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**The proportion of failed induction of labour and associated factors among women undergoing induction of labour in Dessie referral hospital; Northeast Ethiopia a cross-sectional study**

**Abstract**

**Background:** There are several complications of pregnancy that confer significant ongoing risk to the mother or fetus. For these conditions, induction of labour is as an artificial termination of pregnancy utilized to decrease both maternal and neonatal morbidity and mortality. The process of inducing labour is not always successful and sometimes fails to achieve a safe vaginal delivery.

**Method:** Retrospective cross-sectional study was conducted on medical records of 319 registered women who undergo labour induction at Dessie referral hospital from **January 01 to February 2017**. Systematic sampling techniques **were** used to select the samples. The data was cleaned, edited, coded, and entered into EPI INFO version 3.5 and exported and analyzed by SPSS with windows version 20.0. Bivariate and multivariate logistic regression statistical model was used to identify factors associated with the outcome variable. Adjusted odds ratio with 95% CI was computed to see the strength of association.

**Result:** The proportion of failed induction of labour was 19.7 %. Multivariable logistic regression analysis showed that women live in a rural area [4.171(1.358-12.807)], primipara [AOR=1.72(1.67-4.415)] and women whose Bishop score is unfavourable [0.147(0.066-0.327)] were significantly associated with failed induction of labour.

**Conclusion:** The proportion of failed induction of labour was relatively high in the study area. Variables which increased the likelihood of failed induction were living rural area, primigravidity and unfavourable bishop score before induction of labour.

**Keywords:** proportion, failed induction of labour, associated factors, Ethiopia

## 29 **Introduction**

30 Induction of labour is defined as the process of artificially stimulating the uterus to start labour.  
31 It is usually performed by administering oxytocin or prostaglandins to the pregnant woman or by  
32 manually rupturing the amniotic membranes. The goal of labour induction is for achieving  
33 vaginal birth by stimulating the contraction of the uterus. Labour induction may be  
34 recommended if the health of the mother or fetus is at risk(1).

35 The World Health Organization (WHO) recommends labour induction be performed with a  
36 clear medical indication and when expected benefits outweigh potential harms. Major Indications  
37 for induction of labour include post-term pregnancies, pre-labour rupture of membranes,  
38 maternal medical conditions like hypertensive disorders, diabetes, renal diseases, fetal  
39 compromise, chorioamnionitis, abruption placenta, intrauterine fetal death and others(2, 3).  
40 Elective induction of labour also takes place when a mother wishes to deliver at a particular time  
41 (after term). However, the World Health Organisation (WHO) recommends that induction of  
42 labour be done for medical and obstetric reasons only due to risks associated with the  
43 procedure(4).

44 Even though labour induction had varied benefits there is a risk to the mother or fetus, this  
45 intervention may result in an undesirable effect. Induction sometimes fails with potential risks of  
46 the increased rate of operative vaginal delivery, caesarean birth, excessive uterine activity,  
47 abnormal fetal heart rate patterns, uterine rupture, maternal water intoxication, delivery of  
48 preterm infant due to incorrect estimation of dates, and possibly cord prolapse. Medical problems  
49 that were present before pregnancy or occurring during pregnancy may contribute to these  
50 complications (5-8).

51 The outcome of labour induction will be either success or failure. But no consensus has been  
52 reached regarding the diagnosis of failed induction. A variety of endpoints have been suggested  
53 including cesarean delivery, not achieving vaginal delivery within a specified time, not  
54 achieving active labour within a specified time, or failure to achieve the active phase of labour  
55 may use to diagnose failed inductions. Many factors lead to failed induction such as initial poor

56 cervical Bishop's score at induction (indicating an unripe cervix), nulliparity, fetal macrosomia, a  
57 high body mass index and advanced maternal age(9-11).

58 Developing countries bear a disproportionate share of maternal deaths: 99 per cent occur in  
59 developing countries compared to 1 per cent in more developed nations. Sub-Saharan Africa and  
60 South Asia accounted for 87 per cent of global maternal deaths and 50 per cent of all deaths  
61 occurred in six nations: India, Nigeria, Pakistan, Afghanistan, Ethiopia, and the Democratic  
62 Republic of Congo(5).

63 In developing countries, the improvement of maternal and perinatal health strongly depends on  
64 the strengthening of health systems. When resources are scarce, caesarean sections that are not  
65 medically indicated, if done in large numbers, represent a serious resource drain. At the same  
66 time as unnecessary overuse of surgical practices is being assessed in some countries, millions of  
67 women in other countries who need these procedures do not have access to them, putting their  
68 own and their children's lives at risk(14).

69 For pregnant women, optimizing intrapartum care appears to be the single most important  
70 intervention for reducing maternal mortality in high-income countries( resource-rich settings ),  
71 middle income and low-income countries(resource-limited settings). This intrapartum care is not  
72 the only intervention for reducing maternal mortality and morbidity but also it reduces neonatal  
73 mortality and morbidity by improving the outcome of pregnancy(15).

74 There are several numbers of complications of pregnancy that confer significant ongoing risk to  
75 the mother or fetus. Most of these were preeclampsia; preterm premature rupture of the  
76 membranes (PPROM); intrauterine growth restriction (IUGR); and post-term pregnancy). For  
77 these conditions, induction of labour is often the principal medical intervention utilized to  
78 decrease both maternal and neonatal morbidity and mortality(1).

79 Because of the risk of failed induction of labour, a variety of maternal and fetal factors as well  
80 as screening tests have been suggested to predict labour induction success. These include  
81 maternal factors such as parity, height, weight, body mass index (BMI), maternal age, Bishop  
82 Score and its components and fetal factors such as birth weight and gestational age (9, 13, 16,  
83 17).

84 Even though there is the fact that induction of labour plays a significant role in the reduction of  
85 maternal mortality and neonatal mortality the success rate and contributing factors, as well as  
86 failed induction and aggravating factors, were not known. Also with controversies surrounding  
87 the use of induction with oxytocin to initiate labour and the absence of technological supports to  
88 evaluate the likelihood of success in resource-limited settings, there are little evidence about the  
89 outcome of induction in Ethiopian hospitals. So in this study, we aimed to assess the proportion  
90 of failed labour induction and associated factors among women undergoing labour induction at  
91 the Dessie referral hospital.(Figure 1)

## 92 **Materials and Methods:**

93 A facility-based cross-sectional study was conducted at Dessie referral hospital, Dessie town,  
94 south-east Ethiopia from January 01 to February, 2017. In Dessie town, there are seven health  
95 centres and one hospital owned by the government, two nongovernment clinics and privately  
96 owned three hospitals and five higher clinics. The total population of Dessie town was 198,801.  
97 Single population formula was used to calculate the sample size, by using 21.4% of the  
98 proportion of failed induction of labour. Systematic random sampling technique was used to  
99 select a sample from the list of women who underwent induction of labour.

## 100 **Data Collection Methods:**

101 Data were collected from medical records of women for whom induction of labour was  
102 performed in Dessie Referral hospital using a pre-tested structured questionnaire. Items were  
103 developed from different kinds of literature to assess socio demography factors, obstetric factors,  
104 types of induction performed and health indication for labour induction. The questionnaire  
105 consists of five sections that have a total of 23 items which describe the purpose of the study.

## 106 **Analysis:**

107 After checking its completeness and appropriateness, the collected data were entered by EPI  
108 INFO version 3.5 and exported to SPSS version 20.0 for analysis. Different statistical analysis  
109 including descriptive statistics and bivariate and multivariate logistic regression analysis was  
110 conducted to determine the relationship between the dependent and independent variables. First  
111 binary logistic regression was used to identify variables and after these variables having p value,

112 less than 0.25 was fitted to a multivariate logistic regression model to determine the relationship  
113 between the dependent and independent variables. Adjusted odds ratio with 95% CI was  
114 computed to see the strength of association. The analyzed data was presented using texts, tables,  
115 charts and graphs

#### 116 **Ethical consideration:**

117 Ethical clearance letter was obtained from the ethical review board of Wollo University College  
118 of **Medicine and** health sciences. Official permission letters were also obtained from Dessie town  
119 health department and for Dessie referral hospital. Confidentiality and anonymity of the record  
120 had been ensured throughout the execution of the study by taking only the required information  
121 without using the name of the client.

#### 122 **Result:**

##### 123 **Socio-demographic characteristics:**

124 A total of 319 medical records of mothers who gave birth after induction of labour were selected  
125 for study purpose. The age of the study subjects ranged from 19-37 years and mean age and  
126 standard deviation of the selected women was 25.97 (SD=4.81) and 256 of all samples were  
127 below 30 years of age. (Table1)

##### 128 **Obstetric condition**

129 Most of the women 198(62.1%) were primiparous. The mean gestational age was 37.96 weeks  
130 (range: 32-43 weeks). (Table 2)

131 Of the included 319 women, 133(41.7%) undergone induction of labour due to hypertensive  
132 disorder followed by 111(34.8%) due to premature rupture of membrane (PROM). (Figure 2)

##### 133 **The outcome of labour induction**

134 Out of the total 170(53.3%) of women delivered vaginally within 8 hours after induction was  
135 started, while 136(42.6%) delivered by cesarean section (CS)(Figure 3).From women who  
136 delivered by cesarean section 63(19.7%) undergone CS due to failed induction of labour,  
137 40(12.5%) were due to fetal distress. (Figure 4)

138 From a total of 319 women sampled in 12(3.8%) of the cases membranes were changed into  
139 meconium after induction of labour. Following induction in 15(4.7%) of the cases, fetal heart  
140 rate was recorded as non-reassuring. (Table 3)

#### 141 **Factors associated with failed induction of labour**

142 In this study, the association of different factors of the respondents with failed induction of  
143 labour was investigated using bivariate and multivariate logistic regression analysis. Different  
144 socio-demographic and obstetric variables were entered in stepwise regression.

145 In the initial model, bivariate analysis there were seven variable; educational status of the  
146 mother, residence of the mother, indication of induction, Gestational age of the fetus, rupture of  
147 membrane before induction of labour, Bishop score of the cervix and parity of the mother shows  
148 statistically significant association with the outcome variable at p-value <0.25.

149 However, multiple logistic regressions show that educational status of the mother, residence and  
150 Bishop Score of the cervix persisted as independent factors for the outcome variable. The odds of  
151 failed induction were 4.171 times more likely in women lives in rural area [4.171(1.358-12.807)]  
152 than women who live in urban area; the odds of failed induction of labour were 1.720 times more  
153 likely in primipara [AOR=1.72(1.67-4.415)] than women who were multipara; the odds of failed  
154 induction of labour were 0.147 times more likely in women whose Bishop score is unfavourable  
155 [ 0.147(0.066-0.327 )] than women whose Bishop score is favourable one. (Table 4)

#### 156 **DISCUSSION**

157 Induction of labour is one of the fastest-growing procedures in current obstetric practice. The  
158 increasing incidence of induction of labor may be attributed to multiple possible causes.  
159 Increasing trends of maternal morbidity, which as previously discussed may increase the number  
160 of medical indications for IOL, are one possible cause. However, the fact that higher  
161 remunerative payers are associated with higher rates of IOL suggests that nonclinical factors  
162 such as provider or patient preference may also play a role. The World Health Organization and  
163 the American College of Nurse-Midwives (ACNM) both advocate that IOL should only be  
164 performed when there is a clear medical indication supported in the literature and the benefits  
165 outweigh the potential harms (1, 2, 14).

166 The rate of failed induction was 19.7 % ( 15.4%-23.8%). Educational status, resident and  
167 unfavourable Bishop Scores were found to be independent factors of failed induction.

168 This study shows that the rate of failed induction **was similar** to the study done in Hawassa  
169 (17.3%) and Jimma (21.4%)(9, 10). This is due to the similarity in the definition of failed  
170 induction and similarity in setup. In the other way, the rate of failed induction of labour is lower  
171 than the study done in a health resource-poor setting (24.1%) and study done in Addis Abeba  
172 (40.3%). The difference may also be due to complicated obstetric cases being handled. Also,  
173 the finding of this study was higher than the study conducted in many other countries Zambia  
174 (13.4%), Australia (15.2%). This discrepancy may be due to the difference in the quality of  
175 induction care provided by the hospitals.

176 The common indications for induction of labour in the study area were Post-term pregnancy,  
177 premature rupture of membrane and hypertension disorder during pregnancy. Similarly, the  
178 study done in Kathmandu Medical College Teaching Hospital showed predominant indications  
179 for induction were: post-term pregnancy, PROM, oligohydramnios, and others. In the study done  
180 at a regional hospital in KwaZulu-Natal, South Africa the three main indications for induction of  
181 labour were hypertensive disorders, post-dates pregnancy and pre-labour rupture of the  
182 membranes(7). However, the study was done Hawassa public health facilities showed  
183 predominant indications for induction were: the premature rupture of membrane, Preeclampsia,  
184 Post-term and Chorioamnionitis. In the study done at Jimma University, Specialized hospital the  
185 three main indications for induction of labour were the premature rupture of membrane,  
186 Hypertension disorder and Post-term(9).

187 The finding of this study also showed that the odds of failed induction were 4.171 times more  
188 likely in women who live in the rural area than where live in the urban area. This may be due to  
189 women who live in a rural area not come to health institution and appropriate and timely  
190 intervention may not be given. So, induction of labour may fail.

191 The finding of this study also showed that the odds of failed induction were 1.72 times more  
192 likely in primipara mothers. This finding is supported by the study done in Hawassa public  
193 health facilities, Jimma University specialized hospital(9, 10). Most authors have noted that

194 **increased** parity had a favourable bearing on the outcome of induction. Also, labour prolonged in  
195 primiparara women since cervix was not tasted for labour.

196 The odds of failed induction were 0.147 more likely in women with unfavourable Bishop score  
197 than women with favourable Bishop score. This finding is supported by the study done in most  
198 studies reviewed. The finding of this study shows that inducing of labour should better be  
199 performed at the favourable cervix for a good outcome. It also supports the scientific findings of  
200 different literatures that the condition of the cervix at the start of induction is an important  
201 predictor, with the modified Bishop score being a widely used scoring system. Induction of  
202 labour results in a high failure rate if the cervix is not ripe(2, 7, 12, 13, 22, 23).

## 203 **CONCLUSION**

204 The proportion of failed induction of labour was relatively high in the study area. Variables  
205 which increased the likelihood of failed induction were living rural area, primigravidity and  
206 unfavourable bishop score before induction of labour.

## 207 **List of abbreviations and Acronym**

208	CI	Confidence Interval
209	CS	Cesarean Section
210	OR	Odd Ratio
211	IOL	Induction Of Labor
212	ROM	Rupture of Membrane
213	SPSS	Statistical Package for Social Science
214	WHO	World Health Organization

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218 **Competing interests**

219 The authors declare that they have no competing interests.

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290 **Annex: Questionnaire**

291 Factors associated with failed induction of labor at Dessie referral hospital , 2016

292 Participant ID # \_\_\_\_\_ Date: \_\_\_\_\_

293 Part 1: Socio-Demographic and baseline health information

- 294 1. Age (years).....
- 295 2. Parity -----
- 296 3. Religion of the women
- 297 1. orthodox 2. muslim 3. protestant 4. others specify
- 298 4. Ethnic group
- 299 1. Amhara 2. oromo 3. tigrie 4. other specify
- 300 5. Marital Status
- 301 1. Single 2. Married 3. Widowed 4. Divorced 5. Other (Specify)
- 302 6. Education Level
- 303 1. unable to read and write
- 304 2. Grade 1-8
- 305 3. Grade 9-12
- 306 4. Collage and above
- 307 5. Other specify
- 308 7. Occupation
- 309 1. Unemployed 2. Formal Employment 3. Informal Sector 4. Other (Specify)
- 310 8. Residential Address
- 311 1. Urban 2. Rural
- 312 Part 2: Induction of labor
- 313 1. Date and Time induction commenced (from notes).....
- 314 2. Indication(s) for Induction, tick where applicable

- 315 1. Post term
- 316 2. PROM
- 317 3. Hypertensive disorders
- 318 4. Diabetes
- 319 5. IUGR
- 320 6. Others specify
- 321 3. Gestation age in weeks (indicate).....
- 322 4. Membranes already ruptured before induction
- 323 1. Yes 2. No
- 324 If yes go to 5, if no go straight to 6
- 325 5. Liquor foul smelling...
- 326 1. Yes 2. No
- 327 6. Bishop's score (indicate).....
- 328 7. Method of induction (indicate)
- 329 1. Aminotomy
- 330 2. Intravenous oxytocin infusion
- 331 3. Complimentary methods
- 332 8. If misoprostol only, route of administration
- 333 1. Vaginal 2. Oral 3. Sublingual 4. Not applicable
- 334 9. Total amount of misoprostol given (indicate).....
- 335 1. 50ug 2. 100ug 3. 150ug 4. 200ug 5. >200ug

336 10. Uterine hyper stimulation present (as recorded in notes)

337 1. Yes 2. No

338 11. Fetal heart rate non-reassuring following induction of labor

339 1. Yes 2. No

340 12. Change of color of liquor to meconium stained

341 1. Yes 2. No

342 13. Mode of delivery

343 1. Vaginal delivery

344 2. Instrumental vaginal delivery

345 3. Caesarean section

346 14. If delivery by caesarean section, indication:

347 1. Failed induction of labour

348 2. Fetal distress

349 3. cephalopelvic disproportion

350 4. Malposition

351 5. Others indicate.....

352 15. Ruptured Uterus present

353 1. Yes 2. No

354 16. Any other serious maternal morbidity (indicate).....

355 17. Date and time of delivery.....

356 18. Newborn status during delivery

357 1. Alive 2. fresh/macerated stillbirth

358 19. Birth weight in grams.....

359 20. Apgar score at 1 and 5 min..... /.....

360 21. Admission to NICU after delivery

361 1. Yes 2. No

362 22. Reason for admission to NICU (mention)....

363 23. Perinatal death

364 1. Yes 2. No

365 Tables

366 Table 1: Socio demographic characteristics women who undergone induction of labor from  
367 September 1st to August 31st in 2015 (N=319)

Characteristics	Frequency N=319	Percentage %
Age		
<=20	48	15
21-25	127	39.8
26-30	103	32.3
31-35	25	7.8
>=36	16	5
Religion		
Orthodox	65	20.4
Muslim	251	78.7

Protestant	3	0.9
Ethnicity		
Amhara	319	100
Marital status		
Married	319	100
Educational level		
Unable to read and write	51	16
Grade 1-8	102	32
Grade 9-12	97	30.2
Collage and above	69	21.6
Occupation		
Unemployed	247	77.4
Formal employment	72	22.6
Residential address		
Urban	214	67.1
Rural	105	32.9

368

369 Table 2:- Obstetric condition of women who undergone induction of labor from September 1st to  
370 August 31st in 2015 (N=319)

Obstetric conditions	Frequency N=319	Percentage (%)
Parity		



Para 1	198	62.1
Para 2	99	31.0
Para 3	3	0.9
Para 4	16	5.0
Para 5 and above	3	0.9
Indication of induction		
Post term	18	5.6
PROM	111	34.8
Hypertensive disorder	133	41.7
IUGR	6	1.9
IUFD	51	16.0
Gestational age		
Preterm	84	26.3
Term	191	59.9
post term	44	13.8
Membrane rupture before induction		
Yes	111	34.8
No	208	65.2
Bishop score		
Favorable	228	71.5

Unfavorable	91	28.5
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371 Table 3:- Outcome of induction of labor among women who undergone induction of labor from  
372 September 1st to August 31st in 2015 (N=319)

Characteristics	Frequency N=319	Percentage(% )
Time taken for induction		
<8 hour	118	37
8-16 hrs	185	58
>16 hrs	16	5
Non reassuring fetal heart rate		
Yes	15	4.7
No	304	95.3
Change of liquor to meconium		
Yes	12	3.8
No	307	96.2
Mode of delivery		
Vaginal	170	53.3
Instrumental delivery	13	4.1
Cesarean delivery	136	42.6
Indications for cesarean delivery		
Failed induction of labor	63	19.7
	40	12.5

Fetal distress	18	5.6
CPD	15	4.7
Malposition	183	57.4
Not done		
Alive fetus		
Yes	252	79
No	67	21
Birth weight		
<1500g	19	6
1500-2499g	64	20.1
2500-3999g	204	63.9
>4000g	32	10
APGAR score		
<seven	125	39.2
>seven	194	60.8
Outcome of induction		
Failed induction of labor	63	19.7
Success induction of labor	256	80.3

373 Table 4: factors associated with failed induction of labor among women who undergone  
374 induction of labor from September 1st to August 31st in 2015.

Variables	<u>Failed induction of labor</u>	COR(95% CI)	AOR(95%CI)
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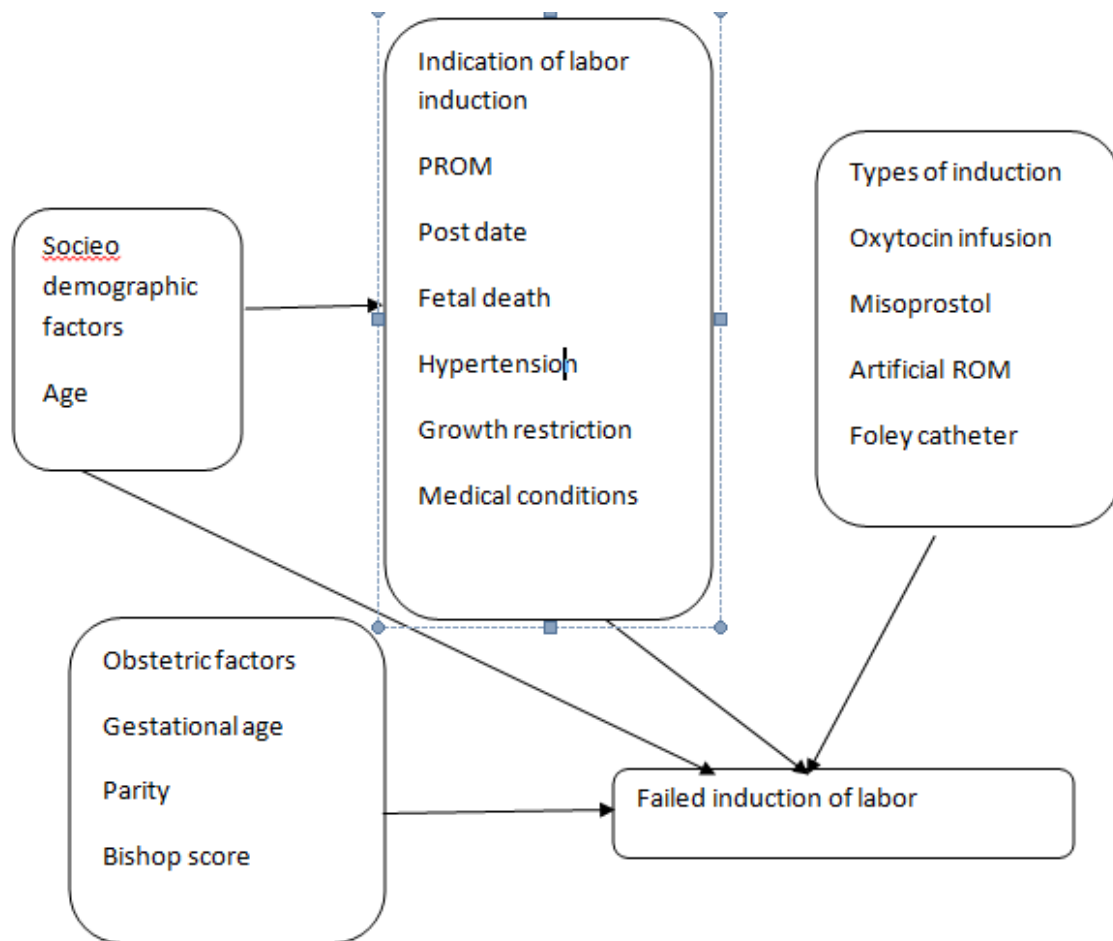
	Yes	No		
Educational status			0.728(0.548-0.967)*	
Unable to read and write	9(17.6%)	42(82.4%)		
Grade 1-8	9(8.8%)	93(91.2%)		
Grade 9-12	29(29.9%)	68(70.1%)		
Collage and above	16(23.2%)	53(76.8%)	1	
Resident				1
Urban	57(26.6%)	157(73.4%)	1	4.171(1.358-
Rural	6(20.7%)	99(84.3%)	5.99(2.49-14.41)*	12.807)**
Indication for induction			1.589(1.215-2.077)*	
Post term	12(66.7%)	6(33.3%)		
PROM	21(18.9%)	90(81.1%)		
Hypertensive disorder	24(18%)	109(82)		
IUGR	6(100)	0(0%)		
IUFD	0(0%)	51(100%)	1	
Gestational age				
Preterm	10(11.9%)	74(88.1%)	1	
Term	41(21.5%)	50(78.5%)		
Post term	12(27.3%)	32(72.7%)	0.889(0.8-0.988)*	
Rupture of membrane before induction of labor				

Yes				
No	21(18.9%)	90(81.1%)	1	
	42(20.2%)	166(79.8%)	0.922(0.515-1.653)	
Gravidity				
Primigravida	44(22.2%)	154(77.8%)	1.534(0.847-2.776)*	1.72(1.67-4.415)**
Multigravida	19(15.7%)	102(84.3%)	1	1
Bishop score				
Favorable	25(11.0%)	203(89.0%)	1	1
Not favorable	38(41.8%)	53(58.2%)	0.414(0.309-0.556)*	0.147(0.066-0.327)**

375 N.B 1 = reference

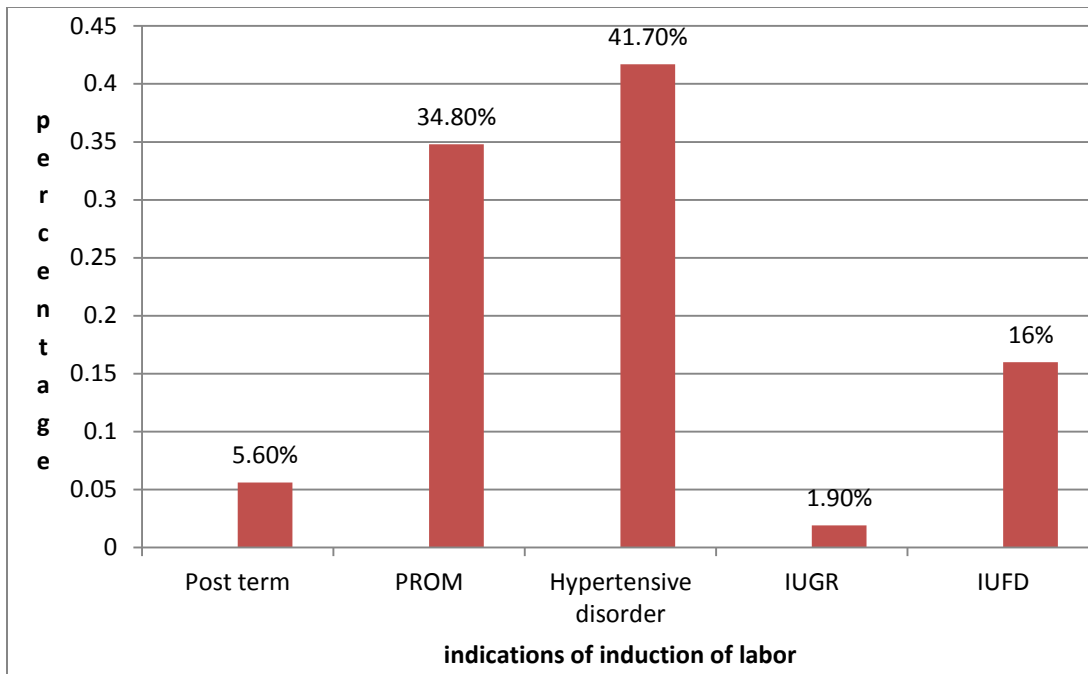
376 \*\* = statistically significant at p-value  $\leq 0.05$

377 Figures



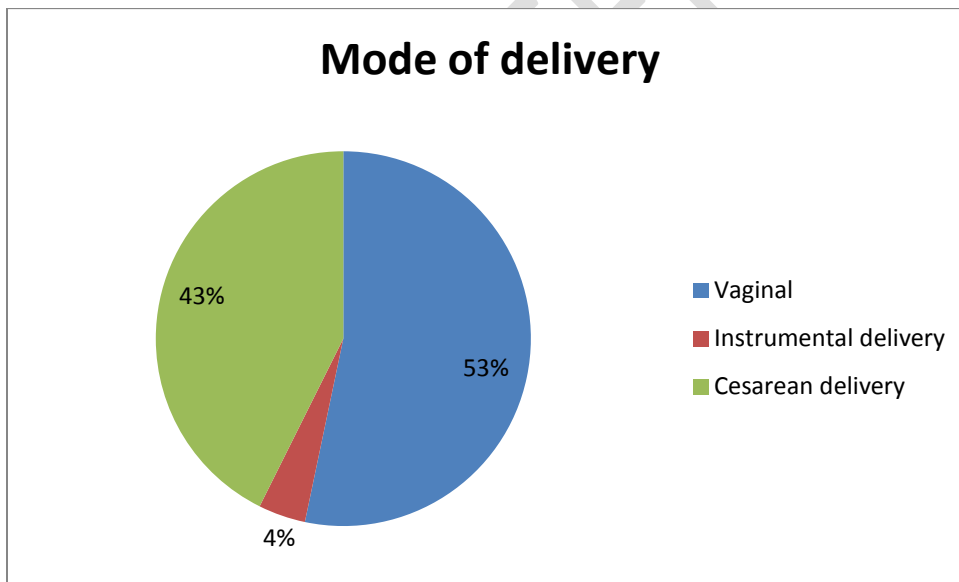
378  
 379 Figure 1. Conceptual frame work of factors affecting failed induction of labor (constructed after  
 380 reviewing literatures

UNDER P...



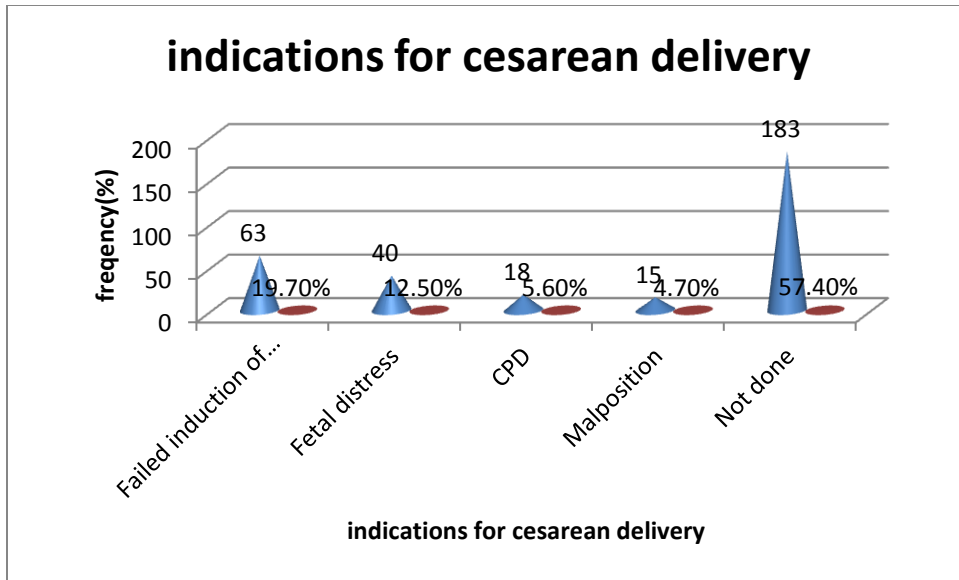
381

382 Figure 2: Indication of induction of labor among women deliver in Dessie referral hospital,  
 383 Ethiopia, 2017.



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385 Figure 3: Mode of delivery among women who undergone induction of labor in Dessie referral  
 386 hospital , Ethiopia, 2017.



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388 Figure 4: reasons for cesarean section among women delivered after induction of labor in Dessie  
 389 referral hospital, Ethiopia, 2017.

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