PREVALENCE AND FACTORS ASSOCIATED WITH OUTCOME OF LABOUR INDUCTION: PROSPECTIVE LONGITUDINAL STUDY AT A TERTIARY HOSPITAL IN KAMPALA, UGANDA

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ABSTRACT

INTRODUCTION: The purpose of the study was to determine the prevalence of, outcome and factors associated with successful induction of labour.

METHODS: A prospective longitudinal study was conducted at a tertiary non-profit teaching hospital in Kampala, Uganda from January to August 2023. A total of 300 pregnant women who underwent induction of labour [IOL] were included in the study. Data was collected from the participants and admission records using a pre-designed questionnaire. Data analysis was done using STATA/SE 12.0 statistical software. The primary outcome measure was the prevalence of IOL and the outcome of IOL as successful or failed induction and the secondary outcomes included mode of delivery, maternal/neonatal complications and factors associated with successful IOL. The association between the different factors and successful IOL was determined using bivariate and multivariable logistic regression analyses. A p-value less than 0.05 was set as a cut off for statistical significance

RESULTS: The prevalence of IOL was 16.5% [±1.7] [300/1815]. Successful IOL occurred in 63% [±5.5] [189/300] while 21% [±4.6] [62/300] had failed induction. The remaining 16% [±4.2] [49/300] had caesarean section [C/S] delivery due to other obstetric indications within 24 hours and before entry into active labour. A favourable Modified Bishop's score [6-13] at start of induction was associated with 100% (37/37) success. The following non cervical factors were positively associated with successful IOL: Normal BMI [aOR=4.0, CI=1.1-13.8], parity≥1 [aOR=7.7,CI=2.1-28.0], prolonged latent labour as an indication [aOR=7.7,CI=2.1-28.0], postdates/post-term as an indication for induction [aOR=3.0,CI=1.3-6.9], emergency induction [aOR=2.7,CI=1.4- 5.4] and attending at least 4 antenatal care visits [aOR=2.6,CI=1.0-6.8]. Starting the IOL with intact amniotic membranes was negatively associated with successful IOL [aOR=0.1, CI=0.0-1.0].

CONCLUSION: IOL is fairly successful intervention in our setting. Favourable Modified Bishop's score is a good indicator for successful IOL. In presence of appropriate indications, IOL should be encouraged as the success rates are comparable to those in other settings.

KEY WORDS Induction of labour, active labour, failed induction, successful induction, associated factors, Uganda.

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BACKGROUND

Induction of labour [IOL] is defined as artificial initiation of labour after age of viability for the purpose of achieving vaginal delivery when the benefits of delivery to the baby and/or mother outweigh that of continuing with the pregnancy[1]. Although the definition of IOL is universally accepted, the definition for the outcome of IOL as either successful or failed is still controversia[l2]. Majority of studies have defined successful IOL as vaginal delivery and failed induction as caesarean delivery[3-5]. Some authors defined successful IOL as ability to enter into active labour within 24 hours after initiation of IOL and failed induction as the inability to do so[6,7]. Labour progress after achieving active labour is influenced by many other factors just as occurs in spontaneous labours and that failed vaginally delivery may be due to other obstetric factors not related to IOL process[8].

The trends of IOL have been increasing steadily over the last decades with worldwide prevalence at about 20% of all deliveries[9]. The rates are variable in the high income countries [9-33%][10] with low- and middle- income countries[LMICs] having the lowest prevalence [1.4-6.8%][11-13]. In Sub Saharan Africa the true prevalence is not well described due to lack of large multicentre studies and uniform health information indicators on induction of labour[14-17].

The outcome of IOL as either successful or failed is also varied[18-23]. In Uganda, studies on labour induction prevalence are limited. IOL should generally be done when there is a proper indication. Induction of labour has been shown to be an intervention that reduces perinatal morbidity and mortality when done for the proper indication and following the proper technique compared to expectant management especially after 41 completed weeks of pregnancy[24-28]. The outcome of labour induction has been shown to be varied depending on various predictors like indication; method used for induction; foetal factors; maternal factors; labour factors[29-31]. Methods of IOL are broadly classified into mechanical and pharmacological.

No method is uniformly superior to the other and the choice depends on clinical scenario with factors like prior uterine surgery, status of cervix, foetal living status, cost and availability of required agents affecting decision making[32]. The commonly used prostaglandins include PGE1 and PGF2. Compared to other prostaglandins, misoprostol, a synthetic prostaglandin E1 is preferred in resource poor countries because it is stable at room temperature, relatively inexpensive and can be given via several routes namely oral, vaginal, sublingual, and buccal, making it an ideal agent for IOL, particularly in Sub-Saharan Africa[33].

Maternal and neonatal outcomes from various methods of labour induction have shown variable results on rates of caesarean section, uterine hyper stimulation and neonatal asphyxia[34].

METHODS

Study Design
This study was a prospective longitudinal study.

Study Setting
St Francis Hospital Nsambya, a private, tertiary care, teaching and referral hospital located in the southern part of Kampala, the capital city of Uganda.

Study Population
The study included 300 pregnant women underwent induction of labour during the study period. Consecutive sampling was used until the sample size, obtained by Fisher's formula for prevalence, was reached.

Study period
The study was conducted from January 2023 to August 2023

Inclusion criteria
Women of sound mind aged at least 18 years with singleton pregnancy in cephalic presentation and gestational age of at least 28weeks of amenorrhea by either 1st trimester scan or by Last Menstrual Period [LMP] dating.

Exclusion criteria

We excluded those with unknown gestational age, on induction of labour that was started at a different facility or transferred during the follow up process.

Primary outcomes: Prevalence of labour induction, Successful induction of labour & failed induction of labour.

Secondary outcome measures: Mode of delivery, Apgar score of new born, Admission to new born unit.

Study procedure

Participants were identified through inquiry from midwives on duty and by checking in the admission records. Participants were guided through the study information chart and informed consent note by the Principal Investigator [PI] or research assistant. All Participants signed two written consent notes witnessed by a member of the research team. One copy remained with the participant while the other copy was attached to the questionnaire. Data were collected using questionnaires by the PI or one of the research assistants which captured the required data and supplemented it with clinical records from the patient's medical file.

The baseline cervical state assessment by the modified Bishop's score was documented at the initial examination of the patient. A score of 6 or less was used as a threshold to classify an "unfavourable" cervix while a score of more than 6 was classified as "favourable" cervix. Participants were followed for 24 hours post-initiation of labour induction and until delivery to monitor induction progress, time to active labour, mode of delivery, and immediate perinatal outcomes.

OPERATIONAL DEFINITION OF TERMS

Successful induction of labour:

Ability to achieve cervical dilatation of 5 cm or more within 24 hours of prostaglandin administration and/or 12hours of oxytocin administration with artificial rupture of membranes as soon as feasible and safe[8].

Failed induction of labour:

Defined as inability to achieve cervical dilatation of 5 cm or more within 24 hours of prostaglandin administration and/or 12hours of oxytocin administration with artificial rupture of membranes as soon as feasible and safe[8].

Hyper stimulation:

Over activity of the uterus as a result of IOL. It can be defined as >5contractions per 10 minutes.

Cycle of induction of labour:

A cycle of IOL refers to the prescribed dosage of the agent (or agents if dual method is used) which includes the dose (amount administered at a time), the frequency and the number of doses over a specified period of time that constitutes one complete treatment.

Induction of labour:

Induction of labour is defined as the process of artificially stimulating the uterus to contract to initiate labour after the age of viability when the benefits of delivery to the baby and/or mother outweigh that of continuing with the pregnancy (1).

Data Analysis

Data analysis was done using STATA/SE 12.0 statistical software. Data were presented in pie charts and tables. Categorical data were summarized using frequency tables while continuous variables were summarized using summary statistics. A Chi-square test was used in testing association of categorical variables to the outcome while continuous data were compared with unpaired student's t-test. The prevalence of Induction of labour was determined by the number of pregnant women induced of labour divided by the total number of pregnant women who delivered during the study period. Dependent variables included: Incidence of labour induction; primary outcomes of IOL: successful induction of labour & failed induction of labour; secondary outcomes of IOL: maternal and neonatal outcomes [e.g. mode of delivery, maternal complications,

Apgar score of new born, Admission to new born unit]. Independent variables included: maternal sociodemographic factors: age, BMI, residence, religion, marital status, education level, occupation; obstetric factors: parity, previous history of IOL, number of ANC visits, cervical status, status of membrane; IOL process: indication, type of IOL, method used; foetal factors: Birthweight, gestational age.

Predictors for successful IOL were determined using modified Poisson regression in bivariate analysis to crudely measure the strength of association between the different factors followed by adjustment in multivariable logistic regression. A p-value less than 0.05 was considered to be statistically significant at multivariate regression. Odds ratio was used as the measure of strength of association.

Ethical considerations

Clearance for the study was given by St Francis Hospital Nsambya administration and Ethical approval obtained from St Francis Hospital Research and Ethics Committee [SFHN-2022-68]. Written informed consent was obtained voluntarily from all participants. Confidentiality of all information collected from the participants was ensured by using anonymous participant's numbers and removing all personal identifiers.

RESULTS

Social demographic characteristics

The ages of participants ranged from 16 to 43 years with mean age of 29±5.3 years. Only 15% [46/300] of the participants had normal Body Mass Index (BMI). Among the study participants, majority were married [93.7%], lived in urban areas [92%] and were employed [73.3%]. At least half of the participants had tertiary level of education. Approximately half of the mothers were multiparous.

Table 1: Participants' socio-demographic variables

Characteristic	N = 300
Age [years], mean [SD]	29.3 [±5.3]
Age [complete years], n [%]	
≤19	4 [1.3]
20-34	238 [79.4]
≥35	58 [19.3]
Weight [kgs], mean [SD]	77.5 [13.3]
Weight [kgs], n [%]	
<90	247 [82.3]
≥90	53 [17.7]
Height [cm], mean [SD]	159.8 [±6.4]
Height [cm], n [%]	
≥150	291 [97.0]
<150	9 [3.0]
BMI [kgs/m2], mean [SD]	30.4 [5.1]
BMI [kgs/m2], n [%]	
Normal [18.5-24.9]	46 [15.3]
Overweight [25-29.9]	103 [34.4]
Obese [≥30]	151 [50.3]
Residence, n [%]	
Urban	276 [92.0]
Rural	24 [8.0]
Religion, n [%]	
Christian	248 [82.7]
Muslim	39 [13.0]
Others	13 [4.4]
Marital status, n [%]	
Married	281 [93.7]
Single	12 [4.0]
Cohabiting	7 [2.3]
Education level, n [%]	
Primary	8 [2.7]
Ordinary secondary	63 [21.0]
Advanced secondary	63 [21.0]
Tertiary	163 [54.3]
Not specified	3 [1.0]
Occupation, n [%]	
Student	8 [2.7]
Housewife	57 [19.0]
Self-employed	75 [25.0]
Salaried/wage	145 [48.3]
Not specified	15 [5.0]
Gravidity, mean [SD]	2.6 [1.8]
Gravidity, n [%]	
1	115 [38.3]
≥2	185 [61.7]
Parity, mean [SD]	1.2 [1.5]
Parity, n [%]	
0	148 [49.3]
1-4	144 [48.0]
≥5	8 [2.7]

SD= Standard Deviation
Others refer to other minority religious groups like orthodox, Hindu, traditional religious practices.

Pregnancy and induction of labour characteristics

The mean gestational age of the participants was 39.3 [±1.9] weeks. All the participants attended antenatal care from various facilities with 82% having attended the recommended 4-8 visits by the time of IOL. Approximately 65.7% were emergency inductions. The commonest indication for IOL was postdates/post term pregnancy. Approximately 10% had favourable modified Bishop's score and oral misoprostol was the most common drug.
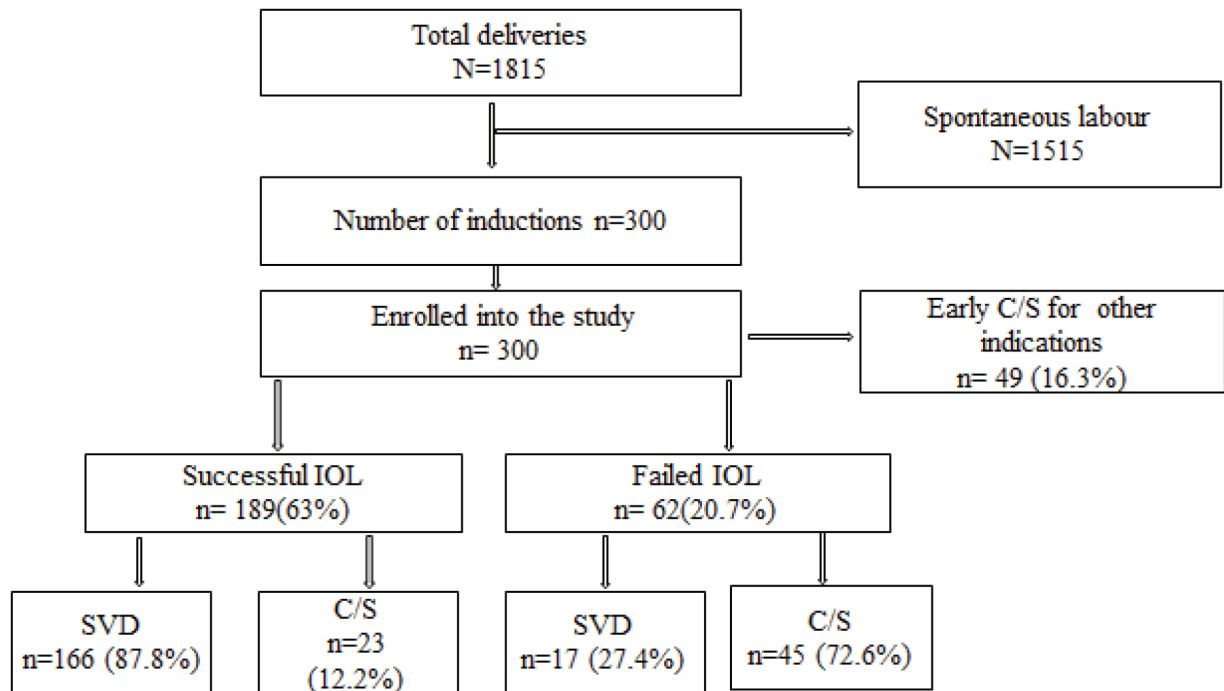
Table 2: Pregnancy and induction of labour variables

Gestational age [WOA], mean [SD]	39.3 [±1.9]
Gestational age [completed WOA], n [%]	
28-34[preterm]	5 [1.7]
35-36 [late preterm]	8 [2.7]
37-40[term]	193 [64.3]
≥41[postdates/post term]	94 [31.3]
No. of ANC visits attended, mean [SD]	5.4 [± 1.8]
No. Of ANC visits attended, n [%]	
4-8	246 [82.0]
<4	53 [17.7]
>8	1 [0.3]
Previous IOL history, n [%]	
No	242 [80.7]
Yes	40 [13.3]
Not specified	18 [6.0]
Indication for IOL, n [%]	
PROM/PPROM	19 [6.3]
Post term/postdates	104 [34.7]
Hypertensive disease	45 [15.0]
Oligohydramnios	5 [1.7]
Foetal factors[e.g. NRFS, congenital anomalies, IUFD, poor BPP]	14 [4.7]
Prolonged latent labour	67 [22.3]
Other	46 [15.3]
Type of IOL, n [%]	
Emergency IOL	197 [65.7]
Elective IOL	103 [34.3]
Status of membrane at start of IOL, n [%]	
Intact	265 [88.3]
Ruptured	32 [10.7]
Not indicated	3 [1.0]
Bishop's score at start of IOL, n [%]	
6-13 [favourable]	41 [13.7]
0-5 [unfavourable]	259 [86.3]
Method of IOL, n [%]	
Oral misoprostol	279 [93.0]
Vaginal prostaglandins [Vaginal misoprostol/ Dinoprostone vaginal]	2 [0.7]
Intravenous Oxytocin	15 [5.0]
Mechanical [Balloon catheter/Amniotomy + Oxytocin]	4 [1.3]
Time of starting IOL, n[%]	
Day	263 [87.7]
Night	37 [12.3]
Duration [complete hrs] of induction	
≤24hours of prostaglandins	182 [60.7]
>24 hours of prostaglandins	62 [20.7]
<12 hours of oxytocin and amniotomy	7 [2.3]
Cannot be assessed [C/S due to other/ alternative indication]	49 [16.3]

WOA = Weeks of Amenorrhea. ANC = Antenatal Care. PPROM = preterm pre-labour rupture of membrane. PROM = Pre-labour rupture of membranes. NRFS = Non-reassuring foetal status. IUFD = intra-uterine foetal demise. BPP = Biophysical profile.

Prevalence of labour induction

During the study period there were a total of 1815 deliveries. A total of 300 women underwent IOL. The prevalence of IOL was 16.5% [300/1815].

A figure showing the overview of participants flow through the study

SVD = spontaneous vaginal delivery.

Primary outcome of labour induction

Successful IOL occurred in 63% [189/300] of the participants. The prevalence of failed induction was 21% [62/300]. Among the participants, 16% [49/300] had caesarean section delivery due to other obstetric indications within 24 hours and before entry into active labour.

Maternal and Neonatal Secondary outcomes

Maternal peripartum complications occurred in 13.7% [41/300] of the participants with the most common being postpartum haemorrhage [PPH]. There was one maternal death due to PPH. Majority of the babies were born alive and more than 80% [260/300] had normal birth weight. Approximately 32% [95/300] of the newborns were admitted to newborn unit for further care.

Table 3: Primary and Secondary maternal and neonatal outcomes of IOL

Characteristic	
Primary outcomes, n [%]	
Successful	189 [63.0]
Failed	62 [20.7]
C/S due to other/alternative indication	49 [16.3]
Maternal Secondary outcomes, n [%]	
Maternal complication of IOL: NO	259[86.3]
Maternal Complication of IOL: YES	41[13.7]
-APH	4[1.3]
- PPH	24[8]
-Hyper stimulation	13[4.3]
Mode of delivery, n [%]	
Vaginal	183 [61.0]
Caesarean section [c/s]	117 [39.0]
Time of delivery, n [%]	
Day	183 [61.0]
Night	117 [39.0]
Neonatal Secondary outcomes	
Life status at delivery, n [%]	
Alive	295 [98.3]
MSB	5 [1.7]
Birth weight of new-born [kgs], mean [SD]	3.3 [±0.6]
Birth weight of new-born [kgs], n [%]	
2.5-3.9 [normal]	260 [86.7]
<2.5 [LBW]	16 [5.3]
≥4.0 [Macrosomia]	24 [8.0]
APGAR score	
1st minute, mean[SD]	8.2 [1.42]
1st minute, n [%]	
>5	293[97.7]
0-5	7[2.3]
5th minute, mean[SD]	**9.4 [1.4]**
5th minute, n [%]	
>5	293 [97.7]
0-5	7 [2.3]
Admission to New-born Unit [NNU], n [%]	
No	205 [68.3]
Yes	95 [31.7]

APH = ante-partum haemorrhage. MSB = macerated stillbirth.
LBW = low birthweight.

Factors associated with successful induction of labour

While controlling for gestational age and type of induction, attending ≥4 antenatal care visits was 2.6 times [aOR=2.6, CI=1.0-6.8] more likely to result in successful labour induction than attending less than 4 antenatal care visits. Normal BMI at start of induction was 4 times [aOR=4.0, CI=1.1-13.8] more likely to result in successful induction than being overweight or obese. Parity of ≥1 was 8 times [aOR=7.7, CI=2.1-28.0] more likely to be successful compared to parity of 0. Having indication for induction of labour as prolonged latent labour and post term/postdates was 8 times [aOR=7.7, CI=2.1-28.0] and 3 times [aOR=3.0, CI=1.3-6.9] more likely to lead to successful induction respectively. Participants who had emergency IOL were 2.7 [aOR=2.7, CI=1.4-5.4] times more likely to have successful induction than their counterpart in the elective inductions. Women with intact amniotic membranes at start of induction were 88% [aOR=0.1, CI=0.0-0.1] less likely to have successful induction compared to those with ruptured amniotic membranes.

Table 4: Multivariate analysis of factors associated with successful IOL

Characteristic	Successful IOL	Failed IOL	aOR	95% CI	p-value
Weight [kgs], n [%]					
<90	158 [77.5]	46 [22.5]	2.1	0.7, 6.3	0.2
≥90	31 [66]	16 [34]			
Height [cm], n [%]					
≥150	186 [76.2]	58 [23.8]	2.4	0.4, 13.1	0.3
<150	3 [42.9]	4 [57.1]			
BMI [kgs/m2], n [%]					
Normal [18.5-24.9]	29 [90.6]	3 [9.4]	4.0	1.1, 13.8	0.0
Overweight/obese [≥25]	160 [73.1]	59 [26.9]			
Gravidity, n [%]					
1	125 [78.3]	36[21.7]	0.6	0.2, 2.1	0.4
≥2	64 [71.1]	26 [28.9]			
Parity, n [%]					
1-4	116 [83.5]	23 [16.5]	7.7	2.1, 28.0	0.0
0	73 [65.2]	39 [34.8]			
ANC attended, n [%]					
≥4	158 [77.5]	46[22.5]	2.6	1.0, 6.8	0.0
<4	31 [66]	16 [34]			
Indication for IOL, n [%]					
Hypertensive disease	18 [52.9]	16 [47.1]	0.6	0.3, 1.5	0.3
Prolonged latent labour	56[94.9]	3 [5.1]	7.7	2.1, 28.0	0.0
Post term/postdates	69[77.5]	20[22.5]	3.0	1.3, 6.9	0.0
Type of IOL, n [%]					
Emergency	130 [80.7]	31 [19.3]	2.7	1.4, 5.4	0.0
Elective	59 [65.6]	31 [34.4]			
State of membrane, n [%]					
Intact	160 [73.1]	59 [26.9]	0.1	0.0, 1.0	0.0
Ruptured	28[96.6]	1[3.4]			
Time of starting IOL, n [%]					
Day	165[73.3]	60[26.7]	0.1	0.0, 0.9	0.0
Night	24[92.3]	2[7.7]			

aOR = adjusted Odds Ratio

DISCUSSION

The prevalence of IOL was 16.5%. This prevalence is lower than the estimated worldwide prevalence of 20% (9) but higher than that reported in LMICs of 1.4-6. This could be accounted for by the setting, a tertiary teaching and referral hospital, in the capital city and having an obstetrician on duty all the time. These factors were found to increase the prevalence of IOL in a previous multicentre study by WHO in LMICs[11].

Successful IOL occurred in 63% of the mothers on IOL. This was almost similar to the findings of study done within East Africa in DR Congo by Tandu-Umba et al in 2013 which showed successful induction prevalence of 66%[14]. The prevalence is however lower than that of other studies done in similar settings including 76% in Uganda[22], 74% in Kenya[20] and 71% in Tanzania[21].Failed induction was about 21%. This prevalence was comparable to that of 22% found in a study at Mbarara Regional referral hospital in western Uganda by Kajabwangu et al in 2019[35].Varied results of failed IOL ranging from 21% to 50% have been recorded[35-37]. This difference is expected due to the heterogeneity in defining successful and failed induction in different studies.

Out of the mothers who underwent IOL, majority [61%] had vaginal delivery. This is in keeping with the other studies which showed similar prevalence of vaginal deliveries among induced pregnancies, 71% in Tanzania[21], 66% in Congo[14] and 76% in Uganda[22]. It should also be noted that 87.2% of those with successful induction were delivered vaginally with about 12% undergoing caesarean deliveries. This underscores the need to separate the mode of delivery from the outcome of induction as either successful or failed induction, as the progress of labour to vaginal delivery can be influenced by other factors even after achieving successful induction. The most commonly [93%] used drug for IOL was oral misoprostol. This is probable due to the dual advantages that misoprostol has over other prostaglandins in LMICs of low cost and heat stability.

Maternal peripartum complications occurred in 13.7% of the participants with the most common being postpartum haemorrhage [PPH]. One death occurred due to refractory PPH secondary to uterine atony while another participant had uterine rupture. A similar incidence of maternal death following induction of labour due to refractory PPH was reported in 2020 by Lueth et al. in a study in Ethiopia[3]. These complications were noted to be more common among high risk mothers like those with multiparity[13].

Favourable modified Bishop's score [score of 6-13] was associated with 100% [37/37] success in this study. Similar findings of positive association were found in other studies[29-31]. The use of prostaglandins for cervical ripening and IOL has been recommended by WHO to increase the chances of success in unfavourable cervix[38].

This study has explored a number of non-cervical factors associated with successful IOL. Compared to mothers with Overweight/obese, mothers with normal BMI were 4 times more likely to have successful IOL [aOR4.0, CI=1.1-13.8]. The weight and height in our study was however, taken at the beginning of IOL. This has been documented in other studies with similar findings[11,29]. Mothers with parity ≥1 were more likely to have successful IOL than nulliparous women [aOR=7.7, CI=2.1-28.0]. This was also positively associated with successful IOL in others studies in our setting[22,35]. This could be due to presence of previously primed oxytocin and prostaglandins receptors which can easily be reactivated unlike in nulliparous women. Emergency induction was positively associated with having a successful IOL when compared to elective induction [aOR=2.7, CI=1.4-5.4]. This outcome is comparable to a study done in western Uganda which had similar findings[35]. Pregnant women who attended at least 4 ANC visits were

2.6 times [p=0.046] more likely to have successful IOL compared to their counterpart who attended less than 4 visits. These results are similar to those of a WHO multicentre study in LMICs[11]. Intact amniotic membrane status at start of induction was negatively associated with successful IOL [aOR=0.1, CI=0.0-1.0]. This could be due to decreased release of prostaglandins when amniotic membrane is intact as documented elsewhere[29].

Strengths and limitations of this study
This study used entry into active labour as the measure for successful IOL thus excluding the confounders of vaginal delivery. This study was single centred and had limited follow up time hence long term outcomes could not be documented.

CONCLUSION
The prevalence of IOL was 16.5%. This was higher than the recorded average for LMICs. Based on the previously recorded high level of unmet need for IOL in LMICs, this prevalence is an improvement. Favourable Modified Bishop's score is a good indicator for successful IOL. Our success rates for IOL are comparable to other settings in the globe.

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REFERENCES

1. Beshir YM, Kure MA, Egata G, Roba KT. Outcome of induction and associated factors among induced labours in public Hospitals of Harari Regional State, Eastern Ethiopia: A two years' retrospective analysis. Plos one. 2021 Nov 9;16(11):e0259723.

2. Lin MG, Rouse DJ. What is a failed labor induction?. Clinical obstetrics and gynecology. 2006 Sep 1;49(3):585-93.

3. Lueth GD, Kebede A, Medhanyie AA. Prevalence, outcomes and associated factors of labor induction among women delivered at public hospitals of MEKELLE town-(a hospital based cross sectional study). BMC pregnancy and childbirth. 2020 Apr 9;20(1):203.

4. Mebratu A, Assefa DG, Zeleke ED, Mengistu N, Woldesenbet TT, Aynalem A, Sefa A, Mellesse D, Tilahun R, Seifu W, Bayisa Y. Failed induction of labor and associated factors among women delivered in Jigjiga University Sheik Hassan Yabare Referral Hospital: a cross-sectional study. Current Medical Research and Opinion. 2022 Sep 2;38(9):1655-62.

5. Melkie A, Ewunetu M, Asmer S, Mekie M, Dagnew E. Determinants of failed oxytocin induction among women who gave birth at referral hospitals of Amhara region, Ethiopia, 2018: A case control study.

6. Grobman WA, Bailit J, Lai Y, Reddy UM, Wapner RJ, Varner MW, Thorp Jr JM, Leveno KJ, Caritis SN, Prasad M, Tita AT. Defining failed induction of labor. American journal of obstetrics and gynecology. 2018 Jan 1;218(1):122-e1.

7. Schoen C, Navathe R. Failed induction of labor. InSeminars in perinatology 2015 Oct 1 (Vol. 39, No. 6, pp. 483-487). WB Saunders.

8. Banos N, Migliorelli F, Posadas E, Ferreri J, Palacio M. Definition of failed induction of labor and its predictive factors: two unsolved issues of an everyday clinical situation. Fetal diagnosis and therapy. 2015 Jun 26;38(3):161-9.

9. Melkie A, Addisu D, Mekie M, Dagnew E. Failed induction of labor and its associated factors in Ethiopia: A systematic review and meta-analysis. Heliyon. 2021 Mar 1;7(3).

10. Lawani OL, Onyebuchi AK, Iyoke CA, Okafo CN, Ajah LO. Obstetric outcome and significance of labour induction in a health resource poor setting. Obstetrics and gynecology international. 2014;2014(1):419621.

11. Bukola F, Idi N, M'Mimunya M, Jean-Jose WM, Kidza M, Isilda N, Faouzi A, Archana S, Paulo SJ, Matthews M, Metin G. Unmet need for induction of labor in Africa: secondary analysis from the 2004-2005 WHO Global Maternal and Perinatal Health Survey (A cross-sectional survey). BMC public health. 2012 Aug 31;12(1):722.

12. Ngene NC. Induction of labour in low-and middle-income countries: Challenges and measures to improve outcomes. Case Reports in Women's Health. 2020 Jan 1;25:e00168.

13. Ngene NC, Moodley J. Induction of labour in low-resource settings. Best Practice & Research Clinical Obstetrics & Gynaecology. 2021 Nov 1;77:90-109.

14. Tandu-Umba B, Tshibangu RL, Muela AM. Maternal and perinatal outcomes of induction of labor at term in the university clinics of Kinshasa, DR Congo.

15. Rade BK, Mitku YM, Weldemicheal AB, Zenebe ZM, Desalegn AY, Bitsu BD. Induction of labor and its determinant factors: retrospective cross-sectional study from a public hospital in Ethiopia. J Preg Child Health. 2018;5(5):1000388.

16. Abisowo OY, Oyinyechi AJ, Olusegun FA, Oyedokun OY, Motunrayo AF, Abimbola OT. Feto maternal outcome of induced versus spontaneous labour in a Nigerian Tertiary Maternity Unit. Tropical Journal of Obstetrics and Gynaecology. 2017;34(1):21-7.

17. Tarimo CS, Wu J, Obure J, Mahande MJ. Prevalence, associated factors, and outcomes for labor induction at a tertiary hospital in Northern Tanzania: A retrospective cohort study 2000-2015.

18. Tripathy P, Pati T, Baby P, Mohapatra SK. Prevalence and predictors of failed induction. Int J Pharm Sci Rev Res. 2016;39(2):189-94.

19. Demssie EA, Deybasso HA, Tulu TM, Abebe D, Kure MA, Teji Roba K. Failed induction of labor and associated factors in Adama hospital medical College, Oromia regional state, Ethiopia. SAGE Open Medicine. 2022 Mar;10:20503121221081009.

20. Esiromo MA. Outcomes of pharmacological induction of labour at or near term at Kenyatta National Hospital (Doctoral dissertation, University of Nairobi, Kenya).

21. Samson J. Predictors of Successful Induction of Labour Using Intra Cervical Foley Balloon Catheter, and Associated Obstetric Outcomes Among Women with Post Date Pregnancy at Iringa Regional Referral Hospital (Master's thesis, University of Dodoma (Tanzania)).

22. Ajok J. Prevalence and Predictors of Vaginal Delivery following Induction of Labour at Kawempe National Referral Hospital, Kampala, Uganda (Doctoral dissertation, Makerere University).

23. Kajabwangu R, Bajunirwe F, Lukabwe H, Atukunda E, Mugisha D, Lugobe HM, Nakalinzi J, Mugyenyi GR. Factors associated with delayed onset of active labor following vaginal misoprostol administration among women at Mbarara Regional Referral Hospital, Uganda. International Journal of Gynecology & Obstetrics. 2021 May;153(2):268-72.

24. Garcia-Simon R, Montañes A, Clemente J, Del Pino MD, Romero MA, Fabre E, Oros D. Economic implications of labor induction. International Journal of Gynecology & Obstetrics. 2016 Apr 1;133(1):112-5.

25. Talaulikar VS, Arulkumaran S. Failed induction of labor: strategies to improve the success rates. Obstetrical & gynecological survey. 2011 Nov 1;66(11):717-28.

26. Caughey AB, Sundaram V, Kaimal AJ, Gienger A, Cheng YW, McDonald KM, Shaffer BL, Owens DK, Bravata DM. Systematic review: elective induction of labor versus expectant management of pregnancy. Annals of internal medicine. 2009 Aug 18;151(4):252-63.

27. Boulvain M, Senat MV, Perrotin F, Winer N, Beucher G, Subtil D, Bretelle F, Azria E, Hejaiej D, Vendittelli F, Capelle M. Induction of labour versus expectant management for large-for-date fetuses: a randomised controlled trial. The Lancet. 2015 Jun 27;385(9987):2600-5.

28. WHO Guidelines Approved by the Guidelines Review Committee. WHO recommendations: Induction of labour at or beyond term. Geneva: World Health Organization. 2018.

29. Ejigu AG, Lambyo SH. Predicting factors of failed induction of labor in three hospitals of Southwest Ethiopia: a cross-sectional study. BMC pregnancy and childbirth. 2021 May 19;21(1):387.

30. Alemayehu BA, Fenta SL, Gezahegn TW, Kassahun EA, Balcha WF. Proportion and factors associated with fetal adverse birth outcome among mothers who gave birth at Felege Hiwot comprehensive specialized hospital, Bahir Dar City, Northwest, Ethiopia 2019. Pan African Medical Journal. 2022;42(1).

31. Batinelli L, Serafini A, Nante N, Petraglia F, Severi FM, Messina G. Induction of labour: clinical predictive factors for success and failure. Journal of Obstetrics and Gynaecology. 2018 Apr 3;38(3):352-8.

32. Penfield CA, Wing DA. Labor induction techniques: which is the best?. Obstetrics and Gynecology Clinics. 2017 Dec 1;44(4):567-82.

33. Tang J, Kapp N, Dragoman M, De Souza JP. WHO recommendations for misoprostol use for obstetric and gynecologic indications. International Journal of Gynecology & Obstetrics. 2013 May 1;121(2):186-9.

34. Caughey AB, Sundaram V, Kaimal AJ, Cheng YW, Gienger A, Little SE, Lee JF, Wong L, Shaffer BL, Tran SH, Padula A. Maternal and neonatal outcomes of elective induction of labor. Evidence report/technology assessment. 2009 Mar(176):1.

35. Kajabwangu R, Bajunirwe F, Lukabwe H, Atukunda E, Munyanderu B, Sanchez E, Nakalinzi J, Mugyenyi GR. Factors associated with delayed onset of active labor following administration of vaginal Misoprostol among women at Mbarara Regional referral hospital, Uganda: A prospective cohort study.

36. Bello FA, Akinyotu OO. Predictors of successful induction of labour at a tertiary obstetric service in Southwest Nigeria. Tropical Journal of Obstetrics and Gynaecology. 2016;33(2):143-8.

37. Khan NB, Ahmed I, Malik A, Sheikh L. Factors associated with failed induction of labour in a secondary care hospital. Journal of the Pakistan Medical Association: JPMA. 2012;62(1):6.

38. World Health Organization. Managing complications in pregnancy and childbirth: a guide for midwives and doctors. In Managing complications in pregnancy and childbirth: a guide for midwives and doctors 2017.