Predicting factors of failed induction of labor in three hospitals of Southwest Ethiopia: a cross-sectional study

Amare Genetu Ejigu* and Shewangizaw H/mariam Lambyo

Abstract

Introduction: Failed induction of labor affects maternal and neonatal outcomes as well as the cost of healthcare, especially in low-resource setting regions in which the prevalence of failed induction is higher despite the incidence of labor induction is low. This study aimed to assess the prevalence of failed induction of labor in southwest Ethiopia.

Method: A hospital-based cross-sectional study was conducted among 441 induced women from March 1 to August 30, 2018. A systematic random sampling technique was used to select study participants. Data were collected using a pretested and structured questionnaire. Bivariable and multivariable logistic regression models were done and fitted to identify predictors of failed induction. An adjusted odds ratio with 95% confidence interval (CI) was calculated to determine the level of significance.

Result: Premature rupture of membrane was the most common cause of labor induction and the commonly used method of labor induction were oxytocin infusion. Cesarean section was done for 28.1% of induced women. Failed induction of labor was found to be 21%. Primiparous [AOR = 2.35 (1.35–4.09)], analgesia/anesthesia [AOR = 4.37 (1.31–14.59)], poor Bishop Score [AOR = 2.37 (1.16–4.84)], Birth weight ≥ 4 k grams [AOR = 2.12 (1.05–4.28)] and body mass index [AOR = 5.71 (3.26–10.01)] were found to be significantly associated with failed induction of labor.

Conclusion: The prevalence of failed induction of labour was found to be high. Preparation of the cervix before induction in primiparous women is suggested to improve the success of induction. To achieve the normal weight of women and newborns, proper nutritional interventions should be given for women of reproductive age. It is better to use analgesia/anesthesia for labor induction when it becomes mandatory and there are no other optional methods of non-pharmacologic pain management.

Keywords: Labor induction, Failed induction, Cesarean section, And Ethiopia
Introduction
Induction of labor (IOL) is an interventional designed to artificially initiate uterine contractions [1]. IOL should be done only when there is a clear medical indication for it and the expected benefits outweigh its potential harm [2]. In the past several years, the incidence of labor induction around the world has continued to be raised [2, 3].

Induction of labor is increased risk of poor maternal and perinatal outcomes (perianal laceration, hysterectomy, intensive care unit admission, longer hospital stay, postpartum hemorrhage, and chorioamnionitis) [4–8]. Cesarean delivery is increased approximately 2–3 fold in women who undergo induction of labor compared with spontaneous labor, and failed induction is the most common indication for cesarean delivery [9–18]. Health care expenses for delivery care services were significantly higher for cesarean section (270 USD) than for vaginal delivery (59 USD) [19]. In Ethiopia, the cesarean section is higher among induced women (38.44%) [20] compared to spontaneous labor (19.2%) [21].

Studies were done in American, African, and Asian countries showed that low Apgar scores at 5 min, low birth weight, neonatal intensive care unit admission, stillbirth, and delayed breastfeeding increased when labor induced [4, 8, 22, 23].

The global prevalence of obesity among women has increased from 6% in 1975 to 15% in 2016 [24]. Obese women are at increased risk of impairment of the active phase of labor (specifically dilatation arrest) and prolonged duration of active phase of labor [25, 26]. Maternal obesity and overweight are associated with adverse pregnancy outcomes [27, 28]. Recent studies have shown that maternal obesity increases the risk of obesity in children, affects fetal metabolism and tissue development through the heritage of maternal obesity-susceptible genes and cognitive performance and behavior of the offspring [29–32]. A meta-analysis study revealed that overweight and obese women contributed 21.7 to 41.7% of children overweight/obesity [33].

According to research; maternal age, gestational age, parity, bishop score, PROM, postterm, previous obstetric complications, and birth weight are the most common contributing factors for failed induction [16, 20]. However, the determinants of failed labor induction are not consistent across different health institutions and sociodemographic status across society. Therefore, this study aimed to assess the prevalence of failed induction of labor among induced women in public hospitals in Keffa, Sheka, and Bench Maji Zone, Southwest Ethiopia.

Methods
Study setting
The study was conducted at Mizan Tepi University Teaching Hospital, Gebretsadik-shaw General Hospital and Tepi General Hospital from March 1 to August 30, 2018. Those 3 hospitals are the only hospitals which provide induction of labor service in the catchment area. Based on the 2017 Population forecast, a total of 2,218,689 population, of whom 1,123,834 females lived in Bench Maji Zone, Kaffa Zone, and Sheka zones [34]. In the study area, there were 103 governmental health facilities, of which 6 hospitals and 97 health centers. During the study period, only 3 hospitals were provided induction of labor. A Hospital-based cross-sectional study was done among induced women who had a singleton pregnancy, cephalic presentation, longitudinal lie and gestational age 28 weeks and beyond during delivery services.

Sample size calculation
A single population proportion formula was used to calculate the required sample size of the study. Considering the assumptions of 95% level of confidence, 4% margin of error, and 21.4%(p) the proportion of failed induction of labor, which was taken from a previous study [35]. Considering a 10% nonresponse rate, the final sample size became 449.

Sampling procedure
A systematic random sampling technique was used to select study respondents. In these three zones, all hospitals that provided induction of labor were included in this study. Distribution of the required sample size was done based on the proportional number of labor inductions performed in each public hospital. The data (the number of labor induction in each public health hospitals) were obtained from delivery register of women prior to actual data collection. Sampling interval approaches were implemented. We calculated the sampling interval (K) using the summation of 6 months of labor induction at public hospitals, which was 1004. Then K = N/n, 1004/449 = 2.23 ≈ 2. Every 2nd induced woman was interviewed and their medical records were reviewed. To start with the first interview, we used lottery method.

Data collection tool techniques
Data were collected by interviewing women as well as reviewing their medical records. Upon admission and through the period of labor and delivery, information regarding obstetric characteristics, indications for IOL, methods used for IOL, and information about the outcome of IOL were collected. To assure the quality of data, before the actual data collection, technical training was given for data collectors and a pretest was done on 5% of the total sample size outside of the study area, which has similar characteristics to the study population. To collect all the required sample sizes, we used 6 trained diploma midwives as data collectors and 2
physicians for supervisors. The supervisors checked each filled questionnaire for completeness, accuracy, and consistency daily.

Data analysis
After data were collected, the questionnaires were coded and entered using Epi data version 3.1 and exported to SPSS software version 20 for analysis. Descriptive statistics were carried out to characterize the study population using different variables. Variables with a $p$-value < 0.2 in the bivariate analysis were entered into the multiple logistic regressions for further analysis. Finally, variables with a $P$ value < 0.05 in the multivariable logistic analysis were considered statistically significant.

Operational definition
Failed induction
is defined as failure to achieve regular (e.g. every 3 min) uterine contractions and cervical change after at least 6–8 h of the maintenance dose of oxytocin administration, with artificial rupture of membranes. Artificial rupture of membranes is done for induction of labor with alive fetus. Artificial rupture of membranes is not done for induction of labor indicated with Intra-Uterine Fetal Death.

Post-term
is defined as a pregnancy that advances to or beyond 42 completed weeks or 294 days of gestation from the first day of the last normal menstrual period.

Table 1 Protocol and schedule used for escalating oxytocin dosage induction of labor in the study area

| Dose and oxytocin concentration | Time | Drops / minute 1 ml = 20 drops | Approximate oxytocin in mIU/ minute |
|--------------------------------|------|--------------------------------|-----------------------------------|
| First dose: 5 IU of oxytocin in 1000 ml fluid | 0:00 h | 20 | 2 |
| | 0:30 h | 40 | 4 |
| | 1:00 h | 60 | 6 |
| | 1:30 h | 80 | 8 |
| Second dose: Add another 5 IU of oxytocin to the remaining first dose fluid | 2:00 h | 50 | 12 |
| | 2:30 h | 60 | 15 |
| | 3:00 h | 80 | 20 |
| Third dose: Add another 5 IU of oxytocin on the remaining second dose fluid | 3:30 h | 50 | 24 |
| | 4:00 h | 60 | 30 |
| | 4:30 h | 80 | 40 |
| | 5:00 h | As above | As above |
| | 5:30 h | As above | As above |

$mIU$ Million international unit, N/S Normal saline and R/L Ringer lactate

Protocol and implementation of induction of labor
In the study area (in all hospitals) both mechanical (balloon catheter and Sweeping membrane) and medical (misoprostol and oxytocin) methods are employed for induction of labor depending on the favorability of the cervix. When the cervix becomes unfavorable (bishop’s score < 4), 25 μg vaginal misoprostol is given in 6 h intervals and if there is no response, the dose of misoprostol is escalated to a maximum of 200 μg for cervical ripening. Sometimes women go to the active phase of labor with misoprostol before oxytocin infusion [36]. Induction of labor in our study setting follows the national guideline protocol in which 5 IU of oxytocin is added into 1000 ml of N/S or R/L solution and adjust the number of drops every 30 min. Induction of labor starting with a low dose of oxytocin and increase every 30 min till adequate uterine contraction is achieved (Table 1, supplementary material).

Results
Socio-demographic characteristics of participants
A total of 441 induced women were interviewed with a response rate of 98.2%. One hundred ninety-one (43.3%) women were in the age group of 24–28 with a mean age was (25.8 years ± 4.89SD), 231(52.4%) women were orthodox Christian, and 247(56%) mothers lived in urban areas (Table 2).

Obstetric characteristics of participants
Two hundred fourteen (48.5%) women in the study were multipara, 258 (58.5%) of pregnancies were found in the gestational age category of 37–41 weeks. The mean fetal...
| Variables                        | Categories                     | Frequency (n = 441) | Percent (%) |
|---------------------------------|--------------------------------|---------------------|-------------|
| Age                             | 19–23                          | 143                 | 32.4        |
|                                 | 24–28                          | 191                 | 43.3        |
|                                 | 29–33                          | 69                  | 15.6        |
|                                 | ≥34                            | 38                  | 8.7         |
| Residence                       | Urban                          | 247                 | 56          |
|                                 | Rural                          | 194                 | 44          |
| Religion                        | Orthodox                       | 231                 | 52.4        |
|                                 | Protestant                     | 112                 | 25.4        |
|                                 | Muslim                         | 78                  | 17.7        |
|                                 | Catholic                       | 20                  | 4.5         |
| Marital status                  | Married                        | 414                 | 93.9        |
|                                 | Not married                    | 21                  | 4.8         |
|                                 | Widowed                        | 4                   | 0.9         |
|                                 | Divorced                       | 2                   | 0.5         |
| Educational status              | Unable to read and write       | 84                  | 19          |
|                                 | Able to read and write         | 133                 | 30.2        |
|                                 | Primary (1–3, 5–9)              | 96                  | 21.8        |
|                                 | Secondary and above             | 128                 | 29          |
| Occupational status             | Gov’t Employee                 | 65                  | 14.7        |
|                                 | House wife                     | 232                 | 52.6        |
|                                 | Merchant                       | 70                  | 15.9        |
|                                 | Others specify<sup>a</sup>     | 74                  | 16.8        |
| Ethnicity                       | Bench                          | 92                  | 20.9        |
|                                 | Kafficho                       | 186                 | 42.2        |
|                                 | Shakacho                       | 94                  | 21.3        |
|                                 | Amhara                         | 34                  | 7.7         |
|                                 | Oromo                          | 19                  | 4.3         |
|                                 | Tigre                          | 6                   | 1.4         |
|                                 | Others specify<sup>b</sup>     | 10                  | 2.3         |
| Parity                          | Primi                          | 227                 | 51.5        |
|                                 | Multi                          | 214                 | 48.5        |
| Gestational age                 | 28–36                          | 82                  | 18.6        |
|                                 | 37–41                          | 258                 | 58.5        |
|                                 | ≥42                            | 101                 | 22.9        |
| Last child alive (<i>n</i> = 214)| Yes                            | 196                 | 91.6        |
|                                 | No                             | 18                  | 8.4         |
| Previous obstetric complications (<i>n</i> = 214)| Yes                | 24                  | 11.3        |
|                                 | No                             | 190                 | 88.7        |
| Analgesia/anesthesia            | Yes                            | 16                  | 3.6         |
|                                 | No                             | 425                 | 96.4        |
| Pre-induction bishop score      | ≤5                             | 310                 | 70.3        |
|                                 | > 5                            | 131                 | 29.7        |
| Body mass index (kg/m<sup>2</sup>) | ≤24                           | 337                 | 76.4        |
gestational age was 38.73 (SD ± 2.72). Of the 214 multiparous induced women, 24 (11.3%) had previous obstetric complications and 18 (8.4%) women were lost their last child. The Bishop scores of 310 (70.3%) study participants were ≤ 5 before the induction of labor (Table 2).

Methods and indications for labor induction
One hundred forty-five (32.9%) women were induced for indication of PROM, 307 (69.6%) mothers were induced with oxytocin infusion and 246 (55.8%) mothers were induced with misoprostol (vaginal and/or oral route) (Table 3).

Outcomes of labor induction
Two hundred forty-three (55.1%) mothers gave normal vaginal birth, and 124 (28.1%) mothers gave birth through cesarean section. Nearly two-thirds (64.5%) of the cesarean section was done due to failed induction of labor. The rest cesarean section cases were done for indication of fetal distress and cephalo-pelvic disproportion. For those cases cesarean section was done before the status of labor induction (failed or succeed) was determined. Fifty-four (10%) induced women experienced uterine hyper-stimulation, 90 (20.4%) induced women faced fetal heart rate nonreassuring, 8 (1.8%) induced women encountered uterine rupture, 57 (12.9%) induced women end up with stillbirth, 169 (38.3%) and 97 (22%) newborns had Apgar scores <7 at 1st and 5th minutes, respectively (Table 4). Three hundred twenty-six (73.9%) mothers had given weight of 2500–3900 g newborn (Fig. 1).

Failed induction of labor
In this study, ninety-two (20.9%) of the study subjects had failed induction of labor (Fig. 2).

Factors associated with failed labor induction
Pre-induction bishop scores ≤5, birth weight ≥ 4000 g, Primiparous, analgesia/anesthesia and body mass index (kg/m²) > 24 were significant factors for failed induction of labor. The odds of induced women whose pre-induction bishop score ≤ 5 were 2.3 times more likely to have failed induction [AOR = 2.37 (1.16–4.84)]. Women whose newborn birth weight ≥ 4000 g were 2 times as likely to have failed induction as compared with women whose newborn birth weight was 2500–3900 g [AOR = 2.12 (1.05–4.28)]. The odds of failed induction were 2.3 times more likely in Primiparous

### Table 2 Socio-demographic and obstetric characteristics of induced women in public hospitals of Keffa, Sheka and Bench-Maji Zone, Southwest Ethiopia, 2018 (Continued)

| Variables                  | Categories       | Frequency (n = 441) | Percent (%) |
|----------------------------|------------------|--------------------|-------------|
| Cervical dilatation (cm)   | > 4              | 104                | 23.6        |
|                            | 1–2              | 326                | 73.9        |
|                            | > 2              | 115                | 26.1        |

* Student, daily labor * Guarage

### Table 3 Indication and method of labor induction among women delivered in public health hospitals of Keffa, Sheka and Bench-Maji Zone, South West Ethiopia, 2018

| Variable                  | Category                        | Frequency | Percent (%) |
|---------------------------|---------------------------------|-----------|-------------|
| Indication                | Post term                       | 101       | 22.9        |
|                           | Premature rapture of membrane   | 145       | 32.9        |
|                           | Hypertensive disorder           | 116       | 26.3        |
|                           | Diabetes mellitus               | 5         | 1.1         |
|                           | Intra uterine growth restriction| 11        | 2.5         |
|                           | Ante partum hemorrhage          | 48        | 10.9        |
|                           | Others *                        | 44        | 10          |

| Methods of Induction      | Balloon catheter               | 51        | 11.6        |
|                           | Sweeping membrane              | 1         | 0.2         |
|                           | Oxytocin infusion              | 307       | 69.6        |
|                           | Misoprostol                    | 246       | 55.8        |

* = Oligohydramnios, intrauterine fetal death
[AOR = 2.35 (1.35–4.09)] than in multiparous women. The odds of failed induction were 4.3 times more likely among women who were given analgesia/anesthesia [AOR = 4.37 (1.31–14.59)] than mothers who were not given. Women whose body mass index > 24 kg/m² were 5.7 times more likely to have failed induction as compared to their counterparts [AOR = 5.71 (3.26–10.01)] (Table 5).

Table 4 Outcomes of inductions of labor among women delivered in public health hospitals of Keffa, Sheka and Bench-Maji Zone, South West Ethiopia, 2018

| Variables                              | Category               | Frequency (n = 441) | Percent (%) |
|----------------------------------------|------------------------|--------------------|-------------|
| Mode of delivery                       | Normal vaginal delivery| 243                | 55.1        |
|                                        | Assisted vaginal delivery| 74                | 16.8        |
|                                        | Caesarean section       | 124                | 28.1        |
| Reason for Caesarean section (n = 124) | Failed induction        | 80                 | 64.5        |
|                                        | CPD                    | 24                 | 19.3        |
|                                        | Fetal distress          | 51                 | 41.1        |
| Uterine hyper stimulation              | Yes                    | 44                 | 10          |
|                                        | No                     | 397                | 90          |
| Uterine rupture                        | Yes                    | 8                  | 1.8         |
|                                        | No                     | 433                | 98.2        |
| Fetal heart rate non-reassuring        | Yes                    | 90                 | 20.4        |
|                                        | No                     | 351                | 79.6        |
| Stillbirth                             | Yes                    | 57                 | 12.9        |
|                                        | No                     | 384                | 87.1        |
| APGAR score less than 7                | At 1 min               | 169                | 38.3        |
|                                        | At 5 min               | 97                 | 22          |

Discussion

This study revealed that failed induction of labor was found to be 20.9% (95% CI: 17.5, 24.7). This is in line with studies done in Nigeria (24.1%), WHO survey in African and Asian countries (20%), southwest Ethiopia (21.4%), and Israel (21.6%) [22, 35, 37, 38]. This finding is higher than studies done in America (15.7%) [39] and southern Ethiopia (17.3%) [20]. This
difference might be due to variation in methods for induction of labor, oxytocin infusion was a commonly used method in the present study, while in the other studies, misoprostol with a balloon catheter was used as a common practice [37]. This might also be due to differences in indications for induction of labor. In our study, PROM was the most common indication in another study, elective and hypertension [8]. This is lower than that done in Latin America, 29.6% [8]. This might because there is a high rate of labor induction in high-income countries as compared to low-income countries [3, 22].

Primiparous women were 2.3 times more likely to have failed induction than multipara women. This study is similar to the previous studies; nulliparous women are at greater risk for both failed inductions and cesarean sections as compared to multiparous women [12, 16, 20, 35, 38, 40, 41]. This might be due to the higher proportion

![Fig. 2 Distribution of induction of labor among women in public health hospitals of Keffa, Sheka and Bench-Maji Zone, South West Ethiopia, 2018](image)

**Table 5** Factors associated with failed induction of labor in public hospitals of Keffa, Sheka and Benchi-Maji Zone, Southwest Ethiopia, 2018

| Variables                              | Failed induction of labor | COR (95.0%CI) | AOR (95.0%CI) | P-value |
|----------------------------------------|---------------------------|---------------|---------------|---------|
| Parity                                 |                           |               |               |         |
| Multi                                  | Yes (n = 92)              | 30            | 184           | 1       |
|                                        | No (n = 349)              | 62            | 165           | 2.30 (1.42, 3.73) | 2.35 (1.35, 4.09)<sup>a</sup> | .002 |
| Primi                                  |                           |               |               |         |
|                                        | Yes (n = 23)              | 23            | 122           | .62 (0.36, 1.04) | 1.06 (0.54, 2.08) | .857 |
|                                        | No (n = 69)               | 69            | 227           | 1       |
| Premature rapture of membrane           |                           |               |               |         |
| Yes                                    | Yes (n = 23)              | 23            | 122           | .62 (0.36, 1.04) | 1.06 (0.54, 2.08) | .857 |
|                                        | No (n = 69)               | 69            | 227           | 1       |
| Body mass index (kg/m²)                | ≤24                       | 43            | 294           | 1       |
|                                        | > 24                      | 49            | 55            | 6.09 (3.69, 10.04) | 5.71 (3.26, 10.01)<sup>a</sup> | .000 |
| Cervical dilatation (cm)               | 1–2                       | 82            | 244           | 3.52 (1.76, 7.07) | 2.30 (0.99, 5.29) | .050 |
|                                        | > 2                       | 10            | 105           | 1       |
| Analgesia/anesthesia                   | Yes                       | 9             | 7             | 5.29 (1.91, 14.63) | 4.37 (1.31, 14.59)<sup>a</sup> | .016 |
|                                        | No                        | 83            | 342           | 1       |
| Bishop score                           | ≤5                        | 77            | 233           | 2.55 (1.40, 4.46) | 2.37 (1.16–4.84)<sup>a</sup> | .017 |
|                                        | > 5                       | 15            | 116           | 1       |
| Newborn birth weight                   | < 2500                    | 6             | 44            | 0.63 (0.25, 1.54) | 0.57 (0.18, 1.76) | .334 |
|                                        | 2500–3900                 | 28            | 268           | 1       |
|                                        | ≥4000                     | 28            | 37            | 3.49 (1.98, 6.16) | 2.12 (1.05, 4.28)<sup>a</sup> | .035 |
| Gestational age                        | 28–36                     | 14            | 68            | .92 (0.47, 1.78) | 0.98 (0.42, 2.24) | .963 |
|                                        | 37–41                     | 47            | 211           | 1       |
|                                        | ≥42                       | 31            | 70            | 1.98 (1.17, 3.37) | 1.71 (0.83, 3.51) | .141 |

<sup>a</sup> = P < 0.05: Statistically significantly associated
of unfavorable bishop scores in Primiparous in the study; it may also be the reason that the lack of important practices likes the use of misoprostol with oxytocin to induction in Primiparous.

Women whose body mass index > 24 kg/m\(^2\) were 5.7 times more likely to had failed induction as compared with women whose body mass index ≤ 24 kg/m\(^2\). This finding is supported by previous findings [38, 39, 41–43]. This could be due to; maternal obesity is related with a lower bishop score, women with lower bishop scores are at greater risk for failed induction [41]. In addition, to achieve vaginal delivery, obese women require more concentration, higher doses, and longer duration of exposure of uterotonics medication, using similar protocol and guidelines on labor induction for all women with different BMI to end up with higher failure rate among obese women [44, 45]. The current study has been shown that uterine contractility impairment is higher among morbid obesity women; uterine contractility dysfunction might lead to failed induction [46].

Women who were given analgesia/anesthesia were 4.3 times more likely to had failed induction as compared to women who were not given analgesia/anesthesia. This finding is supported by studies in which the earlier epidural analgesia was given during labor, the higher the probability of cesarean delivery among induced women [7, 13, 18]. This might be using epidural anesthesia during induction of labor was related to a low bishop score which increased the rate of failed induction [41].

Mothers whose pre-induction bishops score ≤ 5 were 2.3 times more likely to have failed induction as compare to mothers whose pre-induction bishop score > 5. This finding is comparable with the studies [20, 35, 38, 40].

Women whose newborn birth weight > 4000 g were 2 times more likely to have failed induction as compared with women whose newborn birth weight was 2500–3900 g. This study is supported by the previous studies [16, 39]. This might happened due to the mean birth weight of neonates were higher among women who had greater BMI [44], larger BMI leads to lower bishop scores, and failed induction of labor [41].

Conclusion
The prevalence of failed induction of labor was high in the study area. Variables that increased the likelihood of failed induction were body mass index > 24 kg/m\(^2\), bishop score ≤ 5, Primiparous, birth weight ≥ 4000 g, and using analgesia/anesthesia. Preparation of the cervix before starting induction in Primiparous women is recommended to improve the success of induction. To achieve the normal weight of women and newborns, proper nutritional interventions should be given for women of reproductive age. Consider the risk of failed induction in case of the provision of analgesia/anesthesia.

Abbreviations
AOR: Adjusted Odd Ratio; CI: Confidence Intervals; IOL: Induction of Labor; PROM: Prelabor Rupture of the Membranes; SPSS: Statistical Package for Social Scientists; USD: United States dollar

Supplementary Information
The online version contains supplementary material available at https://doi.org/10.1186/s12884-021-03862-x.

Additional file 1.

Acknowledgments
The authors would like to thank Mizan-Tepi University for technical support and ethical approval, study participants, and data collectors.

Authors’ contributions
AGE: Initiated the idea, wrote the proposal, and participated in designing the methodology, supervising the data collection process, analyses the data, and wrote the final paper and manuscript based on the journal’s criteria. SHL: contributed to the designing of the study, proposal writing and supervise the data collection process. All authors have read, reviewed, and approved the final version of the manuscript.

Funding
This work has been funded by Mizan-Tepi University for data collection. This organization did not involve in designing, analysis, and critical review of its intellectual content; preparation for manuscript, and the budget funded by this organization did not include publication.

Availability of data and materials
When an ethics statement was obtained from the zonal health office, hospitals, and women, we had agreed and signed not to publish the raw data retrieved from the induced women. However, the datasets collected and analyzed for the current study are available from the corresponding author and can be obtained on a reasonable request.

Declarations
Ethics approval and consent to participate
Ethical clearance was obtained from the ethical review committee of Mizan-Tepi University. The aim and purpose of the study were described to the study respondents. The respondents were involved in the study after they gave informed verbal and written consent to participate in the study. This study was conducted “in accordance with the Declaration of Helsinki.” Data were taken from respondents. Therefore, confidentiality of respondent data was kept and the data were not used for other purposes other than the purpose of the current study. The minimum age of women who participated in this study was 19. Study respondents were informed about the right to refuse or withdraw from the study when they feel discomfort.

Competing interests
There are no conflicts of interest.
43. Maged AM, El-Semary AM, Marie HM, Belal DS, Hany A, Taymour MA, et al. Effect of maternal obesity on labor induction in postdate pregnancy. Arch Gynecol Obstet. 2018;298(1):45–50. https://doi.org/10.1007/s00404-018-4767-8.

44. Adams AD, Coviello EM, Drassinower D. The effect of maternal obesity on oxytocin requirements to achieve vaginal delivery. Am J Perinatol. 2020; 37(4):349–56.

45. Roloff K, Peng S, Sanchez-Ramos L, Valenzuela GJ. Cumulative oxytocin dose during induction of labor according to maternal body mass index. Int J Gynaecol Obstetr. 2015;131(1):54–8. https://doi.org/10.1016/j.ijgo.2015.04.038.

46. Luca AM, Carvalho JCA, Ramachandran N, Balki M. The effect of morbid obesity or advanced maternal age on oxytocin-induced myometrial contractions: an in vitro study. Can J Anaesth. 2020;67(7):836–46. https://doi.org/10.1007/s12630-020-01615-6.

Publisher’s Note
Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.