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Proportion of failed induction of labor and associated factors among women undergoing induction of labor in Dessie referral hospital; Northeast Ethiopia a cross sectional study

Abstract

Background: There are a number of complications of pregnancy that confer significant ongoing risk to the mother or fetus. For these conditions, induction of labor is as an artificial termination of pregnancy utilized to decrease both maternal and neonatal morbidity and mortality. The process of inducing labor 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 whom undergo labor induction at Dessie referral hospital from September 1st to August 31st. Systematic sampling techniques will be used to select the samples. The data was cleaned, edited, coded, and entered in to 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 outcome variable. Adjusted odds ratio with 95% CI was computed to see the strength of association.

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

Conclusion: The proportion of failed induction of labor was relatively high in the study area. Variables which increased the likelihood of failed induction were living rural area, primigravidity and unfavorable bishop score prior to induction of labor.

Keywords : proportion, failed induction of labor, associated factors , Ethiopia

28 **Introduction**

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

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

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

50 Outcome of labor induction will be either success or failed. But no consensus has been reached
51 regarding the diagnosis of failed induction. A variety of end points have been suggested
52 including cesarean delivery, not achieving a vaginal delivery within a specified time , not
53 achieving active labor within a specified time, or failure to achieve the active phase of labor may
54 use to diagnose failed inductions. Many factors lead to failed induction such as initial poor
55 cervical Bishop's score at induction (indicating an unripe cervix), nulliparity, fetal
56 macrosomia, a high body mass index and advanced maternal age(9-11).

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

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

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

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

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

83 Even though there is the fact that induction of labor plays a significant role in reduction of
84 maternal mortality and neonatal mortality the success rate and contributing factors as well as
85 failed induction and aggravating factors were not known. In addition with controversies

86 surrounding the use of induction with oxytocin to initiate labor and the absence of technological
87 supports to evaluate likelihood of success in resource limited settings, there are little
88 evidences in relation to outcome of induction in Ethiopian hospitals . So in this study we aimed
89 to assess proportion of failed labor induction and associated factors among women undergoing
90 labor induction at Dessie referral hospital.(Figure 1)

91 **Materials and Methods:**

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

99 **Data collection Methods:**

100 Data was collected from medical records of women for whom induction of labor was performed
101 in Dessie Referral hospital using pre tested structured checklist. Items were developed for this
102 study to assess socio demography factors, obstetric factors, types of induction performed and
103 health indication for labor induction. Checklist consist five sections that have a total of 23 items
104 which describe the purpose of the study.

105 **Analysis:**

106 After checking its completeness and appropriateness, the collected data was entered by EPI
107 INFO version 3.5 and exported to SPSS version 20.0 for analysis. Different statistical analyses
108 including descriptive statistics and bivariate and multivariate logistic regression analysis was
109 conducted to determine the relationship between the dependent and independent variables. First
110 binary logistic regression was used to identify variables and after these variables having p value
111 less than 0.25 was fitted to multivariate logistic regression model to determine the relationship
112 between the dependent and independent variables. Adjusted odds ratio with 95% CI was

113 computed to see the strength of association. The analyzed data was presented using texts, tables,
114 charts and graphs

115 **Ethical consideration:**

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

121 **Result:**

122 **Socio-demographic characteristics:**

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

127 **Obstetric condition**

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

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

132 **Outcome of labor induction**

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

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

140 **Factors associated with failed induction of labor**

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

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

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

155 **DISCUSSION**

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

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

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

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

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

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

193 increasing parity had a favorable bearing on the outcome of induction. In addition labor also
194 prolonged in primiparara women since cervix were not tasted for labor.

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

202 **CONCLUSION**

203 The proportion of failed induction of labor was relatively high in the study area. Variables which
204 increased the likelihood of failed induction were living rural area, primigravidity and
205 unfavorable bishop score prior to induction of labor.

206 **List of abbreviations and Acronym**

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

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217 **Competing interests**

218 The authors declare that they have no competing interests.

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279 **Annex: Questionnaire**

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

281 Participant ID # _____ Date: _____

282 Part 1: Socio-Demographic and baseline health information

283 1. Age (years).....

284 2. Parity -----

285 3. Religion of the women

286 1. orthodox 2. muslim 3. protestant 4. others specify

287 4. Ethnic group

288 1. Amhara 2. oromo 3. tigrie 4. other specify

289 5. Marital Status

290 1. Single 2. Married 3. Widowed 4. Divorced 5. Other (Specify)

291 6. Education Level

292 1. unable to read and write

293 2. Grade 1-8

294 3. Grade 9-12

295 4. Collage and above

296 5. Other specify

297 7. Occupation

298 1. Unemployed 2. Formal Employment 3. Informal Sector 4. Other (Specify)

299 8. Residential Address

300 1. Urban 2. Rural

301 Part 2: Induction of labor

302 1. Date and Time induction commenced (from notes).....

303 2. Indication(s) for Induction, tick where applicable

304 1. Post term

305 2. PROM

306 3. Hypertensive disorders

307 4. Diabetes

308 5. IUGR

309 6. Others specify

310 3. Gestation age in weeks (indicate).....

311 4. Membranes already ruptured before induction

312 1. Yes 2. No

- 313 If yes go to 5, if no go straight to 6
- 314 5. Liquor foul smelling...
- 315 1. Yes 2. No
- 316 6. Bishop's score (indicate).....
- 317 7. Method of induction (indicate)
- 318 1. Aminotomy
- 319 2. Intravenous oxytocin infusion
- 320 3. Complimentary methods
- 321 8. If misoprostol only, route of administration
- 322 1. Vaginal 2. Oral 3. Sublingual 4. Not applicable
- 323 9. Total amount of misoprostol given (indicate).....
- 324 1. 50ug 2. 100ug 3. 150ug 4. 200ug 5. >200ug
- 325 10. Uterine hyper stimulation present (as recorded in notes)
- 326 1. Yes 2. No
- 327 11. Fetal heart rate non-reassuring following induction of labor
- 328 1. Yes 2. No
- 329 12. Change of color of liquor to meconium stained
- 330 1. Yes 2. No
- 331 13. Mode of delivery
- 332 1. Vaginal delivery
- 333 2. Instrumental vaginal delivery

- 334 3. Caesarean section
- 335 14. If delivery by caesarean section, indication:
- 336 1. Failed induction of labour
- 337 2. Fetal distress
- 338 3. cephalopelvic disproportion
- 339 4. Malposition
- 340 5. Others indicate.....
- 341 15. Ruptured Uterus present
- 342 1. Yes 2. No
- 343 16. Any other serious maternal morbidity (indicate).....
- 344 17. Date and time of delivery.....
- 345 18. Newborn status during delivery
- 346 1. Alive 2. fresh/macerated stillbirth
- 347 19. Birth weight in grams.....
- 348 20. Apgar score at 1 and 5 min..... /.....
- 349 21. Admission to NICU after delivery
- 350 1. Yes 2. No
- 351 22. Reason for admission to NICU (mention).....
- 352 23. Perinatal death
- 353 1. Yes 2. No
- 354 Tables

355 Table 1: Socio demographic characteristics women who undergone induction of labor from
 356 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

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358 Table 2:- Obstetric condition of women who undergone induction of labor from September 1st to
359 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

360 Table 3:- Outcome of induction of labor among women who undergone induction of labor from
361 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
Fetal distress	40	12.5
CPD	18	5.6
Malposition	15	4.7
Not done	183	57.4
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

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

Variables	<u>Failed induction of labor</u>		COR(95% CI)	AOR(95% CI)
	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)**

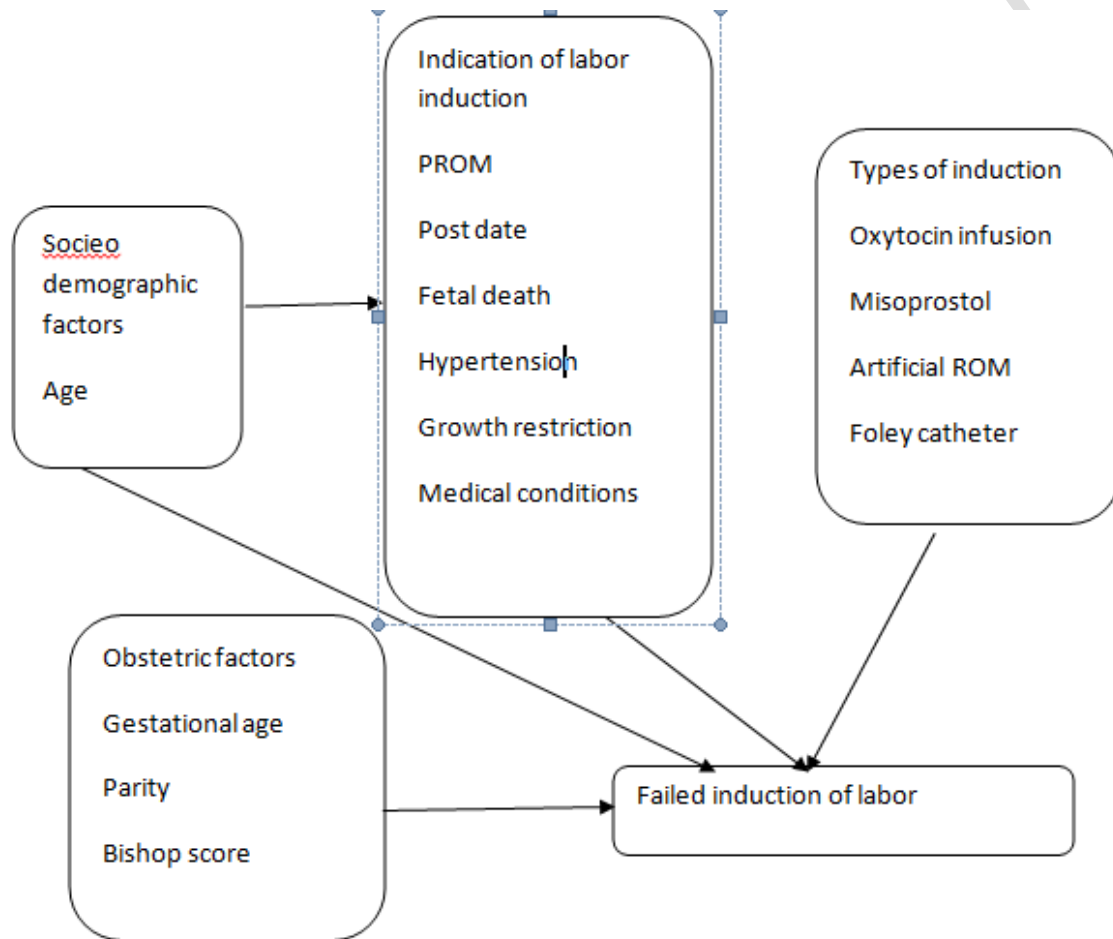
Indication for induction			1.589(1.215-2.077)*	
Post term	12(66.7%)	6(33.3%)		
PROM	21(18.9%)	90(81.1%)		
Hypertensive disorder	24(18%)	109(82)		
IUGR	6(100)	0(0%)		
IUFD	0(0%)	51(100%)	1	
Gestational age				
Preterm	10(11.9%)	74(88.1%)	1	
Term	41(21.5%)	50(78.5%)		
Post term	12(27.3%)	32(72.7%)	0.889(0.8-0.988)*	
Rupture of membrane before induction of labor				
Yes	21(18.9%)	90(81.1%)	1	
No	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)**
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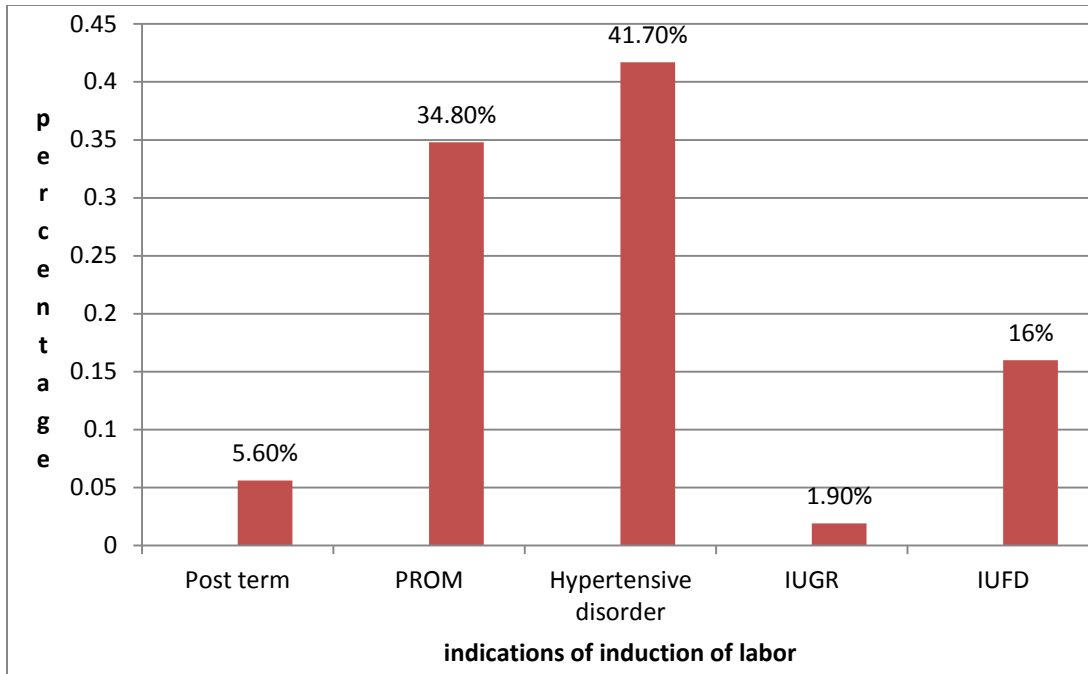
364 N.B 1 = reference

365 ** = statistically significant at p-value <=0.05

366 Figures

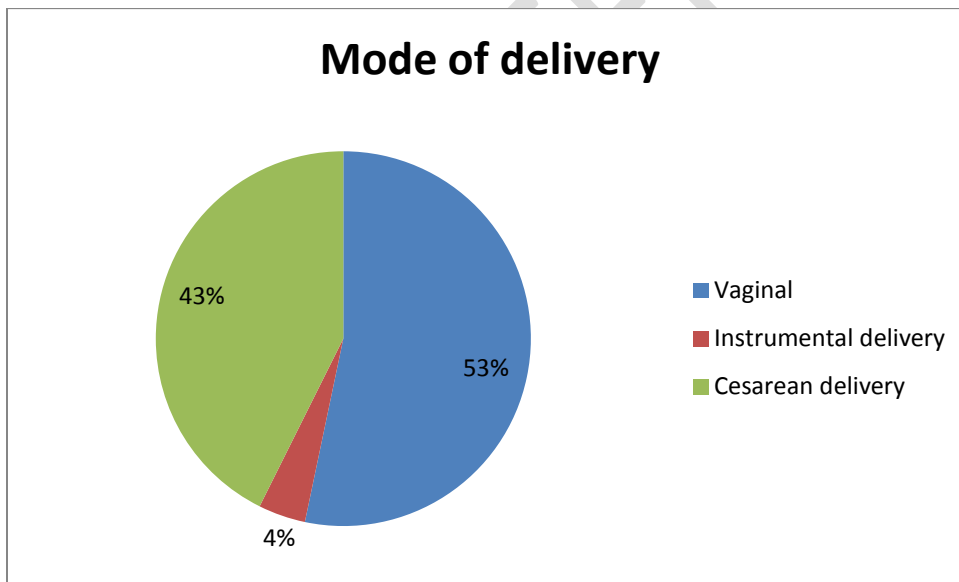


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 368 Figure 1. Conceptual frame work of factors affecting failed induction of labor (constructed after
 369 reviewing literatures



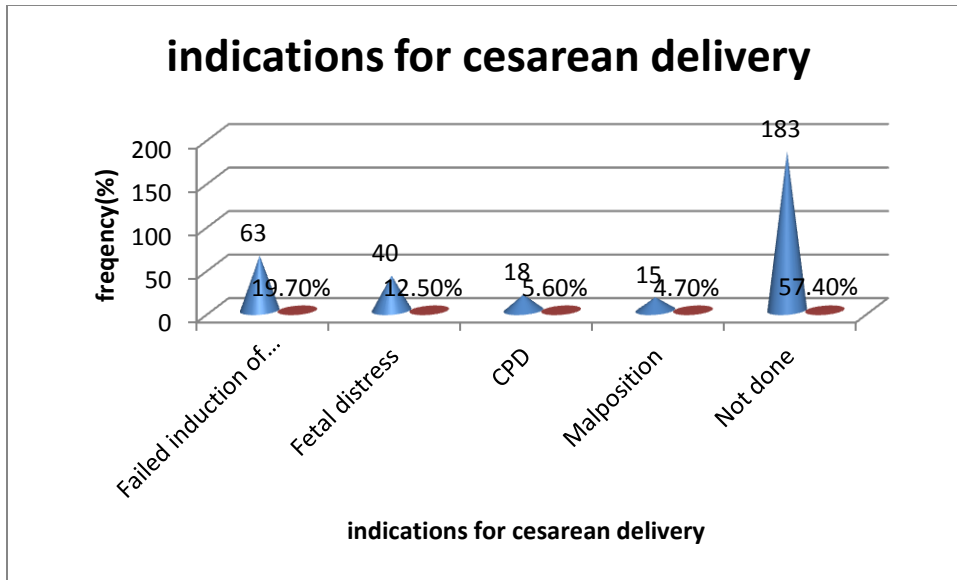
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371 Figure 2: Indication of induction of labor among women deliver in Dessie referral hospital,
 372 Ethiopia, 2017.



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



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

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