

Do Early Antenatal Booking Predicts Maternal Services Utilization? An Analysis of Data from the 2015-16 Tanzania HIV and Malaria Indicators Survey

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Research article

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Abstract

Background

Optimizing maternal and neonatal health requires adequate use of antenatal services which have both curative and preventive services. Little is known on the influence of early antenatal booking on maternal services utilization in Tanzania.

Method:

The study used data from the 2015-16 Tanzania HIV Demographic and Health Survey and Malaria Indicators Survey (2015-16 TDHS-MIS). A total of 6924 women of active reproductive age from 15 to 49 were included in the analysis. Both univariate and multiple regression analyses were used to determine the association between early antenatal booking and maternal services utilization. Separate regression analysis was done for each antenatal service to establish the influence of early antenatal booking on antenatal services.

Results

Only 1586(22.9%) of pregnant women had early antenatal booking. After adjusting for confounders, there was a significant association between early antenatal booking and ever took iron supplement AOR = 1.603 at 95% CI = 1.362–1.887; ever took anti malaria, AOR = 1.495 at 95% CL = 1.306–1.712; ever took de-worming drugs; AOR = 1.404 at 95% CI = 1.24–1.59; adequate TT vaccination, AOR = 1.393 at 95% CI = 1.234–1.571, $p < 0.001$; ever checked blood pressure, AOR = 1.496 at 95% CI = 1.297–1.726; ever donated urine sample, AOR = 1.728 at 95% CI = 1.513–1.975; ever donated blood sample, AOR = 1.596 at 95% CI = 1.312–1.942 and adequate antenatal visits, AOR = 6.260 at 95% CI = 5.433–7.212.

Conclusion

The majority of pregnant women in Tanzania initiate antenatal clinics late in their pregnancy. Early antenatal booking showed a significant association with the utilization of maternal services during pregnancy. Innovative interventional studies are highly recommended to come up with cost-effective strategies which will improve timing for antenatal booking and hence use of the available maternal services in Tanzania

Background

Sustainable Development Goal (SDG) 3.1 has set a target to reduce maternal mortality to less than 70 deaths per 100,000 live births in 2030[1]. Similarly, to reduce global newborns death to 5 deaths per 1000 live births in 2030[1]. Despite the well-set target, the number of maternal and neonatal mortalities remains

unacceptably high. In 2017, about 295 000 maternal death occurred globally, the countries in the sub-Saharan region contributed to about 94% of all deaths[2]. The number of neonatal mortalities is also high globally (18 deaths per 1000 live births)[3] with the largest burden in developing countries including Tanzania (21 deaths per 1000 live births)[4]. The current trend of maternal and neonatal mortalities provides little promise on achieving the target.

Antenatal services utilization, institutional delivery, and postnatal checkups have the potential to reduce both maternal and neonatal mortalities[5]. Services such as iron and folic acid supplementation are important in addressing the challenge of pregnancy-induced anemia. In low resources countries, women become pregnant while anemic. The state of their anemia become worsens with pregnancy and childbirth[6]. The process of providing iron and folic acid supplementation improves their health status. Likewise, the process of iron and folic acid supplementation improves the health status of their developing child. Folic acid is responsible for the prevention of abnormalities in both mothers (anemia, peripheral neuropathy) and fetuses (congenital abnormalities)[7]. To address that health problem, a pregnant woman has to take folic acid supplementation to ensure to have birth to a healthy baby.

Also, in antenatal attendance, a pregnant woman is covered with de-worming drugs. In regions with worm infestation, the use of the de-worming drug is crucial to protect pregnant women from anemia. Tanzania is among the countries which provide de-worming services to all pregnant women. The nutritional intake of a pregnant woman is required by her developing child too[8]. This means the nutritional demand increase during pregnancy. Worm infestation may worsen the nutritional status of these mothers.

Tanzania is among the malaria-endemic regions. Malaria during pregnancy is among major public health problems that cause maternal, fetal, and infant morbidity and mortality. Intermittent treatment of malaria is among the antenatal services provided during pregnancy in malaria-endemic areas. Treatment of malaria is recommended for all pregnant women attending antenatal visits. The region for intermittent treatment for malaria is, the first dose when pregnancy is in the gestation age of 24 weeks and the second dose when the pregnancy is of the gestations age of 28 weeks[8]

All pregnant women are supposed to be protected against tetanus through vaccination. Tetanus is an acute infectious disease which is caused by toxigenic strains of the bacterium called *Clostridium tetani*. The spores of these bacteria are found in the environment regardless of a geographical location[9]. According to WHO recommendations, if a pregnant woman has not previously been vaccinated, or if her immunization status is unknown, she should receive two doses of tetanus vaccination, one month apart with the second dose given at least two weeks before delivery to protect both pregnant women and her child against tetanus[8]. The two doses can protect both of them 1-3years[8]. The third dose is given six months later after the second dose and extends the protection to 6 years[8].

In the antenatal attendance, pregnant women are also checked for their blood pressure in each visit. The baseline recorded blood pressure is used to diagnose pregnancy-induced blood pressure. Early detection of pregnancy-induced hypertension facilitates timely management and hence saves the lives of both mothers and neonates. Blood induced hypertension is among the direct causes of maternal mortalities. A

previous study done in Tanzania on causes of maternal death reported that high blood pressure (eclampsia) contributed up to 34% of all maternal deaths[10]. It is a routine that pregnant women must have a urine test to screen for gestational diabetes during 24 to 28 weeks of pregnancy and preeclampsia.

Although all these services are offered for free in Tanzania, some pregnant women fail to receive them. Despite the benefit and free access, some pregnant women fail to receive these important services in Tanzania.

Previous studies have worked out different factors that are associated with poor utilization of antenatal services. Exposure to media, wealth index of pregnant women's family is a few factors which the literature has mentioned to influence maternal services utilization during pregnancy[11].

Antenatal visit connects pregnant women and their families to the health care system[12]. The majority of pregnant women in Tanzania attend antenatal clinics at least ones[4]. Late antenatal booking may largely contribute to inadequate antenatal visits. Inadequate attendances limit the likelihood of receiving antenatal services. Little is known on whether early initiation of antenatal visits increases the likelihood of antenatal services utilization.

Methods

Study Area and period

The study was conducted in the United Republic of Tanzania from August 22, 2015, through February 14, 2016. Tanzania among the countries found in East Africa. It is the largest country that covers 940,000 square kilometers and 60,000 square kilometers is inland water. The country lies south of the equator and shares borders with eight countries: Kenya and Uganda to the North; Rwanda, Burundi, the Democratic Republic of Congo, and Zambia to the West; and Malawi and Mozambique to the South.

Study design

It was a national-based cross-sectional study utilizing the 2015-16 Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS-MIS) dataset.

Study population

all women of reproductive age (aged 15-49 years) were the study population. The study used Individual file recode (TZIR7BFL) with a total of 13266 women who responded to the survey (97% response rate). The study included only women who remembered the timing for antenatal booking of their youngest child. Those who were not able to recall the timing and those who did not respond to the question were removed from the analysis. A total of 6924 women who had birth within five years presiding the survey were included in the study.

Sampling Technique

Two stages of sampling were used to obtain a sample for urban and rural areas in Tanzania Mainland and Zanzibar. In the first stage, a total of 608 clusters were selected and in the second stage, a systematic selection of households was involved. A total of 22 households were then systematically selected from each cluster, yielding a representative probability sample of 13,376 households for the 2015-16 TDHS-MIS. To enhance representativeness Tanzania was divided into nine geographic zones. Grouping the regions into zones was done to reduce sampling error by increasing the number of people in the denominator. The zone was western (Tabora and Kigoma regions), Northern zone (Kilimanjaro, Tanga, and Arusha), Central zone (Dodoma, Singida and Manyara), Southern Highland zone (Iringa, Njombe, and Iringa), Southern zone (Lindi and Mtwara), South West Highland zone (Mbeya Rukwa and Katavi), Lake zone (Kagera, Mwanza, Geita, Mara, Simiyu, and Shinyanga), Eastern zone (Dar es Salaam, Pwani, and Morogoro) and Zanzibar (Kaskazini Unguja, Kusini Unguja, Mjini Magharibi, Kaskazini Pemba and Kusini Pemba).

Data Collection tool

The 2015-16 TDHS-MIS used household questionnaires and individual questionnaires. These questionnaires based on the Measure DHS standard AIDS Indicator Survey and Malaria Indicator Survey questionnaires standards. They were adapted and modified to reflect the Tanzanian population. They were translated into Kiswahili, Tanzania's national language. The data presented in this study are from the individual questionnaire.

Study variables

Through a literature review, the conceptual framework was developed to guide the conceptualization (figure 1). The conceptual framework had an independent variable which is the timing for the initiation of antenatal visits. The confounding variables which were controlled were the primary independent factors (socio-demographic and obstetric characteristics of a woman). The dependent variables in this study were the utilization of maternal services during pregnancy. The study aimed to ascertain the association between early initiation of antenatal services and the use of maternal services. The primary independent variables have also direct relationship with the use of maternal services utilization that is why they are controlled to establish the relationship between timing for booking and use of services. The outcome variables were independently dummy coded as 1 if women use a service and 0 otherwise. The Independent variable included only timing for antenatal booking.

Results

Socio-demographic Characteristics

The study included 6924 women of reproductive age who had given birth within five years preceding the survey. Majority of study respondents 5113(73.8%) resided in the rural setting of Tanzania, aged 20 to 34

years 4557(65.8%), had primary education 4209(60.8) and were married 5650(86.1%) Table 1

Maternal Services Utilization during pregnancy

When the use of maternal services utilization were assessed, majority of women 3480(50.3%) did not receive adequate vaccination; 2560(37%) did not take deworming drugs; 1276(18.4%) did not take an iron supplement; 2160(31.2%) did not take anti-malaria drugs for intermittent treatment of malaria; 1927(31.2%) their blood pressure were not checked throughout the pregnancy; 2631(38%) never donated urine sample for screening and 870(12.6%) never donated blood sample for screening (figure 2)

The relationship between antenatal services utilization and early antenatal booking

When the relationship between maternal services utilization was assessed, the antenatal booking had a significant relationship with all variables of maternal services utilization, Table 3

The association between early antenatal booking and ever took an iron supplement during pregnancy

After adjusting for confounders, there was a significant association between early antenatal booking and ever took iron supplement during pregnancy; AOR= 1.603 at 95% CI= 1.362 -1.887, $p<0.001$, Table 3

The association between early antenatal booking and ever took anti-malaria during pregnancy

After adjusting for confounders, there was a significant relationship between early antenatal booking and ever taken anti-malaria drug for intermittent treatment for malaria, AOR=1.495 at 95% CL=1.306-1.712, $p<0.001$, Table 4.

The association between early antenatal booking and ever took de-worming drugs during pregnancy

After adjusting for confounders there was a significant association between early antenatal booking and ever taken de-worming drugs during pregnancy; AOR=1.404 at 95% CI=1.24-1.59, $p<0.001$, Table 5.

The association between early antenatal booking and adequate tetanus vaccination

After adjusting for confounders there was a significant association between early antenatal booking and adequate tetanus vaccination during pregnancy, AOR= 1.393 at 95% CI=1.234-1.571, $p<0.001$, Table 6

The association between early antenatal booking and ever checked for blood pressure

After adjusting for confounders, there was a significant relationship between early antenatal booking and ever checked for blood pressure during pregnancy, AOR=1.496 at 95% CI=1.297-1.726, $p<0.001$, Table 7.

The association between early antenatal booking and ever donated urine for screening during pregnancy

After adjusting for confounders there was a significant association between early antenatal booking and ever donated urine sample for screening during pregnancy, AOR= 1.728 at 95% CI=1.513-1.975, $p<0.001$,

The association between early antenatal booking and ever donated a blood sample

After adjusting for confounders there was a significant association between early antenatal booking and ever donated blood sample for screening during pregnancy, AOR= 1.596 at 95% CI=1.312-1.942, $p < 0.001$, Table 9

Discussion

There are maternal and neonatal benefits in maternal services utilization. The services have both preventive and curative abilities to both mothers and their growing fetus. These are given for free in Tanzania. The government plays her role by providing these services to protect both pregnant women and their growing fetus. It is surprising to find some women fail to get these services in Tanzania.

This analysis found that of all maternal services tetanus vaccination was mostly not used service. It was found that 49.7% of women had an adequate tetanus vaccination. A similar study done in Ethiopia reported a higher proportion of women (56.2%) had adequate vaccination[13]. The possible difference could be due to differences in the sampling area. This study involved all women of reproductive age in Tanzania while the study done in Ethiopia included only postnatal mothers in Northern Ethiopia.

The study went further and works out the influence of timing to initiate antenatal visits on adequate tetanus immunization during pregnancy. The study found that there was a significant association between early antenatal booking and adequate tetanus vaccination. Pregnant women who had early antenatal bookings were 1.4 times more likely to have adequate vaccination compared to those with late bookings. A similar finding was reported by a similar study done in Ethiopia[13]. The study recommends an innovative intervention study to find up an effective strategy to improve early antenatal initiation.

The study also found that the majority of women (81.6%) ever received iron supplements during antenatal visits. Despite the high proportion, adherence to daily intake is questionable. A previous study done among pregnant women found a small proportion of only 12% of pregnant women adhere to a daily intake of supplements [14]. An iron supplement is recommended to all pregnant women for the prevention of pregnancy-induced anemia and neonatal underweight[15]. These supplements are offered for free in all antenatal clinics in the country. Wondering enough some women never received the supplement.

The study found there was a significant association between early initiations of antenatal visits and ever took the iron supplement. Women who had early antenatal bookings were 1.4 more likely to ever take an iron supplement compared to those who had a late antenatal booking. A similar finding was reported by a previous study done in Uganda[16].

Although antenatal clinics all over the country offer de-worming drugs to protect pregnant women against worms' infestation, 37% of respondents did not take de-worming drugs during pregnancy. Studies have

reported that de-worming plus iron supplementations have a potential stabilizes hemoglobin level[17, 18].

The study also found that there was a significant association between early antenatal bookings and ever took de-worming drugs. Women who had early bookings were 1.4 times more likely to take de-worming drugs if compared to those who had late bookings.

Tanzania is a malaria-endemic country. Intermittent preventive treatment of malaria is the routine treatment of pregnant women to protect them against malaria during pregnancy. The study found that 68.8% of pregnant women ever took anti-malaria for intermittent treatment of malaria. Like other maternal services, anti-malaria treatment is given for free during antenatal visits. The study found up to 31.2% of interviewed women did not take anti-malaria for intermittent treatment of malaria. A different finding has been reported by a previous study done in Ghana that the majority of pregnant women (98.5%) received at least one dose of anti-malaria for intermittent treatment of malaria[19]. The difference could be due to differences in the study area. The study in Ghana included only urban women while this study included both urban and rural communities.

The study also found that there was a significant association between early antenatal initiations and ever took anti-malaria preventive treatment for malaria. Women who had early antenatal booking were 1.5 more likely to ever receive anti-malarial drugs if compared to those who had a late booking. Similar findings have been reported by a previous study[20].

The study also found that there was a significant relationship between early antenatal bookings and ever checked for blood pressure during pregnancy. Women who had early antenatal booking were 1.5 more likely to ever checked for blood pressure during pregnancy if compared with pregnant women who initiated antenatal visits late. Checking for blood pressure is crucial during pregnancy for early detection of pregnancy-induced hypertension.

Conclusion

The majority of pregnant women in Tanzania initiate antenatal clinics late in their pregnancy. Early antenatal booking showed a significant association with the utilization of maternal services during pregnancy. Innovative interventional studies are highly recommended to come up with cost-effective strategies which will improve timing for antenatal booking and hence use of the available maternal services in Tanzania

Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal Clinic
DHS	Demographic and Health Survey
HIV	Human Immunodeficiency Virus
SDG	Sustainable Development Goal
TDHS-MIS	Tanzania HIV Demographic and Health Survey and Malaria Indicators Survey
TT	Tetanus Toxoid

Declarations

Ethics approval and consent to participate

Data collection and the survey content and protocol were approved by Tanzania's National Institute for Medical Research (NIMR), the Zanzibar Medical Ethics and Research Committee (ZAMREC), the Institutional Review Board of ICF International, and the Centers for Disease Control and Prevention in Atlanta, USA. Participants provided verbal consents and the household interviews took place at the private condition. Participants who were under 18 years old written consent were requested from their parents or guardians.

Consent for publication

Not applicable

Availability of data and material

The data that support this analysis are available from the 2015-16 Tanzania HIV and Malaria Indicators Survey (THMIS). This survey was conducted by the National Bureau of Statistics (NBS) in collaboration with the Tanzania Commission for AIDS (TACAIDS) and the Zanzibar AIDS Commission (ZAC), the Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDEC) (Tanzania) and the USAID-Funded Measure DHS project. Data is available from the authors upon reasonable request and with permission from MEASURE DHS

Competing interests

Authors declare there is no competing interest

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Authors' contributions

FVM did the conceptualization of the study, data analysis and drafted the whole manuscript.

Availability of data and materials

Data set is available and can be shared on request

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Tables

Table 1: Socio-demographic Characteristics

Variables	Frequency	Percent (%)
Place of residence		
Urban	1811	26.2
Rural	5113	73.8
Age group		
Less than 20 years	541	7.8
20 to 34 years	4557	65.8
More than 34 years	1826	26.4
Educational level		
No education	1329	19.2
Primary education	4209	60.8
Secondary	1326	19.2
Higher	60	0.9
Parity		
Para one	1595	23
Para 2-4	3154	45.6
Para 5+	2175	31.4
Wealth index		
Poor	2734	39.5
Middle	1363	19.7
Rich	2827	40.8
Marital Status		
Never in union	441	6.4
Married	5650	86.1
Widow	119	1.7
Separated	714	10.3
Respondent currently working		
Not working	1498	21.6
Working	5426	78.4

Mainland/Zanzibar		
Mainland urban	1618	23.4
Mainland rural	4357	62.9
Unguja (Zanzibar Island)	594	8.6
Pemba (Pemba Island)	355	5.1

Table 2: The relationship between maternal services utilization and antenatal booking

Variables	ANC Booking		X2	p-value
	Early	Late		
Tetanus Injection received				
0 to 1 injection	646(18.6)	2834(81.4)		
2+ Injections	940(27.3)	2504(72.7)	74.715	<0.001
Took Iron Supplement				
No	206(16.1)	1070(83.9)		
Yes	1380(24.4)	4268(75.6)	40.499	<0.001
De-worming				
No	465(18.2)	2095(81.8)		
Yes	1121(25.7)	3243(74.3)	51.716	<0.001
Had intermitted treated for Malaria				
No	364(16.9)	1796(83.1)		
Yes	1222(25.7)	3542(74.3)	65.156	<0.001
Checked for blood pressure during ANC				
No	335(17.4)	1592(82.6)		
Yes	1251(25)	3746(75)	46.094	<0.001
A urine sample is taken during ANC				
No	450(17.1)	2181(82.9)		
Yes	1136(26.5)	3157(73.5)	80.894	<0.001
A blood sample is taken during ANC				
No	136(15.6)	734(84.4)		
Yes	1450(24)	4604(76)	29.811	<0.001

Table 3: The association between early antenatal booking and ever taken an iron supplement during pregnancy

Variable	OR	95%CI		p-value	AOR	95%CI		p-value
		Lower	Upper			Lower	Upper	
ANC Booking								
Late booking	1				1			
Early booking	1.679	1.43	1.973	<0.001	1.603	1.362	1.887	<0.001
Place of residence								
Urban					1			
Rural	0.9	0.782	1.036	0.144	1.711	1.159	2.526	0.007
Age groups								
Less than 20 years	1				1			
20 to 34 years	1.093	0.868	1.376	0.449	1.216	0.936	1.581	0.143
More than 34 years	0.827	0.648	1.055	0.127	1.05	0.77	1.432	0.758
Wealth index								
Poor	1				1			
Middle	1.24	1.048	1.466	0.012	1.173	0.988	1.393	0.069
Rich	1.315	1.149	1.506	<0.001	1.188	0.986	1.432	0.07
Educational level								
No education	1				1			
Primary education	1.299	1.116	1.511	0.001	1.187	1.013	1.391	0.034
Secondary	1.474	1.213	1.792	<0.001	1.207	0.957	1.524	0.112
Higher	1.854	0.871	3.948	0.109	1.374	0.632	2.989	0.423
Parity								
Para one	1				1			
Para 2-4	0.812	0.689	0.957	0.013	0.807	0.668	0.974	0.026
Para 5+	0.649	0.547	0.77	<0.001	0.75	0.592	0.95	0.017
Mainland/Zanzibar								
Mainland urban	1				1			
Mainland rural	0.826	0.71	0.962	0.014	0.593	0.389	0.905	0.015
Unguja (Zanzibar Island)	0.843	0.66	1.076	0.17	0.63	0.431	0.92	0.017

Pemba (Pemba Island)	0.891	0.659	1.203	0.45	0.694	0.441	1.09	0.112
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Table 4: The association between early antenatal booking and ever taken anti-malaria drug for intermittent treatment for malaria during pregnancy

Variable	OR	95%CI		p-value	AOR	95%CI		p-value
		Lower	Upper			Lower	Upper	
ANC Booking								
Late booking	1				1			
Early booking	1.702	1.495	1.939	<0.001	1.495	1.306	1.712	<0.001
Age groups								
Less than 20 years	1				1			
20 to 34 years	1.62	1.35	1.944	<0.001	1.446	1.169	1.787	0.001
More than 34 years	1.631	1.338	1.988	<0.001	1.648	1.27	2.137	<0.001
Place of residence								
Urban	1				1			
Rural	0.483	0.425	0.548	<0.001	0.956	0.688	1.328	0.788
Wealth index								
Poor	1				1			
Middle	1.379	1.199	1.586	<0.001	1.418	1.226	1.641	<0.001
Rich	1.621	1.446	1.817	<0.001	1.589	1.352	1.866	<0.001
Educational level								
No education	1				1			
Primary education	1.71	1.504	1.944	<0.001	1.457	1.271	1.67	<0.001
Secondary	1.499	1.278	1.758	<0.001	1.653	1.354	2.018	<0.001
Higher	2.034	1.122	3.686	0.019	1.456	0.758	2.796	0.26
Parity								
Para one	1				1			
Para 2-4	1.172	1.029	1.334	0.016	1.213	1.04	1.414	0.014
Para 5+	1.016	0.885	1.166	0.822	1.226	1.006	1.493	0.043
Mainland/Zanzibar								
Mainland urban	1				1			
Mainland rural	0.438	0.38	0.506	<0.001	0.647	0.45	0.93	0.019
Unguja (Zanzibar Island)	0.181	0.147	0.222	<0.001	0.172	0.123	0.241	<0.001

Pemba (Pemba Island)	0.257	0.201	0.328	<0.001	0.31	0.211	0.456	<0.001
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Table 5: The association between early antenatal booking and ever taken de-worming drugs during pregnancy

Variable	OR	95%CI		p-value	AOR	95%CI		p-value
		Lower	Upper			Lower	Upper	
ANC Booking								
Late booking	1				1			
Early booking	1.557	1.38	1.758	<0.001	1.404	1.24	1.59	<0.001
Age groups								
Less than 20 years	1				1			
20 to 34 years	1.52	1.27	1.82	<0.001	1.382	1.125	1.696	0.002
More than 34 years	1.236	1.018	1.499	0.032	1.287	1.004	1.65	0.046
Place of residence								
Urban	1				1			
Rural	0.584	0.519	0.656	<0.001	1.53	1.099	2.128	0.012
Wealth index								
Poor	1				1			
Middle	1.165	1.02	1.331	0.025	1.151	1.003	1.32	0.044
Rich	1.534	1.374	1.711	<0.001	1.378	1.185	1.602	<0.001
Educational level								
No education	1				1			
Primary education	1.158	1.021	1.314	0.023	1.019	0.892	1.164	0.777
Secondary	1.219	1.042	1.427	0.013	1.11	0.918	1.342	0.283
Higher	3.358	1.688	6.681	0.001	2.455	1.189	5.067	0.015
Parity								
Para one	1				1			
Para 2-4	1.124	0.992	1.274	0.067	1.116	0.964	1.291	0.942
Para 5+	0.851	0.745	0.972	0.017	0.993	0.824	1.197	<0.001
Mainland/Zanzibar								
Mainland urban	1				1			
Mainland rural	0.51	0.449	0.58	<0.001	0.439	0.307	0.628	<0.001
Unguja (Zanzibar Island)	0.303	0.249	0.369	<0.001	0.22	0.158	0.306	<0.001

Pemba (Pemba Island)	0.612	0.479	0.782	<0.001	0.493	0.337	0.723	<0.001
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Table 6: The association between early antenatal booking and adequately covered with tetanus vaccination during pregnancy

Variable	OR	95%CI		p-value	AOR	95%CI		p-value
		Lower	Upper			Lower	Upper	
ANC Booking								
Late booking	1							
Early booking	1.647	1.47	1.845	<0.001	1.393	1.234	1.571	<0.001
Age groups								
Less than 20 years	1							
20 to 34 years	0.765	0.638	0.918	0.004	1.456	1.176	1.803	0.001
More than 34 years	0.394	0.324	0.48	<0.001	1.425	1.103	1.841	0.007
Place of residence								
Urban	1							
Rural	0.516	0.462	0.575	<0.001	0.75	0.529	1.062	0.105
Wealth index								
Poor	1							
Middle	1.123	0.986	1.279	0.081	1.144	0.996	1.315	0.058
Rich	1.593	1.433	1.771	<0.001	1.316	1.132	1.529	<0.001
Educational level								
No education	1							
Primary education	1.307	1.154	1.48	<0.001	0.875	0.764	1.002	0.053
Secondary	1.676	1.438	1.954	<0.001	0.931	0.768	1.129	0.469
Higher	3.982	2.198	7.216	<0.001	1.503	0.798	2.829	0.207
Parity								
Para one	1							
Para 2-4	0.421	0.37	0.479	<0.001	0.388	0.333	0.451	<0.001
Para 5+	0.201	0.175	0.231	<0.001	0.207	0.171	0.251	<0.001
Mainland/Zanzibar								
Mainland urban	1							
Mainland rural	0.516	0.459	0.581	<0.001	0.987	0.68	1.433	0.944
Unguja (Zanzibar Island)	0.312	0.257	0.38	<0.001	0.436	0.311	0.611	<0.001

Pemba (Pemba Island)	0.183	0.141	0.237	<0.001	0.304	0.203	0.456	<0.001
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Table 7: The association between early antenatal booking and ever checked blood pressure during pregnancy

Variable	OR	95%CI		p-value	AOR	95%CI		p-value
		Lower	Upper			Lower	Upper	
ANC Booking								
Late booking	1				1			
Early booking	1.587	1.388	1.815	<0.001	1.496	1.297	1.726	<0.001
Age groups								
Less than 20 years	1							
20 to 34 years	1.585	1.316	1.909	<0.001	1.193	0.951	1.498	0.127
More than 34 years	1.621	1.323	1.985	<0.001	1.518	1.149	2.006	0.003
Place of residence								
Urban	1							
Rural	0.273	0.234	0.318	<0.001	1.044	0.388	2.81	0.932
Wealth index								
Poor	1				1			
Middle	1.518	1.325	1.741	<0.001	1.215	1.053	1.402	0.008
Rich	5.312	4.634	6.09	<0.001	2.27	1.907	2.702	<0.001
Educational level								
No education	1				1			
Primary education	1.396	1.227	1.588	<0.001	1.275	1.107	1.468	0.001
Secondary	5.515	4.468	6.808	<0.001	2.163	1.688	2.774	<0.001
Higher	36.275	5.01	262.6	<0.001	9.929	1.355	72.76	0.024
Parity								
Para one	1							
Para 2-4	1.101	0.96	1.262	<0.001	1.19	1.003	1.412	0.046
Para 5+	0.77	0.667	0.887	<0.001	0.958	0.775	1.185	0.694
Mainland/Zanzibar								
Mainland urban	1				1			
Mainland rural	0.241	0.206	0.282	<0.001	0.459	0.168	1.25	0.128
Unguja (Zanzibar	4.588	2.841	7.409	<0.001	3.934	1.568	9.871	0.004

Island)								
Pemba (Pemba Island)	3.693	2.123	6.423	<0.001	5.308	1.808	15.58	0.002

Table 8: The association between early antenatal booking and ever donated urine sample for screening during pregnancy

Variable	95%CI			p-value	95%CI			p-value
	OR	Lower	Upper		AOR	Lower	Upper	
ANC Booking								
Late booking	1				1			
Early booking	1.744	1.544	1.97	<0.001	1.728	1.513	1.975	<0.001
Age groups								
Less than 20 years	1				1			
20 to 34 years	1.238	1.033	1.484	0.021	1.075	0.86	1.343	0.525
More than 34 years	1.132	0.932	1.375	0.213	1.27	0.969	1.665	0.083
Place of residence								
Urban	1				1			
Rural	0.236	0.206	0.27	<0.001	0.544	0.163	1.816	0.322
Wealth index								
Poor	1				1			
Middle	1.498	1.315	1.708	<0.001	1.142	0.993	1.313	0.063
Rich	5.202	4.61	5.869	<0.001	1.746	1.492	2.044	<0.001
Educational level								
No education	1				1			
Primary education	1.387	1.226	1.57	<0.001	1.243	1.081	1.429	0.002
Secondary	6.061	5.024	7.313	<0.001	2.027	1.616	2.544	<0.001
Higher	14.106	5.086	39.12	<0.001	3.4	1.188	9.734	0.023
Parity								
Para one	1				1			
Para 2-4	0.832	0.732	0.946	0.005	0.868	0.737	1.021	0.087
Para 5+	0.556	0.486	0.636	<0.001	0.694	0.565	0.851	<0.001
Mainland/Zanzibar								
Mainland urban	1				1			
Mainland rural	0.202	0.176	0.232	<0.001	0.631	0.187	2.121	0.456
Unguja (Zanzibar)	11.867	6.45	21.83	<0.001	18.9	5.611	63.64	<0.001

Pemba (Pemba)	2.114	1.452	3.077	<0.001	5.43	1.624	18.16	0.006
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Table 9: The association between early antenatal booking and ever donated blood sample for screening during pregnancy

Variable	OR	95%CI		p-value	95%CI		p-value	
		Lower	Upper		AOR	Lower		Upper
ANC Booking								
Late booking	1				1			
Early booking	1.7	1.402	2.06	<0.001	1.596	1.312	1.942	<0.001
Age groups								
Less than 20 years	1				1			
20 to 34 years	1.362	1.06	1.75	0.016	1.208	0.9	1.623	0.209
More than 34 years	1.132	0.865	1.481	0.367	1.111	0.778	1.587	0.564
Place of residence								
Urban	1				1			
Rural	0.318	0.255	0.395	<0.001	0.445	0.134	1.484	0.188
Wealth index								
Poor	1				1			
Middle	1.301	1.085	1.559	0.004	1.132	0.94	1.364	0.191
Rich	2.912	2.443	3.472	<0.001	1.332	1.068	1.663	0.011
Educational level								
No education								
Primary education	1.185	0.999	1.405	0.052	1.053	0.88	1.26	0.574
Secondary	3.374	2.549	4.466	<0.001	1.556	1.13	2.143	0.007
Higher	5.535	1.342	22.835	0.018	1.786	0.423	7.541	0.43
Parity								
Para one					1			
Para 2-4	0.921	0.761	1.115	0.401	0.937	0.747	1.175	0.572
Para 5+	0.695	0.571	0.845	<0.001	0.907	0.687	1.198	0.493
Mainland/Zanzibar								
Mainland urban	1				1			
Mainland rural	0.304	0.243	0.38	<0.001	0.93	0.274	3.162	0.908
Unguja (Zanzibar)	2.555	1.446	4.516	0.001	4.687	1.398	15.715	0.012

Figures

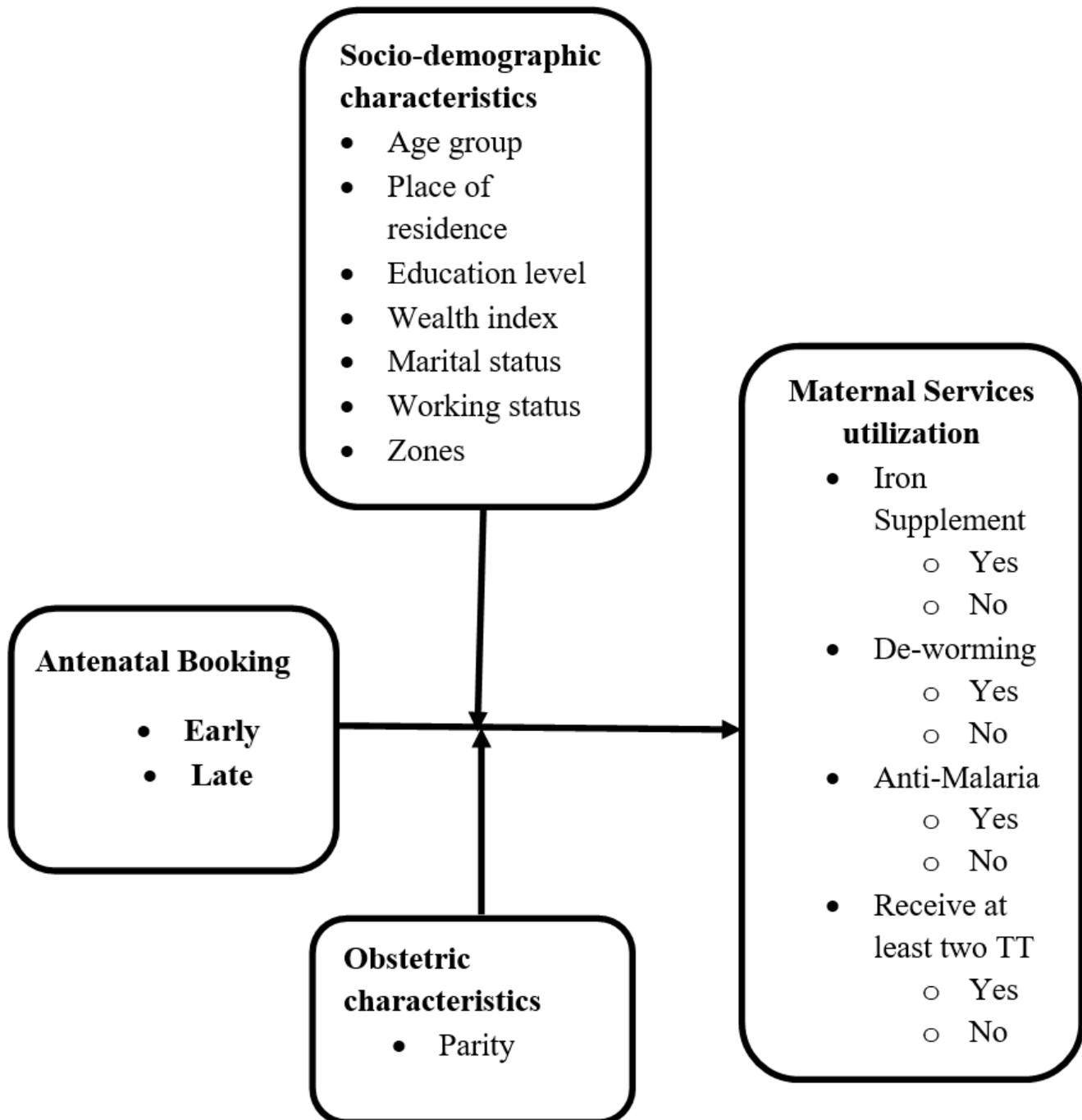


Figure 1

The association between antenatal booking and maternal services utilization

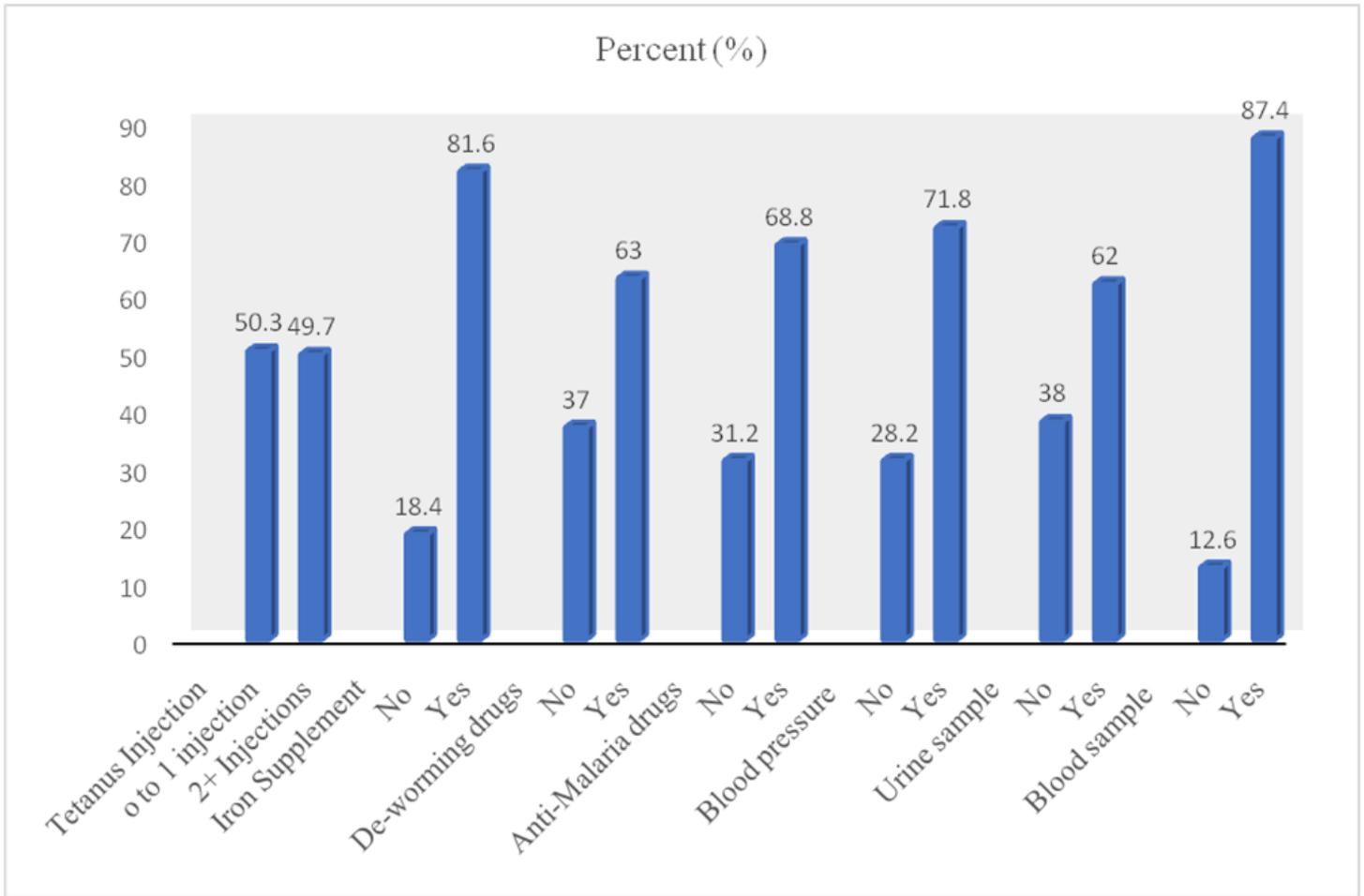


Figure 2

Maternal services utilization among women of reproductive age Tanzania