# Survival time to first antenatal care visit and its predictors among women in Ethiopia

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## Abstract

### Background

First-trimester pregnancy stage is the fastest developmental period of the fetus, in which all organs become well developed and need special care. Yet, many women make their first antenatal visit with the pregnancy already compromised due to fetomaternal complications. This study aimed to fill this dearth using the 2016 national representative data set to augment early antenatal care visits in Ethiopia.

### Methods

A cross-sectional study design using the 2016 Ethiopia Demographic and Health Survey (EDHS) data set. Kaplan-Meir estimate was used to explain the median survival time of the timing of the first ANC visit. Multivariate Cox-proportional hazard regression analysis was performed to identify the factors related to the timing of the first ANC visit. Adjusted hazard ratios (AHR) with a 95% Confidence interval (CI) plus a p-value of < 0.05 were considered to declare a statistically significant association.

### Results

Data for 4666 study participants who had ANC follow-up history during pregnancy were included in the study and analyzed. The overall median survival time in this study was seven months. The timing of the first ANC visit was shorter by 2.5 times (AHR: 2.5; 95% CI: 2.34–3.68), 4.3 times (AHR: 4.3; 95% CI: 2.2–7.66), 4.8 times (AHR: 4.8, 95% CI: 4.56–10.8) among women who attended primary, secondary, and higher education as compared with non-educated one. Similarly, women who were residing in urban areas had 3.6 times (AHR: 3.6; 95% CI: 2.7–4.32) shorter timing of first ANC visit than rural residents. Furthermore, the timing of the first visit among the richest women was 3.2 times (AHR: 3.2; 95% CI: 2.5–9.65) shorter than the poorest women.

### Conclusion

The median survival time of the first ANC visit was seven months. The timing of the first ANC was longer among younger, poorer women, those who had no access to media, who considered distances as a big challenge to reach a health facility and, those with no

**Abbreviations:** AHR, adjusted hazard ratio; ANC, antenatal care; CI, confidence interval; EDHS, Ethiopia Demographic and Health Survey; SPSS, Statistical Package for Social Science; WHO, World Health Organization.

education. Therefore, health care providers and community health workers should provide health education to create community awareness regarding the timing of the first ANC visit.

## Introduction

Despite pregnancy and childbirth being substantial events for women and their families, they are accompanied by a period of intensified vulnerability for both women and their unborn babies [1]. Even though improvement has been made in maternal health care utilization worldwide, maternal mortality and stillbirths remain the top global health challenge [2,3]. Globally, 830 women die every day, and more than 303,000 women die each year as a result of pregnancy and childbirth complications [4]. Of these, 99% of maternal deaths occur in emerging countries compared to 1% in industrialized nations [4]. In Ethiopia, the Maternal Mortality was 412 per 100,000 live births in 2016, one of the highest in the world [5].

According to the WHO's focused antenatal care model recommendation, all pregnant mothers should begin ANC follow-up within the first trimester of pregnancy (within 12 weeks) [6]. In 2016, WHO revised its recommendations to a minimum of eight ANC contacts, with the first contact scheduled to take place in the first trimester (up to 12 weeks of gestation), two contacts scheduled in the second trimester (at 20 and 26 weeks of gestation) and five contacts scheduled in the third trimester (at 30, 34, 36, 38 and 40 weeks); this however, is not currently implemented in Ethiopia [7]. According to the Ethiopian Ministry of health recommendation, the timing of the first ANC visit is appreciable up to 16 weeks of gestation [5]. The $1^{st}$-trimester pregnancy stage is the fastest developmental period of the fetus, in which all organs become well developed and need special care [8,9]. Yet, many women make their first antenatal visit with the pregnancy already compromised due to fetomaternal complications [8,10].

According to studies done in Uganda, and Kenya the average timing of the first ANC visit was 7 and 5 months, respectively [11,12]. Likewise, another study conducted in Northwest Ethiopia reported that 52% of women booked their first ANC visit after 4 months of pregnancy [13].

Regarding factors about the timing of the first ANC visit, various studies showed that maternal age, educational status, wealth index, residence (rural or urban), husband education, pregnancy intention, women's autonomy, distance to a health facility, pregnancy complication, knowledge on timely booking, having decision power to use antenatal care were significantly associated with timely commencement to antenatal care [13–17]. The late initiation of the first ANC visit could result in a missed chance of the prevention of complications, detection, and making an interventional plan for possible adverse pregnancy consequences [17]. Therefore, early initiation of the first ANC is a critical maternal health care service that helps in improving an extensive range of health outcomes for women and children through early detection of potential risk factors [18,19]. Even though timely initiation of ANC is essential, there is delayed initiation of the first ANC visit, and no emphasis is given to the determinants and the timing of the first ANC visit [20]. Even the national representative data from Ethiopia Demographic and Health Survey (EDHS) has limited data on these factors. Therefore, in order to fill the gap, this study assesses the predictors of survival time of first ANC attendance in Ethiopia using a recent version of the EDHS.

## Methods and materials

### Data source

The study used secondary data from the 2016 EDHS. A complete description of the design and methodology of 2016 is found elsewhere [5]. A nationally representative sample was obtained

using a two-stage cluster sampling method. The first and second stages involved the selection of the clusters and households in each cluster, respectively. Further, stratification by rural-urban areas was taken into account. This study was based on data from the Woman's Questionnaire, which was administered to all women aged 15–49 in the selected households.

**Selection criteria.**   All women who had ANC attendance history during the current or last pregnancy within 5 years preceding the survey regardless of the outcome of pregnancy. The analytic sample for the current study comprised of 4666 women.

## Study variables

The time to first antenatal care visit is an outcome of interest which, is estimated in months. A woman who attended an ANC visit within the $1^{st}$ trimester was considered as an event whereas a woman who came to ANC visit within the $2^{nd}$ and $3^{rd}$ trimester was considered as a censored observation.

The independent variables were selected based on a literature review as being factors associated with the timing of the first ANC visit and includes women's age, marital status, education level of the women, wealth index, residence (rural or urban), religion, media exposure, husband's education, working status (occupation), distance to the health facility, health insurance and decision on health care service.

## Data processing and analysis

The data were analyzed using SPSS version 24. Descriptive statistics and weighted percentage were used to display the distribution of ANC booked women with respect to each trimester by their characteristics. The Kaplan-Meir estimate was used to explain the median survival time of the timing of the first ANC visit. Log-rank tests were used to select candidate variables for the multivariate model. Multivariate Cox-proportional hazard regression analysis was performed to identify the factors related to the timing of the first ANC visit. Adjusted hazard ratios (AHR) with a 95% Confidence interval (CI) plus a p-value of $< 0.05$ were considered to declare a statistically significant association. The model fitness was assessed by having -2loglikelihood chi-square value = 1493.53, $p = 0.002$. As recommended, sampling weights that accounted for complex survey design were incorporated in all analyses.

## Ethics approval and consent to participate

Ethical clearance for the study was not required since it is a secondary data analysis from EDHS 2016 database. The researchers received the survey data from USAID–DHS program and then the researchers of this study have maintained the confidentiality of the data. The consent was obtained from the study participants during EDHS data collection.

## Results

## Profile of the study participant related to the timing of antenatal care follow up

Data for 4666 study participants who had ANC follow-up history during pregnancy were included in the study and analyzed. Out of the women who had ANC follow-up, more than half (51.9%) were aged 25–34 years and started ANC visits in the first trimester of pregnancy. While 40.3% of them attended higher education and begin ANC visits within the first trimester of pregnancy. Likewise, the majority (90.9%) of women who were currently married or living with a man started their initial ANC visit within the first trimester of their pregnancy. Furthermore, out of women who had ANC follow-up, 56.9% of women residing in urban areas also

began the first visit of ANC visit within three months of pregnancy. Similarly, 42.8% of orthodox religious followers began their first antenatal care follow-up in the first 3 months of pregnancy. Moreover, 44.8% of women within the richest wealth index category also started their first visit within the first trimester of pregnancy. On the contrary, 39.1% of women who lived far from health facilities did not start their first visit within the recommended time of initial visit.

The overall median survival time (MST) in this study was seven months which was computed from Kaplan-Meier estimates of the survivorship. The median survival time was slightly different in each subcategory of independent factors. For instance, the median survival time was 5 months for women with higher education levels compared to 9 months for women with no education. In summary women from the richest wealth index who had media access, an educated husband, and who were currently married to a man had shorter compared to their counterparts (Table 1).

### Predictors of the timing of first antenatal care visit

All the variables were entered into multivariate Cox-proportional hazard regression analysis using the enter method. After adjusting for potential confounders by the regression, age, residence, religion, educational status of women and husband, occupation, wealth index, access to media, distance to the health facility, decision on health care and health insurance were significant predictors of timing of first ANC visit.

The timing of the first ANC visit was 1.20 (AHR: 1.20; 95% CI: 1.10–2.50), 1.80(AHR: 1.80; 95% CI 1.68–4.90) and, 1.90 times (AHR: 1.90; 95% CI: 1.13–2.38) shorter among women aged 20 to 24, 25 to 34, 35 to 49 compared to those aged 15 to 19 years, respectively. Likewise, the timing of the first ANC visit was shorter by 2.5 times (AHR: 2.50; 95% CI: 2.34–3.68), 4.30 times (AHR: 4.30; 95% CI: 2.20–7.66) and, 4.80 times (AHR: 4.8, 95% CI: 4.56–10.8) among women who attended primary, secondary, and higher education as compared to uneducated. Similarly, women who were residing in urban areas had 3.60 times (AHR: 3.60; 95% CI: 2.70–4.32) shorter timing of first ANC visit than rural residents. Furthermore, the timing of the first visit among the richest woman was 3.20 times (AHR: 3.20; 95% CI: 2.50–9.65) shorter than the poorest woman. Besides, the timing of the first ANC visit among Muslim religious followers was longer by 33% (AHR: 0.67; 95% CI: 0.62–0.73) than an orthodox religious follower. Women who did not have a big challenge to reach the health facility had 4.90 times (AHR: 4.90; 95% CI: 4.50–8.54) shorter timing of ANC visit than women who had a big challenge to arrive in a health facility (Table 2).

### Discussion

WHO recommends that pregnant women should begin antenatal care in the first trimester of pregnancy [6]. This study revealed that the median survival time of pregnant women to initiate the first antenatal care visit was seven months. This finding was in line with a study done in Uganda [11], that reported the MST of the first ANC visit of 7 months, but higher than studies done in Ghana, Nigeria, Kenya, Tanzania, and Pakistan [12,21–24], that reported a MST of less than 4 months. The variation might be due to socio-demographic and cultural barriers among Ethiopian women.

The study also showed that the timing of the first ANC visit was affected by age, residence, religion, educational status of women and husband, occupation, wealth index, access to media, distance to a health facility, decision on health care, and health insurance. In this study, women aged 20 to 24, 25 to 34, and 35 to 49 years have a shorter timing of antenatal care visits than women aged 15–19 years. This finding is supported by studies done by Nigeria [17] and

**Table 1. Percentage of study participants by their characteristics, median survival time, and log-rank test concerning the timing of the first ANC visit (n = 4666).**

| Variable | Categories | Timing of first ANC | | | MST in months | Log Rank test p-value |
|---|---|---|---|---|---|---|
| | | 1st trimester | 2nd trimester | 3rd trimester | | |
| Age | 15–19 | 92(5.10%) | 135(5.50%) | 21(5.10%) | 7 | <0.001 |
| | 20–24 | 424(23.50%) | 509(20.80%) | 86(20.90%) | 6 | |
| | 25–34 | 935(51.90%) | 1251(51.00%) | 196(47.60%) | 7 | |
| | 35–49 | 350(34.40%) | 558(22.70%) | 109(26.50%) | 7 | |
| Educational status | No education | 196(10.90%) | 106(4.30%) | 6(8.80%) | 9 | <0.001 |
| | Primary | 265(14.70%) | 239(9.70%) | 13(3.20%) | 7 | |
| | Secondary | 614(34.10%) | 810(33.00%) | 109(26.50%) | 7 | |
| | Higher | 726(40.30%) | 1298(52.90%) | 284(68.90%) | 5 | |
| Marital status | Never in union | 20(1.10%) | 20(0.80%) | 3(0.70%) | 8 | 0.02 |
| | Currently in union/married | 1638(90.90%) | 2284(93.10%) | 389(94.10%) | 5 | |
| | Formerly in union | 143(7.90%) | 149(6.10%) | 20(4.90%) | 7 | |
| Residence | Urban | 1024(56.90%) | 1897(77.30%) | 358(86.90%) | 5 | <0.001 |
| | Rural | 777(43.10%) | 556(22.70%) | 54(13.10%) | 8 | |
| Religion | Orthodox | 770(42.80%) | 921(37.50%) | 140(34.00%) | 5 | 0.01 |
| | Catholic | 14(0.80%) | 14(0.60%) | 0.00 | 6 | |
| | Protestant | 261(14.50%) | 506(20.60%) | 83(20.10%) | 7 | |
| | Muslim | 743(41.30%) | 996(40.60%) | 182(44.20%) | 7 | |
| | Other | 13(0.70%) | 16(0.70%) | 7(1.70%) | 7 | |
| Wealth index | Poorest | 319(17.70%) | 581(23.70%) | 155(37.60%) | 8 | <0.001 |
| | Poorer | 223(12.40%) | 456(18.60%) | 76(18.40%) | 7 | |
| | Middle | 233(12.90%) | 382(15.60%) | 78(18.90%) | 7 | |
| | Rich | 219(12.20%) | 391(15.90%) | 58(14.10%) | 7 | |
| | Richest | 807(44.80%) | 643(26.20%) | 45(10.90%) | 4 | |
| Occupation | Not Working | 925(51.40%) | 1293(52.70%) | 242(58.70%) | 6 | <0.001 |
| | Working | 876(48.60%) | 1160(47.30%) | 170(41.30%) | 7 | |
| Husband education | No education | 513(31.30%) | 901(39.40%) | 214(55.00%) | 9 | <0.001 |
| | Primary | 534(32.60%) | 893(39.10%) | 129(33.20%) | 8 | |
| | Secondary | 309(18.90%) | 292(12.80%) | 32(8.20%) | 7 | |
| | Higher | 282(17.20%) | 198(8.70%) | 14(3.60%) | 5 | |
| Media access | No | 812(45.10%) | 1429(58.30%) | 299(72.60%) | 7 | <0.001 |
| | Yes | 989(54.90%) | 1024(41.70%) | 113(27.40%) | 5 | |
| The decision on health care service | Respondent alone | 326(19.90%) | 406(17.80%) | 61(15.70%) | 7 | 0.01 |
| | Respondent and husband | 1088(66.40%) | 1482(64.9%) | 235(60.40%) | 7 | |
| | Husband alone | 224(13.70%) | 395(17.30%) | 93(23.90%) | 7 | |
| Health insurance | No | 95(5.30%) | 106(4.30%) | 11(2.70%) | 7 | <0.001 |
| | Yes | 1706(94.70%) | 2347(95.70%) | 401(97.30%) | 6 | |
| Distance to a health facility | Big problem | 704(39.10%) | 1140(46.50%) | 220(53.40%) | 7 | <0.001 |
| | Not big problem | 1097(60.90%) | 1313(53.50%) | 192(46.60%) | 5 | |
| Pregnancy intension | Then | 1473(81.80%) | 1937(79.00%) | 321(77.90%) | 6 | 0.03 |
| | Later | 259(14.40%) | 361(14.70%) | 67(16.30%) | 7 | |
| | No more | 69(3.80%) | 155(6.30%) | 24(5.80%) | 7 | |

**MST** = Mean Survival Time.

Gondar [13]. The justification could be, the fact that awareness and level of health care deci-sion-making increase with the age of the women [25]. Additionally, women younger than 20 years, could be delayed for the first ANC visit due to fear of the social consequence of teenage

**Table 2. Univariate and multivariate cox-regression analysis showing predictors of timing of first antenatal care visit in Ethiopia.**

| Variable | Categories | Unadjusted HR (CI: 95%) | Adjusted HR (CI: 95%) |
|---|---|---|---|
| Age | 15–19 | 1 | 1 |
| | 20–24 | 1.90(1.60–2.70)** | 1.20(1.10–2.50)* |
| | 25–34 | 2.30(2.10–5.30)** | 1.80(1.68–4.90)* |
| | 35–49 | 1.90(1.11–1.46)** | 1.90(1.13–2.38)** |
| Educational status | No education | 1 | 1 |
| | Primary | 3.50(2.84–3.88)** | 2.50(2.34–3.68)* |
| | Secondary | 4.80(2.50–8.77)* | 4.30(2.2–7.66)* |
| | Higher | 5.3(4.96–13.8)** | 4.80(4.56–10.80)** |
| Marital status | Never in union | 1 | 1 |
| | Currently married | 1.30(0.89–1.79) | 1.10(0.77–1.64)* |
| | Formerly in union | 2.90(2.03–5.75)** | 1.90(0.59–5.75) |
| Resident | Urban | 5.10(4.36–6.22)** | 3.60(2.70–4.32)** |
| | Rural | 1 | 1 |
| Religion | Orthodox | 1 | 1 |
| | Catholic | 1.33(0.68–2.67) | 1.10(0.33–9.59) |
| | Protestant | 2.00(0.94–7.50) | 1.61(0.78–6.62) |
| | Muslim | 0.84(0.81–0.89)** | 0.67(0.62–0.73)** |
| | Other | 1.70(0.44–2.84) | 1.30(0.21–1.95) |
| Wealth index | Poorest | 1 | 1 |
| | Poorer | 2.30(1.87–9.52)* | 1.90(0.69–6.35) |
| | Middle | 2.90(2.23–6.28)* | 2.30(1.55–4.73)* |
| | Rich | 3.70(2.80–6.43)** | 2.60(1.80–4.34)* |
| | Richest | 4.87(3.68–10.56)** | 3.20(2.50–9.65)** |
| Occupation | Not Working | 1 | 1 |
| | Working | 2.50(2.22–4.82)* | 1.50(1.35–3.67)* |
| Husband education | No education | 1 | 1 |
| | Primary | 1.50(1.19–3.66)* | 1.50(0.99–4.83) |
| | Secondary | 2.10(1.90–4.52)** | 1.20(1.19–5.30) |
| | Higher | 3.80(2.53–8.94)** | 2.40(1.86–5.22)** |
| Media access | No | 1 | 1 |
| | Yes | 1.90(1.30–2.97)* | 1.20(1.10–2.45)* |
| The decision on health care service | Respondent alone | 2.60(1.87–4.86)** | 0.88(0.39–9.87) |
| | Respondent and husband | 3.80(3.45–9.47)** | 1.20(1.10–6.60)* |
| | Husband/partner alone | 1 | 1 |
| Health insurance | No | 1 | 1 |
| | Yes | 3.30(2.55–9.64)** | 2.80(1.88–6.84)** |
| Distance to a health facility | Big problem | 6.40(5.50–11.83)* | 4.90(4.50–8.54)* |
| | Not a big problem | 1 | 1 |
| Pregnancy intension | Then | 2.00(1.32–4.35)** | 0.67(0.85–6.80) |
| | Later | 1.70(0.67–8.70) | 0.98(0.48–3.95) |
| | No more | 1 | 1 |

*P-value <0.01

**P-value <0.001, HR = Hazard ratio.

pregnancy, which include dismissal from school and stigma; adolescents are at high risk of undecided pregnancy disclosure [26]. Moreover, women who were residing in urban areas had a shorter timing of the first ANC visit than rural residents. The finding was consistent

with studies done in Nigeria [17,27], Tanzania [23], and Uganda [11]. The consistency might be explained by the fact that pregnant women living in rural areas have no maternal health care services due to lack of availability, accessibility, and affordability as compared with urban residents [27]. Likewise, this study revealed that religion is one of the most important influencing factors for the timing of the first ANC services in which Muslim pregnant religious followers have a longer time for early initiation ANC visit as compared to the orthodox religious follower. This finding is also supported by a study done in Nigeria in which orthodox followers were 100% times more likely to initiate early ANC visits than Muslim women [17,28]. This is likely because most Christians go to spiritual places for care during pregnancy as most Christian organizations have mystical houses that enable to deliver a care for women particularly for their followers [29]. Likewise, a pregnant woman whose level of education was primary, secondary, and higher had a shorter timing of first ANC visit compared to those who had no education. This finding was similar to studies done in Ghana [24], Nigeria [27], Nepal [30], and Axum [31]. The plausible reason could be that educated women are better informed and, therefore, more aware of the importance of looking for ANC and other maternal health care services early compared with women with low or no formal education [32]. Similarly, this study revealed that women who had no big challenge to reach the health facility had a shorter timing of the first ANC visit than those who have a big challenge to arrive in the health facility. This finding is steady with studies done in Bahr Dar, Zambia, Cameron, and Tanzania [2,33–35]. This could be justified that the long-distance which takes more time to reach a health facility can influence patients not to seek appropriate maternal health care service at the health institution and can also be an enabling factor to why the women prefer not to have first ANC follow up at all [36]. Our finding also revealed that the poorest women have longer timing of the early initiation of the first ANC visits than their counterparts. This finding is supported by previous studies particularly done in Ethiopia, Pakistan, and Addis Ababa [14,22,37,38]. Financial barriers posed by high out-of-pocket costs for consultations may be an important determinant of low utilization of maternal health services, such as ANC, particularly in areas where scarcity is high and services are more costly [32]. Furthermore, this study found that women who were employed had a shorter time for early initiation of the first ANC visit than those women who were not employed, which is in line with studies done in Addis Ababa [37,39]. Economically empowered and educated women may put more emphasis on maternal and child health care decision which could help to initiate early ANC utilization [40].

Women's participation in the decision-making process is crucial to increase utilization of maternal health care services which helps to reduce maternal mortality. As perceived in this study, mothers who decided jointly with their husband had a shorter time for early initiation of first ANC visit compared to those respondents whose husband made the decision alone, which is consistent with a previous study done here in Ethiopia [14]. This could be due to the fact taking part in the decision-making process helps the women to get support from a husband that in turn increases early initiations of the first ANC visit and utilization of services [13]. Besides, women who had health insurance have shorter timing of first antenatal visit, which is in line with a study done in low and middle-income countries in which the proportion of women reporting the timing of first ANC visit was shorter among insured than uninsured women [41]. Similarly, this finding is also supported by studies which were done in Gabon [42] and Ghana [43–45] and, Tanzanian [46]. The justification of this finding could be that the implementation of health insurance is one of the possible health financing mechanisms to increase maternal health care service utilization including early initiation of ANC by reducing out-of-pocket costs [47,48]. Furthermore, mass media may also play an important role in increasing the use of antenatal care and other maternal health services. In this study, women who had access to media have a shorter timing of the first antenatal care visit than

their counterparts which was in line with previous studies done in Pakistan, Nigeria, and Nepal [22,27,49]. Utilizing mass media to disseminate ANC message may be an effective approach to improve the uptake of early initiation of the first ANC visit [50].

## Conclusion

In this study, the median survival time of the first ANC visit was seven months which is highly delayed as compared to WHO recommendation of ANC visit. Furthermore, women in younger age group classified as poorer in wealth quintile, had no access to media, lived far from the health facility, with no education, living in rural areas, were Muslim religious follower, had no health insurance, and had decided alone on health care decision have longer timing of the first ANC visit. Therefore, all responsible bodies should take a conclusive and proper intervention to prevent adverse fetomaternal outcomes due to the delayed initiation of ANC visits. Health care providers and community health workers should provide health education to create community awareness regarding the timing of the first ANC visit. Finally, the Ethiopian Ministry of Health and Regional Health Bureau have to design a strategy to increase the number of women in the utilization of early ANC follow up and as well they should build health care facilities closer to people especially for women residing in a rural area.

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## References

1. Okedo-Alex IN, Akamike IC, Ezeanosike OB, Uneke CJ. Determinants of antenatal care utilisation in sub-Saharan Africa: a systematic review. BMJ open. 2019; 9(10):e031890. https://doi.org/10.1136/bmjopen-2019-031890 PMID: 31594900

2. Bekele YA, Emiru AA, editors. 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. 30th EPHA Annual Conference; 2019.

**3.** Saronga HP, Duysburgh E, Massawe S, Dalaba MA, Savadogo G, Tonchev P, et al. Efficiency of ante-natal care and childbirth services in selected primary health care facilities in rural Tanzania: a cross-sec-tional study. BMC health services research. 2014; 14(1):96. https://doi.org/10.1186/1472-6963-14-96 PMID: 24581003

**4.** World Health Organization (WHO). Maternal Mortality, Geneva, 2014. website: https://apps.who.int/iris/bitstream/handle/10665/112318/WHO_RHR_14.06_eng.pdf.

**5.** Central Statistical Agency (CSA) [Ethiopia] and ICF. Ethiopia Addis Ababa, and Rockville, Maryland, USA, CSA, and ICF. Demographic and Health Survey; 2016.

**6.** World Health Organization (WHO). Antenatal care randemization trial, Geneva; 2002.

**7.** World Health Organization, WHO recommendations on antenatal care for a positive pregnancy experi-ence, 2016 Geneva. Available: http://apps.who.int/iris/bitstream/10665/250796/1/9789241549912-eng.pdf. 2016.

**8.** WHO. Essential Antenatal,perinatal and post partum care training module: promoting effective preinatal care. Copenhagen: World Health Organization regional office for Europe; 2002.

**9.** Abou-Zahr CL WT, World Health Organization. Antenatal care in developing countries: promises, achievements and missed opportunities: an analysis of trends, levels and differentials, 1990–2001. 2003.

**10.** Pamela L PJ, Wouldes T, et al. Factors affecting ANC attendance by mothers of Pacific infants in New Zealand, the New Zealand Medical Journal; 2005; 118 (1216).

**11.** Kisuule I, Kaye DK, Najjuka F, Ssematimba SK, Arinda A, Nakitende G, et al. Timing and reasons for coming late for the first antenatal care visit by pregnant women at Mulago hospital, Kampala Uganda. BMC pregnancy and childbirth. 2013; 13(1):121.

**12.** Magadi MA MN, Rodrigues RN:. Frequency and timing of antenatal care in Kenya: explaining the varia-tions between women of different communities. Soc Sci Med 2000, 51(4):551–561. https://doi.org/10.1016/s0277-9536(99)00495-5 PMID: 10868670

**13.** Gudayu TW, Woldeyohannes SM, Abdo AA. Timing and factors associated with first antenatal care booking among pregnant mothers in Gondar Town; North West Ethiopia. BMC pregnancy and child-birth. 2014; 14(1):1–7. https://doi.org/10.1186/1471-2393-14-287 PMID: 25154737

**14.** Yaya S, Bishwajit G, Ekholuenetale M, Shah V, Kadio B, Udenigwe O. Timing and adequate attendance of antenatal care visits among women in Ethiopia. PLoS One. 2017; 12(9):e0184934. https://doi.org/10.1371/journal.pone.0184934 PMID: 28922383

**15.** Abuka T, Alemu A, Birhanu B. Assessment of timing of first antenatal care booking and associated fac-tors among pregnant women who attend antenatal Care at Health Facilities in Dilla town, Gedeo zone, southern nations, nationalities and peoples region, Ethiopia, 2014. J Preg Child Health. 2016; 3(258):2.

**16.** Tesfaye G, Loxton D, Chojenta C, Semahegn A, Smith R. Delayed initiation of antenatal care and asso-ciated factors in Ethiopia: a systematic review and meta-analysis. Reproductive health. 2017; 14 (1):150. https://doi.org/10.1186/s12978-017-0412-4 PMID: 29141675

**17.** 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; 6(3):110–9.

**18.** Villar J, Ba'aqeel H, Piaggio G, Lumbiganon P, Belizán JM, Farnot U, et al. WHO antenatal care rando-mised trial for the evaluation of a new model of routine antenatal care. The Lancet. 2001; 357 (9268):1551–64. https://doi.org/10.1016/s0140-6736(00)04722-x PMID: 11377642

**19.** Simkhada B, Teijlingen ERv, Porter M, Simkhada P. Factors affecting the utilization of antenatal care in developing countries: systematic review of the literature. Journal of advanced nursing. 2008; 61 (3):244–60. https://doi.org/10.1111/j.1365-2648.2007.04532.x PMID: 18197860

**20.** Gebresilassie B, Belete T, Tilahun W, Berhane B, Gebresilassie S. Timing of first antenatal care atten-dance and associated factors among pregnant women in public health institutions of Axum town, Tigray, Ethiopia, 2017: a mixed design study. BMC pregnancy and childbirth. 2019; 19(1):1–11. https://doi.org/10.1186/s12884-018-2145-y PMID: 30606156

**21.** Fagbamigbe AF, Mashabe B, Lepetu L, Abel C. Are the timings and risk factors changing? Survival analysis of timing of first antenatal care visit among pregnant women in Nigeria (2003–2013). Interna-tional journal of women's health. 2017; 9:807–19. https://doi.org/10.2147/IJWH.S138329 PMID: 29133984

**22.** Agha S, Tappis H. The timing of antenatal care initiation and the content of care in Sindh, Pakistan. BMC pregnancy and childbirth. 2016; 16(1):190. https://doi.org/10.1186/s12884-016-0979-8 PMID: 27460042

**23.** Gross K, Alba S, Glass TR, Schellenberg JA, Obrist B. Timing of antenatal care for adolescent and adult pregnant women in south-eastern Tanzania. BMC pregnancy and childbirth. 2012; 12(1):16. https://doi.org/10.1186/1471-2393-12-16 PMID: 22436344

24. 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; 20 (1):47. https://doi.org/10.1186/s12884-020-2738-0 PMID: 31959137

25. Osamor PE, Grady C. Women's autonomy in health care decision-making in developing countries: a synthesis of the literature. International journal of women's health. 2016; 8:191. https://doi.org/10.2147/IJWH.S105483 PMID: 27354830

26. 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; 20 (1):1–7. https://doi.org/10.1186/s12884-020-2738-0 PMID: 31959137

27. Aliyu AA, Dahiru T. Predictors of delayed Antenatal Care (ANC) visits in Nigeria: secondary analysis of 2013 Nigeria Demographic and Health Survey (NDHS). The Pan African medical journal. 2017; 26.

28. Solanke BL, Oladosu OA, Akinlo A, Olanisebe SO. Religion as a social determinant of maternal health care service utilisation in Nigeria. African Population Studies. 2015; 29(2).

29. Dairo M, Owoyokun K. Factors affecting the utilization of antenatal care services in Ibadan, Nigeria. Benin Journal of Postgraduate Medicine. 2010; 12(1).

30. 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; 14(1):94. https://doi.org/10.1186/1471-2393-14-94 PMID: 24589139

31. Gebresilassie B, Belete T, Tilahun W, Berhane B, Gebresilassie S. Timing of first antenatal care attendance and associated factors among pregnant women in public health institutions of Axum town, Tigray, Ethiopia, 2017: a mixed design study. BMC pregnancy and childbirth. 2019; 19(1):340. https://doi.org/10.1186/s12884-019-2490-5 PMID: 31533657

32. Kamal SM, Hassan CH, Islam MN. Factors associated with the timing of antenatal care seeking in Bangladesh. Asia Pacific Journal of Public Health. 2015; 27(2):NP1467–NP80. https://doi.org/10.1177/1010539513485786 PMID: 24097925

33. Kyei NN, Campbell OM, Gabrysch S. The influence of distance and level of service provision on antenatal care use in rural Zambia. PLoS One. 2012; 7(10):e46475. https://doi.org/10.1371/journal.pone.0046475 PMID: 23056319

34. 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; 3(1):1–6. https://doi.org/10.1186/s40748-017-0067-8 PMID: 29255616

35. Konje ET, Magoma MTN, 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; 18(1):394. https://doi.org/10.1186/s12884-018-2014-8 PMID: 30290769

36. Isaac O, Mensah C, Anyanful T. The role of transportation in accessing maternal health services: a case study of Sumbrungu health clinic. European Journal of Logistics, Purchasing and Supply Chain Management. 2014; 2(3):24–38.

37. 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; 27(2):139–46. https://doi.org/10.4314/ejhs.v27i2.6 PMID: 28579709

38. Gebremeskel F, Dibaba Y, Admassu B. Timing of first antenatal care attendance and associated factors among pregnant women in Arba Minch Town and Arba Minch District, Gamo Gofa Zone, South Ethiopia. Journal of environmental and public health. 2015; 2015. https://doi.org/10.1155/2015/971506 PMID: 26543485

39. Abuka AA T., Birhanu B.,. 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, J. Pregnancy Child Heal. 2016 (2014) 3.

40. Kawungezi PC, AkiiBua D, Aleni C, Chitayi M, Niwaha A, Kazibwe A, et al. Attendance and utilization of antenatal care (ANC) services: multi-center study in upcountry areas of Uganda. Open journal of preventive medicine. 2015; 5(3):132. https://doi.org/10.4236/ojpm.2015.53016 PMID: 26042190

41. Wang W, Temsah G, Mallick L. Health insurance coverage and its impact on maternal health care utilization in low-and middle-income countries: ICF International; 2014.

42. Sanogo NA, Yaya S. Wealth Status, Health Insurance, and Maternal Health Care Utilization in Africa: Evidence from Gabon. BioMed research international. 2020; 2020:4036830. https://doi.org/10.1155/2020/4036830 PMID: 32461984

43. Twum P, Qi J, Aurelie KK, Xu L. Effectiveness of a free maternal healthcare programme under the National Health Insurance Scheme on skilled care: evidence from a cross-sectional study in two districts

in Ghana. BMJ open. 2018; 8(11):e022614. https://doi.org/10.1136/bmjopen-2018-022614 PMID: 30413503

44. Owoo NS, Lambon-Quayefio MP. National health insurance, social influence and antenatal care use in Ghana. Health Econ Rev. 2013; 3(1):19. https://doi.org/10.1186/2191-1991-3-19 PMID: 23919511

45. Arthur E. Wealth and antenatal care use: implications for maternal health care utilisation in Ghana. Health Econ Rev. 2012; 2(1):14. https://doi.org/10.1186/2191-1991-2-14 PMID: 22866869

46. Kibusi SM, Sunguya BF, Kimunai E, Hines CS. Health insurance is important in improving maternal health service utilization in Tanzania-analysis of the 2011/2012 Tanzania HIV/AIDS and malaria indicator survey. BMC health services research. 2018; 18(1):112. https://doi.org/10.1186/s12913-018-2924-1 PMID: 29439693

47. Nageso D, Tefera K, Gutema K. Enrollment in community based health insurance program and the associated factors among households in Boricha district, Sidama Zone, Southern Ethiopia; a cross-sectional study. Plos one. 2020; 15(6):e0234028. https://doi.org/10.1371/journal.pone.0234028 PMID: 32484840

48. Gouda HN, Hodge A, Bermejo R 3rd, Zeck W, Jimenez-Soto E. The Impact of Healthcare Insurance on the Utilisation of Facility-Based Delivery for Childbirth in the Philippines. PLoS One. 2016; 11(12): e0167268. https://doi.org/10.1371/journal.pone.0167268 PMID: 27911935

49. Acharya D, Khanal V, Singh JK, Adhikari M, Gautam S. Impact of mass media on the utilization of antenatal care services among women of rural community in Nepal. BMC research notes. 2015; 8(1):345. https://doi.org/10.1186/s13104-015-1312-8 PMID: 26264412

50. Acharya D, Khanal V, Singh JK, Adhikari M, Gautam S. Impact of mass media on the utilization of antenatal care services among women of rural community in Nepal. BMC research notes. 2015; 8(1):1–6. https://doi.org/10.1186/s13104-015-1312-8 PMID: 26264412