

# Adverse maternal outcomes associated with Cesarean deliveries and their determinants: hospital based cross sectional, mixed- methods study

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## Abstract

**Purpose** – The purpose of this study was to examine adverse outcomes associated with cesarean deliveries and to assess potential confounding factors.

**Design/methodology/approach** – A hospital-based cross-sectional study was conducted from September 1–30, 2019 using mixed methods of data collection. Multistage sampling was used to draw the eligible study participants. The sample size was calculated using the single population proportion formula. A systematic random sampling technique was used to draw the sample size. 180 original medical records were excluded because of having missed information, leaving 1,618 women as the study population. We used the questionnaire adapted from the Ethiopian Demographic and Health Survey to collect quantitative data and analyzed using SPSS version 22, while thematic analysis for qualitative measures was used to generate themes regarding associated perspectives of participants from a community.

**Findings** – More than 383 women delivered by cesarean section. 20% of the mothers with the mean age at birth of  $26.1 \pm 4.8$  experienced adverse outcomes. Adjusted odds ratio (AOR) was used to measure the association of determinants and was 2.95 (95% CI 1.19–7.29) for nonuse of antenatal care, 3.18 (95% CI 1.43–6.94) for nonuse of prophylaxis, 4.28 (95% CI 1.58–11.61) for history of medical illness and 7.09 (95% CI 1.19–45.59) for use of substandard operation set up compared with their counterparts.

**Research limitations/implications** – Strengths of the study include the finding of the study are reliably reported in mixed study methods examining hospital-based institutional and personal risk factors and exploring the whole community's perspectives. However, the important limitations of the study indicate that the study poses a number of challenges related to studying design, therefore there was not sufficient evidence of causality to draw conclusions from the findings. In addition, the study was conducted at a single hospital so that it is not convenient to generalize the findings of the study for setting different in social and economic status.

**Originality/value** – Based on the findings, attention has been drawn to healthcare personnel to provide training and consultation services for pregnant women and for health care administration to ensure standard set up for operation.

**Keywords** Cesarean section, Adverse maternal outcomes, Ethiopia

**Paper type** Research paper



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## Introduction

A cesarean section refers to the delivery of the fetus, placenta and membrane through abdominal or uterine incision after 28 weeks of gestation and preserves the life of the mother with obstructed labor [1, 2]. The safety and frequency of cesarean sections have increased because of the use of better surgical techniques. Using improved anesthesia, effective antibiotics and blood transfusions ensure a better experience of surgery. However, increased use of cesarean sections does not confer additional health gain [3]. Cesarean section without medical need may increase maternal and neonatal risks and puts women at risk of short- and long-term health problems [3–5].

According to The American College of Obstetricians and Gynaecologists and studies from Australia, cesarean births significantly increased a woman's risk of pregnancy-related fatality compared to a woman who delivered vaginally [6, 7]. Furthermore, there is a strong inverse association between cesarean section rates and maternal, infant and neonatal mortality in a poor community where the proportion of mothers delivered by cesarean section was only 2% of all live births for seven years before the survey. Common indications for cesarean section were cephalopelvic disproportion followed by a previous history of cesarean section, whereas fever and fistula were among the common complications raised after cesarean section [5].

Reports of some studies conducted in different parts of Ethiopia show that adverse maternal outcomes following cesarean deliveries are an important public health problem in Ethiopia. Obstructed labor, malpresentation, fetal distress, hemorrhage and history of previous cesarean surgery were the most important risk factors associated with a cesarean section [8–11]. However, both studies focused solely on secondary data and none on a mixed-methods study approach. Therefore, we called for further research to explore the mothers' and the community's views by identifying confounding risk factors of those most likely to experience adverse maternal outcomes following cesarean deliveries, and excluded those without their entire medical records or with incomplete information. We used the mixed-method approach for data collections.

## Methodology

### *Study design*

Hospital-based cross-sectional study design was employed using both quantitative and qualitative data collection methods.

### *Study setting*

More than 10 specialist physicians and midwives were working in the hospital. The hospital had four delivery coaches and 35 beds. The staff members conducted about 1,798 cesarean deliveries over a period of three years (2015–2018).

*Study population.* Yirgalem hospital medical record center has prenatal and birth information registers for nearly all deliveries, collected by health informatics professionals.

From this register, 1,798 women who had given live births and stillbirths by cesarean section after 28 complete weeks of gestation in 2015–2018 were identified as our source population. The higher rate of prevalence in maternal mortality secondary to adverse events associated with childbirth in the region [5] urged the researchers and health care managers to identify its possible cause and increasing and decreasing risk factors. We excluded 180 (10%) women who had missing information for full-length cesarean section, leaving 1,618 women (90% of the original medical record) for inclusion as the study population. We selected only 383 (24%) samples of the original medical records that had complete information as our study unit. To decide the proportion of the study unit, we considered the feasibility of the study.

We calculated the sample using single population proportion formula considering the prevalence of maternal complications of 38 % (Arab-Minch General Hospital, 2014) [9]. We used a 95% confidence level, power of 80%, odds ratio of two, 5% margin of error and 10% of nonresponse rate. We applied the systematic random sampling technique to allocate the sample over the source population.

We used information on prenatal and birth medical diagnoses and procedures. This information included the hospital's antenatal care and birth register, labor follow-up sheets, operation logbooks, patients' admission history and delivery summary. This information was coded according to the international classification of diseases (ICD) and including demographic, administrative and clinical data for all hospital discharges, maternal characteristics, pregnancy, labor, delivery and infant outcomes collected by the attending midwife or doctor in a standard semi-structured format. We pretested the format on 5% of the sample size in a similar setting and discussed it among data collectors and supervisors. Two trained public health officers supervised the data collection process.

For the qualitative study, we considered focused group discussion, each consisting of a mix of six to eight laboring mothers and their attendants, and three elderly women from the community in order to elicit their views. We conducted phone calls to prove whether the discharged mothers developed adverse outcomes up to 42 completed days of delivery. We consider none if the mother did not respond to phone calls.

*Outcome variables.* An adverse outcome associated with cesarean section was the primary outcome of the study. To estimate the overall incidence of any adverse outcomes associated with cesarean section, we collected preterm and birth data from the hospital. Adverse outcomes associated with cesarean section was defined as unfavorable conditions including the presence of one of the intraoperative or postoperative maternal complications within immediate four postpartum days includes hemorrhage, blood transfusion, hysterectomy, thromboembolism, intensive care unit admission, prolonged length of stay in the hospital, postpartum antibiotics treatment, adjacent internal organ injury, prolonged catheterization, febrile maternal morbidity and death in hospital. Information on adverse maternal outcomes was available from birth and/or hospital data. The data collectors collected information on the adverse maternal outcome as check-box fields that were coded according to the ICD. In all hospital data, events such as postpartum hemorrhage (as diagnosed by the attending clinician) were coded from the medical record according to the ICD.

*Explanatory variables.* Information on maternal and obstetric characteristics of the study populations were exposure variables. These included antenatal care, use of family planning, duration of labor, gravidity and parity, previous cesarean delivery, and were categorized as spontaneous or elective (planned/elective cesarean section, before the onset of labor or induced labor), pregnancy-related adverse condition (overweight /obesity (BMI  $\geq 25.00$  kg/m<sup>2</sup>), diabetes, chronic hypertension, multiple gestations, induction of labor and sexually transmitted infections), mode of delivery, gestational age at deliveries that was reported in completed weeks, based on the best available estimate from ultrasound dating and/or menstrual history, birth order, number of children, family size and smoking at registration and/or during pregnancy. Data on women's demographic characteristics including educational status that was grouped as (no formal education, primary education, and secondary and above) marital status, occupation, age, religion, ethnicity, availability of media, place of residency and average monthly income of the households had been evaluated. Sanitation and hygiene characteristics of the facility including wound care equipment sterility, use of antiseptics, types and frequencies of antibiotics used to treat infection, the sanitary condition of nonmedical services, and the waste disposal system and latrine facilities were used to determine exposures.

*Statistical analysis.* The quantitative data were coded checked and entered using Epi-Info version 7.0 and exported to SPSS Version 21 for analysis. Bivariate logistic regression was

used to assess the degree of association between dependent and independent variables and test the significance of the association. An odds ratio of 95% confidence interval was used to measure the strength of association. Those variables associated at bivariate logistic regression with a significance level of  $p$ -value  $< 0.25$  were entered into a multivariate logistic regression model to identify the important determinants by controlling possible confounding effects. We analyzed qualitative data by thematic areas and triangulated it with quantitative findings.

*Ethical issue.* The College of Medicine and Health Sciences, Hawassa University Institutional Review Board granted ethical approval with Clearance number /Ref No. IRB/054/10, Clearance Date: 05/01/2018, and code/date of 200/18.

## Results

### *Socio-demographic characteristics*

We reviewed 368 maternal medical records with a response rate of 96% and mean age of  $26.1 \pm 4.8$ . The dominant age group of the study participants was within the range of 25–29 years and living in rural areas with a proportion of 66.4%, and most (96%) of the mothers was married.

### *Obstetric characteristics*

More than 84% of the mothers had a regular antenatal visit and were vaccinated with the Tetanus Toxoid vaccination during their current pregnancy. The majority (95.10%) of mothers were presented with single gestation while the remaining mothers presented with multiple gestations. The proportion of primiparous mothers was 48% while about 38% of them were multipara mothers and the remaining were grand multiparous mothers. More than 84% of the mothers were operated on at term while 58% of them were operated on at preterm and post-term gestation (Table 1).

### *Sanitation and hygiene characteristics*

Unavailability of sanitation and hygiene facilities was among different reasons for the morbidity of the mothers following cesarean delivery. A 44-year-old female genital mutilation (FGD) participant shared this observation and related these morbid conditions with a shortage of sterilized equipment. “. . .the health facility is not safe for operated mother b/s of unclean equipment as a result of a shortage in functional latrines and lack of water for sanitation for both doctors and attendants..”

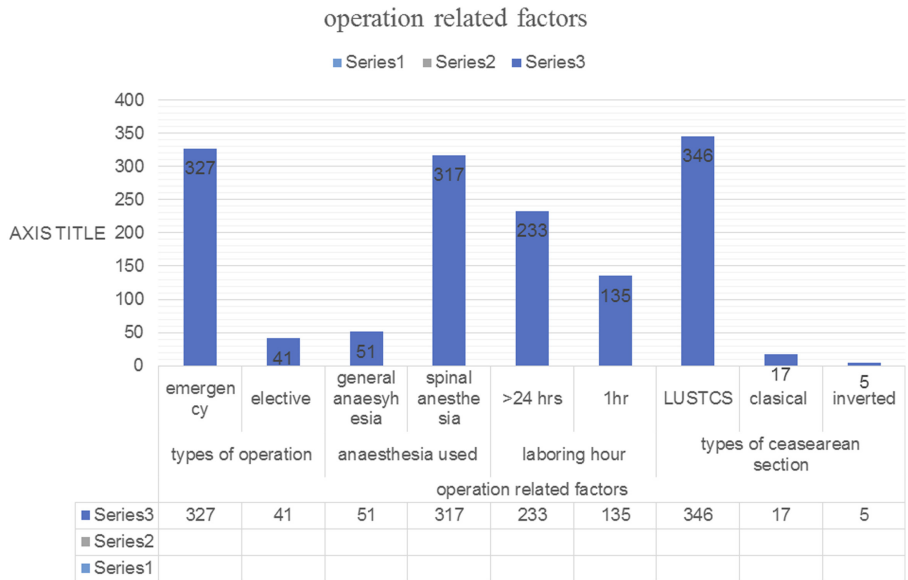
### *Incidence of adverse maternal outcomes following cesarean section*

The physician performed 63.3% of the operations after 24 h delay of the onset of labor. The remaining 36.6% of the operations were performed within the one-hour onset of labor (Table 1). More than 89% of the operations were conducted in an emergency state. More than 86% of the operations were performed using general anesthesia. The proportion of low uterine segment transverse cesarean section type of cesarean section was 94% followed by 4.6% of the classical type of operations. (Figure 1). About 42% of the operations were conducted because of the nonreassuring fetal status of pregnancy followed by 28.5% of operations conducted because of cephalopelvic disproportion. (Figure 2). The proportion of mothers who were free of previous medical illness was more than 77% while more than 16% of them had a history of pregnancy-induced hypertensive disorder, diabetes mellitus and HIV/AIDS. Anemia and surgical site infections remained as common postnatal complications and a few of the mothers developed intra-operative bleeding secondary to uterine atone.

The proportion of mothers who developed complications following cesarean section was 56% and more than 13% of the complications occurred because of intraoperative

**Table 1.**  
History of previous medical illness and obstetric condition of the study participants at Yirgalem General Hospital from January 1 to 31, 2019

Variables	Category	Frequency	Percent
Parity (N = 368)	Primiparous	178	48.36
	Multipara	140	38.04
	Grand multipara	50	13.58
ANC Follow up (N = 368)	Yes	312	84.78
	No	56	15.21
Referral status (N = 368)	Referred from peripheral	294	79.89
	Self-referred	74	20.10
Gestational age (N = 368)	Preterm	28	7.60
	Term	310	84.23
	Post-term	30	8.15
Number of gestation (N = 368)	Single	350	95.10
	Multiple	18	4.89
Duration of labor in hours (N = 368)	<24 hours	230	62.50
	>24 hours	80	21.73
	No labor started	58	15.76



**Figure 1.**  
Types of caesarean section, circumstance to do the operation, type of anesthesia used and time take to decide operation in Yirgalem General Hospital from January 1 to 31, 2019

adverse events. More than 32% of the study participants had developed post-operative complications such as surgical site infection and chronic illnesses. The proportion of mothers who developed surgical site infection was 10.86% followed by 9.78% of chronic illness and 6.52% of incision extension. In addition, the study revealed that two maternal deaths occurred postoperatively because of multiorgan failure secondary to sepsis, cardiogenic shocks and postpartum cardiomyopathy (Table 2).

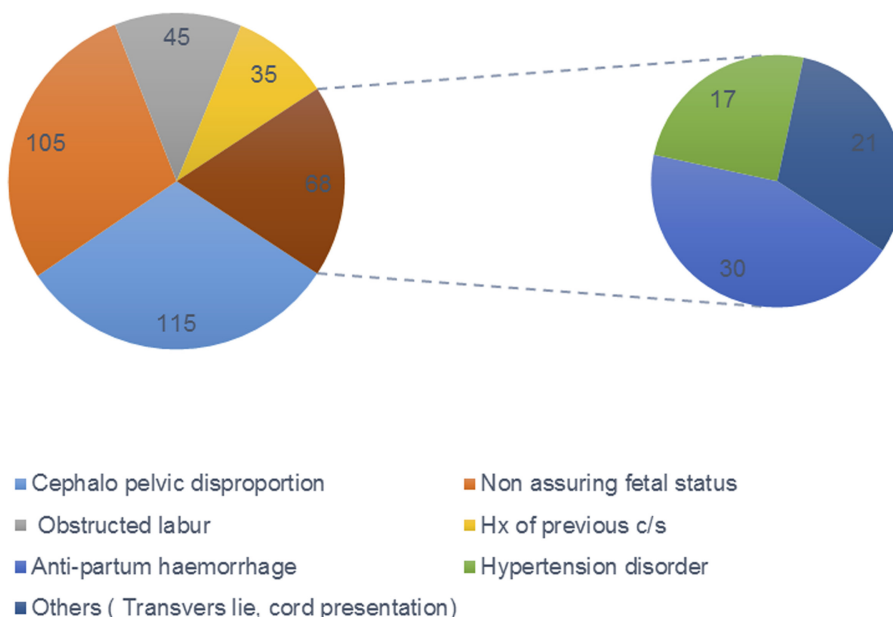
*Determinants of adverse maternal outcomes*

We examined factors determining adverse maternal outcomes following cesarean section using a logistic regression model. In the bivariate logistic regression model analysis,

## Common Indications of C/s

## Outcomes of cesarean deliveries

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**Figure 2.** Common indications for cesarean section in Yirgalem General Hospital from January 1 to 31, 2019

Variables (N = 368)	Frequency	Percent
No complication occurred	160	43.47
Intra-operative bleeding	50	13.58
Surgical site infection (SSI)	40	10.86
Chronic illness (PIHD, DM and HIV/AIDS)	36	9.78
Incision extension	24	6.52
Anemia	20	5.43
Bladder injury	14	3.80
PPH	12	3.26
Wound dehiscence	6	1.63
Others	6	1.63

**Table 2.** History of previous medical illness and adverse maternal outcomes of the study participants at Yirgalem General Hospital from January 1 to 31, 2019

variables showing a  $p$ -value of  $<0.25$  were transferred into multiple logistic regression models to rule out confounders. Nonuse of ANC follow-up during the present pregnancy had a higher risk of developing adverse maternal outcomes compared to mothers having ANC follow up during their previous pregnancy (adjusted odds ratio (AOR) = 2.95, 95% CI 1.19–7.29). Nonuse of prophylactic antibiotics had a higher risk of developing adverse maternal outcome than mothers who used prophylactic antibiotics prior to operations (AOR = 3.18, 95% CI 1.43–6.94). Mothers having a history of medical illness (AOR = 4.28, 95% CI 1.58–11.61) and operated on at an emergency operation theater (AOR = 7.09, 95% CI 1.19–45.59) showed a higher risk of adverse maternal outcomes than their counterparts (Table 3).

**Table 3.**  
Factors associated  
with adverse maternal  
outcome after cesarean  
deliveries at Yirgalem  
General Hospital from  
January 1 to 31, 2019

Variables (N = 368)		Mothers developed complications		95% CI (COR)	95% CI for (AOR)
		Yes	No		
ANC follow up	Yes	92	227	1	1
	No	27	36	1.74 (0.97–3.13)*	2.95(1.19–7.29) **
Medical illness	Yes	38	28	4.39 (2.46–7.84)*	4.28 (1.58–11.61) **
	No	80	236	1	1
Circumstance of surgery	Elective	8	40	1	1
	Emergency	110	224	3.5 (1.33–9.17)*	7.09(1.19–45.59) **
Antibiotics taken before surgery	Yes	38	176	1	1
	No	80	88	4.5(2.79–7.26)*	3.18 (1.43–6.94) **

**Note(s):** 1: Indicates the reference categories  
 \*: Indicates significant association ( $p$ -value < 0.25)  
 \*\*: Indicate highly significant association ( $p$ -value < 0.05)

### Discussion

About 20.9% of laboring mothers admitted to the delivery ward were operated on to give birth. The finding is higher than that recommended by the World Health Organization and reported by the Ethiopian Health Ministry, 2017. The figures indicated that 5–15% and 18% of pregnant mothers underwent cesarean sections, respectively [3, 5]. The finding is also inconsistent with reports of Black Lion and Jimma University Hospitals; where 10% and 8% operations were reported, respectively [8, 12]. The discrepancy could be due to the level of the hospitals. In the study area, a limited number of vaginal births were performed on mothers having a history of previous cesarean sections even in a single episode of fetal distresses because of the absence of specialists to conduct complicated labor using other modes of delivery other than a cesarean section. More than 79% of the mothers were referred from rural areas and had at least one ANC visit. Mothers with similar proportions were referred with common complications of none reassuring fetal heart rate, cephalopelvic disproportion and obstructed labor. This was inconsistent with a retrospective cohort study conducted at Arba Minich General Hospital [13]. This could be due to differences in study designs. The finding of this study and similar studies conducted in different parts of Ethiopia, Nigeria and Finland revealed that more than 46% of the C/S conducted for primiparous mothers [9, 14, 15] and emergencies were major causes for the operations [13, 16, 17]. Spinal anesthesia was used for more than 82% of the operations. The finding was inconsistent with the study conducted in Gondar University Hospital, in which general anesthesia was used for most of operations [10]. This is well explained as differences between study settings.

In the study, bleeding secondary to uterine atone, wound dehiscence, and bowel and bladder injuries were the most common postoperative complications. This finding was inconsistent with the studies conducted in Nigeria, where surgical site infection, anemia, postpartum hemorrhages and respiratory tract infection were common complications [18]. The difference may be due to socioeconomic conditions and quality of obstetric care. These conditions are primarily determined by the poor quality of health care where unavailability and improper utilization of sanitation and hygiene facilities are most likely [19]. A 40 years male FGD participant shared his perception stating “*the complications were occurring due to provision of substandard medical and nursing care, improper hand washing practice, and non-functional latrines.*” “...Nurses were not cooperative: - to provide daily-based nursing care, -to administer prescribed medication, and there was no sufficient water for hand washing, room cleaning, and surgical instrument preparation.” In addition, a 34-year old woman stated that “...the facility was not attractive, and the environment was untidy and full of unclean



equipment, procedure rooms and wards were full of offensive odor. The professionals were not sensible and compassionate to attend urgent maternal care and mothers were exposed to the risk of complication during and after cesarean deliveries...” Moreover, the attitude of professionals may affect the outcomes of cesarean delivery. An old mother from the community stated that *the “majority of mothers experience complications following cesarean delivery because health professionals were negligent to attend delivery as per the standard.”*

In this study, anemia was the most pronounced complication following a cesarean section. This is consistent with the findings of studies conducted in different parts of Ethiopia [9, 17]. However, in the study, bowel and bladder injuries were higher compared to the findings in studies conducted in Jimma University Hospital and South American countries where there were no organ injuries [9, 20]. The study reported that mothers having no ANC follow-up were three times more at risk of developing maternal complications than their counterparts. This is consistent with the study finding of Attat Hospital, south west Ethiopia [17]. Having a history of previous medical illness and conducting the emergency operation was four and seven times more likely to develop adverse maternal outcomes than their counterparts. In addition, not using prophylactic antibiotics during cesarean section had three times more odds to develop maternal complications than using prophylactic antibiotics during a cesarean section. These findings are consistent with the study conducted in different parts of Ethiopia [13, 21].

#### *Strengths and limitations of this study*

The findings of the study were reported in mixed study methods. Hospital-based institutional and personal risk factors were examined as well as the whole community’s perspectives were explored. However, the important limitation of the study indicates that the study poses a number of challenges related to the study design, therefore there was insufficient evidence of causality to draw conclusions from the findings. In addition, the study was conducted at a single hospital so it is not convenient to generalize the findings of the study for different settings in social and economic status.

#### **Conclusions**

Medical illness prior to current pregnancy, nonuse of prophylactic antibiotics prior to operations, and conducting emergency cesarean sections increase the risk of adverse maternal events. Interventions such as the early investigation of pregnant mothers on their antenatal care visit as National and WHO recommendation, use of prophylactic antibiotics and standard operation setup may contribute to minimizing the risk of adverse outcomes following a cesarean section. Optimizing sanitation and hygiene in the facility can also avert the probability of maternal deaths secondary to adverse events.

Conflict of Interest: None

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