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Women's Satisfaction with the Quality of Antenatal Care Services Rendered at Governmental Health Facilities in Northwest Ethiopia: the application of partial proportional odds model

Authors:

Amanu Aragaw Emiru[1]
Getu Degu Alene [2]
Gurmesa Tura Debelew[3]

Author Affiliation and Addresses:

[1]Department of Reproductive Health and Population Studies, College of Medicine and Health sciences, Bahir Dar University, Bahir Dar, Ethiopia. Email: amanuaragaw@yahoo.com

[2] Department of Epidemiology and Biostatistics, College of Medicine and Health sciences, Bahir Dar University, Bahir, Ethiopia. Email: adgetu123@yahoo.com

[3] Department of Population and Family Health, Faculty of Public Health, Institute of Health, Jimma University, Jimma, Ethiopia. Email: gurmesatura@gmail.com

Corresponding author:

Amanu Aragaw Emiru: postal address 79; email: amanuaragaw@yahoo.com: Telephone; +251-918780295

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ABSTRACT

Objectives: We assessed the readiness of health facilities to deliver routine antenatal care; the providers' competences during antenatal consultation; and women's satisfaction with the antenatal care received and its determinants.

Design: Cross-sectional

Setting: Northwest Ethiopia

Participants: 795 pregnant women attending the antenatal clinics at 15 public health facilities and 41 health workers working for the surveyed facilities.

Outcome measures: The outcome variable was women's satisfaction with antenatal care. The outcome was generated from multiple satisfaction items using principal component analysis on an ordered, categorical, and three-point Likert scale. The key hypothesized factors considered were structural and process aspects of care. Data were analyzed using the partial proportional odds model with 95%CI.

Results: The result revealed that only 30.3% of the pregnant women were highly satisfied while 31.7% rated the services as unsatisfactory. The findings showed that process quality indicators better-predicted client satisfaction. In relation to this, better scores in history taking [OR_1=OR_2; 1.81 (95% CI 1.25, 2.60)], counseling [OR_1 = OR_2; 1.89 (95% CI 1.33, 2.69)], and screening [OR_1= OR_2; 18.10 (95% CI 11.52, 28.39)] were associated with achieving higher satisfaction. We also observed significant but lower satisfaction among women in the late trimester of pregnancy [OR_1 = OR_2; 0.87 (95% CI 0.78, 0.97)]. However, we get hardly any significant relationship between structural attributes and client satisfaction.

Conclusions: The study demonstrated that women's satisfaction with antenatal care was low. The contents of antenatal services covered during client-provider interaction were the main factors affecting client satisfaction. This suggests that efforts are required to improve the competencies of health professionals to make them more effective while dealing with clients

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Strengths and limitations of this study

- We tried to assess the three aspects of quality: structure, process, and outcomes

- The study has utilized different data collection methods including facility audit, client exit interview, provider interview, and direct observation.

- The analysis considered the ordered nature of the outcome variable; previous studies often dichotomized satisfaction at the cost of losing information

- However, the presence of an observer during the client-provider interaction may bias the results obtained in a positive direction.

INTRODUCTION

In the past two decades, concerted global efforts have led to increased coverage of maternal health services, even in poor resource settings [1 2]. Yet, improvements in health outcomes did not always follow[2]. Every year, thousands of women die from pregnancy-related complications worldwide[3 4], with 99% of those deaths occur in developing nations including Ethiopia[5].

However, most maternal deaths are not inevitable as health solutions to the causes of complications are well-known [3 6]. The solution includes a strong health system that provides maternal services based on a continuum of care perspective [3]. As part of the continuum, the essence of antenatal care (ANC) is to serve as a platform for important health care activities [3 7] including health promotion and disease prevention, screening and diagnosis of pregnancy-related complications [8 9]. As such, antenatal care creates a unique opportunity for early detection and management of hypertension, gestational diabetes, anemia, malaria, HIV, and other health conditions which otherwise would jeopardize the health of mothers and the growing fetus[10 11].

Evidence has long demonstrated that in the presence of adequate healthcare services and community health workers, there is an opportunity to improve health service utilization and maternal health outcomes[2 12]. In this regard, the government of Ethiopia has made significant strides towards availing health facilities closer to the community, mainly through constructing primary health care facilities and launching a health extension program at the community level [13]. Establishing a voluntary based Women Health Development Army (WHDA) and eliminating

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user charges for maternity services were also among the many efforts. To this effect, 16,440 health posts, 3,547 health centers, and 311 hospitals have been constructed over the past 20 years [14].

While health facility expansion is a welcome development in Ethiopia, many health facilities are opened without the necessary materials and skilled manpower [15]. For example, while 80 percent of the facilities delivered antenatal care, only 41 percent of them were in a position to provide quality service [16]. This is why, the use of maternal services including antenatal care is low, and maternal mortality stands at 412 deaths per 100,000 live births [17]. Indeed, the degree to which a woman can gain access to maternity services is not merely dependent on the availability of services but also on the content and quality of care [1 3 4].

The term quality of care is used widely as a key performance indicator [4 18], but there is no comprehensive instrument to measure quality [4]. Donabedian, defined quality in terms of three major attributes: the structure (resources and organizational structure in health care setting), process (how health service is delivered) and outcome (effect of care on the status of the clients) [19]. According to this model, the ultimate goal for quality is to produce client satisfaction and, therefore, was the main framework of reference for our study in assessing the quality of ANC care and client satisfaction.

A body of literatures have examined the quality of antenatal care in Ethiopia, yet hardly was any published data that examined all the dimensions of quality simultaneously. The available studies focused primarily on the availability of facility in puts[20] or the number of health facility visits by pregnant women [21-23], which largely overlooked the information on how care was delivered and what those visits contained [24].

To this end, we aimed to assess the capacity of public health facilities to deliver quality antenatal care, the completeness of provider-client consultation process, and client satisfaction with the services received.

METHODS

Study design and setting

This was a cross-sectional study using a facility survey, direct observation, and exit interview methods. The study was undertaken in five districts of West Gojjam Zone, Northwest Ethiopia

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from July to August 2018. At the time of the survey, the Zone had a population of 2,611,925 people with women of reproductive age (15-49) making 23.58 % of the population. The zone had 6 governmental hospitals, 103 health centers, and 374 health posts. In addition, it had 114 private clinics and 1 hospital. All maternal health services including antenatal care were provided free of charge in public health facilities [25].

Study population and sampling

The population consisted of public health facilities that provided ANC, pregnant women attending ANC clinic, maternal health care providers, and health authorities working for the surveyed health facilities.

A sample size of 824 was determined for exit interview and observational studies using the formula for single population proportion based on the assumptions: 95% confidence level; 5% margin of error, 42% service availability and readiness of public facilities in Ethiopia [16], design effect of 2, and a 10% non-response rate.

A multi-stage sampling approach was used to select study participants. In the first stage, five districts were selected using simple random sampling technique. Next, fifteen health facilities, consisting of five district hospitals and ten public health centers, were sampled randomly. From the sampled facilities, 795 women were selected using a systematic sampling procedure with probability to proportional size method.

Data collection

In this study, an attempt was made to measure all dimensions of the quality of ANC services: structure, process, and outcome**.** For each dimension of quality, a set of questions were adapted from the WHO guidelines [3 12], the Ethiopian demographic and health survey[17], and the list of interventions recommended by the federal ministry of health of Ethiopia [26].

The survey comprised four main data collection methods: 1) Health facility surveys; 2) provider interview;3) direct observation of ANC consultations; and 4) exit interview with pregnant women. While structured and pre-tested questionnaires were used as a tool for provider and exit client interviews, checklists were used in the facility survey and observation study.

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Experienced midwives who were not affiliated with the surveyed healthcare facilities collected the data. In each health facility, a team consisting of two data collectors was assigned. While one of the team members was responsible to carry out the observational study and facility survey, the other was responsible for managing the exit interview.

A facility survey of all the selected facilities was carried out to assess the availability of essential materials and staffing. A non-participatory observation was also undertaken among 41 maternal health workers who were working at the ANC clinic during the time of the survey. This was aimed to evaluate whether health care workers conformed in conducting key ANC tests or examinations. Following her consultation, each pregnant woman was interviewed at the exit to assess the level of satisfaction on the service she received.

Variables and Measurement

Structural quality was calculated at the facility level, while indices for process attributes and client satisfaction were made at individual women level.

Structure and process attributes

In assessing the availability of physical infrastructure, essential equipment, drugs, diagnostic tests, and staffing indices for each of them were generated. The level of staffing at each health facility was compared to the recommendation of the Ethiopian Standard Agency[27 28]. All these five structural constructs were measured using multiple variables, and each variable was granted a score of "1" if present, and "0" if absent. To generate an index, the variable used to assess each construct was scored and then the sum of the scores was obtained in each construct. Finally, we categorized the indices given into three, poor, fair, and good considering the WHO criteria [29].

A similar approach was also used for the generation of indices for the components of process attributes namely, interpersonal communication, history taking, clinical examination, counseling, and health screening.

The Cronbach's alpha was used to measure the internal consistency of a set of items for the three quality dimensions, and a reliability coefficient of 0.70 or higher was considered acceptable[30].

Outcome variable: the outcome variables, overall client satisfaction was measured by aggregating women's responses to questions regarding the visit into a three scale index using a principal components analysis: 0-50% as 'low satisfaction'(coded 1), 51-79%(coded 2) as having 'moderate satisfaction', and 80-100 %(coded 3) as 'high satisfaction'

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Data analysis

Data collected were entered using the Epinfo software (7.0 version) and analyzed using STATA 14.0. Given the ordinal nature of the outcome variable, a typical approach is to use the standard ordered logit [31]. Yet, the Brant test revealed that the proportional odds assumptions were violated for some independent variables ($\chi2$=63.4 df (16); p< 0.001).

We, therefore, used generalized ordered logistic regression with autofit, also called partial proportional odds model). This model takes into account the ordinal nature of satisfaction as the dependent variable while at the same time allowing for possible violation of the proportional odds assumption. Hence, coefficients of variables for which the proportionality assumptions are met are constrained while allowing the coefficients of the variables for which proportionality assumptions are not met to vary with the point at which the categories of the dependent variable is dichotomized[31].

Moreover, multi-collinearity test between the independent variables was performed using the Variance Inflation Factor (VIF), and no problem was found (the highest value was 2.7).

Patient and public involvement

Patients/public were not involved in setting the research question or the outcome measures, and in the design and implementation of the study. Participation was voluntary based and no incentives were provided. The findings of this study will be disseminated to policy-makers and local-level service implementers.

RESULTS

General characteristics of women

Out of 824 eligible clients, 795 enrolled in the study yielding a response rate of 96.5%. The highest percentage of women were rural residents 575 (72.3%), and belonging to the age range of 20-29 years 433(54.5%). Regarding their age, the mean and standard deviation were 27.8 and 5.9 years, respectively. Of the total respondents, 63.4% did not attend formal education.

About one-third of the participants, 274(34.5) were first-time visitors for ANC, and more than half (52.7% %) of them booked between 3 and 6 months after conception (Table 1).

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Table1: Background characteristics of ANC clients interviewed in public health facilities of West Gojjam Zone, Northwest Ethiopia (N=795)

Description	Number	Percent
Address		
Urban	220	27.7
Rural	575	72.3
Age (Years)		
15-19	91	11.4
20-29	433	54.5
30-39	236	29.7
40+	35	4.4
Education		
No formal Education	504	63.4
Primary Education (Grade 1-8)	212	26.7
Secondary education and above	79	9.9
Occupation		
Farmer	575	72.3
Employee	35	4.4
Merchant	53	6.7
Daily laborer	18	2.3
Others(*including Housewives)	114	14.3
Parity		
Nulliparous	182	22.9
Primipara	190	23.9
Para 2-4	321	40.4
Para 5+	102	12.8
Gestational Age at time of survey		
0-3 months	79	9.9
4-7 months	562	70.7
>=8 months	154	19.4
Number of ANC visits		
1	274	34.5
2-3	436	54.8
4+	85	10.7
Timing of first ANC visit		
First trimester	332	41.8
Second Trimester	419	52.7
Third Trimester	44	5.5
Distance to HCF		
Less than 1 hour	532	66.9
Greater or equal to 1 hour	263	33.1

Health workers *background* characteristics

As can be seen in table 2, Forty-one health workers who worked for 15 health facilities were included in the study. The largest number of health workers observed in any one-health facility

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was four and the smallest was one. Most of the health providers were men (61%). The median age of these health professionals was 29.0 years (Range: 23 to 36 years of age) and the median number of years of professional experience was 3.0 years (Range: 1 to 12 years). This is an indication that most of the providers had worked in their organization long enough to understand and give credible information to pregnant women (Table 2).

Table 2: Background characteristics of maternal health workers in public health facilities of West Gojjam Zone, Northwest Ethiopia (N=41)

Characteristics	Number	Percent
Sex of the provider		
Male	25	61
Female	16	39
Median Age (Range)	29.0(23-36 years)	
Median Experience (Range)	3.0(1-12 years)	
Training received on;		
ANC screening	22	53.7
Counseling	21	51.2
BEmONC	27	65.9
Hypertension management	20	48.8
HIV/PMTCT	32	78.0
CRC	18	43.9
Personally supervised by the supervisor in the last 3 Months		
Yes	15	36.6
No	26	63.4

Structural quality attributes

The analysis presented in table 3 characterizes the structural and process dimensions of quality. Despite there exists heterogeneity in the availability of different components, the overall scores of the facility surveys were reasonably good (70 %). Laboratory consumables were more likely to be available (80%) compared to other structural components. Nonetheless, the availability of infrastructure and general amenities was particularly deficient (59%). Some essential antenatal drugs such as magnesium sulfate, injectable antibiotics, and antihypertensive drugs were also no longer available during the time of the survey (64%).

The availability of basic antenatal care items on the day of the survey varied widely by type of facility, with hospitals generally having many of the items to provide comprehensive antenatal care. Some items were commonly available across facility types, such as suction apparatus (81.5%) and gloves (94.1 %). However, items such as manual vacuum extractor and calcium gluconate in

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the health centers and insecticide-treated bed nets (ITNs) in hospitals were extremely deficient (the result not shown in the table).

Process quality attributes:

Interpersonal performance

Generally, interpersonal aspects of quality were extremely low (average score of 60%), especially concerning warm greeting and welcoming the client (49.9%) and self-introduction of the provider (38.9%). However, this aspect was better in maintaining the privacy of women during the time of consultation (i.e. both visual and auditory), which was observed in 80% of the consultations.

Technical performances

The number of essential ANC services received by the surveyed women, on average, was inadequate (60%). Looking in detail at the results of different dimensions, we found that some technical performance aspects scored poorly, especially health screening (63%) and counseling (69%). At 73%, however, the general history of the pregnant women was rather better.

There were variations in the frequency of carrying out clinical examination and screening tests. While some examinations were done regularly (e.g., weighing, blood pressure, and abdominal palpation), others were done less often. For example, only 64% of the women were checked for anemia. Regrettably, only 2.3% of them received all eight essential health-screening tests and preventive medicines recommended by the Federal Ministry of Health of Ethiopia. Among all the tests and interventions, screening for asymptomatic bacteriuria (31.5%) and intervention for deworming (17.7%) were the lowest, compared to the HIV test (93%).

Table3: Results of structural and process quality components of antenatal care in selected public health facilities of Northwest Ethiopia, 2018

ANC Quality Dimension	Subgroups	Mean Quality score
	Minimum: 0.00-Max: 1.00	
	Number of health facilities	15

Structural Attributes (Health facility survey)	Availability of infrastructure	0.59
	Availability of Essential Equipment	0.77
	availability of staff, guidelines, and job-aids	0.71
	drugs and vaccines	0.64
	diagnostic tests/Lab Supplies	0.80
	Total structural Score	**0.70**
Process Attributes (Observational studies)	Minimum: 0.00-Max: 1.00	
	Number of pregnant women	795
	Interpersonal performance	0.60
	Technical skills	0.69
	- History taking	0.73
	- Clinical examination	0.70
	- Counseling	0.69
	- Health screening and preventive measures	0.63
	Total process Score	**0.65**

Client Satisfaction

The findings on the respondent level of agreement (expressed on a scale ranging from 1 to +5) on various aspects of antenatal care service satisfaction showed that women were satisfied very much on the advice they received about vaginal bleeding than others(mean score=3.71). On the other hand, respondents were highly dissatisfied with the information received about breastfeeding as shown by a mean of 2.54.

Overall scores among the respondents revealed that 241(30.3%) of the clients were highly satisfied, 302(38.0%) were moderately satisfied, and almost one-third, 252(31.7) percentage were unsatisfied. The mean satisfaction score was 3.11, which is approximately equivalent to neutral on the five-point Likert scale (Table 4).

Table4: level of satisfaction of pregnant women visiting public health care facilities in Northwest Ethiopia, 2018

Satisfaction	Ve	sa tis	in dif	di ss	Ve	M ea	S D

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To what extent you agree with the following statements:	ry sat isfi	fied	fere nt	ati sfi ed	ry diss atisf	n	
The health workers in this facility are very friendly and approachable	54	455	270	16	0	3.69	0.626
The health staff are courteous and respectful	36	324	337	91	7	3.37	0.778
The treatment and/or advice I received from the health worker is optimal	29	226	391	107	42	3.12	0.874
The provider gives me opportunities to express the concerns I have	16	194	429	135	21	3.06	0.773
The provider gave me chances to ask him/her questions	13	170	386	185	41	2.91	0.843
I am well informed on the birth preparedness	4	140	473	168	10	2.95	0.675
I am informed about breastfeeding after birth	0	17	446	278	54	2.54	0.654
I am told about how to recognize and proceed in case of vaginal bleeding	41	500	238	15	1	3.71	0.595
I am told about how to recognize and proceed in case of fever	5	228	358	146	58	2.97	0.887
I'm told about how to recognize and proceed in case of premature uterine contractions	8	101	494	150	42	2.85	0.739
I am told about how to recognize and proceed in case of severe headache	2	192	528	73	0	3.15	0.566
I'm told about how to recognize and proceed in case of difficulty in breathing	5	102	552	119	17	2.95	0.622
Average satisfaction						3.11	0.72

Overall satisfaction
    High satisfaction
    Moderate satisfaction
    Low satisfaction
	241 (30.3%)
	302 (38.0%)
	252 (31.7%)						

Factors associated with client satisfaction

Table 6 presents the results of the multivariable partial proportional odds regression model examining the determinants of the overall satisfaction of pregnant women on the antenatal healthcare service received. During the analysis, the three-scale dependent variable produced two panels: panel-one (i.e., low vs. moderate or high satisfaction); and panel two (low or moderate vs. high satisfaction). In each group, the lower values were recorded to "0", while the highest values were recorded to "1" [31].

As can be seen in table 5, the Brant test of parallel lines assumption ($\chi2=63.4$ df (16); p< 0.001) revealed that women's education, number of ANC visits, distance to health facility, and index for clinical examination were the variables that failed to meet assumption. For these variables, the coefficient estimates and odds ratios were intended to differ in the two panels (categories).

Table 5: Brant test of parallel regression assumption using the 0.05 level of significance

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SN	Variables	P- value
1	Address	0.5174
2	Age of women	0.0760
3	Educational status	**0.0007**
4	Distance to health facility	**0.0036**
5	Number of live births	0.6005
6	Gestational Age at the time survey	0.1948
7	Number of ANC visits	**0.0075**
8	Service Year of the provider	0.6578
9	Supervision received by the provider	0.1059
10	Availability of Physical infrastructure(composite index)	0.2240
11	Availability of essential drugs (composite index)	0.3239
12	Interpersonal communication (composite index)	0.3559
13	Skills in history taking (composite index)	0.5167
14	Skills in physical examination (composite index)	**0.0005**
15	Counseling skills (composite index)	0.8421
16	Health Screening (composite index)	0.1398

Note: A significant test statistic provides evidence that the parallel regression assumption has been violated.

After controlling for other factors, significant differences in the ANC service satisfaction was observed by process quality indicators and sociodemographic factors. Residence, distance to clinic, women's, education, number of ANC visits, and gestational age appeared to be important predictors of satisfaction with antenatal care. Moreover, process quality indicators such as history taking, clinical examination, counseling, and health screening also remained significant in the final model ($p < 0.05$).

The Cronbach's alpha values of the items included in the analysis for the three quality dimensions were 0.81 for the satisfaction items, and 0.74 for structural, and 0.74 for process attributes.

As women's educational status, number of ANC visits, distance to the healthcare facility, and clinical examination violated the proportional odds assumption (the Brant test), $OR_1 \neq OR_2$ and separate interpretations at each category were therefore required for these variables. Hence, OR1

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stands for panel one (low vs. moderate or high) while OR2 was for the second panel (low or moderate vs. high satisfaction

In this regard, women with better schooling, increased number of ANC visits, and those living within 60 minutes walking distance from the facility were significantly associated with increased odds of having moderate or high satisfaction [OR1=3.11(95% CI 2.02, 4.81)], [OR1 = 4.16 (95% CI 1.66, 10.23)], and [OR1 = 0.29 (95% CI 0.18, 0.46)], respectively. However, the estimates of these variables fall far short of statistical significance in the second ordinal regression category.

Likewise, better clinical examination score of the process dimension was positively and significantly associated with the two satisfaction categories [Low vs. moderate/high: $OR_1 = 1.69$ (95% CI 1.13, 2.54)], and [low/moderate vs.high:OR_2=4.09(95%CI2.69, 6.24)]. As can be seen in the table, the effects became much stronger when satisfaction level moved from low to high.

However, variables that did not violate the assumption had a single beta coefficient at each of the two satisfaction categories; and hence a single OR1 =2 was reported. Client satisfaction was associated with better process scores. Better scores in history taking [$OR_1 = OR_2$; 1.81 (95% CI 1.25, 2.60)], counseling performance [$OR_1 = OR_2$; 1.89 (95% CI 1.33, 2.69)], and health screening and preventive measures [OR1 = 2; 18.10 (95% CI 11.52, 28.39)] were associated with achieving higher ANC satisfaction scores.

Similarly, being a rural resident was significantly associated with achieving a higher satisfaction score [OR_1= OR_2; 1.89 (95% CI 1.05, 3.41)]. For every one month increase in gestational age of pregnancy, however, the odds of being above a particular satisfaction category was decreased by a factor of 0.87[$OR_1 = OR_2$; 0.87 (95% CI 0.78, 0.97)] (Table 6).

Table 6: multivariable partial proportional odds model showing factors affecting ANC satisfaction in West Gojjam Zone, Northwest Ethiopia, 2018(n=795)

	Multivariable gologit 2model, 95% CI	
Explanatory	Panel One (1 Vs. 2 and 3)	Panel Two (1or 2 Vs 3)

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Variables	OR 1 (95%CI)	Coefficients not varying(OR1=OR2)	OR2(95%CI)	Overall P-value(s)
Education of women	**3.11(2.02,4.81)***		1.34(0.97,1.86)	**0.001**/0.073
Number of ANC visits	**4.16(1.66,10.23)**		0.99(0.51,1.95)	**0.002**/0.996
Walking distance to HCF	**0.29(0.18,0.46)***		0.64(0.39,1.04)	**0.001**/0.072
Clinical examination	**1.69(1.13,2.54)***		**4.09(2.69,6.24)***	**0.011/0.001**
Address		**1.89(1.05,3.41)***		**0.035**
Age		1.10(0.80,1.50)		0.561
Para		0.80(0.63,1.01)		0.065
Gestational at the time of the survey age(months)		**0.87(0.78,0.97)**		**0.01**
Service year of provider (year)		0.99(0.93,1.07)		0.95
Supervision received in the last 3 months		1.34(0.80,2.26)		0.264
Infrastructure		0.78(0.56,1.08)		0.138
Drug availability		0.95(0.70,1.28)		0.728
Interpersonal index		1.16(0.88,1.54)		0.291
History taking		**1.81(1.25,2.60)**		**0.002**
Counseling performance		**1.89(1.33,2.69)***		**0.001**
Health screening		**18.09(11.52,28.39)***		**0.001**

Note. * indicates< 5 % level of significance, ** indicates p< 1% level of significance, *** indicates p< 0.1 level of % level of significance.   1=low satisfaction; 2= moderate satisfaction; and 3= high satisfaction

DISCUSSION

In this study, we analyzed a comprehensive range of structural and process-related factors and some individual characteristics associated with ANC's satisfaction. We used gologit2 with auto fit (Partial proportional odds model) [31] to enable statistical analysis on an ordinal scale, and was, therefore, well-positioned to robustly examine the roles of factors affecting client satisfaction.

Client satisfaction with the quality of antenatal care services, as noted by Mai Do and colleagues, has been increasingly recognized as an important outcome for the healthcare delivery system[32]. Nonetheless, our study found that only 30% of clients had high levels of satisfaction. This proportion of satisfaction was less than the findings in South Ethiopia (32%), Uganda (40%), and

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Oman (59%) [23 33-35]. This lower figure is a serious concern given that low satisfaction may adversely affect women's willingness to return/continuity for other maternal services.

Furthermore, our results revealed that all the dimensions of process quality including, history taking, physical examination, counseling, and screening had positively significant impacts on client satisfaction. Similar findings were also reported by other studies, which indicated a positive association between clinical quality characteristics and client satisfaction [23 36]. A study conducted in India, for example, reaffirmed the importance of adequate clinical examinations in defining clients' expectations and helping to establish trust between the client and providers [37].

It is, however, worth noting that there was no statistically significant association between client satisfaction and all the structural aspects of care, which is consistent with results obtained in previous studies [32 38 39]. This would seem to imply that the mere existence of services is not a guarantee to bring satisfaction. Contrary to our findings, however, others [36 40] showed the positive influence of structural quality indicators on client satisfaction.

The available literature on the associations between maternal education and client satisfaction report inconclusive results. Chemir et al from Ethiopia reported a negative association between maternal education and service satisfaction [41]. Our study, on the contrary, observed that better-educated women were positively and significantly associated with client satisfaction. This finding is similar to that of Rahman et al. in Malaysia [33] who argued that educated women are more aware of the procedures to expect during antenatal care, which probably increases their satisfaction.

Rural-urban divides of residence had a significant impact on client satisfaction, as was a distance to the nearest health facility. We found a significant difference in levels of satisfaction among urban-rural residence, with the highest satisfaction achieved on rural than urban residents. Moreover, living more than an hour walking distance to the clinic was significantly associated with lower satisfaction. The result of this study is consistent with other studies [23 42 43].

Women from rural areas, who also are supposed to live in far distance, are more likely to have lower expectations owing to their previous experience of healthcare and lower chance of exposure to health care information, and therefore they tend to value service they are offered [42], and more likely to report higher levels of satisfaction.

16

Reproductive-related factors such as the number of antenatal visits and gestational age showed a significant association with client satisfaction. Women who made four or more antenatal visits were positively and significantly associated with the low vs moderate or high satisfactions category despite the association turned insignificant in the low or medium vs. high satisfaction category. A previous study conducted in South Ethiopia has also reported a similar finding[23]. The positive association in this regard could be due to developing awareness through repeated visiting. Besides, the repeated antenatal visits could further improve the relationship between providers and women in a positive direction[44], which in turn made them feel good towards the services.

 Another notable finding in this study was the inverse relation between gestation age and level of satisfaction. The possible reason for this negative association could be related to the fact that the late trimester is a time when more complications can occur[45]. These complications could let expectant mothers to demand extra care and support, yet they might be dissatisfied if the service was not to their expectations. Hence, providers should be alert to detect and manage the causes of dissatisfaction in pregnant women.

Despite the important findings evolved in the present study, direct observation of the clinical consultation may bias the results obtained in a positive direction. However, the data collector spent more time at each health care facility and observed many client consultations for each provider, so that the behavior of the providers could probably become normative through time.

CONCLUSIONS

The women's satisfaction towards antenatal care in public facilities was suboptimal and was dependent on an interplay of various factors. A significant contribution to the variation in client satisfaction was attributed to factors related to the real content of care received than do structural attributes. Indeed, the results suggest that more should be done to improve the quality of antenatal care offered at public health facilities; particularly on the technical aspects of health care providers. The findings also suggest that the socio-demographic and reproductive components should not be underestimated.

17

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REFERENCES

1. Kanyangarara M, Munos MK, Walker N. Quality of antenatal care service provision in health facilities across sub–Saharan Africa: Evidence from nationally representative health facility assessments. Journal of global health 2017;**7**(2)
2. World Health Organization. Consultation on improving measurement of the quality of maternal, newborn and child care in health facilities. 2014
3. WHO. WHO recommendations on antenatal care for a positive pregnancy experience: World Health Organization Geneva, Switzerland, 2016.
4. Raven JH, Tolhurst RJ, Tang S, Van Den Broek N. What is quality in maternal and neonatal health care? Midwifery 2012;**28**(5):e676-e83
5. Alkema L, Chou D, Hogan D, et al. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. The Lancet 2016;**387**(10017):462-74
6. Say L, Chou D, Gemmill A, et al. Global causes of maternal death: a WHO systematic analysis. The Lancet Global Health 2014;**2**(6):e323-e33
7. Osungbade KO, Ayinde OO. Maternal complication prevention: evidence from a case-control study in southwest Nigeria. African journal of primary health care & family medicine 2014;**6**(1):1-7

8. Kerber KJ, de Graft-Johnson JE, Bhutta ZA, Okong P, Starrs A, Lawn JE. Continuum of care for maternal, newborn, and child health: from slogan to service delivery. The Lancet 2007;**370**(9595):1358-69

9. Finlayson K, Downe S. Why do women not use antenatal services in low-and middle-income countries? A meta-synthesis of qualitative studies. PLoS medicine 2013;**10**(1):e1001373

10. Guideline W. Daily Iron supplementation in adult women and adolescent girls. Geneva: World Health Organization 2016

11. Horn F, Sabova L, Pinterova E, Hornova J, Trnka J. Prevention of neural tube defects by folic acid-awareness among women of childbearing age in Slovakia. Bratislavske lekarske listy 2014;**115**(2):91-97

12. World Health Organization. Service availability and readiness assessment (SARA): an annual monitoring system for service delivery: reference manual: World Health Organization, 2013.

13. UNFPA. Trends in Maternal Health in Ethiopia. Challenges in Achieving the MDG for Maternal Mortality; In-depth analysis of the EDHS 2000-2011, 2012.

14. Primary health care systems (PRIMASYS): case study from Ethiopia, abridged version. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO.

15. FMOH, EPHI, WHO. Ethiopian Services Availability and Readiness Assessment(SARA) 2016 Summary report. Addis A baba, Ethiopia January, 2017

16. EPHI, FMOH, WHO. Ethiopia Service Availability and ReadinessAssessment: 2016 Summary Report. Addis Ababa Ethiopia. January 2016   https://www.washinhcf.org/documents/Final-SARA-Report-Jan-2017.pdf Acess date: Nov 30,2017

17. Central Statistical Agency (CSA) [Ethiopia] and ICF. 2016 Ethiopia Demographic and Health Survey Key Findings. Addis Ababa, Ethiopia, and Rockville, Maryland, USA. CSA and ICF, 2017.

18. Braithwaite J, Hibbert P, Blakely B, et al. Health system frameworks and performance indicators in eight countries: a comparative international analysis. SAGE open medicine 2017;**5**:2050312116686516

19. Donabedian A. The quality of care: how can it be assessed? Jama 1988;**260**(12):1743-48

20. Desalegn DM, Abay S, Taye B. The availability and functional status of focused antenatal care laboratory services at public health facilities in Addis Ababa, Ethiopia. BMC research notes 2016;**9**(1):403

21. Alemu Y, Aragaw A. Early initiations of first antenatal care visit and associated factor among mothers who gave birth in the last six months preceding birth in Bahir Dar Zuria Woreda North West Ethiopia. Reproductive health 2018;**15**(1):203

22. Ewunetie AA, Munea AM, Meselu BT, Simeneh MM, Meteku BT. DELAY on first antenatal care visit and its associated factors among pregnant women in public health facilities of Debre Markos town, North West Ethiopia. BMC pregnancy and childbirth 2018;**18**(1):173

23. Lakew S, Ankala A, Jemal F. Determinants of client satisfaction to skilled antenatal care services at Southwest of Ethiopia: a cross-sectional facility based survey. BMC pregnancy and childbirth 2018;**18**(1):479

24. Hanefeld J, Powell-Jackson T, Balabanova D. Understanding and measuring quality of care: dealing with complexity. Bulletin of the World Health Organization 2017;**95**(5):368

25. West Gojjam ZoneHealth Office. The 2016/17 Fiscal Year Annual performance report of West Gojjam Zone, Finote Selam ; July, 2017.

26. FMOH. Basic Emergency obstetric and Newborn Care(BEmONC) training manual.Federal Democratic Republic of Ethiopia Ministry of Health , Addis Ababa, Ethiopia, 2013.

27. Ethiopian Standard Agency. Ethiopian standard: General Hospital requirements. First edition, ES 3614:2012, Addis Ababa Ethiopia.

28. Ethiopian Standard Agency. Ethiopian standard: Health centers requirements. First edition, ES 3611:2012, Addis Ababa Ethiopia.

19

29. Heredia-Pi I, Servan-Mori E, Darney BG, Reyes-Morales H, Lozano R. Measuring the adequacy of antenatal health care: a national cross-sectional study in Mexico. Bulletin of the World Health Organization 2016;**94**(6):452
30. Hair J. Multivariate data analysis: Pearson College Division. 2010
31. Williams R. Generalized ordered logit/partial proportional odds models for ordinal dependent variables. The Stata Journal 2006;**6**(1):58-82
32. Do M, Wang W, Hembling J, Ametepi P. Quality of antenatal care and client satisfaction in Kenya and Namibia. International Journal for Quality in Health Care 2017;**29**(2):183-93
33. Rahman MM, Ngadan DP, Arif MT. Factors affecting satisfaction on antenatal care services in Sarawak, Malaysia: evidence from a cross sectional study. SpringerPlus 2016;**5**(1):725
34. Tetui M, Ekirapa EK, Bua J, Mutebi A. Quality of Antenatal care services in eastern Uganda: implications for interventions. Pan African Medical Journal 2012;**13**(1)
35. Ghobashi M, Khandekar R. Satisfaction among expectant mothers with antenatal care services in the Musandam Region of Oman. Sultan Qaboos University Medical Journal 2008;**8**(3):325
36. Onyeajam DJ, Xirasagar S, Khan MM, Hardin JW, Odutolu O. Antenatal care satisfaction in a developing country: a cross-sectional study from Nigeria. BMC public health 2018;**18**(1):368
37. Rani M, Bonu S, Harvey S. Differentials in the quality of antenatal care in India. International journal for quality in health care 2007;**20**(1):62-71
38. Tafese F, Woldie M, Megerssa B. Quality of family planning services in primary health centers of Jimma Zone, Southwest Ethiopia. Ethiopian journal of health sciences 2013;**23**(3):245-54
39. Tancred T, Schellenberg J, Marchant T. Using mixed methods to evaluate perceived quality of care in southern Tanzania. International journal for quality in health care 2016;**28**(2):233-39
40. Owili PO, Muga MA, Mendez BR, Chen B. Quality of care in six sub-Saharan Africa countries: a provider-based study on adherence to WHO's antenatal care guideline. International Journal for Quality in Health Care 2018;**31**(1):43-48
41. Chemir F, Alemseged F, Workneh D. Satisfaction with focused antenatal care service and associated factors among pregnant women attending focused antenatal care at health centers in Jimma town, Jimma zone, South West Ethiopia; a facility based cross-sectional study triangulated with qualitative study. BMC research notes 2014;**7**(1):164
42. Tran TK, Gottvall K, Nguyen HD, Ascher H, Petzold M. Factors associated with antenatal care adequacy in rural and urban contexts-results from two health and demographic surveillance sites in Vietnam. BMC health services research 2012;**12**(1):40
43. Adeyinka O, Jukic AM, McGarvey ST, Muasau-Howard BT, Hawley NL. Predictors of prenatal care satisfaction among pregnant women in American Samoa. BMC pregnancy and childbirth 2017;**17**(1):381
44. Birhanu Z, Assefa T, Woldie M, Morankar S. Determinants of satisfaction with health care provider interactions at health centres in central Ethiopia: a cross sectional study. BMC health services research 2010;**10**(1):78
45. Roomruangwong C, Kanchanatawan B, Sirivichayakul S, Maes M. High incidence of body image dissatisfaction in pregnancy and the postnatal period: Associations with depression, anxiety, body mass index and weight gain during pregnancy. Sexual & Reproductive Healthcare 2017;**13**:103-09

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Women's Satisfaction with the Quality of Antenatal Care Services Rendered at Governmental Health Facilities in Northwest Ethiopia: the application of partial proportional odds model

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1 Women's Satisfaction with the Quality of Antenatal Care Services Rendered at

2 Governmental Health Facilities in Northwest Ethiopia: the application of partial

3 proportional odds model

4 **Authors:**

5 Amanu Aragaw Emiru[1]

6 Getu Degu Alene [2]

7 Gurmesa Tura Debelew[3]

8

9

10 **Author Affiliation and Addresses:**

11 [1]Department of Reproductive Health and Population Studies, College of Medicine and Health

12 sciences, Bahir Dar University, Bahir Dar, Ethiopia. Email: amanuaragaw@yahoo.com

13 [2] Department of Epidemiology and Biostatistics, College of Medicine and Health sciences, Bahir

14 Dar University, Bahir, Ethiopia. Email: adgetu123@yahoo.com

15 [3] Department of Population and Family Health, Faculty of Public Health, Institute of Health,

16 Jimma University, Jimma, Ethiopia. Email: gurrmesatura@gmail.com

17

18 **Corresponding author:**

19 Amanu Aragaw Emiru: postal address 79; email: amanuaragaw@yahoo.com: Telephone; +251-

20 918780295

21

22

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ABSTRACT

Objectives: The study was aimed; 1) To describe the quality of ANC at health facilities in Northwest Ethiopia, including dimensions of structure, process, and outcome; and 2) To assess the relationship between ANC client satisfaction with structure and process quality.

Design: Cross-sectional

Setting: Healthcare facilities providing antenatal care services in Northwest Ethiopia.

Participants: 795 pregnant women attending the antenatal clinics at 15 public health facilities and 41 health workers working for the surveyed facilities.

Outcome measures: The outcome variable was women's satisfaction with antenatal care. The outcome was generated from multiple satisfaction items using principal component analysis on an ordered, categorical, and three-point Likert scale. The key hypothesized factors considered were structural and process aspects of care. Data were analyzed using the partial proportional odds model with 95%CI.

Results: The result revealed that only 30.3% of the pregnant women were highly satisfied while 31.7% were in the low satisfaction category. The findings showed that process quality indicators better-predicted client satisfaction. In relation to this, better scores in history taking [$OR_1=OR_2$; 1.81 (95% CI 1.25, 2.60)], counseling [$OR_1 = OR_2$; 1.89 (95% CI 1.33, 2.69)], and screening [$OR_1 = OR_2$; 18.10 (95% CI 11.52, 28.39)] were associated with achieving higher satisfaction. We also observed significant but lower satisfaction among women in the late trimester of pregnancy [$OR_1 = OR_2$; 0.87 (95% CI 0.78, 0.97)]. However, we get hardly any significant relationship between structural attributes and client satisfaction.

Conclusions: The study demonstrated that women's satisfaction with antenatal care was low. The contents of antenatal services covered during client-provider interaction were the main factors affecting client satisfaction. This suggests that efforts are required to improve the competencies of health professionals to make them more effective while dealing with clients

2

Strengths and limitations of this study

57

58 ▪ We tried to assess the three aspects of quality: structure, process, and outcomes

59 ▪ The study has utilized different data collection methods including facility survey, client
60 exit interview, provider interview, and direct observation. Hence, this could increase the
61 validity of the result and the study.

62 ▪ The analysis considered the ordered nature of the outcome variable; previous studies often
63 dichotomized satisfaction at the cost of losing information

64 ▪ However, the presence of an observer during the client-provider interaction may bias the
65 results obtained in a positive direction. In addition, this study considered only the
66 governmental facilities, and the degree of satisfaction among those who attended private
67 facilities might be rather different to our findings.

INTRODUCTION

68

69 In the past two decades, concerted global efforts have led to increased coverage of maternal health
70 services, even in poor resource settings[1, 2]. Yet, improvements in health outcomes did not
71 always follow[2]. Every year, thousands of women die from pregnancy-related complications
72 worldwide[3, 4]. The Sub-Saharan Africa countries, where Ethiopia is a part, accounted for over
73 86% of the global maternal deaths in 2017 [5].

74 However, most maternal deaths are avoidable as health solutions to the causes of complications
75 are well-known [3, 6]. The solution includes a strong health system that provides maternal services
76 based on a continuum of care perspective [3]. As part of the continuum, the essence of antenatal
77 care (ANC) is to serve as a platform for important health care activities [3, 7] including health
78 promotion and disease prevention, screening and diagnosis of pregnancy-related complications [8,
79 9]. As such, antenatal care creates a unique opportunity for early detection and management of
80 hypertension, gestational diabetes, anemia, malaria, HIV, and other health conditions which
81 otherwise would jeopardize the health of mothers and the growing fetus[10, 11].

82 Evidence has long demonstrated that in the presence of adequate healthcare services and
83 community health workers, there is an opportunity to improve health service utilization and
84 maternal health outcomes[2, 12] . In this regard, the government of Ethiopia has made significant

3

85   strides towards availing health facilities closer to the community, mainly through constructing

86   primary health care facilities and launching a health extension program at the community level

87   [13]. Establishing a voluntary based Women Health Development Army (WHDA) and eliminating

88   user charges for maternity services were also among the many efforts. To this effect, 16,440 health

89   posts, 3,547 health centers, and 311 hospitals have been constructed over the past 20 years [14].

90   While health facility expansion is a welcome development in Ethiopia, many health facilities are

91   opened without the necessary materials and skilled manpower [15]. For example, while 80 percent

92   of the facilities were providing antenatal care, only 41 percent of them were in a position to provide

93   quality service [15]. As a result, the use of maternal services including antenatal care is low, and

94   maternal mortality stands at 412 deaths per 100,000 live births [16]. This suggests that reductions

95   in maternal mortality is not merely due to the availability of services but also on the content and

96   quality of care [1, 3, 4].

97   The term quality of care is used widely as a key performance indicator, but there is no universally

98   agreed metrics to measure quality of care for maternal and newborn health [17-19]. The term

99   quality is a complex concept and described from different perspectives[20]. In the Donabedian

100 model, quality is defined in terms of three major attributes: the structure (resources and

101 organizational structure in health care setting), process (how health service is delivered) and

102 outcome (effect of care on the status of the clients). In this model, client satisfaction was a part of

103 the outcome variables among others[21]. Client satisfaction can be defined as a patient's evaluation

104 of the services offered within the health system, relative to their expectations of care[20].

105 In maternity care, the client-centered approach is an important way of understanding the quality

106 of services received and women's interactions with health services[22]. This is especially

107 important in LMICs where it is recognized that women typically utilize lower quality health

108 services compared with women in developed countries[23]. In order to identify the action points

109 to improve the quality of care the World Health Organization (WHO) has developed a framework

110 using different elements from the provision of care as well as the experience of care, integral to

111 maternal and newborn care provided in the facilities[22]. However, little attempts have been made

112 to provide a complete picture of the quality of ANC delivered by the healthcare system in low-and

113 middle-income countries[24, 25].

4

114
115 A body of literatures have examined the quality of antenatal care in Ethiopia, yet hardly was any
116 published data that examined all the dimensions of quality simultaneously. The available studies
117 focused largely on the availability of facility in puts[26] or service attendance [27-29], which
118 largely overlooked the information on how care was delivered and what those visits contained
119 [30]. Moreover, these studies did not consider the association between client satisfaction and
120 measures of structural and process quality. On the other hand, understanding pregnant women's
121 views and experiences provides an imperative for managers and policy makers to efficiently
122 address their needs and expectations [20].

123 Therefore, this study aimed to assess the quality of antenatal care at health facilities and study the
124 correlation between key quality measures and client satisfaction.

METHODS

Study design and setting

127 This was a cross-sectional study using a facility survey, provider interview, direct observation, and
128 client exit interview. The study was undertaken in five districts of West Gojjam Zone, Northwest
129 Ethiopia from July to August 2018. At the time of the survey, the Zone had a population of
130 2,611,925 people with women of reproductive age (15-49) making 23.58 % of the population. The
131 zone had 6 governmental hospitals, 103 health centers, and 374 health posts. In addition, it had
132 114 private clinics and 1 hospital. All maternal health services including antenatal care were
133 provided free of charge in public health facilities [31].

Study population and sampling

135 The population consisted of public health facilities that provided ANC, pregnant women attending
136 ANC clinic, maternal health care providers, and health authorities working for the surveyed health
137 facilities.

138 This study was part of a large project on the continuum of maternal health care that linked health
139 facility data with a household survey. A number of sampling methods can be used to link
140 characteristics of the sampled facilities to those of the serviced population, yet linking the sample
141 areas(clusters) is the best approach[32] and have been considered in this study. Full details of the

5

142   sampling procedure for the project have been reported elsewhere[33, 34]. In brief, data from

143   household surveys on access to maternity services were linked to health facility data in the same

144   district. The two studies were timed in such a way that one could inform the next.

145   As a first step, a community-based study was done by using a multistage sampling procedure. For

146   this, the study area was first stratified in to 13 rural districts and 2 town administrations. Then,

147   five districts of the zone (4 rural districts and 1 town administration) were selected by simple

148   random sampling. Next, 15 kebeles (3 kebeles from each district) were selected with simple

149   random sampling technique. Kebele is the smallest administrative unit in Ethiopian context.

150   Hence, in this study the population-based study was the basis to identify the facilities to be

151   surveyed.

152   Secondly, the nearby public facilities at which the women sought care were identified during a

153   house-to-house survey. Once the health care facilities were identified by type and location where

154   they found facility survey was done across all the selected facilities. Eligibility of facilities was

155   determined by two characteristics: 1) the facility that was not under construction, and) the facility

156   reported basic maternity and reproductive health services(including ANC, facility delivery,

157   postnatal care and family planning) during the last 12 months preceding the survey. The health

158   facility survey was conducted in all the 15 public health facilities: five district hospitals and ten

159   health centers.

160   All the health care providers that were engaged in the provision of ANC in the selected facilities

161   during the data collection period were included in the study. This approach is in accordance with

162   recommendations by Anthony G. Turner and colleagues [32].

163   For the satisfaction survey and clinical observation, a sample size of 824 was calculated using the

164   formula for single population proportion based on the assumptions: 95% confidence level; 5%

165   margin of error, 42% service availability and readiness of public facilities in Ethiopia [15], design

166   effect of 2, and a 10% non-response rate. Then, the calculated sample size was allocated to each

167   health care facility based on the average daily load of ANC attendees for 2016/17 fiscal year. From

168   the sampled facilities, 795 women were selected using a systematic sampling procedure with

169   probability to proportional size method.

170   **Data collection**

6

171 In this study, an attempt was made to measure all dimensions of the quality of ANC services:
172 structure, process, and outcome. For each dimension of quality, a set of questions were adapted
173 from the WHO guidelines [3, 12], the Ethiopian demographic and health survey[16], and the list
174 of interventions recommended by the federal ministry of health of Ethiopia [35].

175 The survey comprised four main data collection methods: 1) Health facility surveys; 2) provider
176 interview;3) direct observation of ANC consultations; and 4) exit interview with pregnant women.
177 While structured and pre-tested questionnaires were used as a tool for provider and exit client
178 interviews, checklists were used in the facility survey and observation study.

179 Experienced midwives who were not affiliated with the surveyed healthcare facilities collected the
180 data. In each health facility, a team consisting of two data collectors was assigned. While one of
181 the team members was responsible to carry out the observational study and the healthcare provider
182 interview, the other was responsible for managing the exit interview and the facility survey.

183 A facility survey of all the selected facilities was carried out to assess the availability of essential
184 materials and staffing. For staffing the assessment checklist was based on the national
185 standards for each health facility type. A non-participatory observation was also undertaken
186 among 41 maternal health workers who were working at the ANC clinic during the time of the
187 survey. This was aimed to evaluate whether health care workers conformed in conducting key
188 ANC tests or examinations. When possible, the health workers who were observed were also
189 interviewed, but when this was not possible, other providers of antenatal care service were
190 substituted. Following her consultation, each pregnant woman was interviewed at the exit to assess
191 the level of satisfaction on the service she received.

192 **Variables and Measurement**

193 Structural quality was calculated at the facility level, while indices for process attributes and client
194 satisfaction were made at individual women level.

195 **Outcome variable:** the outcome variables was ANC client satisfaction, and computed by
196 aggregating women's responses to a series questions regarding the ANC visit using a principal
197 components analysis.

7

198   During the analysis, important assumptions including Bartlett's Test of Sphericity, Kaiser-Meyer-

199   Olkin (KMO) measure of sampling adequacy, and communalities scores were checked.   The

200   Eigenvalue >1 was used to decide the number of latent variables that we did for extracting factors.

201   Initially, 24 variables were considered for the analysis but eventually 12 variables were dropped

202   as they failed to meet the assumptions of PCA. An index was computed from original variables

203   retained in the process. Thus, we computed a summed index from the retained items of the

204   components that explained 68% of the total variances.

205   Finally, the overall satisfaction index was developed by categorizing the sum of scores into a three

206   point Likert scale: 0-50% as 'low satisfaction' (coded 1), 51-79 %(coded 2) as having 'moderate

207   satisfaction', and 80-100 %(coded 3) as 'high satisfaction'

208   **Main explanatory variables**

209   **Structural attributes:**

210   Facility inventory checklist with 47 items was used to assess structural attributes of the health

211   facilities. Each item was granted '1' if the item was available and functional and a score of '0' if

212   this was not the case. The items in each construct were then added together, with equal weights,

213   to generate the following five indices: 1) an infrastructure index (7 items); 2) Health Staff index

214   (8 variables); 3) an equipment index (10 items); 4) Index for drugs and vaccines (14 items); and

215   5) index for lab capacity and supplies (8 items). Finally, we categorized each index into three

216   categories: poor structure quality, fair and good structure quality. Furthermore, the overall

217   summary score was constructed by aggregating the mean scores of all the five dimension of care

218   and was set as the structure index.

219   **Process attributes**

220   The process attributes comprised interpersonal and technical aspects of the provider–client

221   interaction. Interpersonal aspects included issues such as greeting, maintenance of privacy and

222   handling of client concerns. Technical aspects included observation of specific services performed,

223   such as history-taking, ANC physical examinations, counseling related to pregnancy, and

224   laboratory examinations.

225   A scoring system was established to calculate five dimensions of process attributes from 46 items:

226   (a) interpersonal communication(6 activities), (b) history taking(12 activities); (c) clinical

227   examination(9 activities); (d) counseling(10 activities); and (f) health screening and preventive

228   measures(9 services). This scoring system categorizes whether an accepted standard of quality has

229   been met or not.

8

230   All the procedures/activities provided were weighted equally, and was granted 1 if the activity
231   was observed and performed according to accepted standards of care, and a score of '0' if this was
232   not the case. The scores of the key items for each individual client-provider interaction being
233   observed were added up and averaged to determine a score for each dimension of care.
234   Furthermore, the overall summary score was constructed by aggregating the mean scores of all the
235   dimension of care and was set as the process index. The total scores ranged between 0- 46.
236   Accordingly, the process of quality care was scored as follows: Low quality <23, Moderate quality
237   23- <37 and High quality $\geq$ 37.

Other explanatory variables

239   Other variables included were: i) Facility type; (ii); demographics (iii) socio-economic; and (iv)
240   reproductive characteristics of the women

241   The Cronbach's alpha was used to measure the internal consistency of a set of items for the three
242   quality dimensions, and a reliability coefficient of 0.70 or higher was considered acceptable[36].

Data analysis

244   Data collected were entered using the Epinfo software (7.0 version) and analyzed using STATA
245   14.0. Owing to the ordinal nature of the outcome variable(low, medium, and high satisfaction), a
246   typical approach was to use the standard ordered logit [37]. Yet, the Brant test revealed that the
247   proportional odds assumptions were violated for some independent variables ($\chi2$=63.4 df (16); p<
248   0.001). We, therefore, used a generalized ordered logistic regression with autofit, (also called
249   partial proportional odds model) for assessing the association between satisfaction and explanatory
250   variables.

251   The partial proportional odds model is a hybrid of ordinal regression (same coefficients across the
252   categories) and the default gologit (different coefficients across categories). Hence, if the Brant
253   test was not met, the analysis gave two odds ratios for an explanatory variable [Low vs.
254   medium/high Satisfaction (OR1) and low/medium vs. high satisfaction (OR2)]. Whereas for
255   variables that did not violate the proportional odds assumption a single odds ratio, OR1 = OR2
256   (OR1 = 2) reported [37].

257   The bivariable gologit model was used for variable inclusion to the final multivariable model.
258   Accordingly, the independent variables to be included in the multivariable model were selected
259   when the p value was <0.2 in the bivariable model. Before running the multivariable analysis

9

260 multi-collinearity test between independent variables was done using the Variance Inflation Factor

261 (VIF), and variables were not strongly correlated (the highest value was 2.7).

262 The final multivariable model was applied to define adjusted odds ratios (ORs), measuring the

263 effect of different determinants on being assigned to a higher satisfaction category. Statistical

264 significance for the final model was set at $P < 0.05$.

265 Patient and public involvement

266 Patients/public were not involved in setting the research question or the outcome measures, and in

267 the design and implementation of the study. Participation was voluntary based and no incentives

268 were provided. The findings of this study will be disseminated to policy-makers and local-level

269 service implementers.

270 RESULTS

271 General characteristics of women

272 Out of 824 eligible clients, 795 enrolled in the study yielding a response rate of 96.5%. The highest

273 percentage of women were rural residents 575 (72.3%), and belonging to the age range of 20-29

274 years 433(54.5%). Regarding their age, the mean and standard deviation were 27.8 and 5.9 years,

275 respectively. Of the total respondents, 63.4% did not attend formal education.

276 About one-third of the participants, 274(34.5) were first-time visitors for ANC, and more than half

277 of the women interviewed had their first ANC visit during their second trimester of pregnancy

278 (Table 1).

279 Table1: Background characteristics of ANC clients interviewed in public health facilities of West Gojjam
280 Zone, Northwest Ethiopia (N=795)
281

Description	Number	Percent
Address		
Urban	220	27.7
Rural	575	72.3
Age (Years)		
15-19	91	11.4
20-29	433	54.5
30-39	236	29.7
40+	35	4.4
Education		
No formal Education	504	63.4

10

Primary Education (Grade 1-8)	212	26.7
Secondary education and above	79	9.9
Occupation		
Farmer	575	72.3
Employee	35	4.4
Merchant	53	6.7
Daily laborer	18	2.3
Others(*including Housewives)	114	14.3
Parity		
Nulliparous	182	22.9
Primipara 1	190	23.9
Para 2-4	321	40.4
Para 5+	102	12.8
Gestational Age at time of survey		
0-3 months	79	9.9
4-7 months	562	70.7
>=8 months	154	19.4
Number of ANC visits		
1	274	34.5
2-3	436	54.8
4+	85	10.7
Timing of first ANC visit		
First trimester	332	41.8
Second Trimester	419	52.7
Third Trimester	44	5.5
Distance to HCF		
Less than 1 hour	532	66.9
Greater or equal to 1 hour	263	33.1

Health workers background characteristics

As can be seen in Table 2, forty-one health workers who worked for 15 public health facilities were included in the study. The largest number of health workers observed in any one-health facility was four and the smallest was one. Most of the health providers were men (61%). The median age of these health professionals was 29.0 years (Range: 23 to 36 years of age) and the median number of years of professional experience was 3.0 years (Range: 1 to 12 years). This is an indication that most of the providers had worked in their organization long enough to understand and give credible information to pregnant women (Table 2).

Table 2: Background characteristics of maternal health workers in public health facilities of West Gojjam Zone, Northwest Ethiopia (N=41)

Characteristics	Number	Percent

11

Sex of the provider		
Male	25	61
Female	16	39
Median Age (Range)	29.0(23-36 years)	
Median Experience (Range)	3.0(1-12 years)	
Training received on;		
ANC screening	22	53.7
Counseling	21	51.2
BEmONC	27	65.9
Hypertension management	20	48.8
HIV/PMTCT	32	78.0
CRC	18	43.9
Personally supervised by the supervisor in the last 3 Months		
Yes	15	36.6
No	26	63.4

296
297 **Structural quality attributes**

298 The analysis presented in table 3 characterizes the structural and process dimensions of ANC

299 quality, respectively. Despite there exists heterogeneity in the availability of different components,

300 the summary scores of the facility surveys were reasonably good (70 %). Laboratory consumables

301 were more likely to be available (80%) compared to other structural components. Nonetheless, the

302 availability of infrastructure and general amenities was particularly deficient (59%). Some

303 essential antenatal drugs such as magnesium sulfate, injectable antibiotics, and antihypertensive

304 drugs were also no longer available during the time of the survey (64%) (Table3).

305 Table3: Results of structural and process quality components of antenatal care in selected public
306 health facilities of Northwest Ethiopia.
307

ANC Quality Dimension	Subgroups	Mean Quality score
Structural Attributes (Health facility survey)	Minimum: 0.00-Max: 1.00	
	Number of health facilities	15
	Availability of infrastructure	0.59
	Availability of essential equipment	0.77
	Availability of staff, guidelines, and job-aids	0.71
	Availability of Drugs and vaccines	0.64
	Availability of diagnostic tests/Lab supplies	0.80
	Total structural Score	**0.70**
Process Attributes	Minimum: 0.00-Max: 1.00	
	Number of pregnant women	795
	Interpersonal performance	0.60
	Technical skills	0.69

12

(Observational studies)	- History taking	0.73
	- Clinical examination	0.70
	- Counseling	0.69
	- Laboratory examinations &preventive measures	0.63
	Total process Score	**0.65**

308
309 The availability of basic antenatal care items on the day of the survey varied widely by type of
310 facility, with hospitals generally better in the number of items to provide comprehensive antenatal
311 care. Some items were universally available across facility types, such as suction apparatus
312 (81.5%) and gloves (94.1 %). However, items such as manual vacuum extractor and calcium
313 gluconate in the health centers and insecticide-treated bed nets (ITNs) in hospitals were extremely
314 deficient (Supplementary file 1). The Cronbach's alpha value of all the items measuring structural
315 attributes of ANC quality was 0.74 .

316 **Process quality attributes:**

317 **Interpersonal performance**

318 Generally, interpersonal aspects of quality were extremely low (average score of 60%), especially
319 concerning warm greeting and welcoming the client (49.9%) and self-introduction of the provider
320 (38.9%). However, this aspect was better in maintaining the privacy of women during the time of
321 consultation (i.e. both visual and auditory), which was observed in 80% of the consultations.

322 **Technical performances**

323 The number of essential ANC services received by the surveyed women, on average, was
324 inadequate (60%). Looking in detail at the results of different dimensions, we found that some
325 technical performance aspects scored poorly, especially health screening (63%) and counseling
326 (69%). At 73%, however, the general history of the pregnant women was rather better (Table 3).

327 There were variations in the frequency of carrying out clinical examination and laboratory tests.
328 While some examinations were done regularly (e.g., weighing, blood pressure, and abdominal
329 palpation), others were done less often. For example, only 64% of the women were checked for
330 anemia. Regrettably, only 2.3% of them received all essential laboratory tests and preventive
331 medicines recommended by the Federal Ministry of Health of Ethiopia. Among all the tests and
332 interventions, screening for asymptomatic bacteriuria (31.5%) and intervention for deworming

13

333 (17.7%) were the lowest, compared to the HIV test (93%) (Supplementary file 2). The Cronbach's

334 alpha value of all the items measuring process attributes of ANC quality was 0.74.

Client Satisfaction

336 The findings on the respondent level of agreement (expressed on a scale ranging from 1 to +5) on

337 various aspects of antenatal care service satisfaction showed that women were satisfied very much

338 on the advice they received about vaginal bleeding than others(mean score=3.71). Although the

339 difference was marginal, respondents were highly dissatisfied with the information received about

340 breastfeeding as shown by a mean of 2.54.

341 Overall scores among the respondents revealed that 241(30.3%) of the clients were highly

342 satisfied, 302(38.0%) were moderately satisfied, and almost one-thirds, 252(31.7) percentage were

343 unsatisfied. The mean satisfaction score was 3.11, which is approximately equivalent to neutral on

344 the five-point Likert scale (Table 4). The items were checked for reliability using Cronbach's

345 alpha internal consistency coefficient and the overall alpha value was 0.81

346 Table 4: level of satisfaction of pregnant women visiting public health care facilities in Northwest

347 Ethiopia.

348

Satisfaction To what extent you agree with the following statements:	Very satisfied (%)	Satisfied (%)	Indifferent (%)	Dissatisfied (%)	Very dissatisfied (%)	Mean	SD
The health workers in this facility are very friendly and approachable	6.8	57.2	34.0	2.0	0	3.69	0.626
The health staff are courteous and respectful	4.5	40.8	42.4	11.5	0.9	3.37	0.778
The treatment and/or advice I received from the health worker is optimal	3.5	28.4	49.2	11.6	5.3	3.12	0.874
The provider gives me opportunities to express the concerns I have	2.0	24.4	54.0	17.0	2.6	3.06	0.773
The provider gave me chances to ask him/her questions	1.6	21.4	48.6	23.3	5.2	2.91	0.843
I am well informed on the birth preparedness	0.5	17.6	59.5	21.1	1.3	2.95	0.675
I am informed about breastfeeding after birth	-	2.1	56.1	35.0	6.8	2.54	0.654
I am told about how to recognize and proceed in case of vaginal bleeding	5.2	62.9	30.0	1.9	0.1	3.71	0.595
I am told about how to recognize and proceed in case of fever	0.6	28.7	45.0	18.4	7.3	2.97	0.887
I'm told about how to recognize and proceed in case of premature uterine contractions	1.0	12.7	62.1	18.9	5.3	2.85	0.739
I am told about how to recognize and proceed in case of severe headache	0.2	24.2	66.4	9.2	--	3.15	0.566

14

I'm told about how to recognize and proceed in case of difficulty in breathing	0.6	12.8	69.4	15.0	2.1	2.95	0.622
Average satisfaction						3.11	0.72
Overall satisfaction							
High satisfaction	241 (30.3%)						
Moderate satisfaction	302 (38.0%)						
Low satisfaction	252 (31.7%)						

349

Factors associated with client satisfaction

351 As stated earlier in the methods section we applied the multivariable partial proportional odds
352 regression model to examine the determinants of the overall satisfaction of pregnant women on
353 the antenatal healthcare service received. During the analysis, the three-scale dependent variable
354 produced two panels: panel-one (i.e., low vs. moderate/ high satisfaction); and panel two (low
355 /moderate vs. high satisfaction). In each group, the lower values were recoded to "0", while the
356 highest values were recorded to "1". A positive coefficient (equivalent to OR> 1) implied that
357 increases in the explanatory variable led to higher levels of client satisfaction, while negative
358 coefficient (OR <1) mean that increase in the explanatory value led to less satisfaction [37].

359 The Brant test of parallel lines assumption ($\chi2=63.4$ df (16); p< 0.001) revealed that women's
360 education, number of ANC visits, distance to health facility, and index for clinical examination
361 were the variables that failed to meet assumption. For these variables, the coefficient estimates and
362 odds ratios were intended to differ in the two panels (categories) (Supplementary file 3).

363 After adjusting for all the covariates, significant differences in the ANC service satisfaction was
364 observed by process quality indicators and socio-demographic factors. Residence, distance to
365 clinic, women's, education, number of ANC visits, and gestational age appeared to be important
366 predictors of satisfaction with antenatal care. Moreover, process quality indicators such as history
367 taking, clinical examination, counseling, and health screening also remained significant in the final
368 model (p < 0.05).

369 As women's educational status, number of ANC visits, distance to the healthcare facility, and
370 clinical examination violated the proportional odds assumption (the Brant test), $aOR_1 \neq aOR_2$ and
371 separate interpretations at each category were therefore required for these variables. Hence, aOR1
372 stands for panel one (low vs. moderate or high) while aOR2 was for the second panel (low/
373 moderate vs. high satisfaction

15

374 In this regard, women with better schooling [aOR1=3.11(95% CI 2.02, 4.81)], and those with

375 increased number of ANC visits [aOR1 = 4.16 (95% CI 1.66, 10.23)] were significantly associated

376 with increased odds of having moderate or high satisfaction, but no significant difference for

377 low/moderate vs. high scores. However, the findings revealed that living within 60 minutes

378 walking distance significantly reduced the odds of being satisfied [low vs. moderate/high scores,

379 aOR1 = 0.29 (95% CI 0.18, 0.46)] though it failed to achieve statistical significance in the second

380 category[low/moderate vs. high scores].

381

382 Being better in clinical examination of the process dimension was positively and significantly

383 associated with the two satisfaction categories [Low vs. moderate/high: $aOR_1 = 1.69$ (95% CI 1.13,

384 2.54)], and [low/moderate vs.high:$aOR_2=4.09$(95%CI2.69, 6.24)]. As can be seen in the table 5,

385 the effects became much stronger when satisfaction level moved from low to high category.

386 However, variables that did not violate the assumption had a single beta coefficient at each of the

387 two satisfaction categories; and hence a single aOR1 =2 was reported. Client satisfaction was

388 associated with better process scores. Better scores in history taking [$aOR_1 = aOR_2$; 1.81 (95% CI

389 1.25, 2.60)], counseling performance [$aOR_1 = aOR_2$; 1.89 (95% CI 1.33, 2.69)], and health

390 screening and preventive measures [aOR1 = 2; 18.10 (95% CI 11.52, 28.39)] were associated with

391 achieving higher ANC satisfaction scores.

392 Similarly, being a rural resident was significantly associated with achieving a higher satisfaction

393 score [aOR_1= aOR_2; 1.89 (95% CI 1.05, 3.41)]. For every one month increase in gestational age

394 of pregnancy, however, the odds of being above a particular satisfaction category was decreased

395 by a factor of 0.87[$OR_1 = OR_2$; 0.87 (95% CI 0.78, 0.97)] (Table 5).

396 Table 5: multivariable partial proportional odds model showing factors affecting ANC satisfaction in
397 West Gojjam Zone, Northwest Ethiopia (n=795)
398

Explanatory Variables	Outcome variables (panels)			
	Panel One (1 Vs. 2 and 3)		Panel Two (1or 2 Vs 3)	
	aOR 1 (95%CI)	Coefficients not varying(OR1=OR2)	aOR2(95%CI)	Overall P-value(s)
Education of women (Attended at least primary education vs.no schooling[Ref])	**3.11(2.02,4.81)***		1.34(0.97,1.86)	**0.001**/0.073
Number of ANC visits (>=4, <4 visits[]Ref)	**4.16(1.66,10.23)**		0.99(0.51,1.95)	**0.002**/0.996

16

Walking distance to HCF (< 1 hour, >=1 hr. [Ref])	**0.29(0.18,0.46)*****		0.64(0.39,1.04)	**0.001**/0.072
Clinical examination (At least fair, Poor[Ref])	**1.69(1.13,2.54)***		**4.09(2.69,6.24)*****	**0.011/0.001**
Address (Rural, Urban[Ref])		**1.89(1.05,3.41)***		**0.035**
Age in years (20+, 15-19[Ref])		1.10(0.80,1.50)		0.561
Para(Para1+, Nulliparous[Ref])		0.80(0.63,1.01)		0.065
Gestational age in months(Cont.)		**0.87(0.78,0.97)****		**0.01**
Service year of provider (year)(Cont.)		0.99(0.93,1.07)		0.95
Supervision received in the last 3 months (Yes, no[Ref])		1.34(0.80,2.26)		0.264
Infrastructure (At least fair, Poor[Ref])		0.78(0.56,1.08)		0.138
Drug availability (At least fair, Poor[Ref])		0.95(0.70,1.28)		0.728
Interpersonal index (At least fair, Poor[Ref])		1.16(0.88,1.54)		0.291
History taking (At least fair, Poor[Ref])		**1.81(1.25,2.60)****		**0.002**
Counseling performance (At least fair, Poor[Ref])		**1.89(1.33,2.69)*****		**0.001**
Laboratory tests and preventive meeasures (At least fair, Poor[Ref])		**18.09(11.52,28.39)*****		**0.001**

399

400 Note. * indicates< 5 % level of significance, ** indicates p< 1% level of significance, *** indicates p<
401 0.1 level of % level of significance.   1=low satisfaction; 2= moderate satisfaction; and 3= high
402 satisfaction

DISCUSSION

404 In this study, we analyzed a comprehensive range of structural and process-related factors and

405 some individual characteristics associated with ANC's satisfaction. Structural and process

406 attributes were the key independent variables of interest in the regression estimation.

407 Demographics and Socio-economic characteristics were also the other sets of explanatory

408 variables included in this study.

409 Client satisfaction with the quality of antenatal care services, as noted by Mai Do and colleagues,

410 has been increasingly recognized as an important outcome for the healthcare delivery system[38].

411 Nonetheless, our study found that only 30% of clients had high levels of satisfaction. This

412 proportion of satisfaction was less than the findings in South Ethiopia (32%), Uganda (40%), and

17

413 Oman (59%) [29, 39-41]. This lower figure is a serious concern given that low satisfaction may

414 adversely affect women's willingness to return/continuity for other maternal services.

415 Furthermore, our results revealed that all the dimensions of process quality including, history

416 taking, physical examination, counseling, and screening had positively significant impacts on

417 client satisfaction. Similar findings were also reported by other studies, which indicated a positive

418 association between clinical quality characteristics and client satisfaction [29, 42]. A study

419 conducted in India, for example, reaffirmed the importance of adequate clinical examinations in

420 defining clients' expectations and helping to establish trust between the client and providers [43].

421 It is, however, worth noting that there was no statistically significant association between client

422 satisfaction and all the structural aspects of care, which is consistent with results obtained in

423 previous studies [38, 44, 45]. This would seem to imply that the mere existence of services is not

424 a guarantee to bring satisfaction. Contrary to our findings, however, others [42, 46] showed the

425 positive influence of structural quality indicators on client satisfaction.

426 The available literature on the associations between maternal education and client satisfaction

427 report inconclusive results. Chemir et al from Ethiopia reported a negative association between

428 maternal education and service satisfaction [47]. Our study, on the contrary, observed that better-

429 educated women were positively and significantly associated with client satisfaction. This finding

430 is similar to that of Rahman et al. in Malaysia [39] who argued that educated women are more

431 aware of the procedures to expect during antenatal care, which probably increases their

432 satisfaction.

433 Rural-urban divides of residence had a significant impact on client satisfaction, as was a distance

434 to the nearest health facility. We found a significant difference in levels of satisfaction among

435 urban-rural residence, with the highest satisfaction achieved on rural than urban residents.

436 Moreover, living within an hour walking distance to the clinic was significantly associated with

437 lower satisfaction. The result of this study is consistent with other studies [29, 48, 49]. Women

438 from rural areas, who also are supposed to live in far distance, are more likely to have lower

439 expectations owing to their previous experience of healthcare and lower chance of exposure to

440 health care information, and therefore they tend to value service they are offered [48], and more

441 likely to report higher levels of satisfaction.

18

442 Reproductive-related factors such as the number of antenatal visits and gestational age showed a

443 significant association with client satisfaction. Women who made four or more antenatal visits

444 were positively and significantly associated with the low vs moderate or high satisfactions category

445 despite the association turned insignificant in the low or medium vs. high satisfaction category. A

446 previous study conducted in South Ethiopia has also reported a similar finding[29]. The positive

447 association in this regard could be due to developing awareness through repeated visiting. Besides,

448 the repeated antenatal visits could further improve the relationship between providers and women

449 in a positive direction[50], which in turn made them feel good towards the services.

450 Another notable finding in this study was the inverse relation between gestation age and level of

451 satisfaction. The possible reason for this negative association could be related to the fact that the

452 late trimester is a time when more complications can occur[51]. These complications could let

453 expectant mothers to demand extra care and support, yet they might be dissatisfied if the service

454 was not to their expectations. Hence, providers should be alert to detect and manage the causes of

455 dissatisfaction in pregnant women.

456 Despite the important findings evolved in the present study, some caution needs to be taken in

457 interpreting the results as our study had the following limitations. First, our study assessed the

458 satisfaction level of pregnant women who attended public facilities only; yet, the degree of

459 satisfaction for women who attended private facilities might be rather different to our findings.

460 Second, the presence of an observer during the client-provider interaction could generate bias

461 through the Hawthorne effect. Nonetheless, the data collector spent more time at each health care

462 facility and observed many client consultations for each provider. In relation to this, Leonard et al.

463 reported that the quality of health workers performance increased by 20% on average when being

464 observed but that was only temporary and 10-15 observations later the behavior of the providers

465 became normative[52].

466 Third, social desirability bias might also be a concern in cases that women in exit interviews feel

467 they need to respond in a way expected of them. Yet, satisfaction was measured using a summary

468 of client's responses to a series of questions, which is less subjective than asking a single question.

469 In addition, the use of interviewers who were not affiliated to the surveyed facilities might have

470 mitigated against this.

19

471 Finally, we have been constrained by the lack of consistency in defining quality in the existing
472 literature. Hence, the definition we used could not be refined to certain variables listed by the
473 researchers. The unmeasured factors, however, might influence client's satisfaction.

CONCLUSIONS

475 The women's satisfaction towards antenatal care in public facilities was suboptimal and was
476 dependent on an interplay of factors at various levels. A significant contribution to the variation in
477 client satisfaction was mainly attributed to factors related to the contents of the care received than
478 do structural attributes.

479 Indeed, the study suggests that availing inputs may not be enough to ensure in bringing client
480 satisfaction. Rather, providers may need further supporting mechanisms to offer ANC that clients
481 regard as satisfactory. In so doing, facilities will increase the levels of providers' performance and
482 client's satisfaction, and improve the overall quality of care offered at public health facilities.
483 Finally, the context of this study was an exclusively public health facility setting. Therefore, future
484 studies linking different health system complexities would add value to the evidence generated by
485 our study.

486

487

20

499 **Ethics approval:** the study received ethical approval from the Ethical Review Board of Bahir Dar

500 University (protocol no.: 087/18-04). A formal letter of permission was granted from the Amhara

501 Regional Health Bureau and line offices. The person in charge of each facility and care providers

502 were informed and their agreement received before the onset of data collection. Moreover, all the

503 study participants were informed about the purpose of the study, their right to refuse and assurance

504 of confidentiality. Then, informed verbal informed consent was obtained from each study

505 participant. Personal identifiers were excluded from the data collection form to maintain privacy

506 and confidentiality.

507

508 **Provenance and peer review:** Not commissioned; externally peer- reviewed.

509 **Data sharing statement**: All data relevant to the study are included in the article or uploaded as

510 supplementary information.

511 # REFERENCES

512 1.   Kanyangarara M, Munos MK, Walker N. Quality of antenatal care service provision in health
513 facilities across sub–Saharan Africa: Evidence from nationally representative health facility assessments.
514 Journal of global health. 2017;7(2).
515 2.   World Health Organization. Consultation on improving measurement of the quality of maternal,
516 newborn and child care in health facilities: World Health Organization,; 2014. Available from:
517 https://www.who.int/maternal_child_adolescent/documents/measuring-care-quality/en/.
518 3.   WHO. WHO recommendations on antenatal care for a positive pregnancy experience. World
519 Health Organization Geneva, Switzerland; 2016.
520 4.   Raven JH, Tolhurst RJ, Tang S, Van Den Broek N. What is quality in maternal and neonatal
521 health care? Midwifery. 2012;28(5):e676-e83.
522 5.   World Health Organization. Trends in maternal mortality 2000 to 2017: estimates by WHO,
523 UNICEF. UNFPA, World Bank Group and the United Nations Population Division; 2019.
524 6.   Say L, Chou D, Gemmill A, Tunçalp Ö, Moller A-B, Daniels J, et al. Global causes of maternal
525 death: a WHO systematic analysis. The Lancet Global Health. 2014;2(6):e323-e33.
526 7.   Osungbade KO, Ayinde OO. Maternal complication prevention: evidence from a case-control
527 study in southwest Nigeria. African journal of primary health care & family medicine. 2014;6(1):1-7.
528 8.   Kerber KJ, de Graft-Johnson JE, Bhutta ZA, Okong P, Starrs A, Lawn JE. Continuum of care for
529 maternal, newborn, and child health: from slogan to service delivery. The Lancet. 2007;370(9595):1358-
530 69.
531 9.   Finlayson K, Downe S. Why do women not use antenatal services in low-and middle-income
532 countries? A meta-synthesis of qualitative studies. PLoS medicine. 2013;10(1):e1001373.
533 10.   World Health Organization. Daily iron supplementation in adult women and adolescent girls.
534 Geneva, Switzerland. 2016. Available from:
535 https://www.who.int/nutrition/publications/micronutrients/guidelines/daily_iron_supp_womenandgirls/en
536 /.

11.   Horn F, Sabova L, Pinterova E, Hornova J, Trnka J. Prevention of neural tube defects by folic acid-awareness among women of childbearing age in Slovakia. Bratislavske lekarske listy. 2014;115(2):91-7.

12.   World Health Organization. Service availability and readiness assessment (SARA): an annual monitoring system for service delivery: reference manual: World Health Organization; 2013. Available from: https://www.who.int/healthinfo/systems/sara_reference_manual/en/.

13.   Medhanyie A, Spigt M, Kifle Y, Schaay N, Sanders D, Blanco R, et al. The role of health extension workers in improving utilization of maternal health services in rural areas in Ethiopia: a cross sectional study. BMC health services research. 2012;12(1):352.

14.   Primary health care systems (PRIMASYS): case study from Ethiopia, abridged version. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO.

15.   EPHI, FMOH, WHO. Ethiopia Service Availability and ReadinessAssessment: 2016 Summary Report. Addis Ababa Ethiopia. January 2016   https://www.washinhcf.org/documents/Final-SARA-Report-Jan-2017.pdf Acess date: Nov 30,2017.

16.   Central Statistical Agency (CSA) [Ethiopia] and ICF. 2016 Ethiopia Demographic and Health Survey Key Findings. Addis Ababa, Ethiopia, and Rockville, Maryland, USA. CSA and ICF, 2017.

17.   Brizuela V, Leslie HH, Sharma J, Langer A, Tunçalp Ö. Measuring quality of care for all women and newborns: how do we know if we are doing it right? A review of facility assessment tools. The Lancet Global Health. 2019;7(5):e624-e32.

18.   Braithwaite J, Hibbert P, Blakely B, Plumb J, Hannaford N, Long JC, et al. Health system frameworks and performance indicators in eight countries: a comparative international analysis. SAGE open medicine. 2017;5:2050312116686516.

19.   Sheffel A, Karp C, Creanga AA. Use of Service Provision Assessments and Service Availability and Readiness Assessments for monitoring quality of maternal and newborn health services in low-income and middle-income countries. BMJ global health. 2018;3(6):e001011.

20.   Larson E, Sharma J, Bohren MA, Tunçalp Ö. When the patient is the expert: measuring patient experience and satisfaction with care. Bulletin of the World Health Organization. 2019;97(8):563.

21.   Donabedian A. The quality of care: how can it be assessed? Jama. 1988;260(12):1743-8.

22.   Tunçalp Ö, Were W, MacLennan C, Oladapo O, Gülmezoglu A, Bahl R, et al. Quality of care for pregnant women and newborns—the WHO vision. BJOG: an international journal of obstetrics & gynaecology. 2015;122(8):1045-9.

23.   Sharma J, Leslie HH, Kundu F, Kruk ME. Poor quality for poor women? Inequities in the quality of antenatal and delivery care in Kenya. PloS one. 2017;12(1).

24.   Afulani PA, Phillips B, Aborigo RA, Moyer CA. Person-centred maternity care in low-income and middle-income countries: analysis of data from Kenya, Ghana, and India. The Lancet Global Health. 2019;7(1):e96-e109.

25.   Heredia-Pi I, Servan-Mori E, Darney BG, Reyes-Morales H, Lozano R. Measuring the adequacy of antenatal health care: a national cross-sectional study in Mexico. Bulletin of the World Health Organization. 2016;94(6):452.

26.   Desalegn DM, Abay S, Taye B. The availability and functional status of focused antenatal care laboratory services at public health facilities in Addis Ababa, Ethiopia. BMC research notes. 2016;9(1):403.

27.   Alemu Y, Aragaw A. Early initiations of first antenatal care visit and associated factor among mothers who gave birth in the last six months preceding birth in Bahir Dar Zuria Woreda North West Ethiopia. Reproductive health. 2018;15(1):203.

28.   Ewunetie AA, Munea AM, Meselu BT, Simeneh MM, Meteku BT. DELAY on first antenatal care visit and its associated factors among pregnant women in public health facilities of Debre Markos town, North West Ethiopia. BMC pregnancy and childbirth. 2018;18(1):173.

29.   Lakew S, Ankala A, Jemal F. Determinants of client satisfaction to skilled antenatal care services at Southwest of Ethiopia: a cross-sectional facility based survey. BMC pregnancy and childbirth. 2018;18(1):479.

22

588 30.   Hanefeld J, Powell-Jackson T, Balabanova D. Understanding and measuring quality of care:
589 dealing with complexity. Bulletin of the World Health Organization. 2017;95(5):368.
590 31.   West Gojjam ZoneHealth Office. The 2016/17 Fiscal Year Annual performance report of West
591 Gojjam Zone, Finote Selam ; July, 2017.
592 32.   Turner AG, Angeles G, Tsui AO, Wilkinson M, Magnani R. Sampling manual for facility surveys
593 for population, maternal health, child health and STD programs in developing countries. 2000.
594 33.   Emiru AA, Alene GD, Debelew GT. Women's retention on the continuum of maternal care
595 pathway in west Gojjam zone, Ethiopia: multilevel analysis. BMC Pregnancy and Childbirth. 2020;20:1-
596 14.
597 34.   Emiru AA, Alene GD, Debelew GT. The role of maternal health care services as predictors of
598 time to modern contraceptive use after childbirth in Northwest Ethiopia: Application of the shared frailty
599 survival analysis. PloS one. 2020;15(2):e0228678.
600 35.   FMOH. Basic Emergency obstetric and Newborn Care(BEmONC) training manual.Federal
601 Democratic Republic of Ethiopia Ministry of Health , Addis Ababa, Ethiopia, 2013.
602 36.   Hair J, Black WC, Babin BJ, Anderson RE. Multivariate data analysis: International version. New
603 Jersey, Pearson. 2010.
604 37.   Williams R. Generalized ordered logit/partial proportional odds models for ordinal dependent
605 variables. The Stata Journal. 2006;6(1):58-82.
606 38.   Do M, Wang W, Hembling J, Ametepi P. Quality of antenatal care and client satisfaction in
607 Kenya and Namibia. International Journal for Quality in Health Care. 2017;29(2):183-93.
608 39.   Rahman MM, Ngadan DP, Arif MT. Factors affecting satisfaction on antenatal care services in
609 Sarawak, Malaysia: evidence from a cross sectional study. SpringerPlus. 2016;5(1):725.
610 40.   Tetui M, Ekirapa EK, Bua J, Mutebi A. Quality of Antenatal care services in eastern Uganda:
611 implications for interventions. Pan African Medical Journal. 2012;13(1).
612 41.   Ghobashi M, Khandekar R. Satisfaction among expectant mothers with antenatal care services in
613 the Musandam Region of Oman. Sultan Qaboos University Medical Journal. 2008;8(3):325.
614 42.   Onyeajam DJ, Xirasagar S, Khan MM, Hardin JW, Odutolu O. Antenatal care satisfaction in a
615 developing country: a cross-sectional study from Nigeria. BMC public health. 2018;18(1):368.
616 43.   Rani M, Bonu S, Harvey S. Differentials in the quality of antenatal care in India. International
617 journal for quality in health care. 2007;20(1):62-71.
618 44.   Tafese F, Woldie M, Megerssa B. Quality of family planning services in primary health centers of
619 Jimma Zone, Southwest Ethiopia. Ethiopian journal of health sciences. 2013;23(3):245-54.
620 45.   Tancred T, Schellenberg J, Marchant T. Using mixed methods to evaluate perceived quality of
621 care in southern Tanzania. International journal for quality in health care. 2016;28(2):233-9.
622 46.   Owili PO, Muga MA, Mendez BR, Chen B. Quality of care in six sub-Saharan Africa countries: a
623 provider-based study on adherence to WHO's antenatal care guideline. International Journal for Quality
624 in Health Care. 2018;31(1):43-8.
625 47.   Chemir F, Alemseged F, Workneh D. Satisfaction with focused antenatal care service and
626 associated factors among pregnant women attending focused antenatal care at health centers in Jimma
627 town, Jimma zone, South West Ethiopia; a facility based cross-sectional study triangulated with
628 qualitative study. BMC research notes. 2014;7(1):164.
629 48.   Tran TK, Gottvall K, Nguyen HD, Ascher H, Petzold M. Factors associated with antenatal care
630 adequacy in rural and urban contexts-results from two health and demographic surveillance sites in
631 Vietnam. BMC health services research. 2012;12(1):40.
632 49.   Adeyinka O, Jukic AM, McGarvey ST, Muasau-Howard BT, Hawley NL. Predictors of prenatal
633 care satisfaction among pregnant women in American Samoa. BMC pregnancy and childbirth.
634 2017;17(1):381.
635 50.   Birhanu Z, Assefa T, Woldie M, Morankar S. Determinants of satisfaction with health care
636 provider interactions at health centres in central Ethiopia: a cross sectional study. BMC health services
637 research. 2010;10(1):78.

23

638   51.   Roomruangwong C, Kanchanatawan B, Sirivichayakul S, Maes M. High incidence of body image
639   dissatisfaction in pregnancy and the postnatal period: Associations with depression, anxiety, body mass
640   index and weight gain during pregnancy. Sexual & Reproductive Healthcare. 2017;13:103-9.
641   52.   Leonard K, Masatu MC. Outpatient process quality evaluation and the Hawthorne Effect. Social
642   science & medicine. 2006;63(9):2330-40.

643

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Supplementary file 1: Availability and functionality of items among hospitals and health centers offering ANC services in West Gojjam Zone, Northwest Ethiopia.

No	Items per dimension	Facility Type		Total
		Hospitals (n=5)	Health centers (n=10)	(n=15)
1	**Availability of infrastructure (7)**			
	▪ Water within the compound	5	5	10
	▪ Electricity from any source (e.g. electricity grid, generator, solar, or other)	5	5	10
	▪ Ambulance/any vehicle for emergence (available free of charges)	4	4	8
	▪ Functioning landline telephone or a mobile phone supported by the facility	5	6	11
	▪ Functioning computer	4	6	10
	▪ Internet access within the facility	1	---	1
	▪ Separate room for ANC consultations with auditory and visual privacy	5	8	13
	Group average			**9**
2	**Essential equipment(10)**			
	▪ Blood pressure apparatus	5	8	13
	▪ Stethoscope	5	9	13
	▪ Thermometer	4	7	11
	▪ Adult scale(Functional)	8	5	12
	▪ Fetoscope	5	10	15
	▪ Gloves(non-sterile)	5	10	15
	▪ Gloves sterile	5	9	14
	▪ Vacuum aspiration equipment (MVA) set	5	3	8
	▪ Suction apparatus	5	7	12
	▪ MUAC Tape mother	3	6	9
	Group average			**12**
3	Availability of essential drugs and vaccines (14)			

1

• Tetanus toxoid	5	10		15
• Iron/ Folic acid	4	9		13
• IV fluids(of any type)	5	7		12
• Magnesium sulfate (injection)	3	---		3
• Calcium gluconate	2	-----		2
• Antiretroviral drugs	5	4		9
• Insecticide treated bed nets	------	2		2
• Anti-malaria drugs (Quartum, Quinine, and other)	4	7		11
• Anti-helminthes (mebendazole or others)	5	9		14
• Cotrimoxazole	5	8		13
• Parenteral antibiotics	5	3		8
• Methyldopa or propranolol or any other antihypertensive	5	3		8
• Diazepam (injection)	4	5		9
• Parenteral oxytocic	5	10		15
Group average				**10**
4	Diagnostic Capacities (8)			
▪ Urine pregnancy test (HCG)	4	5		9
▪ .Hemoglobin test	4	6		10
▪ Blood and RH grouping	5	8		13
▪ .Malaria diagnostic capacity	5	9		14
▪ Proteinuria test	5	7		12
▪ RPR for Syphilis	4	8		12
▪ HIV test	5	8		13
▪ Urinalysis for bacteriuria	5	8		13
Group average				**12**
5	Staffing and guidelines/job aids	Standard	Available	Standard	Available	

2

I	Staffing					
	Generalist(non-specialist) medical doctors	14	5	1	---	5
	Gynecologist and obstetrician	2	------			----
	Health officer			2	10	10/10
	Nurses of all categories	97	1	5	10	11
	Midwives	13	4	3	8	12
	Laboratory technicians/technologists	10	5	2	10	15
	Pharmacist or pharmacy technician	10	4	3	9	13
II.	ANC checklists and/job aids		Hospital	Health center		
			4	7		11
	Group average					11
	Total structural Score (Average)					11

Supplementary file 2: Summary of the procedures and processes of care provided during antenatal visit in west Gojjam Zone, Northwest Ethiopia

	Clinical observation			
1	**Interpersonal performance(6)**	Hospital (n=130)	HC (n=665)	Total (n=795)
1	The health worker greeted women in a friendly way	62	335	397
2	The health worker introduced him self	49	260	309
3	The health worker called the client by name	77	291	368
4	The health worker ensured privacy (visual and auditory)	103	533	636
5	The health worker encouraged women to ask questions	99	576	675
6	Gave attention to what the woman talks about	78	398	476
	INTERPERSONAL PERFORMANCE			**477**
2	**Technical performance(40)**			
A	**history taking(12)**			
1	The health worker asked or checked client card about her age	97	525	622
2	The health worker asked about number of previous pregnancies	100	513	613
3	The health worker asked about duration of present pregnancy	102	555	657
4	The health worker asked about the previous obstetric history, if relevant (such as stillbirth, abortion, neonatal loss…)	82	436	518
5	The health worker asks asked about any co-morbidity(hypertension, DM)	86	438	524
6	The health worker asked whether the woman feel fetal movements, if relevant [consider GA and parity]	96	472	568
	Asks whether she has experienced any of the following for current pregnancy:			
7	Vaginal bleeding	96	510	606

1

8	Fever	92	471	563
9	Severe headaches and/or blurred vision	99	518	617
10	Swollen face or hands	104	541	645
11	Convulsions or loss of consciousness	72	402	474
12	Severe abdominal pain	94	467	561
	Average			580
B	CLINICAL EXAMINATION(9)			
1	Check weight	95	484	579
2	Take blood pressure	91	455	546
3	Measured MUAC	60	348	408
4	Check signs of anemia	84	432	516
5	Check for edema	102	452	554
	Performs the following steps for abdominal examination:			
6	Inspect abdomen	108	556	664
7	Palpate abdomen for size and fetal position	111	574	685
8	measure fundal height with measuring tape	78	414	492
9	Checks fetal heart rate with fetoscope	92	474	566
	Average			**557**
C	Laboratory tests &preventive measures (9)			
	Laboratory examinations(6)			
1	urine protein test	120	379	499
2	Urinalysis for bacteriuria	39	211	250
3	Hemoglobin or HCT	76	379	455

2

4	ABO blood grouping/RH Factor	98	469	567
5	HIV Test	120	619	739
6	RPR for Syphilis	74	373	447
	Preventive measures(3)			
7	checked for anemia and prescribed iron/folic acid	117	575	692
8	Deworming checked and given if eligible	26	115	141
9	Tetanus toxoid immunization status is checked and given	117	605	722
	Average			**501**
D	Counselling given on the following topics(10)			
1	Discuss about place of delivery	95	476	571
2	Inform about birth preparedness &emergency readiness	100	503	603
3	Diet and nutrition	106	556	662
4	Personal hygiene and self-care	94	465	559
5	Importance of bed-nets	68	505	573
6	Information on signs of true labor	78	385	463
7	postpartum family planning	61	316	377
8	HIV and PMTCT	106	550	656
9	Counsel on STI including syphilis	75	377	452
10	Danger signs of pregnancy and actions to be taken	102	472	574
	Average for counseling			**549**
	Average for technical performance			**475**

3

Supplementary file 3: Brant test of parallel regression assumption using the 0.05 level of significance

SN	Variables	P- value
1	Address	0.5174
2	Age of women	0.0760
3	Educational status	**0.0007**
4	Distance to health facility	**0.0036**
5	Number of live births	0.6005
6	Gestational Age at the time survey	0.1948
7	Number of ANC visits	**0.0075**
8	Service Year of the provider	0.6578
9	Supervision received by the provider	0.1059
10	Availability of Physical infrastructure(composite index)	0.2240
11	Availability of essential drugs (composite index)	0.3239
12	Interpersonal communication (composite index)	0.3559
13	Skills in history taking (composite index)	0.5167
14	Skills in physical examination (composite index)	**0.0005**
15	Counseling skills (composite index)	0.8421
16	Health Screening (composite index)	0.1398

Note: A significant test statistic provides evidence that the parallel regression assumption has been violated.

1

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	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	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2-5
Objectives	3	State specific objectives, including any prespecified hypotheses	2
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,6,7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7,8,9
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	*7,8,9*
Bias	9	Describe any efforts to address potential sources of bias	6,9,10
Study size	10	Explain how the study size was arrived at	5,6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9-10
		(*b*) Describe any methods used to examine subgroups and interactions	9-10
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	9-10
		(*e*) Describe any sensitivity analyses	9-10
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	10
		(b) Give reasons for non-participation at each stage	10
		(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	10,11,12
		(b) Indicate number of participants with missing data for each variable of interest	10,11,12
Outcome data	15*	Report numbers of outcome events or summary measures	14

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	15-17
		(*b*) Report category boundaries when continuous variables were categorized	17
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	17
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	12-13
Discussion			
Key results	18	Summarise key results with reference to study objectives	17-19
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	19-20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	20
Generalisability	21	Discuss the generalisability (external validity) of the study results	20
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	21

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Women's Satisfaction with the Quality of Antenatal Care Services Rendered at Public Health Facilities in Northwest Ethiopia: the application of partial proportional odds model

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1 Women's Satisfaction with the Quality of Antenatal Care Services Rendered at

2 Public Health Facilities in Northwest Ethiopia: the application of partial proportional

3 odds model

4 **Authors:**

5 Amanu Aragaw Emiru[1]

6 Getu Degu Alene [2]

7 Gurmesa Tura Debelew[3]

8

9

10 **Author Affiliation and Addresses:**

11 [1]Department of Reproductive Health and Population Studies, College of Medicine and Health

12 Sciences, Bahir Dar University, Bahir Dar, Ethiopia. Email: amanuaragaw@yahoo.com

13 [2] Department of Epidemiology and Biostatistics, College of Medicine and Health Sciences, Bahir

14 Dar University, Bahir, Ethiopia. Email: adgetu123@yahoo.com

15 [3] Department of Population and Family Health, Faculty of Public Health, Institute of Health,

16 Jimma University, Jimma, Ethiopia. Email: gurrmesatura@gmail.com

17

18 **Corresponding author:**

19 Amanu Aragaw Emiru: postal address 79; email: amanuaragaw@yahoo.com: Telephone; +251-

20 918780295

21

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23 **Keywords:** antenatal, quality, structure, process, satisfaction

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29 **ABSTRACT**

30 **Objectives:** The study was aimed; 1) To describe the quality of ANC at public health facilities in

31 Northwest Ethiopia, including dimensions of the structure, process, and outcome; and 2) To assess

32 the relationship between ANC satisfaction and structure and process dimension of ANC quality

33 **Design:** Cross-sectional

34 **Setting:** Healthcare facilities providing antenatal care services in Northwest Ethiopia.

35 **Participants:** 795 pregnant women attending the antenatal clinics at 15 public health facilities and

36 41 health workers working for the surveyed facilities.

37 **Outcome measures:** The outcome variable, women's satisfaction with antenatal care was

38 constructed from multiple satisfaction items using principal component analysis on an ordered,

39 categorical, and three-point Likert scale. The key hypothesized factors considered were structural

40 and process aspects of care. Data were analyzed using the partial proportional odds model with

41 95%CI.

42 **Results:** The result revealed that only 30.3% of the pregnant women were highly satisfied, whereas

43 31.7% had a lower satisfaction level. The findings showed that process quality indicators better-

44 predicted client satisfaction. In relation to this, better scores in history taking [$OR_1 = OR_2$; 1.81

45 (95% CI 1.25, 2.60)], counseling [$OR_1 = OR_2$; 1.89 (95% CI 1.33, 2.69)], and screening [$OR_1 =

46 OR_2$; 18.10 (95% CI 11.52, 28.39)] were associated with achieving higher satisfaction. We also

47 observed a significant but lower satisfaction among women in the late trimester of pregnancy [$OR_1

48 = OR_2$; 0.87 (95% CI 0.78, 0.97)]. However, we did not see any significant relationship between

49 structural variables and client satisfaction.

50 **Conclusions:** The study demonstrated that women's satisfaction with antenatal care was low. The

51 contents of antenatal care services covered during client-provider interaction were the main factors

52 affecting client satisfaction. This suggests that efforts are required to improve the competencies of

53 health professionals to make them more effective while dealing with clients

54

55

2

Strengths and limitations of this study

- We tried to assess the three aspects of quality: structure, process, and outcomes

- The study has utilized different data collection methods including facility survey, client exit interview, provider interview, and direct observation. Hence, this could increase the validity of the result and the study.

- The analysis considered the ordered nature of the outcome variable; previous studies often dichotomized satisfaction at the cost of losing information

- However, the presence of an observer during the client-provider interaction might have biased (Hawthorne effect) the results obtained in a positive direction. In addition, this result could not be generalized to the pregnant women visiting private facilities, as the pregnant women visiting them may be different in many aspects.

INTRODUCTION

In the past two decades, concerted global efforts have led to increased coverage of maternal health services, even in poor resource settings[1, 2]. Yet, improvements in health outcomes did not always follow[2]. Every year, thousands of women die from pregnancy-related complications worldwide[3, 4]. The Sub-Saharan Africa countries, where Ethiopia is a part, accounted for over 86% of the global maternal deaths in 2017 [5]. Maternal mortality in Ethiopia stands at 412 deaths per 100,000 live births[6].

However, most maternal deaths are avoidable as health solutions to the causes of complications are well-known [3, 7]. The solution includes a strong health system that provides maternal services based on a continuum of care perspective [3]. As part of the continuum, the essence of antenatal care (ANC) serves as a platform for important health care activities [3, 8], including health promotion and disease prevention, screening, diagnosis, and management of pregnancy-related complications [9, 10]. As such, antenatal care creates a unique opportunity for early detection and management of hypertension, gestational diabetes, anemia, malaria, HIV, and other health conditions which otherwise would jeopardize the health of mothers and the growing fetus[11, 12].

Evidence demonstrated that in the presence of adequately resourced healthcare services and community mobilization, there is an opportunity to improve health service utilization and maternal

3

84   health outcomes [2, 13]. In this regard, the government of Ethiopia has made significant strides

85   towards availing health facilities closer to the community, mainly through constructing primary

86   health care facilities and launching the health extension program[14]. Establishing a voluntary

87   based women health development army (WHDA) to create awareness and increase demand for

88   health services at the community level and waiving user charges for maternity services were also

89   among the new endeavors that the government of Ethiopia has put in place [15].

90   While expanding access to health services is an important milestone in Ethiopia, many health

91   facilities started service provision without being adequately equipped with the necessary materials

92   and skilled health workforce[16]. For example, despite 80 percent of the facilities were providing

93   ANC, only 41 percent of them were in a position to provide a high-quality ANC service [16]. This

94   has contributed to a lower rate of maternal health utilization, including ANC services. Improving

95   the quality of ANC services is one of the key elements the health system has to invest in to reduce

96   maternal mortality [1, 3, 4].

97   The term quality of care is used widely as a key performance indicator, but there is no universally

98   agreed metrics to measure the quality of care for maternal and newborn health [17-19]. The term

99   quality is a complex concept and described from different perspectives[20]. In the Donabedian

100   model, quality is defined in terms of three major attributes: the structure (resources and

101   organizational structure in health care setting), process (how health service is delivered), and

102   outcome (effect of care on the status of the clients). In this model, client satisfaction was a part of

103   the outcome variables among others[21]. Client satisfaction can be defined as a patient's evaluation

104   of the services offered within the health system, relative to their expectations of care[20].

105   In the context of maternity care, a client-centered approach is an important way of understanding

106   the quality of services received or provided [22]. This is especially important in low-and

107   middle-income countries (LMICs) where it is recognized that women typically receive lower-

108   quality health services compared with women in developed countries[23].

109   In order to identify the action points to improve the quality of care the World Health Organization

110   (WHO) has developed a framework using different elements from the provision of care as well as

111   the experience of care, integral to maternal and newborn care provided in the facilities[22].

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112   However, little attempts have been made to provide a complete picture of the quality of ANC

113   delivered by the healthcare system in LMICs[24, 25].

114   A body of literature has examined the quality of antenatal care in Ethiopia, yet hardly was any

115   published data that examined all the dimensions of quality simultaneously. The available studies

116   focused largely on the availability of facility inputs [26] or service attendance [27-29], which

117   largely overlooked the information on the content and how care was delivered [30]. Moreover,

118   these studies did not consider the association between client satisfaction and quality measures of

119   the structure and process of ANC. On the other hand, although understanding pregnant women's

120   levels of ANC service satisfaction is imperative to design an approach to meet the needs and

121   expectations of pregnant women [20], this notion has little been explored.

122   Therefore, this study was aimed to; 1)describe the quality of ANC at public health facilities

123   including structure, process, and outcome dimensions; and 2) assess the relationship between ANC

124   satisfaction and structure and process dimension of ANC quality.

125   **METHODS**

126   **Study design and setting**

127   This was a cross-sectional study using a blend of methods (a facility survey, provider interview,

128   direct observation, and client exit interview). The study was conducted in five districts of West

129   Gojjam Zone, Northwest Ethiopia from July to August 2018. At the time of the survey, the Zone

130   had a population of 2,611,925 people with women of reproductive age (15-49) making 23.58 % of

131   the total population. The zone had 6 governmental hospitals, 103 health centers, and 374 health

132   posts. In addition, it had 114 private clinics and 1 private hospital. All maternal health services,

133   including ANC services, were provided free of charge in public health facilities[31].

134   **Study population and sampling**

135   The population consisted of public health facilities that provided ANC, pregnant women attending

136   ANC clinic, maternal health care providers, and health authorities working for the surveyed health

137   facilities.

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138 This study was part of a large project on the continuum of maternal health care that linked health

139 facility data with a household survey. A number of sampling methods can be used to link

140 characteristics of the sampled facilities to those of the serviced population, yet linking the sample

141 areas(clusters) is the best approach[32] and has been considered in this study. Full details of the

142 sampling procedure for the project have been reported elsewhere[33, 34]. In brief, data from

143 household surveys on access to maternity services were linked to health facility data in the same

144 district. The two studies were timed in such a way that one could inform the next.

145 As a first step, a community-based study was conducted using a multistage sampling procedure.

146 For this, the study area was first stratified into 13 rural districts and 2 town administrations. Then,

147 five districts of the zone (4 rural districts and 1 town administration) were selected by a simple

148 random sampling method. Next, 15 kebeles (3 kebeles from each district) were selected using a

149 simple random sampling technique. Kebele is the smallest administrative unit in the Ethiopian

150 context. Hence, in this study, the population-based study was the basis to identify the facilities to

151 be surveyed.

152 Secondly, the nearby public facilities at which the women sought care were identified during a

153 house-to-house survey. Once the health care facilities were identified by type and location where

154 they were found facility survey was done across all the selected facilities. The facility reported

155 basic maternity and reproductive health services (including ANC, facility delivery, postnatal care,

156 and family planning) during the last 12 months preceding the survey was the eligibility criteria to

157 select health facilities. The health facility survey was conducted in all the 15 public health

158 facilities: five primary hospitals and ten health centers.

159 All the health care providers that were engaged in the provision of ANC in the selected facilities

160 during the data collection period were included in the study. This approach is in accordance with

161 recommendations by Anthony G. Turner and colleagues [32].

162 For the satisfaction survey and clinical observation data, a sample size of 824 was calculated using

163 the single population proportion formula based on the following assumptions: 95% confidence

164 level; 5% margin of error, 42% service availability and readiness of public facilities for ANC in

165 Ethiopia [16], design effect of 2, and a 10% non-response rate. Then, the calculated sample size

166 was allocated to each health care facility based on the average daily load of ANC attendees for the

6

167 2016/17 fiscal year. From the sampled facilities, 795 women were selected using a systematic
168 sampling procedure with probability to proportional size method.

Data collection

170 In this study, an attempt was made to measure all dimensions of the quality of ANC services:
171 structure, process, and outcome**.** For each dimension of quality, a set of questions were adapted
172 from the WHO guidelines [3, 13], the Ethiopian demographic and health survey[35], and the list
173 of interventions recommended by the federal ministry of health of Ethiopia [36].

174 The survey comprised four main data collection methods: 1) Health facility surveys; 2) provider
175 interview; 3) direct observation of ANC consultations; and 4) exit interview with pregnant women.
176 Structured and pre-tested questionnaires were used for service providers and client exit interviews,
177 and checklists were used for facility survey and observation.

178 Experienced midwives who were not affiliated with the surveyed healthcare facilities collected the
179 data. In each health facility, a team consisting of two data collectors was assigned. While one of
180 the team members was responsible to carry out the observational study and conduct a healthcare
181 provider interview, the other was responsible for managing the exit interview and doing the facility
182 survey.

183 A facility survey of all the selected facilities was carried out to assess the availability of essential
184 materials and staffing. For staffing, the assessment checklist was based on the national staffing
185 standards for each type of health facility. A non-participatory observation was also made among
186 41 maternal health workers who were working at the ANC clinic during the time of the survey.
187 This was aimed to evaluate whether health care workers conformed in interaction and conducting
188 key ANC tests or examinations. When possible, the health workers who were observed were also
189 interviewed, but when this was not possible, other providers of antenatal care service were
190 substituted. Following her consultation, each pregnant woman was interviewed at the exit to assess
191 the level of satisfaction on the service she received.

Variables and Measurement

193 Structural quality was calculated at the facility level, while indices for process attributes and client
194 satisfaction were made at individual women level.

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195 **Outcome variable:** the outcome variable was ANC client satisfaction, and computed by

196 aggregating women's responses to a series of questions regarding the ANC visit using a principal

197 components analysis.

198 During the analysis, important assumptions including Bartlett's Test of Sphericity, Kaiser-Meyer-

199 Olkin (KMO) measure of sampling adequacy, and communalities scores were checked. The

200 Eigenvalue >1 was used to decide the number of latent variables that we did for extracting factors.

201 Initially, 24 variables were considered for the analysis but eventually, 12 variables were dropped

202 as they failed to meet the assumptions of PCA. An index was computed from the original variables

203 retained in the process. Thus, we computed a summed index from the retained items of the

204 components that explained 68% of the total variances.

205 Finally, the overall satisfaction index was developed by categorizing the sum of scores into a three-

206 point Likert scale: 0-50% as 'low satisfaction' (coded 1), 51-79 %(coded 2) as having 'moderate

207 satisfaction', and 80-100 %(coded 3) as 'high satisfaction'

208 **Main explanatory variables**

209 **Structural attributes:**

210 A facility inventory checklist with 47 items was used to assess the structural attributes of the

211 health facilities. Each item was scored '1' if the item was available and functional and a score of

212 '0' if this was not the case. The items in each construct were then added together, with equal

213 weights, to generate the following five indices: 1) an infrastructure index (7 items); 2) Health Staff

214 index (8 variables); 3) an equipment index (10 items); 4) Index for drugs and vaccines (14 items);

215 and 5) index for lab capacity and supplies (8 items) (supplementary file 1). Finally, we categorized

216 each index into three categories: poor structure quality, fair and good structure quality.

217 Furthermore, the overall summary score was constructed by aggregating the mean scores of all the

218 five dimensions of care and was set as the structure index.

219 **Process attributes**

220 The process attributes comprised interpersonal and technical aspects of the provider-client

221 interaction. Interpersonal aspects included issues such as greeting, maintenance of privacy, and

222 handling of client concerns. Technical aspects included observation of specific services performed,

223 such as history-taking, ANC physical examinations, counseling related to pregnancy, and

224 laboratory examinations.

8

225   A scoring system was established to calculate five dimensions of process attributes from 46 items:

226   (a) interpersonal communication(6 activities), (b) history taking(12 activities); (c) clinical

227   examination (9 activities); (d) counseling(10 activities); and (f) health screening and preventive

228   measures(9 services) (supplementary file 2). This scoring system categorizes whether an accepted

229   standard of quality has been met or not.

230   All the procedures/activities provided were weighted equally and was granted ''1'' if the activity

231   was observed and performed according to accepted standards of care, and a score of '0' if this was

232   not the case. The scores of the key items for each individual client-provider interaction being

233   observed were added up and averaged to determine a score for each dimension of care.

234   Furthermore, the overall summary score was constructed by aggregating the mean scores of all the

235   dimensions of care and was set as the process index. The total scores ranged between 0- 46.

236   Accordingly, the process of quality care was scored as follows: Low quality <23, Moderate quality

237   23- <37, and High quality ≥ 37.

238   **Other explanatory variables**

239   Other variables included were: i) Facility type, (ii) demographics, (iii) socio-economic, and (iv)

240   reproductive characteristics of the women.

241   The Cronbach's alpha was used to measure the internal consistency of a set of items for the three

242   quality dimensions, and a reliability coefficient of 0.70 or higher was considered acceptable[37].

243   **Data analysis**

244   The collected data were entered using the Epi-info version 7.0 and analyzed using STATA

245   software version 14.0. Owing to the ordinal nature of the outcome variable(low, medium, and high

246   satisfaction), a typical approach was to use the standard ordered logit [38]. Yet, the Brant test

247   revealed that the proportional odds assumptions were not fulfilled for some independent variables

248   ($\chi2$=63.4 df (16); p< 0.001). We, therefore, used a generalized ordered logistic regression with

249   auto fit, (also called partial proportional odds model) for assessing the association between

250   satisfaction and explanatory variables.

251   The partial proportional odds model is a hybrid of ordinal regression (same coefficients across the

252   categories) and the default gologit (different coefficients across categories). Hence, since the Brant

9

253 test was not met, the analysis gave two odds ratios for an explanatory variable [Low vs.
254 medium/high Satisfaction (OR1) and low/medium vs. high satisfaction (OR2)]. Whereas for
255 variables that did not violate the proportional odds assumption a single odds ratio, OR1 = OR2
256 (OR1 = 2) reported [38].

257 The bivariable gologit model was used for variable inclusion in the final multivariable model.
258 Accordingly, the independent variables to be included in the multivariable model were selected
259 when the p-value was <0.2 in the bivariable model. Before running the multivariable analysis
260 multi-collinearity test between independent variables was done using the Variance Inflation Factor
261 (VIF), and variables were not strongly correlated (the highest value was 2.7).

262 The final multivariable model was applied to define adjusted odds ratios (ORs), measuring the
263 effect of different determinants on being assigned to a higher satisfaction category. Statistical
264 significance for the final model was set at P < 0.05.

265 **Patient and public involvement**

266 Patients/public were not involved in setting the research question or the outcome measures, and in
267 the design and implementation of the study. Participation was voluntary based and no incentives
268 were provided. The findings of this study will be disseminated to policy-makers and local-level
269 service implementers.

270 **RESULTS**

271 **General characteristics of women**

272 Out of 824 eligible clients, 795 enrolled in the study yielding a response rate of 96.5%. The highest
273 percentage of women were rural residents 575 (72.3%), and belonging to the age range of 20-29
274 years 433(54.5%). Regarding their age, the mean and standard deviation were 27.8 and 5.9 years,
275 respectively. Of the total respondents, 63.4% did not attend formal education.

276 About one-third of the participants, 274(34.5) were first-time visitors for ANC, and more than half
277 of the women interviewed had their first ANC visit during their second trimester of pregnancy
278 (Table 1).

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279 Table1: Background characteristics of ANC clients interviewed in public health facilities of West Gojjam
280 Zone, Northwest Ethiopia (N=795)
281

Description	Number	Percent
Address		
Urban	220	27.7
Rural	575	72.3
Age (Years)		
15-19	91	11.4
20-29	433	54.5
30-39	236	29.7
40+	35	4.4
Education		
No formal Education	504	63.4
Primary Education (Grade 1-8)	212	26.7
Secondary education and above	79	9.9
Occupation		
Farmer	575	72.3
Employee	35	4.4
Merchant	53	6.7
Daily laborer	18	2.3
Others(*including Housewives)	114	14.3
Parity		
Nulliparous	182	22.9
Primipara 1	190	23.9
Para 2-4	321	40.4
Para 5+	102	12.8
Gestational age at time of the survey		
0-3 months	79	9.9
4-7 months	562	70.7
>=8 months	154	19.4
Number of ANC visits		
1	274	34.5
2-3	436	54.8
4+	85	10.7
Timing of first ANC visit		
First trimester	332	41.8
Second Trimester	419	52.7
Third Trimester	44	5.5
Distance to HCF		
Less than 1 hour	532	66.9
Greater or equal to 1 hour	263	33.1

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Health workers background characteristics

286 As can be seen in Table 2, forty-one health workers who worked for 15 public health facilities
287 were included in the study. The largest number of health workers observed in any one-health

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288 facility was four and the smallest was one. Most of the health providers were men (61%). The

289 median age of these health professionals was 29.0 years (range: 23 to 36 years) and the median

290 year of professional experience was 3.0 years (range: 1 to 12 years). This is an indication that most

291 of the providers had worked in their organization long enough to understand and give valuable

292 information to pregnant women (Table 2).

293 Table 2: Background characteristics of maternal health workers in public health facilities of West Gojjam
294 Zone, Northwest Ethiopia (N=41)
295

Characteristics	Number	Percent
Sex of the provider		
Male	25	61
Female	16	39
Median Age (Range)	29.0(23-36 years)	
Median Experience (Range)	3.0(1-12 years)	
Training received on;		
ANC screening	22	53.7
Counseling	21	51.2
BEmONC	27	65.9
Hypertension management	20	48.8
HIV/PMTCT	32	78.0
CRC	18	43.9
Personally supervised by the supervisor in the last 3 Months		
Yes	15	36.6
No	26	63.4

296 Note: CRC= compassionate and respectful care; BEmONC= Basic emergency obstetrics and newborn
297 care; ANC= Antenatal care; PMTCT=Prevention of mother to child transmission
298

Structural quality attributes

300 The analysis presented in table 3 characterizes the structural and process dimensions of ANC

301 quality, respectively. Despite there exists heterogeneity in the availability of different components,

302 the summary scores of the facility surveys were reasonably good (70 %). Laboratory consumables

303 were more likely to be available (80%) compared to other structural components. Nonetheless, the

304 availability of infrastructure and general amenities was particularly deficient (59%). Some

305 essential antenatal drugs such as magnesium sulfate, injectable antibiotics, and antihypertensive

306 drugs were not available during the time of the survey (64%) (Table3).

307 Table3: Results of structural and process quality components of antenatal care in selected public
308 health facilities of Northwest Ethiopia.
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ANC Quality Dimension	Subgroups	Mean Quality score
Structural Attributes (Health facility survey)	Minimum: 0.00-Max: 1.00	
	Number of health facilities	15
	Availability of infrastructure	0.59
	Availability of essential equipment	0.77
	Availability of staff, guidelines, and job-aids	0.71
	Availability of Drugs and vaccines	0.64
	Availability of diagnostic tests/Lab supplies	0.80
	Total structural Score	**0.70**
Process Attributes (Observational studies)	Minimum: 0.00-Max: 1.00	
	Number of pregnant women	795
	Interpersonal performance	0.60
	Technical skills	0.69
	- History taking	0.73
	- Clinical examination	0.70
	- Counseling	0.69
	- Laboratory examinations &preventive measures	0.63
	Total process Score	**0.65**

310
311 The availability of basic antenatal care items on the day of the survey varied widely by type of

312 facility, with hospitals generally better in the number of items to provide comprehensive antenatal

313 care. Some items were universally available across facility types, such as suction apparatus

314 (81.5%) and gloves (94.1 %). However, items such as manual vacuum extractor and calcium

315 gluconate in the health centers and insecticide-treated bed nets (ITNs) in hospitals were extremely

316 deficient **(Supplementary file 1).** The Cronbach's alpha value of all the items measuring structural

317 attributes of ANC quality was 0.74.

318 **Process quality attributes:**

319 **Interpersonal performance**

320 Generally, interpersonal aspects of quality were extremely low (average score of 60%), especially

321 concerning warm greeting and welcoming the client (49.9%) and self-introduction of the provider

322 (38.9%). However, this aspect was better in maintaining the privacy of women during the time of

323 consultation (i.e. both visual and auditory), which was observed in 80% of the consultations.

324 **Technical performances**

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325 The number of essential ANC services received by the surveyed women, on average, was
326 inadequate (60%). Looking in detail at the results of different dimensions, we found that some
327 aspects of technical performance scored poorly, especially health screening (63%) and counseling
328 (69%). However, eliciting the general history of pregnant women was rather better, 73% (Table
329 3).

330 There were variations in the frequency of carrying out a clinical examination and laboratory tests.
331 While some examinations were done regularly (e.g., weighing, blood pressure measurement, and
332 abdominal palpation), other tests or activities such as hemoglobin, urinalysis, and deworming were
333 done less often. For example, only 64% of the women were checked for anemia. Regrettably, only
334 2.3% of them received all essential laboratory tests and preventive medicines recommended by the
335 Federal Ministry of Health of Ethiopia. Among all the tests and interventions, screening for
336 asymptomatic bacteriuria (31.5%) and intervention for deworming (17.7%) were among the
337 lowest, compared to the HIV test (93%) (**Supplementary file 2**). The Cronbach's alpha value of
338 all the items measuring process attributes of ANC quality was 0.74.

339 **Client Satisfaction**

340 The respondent's level of agreement on the various aspects of antenatal care service satisfaction
341 was expressed on a scale ranging from 1 to 5. As can be seen in table 4 the mean level of
342 satisfaction ranged from 2.54 for the information received about breastfeeding after birth) to 3.71
343 (for those who reported their level of satisfaction about the advice they obtained about vaginal
344 bleeding).
345 Overall scores among the respondents revealed that 241(30.3%) of the clients were highly
346 satisfied, 302(38.0%) were moderately satisfied, and almost one-third, 252(31.7%) were
347 unsatisfied. The mean satisfaction score was 3.11, which is approximately equivalent to neutral on
348 the five-point Likert scale. The items were checked for reliability using Cronbach's alpha internal
349 consistency coefficient and the overall alpha value was 0.81

350 Table 4: level of satisfaction of pregnant women visiting public health care facilities in Northwest
351 Ethiopia.

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Satisfaction To what extent you agree with the following statements:	Very satisfied (%)	Satisfied (%)	Indifferent (%)	Dissatisfied (%)	Very dissatisfied (%)	Mean	SD
The health workers in this facility are very friendly and approachable	6.8	57.2	34.0	2.0	0	3.69	0.626
The health staff are courteous and respectful	4.5	40.8	42.4	11.5	0.9	3.37	0.778
The treatment and/or advice I received from the health worker is optimal	3.5	28.4	49.2	11.6	5.3	3.12	0.874
The provider gives me opportunities to express the concerns I have	2.0	24.4	54.0	17.0	2.6	3.06	0.773
The provider gave me chances to ask him/her questions	1.6	21.4	48.6	23.3	5.2	2.91	0.843
I am well informed on the birth preparedness	0.5	17.6	59.5	21.1	1.3	2.95	0.675
I am informed about breastfeeding after birth	-	2.1	56.1	35.0	6.8	2.54	0.654
I am told about how to recognize and proceed in case of vaginal bleeding	5.2	62.9	30.0	1.9	0.1	3.71	0.595
I am told about how to recognize and proceed in case of fever	0.6	28.7	45.0	18.4	7.3	2.97	0.887
I'm told about how to recognize and proceed in case of premature uterine contractions	1.0	12.7	62.1	18.9	5.3	2.85	0.739
I am told about how to recognize and proceed in case of severe headache	0.2	24.2	66.4	9.2	--	3.15	0.566
I'm told about how to recognize and proceed in case of difficulty in breathing	0.6	12.8	69.4	15.0	2.1	2.95	0.622
Average satisfaction						3.11	0.72

Overall satisfaction
    High satisfaction
    Moderate satisfaction
    Low satisfaction
	241 (30.3%)
	302 (38.0%)
	252 (31.7%)						

354   *Note: 1=very dissatisfied, 2=dissatisfied, 3=indifferent, 4=satisfied, 5=very satisfied; SD=standard*

355   *deviation*

356   **Factors associated with client satisfaction**

357   As stated earlier in the methods section we applied the multivariable partial proportional odds

358   regression model to examine the determinants of the overall satisfaction of pregnant women on

359   the antenatal healthcare service received. During the analysis, the three-scale dependent variable

360   produced two panels: panel-one (i.e., low vs. moderate/ high satisfaction); and panel two (low

361   /moderate vs. high satisfaction). In each group, the lower values were recoded to "0", while the

362   highest values were recorded to "1". A positive coefficient (equivalent to OR> 1) implied that

363   increases in the explanatory variable led to higher levels of client satisfaction, while negative

364   coefficient (OR <1) means that increase in the explanatory value led to less satisfaction [38].

15

365 The Brant test of parallel lines assumption ($\chi 2$=63.4 df (16); p< 0.001) revealed that women's

366 education, number of ANC visits, distance to a health facility, and index for clinical examination

367 were the variables that failed to meet assumption. For these variables, the coefficient estimates and

368 odds ratios were intended to differ in the two panels (categories) (Supplementary file 3).

369 After adjusting for all the covariates, significant differences in the ANC service satisfaction was

370 observed by process quality indicators and socio-demographic factors. Residence, distance to a

371 health facility, women's, education, number of ANC visits, and gestational age appeared to be

372 important predictors of satisfaction with antenatal care. Moreover, process quality indicators such

373 as history taking, clinical examination, counseling, and health screening also remained significant

374 in the final model (p < 0.05).

375 As women's educational status, number of ANC visits, distance to the healthcare facility, and

376 clinical examination did not satisfy the proportional odds assumption (the Brant test), $aOR_1 \neq aOR_2$

377 and separate interpretations at each category were therefore required for these variables. Hence,

378 aOR1 stands for panel one (low vs. moderate or high) while aOR2 was for the second panel (low/

379 moderate vs. high satisfaction

380 In this regard, women with better schooling [aOR1=3.11(95% CI 2.02, 4.81)], and those with

381 increased number of ANC visits [aOR1 = 4.16 (95% CI 1.66, 10.23)] were significantly associated

382 with increased odds of having moderate or high satisfaction, but no significant difference observed

383 for low/moderate vs. high scores. However, the findings revealed that living within 60 minutes

384 walking distance significantly reduced the odds of being satisfied [low vs. moderate/high scores,

385 aOR1 = 0.29 (95% CI 0.18, 0.46)] though it failed to achieve statistical significance in the second

386 category[low/moderate vs. high scores].

387
388 Being better in clinical examination of the process dimension was positively and significantly

389 associated with the two satisfaction categories [Low vs. moderate/high: aOR_1 = 1.69 (95% CI 1.13,

390 2.54)], and [low/moderate vs.high:aOR_2=4.09(95%CI2.69, 6.24)]. As can be seen in Table 5, the

391 effects became much stronger when satisfaction level moved from low to high category.

392 However, variables that did not violate the assumption had a single beta coefficient at each of the

393 two satisfaction categories; and hence a single aOR1 =2 was reported. Client satisfaction was

394 associated with better process scores. Better scores in history taking [aOR_1 = aOR_2; 1.81 (95% CI

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395 1.25, 2.60)], counseling performance [aOR_1 = aOR_2; 1.89 (95% CI 1.33, 2.69)], and health

396 screening and preventive measures [aOR1 = 2; 18.10 (95% CI 11.52, 28.39)] were associated with

397 achieving higher ANC satisfaction scores.

398 Similarly, being a rural resident was significantly associated with achieving a higher satisfaction

399 score [aOR_1= aOR_2; 1.89 (95% CI 1.05, 3.41)]. For every one month increase in gestational age

400 of a pregnancy, however, the odds of having above a particular satisfaction category was decreased

401 by a factor of 0.87[OR_1 = OR_2; 0.87 (95% CI 0.78, 0.97)] (Table 5).

402 Table 5: multivariable partial proportional odds model showing factors affecting ANC satisfaction in
403 West Gojjam Zone, Northwest Ethiopia (n=795)
404

Explanatory Variables	Outcome variables (panels)			
	Panel One (1 Vs. 2 and 3)		Panel Two (1or 2 Vs 3)	
	aOR 1 (95%CI)	Coefficients not varying(OR1=OR2)	aOR2(95%CI)	Overall P-value(s)
Education of women -Attended at least primary education - No schooling[Ref])	**3.11(2.02,4.81)***		1.34(0.97,1.86)	**0.001**/0.073
Number of ANC visits - >=4 - <4 visits[]Ref)	**4.16(1.66,10.23)***		0.99(0.51,1.95)	**0.002**/0.996
Walking distance to HCF - < 1 hour - >=1 hour [Ref])	**0.29(0.18,0.46)***		0.64(0.39,1.04)	**0.001**/0.072
Clinical examination - At least fair - Poor[Ref])	**1.69(1.13,2.54)***		**4.09(2.69,6.24)***	**0.011/0.001**
Address (Rural, Urban[Ref])		**1.89(1.05,3.41)***		**0.035**
Age in years - Greater or equal to 20 - 15-19[Ref])		1.10(0.80,1.50)		0.561
Parity - Para 1+ - Nulliparous[Ref]		0.80(0.63,1.01)		0.065
Gestational age in months(Cont.)		**0.87(0.78,0.97)***		**0.01**
Service year of providers (year)(Cont.)		0.99(0.93,1.07)		0.95
Supervision received in the last 3 months - Yes		1.34(0.80,2.26)		0.264

17

- No [Ref])				
Infrastructure - At least fair, - Poor[Ref])		0.78(0.56,1.08)		0.138
Drug availability - At least fair - Poor[Ref])		0.95(0.70,1.28)		0.728
Interpersonal index - At least fair - Poor[Ref])		1.16(0.88,1.54)		0.291
History taking - At least fair, - Poor[Ref])		**1.81(1.25,2.60)***		**0.002**
Counseling performance - At least fair - Poor[Ref])		**1.89(1.33,2.69)***		**0.001**
Laboratory tests and preventive measures - At least fair - Poor[Ref])		**18.09(11.52,28.39)***		**0.001**

405
406 Note. * indicates< 5 % level of significance; 1=low satisfaction; 2= moderate satisfaction; and 3= high
407 satisfaction; Ref= reference category.

DISCUSSION

409 In this study, we analyzed a comprehensive range of structural and process-related factors and

410 some individual characteristics associated with ANC's satisfaction. The study identified critical

411 gaps in the quality of routine antenatal care and women's satisfaction with antenatal care was low

412 at public health facilities. The contents of antenatal services covered during client-provider

413 interaction were the main factors affecting their satisfaction. The study also revealed that

414 community features (e.g. residency) and individual women's characteristics including women's

415 education, number of ANC visits, and gestational age appeared to be important predictors of

416 satisfaction. However, we get hardly any significant relationship between structural attributes and

417 client satisfaction.

418 Client satisfaction with the quality of antenatal care services, as noted by Mai Do and colleagues,

419 has been increasingly recognized as an important outcome for the healthcare delivery system[39].

420 Nonetheless, our study found that only 30% of clients had high levels of satisfaction. This

421 proportion of satisfaction was less than the findings in South Ethiopia (32%), Uganda (40%), and

18

422 Oman (59%) [29, 40-42]. This lower figure is a serious concern given that low satisfaction may

423 adversely affect women's willingness to return and seek care for subsequent maternal services

424 including skilled birth and postnatal care[22].

425 Furthermore, our results revealed that all the dimensions of process quality including, history

426 taking, physical examination, counseling, and screening had positively significant impacts on

427 client satisfaction. Similar findings were also reported by other studies, which indicated a positive

428 association between clinical quality characteristics and client satisfaction [29, 43]. A study

429 conducted in India, for example, reaffirmed the importance of adequate clinical examinations in

430 defining clients' expectations and helping to establish trust between the client and providers [44].

431 It is, however, worth noting that there was no statistically significant association between client

432 satisfaction and all the structural aspects of care, which is consistent with results obtained in

433 previous studies [39, 45, 46]. This would seem to imply that the mere existence of services is not

434 a guarantee to bring satisfaction. Contrary to our findings, however, others [43, 47] showed the

435 positive influence of structural quality indicators on client satisfaction.

436 The available literature on the associations between maternal education and client satisfaction

437 reported inconclusive results. Chemir and colleagues from Ethiopia reported a negative association

438 between maternal education and service satisfaction [48]. Our study, on the contrary, showed that

439 better-educated women had a higher level of satisfaction than their counterparts did. This finding

440 is similar to that of Rahman and colleagues in Malaysia [40] who argued that educated women are

441 more aware of the actual procedures to expect during antenatal care.

442 Rural-urban divides of residence had a significant impact on client satisfaction, as was a distance

443 to the nearest health facility. We found a significant difference in levels of satisfaction between

444 urban and rural residents, with the highest satisfaction achieved among rural than urban dwellers.

445 Moreover, living within an hour walking distance to the clinic was significantly associated with

446 lower satisfaction. The result of this study is consistent with other studies [29, 49, 50]. Women

447 from rural areas, who also are supposed to live in the far distance, are more likely to have lower

448 expectations owing to their previous experience of healthcare and lower chance of exposure to

449 health care information, and therefore they tend to value service they are offered and more likely

450 to report higher levels of satisfaction [49].

19

451 Reproductive-related factors such as the number of antenatal visits and gestational age showed a

452 significant association with client satisfaction. Women who made four or more antenatal visits

453 were positively and significantly associated with the low vs moderate or high satisfactions category

454 despite the association turned insignificant in the low or medium vs. high satisfaction category. A

455 previous study conducted in Southern Ethiopia has also reported a similar finding[29]. The positive

456 association in this regard could be due to developing awareness through repeated visiting. Besides,

457 the repeated ANC visits could further improve the relationship between providers and women in

458 a positive direction, which in turn made them feel good towards the services [51].

459 Another notable finding in this study was the inverse relation between gestation age and level of

460 satisfaction. The possible reason for this negative association could be related to the fact that the

461 late trimester is a time when more complications can occur[52]. These complications could let

462 expectant mothers demand extra care and support; hence, they might be dissatisfied if the service

463 was not to their expectations.

464 Despite the important findings evolved in the present study, some caution needs to be taken in

465 interpreting the results as our study had the following limitations. First, our study assessed the

466 satisfaction level of pregnant women who attended public facilities only; yet, the degree of

467 satisfaction for women who attended private facilities might be rather different from our findings.

468 Second, the presence of an observer during the client-provider interaction could generate bias

469 through the Hawthorne effect. Nonetheless, the data collector spent more time at each health care

470 facility and observed many client consultations for each provider. In relation to this, Leonard et al.

471 reported that the quality of health workers' performance increased by 20% on average when being

472 observed but that was only temporary and 10-15 observations later the behavior of the providers

473 became normative[53].

474 Third, social desirability bias might also be a concern in cases that women in exit interviews feel

475 they need to respond in a way expected of them. Yet, satisfaction was measured using a summary

476 of the client's responses to a series of questions, which is less subjective than asking a single

477 question. In addition, the use of interviewers who were not affiliated with the surveyed facilities

478 might have mitigated against this.

479 Finally, we have been constrained by the lack of consistency in defining quality in the existing
480 literature. Hence, the definition we used could not be refined to certain variables listed by the
481 researchers. The unmeasured factors, however, might have influenced the client's satisfaction as
482 well.

CONCLUSIONS

484 The women's satisfaction towards antenatal care in public facilities was suboptimal and was
485 dependent on an interplay of factors at various levels. A significant contribution to the variation in
486 client satisfaction was mainly attributed to factors related to the contents of the care received than
487 do structural attributes.

488 Indeed, the study suggests that availing inputs may not be enough to ensure in bringing client
489 satisfaction. Rather, providers may need further supporting mechanisms to offer ANC that clients
490 regard as satisfactory. In so doing, facilities will increase the levels of providers' performance and
491 client satisfaction, and improve the overall quality of care offered at public health facilities.
492 Finally, the context of this study was an exclusively public health facility setting. Therefore, future
493 studies linking different health system complexities would add value to the evidence generated by
494 our study.

497 **Author Contributions:** AAE, GDA, and GTD conceived and designed this study; AAE, GDA,
498 and GTD participated in the data analysis and the interpretation of the findings. AAE wrote the
499 first draft of the manuscript and; AAE, GDA, and GTD made a critical review of the manuscript.
500 All authors read, edited, and approved the final manuscript.

504 **Competing interests:** None declared.

505 **Patient consent for publication**: Not required.

21

Ethics approval: the study received ethical approval from the Ethical Review Board of Bahir Dar University (protocol no.: 087/18-04). A formal letter of permission was granted from the Amhara Regional Health Bureau and line offices. The person in charge of each facility and care providers were informed and their agreement received before the onset of data collection. Moreover, all the study participants were informed about the purpose of the study, their right to refuse, and assurance of confidentiality. Then, informed verbal informed consent was obtained from each study participant. Personal identifiers were excluded from the data collection form to maintain privacy and confidentiality.

Provenance and peer review: Not commissioned; externally peer-reviewed.

Data sharing statement: All data relevant to the study are included in the article or uploaded as supplementary information.

REFERENCES

1.   Kanyangarara M, Munos MK, Walker N. Quality of antenatal care service provision in health facilities across sub–Saharan Africa: Evidence from nationally representative health facility assessments. Journal of global health. 2017;7(2).

2.   World Health Organization. Consultation on improving measurement of the quality of maternal, newborn and child care in health facilities: World Health Organization,; 2014. Available from: https://www.who.int/maternal_child_adolescent/documents/measuring-care-quality/en/.

3.   WHO. WHO recommendations on antenatal care for a positive pregnancy experience. World Health Organization Geneva, Switzerland; 2016.

4.   Raven JH, Tolhurst RJ, Tang S, Van Den Broek N. What is quality in maternal and neonatal health care? Midwifery. 2012;28(5):e676-e83.

5.   World Health Organization. Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF. UNFPA, World Bank Group and the United Nations Population Division; 2019.

6.   Central Statistical Agency (CSA) [Ethiopia] and ICF. 2016 Ethiopia Demographic and Health Survey Key Findings. Addis Ababa, Ethiopia, and Rockville, Maryland, USA. CSA and ICF, 2017.

7.   Say L, Chou D, Gemmill A, Tunçalp Ö, Moller A-B, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. The Lancet Global Health. 2014;2(6):e323-e33.

8.   Osungbade KO, Ayinde OO. Maternal complication prevention: evidence from a case-control study in southwest Nigeria. African journal of primary health care & family medicine. 2014;6(1):1-7.

9.   Kerber KJ, de Graft-Johnson JE, Bhutta ZA, Okong P, Starrs A, Lawn JE. Continuum of care for maternal, newborn, and child health: from slogan to service delivery. The Lancet. 2007;370(9595):1358-69.

10.   Finlayson K, Downe S. Why do women not use antenatal services in low-and middle-income countries? A meta-synthesis of qualitative studies. PLoS medicine. 2013;10(1):e1001373.

11.   World Health Organization. Daily iron supplementation in adult women and adolescent girls. Geneva, Switzerland. 2016. Available from:

22

544 https://www.who.int/nutrition/publications/micronutrients/guidelines/daily_iron_supp_womenandgirl
545 s/en/.
546 12.   Horn F, Sabova L, Pinterova E, Hornova J, Trnka J. Prevention of neural tube defects by folic acid-
547 awareness among women of childbearing age in Slovakia. Bratislavske lekarske listy. 2014;115(2):91-7.
548 13.   World Health Organization. Service availability and readiness assessment (SARA): an annual
549 monitoring system for service delivery: reference manual: World Health Organization; 2013. Available
550 from: https://www.who.int/healthinfo/systems/sara_reference_manual/en/.
551 14.   Medhanyie A, Spigt M, Kifle Y, Schaay N, Sanders D, Blanco R, et al. The role of health extension
552 workers in improving utilization of maternal health services in rural areas in Ethiopia: a cross sectional
553 study. BMC health services research. 2012;12(1):352.
554 15.   Primary health care systems (PRIMASYS): case study from Ethiopia, abridged version. Geneva:
555 World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO.
556 16.   EPHI, FMOH, WHO. Ethiopia Service Availability and ReadinessAssessment: 2016 Summary
557 Report. Addis Ababa Ethiopia. January 2016   https://www.washinhcf.org/documents/Final-SARA-
558 Report-Jan-2017.pdf Acess date: Nov 30,2017.
559 17.   Brizuela V, Leslie HH, Sharma J, Langer A, Tunçalp Ö. Measuring quality of care for all women
560 and newborns: how do we know if we are doing it right? A review of facility assessment tools. The
561 Lancet Global Health. 2019;7(5):e624-e32.
562 18.   Braithwaite J, Hibbert P, Blakely B, Plumb J, Hannaford N, Long JC, et al. Health system
563 frameworks and performance indicators in eight countries: a comparative international analysis. SAGE
564 open medicine. 2017;5:2050312116686516.
565 19.   Sheffel A, Karp C, Creanga AA. Use of Service Provision Assessments and Service Availability and
566 Readiness Assessments for monitoring quality of maternal and newborn health services in low-income
567 and middle-income countries. BMJ global health. 2018;3(6):e001011.
568 20.   Larson E, Sharma J, Bohren MA, Tunçalp Ö. When the patient is the expert: measuring patient
569 experience and satisfaction with care. Bulletin of the World Health Organization. 2019;97(8):563.
570 21.   Donabedian A. The quality of care: how can it be assessed? Jama. 1988;260(12):1743-8.
571 22.   Tunçalp Ö, Were W, MacLennan C, Oladapo O, Gülmezoglu A, Bahl R, et al. Quality of care for
572 pregnant women and newborns—the WHO vision. BJOG: an international journal of obstetrics &
573 gynaecology. 2015;122(8):1045-9.
574 23.   Sharma J, Leslie HH, Kundu F, Kruk ME. Poor quality for poor women? Inequities in the quality of
575 antenatal and delivery care in Kenya. PloS one. 2017;12(1).
576 24.   Afulani PA, Phillips B, Aborigo RA, Moyer CA. Person-centred maternity care in low-income and
577 middle-income countries: analysis of data from Kenya, Ghana, and India. The Lancet Global Health.
578 2019;7(1):e96-e109.
579 25.   Heredia-Pi I, Servan-Mori E, Darney BG, Reyes-Morales H, Lozano R. Measuring the adequacy of
580 antenatal health care: a national cross-sectional study in Mexico. Bulletin of the World Health
581 Organization. 2016;94(6):452.
582 26.   Desalegn DM, Abay S, Taye B. The availability and functional status of focused antenatal care
583 laboratory services at public health facilities in Addis Ababa, Ethiopia. BMC research notes.
584 2016;9(1):403.
585 27.   Alemu Y, Aragaw A. Early initiations of first antenatal care visit and associated factor among
586 mothers who gave birth in the last six months preceding birth in Bahir Dar Zuria Woreda North West
587 Ethiopia. Reproductive health. 2018;15(1):203.
588 28.   Ewunetie AA, Munea AM, Meselu BT, Simeneh MM, Meteku BT. DELAY on first antenatal care
589 visit and its associated factors among pregnant women in public health facilities of Debre Markos town,
590 North West Ethiopia. BMC pregnancy and childbirth. 2018;18(1):173.

23

591   29.   Lakew S, Ankala A, Jemal F. Determinants of client satisfaction to skilled antenatal care services
592   at Southwest of Ethiopia: a cross-sectional facility based survey. BMC pregnancy and childbirth.
593   2018;18(1):479.
594   30.   Hanefeld J, Powell-Jackson T, Balabanova D. Understanding and measuring quality of care:
595   dealing with complexity. Bulletin of the World Health Organization. 2017;95(5):368.
596   31.   West Gojjam ZoneHealth Office. The 2016/17 Fiscal Year Annual performance report of West
597   Gojjam Zone, Finote Selam ; July, 2017.
598   32.   Turner AG, Angeles G, Tsui AO, Wilkinson M, Magnani R. Sampling manual for facility surveys for
599   population, maternal health, child health and STD programs in developing countries. 2000.
600   33.   Emiru AA, Alene GD, Debelew GT. Women's retention on the continuum of maternal care
601   pathway in west Gojjam zone, Ethiopia: multilevel analysis. BMC Pregnancy and Childbirth. 2020;20:1-
602   14.
603   34.   Emiru AA, Alene GD, Debelew GT. The role of maternal health care services as predictors of time
604   to modern contraceptive use after childbirth in Northwest Ethiopia: Application of the shared frailty
605   survival analysis. PloS one. 2020;15(2):e0228678.
606   35.   Langlois ÉV, Miszkurka M, Zunzunegui MV, Ghaffar A, Ziegler D, Karp I. Inequities in postnatal
607   care in low-and middle-income countries: a systematic review and meta-analysis. Bulletin of the World
608   Health Organization. 2015;93:259-70G.
609   36.   FMOH. Basic Emergency obstetric and Newborn Care(BEmONC) training manual.Federal
610   Democratic Republic of Ethiopia Ministry of Health , Addis Ababa, Ethiopia, 2013.
611   37.   Hair J, Black WC, Babin BJ, Anderson RE. Multivariate data analysis: International version. New
612   Jersey, Pearson. 2010.
613   38.   Williams R. Generalized ordered logit/partial proportional odds models for ordinal dependent
614   variables. The Stata Journal. 2006;6(1):58-82.
615   39.   Do M, Wang W, Hembling J, Ametepi P. Quality of antenatal care and client satisfaction in Kenya
616   and Namibia. International Journal for Quality in Health Care. 2017;29(2):183-93.
617   40.   Rahman MM, Ngadan DP, Arif MT. Factors affecting satisfaction on antenatal care services in
618   Sarawak, Malaysia: evidence from a cross sectional study. SpringerPlus. 2016;5(1):725.
619   41.   Tetui M, Ekirapa EK, Bua J, Mutebi A. Quality of Antenatal care services in eastern Uganda:
620   implications for interventions. Pan African Medical Journal. 2012;13(1).
621   42.   Ghobashi M, Khandekar R. Satisfaction among expectant mothers with antenatal care services in
622   the Musandam Region of Oman. Sultan Qaboos University Medical Journal. 2008;8(3):325.
623   43.   Onyeajam DJ, Xirasagar S, Khan MM, Hardin JW, Odutolu O. Antenatal care satisfaction in a
624   developing country: a cross-sectional study from Nigeria. BMC public health. 2018;18(1):368.
625   44.   Rani M, Bonu S, Harvey S. Differentials in the quality of antenatal care in India. International
626   journal for quality in health care. 2007;20(1):62-71.
627   45.   Tafese F, Woldie M, Megerssa B. Quality of family planning services in primary health centers of
628   Jimma Zone, Southwest Ethiopia. Ethiopian journal of health sciences. 2013;23(3):245-54.
629   46.   Tancred T, Schellenberg J, Marchant T. Using mixed methods to evaluate perceived quality of
630   care in southern Tanzania. International journal for quality in health care. 2016;28(2):233-9.
631   47.   Owili PO, Muga MA, Mendez BR, Chen B. Quality of care in six sub-Saharan Africa countries: a
632   provider-based study on adherence to WHO's antenatal care guideline. International Journal for Quality
633   in Health Care. 2018;31(1):43-8.
634   48.   Chemir F, Alemseged F, Workneh D. Satisfaction with focused antenatal care service and
635   associated factors among pregnant women attending focused antenatal care at health centers in Jimma
636   town, Jimma zone, South West Ethiopia; a facility based cross-sectional study triangulated with
637   qualitative study. BMC research notes. 2014;7(1):164.

24

638   49.   Tran TK, Gottvall K, Nguyen HD, Ascher H, Petzold M. Factors associated with antenatal care
639   adequacy in rural and urban contexts-results from two health and demographic surveillance sites in
640   Vietnam. BMC health services research. 2012;12(1):40.
641   50.   Adeyinka O, Jukic AM, McGarvey ST, Muasau-Howard BT, Hawley NL. Predictors of prenatal care
642   satisfaction among pregnant women in American Samoa. BMC pregnancy and childbirth.
643   2017;17(1):381.
644   51.   Birhanu Z, Assefa T, Woldie M, Morankar S. Determinants of satisfaction with health care
645   provider interactions at health centres in central Ethiopia: a cross sectional study. BMC health services
646   research. 2010;10(1):78.
647   52.   Roomruangwong C, Kanchanatawan B, Sirivichayakul S, Maes M. High incidence of body image
648   dissatisfaction in pregnancy and the postnatal period: Associations with depression, anxiety, body mass
649   index and weight gain during pregnancy. Sexual & Reproductive Healthcare. 2017;13:103-9.
650   53.   Leonard K, Masatu MC. Outpatient process quality evaluation and the Hawthorne Effect. Social
651   science & medicine. 2006;63(9):2330-40.

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25

Supplementary file 1: Availability and functionality of items among hospitals and health centers offering antenatal care services in West Gojjam Zone, Northwest Ethiopia.

No	Items per dimension	Facility Type		Total (n=15)
		Hospital (n=5)	Health center (n=10)	
1	**Availability of infrastructure (7)**			
	▪ Water within the compound	5	5	10
	▪ Electricity from any source (e.g. electricity grid, generator, solar, or other)	5	5	10
	▪ Ambulance/any vehicle for emergence (available free of charges)	4	4	8
	▪ Functioning landline telephone or a mobile phone supported by the facility	5	6	11
	▪ Functioning computer	4	6	10
	▪ Internet access within the facility	1	---	1
	▪ Separate room for ANC consultations with auditory and visual privacy	5	8	13
	Group average			**9**
2	**Essential equipment(10)**			
	▪ Blood pressure apparatus	5	8	13
	▪ Stethoscope	5	9	13
	▪ Thermometer	4	7	11
	▪ Adult scale(Functional)	8	5	12
	▪ Fetoscope	5	10	15
	▪ Gloves(non-sterile)	5	10	15
	▪ Gloves sterile	5	9	14
	▪ Vacuum aspiration equipment (MVA) set	5	3	8
	▪ Suction apparatus	5	7	12
	▪ MUAC Tape mother	3	6	9
	Group average			**12**
3	Availability of essential drugs and vaccines (14)			

1

• Tetanus toxoid	5	10	15
• Iron/ Folic acid	4	9	13
• IV fluids(of any type)	5	7	12
• Magnesium sulfate (injection)	3	---	3
• Calcium gluconate	2	-----	2
• Antiretroviral drugs	5	4	9
• Insecticide treated bed nets	------	2	2
• Anti-malaria drugs (Quartum, Quinine, and other)	4	7	11
• Anti-helminthes (mebendazole or others)	5	9	14
• Cotrimoxazole	5	8	13
• Parenteral antibiotics	5	3	8
• Methyldopa or propranolol or any other antihypertensive	5	3	8
• Diazepam (injection)	4	5	9
• Parenteral oxytocic	5	10	15
Group average			**10**
4	Diagnostic Capacities (8)			
	▪ Urine pregnancy test (HCG)	4	5	9
	▪ Hemoglobin test	4	6	10
	▪ Blood and Rh grouping	5	8	13
	▪ .Malaria diagnostic capacity	5	9	14
	▪ Proteinuria test	5	7	12
	▪ RPR for Syphilis	4	8	12
	▪ HIV test	5	8	13
	▪ Urinalysis for bacteriuria	5	8	13
	Group average			**12**
5	Staffing and guidelines/job aids	Standard	Available	Standard	Available	

2

I	Staffing					
	Generalist(non-specialist) medical doctors	14	5	1	---	5
	Gynecologist and obstetrician	2	------			----
	Health officer			2	10	10/10
	Nurses of all categories	97	1	5	10	11
	Midwives	13	4	3	8	12
	Laboratory technicians/technologists	10	5	2	10	15
	Pharmacist or pharmacy technician	10	4	3	9	13
II.	ANC checklists and/job aids		Hospital	Health center		
			4	7		11
	Group average					11
	Total structural Score (Average)					11

Note: MUAC=mid upper arm circumference; ANC=antenatal care; HCG=Human chorion gonadotropin hormone; MVA=manual vacuum aspiration;

3

Supplementary file 2: Summary of the procedures and processes of care provided during antenatal visit in west Gojjam Zone, Northwest Ethiopia

	Clinical observation	Facility type		
1	**Interpersonal performance(6)**	**Hospital (n=130)**	**Health Center (n=665)**	**Total (n=795)**
1	The health worker greeted women in a friendly way	62	335	397
2	The health worker introduced him self	49	260	309
3	The health worker called the client by name	77	291	368
4	The health worker ensured privacy (visual and auditory)	103	533	636
5	The health worker encouraged women to ask questions	99	576	675
6	Gave attention to what the woman talks about	78	398	476
	Average			**477**
2	**Technical performance(40)**			
A	**History taking(12)**			
1	The health worker asked or checked client card about her age	97	525	622
2	The health worker asked about number of previous pregnancies	100	513	613
3	The health worker asked about duration of present pregnancy	102	555	657
4	The health worker asked about the previous obstetric history, if relevant (such as stillbirth, abortion, neonatal loss…)	82	436	518
5	The health worker asks asked about any co-morbidity(hypertension, diabetic mellitus)	86	438	524
6	The health worker asked whether the woman feel fetal movements, if relevant [consider gestational age and parity]	96	472	568
	Asks whether she has experienced any of the following for current pregnancy:			

1

7	Vaginal bleeding	96	510	606
8	Fever	92	471	563
9	Severe headaches and/or blurred vision	99	518	617
10	Swollen face or hands	104	541	645
11	Convulsions or loss of consciousness	72	402	474
12	Severe abdominal pain	94	467	561
	Average			580
B	Clinical Examination (9)			
1	Check body weight	95	484	579
2	Take blood pressure	91	455	546
3	Measured mid upper arm circumference (MUAC)	60	348	408
4	Check signs of anemia	84	432	516
5	Check for edema	102	452	554
	Performs the following steps for abdominal examination:			
6	Inspect abdomen	108	556	664
7	Palpate abdomen for size and fetal position	111	574	685
8	measure fundal height with measuring tape	78	414	492
9	Checks fetal heart rate with fetoscope	92	474	566
	Average			**557**
C	Laboratory tests &preventive measures (9)			
	Laboratory examinations(6)			
1	urine protein test	120	379	499
2	Urinalysis for bacteriuria	39	211	250

2

3	Hemoglobin or Hematocrit	76	379	455
4	Blood grouping (ABO type and Rhesus factor)	98	469	567
5	Test for Human immune-deficiency virus (HIV)	120	619	739
6	Syphilis test using rapid plasma regain(RPR)	74	373	447
	Preventive measures(3)			
7	check for anemia and prescribed iron/folic acid	117	575	692
8	Deworming checked and given if eligible	26	115	141
9	Tetanus toxoid immunization status is checked and given	117	605	722
	Average			**501**
D	Counselling given on the following topics(10)			
1	Advantages of facility delivery	95	476	571
2	Birth preparedness &emergency readiness	100	503	603
3	Diet and nutrition	106	556	662
4	Personal hygiene and self-care	94	465	559
5	Importance of bed-nets	68	505	573
6	Information on signs of true labor	78	385	463
7	postpartum family planning	61	316	377
8	Mother to child transmission of HIV and its prevention	106	550	656
9	Counsel on sexually transmitted infections including syphilis	75	377	452
10	Danger signs of pregnancy and actions to be taken	102	472	574
	Average for counseling			**549**
	Average for technical performance			**475**

3

Supplementary file 3: Brant test of parallel regression assumption using the 5 percent level of significance

SN	Variables	P- value
1	Address	0.5174
2	Age of women	0.0760
3	Educational status	**0.0007**
4	Distance to health facility	**0.0036**
5	Number of live births	0.6005
6	Gestational Age at the time survey	0.1948
7	Number of ANC visits	**0.0075**
8	Service Year of the provider	0.6578
9	Supervision received by the provider	0.1059
10	Availability of Physical infrastructure(composite index)	0.2240
11	Availability of essential drugs (composite index)	0.3239
12	Interpersonal communication (composite index)	0.3559
13	Skills in history taking (composite index)	0.5167
14	Skills in physical examination (composite index)	**0.0005**
15	Counseling skills (composite index)	0.8421
16	Health Screening (composite index)	0.1398

Note: A significant test statistic provides evidence that the parallel regression assumption has not been fulfilled.

1

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	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	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2-5
Objectives	3	State specific objectives, including any prespecified hypotheses	2
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,6,7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7,8,9
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	*7,8,9*
Bias	9	Describe any efforts to address potential sources of bias	6,9,10
Study size	10	Explain how the study size was arrived at	5,6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9-10
		(*b*) Describe any methods used to examine subgroups and interactions	9-10
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	9-10
		(*e*) Describe any sensitivity analyses	9-10
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	10
		(b) Give reasons for non-participation at each stage	10
		(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	10,11,12
		(b) Indicate number of participants with missing data for each variable of interest	10,11,12
Outcome data	15*	Report numbers of outcome events or summary measures	14

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	15-17
		(*b*) Report category boundaries when continuous variables were categorized	17
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	17
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	12-13
Discussion			
Key results	18	Summarise key results with reference to study objectives	17-19
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	19-20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	20
Generalisability	21	Discuss the generalisability (external validity) of the study results	20
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	21

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.