

# Factors Associated with Uptake of De-Worming Drugs During Pregnancy Among Women of Reproductive Age in Tanzania; 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

Uptake of deworming drugs is one of the important antenatal strategies in preventing anaemia in pregnancy. Little is known about the factors associated with uptake of the de-worming drugs. This study aimed at identifying the factors associated with the uptake of de-worming drugs during pregnancy among women of reproductive age.

**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 factors associated with uptake of deworming drugs among women of reproductive age in Tanzania.

**Results:** Majority of interviewed women 3864(60.1%) took deworming drug while a total of 2560(39.9%) did not take deworming drugs. After controlling for confounders, factors associated with uptake of deworming drugs were early antenatal booking, (AOR=1.404 at 95% CI=1.24-1.59,p<0.001); age group of a woman [20 to 34years (AOR=1.382 at 95% CI=1.125-1.696, p=0.002), more than 34years (AOR=1.287 at 95% CI=1.004-1.65, p=0.046)] age less than 20 years was a reference population; rural residence (AOR=1.53 at 95% CI=1.099-2.128,p=0.012); wealth index [middle (AOR=1.151 at 95% CI=1.003-1.32,p=0.044), rich (AOR=1.378 at 95% CI=1.185-1.602, p<0.001) poor was a reference population; level of education [higher level (AOR=2.455 at 95% CI=1.189-5.067,p=0.015)] no formal education was a reference population; parity [para 5 and above (AOR=0.993 at 95% CI=0.824-1.197,p<0.001)] para one was the reference population; zones [Mainland rural (AOR=0.439 at 95% CI=0.307-0.628,p<0.001), Zanzibar Island (AOR=0.22 at 95% CI=0.158-0.306, p<0.001) and Pemba Island AOR=0.493 at 95% CI=0.337-0.723, p<0.001.

## Conclusion

Factors associated with uptake of deworming drugs were early antenatal booking, age group, rural residence, zonal residence, wealth index, level of education, and parity. Considering the outcomes of anaemia in pregnancy, clinicians should consider all the modifiable factors affecting the uptake of the deworming drugs during pregnancy to every woman of reproductive age before and after conception. Whenever possible, it should be done even beyond antenatal clinics.

## Background

De-worming drugs are usually given to women of reproductive age during their pregnancy to treat helminthiasis infection. Helminthiasis is a macro parasitic disease in which a part of the human body, mainly the intestine, is infected with parasitic worms, known as helminthes. About a quarter of the general world population [1], and more than one third of all pregnant women in developing countries are

infected with one or more of the intestinal helminthes. The prevalence varies with geographical locations. In some endemic regions, the prevalence of helminthes in pregnant women is as high as 70% [2].

Human gets infected by ingestion of viable eggs through food or water (*A. lumbricoides* and *T. trichiura*), or by skin penetration when walking barefooted on soil contaminated soil (Hookworm). *Ancylostoma duodenale*, (one type of hookworm) can also be transmitted through the ingestion of larvae. Inside the human body, the adult parasite produces eggs, which are passed in human feces and deposited in the external environment on defecation, where they can stay viable for several months for re-infection. The adult helminthes cause internal bleeding, intestinal obstruction and inflammation, the release of anticoagulant substances and reduced availability of nutrients necessary for the erythropoiesis process through anorexia, vomiting, and diarrhea [3]. All these contribute to iron-deficiency anaemia.

Although maternal death is multifactorial, iron-deficiency anaemia in pregnancy due to helminthic infection contributes to increased anaemia-related maternal and neonatal mortality, premature delivery, and low birth weight, especially in endemic regions [4]. Among several associated factors, recent studies revealed an association between elevated helminthiasis infection and illiteracy, absence of latrine and regular consumption of raw and/or unwashed fruit among pregnant women [5].

While health education on hygiene and wearing shoes are important measures for prevention, administration of deworming drugs during antenatal visits remains important.

Despite few inconsistencies in some studies regarding the antenatal effect of deworming [6], WHO recommends preventive chemotherapy using single-dose albendazole (400 mg) or mebendazole (500 mg) in pregnant women in areas where the prevalence of anaemia in pregnancy is 40% or higher and the baseline prevalence of hookworm and/or *T. trichiura* infection is 20% or higher [7]. In a study in Nigeria to compare the pregnant outcomes among those who received 500 mg mebendazole and those who did not receive, the prevalence of anaemia at 37 weeks gestation and above among the treatment arm was significantly lower than in the placebo group (12.6% vs 29.9%,  $p < 0.001$ ) [8]. Similar findings have been reported elsewhere [9].

In several endemic regions, especially sub Saharan Africa, the control of hookworm and other geohelminthes infection is incorporated in the routine antenatal care programmes. Therefore, when women attend the ANC clinics, they freely obtain the drugs, and take them in as a Directly Observed Treatment (DOT). In some cases, when the drugs are out of stock, women are instructed to buy and take them in the absence of healthcare providers.

In Tanzania, de-worming by mebendazole 400 mg for all pregnant women attending antenatal clinics across the country remains a routine in antenatal clinics [10]. However, while preconception anaemia remains a challenge [11], and the overall prevalence of anaemia among women of reproductive age increased from 40% in 2010 to 45% in 2015-16 [10], it remains higher among pregnant women (57%) compared to both breastfeeding mothers (46%) and women who are neither pregnant nor breastfeeding (43%) [10]. Among several other questions regarding this increased proportion of anaemia, is whether

they truly uptake the deworming drugs given during their antenatal visits, and the associated factors to the uptake. Therefore, this retrospective study was conducted to discover the factors associated with the uptake of de-worming drugs during pregnancy among women of reproductive age in Tanzania.

## Methods

### Study design and data

This study was a cross-sectional analysis of a dataset from the 2015-16 Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS-MIS) dataset (2015-16TDHS-MIS).

### The 2015-16 Tdhs-mis

This section of the method is a part of the previously published report of the 2015-16 Tanzania Demographic and Health Survey and Malaria Indicator Survey report [10].

Since 1991, National Bureau of Statistics (NBS) and the Office of Chief Government Statistician (OCGS), Zanzibar, in collaboration with the Ministry of Health, Community Development, Gender, Elderly, and Children on the Tanzania Mainland and the Ministry of Health, Zanzibar, have been conducting a series of national wide surveys to measure levels, patterns, and trends in demographic and health indicators. The 2015-16 TDHS-MIS is the sixth in series of the Tanzania Demographic and Health Survey and Malaria Indicator Survey, with the primary objective of providing up-to-date estimates of basic demographic and health indicators for successful policy planning and implementation.

Participants' information on fertility levels, marriage, sexual activity, fertility preferences, awareness and use of family planning methods, breastfeeding practices, nutrition, child-hood and maternal mortality, maternal and child health, malaria, and other health-related issues were collected and analysed.

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).

Four questionnaires based on the DHS program's standard were used for the 2015-16 TDHS-MIS[10]: The Household Questionnaire, the Woman's Questionnaire, the Man's Questionnaire, and the Biomarker Questionnaire. In this study, the Woman's Questionnaire was used to collect information from all eligible women age 15–49. The information collected includes background characteristics, birth history and childhood mortality, knowledge and use of family planning methods, fertility preferences, access to antenatal services, delivery, and postnatal care, breastfeeding and infant feeding practices, vaccinations and childhood illnesses, marriage and sexual activity, women's work and husbands' background characteristics, adult mortality, including maternal mortality, malaria, domestic violence, and other health related issues.

## Study Population And Data Extraction

The study population included all women of reproductive age (aged 15–49 years). The study used Individual file recode (TZIR7BFL) with a total of 13266 women who responded to the survey (97% response rate). The analysis 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 preceding the survey were included in the study.

## Statistical analysis

Statistical Package for Social Sciences (IBM SPSS version 20) was employed for data analysis. The variables were first described in terms of percentage and frequencies. Then, the association between the dependent and independent variables were assessed by using Chi-squared test. The variables that revealed a significant association were fitted in a binary logistic regression model in order to determine the significant predictors of the uptake of de-worming drugs. Variables were significantly associated with uptake of de-worming drugs if  $p$ -value < 5%.

## 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)

Table 1  
Socio-demographic Characteristics

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

<b>Variables</b>	<b>Frequency</b>	<b>Percent (%)</b>
Working	5426	78.4
<b>Mainland/Zanzibar</b>		
Mainland urban	1618	23.4
Mainland rural	4357	62.9
Unguja (Zanzibar Island)	594	8.6
Pemba (Pemba Island)	355	5.1

### **The relationship between women's characteristics and uptake of deworming drugs**

Women's characteristics which showed a significant relationship with the uptake of deworming drugs were timing for antenatal booking ( $p < 0.001$ ), place of residence ( $p < 0.001$ ), age group ( $p < 0.001$ ), an education level ( $p < 0.001$ ), parity ( $p < 0.001$ ), wealth index ( $p < 0.001$ ), zones ( $p < 0.001$ ) and number of antenatal visits ( $p < 0.001$ ) (Table 2).

Table 2  
The relationship between women's characteristics and uptake of deworming drugs

Variables	Uptake of deworming drugs			p-value
	No n(%)	Yes n(%)	X2	
<b>Antenatal Booking</b>				
Early Booking	465(29.3)	1121(70.7)		
Late Booking	2095(39.2)	3243(60.8)	51.716	< 0.001
<b>Place of residence</b>				
Urban	509(28.1)	1302(71.9)		
Rural	2051(40.1)	3062(59.9)	82.742	< 0.001
<b>Age group</b>				
Less than 20 years	243(44.9)	298(55.1)		
20 to 34 years	1591(34.9)	2966(65.1)		
More than 34 years	726(39.8)	1100(60.2)	29.028	< 0.001
<b>Educational level</b>				
No education	534(40.2)	795(59.8)		
Primary education	1545(36.7)	2664(63.3)		
Secondary	471(35.5)	855(64.5)		
Higher	10(16.7)	50(83.3)	17.813	< 0.001
<b>Parity</b>				
Para one	590(37)	1005(63)		
Para 2–4	1082(34.3)	2072(65.7)		
Para 5+	888(40.8)	1287(59.2)	23.498	< 0.001
<b>Wealth index</b>				
Poor	1141(41.7)	1593(58.3)		
Middle	519(38.1)	844(61.9)		
Rich	900(31.8)	1927(68.2)	59.320	< 0.001
<b>Zones</b>				
Mainland urban	404(25)	1214(75)		

Variables	Uptake of deworming drugs			p-value
	No n(%)	Yes n(%)	X2	
Mainland rural	1720(39.5)	2637(60.5)		
Unguja (Zanzibar Island)	311(52.4)	283(47.6)		
Pemba (Pemba Island)	125(35.2)	230(64.8)	172.569	< 0.001

## Factors Associated With Uptake Of De-worming Drugs During Pregnancy

After controlling of confounders, factors associated with uptake of deworming drugs were early antenatal booking, (AOR = 1.404 at 95% CI = 1.24–1.59,  $p < 0.001$ ); age group of a woman [20 to 34 years (AOR = 1.382 at 95% CI = 1.125–1.696,  $p = 0.002$ ), more than 34 years (AOR = 1.287 at 95% CI = 1.004–1.65,  $p = 0.046$ )] age less than 20 years was a reference population; rural residence (AOR = 1.53 at 95% CI = 1.099–2.128,  $p = 0.012$ ); wealth index [middle (AOR = 1.151 at 95% CI = 1.003–1.32,  $p = 0.044$ ), rich (AOR = 1.378 at 95% CI = 1.185–1.602,  $p < 0.001$ ) poor was a reference population; level of education [higher level (AOR = 2.455 at 95% CI = 1.189–5.067,  $p = 0.015$ )] no formal education was a reference population; parity [para 5 and above (AOR = 0.993 at 95% CI = 0.824–1.197,  $p < 0.001$ )] para one was the reference population; zones [Mainland rural (AOR = 0.439 at 95% CI = 0.307–0.628,  $p < 0.001$ ), Zanzibar Island (AOR = 0.22 at 95% CI = 0.158–0.306,  $p < 0.001$ ) and Pemba Island AOR = 0.493 at 95% CI = 0.337–0.723,  $p < 0.001$ ]

Table 3  
Factors associated with uptake of de-worming drugs during pregnancy

Variable	OR	95%CI		p-value	AOR	95%CI		p-value
		Lower	Upper			Lower	Upper	
<b>ANC Booking</b>								
Late booking	1				1			
Early booking	1.557	1.38	1.758	< 0.001	1.404	1.24	1.59	< 0.001
<b>Age groups</b>								
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
<b>Place of residence</b>								
Urban	1				1			
Rural	1.713	1.713	1.926	< 0.001	1.53	1.099	2.128	0.012
<b>Wealth index</b>								
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
<b>Educational level</b>								
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
<b>Parity</b>								
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
<b>Mainland/Zanzibar</b>								
Mainland urban	1				1			

Variable	OR	95%CI		p-value	AOR	95%CI		p-value
		Lower	Upper			Lower	Upper	
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

## Discussion

In the present study, the proportion of women who reported to have taken in the deworming drugs during their pregnancy was 60.1%. This proportion is lower than the proportion of women who attend at least one antenatal visit in Tanzania, which is about 98% [10]. This implies that, a significant proportion of pregnant women attend ANC but do not comply to deworming drugs.

In this study, the factors that directly affect the uptake of deworming drugs include: Early antenatal booking, age group of a woman rural, residence, wealth index, level of education, parity, and the zone of residence.

Women who attend early in the antenatal clinic are more likely to uptake the deworming drugs than those who attend later. Early attendance in the antenatal clinic is related to knowledge regarding the use of deworming drugs [12], while late initiation of antenatal care (ANC) is associated with poor knowledge [13]. Therefore, those who attend early in the antenatal clinics are more knowledgeable about the importance of up taking the deworming drugs than those who attend late or never. These findings underscore the importance of reproductive health education including uptake of deworming drugs among women of reproductive health even before they become pregnant, and whenever possible, beyond antenatal clinics.

The findings of this study also revealed that, women above 20 years of age were more likely to uptake the deworming drugs than woman below 20 years. Consistent with this, a recent study reveals that the odds of helminthic infection among pregnant women aged below 21 were more than twice as much as those above 21 years [2]. These findings may have multiple explanations: Firstly, unlike women above 20 years of age, most women at the age below 20 in Tanzania are at their secondary and college education. Therefore, the majority are unmarried and have their pregnancies unplanned. While unplanned pregnancy is associated with late initiation of antenatal care [13], planned pregnancy is associated with early initiation of antenatal services [12], and health-seeking behavior [14] which are important factors for the uptake of the deworming drugs.

Secondly, women above 20 years are likely to be multiparous and/or multigravida, while women at the age below 20 in Tanzania are mostly primigravida / primipara [10]. Multiparous women are likely to have had more antenatal attendances in their previous pregnancies. Because antenatal clinics are the main

sources of antenatal knowledge among the women in Tanzania, and each time a woman attends, is an opportunity for more education, then the number of pregnancy a woman has ever had is likely to be proportional to the level of knowledge about antenatal services. In the recent study in Sri Lanka, multiparous women (2–4 children) were more knowledgeable about complication readiness in pregnancy than nulliparous women [15]. The level of knowledge is a significant factor for early initiation of ANC and compliance to deworming drugs.

In this study, however, women who are para 5 and above (Grand multipara) were slightly negatively associated with compliance in taking deworming drugs. The reason could be that, the grand multipara women find themselves more experienced to pregnancy and to routine ANC services. This confidence delays their antenatal initiation and impairs compliance in taking deworming drugs. The role of grand multiparity in reducing the odds of ANC attendance is reported in several other studies [16][17]. These observations warrant a need for a special educational and sensitization program targeting grand multiparas, not only about compliance in taking the deworming drugs but also on the utilization of family planning programs.

The findings of this study reveal that wealthier women are more likely to uptake the deworming drugs than the poor [middle (AOR = 1.151 at 95% CI = 1.003–1.32,  $p = 0.044$ ), rich (AOR = 1.378 at 95% CI = 1.185–1.602,  $p < 0.001$ ). This has a dual explanation: First, being wealthier implies that women are, not only able to afford transport to the clinic where they can access the services, but also able to afford the deworming drugs from the pharmaceutical stores when the ANC clinics run out of stock [13]. The influence of wealth on utilization of ANC has been reported in Nigeria [18], and Ghana [19]. Second, wealthier and employed women are more likely to attend antenatal clinics early than unemployed [18], which is a significant factor for the uptake of deworming drugs. This accounts for the importance of women's economic empowerment in improving ANC utilization including uptake of the deworming drugs.

In this study, women with a higher level of formal education were more likely to uptake the deworming drugs than women without formal education (AOR = 2.455 at 95% CI = 1.189–5.067,  $p = 0.015$ ). More intriguingly, recent evidences reveal that, the odds of intestinal parasitic infection among illiterate pregnant mothers is more than 2 folds higher than the educated pregnant mothers [2]. Combining the two observations, it can be suggested that, women with formal education are likely to have knowledge on the importance of hygiene and compliance to deworming drugs during pregnancy, and health-seeking behavior than those without formal education. Besides, formal education by pregnant women is associated with early ANC initiation [20], an important factor for the compliance to deworming drugs. These findings support the national and international call for women's educational empowerment, if proper uptake of deworming drugs and other antenatal services are to be achieved.

Regarding the influence of geographical residence on the uptake of deworming drugs, (Table 3), mainland urban areas are associated with higher uptake than the mainland rural areas and in Zanzibar and Pemba islands. This observation correlates with the higher prevalence of helminthiasis in rural areas than urban areas reported in a recent study [2]. Similarly, the lower uptake in Zanzibar and Pemba islands correlates

with their corresponding higher prevalence of helminthiasis than in mainland urban [3]. While more exploratory studies are warranted, the differences in uptake may be explained by inadequate campaigns among pregnant women, delayed ANC initiation in rural compared to urban [20] and the higher illiteracy rate among pregnant women in rural areas [5].

## Strength And Limitation And Strength Of The Study

The strength of this study is that it was community-based which covered participants from all the nine zones of Tanzania. Therefore, the findings may represent the factors associated with uptake of deworming drugs during pregnancy among women of reproductive age in Tanzania. However, being a retrospective study, it included only women who remembered the timing for antenatal booking of their youngest child, which may lead to recall bias.

## Conclusion

Uptake of deworming drugs is lower than the expected proportion of women attending ANC in Tanzania. Factors associated with uptake of deworming drugs were early antenatal booking, age group, rural residence, zonal residence, wealth index, level of education, and parity. Considering the outcomes of anaemia in pregnancy, education on the importance of deworming during pregnancy should be insisted to every woman of reproductive age before and after conception. Whenever possible, it should be done even beyond antenatal clinics. Furthermore, women should be economically empowered, and formally educated for proper achievement of uptake of deworming drugs and utilization of other antenatal services.

## Recommendation

Clinicians in antenatal clinics should consider all the modifiable factors associated with uptake of deworming drugs among women of reproductive age in order to improve the uptake. Whenever possible, the deworming drugs should be made available in the antenatal clinics. When the deworming drugs are out of stock, and the women required to buy on their own, emphasis should be provided on the importance of uptake and the risks associated with the skipping.

Vomiting is a common problem in pregnancy, and some women may fear to take in anything orally. In such situations, clinicians should individualize care depending on the client's needs and provide the necessary support to the client.

## Abbreviations

**ANC**-Antenatal care

**TDHS**-Tanzania Demographic Health Survey

## Declarations

### Ethics approval and consent to participate

This study involved analysis of secondary data only. Therefore, no formal ethical approval was required. However, permission to use the data for this particular research and publishing in peer reviewed journal was obtained from DHS measures.

### Data Availability

The data that support this analysis are available from the 2015-16 Tanzania HIV and Malaria Indicators Survey (THMIS). Data is available from the authors upon reasonable request and with permission from MEASURE DHS.

**Competing interests:** The authors declare that they have no competing interests

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### Authors' Contributions

Vicent, Bankanie drafted the manuscript and led the process of critical revision of the manuscript. Fabiola V. Moshi developed the study framework and study design, performed the statistical analysis, drafted the methods section of the paper, and participated in critical revision of the manuscript. Li Yinglan contributed to the literature review, discussion, critical review, editing, and provided overall guidance and supervision. All authors have read and approved this manuscript to be processed for publication.

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