Adherence level of Health care Providers to first visit antenatal care guideline and its effect on perinatal outcome in Tigray public Health institutions, 2017/18: Cohort study

Abera Haftu Melkamu (✉ aberahaftu@gmail.com)

Mekelle University

Tesfay Adhena Hailu

"axum university

Brhane G/her G/micheal

Mekelle University

Hadgay Hagos Adhanu

Mekelle University

Mhiret-AB Mehari Reda

Mekelle University

Assefa Hagos Kebede

Mekelle University

Tsige Araya Hailu

Mekelle University

Hailemaryam Berhe Kahsa

Mekelle University

Haftu Berhe Gebru

Mekelle University

Alemayehu Bayray Kahsay

Mekelle University

Research article

Abstract

Background: Antenatal care is one of the medical services delivered to pregnant women for the safety of the mother and the neonate. Guidelines are developed to ensure quality, uniformity and consistency of care for clients. One of the guidelines is focused antenatal care. Despite this fact, there is a paucity of information regarding the adherence of health professionals in the implementation of the guidelines and its effect on the perinatal outcomes.

Objective : To assess adherence level of health care providers to first visit antenatal care guidelines and its effect on perinatal outcomes among mothers in Tigray Public health institutions in 2017/18.

Methods : Cohort study design was employed with sample size of 1545. Among the participants 501(496 with complete follow up) were recruited to exposed groups and 1044 for non-exposed groups. The ratio of exposed to non-exposed group was 1:2. In the selection of study sites simple random sampling method was used but to select study participants consecutive sampling technique was employed. Women with full adherence to the first antenatal guideline were considered as exposed group, whereas those with incomplete adherence were considered as non- exposed group. It was assumed that the risk of complication among the non-exposed group was twice as that of the exposed group. Data was entered to Epi data version 3.51 and exported to SPSS version 20 for further analysis. Binary logistic regression was employed to determine the associated factors and multivariable analysis was done to control the confounding factors and significance was declared at CI of 95% and p-value of <0.05. Relative risk was used to express the association and effect of adherence on the perinatal outcome.

Result: Overall, the level of complete adherence to antenatal care guideline was 32.2% .The risks of antenatal, intranatal and neonatal complication was 21%, 41.3% and 26.8% respectively. The risk of maternal and neonatal complication is higher in non-exposed groups, pregnancy induced hypertension and postpartum hemorrhage risks were 1.6%:6.2% and 2.6%:4.3% among exposed and non-exposed groups and a neonatal complication of low birth weight and preterm labor was 5.8%:8.2% and 6.7%:8% among exposed and non-exposed groups respectively. Effect of complete adherence was found to be significant in reducing maternal and neonatal complications. Neonatal complications, anemia, postpartum hemorrhage and early neonatal death was reduced by 40% among the women with complete adherence, maternal sepsis and neonatal sepsis were reduced by 60% among the exposed groups and pregnancy induced hypertension was reduced by about 70% in women with complete adherence.

Conclusion and recommendations: Overall providers' complete adherence to antenatal care guideline at first visit influences both maternal and neonatal outcomes. On average the risks of developing antenatal, intranatal and post natal complications were reduced by almost 50% among the exposed groups. The Federal Ministry of Health and teaching institutions should capacitate their staff to strictly adhere to the implementation of the guidelines Key words: antenatal, adherence, perinatal outcome, providers

Background

Antenatal care is a kind of preventive service which is designed primarily for pregnant women. Its primary aim is preventing and detecting the problems that would affect both mothers and their infants during pregnancy index period (1).The optimal care which is considered adequate for pregnant women is four visits with the concept of focused antenatal care (2).

Every visit should include an adequate care to the whole condition of the pregnant women and it needs to incorporate four main categories of services: determining preexisting health problems, early detection of complication, health promotion and disease prevention and birth preparedness and complication planning. The first antenatal care visit is very important to identify women's category who need special care and who does not need special care, so health care providers should ensure that comprehensive services are provided (2).

Adherence to the standard guidelines plays an important role in ensuring the uniformity of clinical services and overall in improving the health status of the clients based on their specific needs (3). Many studies measuring the effect of the guidelines had shown significant improvement and better outcome in every process of health care related services (4). The first antenatal care visit is a good opportunity to predict those pregnant women's who would probably end up with unfavorable obstetrical outcome (2).

About 830 women die every day around the world which is related to pregnancy and child birth complications and most of these deaths are from third world countries (5). Between 1990 and 2015, maternal mortality worldwide dropped by about 44%. Between 2016 and 2030, as part of the sustainable development goals, the target is to reduce the global maternal mortality ratio to less than 70 per 100 000 live births. Most maternal deaths are preventable, as the health care solutions to prevent or manage complications are well known. All women need access to antenatal care in pregnancy, skilled care during childbirth, and care and support in the weeks after childbirth (6).

In order to provide adequate antenatal care (ANC), minimize maternal morbidity and mortality, and ensure safe labour and delivery and to provide sufficient post natal care a skilled provider is needed[6]. The 2016 EDHS result showed that among women who gave birth, 62% had attended their antenatal follow up at least once in their last birth (7). Maternal mortality (MM) ratio and the number of pregnant women who attended their ANC follow up, labour and delivery and postnatal follow by skilled man power are direct indicators of maternal and neonatal health (8). More than 80% of maternal deaths are related to direct causes (9). Adequacy and quality of ANC is considered as crucial and vital services in determining the pregnancy outcome. These services has been recognized as one of the pillars of safe motherhood, basic obstetrical care and it contributes a great role in the reduction of maternal and neonatal mortality. There are plenty of evidences that the newly adapted WHO guideline of FANC enhances quality of care and which is highly acceptable to clients and health care providers (10).

Although worldwide there has been a huge decline in maternal mortality ratio (MMR) sub-Saharan African countries still has the highest maternal mortality (11). Ethiopia is one of the sub Saharan countries with huge MMR which is 412 per 100,000 live births according to EDHS 2016.

There is evidence that proper implementation of guidelines in offering of health services not only improves the quality of care, but also fulfills client needs. Many epidemiological studies have illustrated that high level quality ANC is important in reducing perinatal complications and adverse pregnancy related outcomes (8).

Studies have shown that complete adherence to first antenatal visit guideline is low across health facilities. Implementation of the guideline is influenced by many different factors (12). Adherence has been defined as "following and implementing of officially recognized guidelines, protocols, standards and institutional requirements in acceptable fashion" (13). Many studies have been conducted on the coverage and determinants of ANC utilization in our settings but less emphasis have been given to the level of adherence towards the recommendation and its effect on perinatal outcomes. This study is therefore aimed to assess health care Providers adherence level to first antenatal care guidelines and its effect on perinatal outcomes in Tigray public health institutions.

Methodology

Study area and period

The study was conducted in Tigray Public Health institutions. Tigray is located in the Northern part of Ethiopia and around 783km away from the capital city Addis Ababa. Around 5.5 million people are found in this region (census 2007). The region is the owner of 216 health centers, 15 General Hospitals and 2 Referral Hospitals. Among the selected zones (southern, Mekele & southeastern zones) there are about 61 health centers , 5 Primary Hospitals, 1 Referral Hospital and 6 General Hospitals. The study was conducted from July 1, 2017 to December 2018.

Study design

Cohort study design was employed (retrospective & prospective)

Source Population

 Source population were women who come up for   labour and delivery services in Tigray Public Health institutions

Exposed group: Mothers who came to the health facility for delivery services whose first visit antenatal care guideline was complete.

Non-exposed group: Mothers who came to the health facility for delivery services whose first visit antenatal care guideline was incomplete.

Study population:

- All selected women who come for labour and delivery services in Tigray public health institutions.
- **Non-exposed group**: All selected mothers coming to the health facility for delivery services whose first ANC guideline visit was incomplete
- **Exposed group**: All selected mothers coming to the health facility for delivery services whose first ANC guideline visit was complete.

Eligibility criteria

Inclusion criteria

All women coming for delivery services in the public health facilities

Exclusion criteria

Women who has known medical illness (DM, HTN, CLD)

Sample size determination and Sampling procedures

Sample size

Sample size was calculated using double population proportion formula for cohort study considering the following assumptions:

CI=95%

Power-80%

A one-to-two ratio of exposure to non-exposure.

Since there is no documented evidence in the setting, it is assumed that the complication rate was twice as high amongst the unexposed group (incomplete adherence) as compared to exposed group (complete adherence).

By taking prevalence of pregnancy complication (PIH/preeclampsia-eclampsia) among the mothers with complete adherence to be 5.1% from previous study in Ghana (11).

$$n_1 = \frac{\left[Z_{\alpha/2}\sqrt{\left(1+\frac{1}{r}\right)P(1-P)} - Z_{\beta}\sqrt{P_1(1-P_1)+\frac{P_2(1-P_2)}{r}} \right]^2}{(P_1 - P_2)^2}$$

The final total sample size is 1002; multiplying by 1.5 of design effect the final result is 1503; 501 for exposed group and 1002 for non- exposed group.

Among these sample size 5 was lost during follow up for the exposed group and 42 extra samples was added to the non-exposed groups during selecting of the samples , finally 496 participants had completed their follow up for exposed groups and 1044 for non-exposed groups. A total of 1540 participants had completed the cohort follow up.

Sampling technique

Simple random sampling was used to select the study site and population proportion distribution was used for each selected health facility. Convenient sampling method was used to select the study participants. Women who have complete adherence to the first antenatal care guideline were considered as exposed group whereas those with incomplete adherence were considered as non-exposed group. Exposed and non-exposed mothers who fulfill the inclusion criteria were enrolled to the cohort study. Those selected participants were followed until the end of postpartum period (six weeks after delivery). Among the seven zones of the region 40% was selected by simple random selection technique. In this selected zones there are about 73 health facilities. By using simple lottery method 20 of them were selected. The sample size was distributed to each selected health facility by probability proportion to size (PPS) according to their ANC flow rate.

Data collection

Data collection tool and measurement

In this study, participants were interviewed using interview guide for their socio-demographic variables and a checklist was used to score provider adherence to antenatal care guidelines. Adherence to first antenatal visit guidelines was used as a proxy for adherence to guidelines in general. The questions on the checklist are based on the requirements for first antenatal visit as per the safe mother practice (SMP) and WHO focused antenatal care guideline. After recruiting the study participants to the exposed and non-exposed groups, they were followed till the end of the postpartum period (six weeks after delivery).

Data collection process

Every woman who got delivery services at the health facilities on any day, who met the inclusion criteria and provided informed consent for participation, were enrolled into the study. At recruitment, during the first antenatal visit professionals' performance to first antenatal visit was assessed using a standardized checklist from women's card to determine level of providers' adherence. All women were followed until 6 weeks postpartum to complete data collection on outcomes. Follow up were made during delivery, at sixth postpartum day and sixth postpartum week in the respective health institutions. In case of disappearance participants were given phone calls to trace them. 20 BSc degree midwives were recruited as data collectors. Similarly 3 MSc holders were assigned to supervise the data collection process. Data was collected from the antenatal card, by asking the mother directly and by following the mother prospectively until 6 weeks postpartum.

Variables

Dependent variables

Adherence level of health care providers and perinatal outcome

Independent variable

Socio-demographic factors (age, educational level, marital status and employment status)

Maternal factors (parity, trimester at first antenatal care visit, previous pregnancy history and number of times antenatal clinic was attended during pregnancy)

Neonatal factors (mode of delivery, duration of delivery, place of birth)

Operational definitions

Level of adherence: Each variable adhered to, scored a point of 1 while non-adherence scored 0. A total score of 18 was considered as complete adherence to guidelines. Non-adherence to any of the variables was classified as incomplete adherence.

Antenatal complication: having at least one of the following: anemia in pregnancy, pregnancy induced hypertension/pre-eclampsia/eclampsia, malaria in pregnancy, ante partum vaginal bleeding, malaria, IUFD/IUFG, PROM, Preterm labor.

Delivery complication: having at least one of the following: pregnancy induced hypertension/pre-eclampsia/eclampsia, ruptured uterus, and obstructed labor, vaginal tears, perineal tears, C/S, DD.

Post-delivery complication: having at least one of the following: postpartum hemorrhage, anemia, malaria, PIH & sepsis

Neonatal complication: having at least one of the following: preterm, post-maturity, low birth weight, neonatal jaundice, asphyxia, still birth and neonatal mortality.

Data processing and management

Data analysis

Epi data version 3.5.1 software was used for data entry and it was analyzed by SPSS version 20 software. Descriptive analysis was presented using mean and proportions. Data were presented using tables, figures and texts. Determinants of maternal and neonatal complications, as well as the effect of complete adherence on pregnancy outcomes was estimated and expressed as relative risks (RRs) with their 95% confidence intervals (CI). Binary logistic regression was used to see the association between variables. Significance was declared at P-value <0.05.

Data quality assurance

A standardized English version measuring questionnaire was adapted and translated into Tigrigna (local language) by experts then translated back to English to check for consistency. The questionnaire was reviewed by senior researchers and comments were incorporated for internal validity. In addition pre-test was done in 10% of the calculated sample size. Data collectors and supervisors were trained for 3 days on the tools and process of data collection. Collected data were checked by the supervisor and principal investigator for completeness of the data.

Ethical consideration

Ethical clearance was obtained from the institutional review board of Mekele University, College of Health Sciences and support letter was given by the Tigray Regional Health Bureau to the respective administrations of the health facilities. All participants were informed of the objective, anonymity of the study and they were also informed that they are free to withdraw at any time if they want to do so. Finally written informed consent was obtained from the participants.

Results

Socio demographic characteristics of study participants who gave birth in Tigray public health institutions

A total of 1545 participants were enrolled based on the eligibility criteria and the follow up was complete for 1540 (496 for exposed and 1044 for non-exposed groups) participants. The study participants mean age (SD) was 26.5±5.1 with minimum and maximum of 14 and 45 years respectively. (Table 1)

Table1: Socio demographic characteristics of study participants who gave birth in Tigray public health institutions, 2017. (N=1540)

Variables	Exposed group (%) N=496	Non-exposed group (%) N=1044	Total (%)
Age			
<=18	13(2.6)	32(3.1)	45(2.9)
19-25	219(44.2)	456(43.7)	675(43.8)
26-30	163(32.9)	356(34.1)	519(33.7)
31-35	73(14.7)	148(14.2)	221(14.4)
>=36	28(5.6)	52(5)	80(5.2)
Residence			
Urban	400(80.6)	781(74.8)	1181(76.7)
Rural	96(19.4)	263(25.2)	359(23.3)
Marital status			
Married	455(91.7)	964(92.3)	1419(92.1)
Single	33(6.7)	51(4.9)	84(5.5)
Divorced	7(1.4)	25(2.4)	32(2.1)
Widowed	1(0.2)	4(0.4)	5(0.3)
Religion			
Orthodox	467(94.2)	944	1411(91.6)
Muslim	24(4.8)	92(8.8)	116(7.5)
Catholic	2(0.4)	3(0.3)	5(0.3)
Protestant	3(0.6)	5(0.5)	8(0.5)
Educational level			
No education	89(17.9)	253(24.2)	342(22.2)
Read and write	36(7.3)	97(9.3)	133(8.6)
Primary school	117(23.6)	247(23.7)	364(`23.6)
Secondary school and above	254(51.2)	447(42.8)	701(45.5)
Occupation			
House wife	312(62.9)	648(62.1)	960(62.3)
Government employee	75(15.1)	150(14.4)	2259(14.6)

Nongovernmental employee	16(3.2)	53(5.1)	69(4.5)
Private organization	77(15.5)	155(14.8)	232(15.1)
Daily laborer	10(2)	15(1.4)	25(1.6)
Others	6(1.2)	23(2.2)	29(1.9)
Ethnicity			
Tigray	489(98.6)	1026(98.3)	1515(98.4)
Amhara	6(1.2)	15(1.4)	21(1.4)
Others	1(0.2)	3(0.3)	4(0.3)
Monthly income			
<=500 birr	11(2.2)	58(5.6)	69(4.5)
501-1500	97(19.6)	264(25.3)	361(23.4)
1501-3000	145(29.2)	343(32.9)	488(31.7)
3001-95000	118(23.8)	199(19.1)	317(20.6)
5001-10000	108(21.8)	165(15.8)	273(17.7)
>=10001	17(3.4)	15(1.4)	32(2.1)

Maternal and neonatal complications related characteristics among women who gave birth in Tigray public health institutions, 2017.

From the total sample both from the exposed and non-exposed groups the complication of antenatal, delivery/post-delivery and neonatal complications was 21%, 41.3% &26.8% respectively. Incidence of previous pregnancy complications among the exposed and exposed group were 6.2% and 9.2% consecutively

Postnatal follow up of study participants who gave birth in Tigray public health institutions

According to this study result women gave less attention to postnatal follow up, only few of them had completed their follow up in the normal standard. (Figure 1)

Health institutions of study participants who gave birth in Tigray public health institutions

The participants were from different health institutions starting from health center to referral hospital, majority of them were from general hospitals. (Figure 2)

Measuring adherence of health care providers among women who gave birth in Tigray public health institutions

Among the study participants, the providers adherence to antenatal care based on the checklist is 32.2%. Majority of the providers adhere to checking of the age of participants while half of them failed to adhere to providing of ITN which is 97.1% & 51.4% respectively. (Table 2)

Table 2: Adherence of health care providers to antenatal care guideline among women who gave birth in Tigray public health institutions. (N=1540)

Variable	Frequency	Percent
Level of adherence		
Complete	496	32.2
Incomplete	1044	67.8
Age checked		
Yes	1495	97.1
No	45	2.9
GA registered		
Yes	1461	94.9
No	79	5.1
Urine test done		
Yes	1457	94.6
No	83	5.4
Weight checked		
Yes	1472	95.6
No	68	4.4
Past medical history		
Yes	1263	82
No	277	18
Past obstetric history		
Yes	1260	81.8
No	280	18.2
Past gynecologic history		
Yes	1208	78.4
No	332	21.6
Past surgical history		
Yes	1203	78.1
No	337	21.9
Hemoglobin test done		

Yes	1433	93.1
No	107	6.9
BP checked		
Yes	1472	95.6
No	68	4.4
Iron tablet prescribed		
Yes	1441	93.6
No	99	6.4
Parity checked		
Yes	1464	95.1
No	76	4.9
Abdominal examination done		
Yes	1451	94.2
No	89	5.8
TT vaccinate recorded		
Yes	1400	90.9
No	140	9.1
ITN provided		
Yes	749	48.6
No	791	51.4
Screened for VDRL		
Yes	1329	86.3
No	211	13.7
Screened for HBSA		
Yes	1121	72.8
No	419	27.2
PITC provided		
Yes	1457	94.6
No	83	5.4

Incidence of maternal and neonatal complication

The overall risk of developing maternal and neonatal complications is higher among the non-exposed groups compare to their counterpart. Incidence of PIH and PPH is 4.7% & 3.7% respectively. Incidences of those two maternal complications among the exposed and non-exposed groups were 1.6:6.2 and 2.6:4.3% respectively.   (Table 3)

Table 3: Risk of maternal and neonatal complications among the two comparison cohort groups

Complication	Incidence (%) N=1540	Complete adherence N= 496	Incomplete adherence N= 1044	p-value
Maternal				
PIH	73(4.7)	8(1.6)	65(6.2)	0.000
Anemia	109(7.1)	27(5.4)	82(7.9)	0.085
PPH	58(3.7)	13(2.6)	45(4.3)	0.104
Maternal sepsis	123(8)	25(5)	98(9.4)	0.003
Critical condition	39(2.5)	14(2.8)	25(2.4)	0.617
ICU admitted	139(9)	19(3.8)	120(11.5)	0.000
Any Antenatal complication	324(21)	74(14.9)	250(24)	0.000
Delivery/post-partum complication	413(26.8)	91(18.3)	322(31)	0.000
Instrumental delivery	79(5.1)	19(3.8)	60(5.7)	0.000
Delivery by c/s	253(16.4)	58(11.7)	195(18.7)	0.000
Induced labor	121(7.8)	29(5.8)	92(8.8)	0.043
Neonatal				
Neonatal sepsis	145(9.41)	27(5.4)	118(11.3)	0.000
Early neonatal death	38(2.46)	10(2)	28(2.7)	0.431
Late neonatal death	28(1.81)	10(2)	18(1.7)	0.689
Asphyxia	130(8.44)	27(5.4)	103(9.9)	0.004
LBW	115(7.46)	29(5.8)	86(8.2)	0.095
Preterm	116(7.53)	33(6.7)	83(8)	0.368
Neonatal complication	413(26.81)	91(18.3)	322(31)	0.000

Determinant factors of provider adherence among women's who gave birth in Tigray public health institutions

Binary logistic regression was done to identify the determinant factors of health care provider adherence to antenatal care and significance was declared at p-value of 0.05 with CI of 95%. Independent factors

which were significant at bivariate logistic regression was taken to multivariate analysis for possible control of confounding factors. Woman whose spouse educational level with read and write was 1.74 more risky to have incomplete adherence when compare to those with educational level of secondary school and above. (ARR=1.74(1.11-2.74)). (Table 4)

Table 4: Determinant factors of health care providers' adherence to antenatal guideline among women who gave birth in Tigray public health institutions.

Variable	p-value	Unadjusted RR	Adjusted RR	p-value
Spouse educational level				
No education	0.000	0.542(0.390-0.752)	0.95(0.590-1.53)	0.835
Read and write	0.851	1.033(0.735-1.45)	1.74(1.11-2.74)	0.016
Primary	0.148	0.81(0.608-1.0.78)	1.05(0.748-1.478)	0.772
Secondary and above				
Income				
<=500	0.000	0.167(0.065-0.432)	0.188(0.071-0.499)	0.001
501-1500	0.003	0.324(0.156-0.674)	0.348(0.162-0.748)	0.007
1501-3000	0.007	0.373(0.181-0.767)	0.377(0.180-0.790)	0.010
3001-5000	0.082	0.523(0.252-1.086)	0.533(0.256-1.112)	0.094
5001-10000	0.143	0.578(0.277-1.205)	0.584(0.279-1.221)	0.153
>=10001				

Effect of complete adherence on risk of pregnancy complications

Overall the risks of developing maternal and neonatal complication was reduced significantly among women with complete adherence of first antenatal care guideline. The risk of antenatal complication was reduced by 45% among the exposed group (ARR= 0.55 (0.413-0.739)) and risk of delivery complication was reduced by 52% among the exposed groups (ARR=0.48(0.381-0.604)).   (Table 5)

Table 5: Effect of complete adherence on risks of pregnancy complications among women who gave birth in Tigray public health institutions.

Complication	Crude RR 95% CI	p-value	Adjusted RR 95% CI	p-value
Any antenatal complication	0.557(0.419-0.741)	0.000	0.553(0.413-0.739)	0.000
Any delivery/post delivery	0.498(0.397-0.625)	0.000	0.480(0.381-0.604)	0.000
Neonatal	0.504(0.387-0.655)	0.000	0.596(0.446-0.796)	0.000
Anemia	0.675(0.431-1.058)	0.086	0.584(0.366-0.930)	0.024
PIH	0.247(0.118-0.519)	0.000	0.262(0.122-0.565)	0.001
PPH	0.598(0.319-1.118)	0.107	0.625(0.322-1.214)	0.165
Maternal sepsis	0.512(0.326-0.806)	0.004	0.419(0.260-0.676)	0.000
Early neonatal death	0.747(0.360-1.545)	0.433	0.633(0.288-1.389)	0.254
Neonatal sepsis	**0.452(0.293-0.636)**	**0.000**	**0.395(0.251-0.622)**	**0.000**

Discussion

In this study a total of 1540 participants were enrolled to the cohort study, among this study participants 496 of them were enrolled to complete adherence. Overall the complete adherence to antenatal care guideline based on the checklist was about 32.2% and among the checklists' adherence of checking participants age was high when compare to the rest parameters which is 97.1%. A similar study done in Ghana, complete adherence was about 48.5% (3).

Globally, developing countries still experience a challenge of poorly implemented ANC programs with irregular clinical visits and long waiting times plus poor feedback to the women (14). A study in Hadiya zone, Ethiopia found that majority of the mothers who attended ANC did not receive adequate number of visits and initiated the visits later than recommended by the World Health Organization (15). This result is supported in this study that implementation of the guideline and providing of adequate antenatal care to pregnant women is still low. The consistency of the result could be because of similar population and similar culture of the nation.

In this study history of previous pregnancy complication was 8.2% which is consistent with a similar study conducted in Ghana which is around 7.7% (16). This might be due to the similar socio demographic characteristics because both countries are found in Africa, where they have a shared economic background.

In this study the overall antenatal complication was about 21% which is lower than the study conducted in Ghana where antenatal complication was 68.1% (3).This variation could be due to the programme and follow up implemented now in every country is strict and Ethiopia is one of the nations which follow this agendum. That might be the reason why antenatal complication is reduced. The incidence of PIH and PPH is about 4.7% and 3.7% respectively in this study. This study is different from a Ghana study which is 5.3% and 2.1% respectively for PIH and PPH (3). The variation of these results might be because of the time of study and nature of the countries.

The study showed that risk of delivery and postpartum complication was about 26.8% and the incidence of preterm labour, low birth weight and neonatal death was 7.53%, 7.46% and 1.83% respectively. This is not in line with a study from Ghana where the risk of post-partum complication was 68.6 % (3). Whereas the incidences for preterm labour, LBW and neonatal death were 5.3%, 6.1% and 1.4% respectively. This is almost similar to the study conducted here. The variation for the risk might be the site and the time of the study conducted.

There are many different factors which obscure adherence in different organizations. A study done in Mozambique showed that factors which deteriorate the quality of FANC and adherence were system and structure of a given organization, healthcare providers' related factors and from clients (2). In this study factors associated with providers' adherence were educational level and income of the study participants.

In this study there is a big variation among the exposed and non- exposed groups of study participants to develop antenatal, intranatal and postnatal complications. The risk among the non- exposed group is twice of the exposed group to the providers' adherence level, the result showed that the incidence of anemia, maternal sepsis, instrumental delivery, asphyxia and early neonatal death was 5.4:7.9%, 5:9.4%, 3.8:5.7%, 5.4:9.9% & 2:2.75 for exposed and non- exposed groups respectively. Effect of complete adherence on maternal and neonatal risks was profound and significant when compare to the women with incomplete adherence. The risk of neonatal complication, anemia, PPH and early neonatal death was reduced by 40% when compared to the non- exposed groups and maternal and neonatal sepsis was reduced by 60% and PIH was reduced by almost 70% among the women with complete adherence when compare to the other groups.

Strength and Limitations

Strength

More or less the participants had completed their follow up in good manner and the information obtained were primary and the data were collected from three big zones and would probably will be easy to generalize the finding.

Limitation

The limitation of this study was time consuming to recruit the study participants specially the exposed groups.

Conclusions

Overall providers' complete adherence to antenatal care guideline at first visit influences both maternal and neonatal outcomes. On average the risks of developing antenatal, intranatal and post natal complications were reduced almost by 50% among the exposed groups.

Recommendations

According to the result, complete adherence to antenatal guideline had played a great role in reducing of maternal and neonatal mortality and morbidity, so the FMOH and teaching institutions should give emphasis in empowering of the health professionals to adhere to the guidelines in an appropriate and standard manner. In addition, every health institution should supervise their workers during day to day activities how they implement the guideline.

Abbreviations

ANC: antenatal care

APH: antepartum hemorrhage

EDHS: Ethiopian demographic health survey

FMOH: federal minster of Health

MMR: maternal mortality ratio

PPH: postpartum hemorrhage

Declarations

Authors' contributions

Abera Haftu had participated starting from drafting of the proposal, data collection, data analysis and manuscript writing. Assefa Hagos and Tsige Araya drafted the proposal and revised it critically in the design and analysis of the research. Mhiret-AB Mehari was involved mainly in data collection, design and revising in draft of the manuscript and interpretation of the final result. Haftu Berhe, Alemayehu Bayray and Hailemaryam Berhe participated in analysis of the research and manuscript writing. Hadgay Hagos and Tesfay Adhena involved in data collection and manuscript writing. All authors read and approved the final manuscript.

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Competing interests

We have no any competing interest.

Availability of data and materials

The data sets used during the current study are available from the corresponding author on reasonable request.

Consent for publication

Not applicable.

Ethics approval and consent to participate

Ethical clearance was obtained from Mekele University, College of Health Sciences Ethical review board. Permission letters were also sought from Tigray Regional education Bureau and the letter was distributed to each selected sites. Written Informed consent from the participants was obtained after clear explanation of the purpose of the study.

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References

1. Amoakoh-coleman M, Agyepong IA, Kayode GA, Grobbee DE, Klipstein-grobusch K, Ansah EK. Public health facility resource availability and provider adherence to first antenatal guidelines in a low resource setting in Accra , Ghana. *BMC Health Serv Res*. 2016:1-9. doi:10.1186/s12913-016-1747-1.

2. Biza A, Jille-Traas I, Colomar M, et al. Challenges and opportunities for implementing evidence-based antenatal care in Mozambique: a qualitative study. *BMC Pregnancy Childbirth*. 2015;15(1):200. doi:10.1186/s12884-015-0625-x.

3. Amoakoh-Coleman M, Klipstein-Grobusch K, Agyepong IA, Kayode GA, Grobbee DE, Ansah EK. Provider adherence to first antenatal care guidelines and risk of pregnancy complications in public sector facilities: a Ghanaian cohort study. doi:10.1186/s12884-016-1167-6.

4. Lincetto O, Mothebesoane-Anoh S, Gomez P, Munjanja S. Antenatal Care.

5. Alkema L, Chou D, Hogan D, Zhang S, Moller AB, Gemmill A, 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. Lancet. 2016; 387 (10017): 462-74.

6. WHO, maternal mortality fact sheet 2016 , accessed on January 10, 2017 http://www.who.int/mediacentre/factsheets/fs348/en/

7. Central Statistical Agency Addis Ababa, Ethiopia The DHS ProgramICF Rockville, Maryland, USA Ethiopian Demographic and Health Survey 20168. factors influencing the quality of antenatal care in. 2009;(November).

8. Bereket Yohanes MT, Wondimagegn Paulos. Mothers￼ Utilization Of Antenatal Care And Their Satisfaction With Delivery Services In Selected Public Health Facilities Of Wolaita Zone, Southern Ethiopia. International Journal of Scientific and Technology Research. 2013;2(2).

9. Nadia Abd El-Hamed M RMH, Walaa Mohamed M , Sally Khairat A, Adel Mohemed S, Talaat Refaat I , Haitham Mohemed Abd Elmoneem. Egyptian Women's Satisfaction and Perception of Antenatal Care. International Journal of Tropical Disease and Health. 2012;2:145-56.

10. barriers to utilization of focused antenatal care among pregnant women in ntchisi district in malawi Christina Leah Banda Master ' s Thesis University of Tampere Tampere School of Health Sciences (Public Health). 2013.

11. Reference.MD. Definition of Adherence to guidelines. 2013. Available: http://www.reference.md/files/ D019/mD019983.html.

12. Amoakoh-coleman M, Agyepong IA, Zuithoff NPA, et al. Client Factors Affect Provider Adherence to Clinical Guidelines during First Antenatal. 2016;2:1-13. doi:10.1371/journal.pone.0157542.

13. Villar, J.; Bakketeig, L.; Donner, A., et al. The WHO Antenatal Care Randomized Controlled Trial: Manual for Implementation of New Model. 2002. p. 6-28.

14. Zeine A, Mirkuzie W, Shimeles O. Factors Influencing Antenatal Care Service Utilization in Hadiya Zone. Ethiopian Journal of Health Sciences. 2010; 20:75–82. [PubMed: 22434964]

15. WHO. Opportunities for Africa's newborns: Antenatal Care. 2013. Report. Available: http://www.who. int/pmnch/media/publications/aonsectionIII
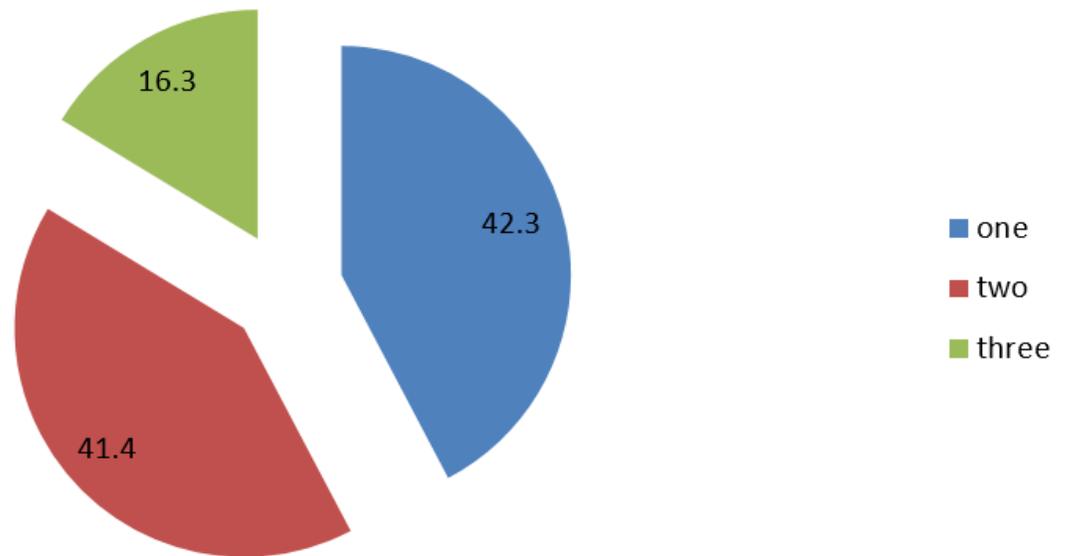
Figures

Figure 2

Postnatal follow up women's who gave birth in Tigray public health institutions

type of health facility

- health center — 16.60%
- primary hospital — 19.90%
- general hospital — 50.40%
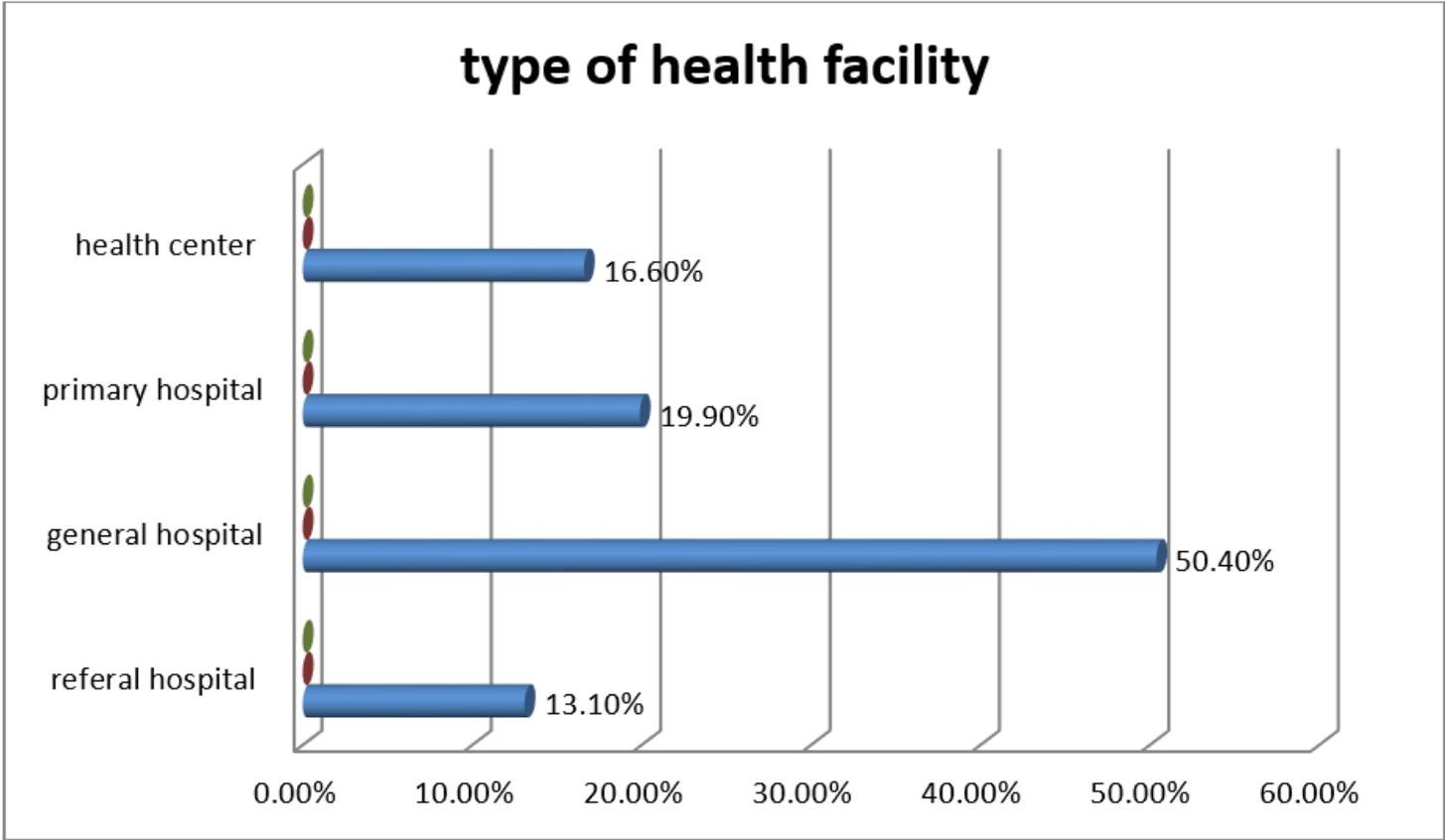- referal hospital — 13.10%

Figure 4

Type of health facility where women's gave birth in Tigray public health institutions