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Early Initiation of Antenatal Care and Factors Associated with Early Antenatal Care Initiation at public Health Facilities at resource limited setting, 2021.

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Abstract

Objectives: Early initiation of antenatal care services is one of essential ways to detect, manage and prevent adverse outcomes of pregnancy. Even though significant numbers of pregnant mothers were initiating the follow up on the recommended time in developed countries, it remains unacceptably low in low income countries including Ethiopia. The aim of the study was to assess the proportion and factors associated for early initiation of antenatal care follow up among pregnant women attending antenatal care service at Bahir Dar Zuria Special zone public health centers, Bahir Dar, Ethiopia.

Method: An institutional based cross sectional study was conducted from Dec, 15/2020 to March 1, 2021. A total of 592 participants were selected using systematic random sampling method and participated on the study. Data were collected through structured and pre tested questioners. Binary Logistic regression models were also used to identify factors associated with early initiation of antenatal care services.

Result: The study showed that 48.6% of the participants were started their first antenatal care services before 16 weeks of gestation. Family size less than five (AOR= 2.0, 95% CI; 1.25-3.25), urban residence (AOR=3.0,95%CI;1.48,6.17), secondary education (AOR=2.1,95%CI;1.3-3.6), college level and above (AOR=3.5,95%CI;1.8-6.8), primi gravida (AOR=2.6,95%CI;1.65-4.14), planned pregnancy (AOR=3.5,95%CI;1.5-8.1) and knowledge on early initiation of 1st ANC (AOR= 1.7, 95%CI; 1.14-2.55), were significantly associated with early initiation of first antenatal care.

Conclusion and recommendation: the study showed that more than half of the participants were not initiate their ANC service timely. Family sizes, residence, educational status of women, gravidity, were among factors significantly associated with early initiation of antenatal care service. Additionally dissemination of information about recommended time to initiate ANC services and cooperative effort to improve women's educational status to increase knowledge on early initiation of first antenatal care has to be conducted.

Keywords: Antenatal care, early initiation, pregnancy

Strength and limitation of the study

- The study was done based on the data collected from different five health centers to ensure representativeness and to obtain reliable estimates, and therefore the study findings have the potential to inform policymakers and programmers and also aid in designing appropriate interventions at zonal and regional levels.

- The study didn't include private health facilities instead only use governmental public health facilities data so pregnant mothers from private facilities were not included

Introduction

The physiological symptoms of pregnancy and the symptoms of pregnancy-related complications are sometimes difficult to differentiate. Pregnancy-related complications are risky health conditions that occur during pregnancy, it can involve the mother's and the child's health. Sometimes, health conditions the woman had before she became pregnant can lead to complications during pregnancy and Some women have health conditions that arise during pregnancy(1,2).

To avert the problems, various maternal health care services are being provided. Among those services, Antenatal care(ANC) service is one of essential and key strategies for reducing maternal and neonatal morbidity and mortality directly through detection and treatment of pregnancy-related illnesses (2)(3). Early initiation of ANC visits enables health care providers to diagnose early pregnancy related complications and institute timely and appropriate interventions (4). According to World Health Organization (WHO) recommendation pregnant women in developing countries have to get at least four ANC visits, and initiate early ANC follow up (2).

Huge progress has been made globally, however still maternal health is a global agenda. WHO 2019 report shows about 295 000 maternal deaths occurred in the globe due to pregnancy and childbirth related complications among those deaths 94% of all maternal deaths occur in low and lower-middle-income countries.(1,5) Sub-Saharan Africa and Southern Asia accounted for approximately 86% of the estimated global maternal deaths in 2017 (5).

Many maternal and prenatal deaths occur in women who have not received timely, inadequate and no utilization of ANC (3). Early antenatal care attendance during the first three months of gestation plays a major role in detecting and treating complications that occur during pregnancy (6). In Ethiopia 412 maternal deaths per 100,000 live birth occur in 2016 due to pregnancy or childbirth related complications and targeted reduction to 199/100,000 live births by 2020, EDHS (4).

Despite ANC is provided free of charge and there is increased accessibility, but early initiation of ANC is still a major problem (7). The Only 28% of women had their first ANC during the first trimester, while 43% of women in urban areas receive ANC within their first trimester of pregnancy, compared with 22% of those in rural areas, EDHS(8). Early initiation of ANC has

many benefits, like comprehensive health assessments including maternal baselines data such as weight, blood pressure, urinalysis will be assessed and have a direct relation with good prenatal outcome for the mother and unborn fetus, and leads to delivery of healthy baby. Not attending ANC service early has increased the risk of poor pregnancy outcomes, maternal and neonatal mortality. Maternal education, previous history of early booking, age, and perception on frequency of ANC visit per pregnancy were significantly associated with the early ANC visit, awareness creation and strengthening on the importance of the early ANC visit need to be emphasized at the time of service provision(9,10).

Numbers of activities were done by the government to improve the early initiation of antenatal care in Ethiopia. Among those activities enhanced coordination of health extension workers, health development army , extended supportive supervision systems at national, regional, zonal, woreda, primary health care unit and community levels on maternal health services including early ANC initiation were the major activities.(11).

However, the factors associated with early initiation of ANC are not the same across different cultures, socio economic status and distance/access to health institution within a society. Thus assessing the factors associated for early initiation of ANC follow up in different set up is important to improve maternal health services. Therefore, this study aimed at determining the magnitude, know information gaps on the early initiation of ANC and identify factors associated with it among pregnant women attending antenatal clinic in public health centers in Bahir Dar Zuria Special Zone, Ethiopia.

Methods

Study area

Institutional based cross-sectional study was conducted in Bahir Dar Zuria special zone from December, 15, 2020 to march 1, 2021. A total population of Bahir Dar city estimated to be 345,084 and 81,371 of them are women of reproductive age group. The city currently has 3 governmental hospitals, 4 private hospitals, 10 governmental health centers, 10 health posts, and more than 39 private clinics. Most health facilities in the city provide ANC services. There are more than 405 health care providers including health extension working at health centers of Bahir Dar city administration, among those 47 are midwives. Out of the total female population

11629 pregnancies is expected in 2020 Gregorian calendar. According to the 2020 Gregorian calendar annual zonal report, the antenatal coverage in the study area was 100% (3,4,12)
The study was conducted in five public health centers (Han HC, Shimbit HC, Dagmawi Minilik HC, Shumabo HC and Meshentie HC).

Study variables

Dependent variables

ANC initiation –early/late

Independent variables

Socio-demographic and economic factors: maternal age, educational status, occupation, marital status, ethnicity, religion, income, family size and residence, husband educational

Pregnancy & maternal related factors: gravidity, history of abortion, health status of present pregnancy/danger sign, plan of pregnancy/unwanted pregnancy, past experience of antenatal care utilization, knowledge and awareness on timing of first antenatal care and Previous pregnancy complication

Behavioral factors: information access, free of pain, access to media and distance of health facilities

Source population

All pregnant women attending antenatal care service in public health centers of Bahir Dar city

Study population

All pregnant women attending their antenatal care service in public health centers of Bahir Dar Zuria Special Zone during the data collection period.

Inclusion criteria

Pregnant women attending antenatal care service were included to the study

Exclusion criteria

Women who have either unknown gestational age or not having ultrasound result or not known with physical examination and pregnant women who had danger signs of pregnancy/seriously ill were excluded from this study.

Sampling Technique/ Procedure

To select participants, systematic random sampling techniques were applied. The total sample size was proportionally allocated from the randomly selected five health centers based on their ANC loads. By considering; N (total pregnant woman who came for first ANC visit in previous two months in five health centers = 971), n (calculated sample size = 610) and k-interval K = N/n, = 971/610 = 2, the first client was selected by lottery method among the first two ANC service users in each health centers. n = sample size allocated to each health centers, N = number of ANC clients in a health center in previous two month's performance (Han health center = 349, Shimbit health center = 200, Dagmawi Minilik health center = 251, Shumabo health center =98 and Meshentie health center =73). Then the final sample size proportionally allocated for each health centers.

Sample Size Determination

The sample size was calculated using single population proportion formula. Taking 46.8% prevalence of early initiation of antenatal care from previous study(13). With an assumption of 95% confidence interval (z=1.96), 5% margin of error (d=0.05), 10% nonresponse rate and 1.5 design effect.

$n= (Z\alpha/2)^2 P(1-P)/d^2$ $n = (1.96)^2 0.468(1-0.468)/0.05^2=381$

Where, n-sample size

Zα/2-Z value at 95% level of confidence [1.96]

P- is the proportion of early initiation of ANC

d- the margin of error at 95%confidence interval

By considering the 10% non-response rate 381×10/100=38

Final sample size was 381×1.5+38 =610

Operational definitions

Antenatal care- is Pregnancy related services given by skilled health care providers starting from conception up to the onset of labor (2,14,15)

Early antenatal care- is the first antenatal care received as soon as the pregnancy is suspected till 16 weeks of gestation (16–18).

Data Collection Tool and Methods

Data related to socio-demographic, economic factors, pregnancy, maternal related factors and behavioral factors were collected by using a pretested and semi structured questionnaire. The questionnaire was first developed in English and later translated into Amharic and finally re-translated back to English to check its consistency. Training was given to the supervisors and data collectors for two days by the principal investigator on the details of the questionnaire. Pretest was done in a public health centers that is not selected for the study. The interview was conducted in Amharic. Eligible mothers are interviewed face-to-face at exist of antenatal care clinic. The interview was conducted by 4 midwives and supervised by 2-degree holder health professionals.

Data Management and Analysis

The data were entered, coded and cleaned using EPI data version 4.6. After completion of entry the data were export to SPSS version 23 for analysis. Missing data were managed by observing cross tabulation results percentages. Bi-variable logistic regression was used to identify the association between independent variables and dependent variables, variables with p-value of less than 0.2 will be entered for multi-variable logistic regression analysis to determine various factors on the outcome variable and to control confounding effect. Adjusted odds ratio (AOR) with 95% confidence interval (CI) was used to identify the independent predictors of early initiation of antenatal care. P values less than 0.05 were taken as statistically significance. Model fitness was tested by using Hosmer-Lemeshow Goodness of fit test.

Data Quality Assurance

To ensure the quality of this research training were given to data collectors and supervisors. Pretest were carried out in 5% of sample size prior to actual data collection out of the study area, to assess the validity of the questionnaire to check clarity of questions, ambiguity, arrangement of questions, order & options for the questions and skipping pattern accordingly. The whole data collection procedures were closely supervised by field supervisors and investigators to ensure the completeness and reliability of the gathered information throughout the data collection process.

Patient and public involvement

neither patients nor the public were involved in the design, planning, conduct or reporting of this study.

Ethical Considerations

Ethical clearance was obtained from Yom post graduate college department of project planning and management, Research Ethical review board with reference ID.. YC//207//2013. A legal official letter was submitted to the Bahir Dar city administration health department office to obtain their permission. Confidentiality of the data was maintained by using the data only for the study purpose and keeping the data from third party.

Result

In this study a total of 610 participants with 97% (592) response rate were participated. Among the total pregnant women whose data were analyzed 85.7% of the respondents were followers of Orthodox Christian religion. The age of the respondents ranged from 17 to 45 years with a mean age of 26.31 (SD 4.72 years). More than three-fourth 80.3 % (476) of them were resides in urban areas and 50% (297) were house wife. The majority of the respondents 98.1% (581) were married. 61.3% (366) of respondents were attended secondary and above in their educational level. More than half of the respondents 56.7 % (337) were get information from their families to start first antenatal care follow up. 57.6% (341) of respondents were multi-gravida and the mean gestational age of the respondents was 16.01 (SD 6.18) weeks and among those respondents two hundred seventy-eights (46.8%) had antenatal follow up in their previous pregnancies and five hundred forty-seven (92.1%) of pregnancies were planned. 13.7%(81) of the respondent had history of abortion. 51.5% (305) of respondent had knowledge on the timing of first ANC and 59.6% (353) of respondent had knowledge on the frequency of antenatal care follow up.(table 1, table 2, table 3)

Table 1: The socio- demographic characteristics of the pregnant women selected public health center in Bahir Dar special zone, 2021(n=592)

Variables	Characteristics	Frequency	Percent
Age	>25	293	49.5
	≥25	299	50.5
Residence	Urban	476	80.3
	Rural	116	19.6

	Orthodox	508	85.7
Religion	Muslim	67	11.3
	Protestant	17	2.9
Educational status	Primary	229	38.7
of women	Secondary & preparatory	208	35.1
	College and above	155	26.2
Women occupation	House wife	297	50.2
	Farmer	91	15.4
	Employed Gov't/NGO	117	19.8
	Merchant	87	14.7
Monthly income	<2000	100	16.9
	>=2000	492	83.1
Marital status	Married	581	98.1
	Unmarried/cohabitation	11	1.9
Husband	Primary	170	28.7
educational status	Secondary & preparatory	199	33.6
	College and above	211	35.6
Means of	On foot	207	35
transportation	Taxi/Bajaj	385	65
Family size	< 5	395	66.7
	≥ 5	197	33.3
Distance to reach	<30 minutes	181	30.6
HC on foot came	>30 minutes	17	2.9
Cost of transport	<3 birr	12	2
	3-9 birr	220	37.2
	>9 birr	147	24.8

Table 2: Obstetric characteristics of pregnant women in selected public health centers of Bahir Dar special zone, 2021(n=592)

Variables	Description	Frequency	Percent
Gravida	One	251	42.4
	Two & above	341	57.6
History of abortion	Yes	81	13.7
	No	511	86.3
Minor disorders of pregnancy	Yes	140	23.6
	No	452	76.4

Table 3: Previous pregnancy and knowledge's of pregnant women related factors in public health centers of Bahir Dar special zone, 2021 (n = 592)

Variables	Characteristics	Frequency	Percent
Had ANC follow up in your last px.	Yes	278	46.8
	No	46	7.7
Place of delivery who had previous birth	Home	47	7.9
	Health facilities	265	44.8
Rout of delivery who had previous birth	SVD	243	41
	C/S	69	11.7
Outcome of last birth	Alive	298	50.3
	Still birth	14	2.4
Knowledge on early initiation of first ANC	<16wk	304	51.5
	≥16wk	288	48.5

Frequencies for	Once	10	1.7
ANC follow up	2-3	212	35.8
	≥4	353	59.6
ANC service reduce	Yes	518	87.5
PMTCT	No	74	12.5

Factors Associated with Early Initiations of First ANC Visit

Bi-variable analysis showed that Age of women, residency, educational status of women, occupation of women, monthly income, means of transportation, gravidity, knowledge on early initiation of first ANC, family size, plan of pregnancy and minor disorders of current pregnancy were candidate variable for multivariable analysis. On multivariable analysis family size, gravidity, residence, educational status of women, plan of pregnancy and knowledge on early initiation of first ANC, were true determinants of early initiation of first ANC visit at the p-value less than 0.05. The findings showed that those family size less than five were 2 times more likely to initiate early ANC than those family size is greater than five (AOR= 2.0, 95% CI; 1.25-3.25), those urban residence were 3 times more likely to initiate early than those residence were rural (AOR=3.0,95%CI;1.48,6.17), respondents with college level and above were 3.5 times more likely to initiate early ANC as compared to those with primary school (AOR=3.5, 95% CI; 1.8-6.8), those with secondary education are 2.1 times more likely to initiate than those with primary education(AOR=2.1,95%CI;1.3-3.6). respondents with primi gravida were 2.6 times more likely to initiate early than those respondents who had multigravida (AOR=2.6,95%CI;1.65-4.14), respondents with planned pregnancy were 3.5 times more likely to initiate early than those respondents with unplanned pregnancy(AOR=3.5,95%CI;1.5-8.1) and respondents who had knowledge on early initiation of first ANC were more likely to start early as compared to their counterparts (AOR= 1.7, 95%CI; 1.14-2.55), were significantly associated with early initiation of antenatal care. (Table 4).

Table 4: Factors association with early initiation of ANC, public health centers of Bahir Dar special zone, 2021(n=592)

Variables	Early initiation ANC		Odds ratio	
	Yes	No	COR(95%CI)	AOR(95%CI)
Age of women				
<25	113	180	2.8(2.0-3.9)	1.0(0.54-1.8)
≥25	191	108	1	1
Residence				
Urban	201	275	10.8(5.9-19.8)	3.0(1.48-6.17) **
Rural	103	13	1	1
Education of women				
Primary	177	52	1	1
Secondary	85	123	4.9(3.25-7.45)	2.1(1.3-3.6) **
College/above	42	113	9.1(5.7-14.6)	3.5(1.8-6.8)**
Occupation of women				
House wife	152	132	0.67(0.44-1.0)	1.1(0.71-2.01)
Farmer	76	27	0.27(0.1-0.48)	0.51(0.25-1.01)
Employed	23	61	2.0(1.1-3.76)	1.3(0.6-2.74)
Merchant	53	68	1	1
Monthly income				
<2000 birr	76	24	1	1
>=2000 birr	228	264	3.6(2.24-5.99)	1.09(0.57-2.07)
Means of transport				
On foot	129	78	1	**1**
Taxi/Bajaj	175	210	1.98(1.4-2.8)	1.4(0.93-2.13)
Gravida				
One	78	173	4.3(3.0-6.1)	2.6(1.65-4.14) **
Two and above	226	115	1	1
knowledge on early initiation				
<16wk	192	175	1.2(1.06-1.75)	0.37(0.27-0.5) **
>=16wk	112	113	1	1
Family size				

<5	163	232	3.5(2.4-5.1)	2.0(1.25-3.25) **
>=5	141	56	1	1
Plan of pregnancy				
Yes	268	279	4.1(1.9-8.8)	3.5(1.5-8.1) **
No	36	9	1	1
Minor disorders of px				
Yes	16	23	1.56(0.8-3.02)	1.3(0.57-3.0)
No	288	265	1	1

*N.B 1=Reference category *= significant at P<0.0.5, **=significant at P<0.001.*

Discussion

This study aimed to assess the proportion of early booking of antenatal care at public health facilities found in Bahir dar special zone. Additionally it targeted to identify factors associated with early initiation of ANC across Bahir dar Zone. Based on WHO recommendation pregnant women have to start first ANC booking within First trimesters. In Ethiopia due to high governmental effort the proportion of women with the recommended four or more ANC visits increased from 12% in 2005 to 43% in 2019. During this same time period, the proportion of women who received ANC in the first trimester increased from 6% to 28% (8).

Only 48.6% pregnant women were started their First ANC Visit within the recommended time in the study area. This finding is in line with prior studies conducted in southern Ethiopia 49.7%(12), Adigrat town, Tigray Ethiopia 48.2% (19) and Addis Zemen south Gondar, Ethiopia 47.5%(20). The proportion of early initiation of ANC was higher than the report of Mini Ethiopian demographic health survey conducted in 2019 which was only 28%. The variation between these finding could be due to EDHS covered more remote areas where as health centers could be a major predictor of ANC service (8). However the proportion of this study is less than study conducted in Addis Ababa which was 58% of the women started their visit within first trimesters (21). This difference might be due to Addis Ababa is the capital of the country and the community there might have better health awareness than the study area.

Maternal education was the major significant factor in multivariable analysis, Mothers with college degree and above were 3.5 times and mother with secondary school and above were 2.1 times more likely to initiate ANC service with the recommended time than mothers with only

primary school. This finding was similar with study conducted at wollita sodo zone Ethiopia(17), and Myanmar(14). This might be due to mothers with high level education may have knowledge about what is necessary during pregnancy, the importance of ANC and importance of early initiate the service.

Pregnant women who had knowledge on early initiation of first ANC were 0.37 times more likely to initiate early as compared to their counterparts and this finding was consistent with the studies conducted in Addis Zemen hospital(20), central zone of Tigray (22) , study conducted in Benshanigul (23)and Ghana(24). This might be due to mothers with poor ANC knowledge may not have enough awareness about the importance of early initiate of ANC and also may not know time to initiate the services.

Planned pregnancy also found to be a significant factor for early initiation of ANC, pregnant women with planned pregnancy were 3.5 times more likely to initiate early ANC than their counter part. This finding is consistent with studies from eastern zone Tigray(25) and Mandalay, Myanmar(14), this may be due to that timing of ANC affected by decision the women make during pregnancy, so it takes time starting from accepting the pregnancy itself to acknowledging the need for ANC.

Place of residence also has a great impact on time to initiate ANC booking, the study showed that women reside in urban were 3 times more likely to initiate ANC follow up compare to women reside in rural this result is consistence with those studies undertaken in 2019 Mini EDHS(8) and Mandalay, Myanmar(14). The possible reason for this finding is that women reside in urban has the chance to access health facilities nearby than women reside in rural.

Conclusions and Recommendations

The study showed that more than half of the participants were not initiate their ANC service timely. Family size, residence, educational status of women, gravidity, plan of pregnancy and knowledge on early initiation of first ANC were factors significantly associated with early initiation of antenatal care service. Additionally dissemination of information about recommended time to initiate ANC services and cooperative effort to improve women's educational status to increase knowledge on early initiation of first antenatal care has to be conducted.

Abbreviations

ANC: antenatal care; HC: health centers; CSA: Central statistics agency;

EDHS: Ethiopian demographic and health survey; IRB: Institutional Review

Board; FMOH: Federal Ministry of Health; MM: maternal mortality; WHO: World Health Organization;

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Availability of data and materials

The datasets during and/or analyzed during the current study is available from the corresponding author on reasonable request.

Authors' contributions

Proposal preparation, acquisition of data, analysis and Interpretation of data was done by EA (principal investigator). Drafting the article, revising it critically for intellectual content, and final approval of the version to be published was done by EA, ZR and GH. All authors read and approved the final manuscript**.**

Competing interests

The authors declare that they have no competing interests.

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Ethical Considerations

Ethical clearance was obtained from Yom post graduate college department of project planning and management, Research Ethical review board with reference ID YC//207//2013. A legal official letter was submitted to the Bahir Dar city administration health department office to obtain their permission. Confidentiality of the data was maintained by using the data only for the study purpose and keeping the data from third party.

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STROBE—Checklist is used for this study

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	II
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	3	State specific objectives, including any prespecified hypotheses	
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	3
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4*
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6
		(*b*) Describe any methods used to examine subgroups and interactions	6
		(*c*) Explain how missing data were addressed	6
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6
		(*e*) Describe any sensitivity analyses	6
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7&8
		(b) Indicate number of participants with missing data for each variable of interest	7
Outcome data	15*	Report numbers of outcome events or summary measures	7,8&9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10

		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	11
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	11
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12&13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

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Early Initiation of Antenatal Care and Factors Associated with Early Antenatal Care Initiation at public Health Centers at Bahir dar Zuria Zone, 2021:Cross Sectional Study Design

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Early Initiation of Antenatal Care and Factors Associated with Early Antenatal Care Initiation at public Health Centersat Bahir dar Zuria Zone, 2021:Cross Sectional Study Design

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Abstract

Objectives: This study aimedto assess the proportion and factors associated with early initiation of antenatal care follow up among pregnant women attending antenatal care service at Bahir Darzuria zone public health centers, Bahir Dar, Ethiopia.

Design: An institutional based cross sectional study was conducted from Dec, 15/2020 to March 1, 2021. Systematic random sampling techniques were applied to select the participant.

Setting: This study conducted in fivePublic health centers (Han HC, Shimbit HC, Dagmawi Minilik HC, Shumabo HC and Meshentie HC) found in Bahir Dar Zuria Special Zone.

Participant: Pregnant mothers who were attending their antenatal care service during the data collection period were enrolled in this study. A total of 592 mothers were interviewed for the study.

Outcome measure: Early Initiation of Antenatal Care services

Result: It was found that48.6% with [95% CI 41.6, 53.5] of the participants began their first antenatal care services before 16 weeks of gestation. Family size less than five (Adjusted odds ratio (AOR)= 2.0, 95% CI; 1.25-3.25), urban residence (AOR=3.0,95%CI;1.48,6.17), secondary education (AOR=2.1,95%CI;1.3-3.6), college level and above (AOR=3.5,95%CI;1.8-6.8), primi gravida (AOR=2.6,95%CI;1.65-4.14), planned pregnancy (AOR=3.5,95%CI;1.5-8.1) and knowledge on early initiation of 1st ANC (AOR= 1.7, 95%CI; 1.14-2.55), were significantly associated with early initiation of first antenatal care.

Conclusion and recommendation: The study found that a significant number of the participants had not received ANC services in a timely manner. Socio-demographic and obstetric characteristics of the respondents were the major factors to determine timely booking of ANC services. Additionally dissemination of information about recommended time to initiate ANC services and cooperative effort to improve women's educational status to increase knowledge on early initiation of first antenatal care has to be conducted by Health extension workers, Bahir dar city administration, Regional and federal health bureaus respectively.

Keywords: Antenatal care, early initiation, pregnancy

Strength and limitation of the study

- To ensure the quality of this research, training was given to data collectors and supervisors. Pretest was carried out prior to actual data collection to assess the validity of the questionnaire.
- The study presented the self-reported data by the women attending their antenatal care service at the study area.Therefore there is a possibility ofsocial desirability and recall bias.
- The finding of this study was not triangulated on qualitative finding

Introduction

The physiological symptoms of pregnancy and the symptoms of pregnancy-related complications are sometimes difficult to differentiate. Pregnancy-related complications are risky health conditions that occur during pregnancy,it can involve the mother's and the child's health. (1,2).

To avert the problems, various maternal health care services are being provided.Among those services,Antenatal care(ANC) service is one of essential and key strategies for reducing maternal and neonatal morbidity and mortality directly through detection and treatment of pregnancy-related illnesses(2)(3)(4).

According to World Health Organization (WHO) recommendation pregnant women in developing countries have to get at least eight ANC visits, and initiate early ANC follow up(2).As per the 2016 WHO recommendation, Ethiopia is replaced the previous four-visit Focused ANC model with the new ANC eight-contact model(5).Huge progress has been made globally, however stillmaternal health is a global agenda. WHO 2019 report shows about 295 000 maternal deaths occurred in the globe due to pregnancy and childbirth related complications.(1,6) Sub-Saharan Africa and Southern Asia accounted for approximately 86% of the estimated global maternal deaths in 2017 (6).

Early antenatal care attendance during the first three months of gestation plays a major role in detecting and treating complications that occur during pregnancy (7).In Ethiopia 412 maternal deaths per 100,000 live birth occur in 2016 due to pregnancy or childbirth related complications andtargeted reduction to 199/100,000 live births by 2020, Ethiopian Demographic Health Survey(EDHS)(4).

Despite ANC is provided free of charge and there is increased accessibility, but early initiation of ANC is still a major problem(8). In Ethiopia only 28% of women had their first ANC during the first trimester, while 43% of women in urban areas receive ANC within their first trimester of pregnancy, compared with 22% of those in rural areas, EDHS(9). Maternal education, previous history of early booking, age, and perception on frequency of ANC visit per pregnancy were significantly associated with the early ANC visit, awareness creation and strengthening on the importance of the early ANC visit need to be emphasized at the time of service provision(10,11).

Numbers of activities were done by the government to improve the early initiation of antenatal care in Ethiopia. Among those activities enhanced coordination of health extension workers, health development army , extended supportive supervision systems at national, regional, zonal, woreda, primary health care unit and community levels on maternal health services including early ANC initiation were the major activities.(12).

However, the factors associated with early initiation of ANC are not the same across different cultures, socio economic status and distance/access to health institution within a society. Thus assessing the factors associated for early initiation of ANC follow up in different set up is important to improve maternal health services. Therefore, this study aimed at determining the magnitude and identify factors associated with it among pregnant women attending antenatal clinic in public health centers in Bahir Dar Zuria Special Zone, Ethiopia.

Methods

Study area

Institutional based cross-sectional study was conducted in Bahir Dar Zuria special zone from December, 15, 2020 to march 1, 2021. A total population of Bahir Dar city estimated to be 345,084 and 81,371 of them are women of reproductive age group. The city currently has 3 governmental hospitals, 4 private hospitals,10 governmental health centers, 10 health posts, and more than 39 private clinics. There are more than 405 health care providers including health extension working at health centers of Bahir Dar city administration, among those 47 are midwives. According to the 2020 G.C annual zonal report, the antenatal coverage in the study area was 100% (3,4,13)

The study was conducted in five public health centers (Han HC, Shimbit HC, Dagmawi Minilik HC, Shumabo HC and Meshentie HC).

Study variables

Dependent variables

ANC initiation –early/late

Independent variables

Socio-demographic and economic factors: maternal age, educational status, occupation, marital status, ethnicity, religion, income, family size and residence, husband educational

Pregnancy & maternal related factors: gravidity, history of abortion, health status of present pregnancy/danger sign, plan of pregnancy/unwanted pregnancy, past experience of antenatal care utilization, knowledge and awareness on timing of first antenatal care and Previous pregnancy complication

Behavioral factors: information access, free of pain, access to media anddistance of health facilities

Study population

All pregnant women attending their antenatal care service in public health centers of Bahir Dar Zuria Special Zoneduring the data collection period.

Inclusion criteria

Pregnant women attending antenatal care service were included to the study

Exclusion criteria

Women who have either unknown gestational age or not having ultrasound result or not known with physical examination and pregnant women who had danger signs of pregnancy/seriously ill were excluded from this study.

SamplingTechnique/ Procedure

To select participants, systematic random sampling techniques were applied. The total sample size was proportionally allocated from the randomly selected five health centers based on their ANC loads. By considering; N (total pregnant woman who came for first ANC visit in previous two months in five health centers = 971), n (calculated sample size = 610) and k-interval K = N/n, = 971/610 = 2, the first client was selected by lottery method among the first two ANC service users in each health centers. n = sample size allocated to each health centers, N = number of ANC clients in a health center in previous two month's performance (Han health center = 349, Shimbit health center = 200, Dagmawi Minilik health center = 251, Shumabo health center =98 and Meshentie health center =73). Then the final sample size proportionally allocated for each health centers.

Sample Size Determination

The sample size was calculated using single population proportion formula. Taking 46.8% prevalence of early initiation of antenatal care from previous study(14). With an assumption

of 95% confidence interval (z=1.96), 5% margin of error (d=0.05), 10% nonresponse rate and 1.5 design effect.

$n= (Z\alpha/2)^2P(1-P)/d^2$ $n = (1.96)^2\ 0.468(1-0.468)/0.05^2=381$

Where, n-sample size

Zα/2-Z value at 95% level of confidence [1.96]

P- is the proportion of early initiation of ANC

d- the margin of error at 95%confidence interval

By considering the 10% non-response rate 381×10/100=38

Final sample size was 381×1.5+38 =610

Operational definitions

Antenatal care- is Pregnancy related services given by skilled health care providers starting from conception up to the onset of labor (2,15,16)

Early antenatal care- is the first antenatal care received as soon as the pregnancy is suspected till 16 weeks of gestation (17–19).

Data Collection Tool andMethods

Data related to socio-demographic, economic factors, pregnancy, maternal related factors and behavioral factors were collected by using a pretested and semi structured questionnaire(see appendix 1).The questionnaire was first developed in English and later translated into Amharic and finally re-translated back to English to check its consistency(20). Training was given to the supervisors and data collectors for two days by the principal investigator on the details of the questionnaire. The interview was conducted in Amharic. Face-to-face interviews were conducted with eligible mothers at an antenatal care clinic. Interviews were conducted by four midwives and supervised by two health professionals with degrees. Information related to gestational age was taken from mothers ultrasound result.

Data Management and Analysis

The data were entered, coded and cleaned using EPI data version 4.6. After completion of entry the data were export to SPSS version 23 for analysis. Missing data were managed by observing cross tabulation results percentages. Bi-variable logistic regression was used to identify the association between independent variables and dependent variables, variables with p-value of less than 0.2 used for multi-variable logistic regression analysis to determine various factors on

the outcome variable and to control confounding effect. Adjusted odds ratio (AOR) with 95% confidence interval (CI) was used to identify the independent predictors of early initiation of antenatal care. P values less than 0.05 were taken as statistically significance. The goodness of fit of the model was assessed using HosmerLemeshow's statistical test and its values above 5% which is 0.76 indicate that the model has a good predictive ability. A multicollinearity test was performed for the variables included in the final multivariable model. Hence, the variables had a VIF value of less than five.

Data Quality Assurance

To ensure the quality of this research training were given to data collectors and supervisors. Pretest were carried out in 5% of sample size prior to actual data collection out of the study area, to assess the validity of the questionnaire to check clarity of questions, ambiguity, arrangement of questions, order & options for the questions and skipping pattern accordingly. The whole data collection procedures were closely supervised by field supervisors and investigators to ensure the completeness and reliability of the gathered information throughout the data collection process.

Patient and public involvement

neither patients nor the public were involved in the design, planning, conduct or reporting of this study.

Ethical Considerations

Ethical clearance was obtained from Yom post graduate college department of project planning and management, Research Ethical review board with reference ID. YC//207//2013. A legal official letter was submitted to the Bahir Dar city administration health department office to obtain their permission.Each participant gave written informed consent to participate in the study before data collection began.

Result

Socio-demographic characteristics of the respondent

A total of 592 pregnant women took part in the study. 48.6% (95% CI 41.6, 53.5) of the participants started their first antenatal care services before 16 weeks of gestation.Of the

respondents 85.7% were followers of Orthodox Christian religion. The age of the respondents ranged from 17 to 45 years with a mean age of 26.31 (SD 4.72 years). More than three-fourth (476) of them were resides in urban areas.61.3% (366) of respondents were attended secondary and above in their educational level. (Table 1)

Obstetric characteristics of the respondent

Regarding Obstetric characteristics of the study participants, 57.6% (341) of respondents were multi-gravida and two hundred seventy-eights (46.8%) had antenatal follow up in their previous pregnancies and five hundred forty-seven (92.1%) of pregnancies were planned. 13.7%(81) of the respondent had history of abortion. 51.5% (305) of respondent had knowledge on the timing of first ANC (Table 2, Table 3)

Table 1: The socio- demographic characteristics of thepregnant women selected public health center in Bahir Dar special zone, 2021(n=592)

Variables	Characteristics	Frequency	Percent
Age	>25	293	49.5
	≥25	299	50.5
Residence	Urban	476	80.3
	Rural	116	19.6
	Orthodox	508	85.7
Religion	Muslim	67	11.3
	Protestant	17	2.9
Educational status	Primary	229	38.7
of women	Secondary & preparatory	208	35.1
	College and above	155	26.2
Women occupation	House wife	297	50.2
	Farmer	91	15.4
	Employed Gov't/NGO	117	19.8
	Merchant	87	14.7
Monthly income	<2000	100	16.9

	>=2000	492	83.1
Marital status	Married	581	98.1
	Unmarried/cohabitation	11	1.9
Husband educational status	Primary	170	28.7
	Secondary & preparatory	199	33.6
	College and above	211	35.6
Means of transportation	On foot	207	35
	Taxi/Bajaj	385	65
Family size	< 5	395	66.7
	≥ 5	197	33.3
Distance to reach HC on foot came	<30 minutes	181	30.6
	>30 minutes	17	2.9
Cost of transport	<3 birr	12	2
	3-9 birr	220	37.2
	>9 birr	147	24.8

Table 2: Obstetric characteristics of pregnant women in selected public health centers of Bahir Dar special zone, 2021(n=592)

Variables	Description	Frequency	Percent
Gravida	One	251	42.4
	Two & above	341	57.6
History of abortion	Yes	81	13.7
	No	511	86.3
Minor disorders of pregnancy	Yes	140	23.6
	No	452	76.4

Table 3: Previous pregnancy and knowledge's of pregnant women related factors in public health centers of Bahir Dar special zone, 2021 (n = 592)

Variables	Characteristics	Frequency	Percent
Had ANC follow up in your last px.	Yes	278	46.8
	No	46	7.7
Place of delivery who had previous birth	Home	47	7.9
	Health facilities	265	44.8
Rout of delivery who had previous birth	SVD	243	41
	C/S	69	11.7
Outcome of last birth	Alive	298	50.3
	Still birth	14	2.4
Knowledge on early initiation of first ANC	<16wk	304	51.5
	≥16wk	288	48.5
Frequencies for ANC follow up	Once	10	1.7
	2-3	212	35.8
	≥4	353	59.6
ANC service reduce PMTCT	Yes	518	87.5
	No	74	12.5

Factors Associated with Early Initiations of First ANC Visit

Bi-variable analysis showed that Age of women, residency, educational status of women, occupation of women, monthly income, means of transportation, gravidity, knowledge on early initiation of first ANC, family size, plan of pregnancy and minor disorders of current pregnancy were candidate variable for multivariable analysis. On multivariable analysis family size, gravidity, residence, educational status of women, plan of pregnancy and

knowledge on early initiation of first ANC, were true determinants of early initiation of first ANC visit at the p-value less than 0.05. The findings showed that those family size less than five were 2 times more likely to initiate early ANC than those family size is greater than five (AOR= 2.0, 95% CI; 1.25-3.25), those urban residence were 3 times more likely to initiate early than those residence were rural (AOR=3.0,95%CI;1.48,6.17), respondents with college level and above were 3.5 times more likely to initiate early ANC as compared to those with primary school (AOR=3.5, 95% CI; 1.8-6.8), those with secondary education are 2.1 times more likely to initiate than those with primary education(AOR=2.1,95%CI;1.3-3.6). respondents with primi gravida were 2.6 times more likely to initiate early than those respondents who had multigravida (AOR=2.6,95%CI;1.65-4.14), respondents with planned pregnancy were 3.5 times more likely to initiate early than those respondents with unplanned pregnancy(AOR=3.5,95%CI;1.5-8.1) and respondents who hadknowledge on early initiation of first ANC were more likely to start early as compared to their counterparts (AOR=1.7(1.14-2.55), were significantly associated with early initiation of antenatal care.(Table 4).

Table 4: Factors association with early initiation of ANC, public health centers of Bahir Dar special zone, 2021(n=592)

Variables	Early initiation ANC		Odds ratio	
	Yes	No	COR(95%CI)	AOR(95%CI)
Age of women				
<25	113	180	2.8(2.0-3.9)	1.0(0.54-1.8)
≥25	191	108	1	1
Residence				
Urban	201	275	10.8(5.9-19.8)	3.0(1.48-6.17) **
Rural	103	13	1	1
Education of women				
Primary	177	52	1	1
Secondary	85	123	4.9(3.25-7.45)	2.1(1.3-3.6) **
College/above	42	113	9.1(5.7-14.6)	3.5(1.8-6.8)**

Occupation of women				
House wife	152	132	0.67(0.44-1.0)	1.1(0.71-2.01)
Farmer	76	27	0.27(0.1-0.48)	0.51(0.25-1.01)
Employed	23	61	2.0(1.1-3.76)	1.3(0.6-2.74)
Merchant	53	68	1	1
Monthly income				
<2000 birr	76	24	1	1
>=2000 birr	228	264	3.6(2.24-5.99)	1.09(0.57-2.07)
Means of transport				
On foot	129	78	1	**1**
Taxi/Bajaj	175	210	1.98(1.4-2.8)	1.4(0.93-2.13)
Gravida				
One	78	173	4.3(3.0-6.1)	2.6(1.65-4.14) **
Two and above	226	115	1	1
knowledge on early initiation				
yes	112	175	2.6(1.4-3.79)	1.7(1.14-2.55) **
no	192	113	1	1
Family size				
<5	163	232	3.5(2.4-5.1)	2.0(1.25-3.25) **
>=5	141	56	1	1
Plan of pregnancy				
Yes	268	279	4.1(1.9-8.8)	3.5(1.5-8.1) **
No	36	9	1	1
Minor disorders of px				
Yes	16	23	1.56(0.8-3.02)	1.3(0.57-3.0)
No	288	265	1	1

*N.B 1=Reference category *= significant at P<0.0.5, **=significant at P<0.001.*

Discussion

This study aimed to assess the proportion of early booking of antenatal care at public health centers found in Bahir dar special zone. Additionally it targeted to identify factors associated with early initiation of ANC across Bahir dar Zone. Based on WHO recommendation pregnant women have to start first ANC booking within First trimesters. In Ethiopia due to high

governmental effort the proportion of women with the recommended four or more ANC visits increased from 12% in 2005 to 43% in 2019. During this same time period, the proportion of women who received ANC in the first trimester increased from 6% to 28%(9).

In the study area, 48.6% of pregnant women received their First ANC visit within the recommended time frame. This finding is in line with prior studies conducted in southern Ethiopia 49.7%(13), Adigrat town, Tigray Ethiopia 48.2% (21) and Addis Zemen south Gondar, Ethiopia 47.5%(22). The proportion of early initiation of ANC was higher than the report of Mini Ethiopian demographic health survey conducted in 2019 which was only 28%. The variation between these finding could be due to this study was conducted in Bahir dar Zuria zone where Antenatal care coverage proportion are relatively high; hence, findings may not be similar in other parts of Ethiopia where there is a low proportion of Antenatal care coverage (9).Study from Addis Ababa showed higher Proportion of early ANC initiation than the current study, 58% of the women started their visit within first trimesters (23). This difference might be due to Addis Ababa is the capital of the country and the community there might have better health awareness than the current study (9).

Maternal education was the major significant factor in multivariable analysis, Mothers with college degree and above were 3.5 times and mother with secondary school and above were 2.1 times more likely to initiate ANC service with the recommended time than mothers with only primary school. This finding was similar with study conducted at wollita sodo zone Ethiopia(18), and Myanmar(15). This might be due to mothers with high level education may have knowledge about what is necessary during pregnancy, the importance of ANC and importance of early initiate the service.

Pregnant women who had knowledge on early initiation of first ANC were 1.7 times more likely to initiate early as compared to their counterparts and this finding was consistent with the studies conducted in Addis Zemen hospital(22), central zone of Tigray (24) , study conducted in Benshanigul (25)and Ghana(26).This might be due to mothers with poor ANC knowledge may not have enough awareness about the importance of early initiate of ANC and also may not know time to initiate the services.

Planned pregnancy also found to be a significant factor for early initiation of ANC, pregnant women with planned pregnancy were 3.5 times more likely to initiate early ANC than their counter part. This finding is consistent with studies from eastern zone Tigray(27) and Mandalay, Myanmar(15), this may be due to that timing of ANC affected by decision the women make during pregnancy, so it takes time starting from accepting the pregnancy itself to acknowledging the need for ANC.

Place of residence also has a great impact on time to initiate ANC booking, the study showed that women reside in urban were 3 times more likely to initiate ANC follow up compare to women reside in rural this result is consistence with those studies undertaken in 2019 Mini EDHS(9) and Mandalay, Myanmar(15). The possible reason for this finding is that women reside in urban has the chance to access health facilities nearby than women reside in rural.

The finding of this study was not triangulated with qualitative report, we were unable to include qualitative findings because the study was done during the COVID-19 epidemic, which had a substantial impact on our activities. Additionally the study presented the self-reported data, which was prone for social desirability and recall bias which we tried to eliminate as much as possible.

Conclusions

The study found that a significant number of the participants had not received ANC services in a timely manner. Socio-demographic and obstetriccharacteristics of the respondents were the major factors to determine timely booking of ANC services. Family size, residence, educational status of women, gravidity, plan of pregnancy and knowledge on early initiation of first ANC were factors significantly associated with early initiation of antenatal care service.

Recommendations

Additionally dissemination of information about recommended time to initiate ANC services and cooperative effort to improve women's educational status to increase knowledge on early initiation of first antenatal care has to be conducted by Health extension workers, Bahir dar city administration, Regional and federal health bureaus.

Abbreviations

ANC: antenatal care; HC: health centers; CSA: Central statistics agency;
EDHS: Ethiopian demographic and health survey; IRB: Institutional Review Board; FMOH: Federal Ministry of Health; MM: maternal mortality; WHO: World Health Organization;

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Availability of data and materials

The datasets during and/or analyzed during the current study is available from the corresponding author on reasonable request.

Authors' contributions

Proposal preparation, acquisition of data, analysis and Interpretation of data was done by EA (principal investigator). Drafting the article, revising it critically for intellectual content, and final approval of the version to be published was done by EA, ZR and GH. All authors read and approved the final manuscript**.**

Competing interests

The authors declare that they have no competing interests.

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Ethical Considerations

Ethical clearance was obtained from Yom post graduate college department of project planning and management, Research Ethical review board with reference ID. YC//207//2013. A legal official letter was submitted to the Bahir Dar city administration health department office to obtain their permission.Each participant gave written informed consent to participate in the study before data collection began.

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Appendix 1 Questioner (English)

Annex I-English version information sheet and consent form

Yom Post Graduate

Department Project Planning and Management

Greeting

Good Morning / Good after noon

My name is ESKAHUN AMBAYE I am a student at Yom institute of economic development department of project planning and management. This study is aimed to assess the prevalence and determinant factors of early antenatal care follow up utilization among pregnant women attending antenatal care service at public health facilities of Bahir Dar Zuria zone, Amhara, Ethiopia, 2020. The results from this study will help different stake holders and health care providers design different feasible and accessible interventions to improve the prevalence of early antenatal care service utilization in the study area. And, since you met the criteria for the study participant selection, you are selected to be the participant for the study. The data contained in this interview will solely be used for this study, and your response will be kept confidential. For this purpose, on this interview, your name will not be written and there is no any means to check and link the study results to your responses. With the interview, if there any problem or unclear to you, you can communicate openly and for any question/s from the interview, you have the right to give no answer or stop the interview, but your participation is highly important for the success of the study. So, we politely request your cooperativeness to participate the interview.

Do you agree to participate in this study? Yes, _____Continue.

No _____

Thank you once again for your participation in the study.

Investigator Name _____ Signature_____

Date of interview_____ Time started _____ Ending_____

Contact =+2510910210427

5.4.3Annex II- English questionnaire

Questionnaire code number---

Part –I Socio demographic and economic variables

S.N	**Questions**	**Response and codes**	**Remark/Skip**
101	Age	----------	
102	Place of residence	1.Urban 2. Rural	
103	Religion	1. Orthodox 2. Muslim 3. Protestant 4. others	
104	Ethnicity	1. Amhara 2. Oromo 3. Tigray 4. others	
105	Marital status	1.married 2.cohabitation 3. divorced 4.widowed	
106	Educational status	1.illiterate 2.Read and write only 3.Primary (1-8) 4.9-12 5.College level and above	
107	Occupation	1.house wife 2.farmer 3.Employed/Gov't &NGO/ 4.merchant 5. other	

108	Monthly income	----------	
110	Husband education	1.illiterate 2.Read and write only 3.Primary (1-8) 4.9-12 5.College level and above	
111	Husband occupation	1. Employed/gov't &Ngo/ 2. Farmer 3.Daily laborer 4.Merchant 5. Other	
112	Transportation access	1.Yes 2.No	
113	If, yes transportation cost that you pay for coming to and back from this hospital?	----------	
Part-II history of previous pregnancy			
114	Have you had antenatal follow up in your last pregnancy?	1.Yes 2.No	
115	If yes-----How many visits did you get in your last pregnancy?	1. Once 2. 2-3 visits 3. 4 and more	
116	Time/duration/ of your pregnancy when you start antenatal follows up in your last	1.≤20weeks 2.21-34weeks	

	pregnancy? (In week)	3.≥35weeks	
117	Did you encounter any problem during your pregnancy?	1.Yes 2.No	
118	If yes what was the problem?	1.Hypertensive disorders 2.Antepartum hemorrhage 3.Anemia 4.Other------	
119	Where did you delivered your last baby?	1.Health center 2.Hospital 3.Home 4. other----	
120	What was the outcome of your last delivery?	1.Alive 2.dead	
121	What was the route of delivery?	1.Spontaneously Vaginal 2.Assisted vaginal 3.Caesarean section 4.Other----	
Part- III Knowledge Of ANC			
122	Is antenatal care follow up beneficial for the woman?	1.Yes 2.No	
123	Is antenatal follow up beneficial for the fetus?	1.Yes 2.No	
124	When is the ideal age of pregnancy to start antenatal follow-up?(In weeks)	1. ≤16weeks 2. >16weeks	
125	How many times do you think a women needs to go for ANC?	1.Once 2.2-3x 3.>4 x	
	Part-IV Obstetric history		
126	Gravidity	1.Premi gravida 2.Multi gravida	

127	History of abortion	1.Yes 2.No	
128	Parity	1.Nulli para 2. Primipara 3.Multi para	
129	Family size	--------	
	Part- V History of current pregnancy		
130	Is the pregnancy planned	1.Yes 2. No	
131	Waiting time to complete the service?	----------	
132	Time /duration/of pregnancy in weeks	1. ≤16weeks 2. 16-20weeks 3.21-34weeks 4.≥35weeks	
133	Is there Anyone who advise you to come ANC follow up?	1.Yes 2.No	
134	If yes, from whom you get it?	1. Health professional 2. Media 3. Neighbor 4. families 5. Other----	
135	Is there a problem in current pregnancy?	1. Yes 2. No	

	If yes what type of problem------		

STROBE—Checklist is used for this study

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	II
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	3	State specific objectives, including any prespecified hypotheses	
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	3
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4*
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6
		(*b*) Describe any methods used to examine subgroups and interactions	6
		(*c*) Explain how missing data were addressed	6
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6
		(*e*) Describe any sensitivity analyses	6
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7&8
		(b) Indicate number of participants with missing data for each variable of interest	7
Outcome data	15*	Report numbers of outcome events or summary measures	7,8&9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10

		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	11
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	11
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12&13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

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Early initiation of antenatal care and its associated factors among pregnant women attending antenatal care at public health centers in Bahir Dar Zuria zone, Northwest Ethiopia, 2021: a cross-sectional study

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Abstract

Objectives: This study aimed to assess the prevalence of, and factors associated with, early initiation of antenatal care (ANC) follow up among pregnant women attending ANC services at Bahir Dar Zuria zone public health centers, Bahir Dar, Northwest Ethiopia.

Design: An institution-based, cross-sectional study was conducted from December 15, 2020 to March 1, 2021. A systematic random sampling technique was applied to select the study participants.

Setting: Five public health centers (Han HC, Shimbit HC, Dagmawi Minilik HC, Shumabo HC and Meshentie HC) in Bahir Dar Zuria zone.

Participants: Pregnant mothers who were attending their antenatal care service during the data collection period were enrolled in this study. A total of 592 mothers were interviewed for the study.

Outcome measure: Early initiation of ANC services (within 16 weeks of gestation)**.**

Results: 48.6% (95% CI 41.6, 53.5) of participants began their first ANC service before 16 weeks of gestation. Family size less than five (adjusted odds ratio [AOR] 2.0, 95% CI 1.25-3.25), urban residence (3.0, 1.48-6.17), secondary education (2.1, 1.3-3.6), college level education and above (3.5, 1.8-6.8), primi gravida (2.6, 1.65-4.14), planned pregnancy (3.5, 1.5-8.1), and knowledge about early initiation of first ANC (1.7, 1.14-2.55) were significantly associated with early initiation of ANC.

Conclusion: A substantial number of the participants had not received ANC services in a timely manner. Socio-demographic and obstetric characteristics of the respondents were associated timely booking of ANC services. Dissemination of information about recommended time to initiate ANC services and efforts to improve women's educational status to increase knowledge on early initiation ANC are needed in the region.

Keywords: Antenatal care, early initiation, pregnancy

Strengths and limitations of this study

- Pretest was carried out prior to actual data collection to assess the validity of the questionnaire used in the study.
- Training was given for data collectors and supervisors to ensure the quality of the data obtained.
- The study uses self-reported data from women attending their antenatal care service in the study area; therefore, there is a possibility of social desirability and recall bias.
- The findings of this study were not triangulated with relevant qualitative data.

Introduction

The physiological symptoms of pregnancy and the symptoms of pregnancy-related complications are sometimes difficult to differentiate. Pregnancy-related complications are risky health conditions that occur during pregnancy. It can involve the mother's and the child's health (1,2).

To avert pregnancy-related complications, various maternal health care services are being provided. Among those services, antenatal care service is one of the essential and key strategies to reduce maternal and neonatal morbidity and mortality directly through the detection and treatment of pregnancy-related illnesses (2–4).

According to world health organization (WHO) recommendation pregnant women in developing countries have to get at least eight ANC visits and initiate early antenatal care follow up which helps to early detect and manage complications occur during pregnancy (2). As per the 2016 WHO recommendation, Ethiopia is replaced the previous four-visit focused ANC model with the new ANC eight-contact model(5).

Huge progress has been made globally, however still maternal health is a global agenda. WHO 2019 report shows about 295,000 maternal deaths occurred in the globe due to pregnancy and childbirth related complications (1,6). Sub-Saharan Africa and Southern Asia accounted for approximately 86% of the estimated global maternal deaths in 2017 (6).

Early ANC attendance during the first three months of gestation plays a major role in detecting and treating complications that occur during pregnancy (7). In Ethiopia 412 maternal deaths per 100,000 live birth occur in 2016 due to pregnancy or childbirth-related complications and targeted reduction to 199/100,000 live births by 2020(4).

Despite ANC being provided free of charge and there is increased accessibility, early initiation of ANC is still major problem (8). In Ethiopia, only 28% of women had their first ANC during the first trimester, while 43% of women in urban areas receive ANC within their first trimester of pregnancy, compared with 22% of those in rural areas(9). Maternal education, previous history of early booking, maternal age, and perception of the frequency of ANC visits per pregnancy were significantly associated with the early ANC visit, awareness creation and strengthening on the importance of the early ANC visit need to be emphasized at the time of service provision(10,11).

Numbers of activities were done by the government to improve the early initiation of antenatal care in Ethiopia. Among those activities enhanced coordination of health extension workers, health development army and extended supportive supervision systems at national, regional, zonal, woreda, primary health care unit, and community levels on maternal health services including early ANC initiation were the major activities (12).

However, the factors associated with early initiation of ANC are not the same across different cultures, socioeconomic status, and distance/access to health institutions within society. Thus assessing the factors associated with early initiation of ANC follow-up in different setups is a key to improving maternal health services. Therefore, this study aimed to determine the magnitude and identify factors associated with it among pregnant women attending antenatal care in public health centers in Bahir Dar Zuria zone, Northwest Ethiopia.

Methods

Study design and setting

Institution-based cross-sectional study was conducted in Bahir Dar Zuria zone from December 15, 2020 to march 1, 2021. The total population of Bahir Dar city is estimated to be 345,084, and 81,371 of the total population is women of reproductive age group. The city currently has 3 governmental hospitals, 4 private hospitals, 10 governmental health centers, 10 health posts, and

more than 39 private clinics. There are more than 405 health care providers including health extension working at health centers of Bahir Dar city administration, among those 47 are midwives. According to the 2020 G.C annual zonal report, the antenatal coverage in the study area was 100% (3,4,13).

This study was conducted in five public health centers (Han HC, Shimbit HC, Dagmawi Minilik HC, Shumabo HC, and Meshentie HC).

Study variables

Dependent variable

ANC initiation –early (<16weeks of gestation)/late ≥ 16 weeks of gestation).

Independent variables

Socio-demographic and economic factors: maternal age, educational status, occupation, marital status, ethnicity, religion, income, family size, residence, and husband's education.

Pregnancy & maternal-related factors: gravidity, history of abortion, the health status of present pregnancy/danger sign/, plan of pregnancy/unwanted pregnancy/, the experience of antenatal care utilization, knowledge and awareness on the timing of first antenatal care, and Previous pregnancy complication.

Behavioral factors: information access, free of pain, access to media, and distance of health facilities.

Study population

All pregnant women attending their antenatal care service in public health centers of Bahir Dar Zuria zone during the data collection period.

Inclusion criteria

Pregnant women attending antenatal care service were included to the study.

Exclusion criteria

Women who have either unknown gestational age or do not have ultrasound results or are not known with physical examination and pregnant women who had danger signs of pregnancy/were seriously ill/ were excluded from this study.

Sampling procedures

To select participants, a systematic random sampling technique was applied. The total sample size was proportionally allocated from the randomly selected five health centers based on their ANC loads. By considering; N (total pregnant women who came for their first ANC visit in the previous two months in five health centers = 971), n (calculated sample size = 610), and k-interval K = N/n, = 971/610 = 2, the first client was selected by lottery method among the first two ANC service users in each health centers. n = sample size allocated to each health center, N = number of ANC clients in a health center in the previous two month's performance (Han health center = 349, Shimbit health center = 200, Dagmawi Minilik health center = 251, Shumabo health center =98 and Meshentie health center =73). Then the final sample size was proportionally allocated for each health center.

Sample size determination

The sample size was calculated using single population proportion formula. Taking 46.8% prevalence of early initiation of antenatal care from previous study(14). With an assumption of 95% confidence interval (z=1.96), 5% margin of error (d=0.05), 10% non-response rate and 1.5 design effect.

$n= (Z\alpha/2)^2 P (1-P)/d^2$ $n = (1.96)^2 0.468(1-0.468)/0.05^2=381$

Where, n-sample size

Zα/2-Z value at 95% level of confidence [1.96]

P- Is the proportion of early initiation of antenatal care

d- The margin of error at 95% confidence interval

By considering the 10% non-response rate 381×10/100=38

Final sample size was 381×1.5+38 =610.

Operational definitions

Antenatal care: is pregnancy related services given by skilled health care providers starting from conception up to the onset of labor (2,15,16).

Early antenatal care: is the first antenatal care received as soon as the pregnancy is suspected till 16 weeks of gestation (17–19).

Data collection

Data related to socio-demographic, economic factors, pregnancy, maternal-related factors, and behavioral factors were collected by using a pretested and semi-structured questionnaire (see appendix 1). The questionnaire was first developed in English, translated into Amharic and finally re-translated back to English to check its consistency. Training was provided for the supervisors and data collectors for two days by the principal investigator on the details of the questionnaire. The interview was conducted in Amharic by four midwives with eligible mothers at antenatal clinic, and supervised by two health professionals with degrees. Information related to gestational age was taken from the mothers ultrasound result.

Data management and analysis

The data were entered, coded, and cleaned using EPI data version 4.6. After completion of the entry, the data were exported to SPSS version 23 for analysis. Missing data were managed by observing cross-tabulation results percentages. Bi-variable logistic regression was used to identify the association between independent variables and dependent variables, and variables with a p-value of less than 0.2 were used for multi-variable logistic regression analysis to determine various factors on the outcome variable and to control the confounding effect. Adjusted odds ratio (AOR) with a 95% confidence interval (CI) was used to identify the independent predictors of early initiation of antenatal care. P values less than 0.05 were taken as statistically significance. The goodness of fit of the model was assessed using Hosmer Lemeshow's statistical test and its values above 5% which is 0.76 indicate that the model has a good predictive ability. A multicollinearity test was performed for the variables included in the final multivariable model. Hence, the variables had a VIF value of less than five.

Data quality assurance

To ensure the quality of this research training was given to data collectors and supervisors. Pretests were carried out in 5% of the sample size before actual data collection out of the study area, to assess the validity of the questionnaire to check the clarity of questions, ambiguity, arrangement of questions, order & options for the questions, and skipping pattern accordingly. The whole data collection procedures were closely supervised by field supervisors and investigators to ensure the completeness and reliability of the gathered information throughout the data collection process.

Ethical considerations

Ethical clearance was obtained from Yom post graduate college department of project planning and management, Research Ethical review board with a reference ID. YC//207//2013. A legal official letter was submitted to the Bahir Dar city administration health department office to obtain their permission. Each participant gave written informed consent to participate in the study before data collection began.

Patient and public involvement

None.

Results

Socio-demographic characteristics

A total of 592 pregnant women took part in the study. 48.6% (95% CI 41.6, 53.5) of the participants started their first antenatal care services before 16 weeks of gestation. Of the respondents, 85.7% were followers of the Orthodox Christian religion. The age of the respondents ranged from 17 to 45 years with a mean age of 26.31 (SD 4.72 years). More than three-fourths (476) of them were resides in urban areas. 61.3% (366) of respondents attended secondary and above in their educational level (Table 1).

Obstetric characteristics

Regarding obstetric characteristics of the study participants, 57.6% (341) of respondents were multi-gravida, two hundred seventy-eights (46.8%) had antenatal follow up in their previous pregnancies and five hundred forty-seven (92.1%) of pregnancies were planned. 13.7%(81) of the respondent had a history of abortion. 51.5% (305) of the respondent knew the timing of the first ANC (Table 2, Table 3).

Table 1: Socio-demographic characteristics of pregnant women at selected public health centers in Bahir Dar special zone, 2021(n=592)

Variables	Characteristics	Frequency	Percent
Age	>25	293	49.5
	≥25	299	50.5
Residence	Urban	476	80.3
	Rural	116	19.6
Religion	Orthodox	508	85.7
	Muslim	67	11.3
	Protestant	17	2.9
Educational status of women	Primary	229	38.7
	Secondary & preparatory	208	35.1
	College and above	155	26.2
Women occupation	House wife	297	50.2
	Farmer	91	15.4
	Employed Gov't/NGO	117	19.8
	Merchant	87	14.7
Monthly income	<2000	100	16.9
	>=2000	492	83.1
Marital status	Married	581	98.1
	Unmarried/cohabitation	11	1.9
Husband educational status	No education	12	2
	Primary	170	28.7
	Secondary & preparatory	199	33.6
	College and above	211	35.6
Means of transportation	On foot	207	35
	Taxi/Bajaj	385	65
Family size	< 5	395	66.7

	≥ 5	197	33.3
Distance to reach HC on foot came	<=30 minutes >30 minutes	186 21	31.6 3.4
Cost of transport	<3 birr 3-9 birr >9 birr	16 220 149	2.7 37.2 25.1

Table 2: Obstetric characteristics of pregnant women at selected public health centers of Bahir Dar special zone, 2021 (n=592)

Variables	Description	Frequency	Percent
Gravida	One Two & above	251 341	42.4 57.6
History of abortion	Yes No	81 511	13.7 86.3
Minor disorders of pregnancy	Yes No	140 452	23.6 76.4

Table 3: Previous pregnancy and knowledge of pregnant women and related factors in public health centers of Bahir Dar special zone, 2021 (n = 592)

Variables	Characteristics	Frequency	Percent
Had ANC follow up in your last pregnancy.	Yes No	278 46	46.8 7.7
Place of delivery who had previous birth	Home Health facilities	47 265	7.9 44.8

Rout of delivery who had previous birth	SVD C/S	243 69	41 11.7
Outcome of last birth	Alive Still birth	298 14	50.3 2.4
Knowledge on early initiation of first ANC	<16wk ≥16wk	304 288	51.5 48.5
Frequencies for ANC follow up	Once 2-3 ≥4	10 212 353	1.7 35.8 59.6
ANC service reduce PMTCT	Yes No	518 74	87.5 12.5

Factors associated with early initiation of first ANC visit

Bi-variable analysis showed that the Age of women, residency, educational status of women, occupation of women, monthly income, means of transportation, gravidity, knowledge of early initiation of first ANC, family size, plan of pregnancy, and minor disorders of current pregnancy were candidate variables for multivariable analysis. On multivariable analysis family size, gravidity, residence, educational status of women, plan of pregnancy, and knowledge on early initiation of first ANC were true determinants of early initiation of first ANC visit at the p-value less than 0.05. The findings showed that those family size less than five were 2 times more likely to initiate early ANC than those family size is greater than five (AOR= 2.0, 95% CI; 1.25-3.25). Urban resident were 3 times more likely to initiate early than those residence were rural (AOR=3.0, 95%CI; 1.48-6.17). Respondents with college level and above were 3.5 times more likely to initiate early ANC as compared to those with primary school (AOR=3.5, 95% CI; 1.8-6.8), and those with secondary education are 2.1 times more likely to initiate than those with primary education(AOR=2.1,95%CI;1.3-3.6). Respondents with primi gravida were 2.6 times more likely to initiate early than those

respondents who had multigravida (AOR=2.6, 95%CI; 1.65-4.14). Respondents with planned pregnancy were 3.5 times more likely to initiate early than those respondents with an unplanned pregnancy (AOR=3.5, 95%CI;1.5-8.1) and respondents who knew early initiation of first ANC were more likely to start early as compared to their counterparts (AOR=1.7(1.14-2.55) (Table 4).

Table 4: Factors association with early initiation of ANC, public health centers of Bahir Dar special zone, 2021(n=592)

Variables	**Early initiation ANC**		**Odds ratio**	
	Yes	**No**	**COR(95%CI)**	**AOR(95%CI)**
Age of women				
<25	113	180	2.8(2.0-3.9)	1.0(0.54-1.8)
≥25	191	108	1	1
Residence				
Urban	201	275	10.8(5.9-19.8)	3.0(1.48-6.17) **
Rural	103	13	1	1
Education of women				
Primary	177	52	1	1
Secondary	85	123	4.9(3.25-7.45)	2.1(1.3-3.6) **
College/above	42	113	9.1(5.7-14.6)	3.5(1.8-6.8)**
Occupation of women				
House wife	152	132	0.67(0.44-1.0)	1.1(0.71-2.01)
Farmer	76	27	0.27(0.1-0.48)	0.51(0.25-1.01)
Employed	23	61	2.0(1.1-3.76)	1.3(0.6-2.74)
Merchant	53	68	1	1
Monthly income				
<2000 birr	76	24	1	1
>=2000 birr	228	264	3.6(2.24-5.99)	1.09(0.57-2.07)
Means of transport				
On foot	129	78	1	**1**
Taxi/Bajaj	175	210	1.98(1.4-2.8)	1.4(0.93-2.13)
Gravida				

One	78	173	4.3(3.0-6.1)	2.6(1.65-4.14) **
Two and above	226	115	1	1
knowledge on ANC				
yes	112	175	2.6(1.4-3.79)	1.7(1.14-2.55) **
no	192	113	1	1
Family size				
<5	163	232	3.5(2.4-5.1)	2.0(1.25-3.25) **
>=5	141	56	1	1
Plan of pregnancy				
Yes	268	279	4.1(1.9-8.8)	3.5(1.5-8.1) **
No	36	9	1	1
Minor disorders				
Yes	16	23	1.56(0.8-3.02)	1.3(0.57-3.0)
No	288	265	1	1

*N.B 1=Reference category *= significant at P<0.0.5, **=significant at P<0.001.*

Discussion

This study aimed to assess the proportion of early booking of antenatal care at public health centers found in Bahir Dar Zuria zone. Additionally, it targeted to identify factors associated with early initiation of ANC across the Bahir Dar Zuria zone. Based on WHO recommendation pregnant women have to start the first ANC booking within the first trimesters. In Ethiopia, due to high governmental effort, the proportion of women with the recommended four or more ANC visits increased from 12% in 2005 to 43% in 2019. During this same period, the proportion of women who received ANC in the first trimester increased from 6% to 28% (9).

In the study area, 48.6% of pregnant women received their First ANC visit within the recommended time frame. This finding is in line with prior studies conducted in southern Ethiopia 49.7%(13), Adigrat town Tigray Ethiopia 48.2% (20), and Addis Zemen south Gondar Ethiopia 47.5%(21). The proportion of early initiation of ANC was higher than the report of the Mini Ethiopian demographic health survey conducted in 2019 which was only 28%. The variation between these findings could be due to this study was conducted in Bahir Dar Zuria zone where the Antenatal care coverage proportion is relatively high; hence, findings may not be similar in other parts of Ethiopia where there is a low proportion of antenatal care coverage (9). A study from Addis Ababa showed a higher proportion of early ANC initiation than the current

study, 58% of the women started their visit within the first trimesters (22). This difference might be due to Addis Ababa is the capital of the country and the community there might have better health awareness than the current study (9).

Maternal education was the major significant factor in multivariable analysis, Mothers with college degree and above were 3.5 times and mother with secondary school and above were 2.1 times more likely to initiate ANC service with the recommended time than mothers with only primary school. This finding was similar with study conducted at wollita sodo zone Ethiopia(18), and Myanmar(15). This might be due to mothers with high level education may have knowledge about what is necessary during pregnancy, the importance of ANC and importance of early initiate the service.

Pregnant women who had knowledge on early initiation of first ANC were 1.7 times more likely to initiate early as compared to their counterparts and this finding was consistent with the studies conducted in Addis Zemen hospital(21), central zone of Tigray (23) , Benshanigul (24)and Ghana(25). This might be due to mothers with poor ANC knowledge may not have enough awareness about the importance of early initiate of ANC and also may not know time to initiate the services.

Planned pregnancy was also found to be a significant factor for early initiation of ANC. Pregnant women with planned pregnancy were 3.5 times more likely to initiate early ANC than their counterparts. This finding is consistent with studies from eastern zone Tigray(26) and Mandalay, Myanmar(15), this may be due to the timing of ANC being affected by the decision the women make during pregnancy, so it takes time starting from accepting the pregnancy itself to acknowledging the need for ANC.

Place of residence also has a great impact on time to initiate ANC booking, the study showed that women reside in urban were 3 times more likely to initiate ANC follow up compare to women reside in rural. This result is consistence with those studies undertaken in 2019 (9) and Mandalay, Myanmar(15). The possible reason for this finding is that women reside in urban has the chance to access health facilities nearby than women reside in rural.

The findings of this study were not triangulated with qualitative findings, we were unable to include qualitative findings because the study was done during the COVID-19 epidemic, which

had a substantial impact on our activities. Additionally the study presented the self-reported data, which was prone for social desirability and recall bias which we tried to eliminate as much as possible.

Conclusions

The study found that a significant number of the participants had not received ANC services in a timely manner. Socio-demographic and obstetric characteristics of the respondents were the major factors to determine timely booking of ANC services. Family size, residence, educational status of women, gravidity, plan of pregnancy and knowledge on early initiation of first ANC were factors significantly associated with early initiation of antenatal care service. Additionally dissemination of information about recommended time to initiate ANC services and cooperative effort to improve women's educational status to increase knowledge on early initiation of first antenatal care has to be conducted by Health extension workers, Bahir Dar city administration, Regional and federal health bureaus.

Abbreviations

ANC: antenatal care; HC: health centers; CSA: Central statistics agency;
EDHS: Ethiopian demographic and health survey; IRB: Institutional Review
Board; FMOH: Federal Ministry of Health; MM: maternal mortality; WHO: World Health Organization;

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Data availability statement

The datasets during and/or analyzed during the current study is available from the corresponding author on reasonable request.

Contributors

Proposal preparation, acquisition of data, analysis and Interpretation of data was done by EA (principal investigator). Drafting the article, revising it critically for intellectual content, and final approval of the version to be published was done by EA, ZR and GH. All authors read and approved the final manuscript**.**

Competing interests

The authors declare that they have no competing interests.

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Ethics statement

Ethical clearance was obtained from Yom post graduate college department of project planning and management, Research Ethical review board with reference ID. YC//207//2013. A legal official letter was submitted to the Bahir Dar city administration health department office to obtain their permission. Each participant gave written informed consent to participate in the study before data collection began.

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Appendix 1 Questioner (English)

Annex I-English version information sheet and consent form

Yom Post Graduate

Department Project Planning and Management

Greeting

Good Morning / Good after noon

My name is ESKAHUN AMBAYE I am a student at Yom institute of economic development department of project planning and management. This study is aimed to assess the prevalence and determinant factors of early antenatal care follow up utilization among pregnant women attending antenatal care service at public health facilities of Bahir Dar Zuria zone, Amhara, Ethiopia, 2020. The results from this study will help different stake holders and health care providers design different feasible and accessible interventions to improve the prevalence of early antenatal care service utilization in the study area. And, since you met the criteria for the study participant selection, you are selected to be the participant for the study. The data contained in this interview will solely be used for this study, and your response will be kept confidential. For this purpose, on this interview, your name will not be written and there is no any means to check and link the study results to your responses. With the interview, if there any problem or unclear to you, you can communicate openly and for any question/s from the interview, you have the right to give no answer or stop the interview, but your participation is highly important for the success of the study. So, we politely request your cooperativeness to participate the interview.

Do you agree to participate in this study? Yes, _____Continue.

No _____

Thank you once again for your participation in the study.

Investigator Name _____ Signature_____

Date of interview_____ Time started _____ Ending_____

Contact =+2510910210427

5.4.3Annex II- English questionnaire

Questionnaire code number---

Part –I Socio demographic and economic variables

S.N	**Questions**	**Response and codes**	**Remark/Skip**
101	Age	----------	
102	Place of residence	1.Urban 2. Rural	
103	Religion	1. Orthodox 2. Muslim 3. Protestant 4. others	
104	Ethnicity	1. Amhara 2. Oromo 3. Tigray 4. others	
105	Marital status	1.married 2.cohabitation 3. divorced 4.widowed	
106	Educational status	1.illiterate 2.Read and write only 3.Primary (1-8) 4.9-12 5.College level and above	
107	Occupation	1.house wife 2.farmer 3.Employed/Gov't &NGO/ 4.merchant 5. other	

108	Monthly income	----------	
110	Husband education	1.illiterate 2.Read and write only 3.Primary (1-8) 4.9-12 5.College level and above	
111	Husband occupation	1. Employed/gov't &Ngo/ 2. Farmer 3.Daily laborer 4.Merchant 5. Other	
112	Transportation access	1.Yes 2.No	
113	If, yes transportation cost that you pay for coming to and back from this hospital?	----------	
Part-II history of previous pregnancy			
114	Have you had antenatal follow up in your last pregnancy?	1.Yes 2.No	
115	If yes-----How many visits did you get in your last pregnancy?	1. Once 2. 2-3 visits 3. 4 and more	
116	Time/duration/ of your pregnancy when you start antenatal follows up in your last	1.≤20weeks 2.21-34weeks	

	pregnancy? (In week)	3.≥35weeks	
117	Did you encounter any problem during your pregnancy?	1.Yes 2.No	
118	If yes what was the problem?	1.Hypertensive disorders 2.Antepartum hemorrhage 3.Anemia 4.Other------	
119	Where did you delivered your last baby?	1.Health center 2.Hospital 3.Home 4. other----	
120	What was the outcome of your last delivery?	1.Alive 2.dead	
121	What was the route of delivery?	1.Spontaneously Vaginal 2.Assisted vaginal 3.Caesarean section 4.Other----	
Part- III Knowledge Of ANC			
122	Is antenatal care follow up beneficial for the woman?	1.Yes 2.No	
123	Is antenatal follow up beneficial for the fetus?	1.Yes 2.No	
124	When is the ideal age of pregnancy to start antenatal follow-up?(In weeks)	1. ≤16weeks 2. >16weeks	
125	How many times do you think a women needs to go for ANC?	1.Once 2.2-3x 3.>4 x	
	Part-IV Obstetric history		
126	Gravidity	1.Premi gravida 2.Multi gravida	

127	History of abortion	1.Yes 2.No	
128	Parity	1.Nulli para 2. Primipara 3.Multi para	
129	Family size	--------	
	Part- V History of current pregnancy		
130	Is the pregnancy planned	1.Yes 2. No	
131	Waiting time to complete the service?	----------	
132	Time /duration/of pregnancy in weeks	1. ≤16weeks 2. 16-20weeks 3.21-34weeks 4.≥35weeks	
133	Is there Anyone who advise you to come ANC follow up?	1.Yes 2.No	
134	If yes, from whom you get it?	1. Health professional 2. Media 3. Neighbor 4. families 5. Other----	
135	Is there a problem in current pregnancy?	1. Yes 2. No	

	If yes what type of problem------		

STROBE—Checklist is used for this study

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	II
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	3	State specific objectives, including any prespecified hypotheses	
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	3
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4*
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6
		(*b*) Describe any methods used to examine subgroups and interactions	6
		(*c*) Explain how missing data were addressed	6
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6
		(*e*) Describe any sensitivity analyses	6
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7&8
		(b) Indicate number of participants with missing data for each variable of interest	7
Outcome data	15*	Report numbers of outcome events or summary measures	7,8&9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10

		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	11
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	11
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12&13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14