Adverse obstetric outcome and its associated factors in public hospitals of North Ethiopia: does parity make a difference?

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Abstract

Background: Direct obstetric causes account for nearly 75% of all maternal deaths. Controversy prevails in the effect of grand multiparity on adverse obstetric outcomes. This study thus aimed to determine and compare the obstetric outcomes in low multiparous (LM) and grand multiparous (GM) women in Public Hospitals of North Ethiopia.

Method: An institution-based comparative cross-sectional study was done among 540 (180 GM and 360 LM) participants from January 1 to March 30, 2021. The data was collected through face-to-face interviews and a review of clinical records and birth registries. Epi-Data version 4.6 was used for data entry and analysis was performed using SPSS version 25.0 statistical software. A *p*-value of ≤ 0.05 (2-tailed) was used to consider the significance of statistical tests.

Result: The prevalence of adverse obstetric outcomes was 32.6% (95% CI: 28.7–36.5). Antepartum hemorrhage, anemia, and postpartum hemorrhage were higher in grand multiparous women. Whereas, prolonged labor, induction/augmentation, prelabor rupture of membrane, episiotomy, and post-term pregnancy was higher in low multiparous women. Income (AOR (CI) = 3.15 (1.30–7.63), alcohol consumption (AOR (CI) = 3.15 (1.49–6.64), preterm delivery (AOR (CI) = 9.24 (2.28–27.3), cesarean delivery (AOR (CI) = 13.6 (6.18–30.1), and low birth weight (AOR (CI) = 3.46 (1.33–9.03) significant predictors of adverse obstetric outcomes. However, parity did not show a statistically significant difference in obstetric outcomes.

Conclusion: In the study area, obstetric complications were high compared to a systematic review and meta-analysis study done in the country (26.88%). Socio-economic status, alcohol consumption, gestational age at delivery, mode of delivery, and birth weight were significant associates of the obstetric outcome. There was no statistically significant difference in obstetric outcomes between GM and LM women. Socio-economic development, avoiding alcohol consumption, early identification and treatment of complications, and adequate nutrition and weight gain during pregnancy are needed regardless of parity.

Keywords: Adverse obstetric outcome, Grand multipara, Low multipara, Comparative study

Introduction

Globally, in 2017, an estimated 295,000 women died during pregnancy, delivery, and the postpartum period. Most (94%) of all deaths occurred in low and lower-middle-income countries such as Ethiopia. Sub-Saharan Africa accounted for nearly 66% of the global maternal deaths, while Southern Asia accounted for about 20% [1]. However, maternal deaths only tell part of the story.

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For every single woman who dies of pregnancy-related complications, between 20 and 30 more suffer short- and long-term disabilities, such as infections, hemorrhage, obstetric fistula, uterine rupture, or pelvic inflammatory disease [2]. In Ethiopia, more than 500,000 women and girls suffer from disabilities as a result of complications during pregnancy and childbirth each year [2]. According to a WHO report, pregnancy complications account for nearly 75% of all maternal deaths [1]. The top causes of maternal deaths in In Ethiopia are hemorrhage (29.9%), obstructed labor (22.3%), pregnancy-induced hypertension (16.9%), puerperal sepsis (14.68%), and unsafe abortion (8.6%) [3].

A prospective cohort study in Bangladesh reported a 25% magnitude of obstetric complications [4]. In Uganda, one-third of women reported an adverse pregnancy outcome [5]. Similarly, a comparative study in Southern Ethiopia determined the prevalence of adverse obstetric outcomes at 39%. The study further reported a higher prevalence of hypertensive disorders of pregnancy, antepartum hemorrhage (APH), and premature rupture of membrane (PROM) among grand multiparous women, while the higher risk of obstructed labor and cesarean delivery among low multiparous women [6]. Extreme ages and a history of stillbirth/miscarriage significantly increased the risks of obstetric complications [4]. History of medical illnesses, previous cesarean delivery, and high birth weight were also significant factors of adverse obstetric outcomes [6].

Various studies have investigated the impact of grand multiparity on adverse obstetric and perinatal outcomes, and mixed findings were reported. Some studies showed an increased incidence of obstetric complications among grand multiparas, however, other studies explored a comparable risk of complications. A study in Saudi Arabia found that grand multiparous women have a comparable risk of maternal and neonatal complications compared to other parity groups [7]. Similarly, a comparative study in Southern Ethiopia found that parity did not show a statistically significant difference in obstetric outcomes [6]. However, grand multiparity was found to be a risk factor for PROM, stillbirth, and preterm delivery in Tanzania [8]. It was also associated with adverse maternal outcomes like cesarean delivery, fetal macrosomia, diabetes mellitus, and pregnancy-induced hypertension [9].

Sustainable development goal 3.1 sets a target for all global nations to decrease the maternal mortality ratio to less than 70 by 2030 [10]. Furthermore, the Global Strategy for Women's, Children's, and Adolescents' Health planned to design programs aimed at maternal and child health globally [11]. Although older literature showed the effect of parity on maternal and perinatal outcomes, recent reports fail to support these findings. Hence, this study planned to determine and compare adverse obstetric outcomes in grand multiparous (GM) and low multiparous (LM) women and identify its associated factors in public hospitals of North Ethiopia.

Methods

Study design, setting, and period

An institution-based comparative cross-sectional study was done in North Shewa Zone public hospitals from January 1 to March 30, 2021. North Shewa is one of the 10 zones in the Amhara region of Ethiopia and is 130 km far from Addis Ababa, the capital of Ethiopia. Based on the 2007 national census, it has a total population of 1,837,490; 928,694 men and 908,796 women [12]. There are 12 Hospitals (2 private, 9 public, and 1 comprehensive specialized hospital). There are about 303 midwives, 766 Nurses, 120 Laboratory professionals, 130 Pharmacists, 150 General Practitioners, 15 Specialists, 25 integrated emergency surgical officers (IESO), and 54 Anesthesia professionals working in the zone.

Study population and inclusion and exclusion criteria

All multiparous women who gave birth in the study area were the source population. Randomly selected multiparous women in labor wards during the study period were the study population. Multiparous women with a single fetus/neonate at a gestational age of 28 weeks or above were included. Multiparous women with twin gestation/delivery, with known medical conditions like diabetes, HIV, and hypertension, referred from other health institutions, home delivery, and those who were unable to communicate or seriously ill were excluded from the study.

Sample size calculation

The sample size was computed using Open-Epi version 3.03 statistical software. The following assumptions were made: the power of the study (1-β) to be 80%, 95% confidence interval (CI), the estimated ratio of unexposed (LM)-to exposed (GM) ratio is 2:1, and the percent of outcome among non-exposed group and odds ratio of previous studies were used as indicated in Table 1 below. Adding a 10% non-response rate, the largest sample size was 548 (183 GM and 365 LM).

Sampling procedure

Simple random sampling was applied to select 5 hospitals. The average number of deliveries in these hospitals was estimated to be 639 per month. The sample size was proportionally allocated to each hospital based on their respective number of deliveries (Fig. 1). For each grand multiparous woman, two

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Table 1 Sample size calculation for adverse obstetric outcomes in low multiparous and grand multiparous women who give birth in North Shewa Zone Hospitals, 2021

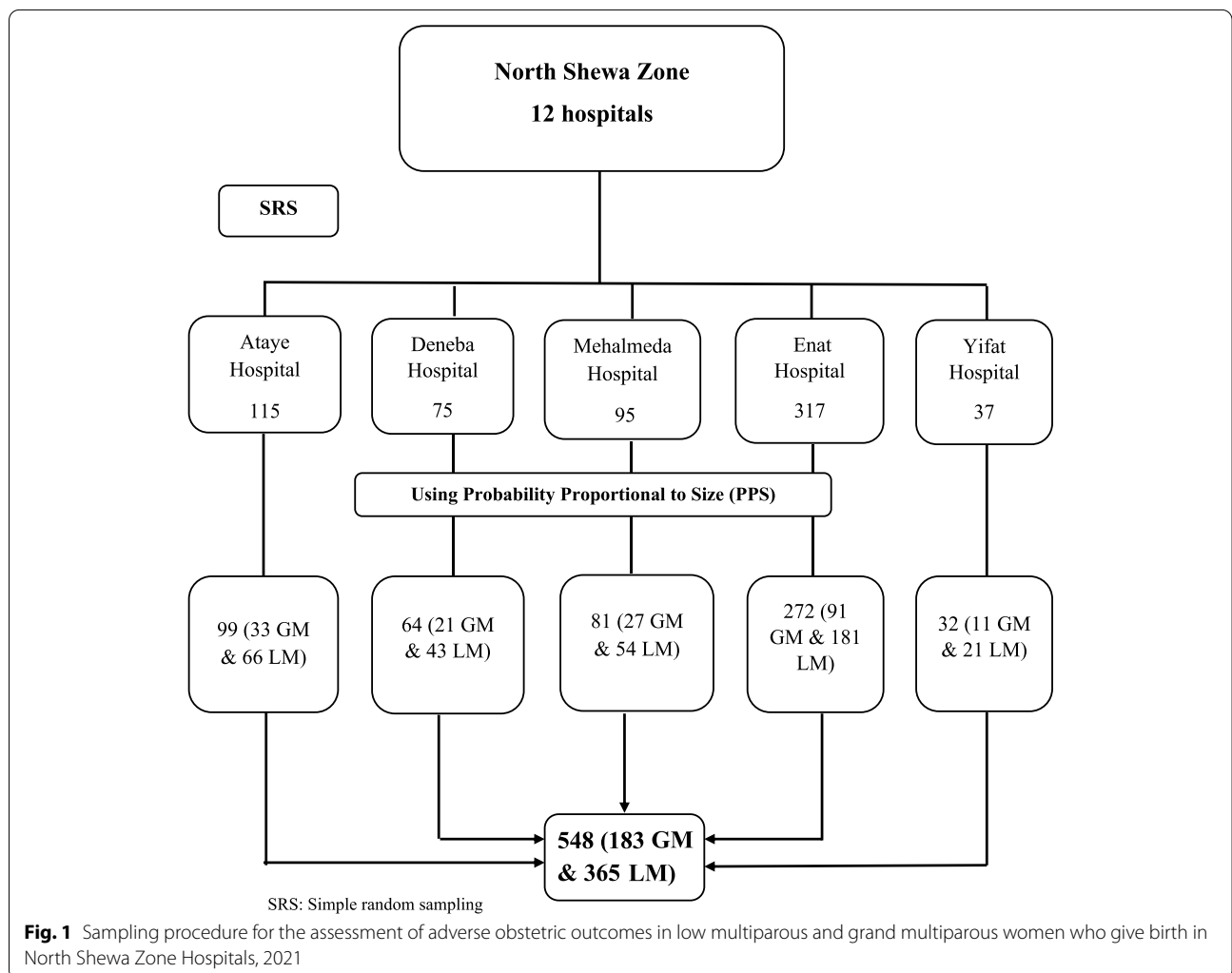| Variables	% of outcome in unexposed group	Adjusted odds ratio	Sample size GM/LM [Total]	Reference
Anemia	16.8	3.5	44/88 [132]	[13]
Home delivery	20.66	1.87	166/332 [**498**]	[14]
Preterm delivery	5.8	5.3	47/93 [140]	[15]
Cesarean section	37.9	2.7	55/110 [165]	[9]

low multiparous women from the same hospital were selected consecutively as they were present.

Data collection tool and quality control

A structured and pre-tested questionnaire was used to obtain information from demographic characteristics, antenatal and obstetric history, and obstetric complications. The data was collected through face-to-face interviews and a review of clinical records and birth registries. A standard questionnaire was first prepared in English, then translated to the local language Amharic and back to English by an independent translator to keep the consistency of the instrument. The questionnaire was adapted from published articles [6, 9, 15] and modified according to the local context.

Data quality was assured during collection, coding, entry, and analysis. Three diploma and two BSc midwives conducted interviews on daily basis using a

Fig. 1 Sampling procedure for the assessment of adverse obstetric outcomes in low multiparous and grand multiparous women who give birth in North Shewa Zone Hospitals, 2021

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standardized questionnaire for all women who deliver at the hospital within one to two hours of birth or immediately after recovery from a cesarean/complicated delivery. A training was given to the data collectors and supervisors regarding the objective, methods, tool, and data collection procedure to avoid any confusion and have a common understanding of the study. A pretest was done on 27 mothers (5% of the samples; 9 GM and 18 LM) in Arerti primary hospital and necessary amendments were considered following the result. The supervisors and principal investigators follow the daily activities of data collectors and checked the completeness, consistency, and clarity of the data.

Measurements

Low multiparity: a woman having two to four live births or stillbirths after 28 weeks of gestation [6, 15]. Grand multiparity: woman with five or more live births or stillbirths after 28 weeks of gestation [6, 15].

Obstetric outcomes: at least one obstetric complication before, during, and after delivery were considered, i.e., APH, PPH, anemia, PROM, preterm labor, cesarean section, uterine rupture, sepsis, pregnancy-induced hypertension, oligohydramnios, prolonged pregnancy, obstructed labor, induction/augmentation, and maternal death [6, 9].

Data processing and analysis

After data was collected and extracted from records, it was cleaned, coded, and checked for consistency and verification of missing values. Data was entered into Epi-Data version 4.6 and analysis was performed using SPSS version 25.0 statistical software. Descriptive statistics were summarized using frequency tables, percentages, and figures. Cross-tabulation and bivariable and multivariable analysis of variables were computed. Independent variables with a *p*-value of less than 0.25 in the bivariable analysis were exported into the multivariable logistic regression analysis. Multivariable analysis was used to control the possible confounders and identify important predictors of adverse obstetric outcomes. The adjusted odds ratio (AOR) with a 95% confidence interval was used to measure the strength of association. A *p*-value of ≤ 0.05 (2-tailed) was used to consider the significance of statistical tests. The model fitness was checked using Hosmer–Lemeshow goodness-of-fit ($p = 0.688$).

Result

Demographic characteristics

A total of 540 (180 LM and 360 GM) women were included in this analysis with a response rate of 98.9%. About 306 (85%) of LM and 70 (38.9%) of GM women

were within the age range of 21 – 34 years ($p = 0.000$). Three-fourths, 266 (74%) of LM women reside in urban areas, while half 94 (52.2%) of GM women were rural residents ($p = 0.000$). Besides, 158 (44%) of LM and 42 (23.3%) of GM women had attended higher education ($p = 0.000$), and 58 (16.1%) of LM and 62 (34.4%) of GM women married before 18 years ($p = 0.000$). Further, 60 (16.7%) of LM and 32 (17.8%) of GM women have changed partners (Table 2).

Obstetric profile

The mean ($\pm$ SD) gestational age was 39.17 ± 2.27 and 39.02 ± 2.09 weeks for low multiparous and grand multiparous women, respectively. About 342 (95.0%) of LM and 168 (93.3%) of GM women spaced a child for a minimum of two years. The majority of LM 348 (96.7%) and GM 156 (86.7%) women had antenatal care (ANC) follow-up. Abortion, neonatal mortality, and cesarean sections were the most frequently encountered obstetric complications previously. Additionally, 18 (5%) of LM mothers and 38 (21%) of GM mothers had previously given birth at home (Table 3).

Adverse obstetric outcome

The prevalence of adverse obstetric outcomes was 32.6% (95% CI: 28.7–36.5). This was comparable in low multiparous and grand multiparous women (32.8% vs 32.2%). Antepartum hemorrhage, anemia, and postpartum hemorrhage were higher in grand multiparous women. Whereas, PROM, prolonged labor, induction/augmentation, episiotomy, and post-term pregnancy were higher in low multiparous women (Fig. 2).

Determinants of adverse obstetric outcome

Variables with a p-value of ≤ 0.25 in the bivariable logistic regression analysis were selected for the multivariable logistic regression analysis model. When adjusted for the socio-demographic and obstetric factors, parity did not show a statistically significant difference in obstetric outcomes [AOR (CI) = 1.42 (0.74–2.73)]. However, income, alcohol consumption, gestational age at delivery, previous mode of delivery, and birth weight showed a statistically significant association (Table 4).

Mothers in the low-income tertile were three times more likely to develop obstetric complications compared to those in higher-income tertiles (AOR (CI) = 3.15 (1.30–7.63). The odds of adverse obstetric outcomes were higher among cesarean deliveries than the vaginal (AOR (CI) = 13.6 (6.18–30.1). Alcohol consumption increased the risk of adverse obstetric outcomes by threefold (AOR (CI) = 3.15 (1.49–6.64). Adverse obstetric outcomes were nine times more common in women with preterm deliveries (AOR (CI) = 9.24 (2.28–27.3). Further, mothers with

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Table 2 Distribution of socio-demographic data by parity among women who gave birth in North Shewa Zone Hospitals, 2021

Variables	Category	Parity, n (%)		
		LM (360)	GM (180)	*p*-value
Age of the mother	20 – 34 years	306 (85.0)	70 (38.9)	0.000*
	< 20 years	8 (2.2)	4 (2.2)	
	≥ 35 years	46 (12.8)	106 (58.9)	
Residence	Rural	94 (26.1)	94 (52.2)	0.000
	Urban	266 (73.9)	86 (47.8)	
Religion	Christian	304 (84.4)	120 (66.7)	0.000
	Muslim	56 (15.6)	60 (33.3)	
Mother's education	No formal education	66 (18.3)	106 (58.9)	0.000
	Primary	76 (21.1)	14 (7.8)	
	Secondary	60 (16.7)	18 (10.0)	
	Higher education	158 (43.9)	42 (23.3)	
Mother's Occupation	Housewife	164 (45.6)	108 (60.0)	0.000
	Gov't employee	112 (31.1)	26 (14.4)	
	Self-employed	84 (23.3)	46 (25.6)	
Marital status	Married	354 (98.3)	170 (94.4)	0.012
	Others[a]	6 (1.7)	10 (5.6)	
Husband education	No formal education	74 (20.9)	86 (50.6)	0.000
	Primary	68 (19.2)	14 (8.2)	
	Secondary	26 (7.3)	10 (5.9)	
	Higher education	186 (52.5)	60 (35.3)	
Husband occupation	Farmer	116 (32.8)	98 (57.6)	0.000
	Gov't employee	130 (36.7)	44 (25.9)	
	Self-employed	108 (30.5)	28 (16.5)	
Age at marriage	< 18 years	58 (16.1)	62 (34.4)	0.000
	≥ 18 years	302 (83.9)	118 (65.6)	
Changing partner	Yes	60 (16.7)	32 (17.8)	0.746
	No	300 (83.3)	148 (82.2)	
Income (ETB)	Lower tertile	134 (37.2)	88 (48.9)	0.027
	Middle tertile	118 (32.8)	44 (24.4)	
	Higher tertile	108 (30.0)	48 (26.7)	

ETB Ethiopian Birr, *GM* Grand multiparous, *LM* Low multiparous

[a] Single, divorced, and widowed

* Fisher's exact test

low-birth-weight neonates were three times more likely to have adverse obstetric outcomes compared to normal birth weight (AOR (CI) = 3.46 (1.33–9.03) (Table 4).

Discussion

This study compared the adverse obstetric outcomes in low multiparous and grand multiparous women. APH, anemia, and PPH were higher in grand multiparous women. Whereas, PROM, prolonged labor, induction/augmentation, episiotomy, and post-term pregnancy were higher in low multiparous women. Income, alcohol consumption, gestational age at delivery, previous mode of delivery, and birth weight were significant predictors of adverse obstetric outcomes. However, parity showed an insignificant difference in obstetric outcomes.

The current study found that parity was not significantly associated with composite adverse obstetric outcomes. However, APH, anemia, and PPH were higher in grand multiparous women. Whereas, PROM, prolonged labor, induction/augmentation, episiotomy, and post-term pregnancy were higher in low multiparous women. Similarly, a systematic review and meta-analysis finding showed that grand multiparity was not associated with an increased risk of pregnancy outcomes [16]. In Saudi, there is an insignificant increase in the maternal and neonatal risks in grand multiparas compared to the low multiparas. The study further concluded that grand multiparity could not be discouraged given that the women are provided with good perinatal care [7]. A comparative prospective cohort study in Uganda also reported that there was no difference in fetal outcome between grand multiparous and low multiparous women [17]. Further, grand multiparity was found to be an insignificant factor for adverse obstetric outcomes in South Ethiopia [6].

On the contrary, other studies found a statistically significant association between grand multiparity and adverse obstetric outcomes [9, 18, 19]. Grand multiparity

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Table 3 Obstetric characteristics of LM and GM women who gave birth in North Shewa Zone Hospitals, 2021

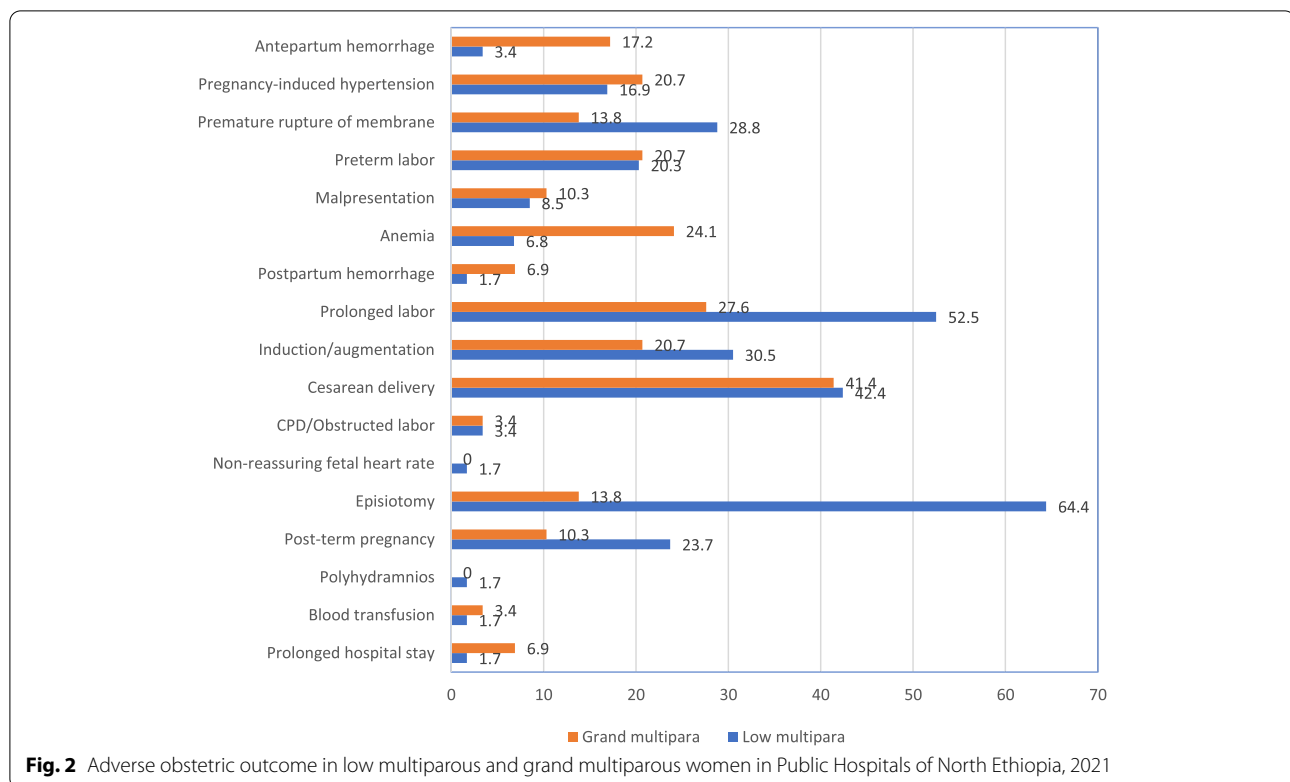| Variables	Category	Parity, n (%)		p-value
		LM (360)	GM (180)	
Interpregnancy interval	< 24 months	18 (5.0)	12 (6.7)	0.425
	≥ 24 months	342 (95.0)	168 (93.3)	
ANC visit	Yes	348 (96.7)	156 (86.7)	0.000
	No	12 (3.3)	24 (13.3)	
GA at first ANC visit	≤ 16 weeks	218 (62.6)	60 (38.5)	0.000
	> 16 weeks	130 (37.4)	96 (61.5)	
Number of ANC visits	1 – 3	118 (33.9)	68 (43.6)	0.037
	≥ 4	230 (66.1)	88 (56.4)	
Past obstetric complications	Yes	136 (37.8)	102 (56.7)	0.000
	No	224 (62.2)	78 (43.3)	
Types of complications	Abortion	60 (16.7)	66 (36.7)	0.007*
	Stillbirth/IUFD	6 (1.7)	30 (16.7)	
	Neonatal mortality	8 (2.2)	28 (15.6)	
	Preterm delivery	12 (3.3)	0 (0.0)	
	Instrumental delivery	32 (8.9)	10 (5.6)	
	Cesarean section	24 (6.7)	10 (5.6)	
	Congenital anomaly	2 (0.6)	0 (0)	
Place of delivery (previous birth)	Home	18 (5.0)	38 (21.1)	0.000
	Health institution	342 (95.0)	142 (78.9)	
Mode of delivery (Previous birth)	Vaginal	320 (88.8)	160 (88.9)	0.000
	Cesarean section	40 (11.1)	20 (11.1)	
Distance of health institutions	< 15 min	134 (37.2)	18 (10.0)	0.000
	15 – 30 min	106 (29.4)	58 (32.2)	
	> 30 min	120 (33.3)	104 (57.8)	
Gestational age	Term	308 (85.6)	162 (90.0)	0.133
	Preterm	24 (6.7)	12 (6.7)	
	Post-term	28 (7.8)	6 (3.3)	
Contraception use	Yes	276 (76.7)	124 (68.9)	0.052
	No	84 (23.3)	56 (31.1)	
Types of contraception used	Injectable	138 (50.0)	50 (40.3)	0.065*
	Implant	100 (36.2)	54 (43.5)	
	IUCD	10 (3.6)	0 (0)	
	OCPs	22 (8.0)	14 (11.3)	
	Natural methods	6 (2.2)	4 (3.2)	
	Tubal ligation	0 (0)	2 (1.6)	
Planned pregnancy	Yes	336 (93.3)	152 (84.4)	0.001
	No	24 (6.7)	28 (15.6)	
Postpartum counseling	Yes	308 (85.6)	136 (75.6)	0.040
	No	52 (14.4)	44 (24.4)	
Alcohol use	Yes	38 (10.6)	14 (7.8)	0.302
	No	322 (89.4)	166 (92.2)	
Newborn sex	Male	190 (52.8)	100 (55.6)	0.542
	Female	170 (47.2)	80 (44.4)	
Birth weight	Low birth weight	38 (10.6)	20 (11.1)	0.887
	Normal	294 (81.7)	148 (82.2)	
	Macrosomic	28 (7.8)	12 (6.7)	
APGAR score	Low	22 (6.1)	18 (10.0)	0.104
	Normal	338 (93.9)	162 (90.0)	

GA Gestational age, *IUCD* Intrauterine contraception device, *IUFD* Intrauterine fetal death, *OCPs* Oral contraception pills, *SVD* Spontaneous vaginal delivery

* Fisher's exact test

was considered a risk pregnancy and increased the risk of obstetric complications in Tanzania [15]. These might be because of the variation in study design, setting, socio-economic status, and lack of account for possible confounders, i.e., interpregnancy interval, chronic disease, nutritional and psychosocial status. Besides, significant outcomes in the previous studies might be related to low health service utilization of grand multiparous women. Further, the differences in antenatal care access and quality may explain this disparity.

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Fig. 2 Adverse obstetric outcome in low multiparous and grand multiparous women in Public Hospitals of North Ethiopia, 2021

According to the current study, mothers in the low-income tertile were three times more likely to develop obstetric complications compared to those in higher-income tertiles. In Korea, the risk of obstetric complications, i.e., cesarean delivery, pre-eclampsia, gestational diabetes, obstetric hemorrhage, and preterm delivery were significantly higher in women with low-income levels [20]. Mothers with low-income levels also had higher risks of death [21]. This could be because women with low socioeconomic status tend to have low educational levels, inadequate prenatal visits, and poor medical service utilization. In addition, prolonged working hours/occupational fatigue and physical exertions likely affect obstetric outcomes.

It was found that the mode of delivery had a positive association with adverse obstetric outcomes. The odds of adverse obstetric outcomes were significantly higher among cesarean deliveries. A prospective cohort in Nepal found that the presence of severe obstetric complications significantly increased the likelihood of cesarean delivery [22]. Cesarean delivery appeared to meet the obstetric need to save the life of the mother and/or fetus and was performed following medical indications, particularly after the onset of labor. The most common obstetric indications of cesarean delivery were malpresentation, prolonged labor, non-reassuring fetal heart rate pattern, and obstructed labor.

The current study identified alcohol consumption as a risk factor for adverse obstetric outcomes. Alcohol consumption increased the risk of adverse obstetric outcomes by threefold. This is comparable with a prospective cohort study in Japan that found alcohol consumption was associated with an increased risk of preterm birth [23]. In addition, women who drink alcohol had significantly higher odds of pregnancy-induced hypertension (PIH) [24]. The mechanism of this link might be due to alcohol induces endothelial dysfunction and insufficient spiral artery remodeling resulting in severe intravascular coagulation, decreased placental perfusion, placental dysfunction, and an imbalance of endogenous angiogenic factors, such as soluble fms-like tyrosine kinase 1 (sFlt-1) and placental growth factor (PlGF). Alcohol could also increase the secretion of prostaglandins that increase cyclic 3′,5′-adenosine monophosphate activity and yield decreased cell division and increased uterine contractions [23, 24].

Gestational age at delivery was found to be an associated risk factor for obstetric complications. Women with preterm deliveries were nine times at higher risk of adverse obstetric outcomes. This finding was supported by a study done in Western Ethiopia, where mothers who developed anemia during pregnancy, PROM, and PIH were more likely to experience preterm birth [25]. Anemia may induce maternal and fetal stress and increase the

Table 4 Determinants of adverse obstetric outcome in Public Hospitals of North Ethiopia, 2021

Variables	Adverse obstetric outcome		COR (95% CI)	AOR (95% CI)
	Yes	No		
Age				
20 – 34 years	126 (71.6)	250 (68.70	1	1
< 20 years	8 (4.5)	4 (1.1)	3.97 (0.97–13.4)	3.44 (0.21–11.7)
≥ 35 years	42 (23.9)	110 (30.2)	0.76 (0.50–1.15)	0.67 (0.35–1.25)
Religion				
Christian	129 (73.3)	295 (81.0)	1	1
Muslim	47 (26.7)	69 (19.0)	1.56 (1.02–2.38)	2.01 (0.99–4.06)
Mother's education				
No formal education	50 (28.4)	122 (33.5)	0.96 (0.61–1.49)	0.74 (0.29–1.87)
Primary	36 (20.5)	54 (14.8)	1.56 (0.93–2.61)	0.45 (0.17–1.21)
Secondary	30 (17.0)	48 (13.2)	1.46 (0.84–2.52)	0.82 (0.36–1.84)
Higher education	60 (34.1)	140 (38.5)	1	1
Age at marriage				
< 18 years	46 (26.1)	74 (20.3)	1.39 (0.91–2.12)	0.79 (0.38–1.64)
≥ 18 years	130 (73.9)	290 (79.9)	1	1
Income (ETB)				
Lower tertile	84 (47.7)	138 (37.9)	1.65 (1.06–2.58)	**3.15 (1.30–7.63)***
Middle tertile	50 (28.4)	112 (30.8)	1.21 (0.75–1.97)	**2.48 (1.22–5.06)***
Higher tertile	42 (23.9)	114 (31.3)	1	1
GA at first ANC visit				
≤ 16 weeks	101 (62.3)	177 (51.8)	1	1
> 16 weeks	61 (37.7)	165 (48.2)	0.65 (0.44–0.95)	0.37 (0.21–1.66)
Previous obstetric complications				
Yes	106 (60.2)	132 (36.3)	2.66 (1.84–3.85)	1.48 (0.88–2.49)
No	70 (39.8)	232 (63.7)	1	
Mode of delivery (Previous birth)				
Vaginal	128 (72.7)	352 (96.7)	1	1
Cesarean section	48 (27.3)	12 (3.3)	11.0 (5.66–21.4)	**13.6 (6.18–30.1)***
Planned pregnancy				
Yes	146 (83.0)	342 (94.0)	1	1
No	30 (17.0)	22 (6.0)	3.19 (1.78–5.72)	1.25 (0.47–3.29)
Alcohol consumption				
Yes	24 (13.6)	28 (7.7)	1.89 (1.06–3.38)	**3.15 (1.49–6.64)***
No	152 (86.4)	336 (92.3)	1	1
GA at delivery				
Term	128 (72.7)	342 (94.0)	1	1
Preterm	26 (14.8)	10 (2.7)	6.95 (3.26–14.8)	**9.24 (2.28–27.3)***
Post-term	22 (12.5)	12 (3.3)	4.89 (2.36–10.2)	**4.82 (1.89–12.3)***
Newborn sex				
Male	105 (59.7)	185 (50.8)	1.43 (0.99–2.06)	1.16 (0.71–1.92)
Female	71 (40.3)	179 (49.2)	1	1
Birth weight				
Normal	130 (73.9)	312 (85.7)	1	1
Low birth weight	34 (19.3)	24 (6.6)	3.40 (1.94–5.96)	**3.46 (1.33–9.03)***
Macrosomic	12 (6.8)	28 (7.7)	1.03 (0.51–2.09)	0.53 (0.19–1.42)
APGAR score				
Low	24 (13.6)	16 (4.4)	3.43 (1.77–6.65)	1.51 (0.52–4.37)
Normal	152 (86.4)	348 (95.6)	1	1
Parity				
Low multiparous	118 (67.0)	242 (66.5)	1	1
Grand multiparous	58 (33.0)	122 (33.5)	0.97 (0.67–1.43)	1.42 (0.74–2.73)

SVD Spontaneous vaginal delivery, *GA* Gestational age

* Statistically significant at p-value < 0.05

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risk of maternal infection stimulating the production of corticotropin-releasing hormone (CRH). Elevated CRH is a major risk factor for preterm labor, premature rupture of the membranes, and pregnancy-induced hypertension and eclampsia [26]. As amniotic fluid contains prostaglandin, PROM elevates fetal plasma interleukin-6 and induces uterine contraction. PIH may cause vascular damage to the placenta causing antenatal bleeding and preterm birth.

Moreover, mothers with low-birth-weight neonates were three times more likely to have adverse obstetric outcomes compared to normal birth weight neonates. Similarly, a cross-sectional study in Wolaita Sodo found that pregnancy-induced hypertension and anemia during pregnancy have independent effects in causing low birth weight [27]. Secondary data analysis in Zimbabwe also stated that the risk of low birth weight was significantly higher among women with PROM, eclampsia, anemia, APH, and preterm labor [28]. Low birth weight indicates the presence of some kind of obstetric complication that adversely affects the growth of the fetus. For example, hypertension in pregnancy may cause abruption placenta, which might result in reduced nutrient and oxygen supply to the growing fetus and may end up in low birth weight, growth restriction, or stillbirth [29]. This might be also due to poor socioeconomic status, inadequate maternal nutrition, and weight gain during pregnancy. This finding may also call attention to early identification and treatment of pregnancy complications and launch the 2016 WHO global recommendations for routine ANC visits.

Limitation

This finding study should be interpreted with the following drawbacks. Due to the insufficient count of cases, it was not possible to examine each specific adverse obstetric outcome separately with parity. There may be also a recall bias on previous obstetric profiles. Since it is a snapshot, it shares the limitation of a cross-sectional study that may not indicate a causal relationship. Finally, as the study was done in a hospital setting, the obstetric outcome of women who gave birth at home was not assessed.

Conclusion and recommendation

The adverse obstetric outcome was significantly associated with income, alcohol consumption, preterm delivery, cesarean delivery, and birth weight. Parity had no significant association with obstetric outcomes. Socioeconomic development, avoiding alcohol consumption, early identification and treatment of complications, and adequate nutrition and weight gain during pregnancy are needed regardless of parity. Attention should be paid to both groups of women for their different obstetric complications. In addition, longitudinal studies are recommended to investigate the effect of parity on adverse obstetric outcomes.

Declarations

Ethics approval and consent to participate
An ethical approval letter was obtained from the ethical review committee of Debre Berhan University, College of Medicine and Health science with protocol number P012. The committee has also approved thumb-printed consent from illiterate mothers. A further formal letter was written to the study hospitals. After the data collectors explained the objective, potential benefits, and risks of the study, written informed consent was obtained from the study subjects. Illiterate mothers were asked to thumbprint on the consent form. Confidentiality and anonymity were also assured. All methods were performed per the declaration of Helsinki ethical principles.
The Debre Berhan University, College of Medicine and Health science ethical review committee approved the procedure for thumb-printed consent from illiterate mothers.

Consent for publication
Not applicable.

Competing interests
The authors declare that there are no conflicts of interest.

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References

1. World Health Organization. Trends in maternal mortality: 2000 to 2017 Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. WHO, 2019. Avail at: https://documents1. worldbank.org/curated/en/793971568908763231/pdf/Trends-in-mater nal-mortality-2000-to-2017-Estimates-by-WHO-UNICEF-UNFPA-World-Bank-Group-and-the-United-Nations-Population-Division.pdf.
2. Maternal and Neonatal Program Effort Index (MNPI): Ethiopia. Avail. At: https://pdf.usaid.gov/pdf_docs/Pnacr873.pdf.
3. Mekonnen W, Gebremariam A. Causes of maternal death in Ethiopia between 1990 and 2016: systematic review with meta-analysis. Ethiop J Heal Dev. 2018;32(4):225–42.
4. Sikder SS, Labrique AB, Shamim AA, Ali H, Mehra S, Wu L, et al. Risk factors for reported obstetric complications and near misses in rural northwest Bangladesh: analysis from a prospective cohort study. BMC Pregnancy Childbirth. 2014;14(1):1–13.
5. Asiki G, Baisley K, Newton R, Marions L, Seeley J, Kamali A, et al. Adverse pregnancy outcomes in rural Uganda (1996–2013): trends and associated factors from serial cross sectional surveys. BMC Pregnancy Childbirth. 2015;15(1):1–12.
6. Yimer NB, Gedefaw A, Tenaw Z, Liben ML, Meikena HK, Amano A, et al. Adverse obstetric outcomes in public hospitals of southern Ethiopia: the role of parity. J Matern Neonatal Med. 2020;35(10):1–8.
7. Al-Shaikh GK, Ibrahim GH, Fayed AA, Al-Mandeel H. Grand multiparity and the possible risk of adverse maternal and neonatal outcomes: a dilemma to be deciphered. BMC Pregnancy Childbirth. 2017;17(1):1–7.
8. Muniro Z, Tarimo CS, Mahande MJ, Maro E, Mchome B. Grand multiparity as a predictor of adverse pregnancy outcome among women who delivered at a tertiary hospital in Northern Tanzania. BMC Pregnancy Childbirth. 2019;19(1):1–8.
9. Alsammani MA, Ahmed SR. Grand multiparity: risk factors and outcome in a tertiary hospital: a comparative study. Mater Sociomed. 2015;27(4):244.
10. SDG Target 3.1 | Maternal mortality: By 2030, reduce the global maternal mortality ratio to less than 70 per 100 000 live births [Internet]. [cited 2022 Jul 21]. Available from: https://www.who.int/data/gho/data/themes/topics/indicator-groups/indicator-group-details/GHO/maternal-mortality
11. Kassebaum NJ, Barber RM, Bhutta ZA, Dandona L, Gething PW, Hay SI, et al. Global, regional, and national levels of maternal mortality, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet. 2016;388(10053):1775–812.
12. Sewasew | North Shewa Zone. [cited 2022 Jul 21]. Available from: https://en.sewasew.com/p/north-shewa-zone
13. Aragaw FA, Mahtemsilllasie M, Jarso H. Grand multiparity and pregnancy related complications among women who gave birth at Jimma University specialized hospital, Jimma, Southwest Ethiopia. Gynecol Obs. 2017;7(4):438.
14. Bililign Yimer N, Tenaw Z, Solomon K, Mulatu T. Inadequate prenatal visit and home delivery as determinants of perinatal outcomes: does parity matter? J Pregnancy. 2019;2019:1–10.
15. Mgaya AH, Massawe SN, Kidanto HL, Mgaya HN. Grand multiparity: is it still a risk in pregnancy? BMC Pregnancy Childbirth. 2013;13(1):1–8.
16. Shah PS, Births KSG on D of L. Parity and low birth weight and preterm birth: a systematic review and meta-analyses. Acta Obstet Gynecol Scand. 2010;89(7):862–75.
17. Nijiru J, Biryabarema C, Kagawa M. Fetal outcomes among grand multiparous and multiparous women in Mulago hospital. Uganda East Afr Med J. 2013;90(3):84–8.
18. Afzal A, Mahajan N, Firdous N. Pregnancy outcomes in grand multiparous patients: a hospital based study from Jammu and Kashmir, India. Int J Reprod Contraception, Obstet Gynecol. 2016;5(3):788–92.
19. Qamar A, Asif U, Qamar S. Maternal and fetal outcome in grand multipara. PAFMJ. 2015;65(1):135–40.
20. Kim MK, Lee SM, Bae S-H, Kim HJ, Lim NG, Yoon S-J, et al. Socioeconomic status can affect pregnancy outcomes and complications, even with a universal healthcare system. Int J Equity Health. 2018;17(1):1–8.
21. Jeong W, Jang S-I, Park E-C, Nam JY. The effect of socioeconomic status on all-cause maternal mortality: a nationwide population-based cohort study. Int J Environ Res Public Health. 2020;17(12):4606.

22. Karkee R, Lee AH, Khanal V, Pokharel PK, Binns CW. Obstetric complications and cesarean delivery in Nepal. Int J Gynecol Obstet. 2014;125(1):33–6.
23. Ikehara S, Kimura T, Kakigano A, Sato T, Iso H, Group JECS. Association between maternal alcohol consumption during pregnancy and risk of preterm delivery: the Japan environment and children's study. BJOG An Int J Obstet Gynaecol. 2019;126(12):1448–54.
24. Iwama N, Metoki H, Nishigori H, Mizuno S, Takahashi F, Tanaka K, et al. Association between alcohol consumption during pregnancy and hypertensive disorders of pregnancy in Japan: the Japan environment and children's study. Hypertens Res. 2019;42(1):85–94.
25. Abadiga M, Wakuma B, Oluma A, Fekadu G, Hiko N, Mosisa G. Determinants of preterm birth among women delivered in public hospitals of Western Ethiopia, 2020: unmatched case-control study. PLoS ONE. 2021;16(1): e0245825.
26. Allen LH. Biological mechanisms that might underlie iron's effects on fetal growth and preterm birth. J Nutr. 2001;131(2):581S-589S.
27. Lake EA, Olana Fite R. Low birth weight and its associated factors among newborns delivered at wolaita sodo university teaching and referral hospital, southern Ethiopia, 2018. Int J Pediatr. 2019;2019:1–8.
28. Feresu SA, Harlow SD, Woelk GB. Risk factors for low birthweight in Zimbabwean women: a secondary data analysis. PLoS ONE. 2015;10(6): e0129705.
29. Asmare G, Berhan N, Berhanu M, Alebel A. Determinants of low birth weight among neonates born in Amhara Regional State Referral Hospitals of Ethiopia: unmatched case control study. BMC Res Notes. 2018;11(1):1–7.

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