all have an influence on ITN utilization.

## VII.	Recommendations

The study demonstrated that about half of the study participants utilize ITN with majority of them above 20 years, hence there's need to (1) provision of adolescent and young people responsive services so that young expectant women are able to come and access antenatal services and receive health education and ITN during pregnancy. (2) Intensify malaria prevention education during ANC visits. (3) Targeted community health activities to target population in rural areas, local intervention efforts should concentrate on the low-income earners, rural dwellers, less educated along with communities contending with cultural norms impeding ITN utilization. (4) Healthcare interventions addressing availability of knowledgeable health care providers on ITN, additionally, healthcare system strengthening activities such as consistent availability of ITNs and presence of competent healthcare professionals trained on malaria in expectant mothers risk is critical for improving ITN utilization.

## VIII.	Acknowledgement

References

[1].	World Health Organization. Global Technical Strategy Meant For Malaria 2016–2030. Geneva: Geneva: WHO; 2015.
[2].	Kenya Ministry Of Health. Kenya Health Information System (KHIS) Statistical Report 2024. Nairobi: Ministry Of Health; 2024.
[3].	Kothari CR. Research Methodology: Methods And Techniques. 2nd Ed. New Delhi: New Age International; 2004.
[4].	Kenya National Bureau Of Statistics (KNBS), Ministry Of Health (MOH) Kenya Malaria Indicator Survey 2020. Nairobi: KNBS; 2020.
[5].	Ministry Of Health, Kenya. Reproductive Health Policy. Nairobi: MOH; 2022
[6].	World Health Organization. World Malaria Report 2022. Geneva: WHO; 2022
[7].	World Health Organization. Sustainable Development Goals. Geneva: WHO; 2022.
[8].	Abu Bonsra E, Amankwah Osei P, Adjei Kyeremeh E, Adama S, Sekyi AG, King EF. Factors Associated With Malaria In Pregnancy Among Women Attending ANC Clinics In Selected Districts Of The Ashanti Region, Ghana. Malar J. 2025 Jan 11;24(1):8. Doi: 10.1186/S12936-025-05244-6
[9].	Schantz-Dunn J, Nour NM. Malaria And Pregnancy: A Global Health Perspective. Rev Obstet Gynecol. 2019;2(3):186.
[10].	Scates SS, Finn TP, Wisniewski J, Et Al. Costs Of Insecticide-Treated Bed Net Distribution Systems In Sub-Saharan Africa. Malar J. 2020;19(1):105. Doi:10.1186/S12936-020-03164-1
[11].	Pooseesod K, Parker DM, Meemon N, Et Al. Ownership And Utilization Of Bed Nets And Reasons For Use Or Non-Use Among Community Members At Risk Of Malaria Along The Thai-Myanmar Border. Malar J. 2021;20(1):305.
[12].	Olapeju B, Choiriyyah I, Lynch M, Et Al. Age And Gender Trends In Insecticide-Treated Net Use In Sub-Saharan Africa: A Multi-Country Analysis. Malar J. 2018;17(1):423. Doi:10.1186/S12936-018-2575-Z
[13].	Mrema S, Okumu F, Schellenberg J, Fink G. Associations Between The Use Of Insecticide-Treated Nets In Early Childhood And Educational Outcomes, Marriage And Child-Bearing In Early Adulthood: Evidence From A 22-Year Prospective Cohort Study In Tanzania. Malar J. 2023;22(1):134. Doi:10.1186/S12936-023-04560-Z.
[14].	Koenker H, Kumoji EK, Erskine M, Opoku R, Sternberg E, Taylor C. Reported Reasons For Non-Use Of Insecticide-Treated Nets In Large National Household Surveys, 2009–2021. Malar J. 2023;22(1):61. Doi:10.1186/S12936-023-04490-W
[15].	Division Of National Malaria Program (DNMP), Ministry Of Health (MOH). Kenya Malaria Strategy: Intensifying Malaria Control And Accelerating Progress Towards Malaria Elimination (2019–2023). Nairobi: MOH; 2023.
[16].	Ministry Of Health Kenya. National Malaria Strategy 2021–2025. Nairobi: MOH; 2021.
[17].	Terefe B, Habtie A, Chekole B. Insecticide-Treated Net Utilization And Associated Aspects Among Pregnant Women In East Africa: Evidence From The Recent National Demographic And Health Surveys, 2011–2022. Malar J. 2023 Nov 14;22(1):349. Doi: 10.1186/S12936-023-04779-W.

[18]. Kenya National Bureau Of Statistics. 2019 Kenya Population And Housing Census: Population Projections 2020–2045. Nairobi: KNBS; 2020.

[19]. Asumah MN, Akugri FA, Akanlu P, Taapena A, Boateng F. Utilization Of Insecticides Treated Mosquito Bed Nets Among Pregnant Women In Kassena-Nankana East Municipality In The Upper East Region Of Ghana. Public Health Toxico. 2021 Dec 22;1(2):1–1

[20]. Demoze L, Adane KC, Gizachew N, Tesfaye AH, Yitageasu G. Utilization Of Insecticide-Treated Nets Among Pregnant Women In East Africa: Evidence From A Systematic Review And Meta-Analysis. BMC Public Health. 2024 Nov 7;24(1):3083. Doi: 10.1186/S12889-024-20621-7. PMID: 39511579; PMCID: PMC11545497

[21]. Klu D, Aberese-Ako M, Manyeh AK, Et Al. Mixed Effect Analysis Of Factors Influencing The Use Of Insecticides Treated Bed Nets Among Pregnant Women In Ghana: Evidence From The 2019 Malaria Indicator Survey. BMC Pregnancy Childbirth. 2022;22:258. Doi: 10.1186/S12884-022-04586-2.