

# High prevalence of cesarean section delivery among health facilities delivered mothers in Bahir Dar city, Amhara region, Ethiopia. A comparative study

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## Research article

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# Abstract

Background Cesarean section delivery prevalence rate has been in an alarming increase worldwide each year; there are large disparities of CS proportion among women who give birth at a public and private health facility. However, there is a lack of evidence regarding the underlying factors and the proportion of CS delivery in public and private health facilities. Therefore this study aimed to assess and compare the prevalence of CS delivery and associated factors among public and private health facilities delivered mother in Bahir Dar city, Amhara region, Ethiopia, Methods An institution-based comparative cross-sectional study design was conducted from March 1-April 15, 2019 health facility in Bahir Dar city. Study participants 724(362 for each public and private facility) were recruited through a systematic random sampling technique. Structured interview administered questionnaires and chart review checklist were used to collect data. The data were entered with Epi info version 7.2 and analyzed using SPSS version 23.0 software. A binary logistic regression model was fitted and an adjusted odds ratio with 95% CI was used to determine the presence and strength of association between independent variables and cesarean section delivery. Results The response rate was 98.3% and 97.2% for public and private health facilities respectively. The prevalence of CS in private health facilities was 198 (56.3%) (95%CI: 50.9, 61.4) and 98 (27.5%) (95%CI: 22.8, 32.2) was in public health facilities. Overall prevalence of CS delivery was 296(41.8%) (95% CI: 38.4, 45.5). Breech presentation (AOR=3.64; 95%CI (1.49, 8.89), urban residence (AOR=6.54; 95%CI (2.59, 16.48) and being referred (AOR=2.44; 95%CI (1.46, 4.08) were variables significantly associated with CS among public facility whereas age between 15-24 (AOR=0.20, 95% CI; 0.07,0.52), governmental employee (AOR=2.28;95%CI (1.39,3.75), self-employed (AOR=3.73;95%CI(1.62,8.59), Para one (AOR=6.79;95%CI(2.02,22.79) Para two (AOR=3.88;95% CI(1.15,13.08), and wealth index being highest level of wealth asset AOR=5.39; 95%CI (1.08, 26.8) in private health facility: Conclusion and recommendation We concluded that there is a statistically significant difference in the prevalence of CS delivery in public and private health facilities. Therefore, there should be a mechanism for a medical audit of labor management.

## Background

Cesarean section (CS) is an operative technique by which a fetus is delivered through an abdominal and uterine incision(1). When adequately indicated it is one of the life-saving procedures that attributed to the decrease of the maternal and neonatal mortality and morbidity rates(2). Cesarean section was at first major operation for high-risk pregnancy. But, the capability to perform safe CS has been one of the major advances in obstetrics in the 20th century and contributed to the more frequent use of the procedure worldwide(3). The safety of the operation has improved with time, largely due to improved surgical and anesthetic techniques(4).

World Health Organization (WHO) suggested that the rates of the cesarean section should not exceed 15% since no additional benefit for the newborns or the mothers is obtained beyond this level based on

what is observed in developed countries. On the other hand, a rate of less than 5% would reflect the difficulty in access to adequate treatment(5). However, WHO released a statement indicating that "at the population level, CS rates higher than 10% were not associated with reductions in maternal and newborn mortality rates(6).

Despite this WHO recommendation, many works of literature have shown the CS rates are rising in developing and low-income countries, just as in their developed country counterpart (7). Sub-Saharan Africa still has the lowest rates of CS delivery, with many countries having national CS rates below 5%(8). There is an inequitable distribution of CS delivery, even within the poor countries; with urban resident women having better access and more CS deliveries than their rural neighbors(9, 10).

The reasons for the rise in the rate of cesarean section delivery include in part an increase in the facility-based delivery and access to health care (11). The national prevalence of CS delivery in Ethiopia is far below the WHO optimum range, 5-15%(12). The figures across the sub-national regions are variable, ranging from <1% - 25%(9).

Ethiopia is among the countries having good progress in reducing maternal mortality with access to obstetric care including Caesarean sections delivery (10).

Cesarean sections are comprehensive obstetrics care service which, prevent both maternal and neonatal morbidity and mortality, however, there are short and long-term risks and high cost associated with CS, and there are no health benefits of CS when the procedure is performed without a medical indication, and there is evidence that maternal death and disability is higher after CS than vaginal birth(13). Studies show the cesarean section (CS) prevalence rate has been in an alarming increase worldwide each year(14).

The national prevalence of cesarean section delivery in very low-income countries like Ethiopia requires specific attention, considering that access to CSs is still insufficient, whereas CSs seem to rise inappropriately in private facilities and some urban setting(15). Both situations are unwanted and it is important to understand the underlining causes to put in place interventions to prevent maternal morbidity and mortality (16). CS delivery is increasing in Ethiopia, which is indicative of access to obstetric care service in the country(17).

WHO published the first new global guidelines on non-clinical interventions, specifically designed to reduce unnecessary CSs delivery(18). However, a little has been known about factors associated with increase CS delivery and there is limited information concerning the prevalence of CS delivery in public and private health facility in Amhara region. Therefore, this study aimed to assess and compare cesarean section delivery and its associated factors among public and private health facilities delivered mothers in Bahir Dar city.

# Methods

## Study Area

The study was conducted among health facilities in Bahir Dar city. Bahir Dar is the capital city of the Amhara National Regional State in the Federal Democratic Republic of Ethiopia. According to the Amhara Bureau of Finance and Economic Development (BOFED), the population of Bahir Dar city was estimated to be 339,683. Among these, 156,376 of them are females. The city has one specialized, one referral and one primary government hospitals (Tibebe Giwon, Felege Hiwot, and Adiss Alem respectively), 11 health centers (including one private health center), 10 health posts and one family guidance association clinic, 4 private general hospital, and 35 medium private clinics, among all 4 public and 5 private health facilities provide Emergency Obstetric and Newborn Care service. According to the Bahir Dar city zone health department 2010 E.C report, there were 15,208 annual deliveries and among this 4,160 had CS deliveries (19).

## Study Design and period

An institutional-based comparative cross-sectional study was conducted from March 1 to April 15, 2019.

## Population

All Women who gave birth in public and private health facilities of Bahir Dar city were the source of population. Women who gave birth in selected public and private health facilities in Bahir Dar city during the study period was the study population

## Sample Size Determination

### Sample size using double proportion formula

The estimated sample size was calculated considering CS proportion( public facility 34% and private facility 47%) from previous study finding in Addis Ababa ((17) by using a double proportion formula( $N$  (in each group) =  $(p_1q_1 + p_2q_2) (f(a,b)) / ((p_1 - p_2))^2$ ). Taking assumptions of power 80, design effect 1.5 then after the calculated sample size was 657. The sample size for factors associated with CS delivery was also calculated using Epi info version 7.2.2 and found to be less than the sample size for the proportion of CS.

Therefore, by adding a possible 10% none response rate the estimated sample size for this study was 724 (362 and 362 subjects study for the public and private facility).

## Sampling Procedure

A multistage systematic random sampling procedure use used. From a total of 9 health facilities (4 public and 5 private) which provide a comprehensive obstetric and newborn care in Bihar Dar city, 3 public and 4 private health facilities were selected using random sampling and included in the study. The required sample size from each group was proportionally allocated using stratified sampling for selected health facilities in each group, based on the previous year's week's average number of client flow. The six-week average client flow of the selected health facilities, Flege Hiwot Referral Hospital, Addis Alem hospital, Bahir Dar health center, GAMBY hospital, Mari stop, Addinas General hospital, and Dr. Amiro MCH specialty clinic were 521,254,363,72,393,173 and 124 respectively. The proportional allocation was done for each facility in each stratum. Systematic random sampling was used to select each study subject. The first case was randomly selected after calculating the interval for both public and private facility and then every 3<sup>rd</sup> case for public and every 2<sup>nd</sup> case for private health facilities were selected from the delivery record till the required sample size was achieved for each facility.

## Operational Definitions

**Medical factors:-** Obstructed Labor, Cephalo-pelvic disproportion, Antepartum hemorrhage, Previous cesarean section scar, Mal-presentation, Preeclampsia/ eclampsia syndrome, Failure to progress, Failed induction, Suspected uterine rupture, Cord prolapsed, Non-reassuring fetal heart rate pattern and post-term (2).

**Cesarean delivery on maternal request:** - defined as a primary cesarean delivery done on request from the mother in the absence of any medical or obstetric indication(6).

## Data Collection Tool and Procedure

The questionnaire and checklist were adapted through reviewing of different works of literature and previous similar studies (17, 20-24). The questionnaire was initially prepared in English, then translated to Amharic, and then translated back into English to check for consistency. A structured questionnaire was used to collect the data through a face to face interview and checklist for reviewing client charts. The Amharic version of the questionnaire was used for data collection. Main variables included in the questionnaire and checklist for assessment, including socio-demographic characteristics of the respondents, previous and current pregnancy history, indication and fetal conduction.

The data was collected by trained seven diploma midwives working in obstetric wards of other health facilities. The data collection process was supervised by two BSc holder senior staff working in the obstetric department. The participants were interviewed after they gave birth and stable to communicate. The checklist was filled after the delivery summary was written. The completed questionnaires were collected every day after checking the completeness, consistency of the data and by providing timely feedback by supervisors.

## **Data Quality Assurance**

To maintain quality of the data, data collectors and supervisors were trained for two days on the objective of the study, the content of the questionnaire, how to fill the questionnaire, respondent rights, informed consent, and technique of interview and how to keep confidentiality and privacy of the study subjects. Before one week of the actual data collection period, the data collection tools were pretested 36 individuals in Tibebe Giwon and Dream Care Hospitals, thereby possible adjustment or modification was made. The principal investigators & supervisors gave feedback and correction daily for the data collectors. The data was cleaned, coded and entered to Epi info window version 7.2.2.

## **Data Processing and Analysis**

Each completed questionnaire was coded on a pre-arranged coding sheet by the principal investigator to minimize errors. Data were entered into a computer using Epi info window version 7.2.2 statistical programs. The data were cleaned accordingly and then exported to statistical package for social science (SPSS) version 23.0 the data were cleaned and analysis was done. Frequencies and percentages were generated. The findings presented by text, tables and graphs and Chi-square tests.

Initially, bivariable logistic regression analysis was performed between the dependent variable and each of the independent variables. Then all variables from bivariable logistic regression analysis found to be statistically significant at (at  $p\text{-value} < 0.05$ ) were fitted into the multivariable logistic regression model to control possible confounder. Adjusted odds ratio (AOR) with 95% confidence interval (CI) was used to measure the strength and significance of the association. If  $P\text{-value} < 0.05$ , indicating the presence of a statistically significant association between cesarean section delivery and independent variables.

# **Results**

## **Socio-demographic characteristics of the respondents**

A total of 708 women have participated in the study with the overall response rate was 97.8%, and 98.3% and 97.2% for public and private health facilities respectively. The mean age of the respondents was 27.31 with  $SD \pm 5.01$  for public and 29.27 with  $SD \pm 4.53$  for private health facilities. Concerning participants' residency, 82.6% in public health facilities and all private health facilities respondents were urban residents and 68 (18.8%) of public and 215(65.1%) of private health facilities respondents had a college diploma and above educational level (Table 1).

## **Obstetric related factors**

Regarding the obstetrics factors of the participants, 156 (43.8%) of them were Para one, and 190 (54.0%) of women were Para four and above in public facilities whereas in private health facilities 65(18.3%) and 13(3.7%) of women respectively. In public 345(96.9%) and private health facilities, 352(100%) of women had antenatal care (ANC) follow up during pregnancy of current delivery. Among women who had ANC follow up 254(73.6%) in public and 343 (97.4%) in private health, facilities had completed their 4th ANC

visits. The majority of mothers 321(90%) gestational age at the time of delivery in public and 348(98.9) in private health facilities were term pregnancy (Table 2).

### **Prevalence of Cesarean section delivery**

The prevalence of cesarean delivery in public health facilities was 98 (27.5%) (95% CI: 22.8, 32.2) and in private health, facilities were 198(56.3%) (95%CI: 50.9, 61.4). The difference in the prevalence of cesarean sections among public and private health facilities was significantly different  $P < 0.001$  being CS delivery much more common in private health facilities. The overall prevalence of CS delivery was 296(41.8%) (95% CI: 38.4, 45.5). Out of CS deliveries performed in public health facilities, 89(90.8%) were an emergency and the rest 9(9.2%) were elective, as compared to 125(63.1%) emergency and 73(36.9%) elective CSs performed in private health facilities (figure 1)

### **Indication of Cesarean Section Delivery**

The leading indications of CS in public health facilities were none reassuring fetal heart rate (NRFHR) 24(24.5%) followed by breech presentation 23(23.5%), Obstructed labour 15(15.3%), previous CS scar 12(12.2%) and none due to maternal request, were as previous cesarean section scar 51(25.8%),NRFHR 50(25.3%),Cephalo-pelvic disproportion 40(20.2%),breech presentation 19(9.6%) and 16(8.1 %) due to maternal request were in private health facilities(Table 3)

### **Factors associated with Cesarean section delivery**

Findings from public health facilities in the bivariable logistic regression analysis showed that fetal presentation, referral status, spouse education and place of residence had statistically associated with cesarean section delivery. Variables remained significant statistically in the multivariable analysis were fetal presentation, women who have breech presentation were 3.64 times more likely to have CS delivery than cephalic presentation (AOR=3.64; 95%CI (1.49, 8.89), urban residence were 6.54 times more likely to have CS delivery than rural (AOR=6.54; 95%CI (2.59, 16.48) and Referral status being referred 2.44 times more likely to have CS than not referred women (AOR=2.44; 95%CI (1.46, 4.08).

From bivariable logistic regression analysis in private health facilities, age of the mother, occupation, party, gravida and wealth index were a statistically significant association with the dependent variable. In the multivariable analysis variables remained statistically associated with CS delivery were: age, women aged 15-24 years was 80% (AOR=0.20, 95% CI; 0.07, 0.52) less likely to have CS delivery as compared to women aged 35 years and above. Occupation of the women being governmental employees 2.28 times

more likely to have CS delivery than housewife women (AOR=2.28;95%CI(1.39,3.75) and women self-employed was 3.73 times more likely to have CS delivery compared with housewife women. (AOR=3.73;95%CI(1.62,8.59), The parity of women being prim Para was 6.79 times more likely to have CS compared with grand multi women (AOR=6.79;95%CI(2.02,22.79) and parity two women were 3.88 times more likely to have CS(AOR=3.88;95% CI(1.15,13.08) than grand multi women. Another factor is the wealth index of the family, being the highest wealth index was 5.39 times more likely to have CS delivery than the lowest wealth index (AOR=5.39; 95%CI (1.08, 26.8) (**additional file 1**).

In this study from the full model, bivariable logistic regression; type of health facility, place of residence, age of mother, occupation, maternal education, spouse education, gravidity, parity, gestational age, fetal presentation, wealth index, and referral status were a statistically significant association with CS delivery.

In multivariable logistic regression model variables statistically associated with overall CS delivery were types of health facility women who delivered at private health facility were 3.45 times more likely to have CS delivery than those delivered in public health facility(AOR=3.45;95%CI(2.24,5.34),Women who have higher education level were 2.64 times more likely to have CS delivery than no formal education women (AOR=2.64;95%CI(1.31,5.3), being urban residence were 4.8 times more likely to have CS delivery than rural (AOR=4.8;95%CI(1.8,12.76) ,fetal presentation being breech presentation were 3.16 times more likely to have CS delivery than cephalic presentation(AOR=3.16;95%CI(1.56,6.39) and referred women were 2.71 times more likely to have CS than not referred women (AOR=2.71;95%CI(1.6,4.59) (Table 4).

## Discussion

Cesarean section is a surgical procedure that can effectively prevent maternal and newborn mortality when used within medically indicated reasons(2). On the contrary, there is evidence that, beyond a certain threshold, increasing cesarean section rates may be associated with increased maternal and perinatal morbidity and mortality(25).

The results of the study revealed that the prevalence of CS delivery in Public health facility was 27.5% (95%CI: 22.8-32.2) which is consistent with other studies conducted in Attet Hospital, Gurage Zone 27.6% (26), Gondar 27%(27),Felege Hiwote 25.4%(23) ,Addis Ababa 31.1%(14) and Harare 26.6%(20). But higher than studies conducted in Morocco 17.83% and India 13.7%(24, 28). This might be attributed to in our study setting the selected health facilities serve as the main referral centers for most complicated pregnancies in the city and around the city.

The prevalence of CS delivery in Private health facilities was 56.3% (95%CI: 50.9- 61.4) which is consistent with the study conducted in Harar 58.7%(20). But higher than the study conducted in Addis Abeba 48.3%(14). This could be due to increased access and utilization of the CS service with time deference. However, the current finding is lower than studies conducted in Brazil 87.9% and Mexico 85.6% (16, 24). This difference might be explained by a difference in accesses to the service, socio-economic differences between countries.

The difference in the prevalence of cesarean section delivery among public and private health facilities was significantly different  $P < 0.001$  being the CS delivery much more common in private health facilities. This finding was supported by other studies conducted in a different setting (20, 21, 29) and Addis Ababa(14). This could be due to that in private health facility women delivered by cesarean section with women request indication. Moreover, private facilities are business-oriented and the procedure might be done without clear medical indication.

The overall prevalence of cesarean section delivery in Public and Private Health facilities was 296 (41.8%) (95% CI: 38.4, 45.5). This finding is higher than studies conducted in Addis Abeba 38.3% and Harar 34.3%(17, 20). This difference might be explained by increased access to the intervention, as it is observed by a large number of health facilities started providing the CS delivery services in the study area and partly, the increased proportion of CS births occurred within the health institutions, particularly the role of private health facilities increased the use of CS, in urban residents of the study area needs to be in to account. The prevalence of CS delivery in this study area far exceeds with the WHO recommended a maximum limit of 15% cesarean section for any geographic area (30). The reason could be due to that, WHO recommended among all delivery whereas in our country most of the delivery happened at home, as a result, the high prevalence might be attributed due only pregnant women perceived the risk of childbirth give birth at the health facility

In multivariable logistic regression fetal presentation, referral status and place of residence were significantly associated with CS delivery among public health facilities. Women who have a breech presentation of the fetus were 3.64 times more likely to have CS delivery than cephalic presentation (AOR=3.64; 95%CI (1.49, 8.89), This finding is consistent with similar studies done in India and Felge Hiwote hospital (23, 24). This might be due to breech presentation is considered as one of the clinical indications by most of the providers to CS delivery for the benefit of the fetus as well as the mother. The women who were referred to in other health facilities were 2.44 times more likely to have CS delivery as compared to self-referred women (AOR=2.44; 95%CI (1.46, 4.08). This finding is supported by other previous studies (23). This might be due to the majority of referred women from other health facilities might have had some obstetric complications including complications requiring operative intervention. Residency, women who had urban residence were 6.54 times more likely to have CS delivery compared with rural residence (AOR=6.54; 95%CI (2.59, 16.48). This finding is supported by similar studies done in

other settings (10, 16, 24). The possible reasons for this could be most rural women cannot afford to deliver in urban private health facilities and usually delivered in rural public settings that have a limited capacity to provide CS, unless they are referred to higher public health facility to the study area and a role of the private health facilities in providing CS to wealthier women mostly in the study area.

In the multivariable logistic regression factors significantly associated with CS delivery in private health facilities were the age of the women, occupation of the women, parity and wealth index. Women aged between 15-24 years was 80% (AOR=0.20, 95% CI; 0.07, 0.52) less likely to have CS as compared to women age 35 and above. This finding was supported by other studies done in Addis Ababa, Mexico, and India(16, 17, 24). The possible explanation might be medical conditions that led to CS delivery like hypertension, diabetes, and macrosomia being more prevalent at an older age group. The odds of the women being governmental employees 2.72 times more likely to have CS (AOR=2.72; 95%CI (1.68, 4.4) and self-employed women were 3.1 times more likely to have CS (AOR=3.1; 95%CI (1.41, 6.79) as compared to housewife women. This finding might be explained by the financial capacity of these women who could afford the fee of CS service provided by private health facilities and some of these women also had the privilege of health insurance from their working organization for covering the cost of the service. Parity, Para one woman was 6.79 times more likely to have CS delivery (AOR=6.79;95%CI (2.02,22.79) and para two women were 3.88 times more likely to have CS(AOR=3.88;95% CI(1.15,13.08) as compared to grand multi women. This finding was supported by studies done in Addis Ababa Ethiopia and other countries (16, 17, 24). The possible explanation might be to avoid the arduous process of labor and delivery for Para one mothers and previous mode of delivery for para two mothers, who have had a traumatic previous birth or complications, or believe incorrectly that vaginal birth is not possible after a previous CS. This finding is a matter of concern particularly for Para one mothers, since this contributes to increased further CS deliveries, considering that the history of CS delivery is one of the critical indications for CS in subsequent delivery. The other significantly associated factor with CS delivery was the wealth index of the family, women with the highest level wealth asset were 5.39 times more likely to have CS delivery as compared to lowest level wealth asset (AOR=5.39; 95%CI (1.08, 26.8).This result is supported by previous studies done in Harer and Mexico(16, 20). This finding elucidates that CS delivery seems to be a choice method for a woman who can afford it rather than being a procedure for safe delivery when medically indicated. Understandably, women with the highest wealth index status prefer to be attended in the private health facilities to avoid all the administrative procedure in the public health facilities that are also associated with poor medical attention due to the larger quantity of women that each provider has to attend daily.

In the full model multivariable logistic regression factors, such as type of health facility and educational status of women were significantly associated with CS, in addition to place of residence, referral status, fetal presentation among public and private health facilities. Type of health facility, the women who delivered in private health facilities were 3.45 times more likely to have CS as compared to women delivered in public health facilities( AOR=3.45;95%CI(2.24,5.34). This finding is supported by studies

conducted in other settings in Ethiopia (20, 21) and another country (15). The possible explanation might be higher private health facility profits and higher provider remuneration for a CS delivery, provider's convenience of CS procedure and relatively lesser time required per birth than spontaneous vaginal delivery/assisted instrumental vaginal delivery. Maternal educational status: women who had college diplomas and above were 2.64 times more likely to have CS delivery as compared to women with no formal education (AOR=2.64;95%CI(1.31,5.3). This finding supported by studies conducted in Addis Ababa and Mexico(16, 17). The reason might be due to the high confidence of most educated women on modern medicine ( on the result CS delivery) and considering cesarean section delivery have less painful, convenient for selecting their delivery date and safer option than vaginal birth.

## Limitations

The study used a quantitative approach alone to collect the data; triangulation with qualitative approach may have been more useful in addressing provider-related factors, for instance, the study did not evaluate the institutional/obstetrician factors such as performing cesarean section for teaching the purpose, economic incentives, time management, and medico-legal issue risk-minimizing behavior.

## Conclusions And Recommendations

In this study, the prevalence of cesarean section delivery in private health facilities was more than twice as high as that of a public health facility and the overall proportion of CS deliveries was high. The difference in the prevalence of cesarean section delivery in public and private health facilities was statistically significant.

The breech presentation compared with the cephalic presentation, women referred compared with not referred women and urban residences compared with its counter were variables significantly associated with CS delivery in a public health facility. Whereas, the age of mother 15-24 years, governmental and self-employed women than housewife women, Para one and two women compared with grand multi women and wealth index being highest level of wealth asset than lowest were variables significantly associated with CS among private health facility.

In the full model public facility compared with the private health facility, Women who have a college diploma and above compared with no formal education, urban residence compared with rural, breech presentation compared with cephalic and referred compared with not referred women were variables significantly associated with CS delivery in overall public and private health facilities.

Comprehensive health education, including the advantage and disadvantages of CS delivery and support about childbirth fear, pain relief should be provided to focusing on urban women. Advocating vaginal

delivery and expectant women shall be fully informed about the risks associated with medically unjustified cesarean section in private health facility. Introducing medical audit of labor-management both in private and public health facilities. Further triangulated study to explore provider related factors and to fully understand why higher educational level women and those women who afforded the fee of private health facility preferred CS delivery

## **Abbreviations**

AOR- Adjusted Odd Ratio, APH- Antepartum Hemorrhage, CPD- Cephalic Pelvic Disproportion, COR- Crude Odd Ratio, CS- Cesarean Section, EDHS- Ethiopia Demographic and Health Survey, EmONC- Ethiopian Emergency Obstetric and Newborn Care, NRFHRP - Non Reassuring Fetal Heart Rate Pattern, PPH- Postpartum Hemorrhage, PROM- Premature Rupture of the Amniotic Fluid Membrane, SPSS- Statistical Package for Social Science, VBAC- Vaginal Delivery After Cesarean Section, VD-Vaginal Delivery, WHO- World Health Organization

## **Declarations**

### **Acknowledgment**

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### **Availability of data and materials**

The dataset supporting the conclusion of this article is included within the article and as additional files

### **Author's contribution**

MBM brought the idea, MBM, ABG, and SMA equally contributed in the proposal development process, data collection, analysis and write up. ABG has prepared the manuscript and all the authors have read and approved the manuscript before submission.

### **Ethical Consideration**

Ethical clearance was obtained from the institute of public health, college of medicine and health sciences, University of Gondar ethical review committee. A written support letter was secured to undertake the study from Amhara region health bureau, Bahir Dar city administrative zone, health department, and each respective health facility office of administration. After the purpose and objective of the study have been informed, verbal consent was obtained from each study participant. Participants were also informed that their participation was voluntarily and they can stop or leave from the participation at any time if they are not comfortable. To keep the confidentiality of any information provided by the study subjects, the data collection tools were anonymous and keeping their privacy during the interview by interviewing them alone.

### **Consent for publication**

Not applicable

### **Competing interest**

Authors declared that there is no conflict of interest

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## Tables

Table1: Socio-demographic characteristics of women who give birth in the selected public and private health facilities in Bahir Dar city, Amhara Regional State, Ethiopia, 2019 (n=708)

Variables	Category	Public health facilities (N=356) Frequency (%)	Private health facilities (N=352) Frequency (%)	Total (N=708) Frequency (%)
Age in years	15-19	11(3.1)	2(.6)	13(1.8)
	20-24	96(27.0)	55(15.6)	151(21.3)
	25-29	137(38.5)	140(39.8)	277(39.1)
	30-34	71(19.9)	98(27.8)	169(23.9)
	35-39	41(11.5)	57(16.2)	98(13.8)
Residency	Rural	62(17.4)	-	62(8.8)
	Urban	294(82.6)	352(100)	646(91.2)
Marital status	Single	6(1.7)	1(0.3)	7(1.0)
	Married	344(96.6)	350(99.4)	694(98.8)
	Divorced	3(0.8)	1(0.3)	4(0.6)
	Widowed	3(0.8)	-	3(0.4)
Maternal Education	No formal education	107(29.6)	3(0.9)	110(15.5)
	Primary school(1-8)	89(24.6)	39(11.1)	128(18.1)
	Secondary9-12)	92(25.4)	95(26.9)	187(26.4)
	Collage and above	68(18.8)	215(61.1)	283(40.0)
Maternal Occupation	Housewife	189(53.1)	154(43.8)	343(48.4)
	Government employee	44(12.4)	157(44.6)	201(28.4)
	Private employee	27(7.6)	26(7.4)	53(7.5)
	Farmer	41(11.6)	-	41(5.8)
	Merchant	37(10.4)	14(4.0)	51(7.2)
	Daily laborer	10(2.8)	-	10(1.4)

	Student	8(2.2)	1(0.3)	9(1.3)
Spouse educational status	No formal education	99(28.6)	3(0.9)	102(14.6)
	Primary school(1-8)	53(15.3)	12(3.4)	65(9.5)
	Secondary(9-12)	83(24.0)	59(16.8)	142(20.3)
	College and above	111(32.1)	277(78.7)	388(55.70)
Spouse Occupation	Government employee	97(28.2)	182(51.7)	279(40.1)
	Self-employee	85(24.7)	106(30.1)	191(27.5)
	Farmer	59(17.2)	-	59(8.5)
	Merchant	88(25.6)	57(16.2)	145(20.9)
	Others*	15(4.2)	6(1.7)	21(3.0)
Wealth index	Lowest	76(21.3)	9(2.6)	85(12.0)
	Second	68(19.1)	111(31.5)	179(25.3)
	Medium	66(18.5)	67(19.0)	133(18.8)
	Fourth	103(28.9)	103(29.3)	206(29.1)
	Highest	43(12.1)	62(17.6)	105(14.8)

Table 2:- Obstetrics factors of women who delivered in the selected public and private health facilities of Bahir Dar city, Amhara Regional State, Ethiopia, 2019 (n=708)

Variables	Category	Public health facilities	Private health facilities(n=352)	Total
		356		N=(708)
		Frequency (%)	Frequency (%)	Frequency (%)
Parity	Para 1	156(43.8)	187(53.1)	343(48.4)
	Para 2	85(23.9)	101(28.7)	186(26.3)
	Para 3	50(14.0)	48(13.6)	98(13.8)
	Para ≥4	65(18.3)	16(4.5)	81(11.4)
Gestational age	Pre term	31(8.7)	3(85.2)	34(4.8)
	Term	321(90)	343(97.4)	664(93.7)
	Post-term	4(1.1)	6(1.7)	10(1.4)
Onset of labor	Spontaneously	296(83.1)	264(75.0)	560(79.0)
	Induced	60(16.4)	88(25.0)	148(20.9)
ANC visit	Yes	345(96.9)	352(100)	697(98.4)
	No	11(3.1)	-	11(1.6)
No of ANC	One	7(2.0)	-	7(1.0)
	Two	28(8.0)	-	28(4.0)
	Three	56(16.2)	9(2.6)	65(9.3)
	Four and above	254(73.6)	343(97.4)	597(85.7)
No of the fetus informed before delivery	Yes	149(41.9)	343(97.4)	492(69.5)
	No	207(58.1)	9(2.6)	216(30.5)
No of fetus	One	147(98.7)	343(100)	490(99.6)
	Two	2(1.3)	-	2(0.4)
Abortion history	Yes	16(7.8)	13(7.7)	29(7.8)
	No	188(92.2)	155(92.3)	343(92.2)
previous infertility	Yes	6(1.7)	-	6(0.8)
	No	350(98.3)	352(100)	702(99.2)

Table 3:-Indications of CS delivery of women who delivered in the selected public and private health facilities in Bahir Dar city, Amhara Regional State, Ethiopia 2019.

Indications	Public	health	Private health	Both public and private
	facilities(n=98)		facilities(n=198)	facility(n=296)
	Frequency (%)		Frequency (%)	Frequency (%)
NRFHR	24(24.5)		50(25.3)	74(25)
CPD	8(8.2)		40(20.2)	48(16.2)
Breech presentation	23(23.5)		19(9.6)	42(14.1)
Previous CS	12(12.2)		51(25.8)	63(21.2)
APH	4(4.1)		-	4(1.3)
Maternal request	-		16(8.1)	16(5.4)
Failed induction	2(2.0)		-	2(.07)
Preeclampsia-eclampsia	5(5.1)		4(2.0)	9(3)
obstructed labor	15(15.3)		12(6.0)	27(9.1)
Post-term	4(4.1)		6 (3.0)	10(3.4)
Twin pregnancy	1(1.0)		-	1(0.34)

Acronyms: APH-Ante Partum Hemorrhage, CS- Cesarean Section, CPD-Cephalo Pelvic Disproportion, NRFHR-

None Reassuring Fetal Heart Rate

Table 4:-Factors associated with CS delivery among women who gave birth in selected public and private health facilities in Bahir Dar city, Amhara Regional State, Ethiopia, 2019 (n=708).

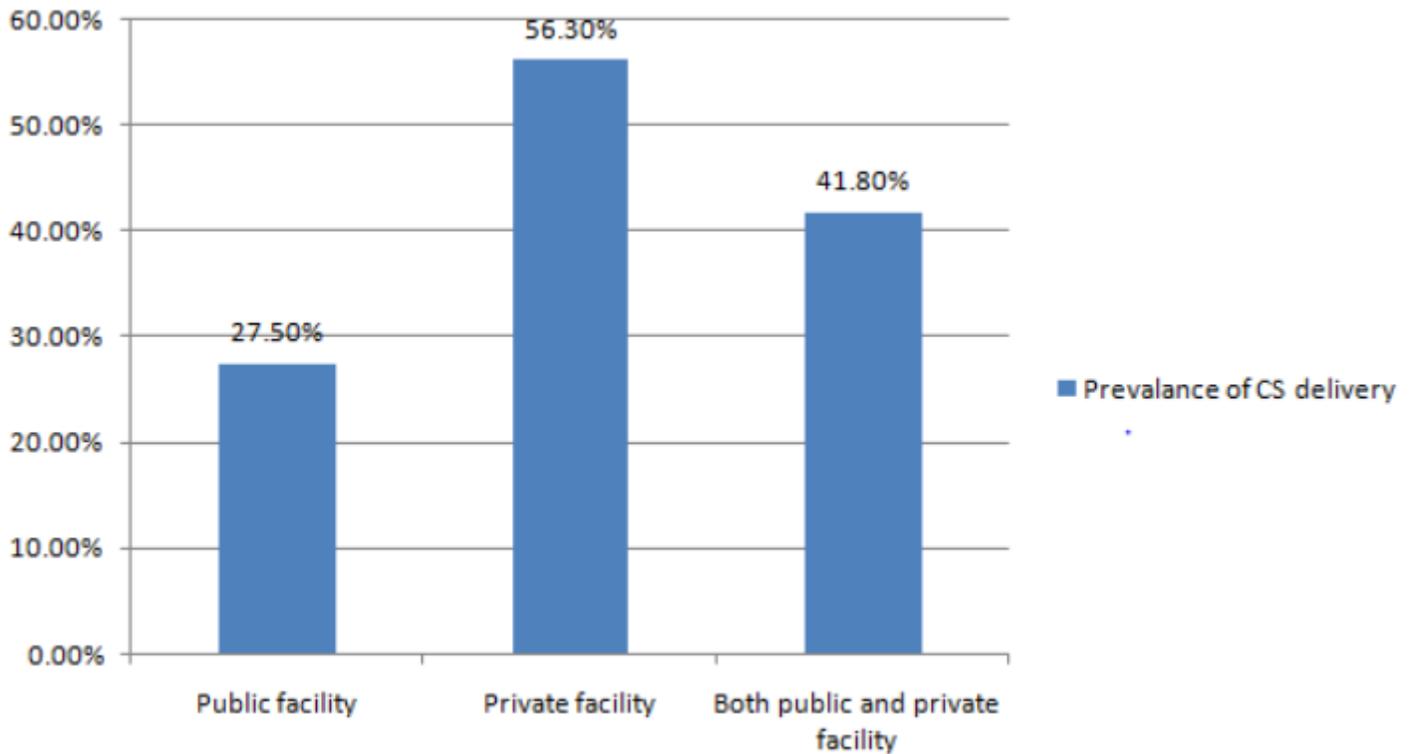
Factors	Category	CS		COR (95%CI)	AOR (95%CI)
		No	Yes		
<b>Health Facility type</b>	Public	258	98	1	1
	Private	154	198	<b>3.38(2.47,4.63)***</b>	<b>3.45(2.24,5.34)***</b>
<b>Age</b>	15-24	117	47	0.47(0.28,0.79)	
	25-34	242	204	0.99(0.64,1.54)	
	>35	53	45	1	1
<b>Maternal Education</b>	No formal education	86	24	1	
	Primary	88	40	1.62(0.90,2.92)	1.09(0.54,2.18)
	Secondary	119	68	<b>2.04(1.19,3.52)**</b>	1.05(0.53,2.08)
	College and above	119	164	<b>4.93(2.96,8.22)**</b>	<b>2.64(1.31,5.3)**</b>
<b>Occupation</b>	House wife	267	133	1	
	Government employee	85	117	<b>2.76(1.95,3.91)***</b>	
	Self-employee	59	45	1.53(0.98,2.37)	
	NGO	1	1	2.0(0.12,32.34)	

<b>Spouse education</b>	No formal education	86	16	1	
	Primary	45	20	<b>2.38(1.12,5.05)*</b>	
	Secondary	85	57	<b>3.60(1.91,6.77)***</b>	
	College and above	192	196	<b>5.48(3.10,9.69)***</b>	
<b>Residence</b>	Rural	55	7	1	1
	Urban	357	289	<b>6.36(2.85,14.17)***</b>	<b>4.8(1.8,12.76)***</b>
<b>Gravid</b>	One	156	179	<b>2.49(1.44,4.27)**</b>	
	Two	83	108	<b>2.19(1.23,3.89)**</b>	
	Three	36	65	1.58(0.83,3.0)	
	Four &above	21	60	1	
<b>Parity</b>	Para one	162	181	<b>2.55(1.49,4.38)**</b>	
	Two	80	106	<b>2.15(1.21,3.83)**</b>	
	Three	33	65	1.45(0.75,2.77)	
	Four & above	21	60		
<b>Gestational age(weeks)</b>	<37	25	9	1	
	37-42	384	280	2.02(0.93,4.4)	
	>42	3	7	<b>6.48(1.37,30.6)*</b>	
<b>Fetal presentation</b>	Cephalic	390	267	1	1

	Breech	22	29	<b>1.92(1.08,3.42)***</b>	<b>3.16(1.56,6.39)**</b>
<b>Wealth index</b>	Lowest	61	23	1	
	Second	106	73	<b>1.82(1.03,3.2)*</b>	
	Medium	78	55	<b>1.87(1.03,3.37)*</b>	
	Fourth	117	89	<b>2.01(1.16,3.5)*</b>	
	Highest	49	56	<b>3.03(1.64,5.61)***</b>	
<b>Referral status</b>	Not referred	307	242	1	1
	Referred	105	54	<b>0.65(0.45,0.94)</b>	<b>2.71(1.60,4.59)***</b>

Note:\*statically significant at  $0.05 < P < 0.01$ , \*\*  $0.01 < p < 0.001$ , \*\*\*  $< 0.001$

## Figures



**Figure 1**

Prevalence of CS delivery of women who delivered in the selected public and private health facilities in Bahir Dar city , Amhara Regional State, Ethiopia,

## Supplementary Files

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