

# Determinants of pelvic organ prolapse among gynecologic patients attending public referral hospitals in Amhara region, Ethiopia, 2020: Institution-based unmatched case-control study design

SAGE Open Medicine  
Volume 10: 1–10  
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DOI: 10.1177/20503121221094182  
journals.sagepub.com/home/smo



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## Abstract

**Background:** Pelvic organ prolapse is a common disorder, with up to 40% of women worldwide having some form of anatomical prolapse, and it is a significant public health problem in developing countries including Ethiopia. The prevalence of pelvic organ prolapse in Ethiopia is 13% in Benchi Maji. This study is designed to provide information about the determinants of pelvic organ prolapse among gynecologic patients attending public referral hospitals in the Amhara region, 2020.

**Method:** Institution-based unmatched case-control study design was conducted from March to June 2020 among randomly selected 348 mothers (116 cases and 232 controls). A convenient sampling technique was used to select cases, and controls were selected by systematic random sampling technique. A pre-tested and structured interviewer-administered questionnaire was used to collect the data. Data were coded and entered into Epi data version 3.1 and then exported to the Statistical Package for Social Science IBM version 25 for analysis. Finally, adjusted odds ratio and 95% confidence intervals were used to declare statistical significance.

**Result:** The result showed that being unable to read and write (illiterate) (adjusted odds ratio=3.91; 95% confidence interval=1.06–14.39), age of women  $\geq 40$  (adjusted odds ratio=2.91; 95% confidence interval=1.255–6.736), giving first birth before age of 20 (adjusted odds ratio=5.72; 95% confidence interval=1.73–18.94), carrying heavy objects (adjusted odds ratio=2.296; 95% confidence interval=1.102–4.785), parity  $\geq 4$  (adjusted odds ratio=7.02; 95% confidence interval=1.16–42.45), and family history of pelvic organ prolapse (adjusted odds ratio=3.09; 95% confidence interval=1.24–7.71) were significantly associated with pelvic organ prolapse.

**Conclusion:** This study concluded that being unable to read and write, age  $\geq 40$ , multiparity, family history of pelvic organ prolapse, early childbirth, and carrying heavy objects were the risk factors of pelvic organ prolapse. Providing health education on planning the number of children, and the impact of carrying heavy loads on pelvic organs, preventing early childbirth, and encouraging women to pursue their education at least up to primary school level is recommended.

## Keywords

Pelvic organ prolapse, case-control, Ethiopia

Date received: 26 July 2021; accepted: 22 March 2022

## Introduction

Pelvic organ prolapse (POP) is defined as downward displacement of pelvic organs, resulting in herniation of those organs into or through the vagina (uterovaginal prolapse) or anal canal (in the case of rectal intussusception and rectal prolapse). Prolapse is a hernia, and the hernial portal is the “levator hiatus” (i.e. the opening in the pelvic floor muscle or “levator ani,” which allows the urethra, vagina, and ano-rectum to transit the abdominal envelope).<sup>1</sup>

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POP is a common disorder, with up to 40% of women worldwide having some form of anatomical prolapse.<sup>2</sup> The few population-based studies on POP available from low- and middle-income countries have reported prevalence rates ranging from 3% to 56%, and commonly include both types of researches on symptomatic and anatomical prolapse.<sup>3</sup>

A study in rural Ghana shows 12.07% of study participants had POP,<sup>4</sup> and in Ethiopia, the prevalence of POP is 1.2% in Tigray and 13% in Benchi Maji.<sup>5</sup> Another study done at Gondar University & Gandhi Memorial hospitals and Jimma university specialized hospitals have shown that POP accounted for 19.9%, 17.2%, and 40.7% of gynecologic operations, respectively.<sup>6,7</sup>

Prolapse is caused by weakness in the pelvic floor muscle, as the menopausal state leads to estrogen deficiency and loss of connective tissue strength.<sup>8</sup> The study conducted in Addis Ababa showed that farmers and housewives of farmers are highly likely to involve in highly demanding activities which will eventually lead to POP,<sup>9</sup> and a common presenting complaint of the patients was mass per vaginam.<sup>7</sup> Parity, vaginal delivery, age, and body mass index (BMI) are the most important risk factors for primary POP, BMI is the only modifiable risk factor in the prevention of primary POP.<sup>10</sup> In most of the cases with POP delivered their previous child at home, only one in eight of these women have had a delivery in hospital.<sup>11</sup>

POP had affected the quality of life in the majority of the affected women; unlike some other societies, more than half failed to seek healthcare advice due to lack of proper knowledge about the condition.<sup>12</sup> POP is a significant public health problem in developing countries including Ethiopia.<sup>13</sup> The majority of women who had suffered for years or even decades from their prolapse condition were severely affected by pain and discomfort.<sup>14</sup>

A study done in Nepal showed that the educational status of women is strongly associated with POP.<sup>15</sup> Another study done in southern Ethiopia indicated that women aged 45–55 years and above are among cases that are more likely to have POP than controls.<sup>16</sup>

The majority of studies done previously in some parts of Ethiopia related to POP identified inconsistent predictors of POP and have focused mainly on the relationships between POP and socio-demographic variables but rarely go beyond. Even though the magnitude of the problem is high, the majority of women suffering from POP do not access health care. So, it is important to strengthen the prevention and treatment services of POP. To be able to develop effective preventive measures, current information about risk factors for the development of POP is essential. Despite that, this study assessed determinants of POP among gynecologic patients attending public referral hospitals in the Amhara region, Ethiopia. Therefore, it is necessary to identify determinants of POP to fill the gaps and to provide concrete information about the risk factors of POP in Amhara region referral hospitals.

## Materials and methods

### Study area

This study was conducted in referral hospitals in the Amhara region. Amhara region is the second-most populous region in Ethiopia with over 21 million inhabitants. Bahrdar is the capital city of the region, which is 565 km Northwest of Addis Ababa.<sup>17</sup> Amhara region is bordered by the state of Sudan to the west and northwest, Tigray to the north, Afar to the east, Benishangul to the west and southwest, and Oromia to the south. Approximately 77% of men and 62% of women are engaged in agricultural activities in the region.<sup>18</sup> There are six referral hospitals in the region and several public and private health institutions. This study was conducted from March to June 2020.

### Study design and period

An institution-based unmatched case-control study design was employed to identify determinants of POP among gynecologic patients attending public referral hospitals. This study was conducted from March to June 2020.

### Population

All gynecologic patients who have attended public referral hospitals in the Amhara region during the data collection period and fulfill eligibility criteria were the study population.

### Inclusion and exclusion criteria

**Cases.** Gynecologic patients who were confirmed for stage “II” and above POP were included. POP was evaluated and described using a standardized Pelvic Organ Prolapse Quantitative Examination (POP-Q) system.

**Controls.** Patients who attended public referral hospitals for gynecologic diseases other than POP were included in the study after the physician confirmed that they were free from POP. Those women with stage “I” prolapse, involuntary for physical examination, and unable to give a response were excluded from the study.

### Sample size determination and sampling procedure

The sample size was determined by using the double population proportion formula for unmatched case-control study using Open EPI-info version7 software by taking BMI < 18.5 kg/m<sup>2</sup> from the previous study as an independent variable since it gave a maximum sample size.<sup>13</sup> The proportion of mothers who had BMI < 18.5 among controls was 6.2%. Accordingly, a minimum detectable OR (odds ratio) of 3.1, a 5% level of precision, a power of 80%, and a 1:2 allocation ratio of POP (cases) to patients without POP

(controls) was assumed. Based on the assumptions, the sample size was determined to be 330. An additional nonresponse rate of 5% was considered, and the final sample size was 348 (116 cases and 232 controls).

### *Sampling procedures and technique*

All referral hospitals, namely, Dessie referral hospital, Debre Birhan referral hospital, Tibebeghion referral hospital, Felegehiwot teaching & referral hospital, Debre Markos referral hospital, and Gondar university teaching and referral hospital were included in the study. The total sample size was proportionally allocated to each referral hospital based on the previous average 2-month gynecologic patient flow for each hospital. Cases were taken consecutively until the calculated sample size was attained, and controls were selected and interviewed by systematic random sampling technique of every six patients after identification of the first patient by lottery method.

### *Outcome variable*

Pelvic organ prolapsed was taken as the outcome variable.

### *Exposure variables*

*Socio-demographic and economic factors.* Age, marital status, occupation, educational status, residence, ethnicity, religion, and monthly income were the socio-demographic and economic factors considered.

*Obstetrics variables.* Age at first marriage, age at first delivery, place of delivery of last pregnancy, mode of delivery of last pregnancy, gravidity, parity, duration of labor, birth weight, instrumental assisted delivery, delivery assisted by non-health professionals, family history of POP, family planning (FP) utilization, antenatal care (ANC) utilization, birth spacing, vaginal tear, and sphincter damage were the obstetrics variables.

*Medical and miscellaneous variables.* Chronic medical illness (diabetes mellitus, hypertension), chronic cough, chronic constipation, carrying a heavy object, BMI, working on the farm (daily), and information on POP were the medical and miscellaneous variables.

### *Operational definitions*

POP is the downward descent of one or more female pelvic organs into or out of the vagina. The pelvic organs consist of the uterus, vagina, bowel, and bladder.<sup>1</sup>

BMI: weight of the mother divided by height square.

Carrying heavy objects: carrying wood and water twice a day and above.

### *Data collection tools and procedures*

A pre-tested structured interviewer-administered questionnaire was used to collect the data which were adapted from relevant literature and modified to the local context in such a way that all the variables to be assessed were included.

The questionnaire was prepared in English and translated to Amharic which is the local language of the study area. Then it was translated back to English by language experts to see its consistency. The questionnaire was reviewed by senior researchers, and feedback was incorporated accordingly. Six midwives and nurses who speak Amharic fluently were recruited as interviewers. Six midwives supervised the data collection process.

A woman who came to the gynecologic clinics in public referral hospitals who met the inclusion criteria was interviewed after being diagnosed and confirmed by the physician. In addition to the interview, the data collectors abstracted clinical data by reviewing the women's medical records. POP was evaluated using a standardized POP-Q system.<sup>19</sup> Stage 0: No prolapse is demonstrated ( $\leq -3$  cm); Stage I: The most distal portion of the prolapse is more than 1 cm above the level of the hymen ( $< -1$  cm); Stage II: The most distal portion of the prolapse is situated between 1 cm above the hymen and 1 cm below the hymen (value between  $-1$  and  $+1$  cm); Stage III: The most distal portion of the prolapse is more than 1 cm beyond the plane of the hymen, but not completely everted meaning no value is  $\geq$  Total vaginal length (TVL)  $-2$  cm (any of the points  $\geq +2$  and  $\leq$  TVL  $-3$  cm), and Stage IV: Complete eversion or eversion to within 2 cm of the total vaginal length of the lower genital tract is demonstrated (any of the points  $\geq$  TVL  $-2$  cm).<sup>19</sup>

### *Data quality control*

The questionnaire was pre-tested on 5% (6 cases and 12 controls) of the sample size at Woldia general hospital which was not included in the main study. Data collectors and supervisors were trained for 3 days concerning the questionnaire, interviewing technique, the purpose of the study, the purpose of maintaining subject's privacy, discipline, and keeping confidentiality. The supervisors conducted day-to-day on-site supervision to make sure the data collection is going smoothly.

### *Statistical analysis*

Data were edited and cleaned for inconsistencies and missing values, and outliers, and analyzed using SPSS 22 statistical software. Descriptive, bivariate, and multivariable logistic regression analysis was executed. Variables showing statistically significant association at the bivariate logistic regression analysis (at  $p < 0.25$ ) were selected and entered into the multivariable logistic regression analysis. Finally, adjusted odds ratio (AOR) and 95% confidence intervals

(CIs) were used to declare statistical significance. A p-value less than 0.05 was used to determine the statistical significance of the tests. The Hosmer and Lemeshow goodness of fit final test was checked for fitness of variables and the value was 0.247. Multicollinearity among the variables was also checked by collinearity statistics (variance inflation factor).

### *Ethical considerations*

Ethical clearance was obtained from the Institutional Review Board (IRB) of Mekelle University, College of Health Sciences. Then, an official letter was written from the research and community service of Mekelle University to the Amhara regional health office. Then permission letters from the health office were processed and written to each respective referral hospital before starting data collection. At the beginning of the data collection, written informed consent was obtained from each respondent after a thorough explanation of the purpose and the procedures of the study. Mothers were also informed that all the data obtained from them were kept confidential and anonymous. Confidentiality of responses was ensured throughout the research process, and the mother had the right to withdraw at any point during data collection.

## **Results**

### *Socio-demographic characteristics of respondents*

A total of 348 participants, 116 gynecologic cases with POP as a case and 232 gynecologic cases without POP as controls, were interviewed with a response rate of 100%. The median age of the respondents was 44.5 (interquartile range (IQR) 16) and 35.0 (IQR 10) years among cases and controls, respectively. The mean age at the first delivery of the respondents was 18.6 (SD  $\pm$  2.2) and 21.5 (SD  $\pm$  2.2) years among cases and controls, respectively. Regarding educational status, 67 (57.8%) of the cases and 36 (15.5%) controls were unable to read and write (Table 1).

### *Obstetrics and gynecologic history of the participants*

Of the total participants, 140 (40.2%) gave their first birth before the age of 20, among these 80 (69.0%) participants were cases and 60 (25.9%) were controls. In all, 102 (87.9%) of cases and 80 (34.9%) of controls gave birth to four or more children. A total of 115 (99.1%) of cases and 199 (86.9%) of controls delivered vaginally, and 14 (12.1%) of cases and 21 (9.2%) of controls were assisted by instruments during their previous birth. Among the total respondents, 25 (21.6%) of cases and 21 (9.1%) of controls had a family history of POP (Table 2).

### *Medical and miscellaneous history of participants*

From the total participants 80 (69.0%), 104 (89.7%) of cases and 231 (99.6%), 232 (100%) of controls had no history of chronic cough and chronic constipation, respectively. Seventy-six (65.5%) of cases and 140 (60.3%) of controls have no information about POP (Table 3).

### *Bivariable and multivariable analysis of factors affecting POP*

First bivariate logistic regression was conducted and then those variables with a p value of less than 0.25 were included in the multivariable logistic regression. Variables such as maternal age, educational status of women, residency, age at first marriage, age at first delivery, number of pregnancy, number of parity, place of previous delivery, duration of labor, delivery attendant, return to work after delivery, FP utilization before last pregnancy, birth spacing, sphincter damage in a previous delivery, family history of POP, carrying heavy objects, work on the farm, and BMI were included in the multivariable analysis model.

Accordingly, maternal age, educational status of women, age at first delivery, number of parity, family history of POP, and carrying heavy objects were found to be independent predictors of POP.

Women age 40 and above among cases were 2.91 times more likely to have POP than their counterparts (AOR = 2.91; 95% CI = 1.255–6.736). The odds of having POP among women unable to read and write were 3.91 times higher than those who were educated secondary school and above (AOR = 3.91; 95% CI = 1.06–14.39) and also first delivery before the age of 20 were 5.7 times more likely to develop POP as compared to those who gave birth after the age of 20 (AOR = 5.72; 95% CI = 1.73–18.94). Women who carry heavy objects were 2.296 times more risk to develop POP as compared to those who did not (AOR = 2.296; 95% CI = 1.102–4.785). Women who have four or more children were 7.02 times more likely to develop POP as compared to those who have less than four children (AOR = 7.02; 95% CI = 1.16–42.45). Women who had a family history of POP were 3.09 times more likely to develop POP as compared to those who had not (AOR = 3.09; 95% CI = 1.24–7.71) (Table 4).

## **Discussion**

Identifying the determinants of POP is critical for many developing countries like Ethiopia, where maternal mortality and fertility remain still high. However, POP is affected by different factors. Thus, this hospital-based case-control study identified determinants of POP among gynecologic patients attending public referral hospitals in the Amhara region, Ethiopia.

**Table 1.** Socio-demographic characteristics of gynecologic women who have attended public referral hospitals in Amhara region, Ethiopia, 2020.

Variables	Case (n = 116)		Control (n = 232)	
	Number	Percentage	Number	Percentage
Maternal age				
<40	23	19.8%	158	68.1%
≥40	93	80.2%	74	31.9%
Occupation				
Housewife	57	49.1%	150	64.7%
Merchant	12	10.3%	32	13.8%
Government employee	2	1.7%	22	9.5%
Farmer	41	35.3%	16	6.9%
Others <sup>a</sup>	4	3.4%	12	5.2%
Household income				
<1000 ETB	85	73.3%	72	31.0%
1000–2000 ETB	28	24.1%	121	52.2%
≥2000 ETB	3	2.65%	39	16.8%
Educational status of the mother				
Can't read and write	67	57.8%	36	15.5%
Can read and write	29	25.0%	43	18.5%
Primary education	8	6.9%	53	22.8%
Secondary and higher	12	10.3%	100	43.1%
Residency				
Urban	31	26.7%	168	72.4%
Rural	85	73.3%	64	27.6%
Religion				
Orthodox	86	74.1%	189	81.5%
Muslim	30	25.9%	41	17.7%
Protestant	0	0%	2	0.9%
Ethnicity				
Amhara	113	97.4%	225	97.0%
Others <sup>b</sup>	3	2.6%	7	3.0%
Marital status of the mother				
Married	90	77.6%	224	96.6%
Single (divorced, widowed)	26	22.4%	8	3.4%
Age at first marriage				
≥20	28	24.1%	144	62.9%
<20	88	75.9%	85	37.1%

<sup>a</sup>Others = student, daily laborer and retirement

<sup>b</sup>Others = Tigraway, Oromo, Afar.

In this study, the odds of having POP were higher among women unable to read and write as compared to those who were educated in secondary school and above. This finding is consistent with pieces of evidence from a study conducted in Tribhuvan University teaching hospital in Nepal and western Nepal, which found that illiterate women were more prone to POP than women who were educated.<sup>15,20</sup> This finding is also similar to a study done in Ethiopia, in Wolayta and Bahrdar.<sup>13,16</sup> This can be because educated women can make decisions and use healthcare services. This might be also educated women may have different ideas on FP services in school, which help to plan the number of pregnancies and parity. Educated women are more likely to be engaged in

occupations that can improve women's health. Therefore, education is expected to prevent POP.

The finding of this study indicated that the age of women ≥40 years old has a higher risk to develop POP as compared to those women who are under 40 years old. This finding is consistent with evidence from studies done in 16 low-income and lower-middle-income countries, such as Nepal, Ghana, and Nigeria.<sup>3,4,20,21</sup> This finding is also similar to studies done in Bahrdar, Tigray region, Wolayta Sodo, Benchi Maji, and Jimma.<sup>5,7,13,16</sup> This might be due to aging can weaken pelvic muscles and ligaments which support pelvic organs, and the risk of vaginal prolapse will increase.<sup>22</sup>

**Table 2.** Obstetrics and gynecologic history of gynecologic women who attended public referral hospitals in Amhara region, Ethiopia, 2020.

Variables	Case (n = 116)		Control (n = 232)	
	Number	Percentage	Number	Percentage
Number of pregnancy				
<4	12	10.3%	138	59.5%
≥4	104	89.7%	94	40.5%
Age at the first delivery				
≥20	36	31.0%	171	74.7%
<20	80	69.0%	58	25.3%
Number of parity				
<4	14	12.1%	149	65.1%
≥4	102	87.9%	80	34.9%
Place of delivery (last birth)				
Health institution	18	15.5%	124	54.1%
Home	98	84.5%	105	45.9%
Mode of delivery (last birth)				
Vaginal birth	115	99.1%	199	86.9%
C/S	1	0.9%	30	13.1%
Instrumental assisted delivery				
Yes	14	12.1%	21	9.2%
No	102	87.9%	208	90.8%
Duration of labor (last birth)				
<8h	40	34.5%	53	23.1%
≥8h	76	65.5%	176	76.9%
Delivery assisted by				
Health professional	17	14.7%	123	53.7%
Non-health professional	99	85.3%	106	46.3%
Return to work after delivery				
<42 days	75	64.7%	89	38.9%
≥42 days	41	35.3%	140	61.1%
ANC utilization during pregnancy				
Yes	44	37.9%	102	44.0%
No	72	62.1%	130	56.0%
FP utilization				
Yes	28	24.1%	142	61.2%
No	88	75.9%	90	38.8%
Birth spacing				
<3 years	37	31.9%	37	16.9%
≥3 years	79	68.1%	182	83.1%
Big baby in the previous childbirth				
Yes	7	6.0%	12	5.2%
No	109	94.0%	217	94.8%
Sphincter damage (in the previous childbirth)				
Yes	22	19.0%	6	2.6%
No	94	81.0%	223	97.4%
Vaginal tear (in the previous birth)				
Yes	28	24.1%	53	23.1%
No	88	75.9%	176	76.9%
Family history of POP				
Yes	25	21.6%	21	9.1%
No	91	78.4%	211	90.9%

ANC: antenatal care; FP: family planning; POP: pelvic organ prolapse.

**Table 3.** Medical and miscellaneous history of gynecologic women who attended public referral hospitals in Amhara region, Ethiopia, 2020.

Variables	Case (n = 116)		Control (n = 232)	
	Number	Percentage (%)	Number	Percentage (%)
Diabetes mellitus				
Yes	5	4.3%	4	1.7%
No	111	95.7%	228	98.3%
Hypertension				
Yes	8	6.9%	11	4.7%
No	108	93.1%	221	95.3%
Chronic cough				
Yes	36	31.0%	1	0.4%
No	80	69.0%	231	99.6%
Chronic constipation				
Yes	12	10.3%	0	0.0%
No	104	89.7%	232	100.0%
Carrying heavy objects				
Yes	72	62.1%	59	25.4%
No	44	37.9%	173	74.6%
Work on the farm (daily)				
Yes	41	35.3%	16	6.9%
No	75	64.7%	216	93.1%
Information on POP				
Yes	40	34.5%	92	39.7%
No	76	65.5%	140	60.3%
BMI				
18.5–24.9 kg/m <sup>2</sup>	70	60.3%	191	82.3%
<18.5 kg/m <sup>2</sup>	41	35.3%	30	12.9%
≥25 kg/m <sup>2</sup>	5	4.3%	11	4.7%

POP: pelvic organ prolapse; BMI: body mass index.

Women having four or more children (parity  $\geq$ four) were more likely to develop POP as compared to those who had less than four children. This result is similar to studies done in Nepal, Nigeria, and Tanzania, and in Ethiopia, in Wolayta, Tigray, and Bahrdar.<sup>13,15,16,21,23,24</sup> This can be because multiparity with increasing maternal age can weaken the pelvic floor muscle and supportive ligaments and risk for developing POP.<sup>1</sup> Although multiple pregnancies were not statistically significant in this study, other studies in Wolayta Sodo and Nepal reported that it has a significant association with POP.<sup>15,16</sup>

Giving birth before the age of 20 (early childbirth) was found to be 5.72 times more risk to develop POP as compared to those who gave birth after the age of 20. This might be related to the high number of parity and pelvic floor muscles and the supportive ligament was not matured and strong to avoid POP.<sup>22</sup> This finding is consistent with a study done in Tribhuvan University teaching hospital in Nepal.<sup>20</sup> However, a study conducted in western Nepal reported a contrary finding to those done in Bahrdar and Wolayta.<sup>13,15,16</sup> This might be due to the fact that this study was done in a large geographical area at a regional level.

The finding of this study indicated that women who have a family history of POP were 3.09 times more likely to develop POP as compared to those who do not have that history. This finding is consistent with other studies done in Ethiopia and Nepal.<sup>13,15,16</sup> This study also found that women who have a history of carrying heavy objects had 2.3 times more risk to develop POP as compared to those who do not have a history of carrying heavy objects. This might be due to the reason that more than half of the respondents among the cases were rural inhabitants and nearly one-third of respondents among cases work daily on the farm, such as those women engaged in farming and carrying heavy objects. This finding is similar to other studies done outside the country in western Nepal, Nigeria, and Tanzania, and Ethiopia, in Wolayta, Tigray, Bahrdar, and Dabat.<sup>13,15,16,21,24,25</sup>

This study was done at the regional level including some variables which were not assessed in the previous study. Even though deep clinical history and physical examination were done to identify women free from POP, there might be a misclassification bias. Since this was an unmatched case-control study, recall bias might also be introduced, and some

**Table 4.** Bivariable and multivariable analysis of determinant factors among gynecologic women who attended public referral hospitals in Amhara region, Ethiopia, 2020.

Variables	Pelvic organ prolapse		COR (95% CI)	AOR (95% CI)	p value
	Cases (n = 116) (%)	Controls (n = 232) (%)			
Educational status of the mother					
Can't read and write	67 (57.8%)	36 (15.5%)	15.5 (7.53, 31.96)	3.91 (1.06, 14.39)*	0.04
Can read and write	29 (25.0%)	43 (18.5%)	5.6 (2.62, 12.04)	2.59 (0.79, 8.52)	0.12
Primary education	8 (6.9%)	53 (22.8%)	1.3 (0.48, 3.27)	0.55 (0.16, 1.97)	0.36
Secondary and higher	12 (10.3%)	100 (43.1%)			
BMI					
18.5–24.9 kg/m <sup>2</sup>	70 (60.3%)	191 (82.3%)			
<18.5 kg/m <sup>2</sup>	41 (35.3%)	30 (12.9%)	3.73 (2.16, 6.43)	2.17 (0.97, 4.87)	0.06
≥25 kg/m <sup>2</sup>	5 (4.3%)	11 (4.7%)	1.24 (0.42, 3.69)	3.2 (0.69, 15.14)	0.14
Residency					
Urban	31 (26.7%)	168 (72.4%)			
Rural	85 (73.3%)	64 (27.6%)	7.2 (4.36, 11.89)	0.66 (0.25, 1.77)	0.41
Place of delivery (last birth)					
Health institution	18 (15.5%)	124 (54.1%)			
Home	98 (84.5%)	105 (45.9%)	6.43 (3.65, 11.32)	0.25 (0.01, 6.55)	0.41
Delivery assisted by					
Health professional	17 (14.7%)	123 (53.7%)			
Non-health professional	99 (85.3%)	106 (46.3%)	6.76 (3.79, 12.03)	3.6 (0.13, 9.84)	0.45
FP utilization					
Yes	28 (24.1%)	142 (61.2%)			
No	88 (75.9%)	90 (38.8%)	4.96 (3.01, 8.18)	1.51 (0.65, 3.53)	0.34
Sphincter damage (previous child birth)					
Yes	22 (19.0%)	6 (2.6%)	8.7 (3.42, 22.14)	1.92 (0.6, 6.11)	0.27
No	94 (81.0%)	223 (97.4%)			
Carrying heavy objects					
Yes	72 (62.1%)	59 (25.4%)	4.8 (2.97, 7.73)	2.3 (1.102, 4.79)*	0.027
No	44 (37.9%)	173 (74.6%)			
Work on the farm (daily)					
Yes	41 (35.3%)	16 (6.9%)	7.4 (3.91, 13.92)	2.4 (0.9, 6.53)	0.08
No	75 (64.7%)	216 (93.1%)			
Age at first marriage					
≥20	28 (24.1%)	144 (62.9%)			
<20	88 (75.9%)	85 (37.1%)	5.32 (3.22, 8.8)	0.27 (0.07, 1.04)	0.06
Maternal age					
<40	23 (19.8%)	158 (68.1%)			
≥40	93 (80.2%)	74 (31.9%)	8.6 (5.06, 14.72)	2.91 (1.255, 6.74)*	0.013
Birth spacing					
<3 years	37 (31.9%)	37 (16.9%)	2.3 (1.36, 3.9)	1.79 (0.766, 4.17)	0.18
≥3 years	79 (68.1%)	182 (83.1%)			
Return to work after delivery					
<42 days	75 (64.7%)	89 (38.9%)	2.89 (1.81, 4.58)	1.49 (0.74, 2.99)	0.27
≥42 days	41 (35.3%)	140 (61.1%)			
Duration of labor (last birth)					
<8 hr	40 (34.5%)	53 (23.1%)	1.75 (1.07, 2.85)	1.03 (0.48, 2.24)	0.93
≥8 hr	76 (65.5%)	176 (76.9%)			
Number of parity					
<4	14 (12.1%)	149 (65.1%)			
≥4	102 (87.9%)	80 (34.9%)	13.6 (7.29, 25.25)	7.02 (1.16, 42.45)*	0.034
Number of pregnancy					
<4	12 (10.3%)	138 (59.5%)			
≥4	104 (89.7%)	94 (40.5%)	12.7 (6.63, 24.43)	0.79 (0.12, 5.23)	0.81
Age at first delivery					
≥20	36 (31.0%)	171 (74.7%)			
<20	80 (69.0%)	58 (25.3%)	6.55 (4.0, 10.73)	5.72 (1.73, 18.94)*	0.004
Family history of POP					
Yes	25 (21.6%)	21 (9.1%)	2.76 (1.47, 5.18)	3.09 (1.24, 7.71)*	0.016
No	91 (78.4%)	211 (90.9%)			

\*Statistically significant at  $p < 0.05$ .



variables such as a big baby in a previous pregnancy and instrumental assisted delivery might need clarification.

## Conclusion

This study concluded that being unable to read and write (illiterate), age of the mother  $\geq 40$ , multiparity ( $\geq 4$  number of parity), family history of POP, giving first birth before the age of 20 (early childbirth), and carrying heavy objects are the risk factors of POP. Women who had a history of carrying heavy loads and having a family history of POP can be exposed to develop organ prolapse. Providing health education on planning of the number of children, and the impact of carrying heavy loads on pelvic organs, preventing early childbirth, and encouraging women to pursue their education at least up to primary school level is recommended.

## Acknowledgements

The authors forward their acknowledgment to Amhara Region health bureau for their cooperation during data collection. They also thank the data collectors, supervisors, and study participants for their contribution for the successful accomplishment of this study.

## Author contributions

N.S.: Conceived and designed the study, supervised the data collection, performed the analysis, interpretation of data, and drafted the article. D.H.: Assisted in designing the study, data interpretation, and critically reviewed the article. T.K.: Assisted in designing the study, data interpretation, and reviewed the article critically. E.A.: Data interpretation and reviewed the article critically. All the authors have read and approved the final article.

## Availability of data and materials

The datasets analyzed during the current study are not publicly available. But the datasets are available from the corresponding author on reasonable request.

## Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Ethical approval

The study was approved by the Institutional Review Board (IRB) of Mekelle University, and has received ethical approval on 20 February 2020 G.C. with Approved ID number, ERC 1538/2020.

## Funding


The author(s) received no financial support for the research, authorship, and/or publication of this article.

## Informed consent

Permission letters from the health office were processed and written to each respective referral hospital before starting data collection. Written informed consent was obtained from each respondent after a thorough explanation of the purpose and the procedures of the study. Confidentiality of responses was ensured throughout the research process.

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## Supplemental material

Supplemental material for this article is available online.

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