Timeliness of antenatal care initiation and its associated factors among pregnant women: Evidence from the 2022 Tdhs-Mis

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ABSTRACT

Reducing maternal mortality and enhancing women's healthcare are key targets of the Third Sustainable Development Goal (SDG), aiming to lower the global maternal mortality ratio (MMR) to 70 per 100,000 live births by 2030. This study examines predictors of the timing of the first antenatal care (ANC) visit among pregnant women in Tanzania. It was pegged on three theoretical frameworks: the Health Belief Model (HBM), the Theory of Planned Behavior (TPB), and Andersen's Behavioral Model. A cross-sectional analysis was conducted using 2022 Tanzania Demographic and Health Survey data. The study population included adult women aged 15–49 years. Data were weighted to reflect the complex survey design. The study employed descriptive statistics to assess ANC initiation across trimesters, log-rank tests to select variables, and multivariate Cox proportional hazards regression to identify timing-related factors. Of 5,195 women, 66% initiated ANC after three months, while 34% did so within the recommended period. Older women (35–49 years) delayed their ANC by 43.7% compared to those aged 15–24 (AHR: 0.77, 95% CI: 0.67–0.90, $p < 0.001$). Education shortened ANC timing: primary (AHR: 1.27, $p = 0.003$), secondary (AHR: 1.30, $p = 0.007$), and higher (AHR: 1.80, $p = 0.008$). Proximity to health facilities (AHR: 1.11, $p < 0.074$), employment (AHR: 1.02, $p < 0.08$), and media exposure (radio: AHR: 1.13, $p = 0.067$; TV: AHR: 1.18, $p = 0.028$) showed a non-significant trend toward earlier ANC. Age, education, distance to facilities, employment, and media exposure significantly influence ANC timing. Health literacy promotion and media campaigns are recommended to enhance timely ANC initiation.

Keywords: Antenatal Care, Maternal Health, Tanzania, Timing of First ANC

I. INTRODUCTION

Reducing maternal mortality and improving women's healthcare are pivotal objectives of the Third Sustainable Development Goal (SDG), which seeks to reduce the global maternal mortality ratio (MMR) to 70 per 100,000 live births by 2030 [1]; [2]. The World Health Organization (WHO) reports a 34% global decline in maternal mortality between 2000 and 2020 [3]. However, Tanzania's MMR remains elevated at 104 deaths per 100,000 live births in the seven years preceding the 2022 TDHS-MIS, signalling a need for intensified efforts to meet the SDG target. Regular antenatal care (ANC) from skilled providers can reduce maternal mortality by 20% [4]; [5].

Research across Sub-Saharan Africa highlights factors influencing ANC timing. In Ethiopia, 42% of women-initiated ANC after 16 weeks, linked to unemployment, low income, and unplanned pregnancies [6]. In Uganda, media exposure (radio and television) correlated with early ANC, alongside age, household size, and religion [7]. Another study found only 30% of Ugandan women attended ANC in the first trimester, associating timely visits with marital status and parity [8]. In Gondar, Ethiopia, 35.4% of women started ANC early, influenced by younger age, later marriage, and decision-making autonomy [9]. A study reported a median ANC initiation time of seven months in Ethiopia, delayed by poverty, lack of media access, and rural residence [10]. In Tanzania, a study found only 3.62% of women in Geita district-initiated ANC in the first trimester, citing barriers like male partner disengagement, poor care quality, and distance to facilities [11]. Another study reported 70.4% of late bookings in Lushoto district, were tied to unemployment and unmarried status [12].

Therefore, while several studies have examined predictors of ANC initiation, their findings demonstrate significant variation across settings, and most are based on localized or facility-level samples, limiting their generalizability. Moreover, existing Tanzanian studies are small-scale and fragmented, with limited exploration of broader social and economic determinants at the population level [6]; [7]; [8]; [9]; [10]; [11]; [12]. Using the 2022 TDHS-MIS, which is both recent and nationally representative, this study addresses these gaps by providing robust evidence on the timing of ANC initiation and its associated factors. Such evidence is crucial for informing maternal health policy in Tanzania. It contributes to the global discourse on how structural and household-level factors shape the timeliness of maternal healthcare utilization. This study aims to: (1) assess social factors affecting the timing of the first

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ANC visit, and (2) evaluate economic factors influencing ANC initiation among Tanzanian women, (3) compare the trend in ANC initiation between the 2015/2016 and 2022 TDHS-MIS datasets offering evidence-based policy recommendations.

1.1 Research Objective

This study aims to: (1) assess social factors affecting the timing of the first ANC visit, (2) evaluate economic factors influencing ANC initiation among Tanzanian women, and (3) compare the trend in ANC initiation between the 2015/2016 and 2022 TDHS-MIS datasets, offering evidence-based policy recommendations.

II. LITERATURE REVIEW

2.1 Theoretical Review

In this study, three theoretical frameworks, the Health Belief Model (HBM), Theory of Planned Behavior (TPB), and Andersen's Behavioral Model guided to understand how the outcome variable is influenced by the independent variables. Rendering to the HBM suggested that the decision to initiate ANC visits is inclined to the perception of susceptibility to complications during pregnancy, the perceived benefits associated with early visits, and perceived barriers associated with accessing health care [13]. The TPB suggests that a woman's decision to seek early ANC is associated with her attitudes towards ANC, personal norms within her social circle, and her seeming control over accessing ANC services [14]. Lastly, Andersen's Behavioral Model classifies causes of health service usage into predisposing factors (Such as Women's Age: Age in years, Place of Residence, Educational Level, Frequency of Reading Newspapers or Magazines, Frequency of Listening to the Radio, Frequency of Watching Television, Frequency of Using the Internet Last Month, Current Marital Status, Husband/Partner's Education Level, and Working Status), enabling factors (Distance to Health Facility, Possession of Health Insurance, and Wealth Index Combined), and need factors (Current Pregnancy Wanted) [15].

2.2 Empirical Estimation Strategy

A multivariate Cox proportional hazards regression model was employed to analyze the time to the first ANC visit, suitable for time-to-event data with censoring. This approach accommodates time-varying covariates and uses maximum likelihood estimation.

III. METHODOLOGY

3.1 Study Data and Design

This study employed a cross-sectional research design using secondary data from the 2022 Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS-MIS), the seventh DHS carried out in Tanzania and gathered data from February to July 2022 using a two-stage stratified sampling method. In the first stage, 629 enumeration areas (EAs) were chosen from the 2012 Tanzania Population and Housing Census (211 urban, 418 rural). In the second stage, 26 households per EA were systematically sampled, aiming for 16,354 households. Women aged 15–49, whether residents or overnight visitors, were eligible for interviews conducted through five questionnaires. This analysis concentrates on a probability sample of 5,195 pregnant women, accessed via the DHS programme (https://www.dhsprogram.com). The cross-sectional design allows for the examination of associations between variables at a single point in time, facilitating the identification of factors associated with ANC timing through descriptive and inferential statistics, including Cox proportional hazards regression.

3.2 Model Specification

A multivariate Cox proportional hazards regression model was employed to analyze the time to the first ANC visit, suitable for time-to-event data with censoring. This approach accommodates time-varying covariates and uses maximum likelihood estimation.

The multivariate Cox proportional hazard regression model is specified as follows

$$h(t\backslash x) = h_o(t)exp\left(B_1x_1 + B_2x_2 + \cdots + B_px_p\right)$$

where, $h(t\backslash x)$ is the hazard function at time t for a woman with factors x, $h_o(t)$ denotes the baseline hazard function and $B_1, B_2, \ldots, B_p$ are coefficients for the factors $x_1, x_2, \ldots, x_p$

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3.3 Variable Definition and Measurement

Data abstraction was performed using the women's recode file (TAZR82FL.DTA) in STATA 16. Survey weights and stratification commands were applied for the clustered sampling design. The analytic sample consisted of 5,195 women aged 15–49 who had given birth five years before the survey and reported using ANC services. The primary outcome variable, time to first ANC visit, was derived from maternity history data and expressed as a continuous measure in months representing the time until the event (first ANC visit) or censoring. Early initiation is defined as occurring within the first trimester. Log-rank tests were used to examine differences, followed by multivariate Cox regression to identify predictors. Independent variables were derived from demographic, socio-economic, and enabling factors, including age, education, residence, marital status, partner's education, media exposure, wealth index, employment, distance to health facilities, health insurance, and pregnancy intention. Pregnancy intention ("current pregnancy wanted") was categorized as "wanted then" (reference), "wanted later," or "not wanted at all" in descriptive analyses (Table 1), but for multivariate modeling, it was dichotomized as "wanted" (then) vs. "unwanted" (later or not at all) due to small cell sizes in the "not at all" category. Missing data were minimal (<5%) and handled through listwise deletion. This method ensured accurate estimates of ANC initiation while considering the survey's complex design.

3.4 Data Processing and Analysis

Data were analyzed using STATA version 16. Descriptive statistics summarized ANC timing by trimester and characteristics. Log-rank tests identified variables for multivariate analysis ($p<0.05$). Multivariate Cox proportional hazards regression assessed predictors, with adjusted hazard ratios (AHRs), 95% confidence intervals (CIs), and $p<0.05$ indicating significance. Model fit was confirmed with a -2 log-likelihood chi-square of 139.24 ($p<0.0001$).

3.5 Comparative Analysis

To assess changes in the timeliness of ANC initiation over time, descriptive statistics from the 2015/16 TDHS-MIS were extracted from the national report published by NBS and ICF (2017). The key indicator, the proportion of women initiating ANC within the first trimester, was compared with estimates derived from the 2022 TDHS-MIS dataset analysed in this study. This comparative approach provided a contextual benchmark to evaluate progress in early ANC utilisation over time, aligning with national maternal health targets.

IV. FINDINGS & DISCUSSION

4.1 Descriptive Findings

According to the 2015/16 TDHS-MIS, only 22% of women initiated ANC within the first trimester. The present analysis shows a marked improvement to 34% in 2022, indicating modest progress over the past seven years. Of 5,195 women, 34% initiated ANC within three months, while 66% delayed beyond this period. Table 1 shows that 50.1% of women with primary education, 58.1% with planned pregnancies, and 59.8% of married women started ANC in the first trimester. Similarly, 52.9% with educated partners, 47.5% aged 25–34, 47.5% classified as rich, 71.5% employed, and 67.2% rural residents initiated early. Conversely, limited media exposure (e.g., 76.8% with no newspapers, 38.6% with no radio) and a lack of insurance (93.7%) were common among early initiators. Log-rank tests confirmed significance ($p < 0.05$) for most variables except marital status.

Table 1

Percentage of Pregnant Women by their Characteristics, and Log-rank test concerning the Timing of the First ANC visit (n = 5,195)

Variable	Category	1st Trimester (%)	2nd Trimester (%)	3rd Trimester (%)	Total (%)	Log Rank test p-value
ype of place of residence	urban	620 (32.8)	800 (27.1)	79 (22.3)	1499(28.9)	<0.001
	rural	1273 (67.2)	2148 (72.9)	275 (77.7)	3696(71.1)	
highest educational level	no education	269 (14.2)	597 (20.3)	115 (32.5)	981(18.9)	<0.001
	primary	948 (50.1)	1491 (50.5)	194 (54.8)	2633(50.7)	
	secondary	633 (33.4)	843 (28.6)	45 (12.7)	1521(29.3)	
	higher	43 (2.3)	17 (0.6)	0 (0.0)	60(1.2)	
frequency of reading newspaper or magazine	not at all	1453 (76.8)	2393 (81.2)	311 (87.9)	4157(80.0)	<0.001
	less than once a week	310 (16.4)	422 (14.3)	29 (8.2)	761(14.6)	

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	at least once a week	130 (6.8)	133 (4.5)	14 (3.9)	277(5.3)	
frequency of listening to radio	not at all	730 (38.6)	1358 (46.0)	200 (56.5)	2288(44.0)	<0.001
	less than once a week	477 (25.2)	701 (23.8)	74 (20.9)	1252(24.1)	
	at least once a week	686 (36.2)	889 (30.2)	80 (22.6)	1655(31.9)	
frequency of watching television	not at all	965 (51.0)	1817 (61.6)	248 (70.1)	3030(58.3)	<0.001
	less than once a week	316 (16.7)	428 (14.5)	42 (11.9)	786(15.1)	
	at least once a week	612 (32.3)	703 (23.9)	64 (18.0)	1379(26.5)	
frequency of using internet last month	not at all	1580 (83.5)	2678 (90.8)	333 (94.1)	4591(88.4)	<0.001
	less than once a week	40 (2.1)	40 (1.4)	7 (2.0)	87(1.7)	
	at least once a week	100 (5.3)	118 (4.0)	5 (1.4)	223(4.3)	
	almost every day	173 (9.1)	112 (3.8)	9 (2.5)	294(5.7)	
current pregnancy wanted	then	72 (58.1)	130 (52.4)	19 (57.6)	221(54.6)	0.0462
	later	52 (41.9)	107 (43.1)	11 (33.3)	170(42.0)	
	not at all	0 (0.0)	11 (4.5)	3 (9.1)	14(3.5)	
distance to health facility	big problem	515 (27.2)	971 (32.9)	168 (47.5)	1654(31.8)	<0.001
	not a big problem	1378 (72.8)	1977 (67.1)	186 (52.5)	3541(68.2)	
covered by health insurance	no	1773 (93.7)	2841 (96.4)	346 (97.7)	4960(95.5)	
	yes	120 (6.3)	107 (3.6)	8 (2.3)	235(4.5)	
current marital status	never in union	154 (8.1)	221 (7.5)	23 (6.5)	398(7.7)	0.7452
	married	1132 (59.8)	1762 (59.8)	213 (60.2)	3107(59.8)	
	living with partner	427 (22.6)	682 (23.1)	79 (22.3)	1188(22.9)	
	widowed	15 (0.8)	30 (1.0)	4 (1.1)	49(0.9)	
	divorced	98 (5.2)	154 (5.2)	25 (7.1)	277(5.3)	
	no longer living together/separated	67 (3.5)	99 (3.4)	10 (2.8)	176(3.4)	
husband/partner's education level	no education, preschool/early childhood education	164 (10.5)	339 (13.9)	66 (22.6)	569(13.2)	<0.001
	primary	825 (52.9)	1358 (55.6)	183 (62.7)	2366(55.1)	
	secondary	475 (30.5)	634 (25.9)	38 (13.0)	1147(26.7)	
	higher	76 (4.9)	61 (2.5)	3 (1.0)	140(3.3)	
	don't know	19 (1.2)	52 (2.1)	2 (0.7)	73(1.7)	
respondent's current age	15-24	617 (32.6)	971 (32.9)	101 (28.5)	1689(32.5)	<0.001
	24-34	899 (47.5)	1268 (43.0)	139 (39.3)	2306(44.4)	
	35-49	377 (19.9)	709 (24.1)	114 (32.2)	1200(23.1)	
wealth index combined	poor	618 (32.6)	1177 (39.9)	196 (55.4)	1991(38.3)	<0.001
	middle	376 (19.9)	635 (21.5)	61 (17.2)	1072(20.6)	
	rich	899 (47.5)	1136 (38.6)	97 (27.4)	2132(41.0)	
working	no	539 (28.5)	993 (33.7)	129 (36.4)	1661(32.0)	0.0001
	yes	1354 (71.5)	1955 (66.3)	225 (63.6)	3534(68.0)	

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3.2 Multivariate Analysis

Table 2 reveals predictors of ANC timing. Women aged 35–49 had a 23% lower hazard of early ANC (AHR: 0.77, 95% CI: 0.67–0.90, $p < 0.001$) compared to those aged 15–24. Education increased the hazard: primary (AHR: 1.27, $p = 0.003$), secondary (AHR: 1.30, $p = 0.007$), and higher (AHR: 1.80, $p = 0.008$) versus no education. Proximity to facilities (AHR: 1.11, $p = 0.074$) and employment (AHR: 1.02, $p = 0.08$) modestly accelerated the initiation of ANC. Media exposure also mattered: weekly radio use (AHR: 1.13, $p = 0.067$), occasional TV viewing (AHR: 1.18, $p = 0.028$), and daily internet use (AHR: 1.41, $p = 0.002$) linked to earlier initiation.

Table 2

Multivariate Cox-Regression Analysis Showing Predictors of Timing of First ANC Visit

Variable	Adjusted Hazard Ratio	Std. Err.	z	p-value	95% confidence interval	
Age						
15-24	**Reference**					
25-34	0.974	0.058	-0.43	0.669	0.866	1.096
35-49	0.779	0.058	-3.31	0.001	0.671	0.903
place of residence						
Urban	**Reference**					
Rural	1.009968	0.067753	0.15	0.882	0.885535	1.151886
education level						
no education	**Reference**					
Primary	1.273214	0.104351	2.95	0.003	1.084272	1.495081
Secondary	1.308182	0.129632	2.71	0.007	1.077258	1.588607
Higher	1.807489	0.40629	2.63	0.008	1.163433	2.808082
husband/partner's education						
no education	**Reference**					
Primary	1.017071	0.092585	0.19	0.852	0.850875	1.21573
Secondary	0.994274	0.106423	-0.05	0.957	0.806115	1.226353
Higher	1.045393	0.177118	0.26	0.793	0.750003	1.457125
don't know	0.665088	0.164841	-1.65	0.1	0.409176	1.081056
wealth index						
Poor	**Reference**					
Middle	1.040731	0.080724	0.51	0.607	0.893954	1.211607
Rich	1.074591	0.094634	0.82	0.414	0.904236	1.27704
distance to the health facility						
big problem	**Reference**					
not a big problem	1.115763	0.068333	1.79	0.074	0.989559	1.258062
current working						
No	**Reference**					
Yes	1.104709	0.062933	1.75	0.08	0.988	1.235205
covered by health insurance						
No	**Reference**					
Yes	1.166133	0.132883	1.35	0.177	0.932721	1.457955
frequency of reading newspapers/magazine						
not at all	**Reference**					
less than once a week	0.961459	0.07028	-0.54	0.591	0.833126	1.109561
at least once a week	1.057476	0.116049	0.51	0.611	0.852822	1.311241
frequency of listening to the radio						
not at all	**Reference**					
less than once a week	1.104481	0.077233	1.42	0.155	0.963023	1.266718
at least once a week	1.130944	0.075848	1.83	0.067	0.991641	1.289816
frequency of watching television						
not at all	**Reference**					
less than once a week	1.187812	0.093045	2.2	0.028	1.018757	1.384921
at least once a week	1.118619	0.086529	1.45	0.147	0.961255	1.301745
frequency of using the internet						

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not at all	**Reference**					
less than once a week	1.054725	0.195934	0.29	0.774	0.732847	1.517975
at least once a week	1.083304	0.135834	0.64	0.523	0.847265	1.3851
almost every day	1.409668	0.153667	3.15	0.002	1.138486	1.745443

4.2 Discussion

The current study found that 34% of pregnant women initiated their first ANC visit early; this proportion is significantly higher compared to the proportion (22%) of the previous survey of TDHS-MIS of 2015/16, consistent with the comparative analysis outlined in Section 2.7. This is possible due to progress made in the health sector, through the expansion of health facilities, health services particularly ANC, and education of maternal and child care (Ministry of Health [Tanzania Mainland], Ministry of Health [Zanzibar], National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), & ICF, 2022). Our findings support the Health Belief Model, a woman who had Health insurance and attained higher levels of education reduced perceived barriers to ANC, hence facilitating earlier initiation of ANC

It was observed in the study that women aged 35–49 had a longer time to initiate ANC, indicating a delayed initiation of antenatal care (HR < 1), compared to younger women aged 15–24. This finding is inconsistent with studies conducted in Gondar, Ethiopia, and Nigeria, which reported that mothers aged 25 years and below were about two times more likely to start ANC within the recommended time compared to those above 25 years [9]; [10]; [16]. This difference may be attributed to the perception among older women that they face a lower risk of pregnancy-related complications and to social norms that consider early ANC initiation unnecessary.

It was also observed that women with primary, secondary, or higher education experienced a shorter time to first ANC initiation (HR > 1) compared to women with no education. This implies a faster initiation of antenatal care among educated women. This finding is consistent with studies conducted in Uganda, Ghana, Ethiopia, and Nepal, which found that women with primary, secondary, or higher education had earlier initiation of ANC compared to those with no education [17]; [18]; [19]; [20]; [10]. This consistency may be explained by the fact that education enhances women's self-awareness and knowledge of the health risks associated with delayed ANC initiation.

The current study further showed that women who did not perceive distance to the health facility as a major problem had a shorter time to initiate their first ANC visit (HR > 1), reflecting earlier ANC initiation, compared to those who considered distance a big problem. This finding is supported by studies conducted in Ethiopia, Cameroon, and Zambia, which reported that women who faced fewer challenges in reaching health facilities initiated ANC earlier than those who experienced access difficulties [10]; [21]; [22]; [23]; [11]. This may be because shorter distance facilitates faster access to health facilities and reduces transportation-related costs.

Moreover, working women demonstrated a shorter time to first ANC initiation (HR > 1) than non-working women, indicating earlier initiation of antenatal care. Similar findings were reported in studies conducted in Addis Ababa and Dilla Town, Gedeo Zone, Ethiopia, where unemployed women were more likely to initiate ANC late compared to employed women [6]; [24]. A plausible explanation is that working women may have greater financial autonomy, enabling them to afford healthcare-related expenses, including transportation to health facilities.

Furthermore, women who listened to the radio or watched television had a shorter time to initiate their first ANC visit (HR > 1) compared to their counterparts, suggesting faster initiation of ANC among women exposed to mass media. This finding aligns with studies conducted in Uganda, Nigeria, and Pakistan, which revealed that women exposed to radio at least once a week were more likely to initiate ANC within the first trimester compared to those with no media exposure [7]; [25]; [26]. Mass media, including radio and television, plays a critical role in promoting positive health-seeking behaviour by disseminating information on the importance of timely initiation of antenatal care and other maternal health services [27].

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

The increase from 22% to 34% in timely ANC initiation signals progress, yet challenges persist, particularly among older women. Education, facility access, employment, and media exposure are key drivers of early ANC. Policymakers should integrate maternal health education into adult literacy programs and develop targeted radio and TV spot messages in local languages addressing common misconceptions, especially those held by older women, to enhance maternal healthcare equity. As a cross-sectional study reliant on self-reported data, further region-specific research is warranted.

5.2 Recommendations

To improve timely ANC initiation, policymakers should prioritize health literacy promotion by integrating maternal health education into adult literacy programs, particularly targeting older women and those with lower

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education. Additionally, develop and disseminate targeted media campaigns via radio and television in local languages to dispel misconceptions about ANC timing and highlight its benefits. Efforts should also focus on reducing access barriers through expanded health facility infrastructure in remote areas and financial support for employed women. Finally, collaboration between government, NGOs, and communities is essential to foster equity in maternal healthcare utilization and accelerate progress toward SDG targets.

REFERENCES

[1] Woldeamanuel BT, Belachew TA. Timing of first antenatal care visits and number of items of antenatal care contents received and associated factors in Ethiopia: multilevel mixed effects analysis. *Reproductive Health*. 2021 Nov 17;18(1):233.

[2] Assembly UG. Transforming our world: the 2030 Agenda for Sustainable Development.

[3] World Health Organization. Trends in maternal mortality 2000 to 2020: estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division. World Health Organization; 2023 Feb 22.

[4] Testa J, Ouedraogo C, Prual A, De Bernis L, Kone B. Determinants of risk factors associated with severe maternal morbidity: application during antenatal consultations. *Journal de Gynecologie, Obstetrique et Biologie de la Reproduction*. 2002 Feb 1;31(1):44-50.

[5] Prual A, Toure A, Huguet D, Laurent Y. The quality of risk factor screening during antenatal consultations in Niger. *Health Policy and Planning*. 2000 Mar 1;15(1):11-6.

[6] Gulema H, Berhane Y. Timing of first antenatal care visit and its associated factors among pregnant women attending public health facilities in Addis Ababa, Ethiopia. *Ethiopian Journal of Health Sciences*. 2017 Mar 15;27(2):139-46.

[7] Sserwanja Q, Mutisya LM, Musaba MW. Exposure to different types of mass media and timing of antenatal care initiation: insights from the 2016 Uganda Demographic and Health Survey. *BMC Women's Health*. 2022 Jan 11;22(1):10.

[8] Towongo MF, Ngome E, Navaneetham K, Letamo G. Factors associated with women's timing of first antenatal care visit during their last pregnancy: evidence from 2016 Uganda Demographic Health Survey. *BMC Pregnancy and Childbirth*. 2022 Nov 10;22(1):829.

[9] Temesgen Worku Gudayu TW, Solomon Meseret Woldeyohannes SM, Abdella Amano Abdo AA. Timing and factors associated with first antenatal care booking among pregnant mothers in Gondar Town; North West Ethiopia.

[10] Seid A, Ahmed M. Survival time to first antenatal care visit and its predictors among women in Ethiopia. *PLoS One*. 2021 May 6;16(5):e0251322.

[11] Konje ET, Magoma MT, Hatfield J, Kuhn S, Sauve RS, Dewey DM. Missed opportunities in antenatal care for improving the health of pregnant women and newborns in Geita District, Northwest Tanzania. *BMC Pregnancy and Childbirth*. 2018 Oct 5;18(1):394.

[12] Njiku F, Wella H, Sariah A, Protas J. Prevalence and factors associated with late antenatal care visit among pregnant women in Lushoto, Tanzania. *Tanzania Journal of Health Research*. 2017 Jul 5;19(3).

[13] Simkhada B, Teijlingen ER, Porter M, Simkhada P. Factors affecting the utilization of antenatal care in developing countries: systematic review of the literature. *Journal of Advanced Nursing*. 2008 Feb;61(3):244-60.

[14] Afaya A, Azongo TB, Dzomeku VM, Afaya RA, Salia SM, Adatara P, Kaba Alhassan R, Amponsah AK, Atakro CA, Adadem D, Asiedu EO. Women's knowledge and its associated factors regarding optimum utilisation of antenatal care in rural Ghana: A cross-sectional study. *PLoS One*. 2020 Jul 9;15(7):e0234575.

[15] Babitsch B, Gohl D, Von Lengerke T. Re-revisiting Andersen's behavioral model of health services use: a systematic review of studies from 1998–2011. *GMS Psycho-Social-Medicine*. 2012 Oct 25;9:Doc11.

[16] Fagbamigbe AF, Abel C, Mashabe B, Adebowale AS. Survival analysis and prognostic factors of the timing of first antenatal care visit in Nigeria. *Advances in Integrative Medicine*. 2019 Sep 1;6(3):110-9.

[17] Towongo MF, Ngome E, Navaneetham K, Letamo G. Factors associated with women's timing of first antenatal care visit during their last pregnancy: evidence from 2016 Uganda Demographic Health Survey. *BMC Pregnancy and Childbirth*. 2022 Nov 10;22(1):829.

[18] Manyeh AK, Amu A, Williams J, Gyapong M. Factors associated with the timing of antenatal clinic attendance among first-time mothers in rural southern Ghana. *BMC Pregnancy and Childbirth*. 2020 Jan 20;20(1):47.

[19] Belay DG, Alemu MB, Aragaw FM, Asratie MH. Time to initiation of antenatal care visit and its predictors among reproductive age women in Ethiopia: Gompertz inverse Gaussian shared frailty model. *Frontiers in Global Women's Health*. 2023 Oct 3;4:917895.

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[20] Joshi C, Torvaldsen S, Hodgson R, Hayen A. Factors associated with the use and quality of antenatal care in Nepal: a population-based study using the demographic and health survey data. *BMC Pregnancy and Childbirth*. 2014 Mar 3;14(1):94.
[21] Tolefac PN, Halle-Ekane GE, Agbor VN, Sama CB, Ngwasiri C, Tebeu PM. Why do pregnant women present late for their first antenatal care consultation in Cameroon? *Maternal Health, Neonatology and Perinatology*. 2017 Dec 13;3(1):29.
[22] Kyei NN, Campbell OM, Gabrysch S. The influence of distance and level of service provision on antenatal care use in rural Zambia.
[23] Alemu Y, Aragaw A. Early initiations of first antenatal care visit and associated factor among mothers who gave birth in the last six months preceding birth in Bahir Dar Zuria Woreda North West Ethiopia. *Reproductive Health*. 2018 Dec 12;15(1):203.
[24] Abuka T. Assessment of timing of first antenatal care booking and associated factors among pregnant women who attend antenatal care at health facilities in Dilla Town, Gedeo Zone, Southern Nations, Nationalities, and Peoples Region, Ethiopia, 2014. *Journal of Pregnancy and Child Health*. 2016 Jan 1.
[25] Aliyu AA, Dahiru T. Predictors of delayed antenatal care (ANC) visits in Nigeria: secondary analysis of 2013 Nigeria Demographic and Health Survey (NDHS). *Pan African Medical Journal*. 2017 Mar 3;26:124.
[26] Agha S, Tappis H. The timing of antenatal care initiation and the content of care in Sindh, Pakistan. *BMC Pregnancy and Childbirth*. 2016 Jul 27;16(1):190.
[27] Fatema K, Lariscy JT. Mass media exposure and maternal healthcare utilization in South Asia. *SSM-Population Health*. 2020 Aug 1;11:100614.

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