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Multilevel analysis of individual and community factors of awareness of obstetric fistula among women of childbearing-age Nepal: analysis of recent Nepal Demographic and Health Survey data 2022.

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Abstract

Background: World Health Organization define, obstetric fistula (OBF) is described as an unusual hole in a woman's vagina and bladder and/or rectum through which her urine and/or feces continually leak. Globally, 50,000 and 100,000 cases of OBF are reported each year. The core of activities focused on reducing fistulas depends on a review of the disorder's knowledge and the features of women at risk of having a lack of understanding. The effect of community-level factors on awareness of obstetric fistula was not yet known in Nepal. Therefore, we aimed to investigate the community- and individual-level factors of awareness of obstetric fistula among childbearing-age women in Nepal.

Methods: The 2022 Nepal Demographic and Health Survey data was used for this study. It included 14,845 childbearing-age women. Because of the clustering effects of DHS data and the binary nature of the outcome variable, a multilevel binary logistic regression model was applied. An adjusted odds ratio with a 95% confidence interval was reported to declare the statistical significance. In addition, the model that had the lowest deviance was the one that best fit the data.

Results: The overall prevalence of awareness of obstetric fistula among childbearing -women in Nepal was 35.9%. Women's age, educational status, working status, birth history, and media exposure significant individual factors while place of residence, and community-level media exposure were found to be statistically significant factors from community-level factors of awareness of OBF among Nepal childbearing-age women.

Conclusion: our study relieved awareness of OBF among childbearing-age women in Nepal was low. The findings of this study will assist policy-makers and public health programmers in understanding the magnitude of OBF awareness and the contributory factors. In addition, it will be useful to increasing awareness of OBF in the communities, and promoting primary prevention approaches through education and motivation efforts.

Keywords: Awareness of obstetric fistula, childbearing age women, Demographic and Health Survey, Nepal, Multilevel analysis.

Strengths and limitations of the study

- ✓ One of the study's advantages was that it used data from a large nationwide survey, which gave it sufficient power to identify the real impact of the independent factors.
- ✓ Secondly, to obtain accurate estimates and standard errors, the sample weight was applied during the analysis. Furthermore, by examining the awareness of OBF the household, and community levels, we were able to investigate hierarchical or clustered patterns that might have an impact on results.
- ✓ One weakness of the study is that it was cross-sectional; therefore, it was not possible to establish a causal relationship between the identified independent variables and awareness of OBF.
- ✓ Because it depends on self-reported data, the DHS is vulnerable to recall bias

Introduction

World Health Organization (WHO) define obstetric fistula(OBF) is described as an unusual hole in a woman's vagina and bladder and/or rectum through which her urine and/or feces continually leak [1]. It is caused by labor that is complicated or delayed along with not having access to rapid and high-quality medical care. Not only does it cause women and girls to leak fluids (pee or feces), but it also often results in long-term medical problems, despondency, loneliness, and suffering [2]. Women have problems during pregnancy and deliveries, which might result in the mother or infant dying [3]. The WHO has established preventative measures for obstetric fistula awareness used to reduce it. These strategies involve facilitating early utilization of obstetric care, postponing the age of the mother's first childbearing, and doing away with damaging customs like female genital mutilation [4].

OBF in low-and middle-income countries are usually caused by protracted, obstructed labor without quick access to high-quality medical care [5]. Numerous misconceptions exist regarding obstetric fistula in low- and middle-income countries the majority of fertile women believed that the disease was caused by punishment by God and that unfortunate events, evil spirits, or socially unacceptable actions by women could also cause it [6-8]. While OBF can occur in both high-income and low-income countries the majority of the burden of obstetric fistula is low- and middle-income countries [9]. Disastrous impact on the health and well-being of the impacted

women on an interpersonal, financial, and emotional level [10, 11] Fistula-related shame, profound sense of loss, and diminished sense of identity and dignity have a detrimental effect on quality of life [11, 12].

One of the most severe and disastrous birth injuries is an obstetric fistula. It is distinguished by a hole that occasionally includes the rectum and is located between the birth canal and the bladder. Approximately 2 million women with untreated obstetrical fistulas reside in poor nations [13, 14]. Research indicates that between 50,000 and 100,000 cases of OBF are reported globally each year [15]. A systematic review and meta-analysis on awareness of obstetric fistula among women revealed that 41.24% were aware of the condition [16]. OBF awareness ranged from 12.8% to 63.9% in Uganda, with an average prevalence of 37.9% [11]. Among the women, 53% have heard of OBF at some point and 34.6% got awareness about the condition from different sources [17]. The prevalence of OBF among pregnant mothers in Nepal was 57.8% [3].

Despite these moderating variables, the primary cause of women's refusal to seek fistula care is their general awareness of how to avoid and take care of obstetric fistulas. Many young girls still silently suffer the pain of obstetric fistula as a result of early marriage, low socioeconomic standing, and inadequate access to medical services [18]. Numerous factors associated with obstetric fistula incorporated: marital status, religion, age, educational status, family wealth index, internet access, birth history, pregnancy termination, sexual activity, current working status, media exposure, and current pregnancy status [9, 16, 18].

Raising awareness of OBF could result in more funding for treatment and avoidance from organizations and encourage more partnerships with other stakeholders[19]. The creation of national outreach efforts for OBF and the core of activities focused on reducing fistulas depend on a review of the disorder's knowledge and the features of women at risk of having a lack of understanding. Despite the high burden of obstetric fistula in reproductive-age women, no national representative studies were conducted particularly in Nepal. Therefore, this study aimed to determine the prevalence and factors associated with the awareness of obstetric fistula among women of reproductive age in Nepal at the individual and community levels using recent national representative data or NDHS.

Methods

Data source, population, and sampling procedure

We used the recent Nepal Demographic and Health Survey(NDHS) (2022) data after a reasonable request from the Measure DHS program[20]available at (https://dhsprogram.com/Data/terms-of-use.cfm). The DHS is conducted every five years to generate updated health and health-related indicators. The data were derived from the measure DHS program and detailed information about the surveys can be found in each country's DHS reports. A multistage stratified sampling technique was employed to select the study subjects. In the first stage, Enumeration Areas (EAs) were randomly selected, whereas in the second stage, households were selected. There are different datasets in DHS, and for this study, we used the Individual Record (IR) file. The dependent and independent variables were extracted from the IR dataset, based on the literature. The final weighted sample size was 14,845.

Study variables

The outcome variable of this study was women's awareness of obstetric fistula. The variable was dichotomized into 1 = 'ever heard of fistula' and 0 = 'never heard of fistula'[7, 9].

The independent variables were further classified into individual level (level 1) variables and community level (level 2) variables. Individual-level variables included age, marital status, religion, educational status, sex of household head, media exposure, internet use, wealth index, sexual experience, birth history, pregnancy termination, current working status, and current pregnancy status. Whereas, community variables involved variables directly taken with no aggregation (residence and contextual region), and variables obtained by aggregating individual values into their respected community (community poverty, community female education, and community media exposure). Since the aggregate values of each variable did not follow a normal distribution curve, we categorized the aggregate values of a cluster into groups based on median values.

Statistical analyses

Descriptive analysis was performed using frequency and percentage distributions to examine the characteristics of respondents. This was followed by bivariate multilevel logistic regression to select variables that had a significant association with awareness of OBF at a p-value less than

0.25. A multicollinearity test was performed using variance inflation factor (VIF) for all statistically significant variables at the bivariate multilevel logistic regression. We developed four different models using the multilevel logistic regression (MLLR) methodology to see whether the community-level and individual/household attributes had any significant connections with the outcome variable (awareness of OBF). The initial model, known as Model I, was a null model empty of any explanatory variables and it represented variation in the awareness of OBF. The second model (model II) comprised individual/household-level factors and the third model (Model III) comprised community-level factors. The last model, (Model IV), was the complete model that included factors at both the individual/household and community levels.

All four MLLR models included fixed and random effects[21, 22]. The random effects revealed the degree of variation in the outcome variable dependent on PSU, which was assessed by Intra-Cluster Correlation (ICC), while the fixed-effect model demonstrated the relationship between the explanatory variables and the outcome variable[23]. The model ft. was assessed using the Akaike's Information Criterion (AIC)[24]. When individuals are randomly selected from two clusters (EAs), the median value of the odds ratio between the cluster with a high likelihood of awareness of OBF and the cluster at lower risk is used to quantify the variation or heterogeneity in awareness of OBF between clusters in terms of the odds ratio scale.

MOR = exp $\sqrt{(2 * \partial^2 * 0.6745)}$~ MOR = exp $(0.95*\partial)$[25] . ∂^2 indicates that cluster variance

We used "melogit" command to run the MLLR models. The analyses were performed using Stata version-14 software (Stata Corp, College Station, Texas, USA). We also followed the guidelines for Strengthening Observational studies in Epidemiology (STROBE)[26]

Result

Background characteristics of respondents

A total of 14,845 reproductive-age women were included in this study. Above two-thirds of (34.17%), women were found in the age groups of 20–29 years followed by the age groups of 30–39 years 4169(28.1%); and most of the women (39.1%) had attained secondary education.

More than half of women (54.02%) lived in urban areas, and the majority of women (78.88%) had media exposure. **(Table 1)**

Awareness of obstetric fistula

The overall awareness of OBF among women of childbearing age in Nepal was 35.9% (95% CI 35.1% to 36.7%).

Factors associated with awareness of OBF among childbearing age women in Nepal

In the multivariable mixed effect binary logistic regression model, a woman's age, women education status, current working, birth history, and media exposure significant individual factors while place of residence, and community-level media exposure were found to be statistically significant factors from community-level factors of awareness of OBF among Nepal childbearing age women. **(Table 2).**

In this finding showed that women between 30 to 39 years old (AOR = 3.38, 95% CI = 1.35-8.93) and between 40 to 49 years old (AOR = 4.68, 95% CI =1.60-13.67) were more likely to aware about OBF than those who were younger age group. The odds of awareness of OBF were higher among women who attended secondary (AOR = 1.65; 95% CI: 1.41, 3.03) and higher (AOR = 4.29; 95% CI: 1.14, 36.70) compared to those with primary level or less. Women who have currently worked were 1.85 times more aware of OBF than women who are not currently working. The odds of awareness of OBF were increased by 2.23 times among women who had a birth history than their counterparts. Women who had media exposure was1.54 times more likely to have awareness of OBF than women who had no media exposure [(AOR=1.54; 95% CI=1.07, 3.09)] **(Table 2).** Regarding community-level factors, we found the awareness of OBF among urban resident women was 1.99 times (AOR= 1.99, 95% CI=1.53, 2.87) higher than women who reside in rural. Higher odds of awareness of OBF among women from high community-level media exposure (AOR=2.05, 95% CI= 1.67, 2.64) compared to those from low community-level media exposure. **(Table 2)**

Random effects (measures of variations) results

The random effect models of the individual/household and community level factors associated with awareness of OBF are shown in **Table 3**. We observed that the values of the AIC and

Deviance decreased across the models, indicating the best-fitted model was chosen based on the lowest deviance value (562.0504) and AIC (616.0504). The ICC in the null model was 16.0%, indicating that 13.6% of the overall variability for awareness of OBF was related to variations between clusters/EA. In addition, the MOR for awareness of OBF in the null model was 2.54, indicating that there was variability between clusters. If we randomly selected an individual from two different clusters, those in the cluster with a high awareness of OBF had 2.54 times the odds of having awareness of OBF compared to those in the cluster with a lower awareness of obstetric fistula. These estimates showed that the variations in the likelihood of awareness of OBF can be attributed to the variances in the clustering at the primary sampling units **(Table 3)**.

Discussion

OBF is a problem that is frequently disregarded in terms of human rights and public health. This study aims to reveal the prevalence and associated factors of OBF among reproductive-age women in Nepal. The overall prevalence of OBF among reproductive-age women was 35.9% (95% CI 35.1% to 36.7%). This finding is in line with other studies conducted in Burkina Faso 36%[27].

The finding of this study is lower than other studies conducted in Ethiopia 40.8% and 38% [9, 28], Nigeria 57.8% [3], and Sab-Saharan Africa 40.85%[6]. The probable reason of the association is there might be lower number of modern health care system and low educational status in Ethiopia [9, 28]. The other reason for the difference might be the effect of population and culture differences that might led to the difference in awareness of OBF [6]. In other words, this finding is higher than other studies conducted in Gambia 12.9% [29], The reason for this discrepancy might be the effect of the difference in the population that women who have OBF may not know about potential treatment choices, which could cause them to live with the problem untreated at residence [29].

Regards to factors, higher age was one of the factors associated with awareness of obstetric fistula. This finding is concordance with other studies conducted in Gambia [29]. The possible reason for the association might be the effect of the basic idea that a woman will have greater exposure to giving birth and dealing with the challenges that come with it as she grows older [29]. The other probable reason for this association could be the impact of the high education and

changing unhealthy habits a formal education enables women to make better healthcare decisions.

A higher level of education is also another factor associated with awareness of obstetric fistula. This finding in line with other studies conducted in Sub-Sharan Africa [7]. This is because of formal education gives women the authority to choose their healthcare providers, like by going to maternal health education forums and obtaining obstetric counseling which raises their awareness of OBF [7]. Furthermore, compared to younger women older women are more likely to have completed higher education. Women who have more knowledge are more likely to use and have access to healthcare information [8].

Mass media exposure is one of the factors associated with awareness on obstetric in Nigeria [30] Ethiopia[9], and Sub-Sharan Africa [7], likewise, it is associated with our study. The possible reason for this association might be the fact that the mass media plays a significant role in the distribution of information regarding OBF and treatment availability [30]. This is because media is the essential function in transferring knowledge including details about obstetric fistula, symptoms, and treatment modality [9]. The finding is most likely attributable to the media's crucial role in spreading information, including details about obstetric fistula, its symptoms, and where to get treatment [30]. The other factor significantly associated with OBF awareness was birth history. This finding is concordance with other studies conducted in Ethiopia [28]. The possible reason for this association might be the effect of would be that more expertise with obstetrics and parenting correlates with increased parity [28]. Every delivery enhances women's knowledge by providing them with information concerning obstetric complications, including OBF [7]. Additionally, women who were single or living together had lower OBF knowledge rates than married women.

The other factor associated with OBF awareness was urban residence. This finding is in line with other studies conducted in Gambia [29] and Burkina Faso [27]. The probable reason for the association differs from several related studies which suggest that public knowledge is higher in urban residence [29]. However, women in rural areas might not have as much access to or experience to mass media, which could further limit their level of understanding and knowledge of medical issues [31]. The other possible reason for this association might be due to the effect of the urban participant's exposure to mass media and other information about the awareness of

obstetric fistula. Having occupations is another factor that was associated with OBF awareness. This association is similar with other studies conducted in Ethiopia [28]. This is because one of the well-known venues where medical professionals offer health education regarding maternal health is the pregnant women's discussion forum [28].

Strengths and limitations of the study

One of the study's advantages was that it used data from a large nationwide survey, which gave it sufficient power to identify the real impact of the independent factors. Secondly, to obtain accurate estimates and standard errors, the sample weight was applied during the analysis. Furthermore, by examining the awareness of OBF at the household, and community levels, we were able to investigate hierarchical or clustered patterns that might have an impact on results. One weakness of the study is that it was cross-sectional; therefore, it was not possible to establish a causal relationship between the identified independent variables and the awareness of OBF. Because it depends on self-reported data, the DHS is vulnerable to recall bias.

Conclusion

In this study, overall awareness of OBF among childbearing age women in Nepal was 35.9%. Women's age, educational status, working status, birth history, and media exposure were significantly associated at the individual level; and also media exposure and residence were found statistically significant associated factors from community-level factors with awareness of OBF among Nepal childbearing-age women. The findings of this study will assist policy-makers and public health programmers in understanding the magnitude of OBF awareness and the contributory factors. In addition, it will be useful to increasing awareness of OBF in the communities, and promoting primary prevention strategies through education and motivation efforts.

Authors' contribution:

BMF conceived the idea. HAA, ZAA, AAA, YMN, BLS, and MM participated in the analysis process. BMF wrote the first draft of the manuscript. Writing review and editing was done by HAA, ZAA, AAA, YMN, BLS and MM. All authors have read and agreed to the final version of the manuscript.

Competing interests

All authors declare that they have no competing interests.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication

Not applicable

Ethics approval and consent to participate

All methods were performed according to the relevant guidelines and regulations. This study did not require ethical approval or participant consent because it was a secondary data analysis of publicly available survey data from the MEASURE DHS program. We have obtained permission to download and use the data from http://www.dhsprogram.com for this study. There are no names or addresses of individuals or households recorded in the datasets.

Availability of data and materials

Permission to get access to the data was obtained from the measure DHS program online request from http://www.dhsprogramcom.website and the data used were publicly available with no personal identifier

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Table 1: Distribution of the study population by socio-demographic and reproductive related characteristics (n = 14,845)

Variables	Category	Weighted frequency	Percent (%)
Age	15-19	2643	17.80
	20-29	5072	34.17
	30-39	4169	28.09
	40-49	2961	19.94
Educational level	No education	3796	25.57
	Primary	4595	30.95
	Secondary	5798	39.06
	Higher	656	4.42
Residence	Urban	8,019	54.02
	Rural	6,826	45.98
Religion	Hindu	12374	83.36
	Buddhist	970	6.54
	Muslim	682	4.60
	Others	818	5.51
Marital status	Unmarried	3203	21.58
	Married	11641	78.42
Wealth index	Poorest	2628	17.70
	Poorer	2857	19.25
	Middle	3028	20.40

	Richer	3197	21.53
	Richest	3135	21.12
Currently working	No	6007	40.46
	Yes	8838	59.54
Sexual experience	Never had sex	3129	21.08
	Had sex	11716	78.92
Birth history	No	4252	28.65
	Yes	10592	71.35
Ever had a terminated pregnancy	No	12007	80.88
	Yes	2838	19.12
Media exposure	No	3135	21.12
	Yes	11710	78.88
Use internet	No	5672	38.21
	Yes	9172	61.79
Distance to health facility	Big problem	5520	37.18
	Not a big problem	9325	62.82
Covered by health insurance	No	13070	88.04
	Yes	1775	11.96
Community female education	Low	7618	51.53
	High	7165	48.47
Community media exposure	Low	7180	48.57
	High	7603	51.43
Community poverty	Low	7504	50.76
	High	7279	49.24
	urban	8,019	54.02
	rural	6,826	45.98

Table 2: Multilevel analysis of factors associated with high-risk fertility behavior among women of childbearing age in Nepal, 2022(N= 14,845)

Variables	**Mode I**	**Model II**	**Model III**	**Model IV**
Age				
15-19		Ref		Ref
20-29		1.38(1.20, 1.58)		2.19(0.94, 5.09)
30-39		1.70(1.44, 2.00)		**3.48(1.35, 8.93)**
40-49		2.17(1.81, 2.60)		**4.68(1.60, 13.67)**
Religion				
Hindu				
Buddhist		0.89(0.74, 1.06)		0.90(0.44, 1.81)

Muslim	0.98(0.74, 1.30)	1
Others	0.99(0.83, 1.17)	1.36(0.81, 2.26)
Education		
No education	Ref	Ref
Primary	1.35(1.21, 1.52)	0.93(0.46, 1.85)
Secondary	2.20 (1.92, 2.51)	**1.65(1.41, 3.03)**
Higher	3.03(2.38, 3.86)	**4.29(1.14, 36.70)**
Wealth status		
Poorest	Ref	Ref
Poorer	1.02(0.90, 1.16)	1.03(0.64, 1.68)
Middle	0.96(0.83, 1.10)	0.81(0.30, 2.11)
Richer	1.14(0.98, 1.33)	1.67(0.21, 13.23)
Richest	1.34(1.12, 1.60)	1()
Marital status		
Unmarried	Ref	Ref
Married	0.94(0.57, 1.55)	0.57(0.03, 9.35)
Currently working		
No	Ref	Ref
Yes	1.18(1.09, 1.29)	**1.85(1.04, 3.30)**
Sex of household head		
Male	Ref	Ref
Female	1.01(0.93, 1.09)	0.74(0.45, 1.22)
Ever had a terminated pregnancy		
No	Ref	Ref
Yes	1.16(1.05, 1.28)	1.08(0.57, 2.03)
Birth history		
No	Ref	Ref
Yes	1.13(0.96, 1.33)	**2.23(1.48, 4.10)**
Sexual experience		
Never had sex	Ref	Ref
Had sex	1.08(0.65, 1.77)	1.61(0.10, 24.98)
Media exposure		
No	Ref	Ref
Yes	1.41(1.27, 1.57)	**1.54(1.07, 3.09)**
Use internet		
No	Ref	Ref
Yes	1.29(1.18, 1.42)	1.56(0.94, 2.58)
Covered by health insurance		
No	Ref	Ref
Yes	1.28(1.13, 1.46)	1.67(0.65, 4.29)
Distance to health facility		
Big problem	Ref	Ref
Not a big problem	1.05(0.96, 1.14)	1.35(0.84, 3.15)

Residence		
Rural	Ref	Ref
Urban	1.01(0.57, 1.79)	**1.53(1.99, 2.87)**
Community female education		
Low		
High	0.91(0.59, 1.40)	1.02(0.64, 1.61)
Community media exposure		
Low		
High	1.00(0.66, 1.52)	**2.05(1.67, 2.64)**
Community poverty		
High	Ref	Ref
Low	0.96(0.64, 1.42)	1.01(0.66, 1.54)

Bold=p-value < 0.05; Ref= Reference

Table 3: Random effect results for awareness of OBF and its individual and community level factors: evidence from NDHS (N= 14,845)

Random effects	**MI**	**MII**	**MIII**	**MIV**
Log-likelihood	-9054.5333	-8738.2152	-302.06669	-281.0252
ICC (95%CI)	16.0(13.7, 18.4)			
AIC	18113.07	17526.43	616.1334	616.0504
BIC	18128.27	17716.46	641.1133	728.346
Deviance	18109.067	17476.43	604.13338	562.0504
MOR (95%CI)	2.54(1.17, 3.86)			

AIC: Akaike information criterion; BIC: Bayesian information criterion

ICC: Intra-class correlation coefficient; MOR: Median odds ratio

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Multilevel analysis of individual and community factors of awareness of obstetric fistula among women of childbearing-age Nepal: analysis of recent Nepal Demographic and Health Survey data 2022.

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Multilevel analysis of individual and community factors of awareness of obstetric fistula among women of childbearing-age Nepal: analysis of recent Nepal Demographic and Health Survey data 2022.

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Abstract

Background: According to the World Health Organization, Obstetric Fistula (OBF) is an abnormal connection between the genital tract and the urinary tract that occurs as the result of obstetric trauma, typically from prolonged obstructed labor. In 2018globally, 50,000 and 100,000 cases of OBF are reported each year. The core of activities focused on reducing fistulas depends on a review of the disorder's knowledge and the features of women at risk of having a lack of understanding. The effect of community-level factors on awareness of obstetric fistula was not yet known in Nepal. Therefore, we aimed to investigate the community- and individual-level factors of awareness of obstetric fistula among childbearing-age women in Nepal.

Methods: The 2022 Nepal Demographic and Health Survey data was used for this study. It included 14,845 childbearing-age women. Because of the clustering effects of DHS data and the binary nature of the outcome variable, a multilevel binary logistic regression model was applied. An adjusted odds ratio with a 95% confidence interval was reported to declare the statistical significance. In addition, the model that had the lowest deviance was the one that best fit the data.

Results: The overall prevalence of awareness of obstetric fistula among childbearing -women in Nepal was 35.9% (95% CI: 35.1%, 36.7%). Educational status(women who attended secondary [AOR = 1.65; 95% CI: (1.41, 3.03)] and higher [AOR = 4.29; 95% CI: (1.14, 36.70)], currently working status [AOR=1.85; 95% CI (1.04, 3.30)], had a birth history [AOR=2.23; 95% CI (1.48, 4.10)], had media exposure [(AOR=1.54; 95% CI:(1.07, 3.09)] and women's age from 30 to 39 and 40 to 49 years old [AOR = 3.38: 95% CI; (1.35,8.93)] and [AOR = 4.68: 95% CI (1.60, 13.67)] respectively at the individual level; and urban residence [AOR =1.53: 95% CI;(1.99, 2.87)], and high community-level media exposure [AOR= 2.05; 95% CI (1.67, 2.64)] at community level were statistically significant factors with awareness of OBF.

Conclusion: our study revealed that awareness of OBF among childbearing-age women in Nepal was low (35.9%). The findings of this study will assist policy-makers and public health programmers in understanding the magnitude of OBF awareness and the contributory factors. In addition, it will be useful to increasing awareness of OBF in the communities, and promoting primary prevention approaches through education and motivation efforts.

Keywords: Awareness of obstetric fistula, childbearing age women, Demographic and Health Survey, Nepal, Multilevel analysis.

Strengths and limitations of the study

- ✓ A large nationwide survey data was used which gave it sufficient power to identify the real impact of the independent factors.
- ✓ Secondly, to obtain accurate estimates and standard errors, the sample weight was applied during the analysis.
- ✓ One weakness of the study is the cross-sectional nature of the study which is difficult to determine the temporal relationship.
- ✓ Because it depends on self-reported data, which is vulnerable to recall bias and sensitive to report.

Introduction

World Health Organization (WHO) defines obstetric fistula as an abnormal connection between the genital tract and the urinary tract (urogenital fistula) or the gastrointestinal tract (most commonly, rectovaginal fistula) that occurs as the result of obstetric trauma, typically from prolonged obstructed labor [1]. It is caused by labor that is complicated or delayed along with not having access to rapid and high-quality medical care. Not only does it cause women and girls to leak fluids (pee or feces), but it also often results in long-term medical problems, despondency, loneliness, and suffering [2]. Women have problems during pregnancy and deliveries, which might result in the mother or infant dying [3]. The WHO has established preventative measures for obstetric fistula awareness to reduce it. These strategies involve facilitating early utilization of obstetric care, postponing the age of the mother's first childbearing, and doing away with damaging customs like female genital mutilation [4].

OBF in low-middle-income countries is usually caused by protracted, obstructed labor without quick access to high-quality medical care [5]. Numerous misconceptions exist regarding obstetric fistula in low- and middle-income countries the majority of fertile women believed that the disease was caused by punishment by God and that unfortunate events, evil spirits, or socially unacceptable actions by women could also cause it [6-8]. While OBF can occur in both high-income and low-income countries but the majority of the burden of obstetric fistula occurs in

low- and middle-income countries [9]. Disastrous impact on the health and well-being of the impacted women on an interpersonal, financial, and emotional level [10, 11] Fistula-related shame, profound sense of loss, and diminished sense of identity and dignity have a detrimental effect on quality of life [11, 12]. OBF is one of the most severe and disastrous birth injuries and approximately 2 million women with untreated obstetrical fistulas in developing countries [13, 14].

According to a WHO report in 2018, globally each year between 50,000 and 100,000 cases of OBF were reported [15]. A systematic review and meta-analysis on awareness of obstetric fistula among women revealed that 41.24% were aware of the condition [16]. OBF awareness ranged from 12.8% to 63.9% in Uganda, with an average prevalence of 37.9% [11]. Among the women, 53% have heard of OBF at some point and 34.6% got awareness about the condition from different sources [17]. The prevalence of OBF among pregnant mothers in Nepal was 57.8% [3]. Despite these moderating variables, the primary cause of women's refusal to seek fistula care is their general awareness of how to avoid and take care of obstetric fistulas. Many young girls still silently suffer the pain of obstetric fistula as a result of early marriage, low socioeconomic standing, and inadequate access to medical services [18]. Numerous factors associated with obstetric fistula incorporated: marital status, religion, age, educational status, family wealth index, internet access, birth history, pregnancy termination, sexual activity, current working status, media exposure, and current pregnancy status [9, 16, 18].

Raising awareness of OBF could result in more funding for treatment and avoidance from organizations and encourage more partnerships with other stakeholders [19]. The creation of national outreach efforts for OBF and the core of activities focused on reducing fistulas depends on a review of the disorder's knowledge and the features of women at risk of having a lack of understanding. Women, who are not aware of obstetric fistula might not seek treatment and they can develop further complications, and the absence of awareness even affects the healing process due to not care themselves. To the best of our search, there is no study conducted in Nepal about awareness of obstetric fistula among childbearing women. Despite the high burden of obstetric fistula in reproductive-age women, no nationally representative studies were conducted particularly in Nepal. Therefore, this study aimed to determine the prevalence and factors

associated with the awareness of obstetric fistula among women of reproductive age in Nepal at the individual and community levels using recent national representative data or NDHS.

Methods

Data source, population, and sampling procedure

We used the recent Nepal Demographic and Health Survey (NDHS) (2022) data after a reasonable request from the Measure DHS program available at the link (https://dhsprogram.com/Data/terms-of-use.cfm) [20]. The DHS is conducted every five years to generate updated health and health-related indicators. The 2022 DHS data of Nepal included a total of 14 sampling strata with proportional allocations. Initially, 476 primary sampling units (PSUs) (248 from urban and 228 from rural) were selected with probability proportional to PSU size and with independent selection in each sampling stratum within the sample allocation. Secondly, thirty households were selected from each cluster, for a total sample size of 14,280 households (7,440 from urban and 6,840 from rural). All women aged 15–49 who were permanent residents of the selected households or were visitors who stayed in the households the night before the survey were eligible to be interviewed. In half of the households (every second household) selected, all men aged 15–49 who were residents of the selected households or visitors who stayed in the household the night before the survey were eligible to be interviewed. The data were derived from the measure DHS program and detailed information about the surveys can be found in each country's DHS reports. A multistage stratified sampling technique was employed to select the study subjects. In the first stage, 476 Enumeration Areas (EAs) were randomly selected, whereas in the second stage, households were selected. There are different datasets in DHS, and for this study, we used the Individual Record (IR) file. The dependent and independent variables were extracted from the IR dataset, based on the literature. The final weighted sample size was 14,845.

Study variables

Outcome variable

The outcome variable of this study was women's awareness of obstetric fistula. The variable was dichotomized into 1 = 'ever heard of fistula' and 0 = 'never heard of fistula'[7, 9].

Independent variables

The independent variables were further classified into individual-level (level 1) variables and community-level (level 2) variables.

Individual-level variables

Individual-level variables included age(15-19, 20-29, 30-39, 40-49), marital status(Unmarried, married), religion(Hindu, Buddhist, Muslim, Others), educational status(no, primary, secondary, higher), sex of household head (male, female), media exposure(no, yes), internet use(no, yes), wealth index(poorest, poorer, middle, richer, and richest), sexual experience(never had sex, had sex), birth history(yes, no), pregnancy termination(yes, no), current working status(yes, no), and current pregnancy status(yes, no).

Community variables

Community variables involved variables directly taken with no aggregation (residence), and variables obtained by aggregating individual values into their respected community (community poverty (low, high), community female education (low, high), and community media exposure (low, high). Since the aggregate values of each variable did not follow a normal distribution curve, we categorized the aggregate values of a cluster into groups based on median values.

Statistical analyses

STATA version 16 statistical software was used for data management and analysis. Descriptive analysis was performed using frequency and percentage distributions to examine the characteristics of respondents. A multicollinearity test was performed using variance inflation factor (VIF) for all individual- and community-level variables which were greater than 10. Missing data were handled by imputation, for categorical variables imputed by mode (highest frequency) whereas, for continuous variables imputed by mean or median after checking the normality of the data. Model fitness was checked using the Hosmer-Lemeshow test with a value of 0.78 which shows the model is fitted.

We developed four different models using the multilevel logistic regression (MLLR) methodology to see whether the community-level and individual/household attributes had any significant connections with the outcome variable (awareness of OBF). The initial model, known as Model I, was a null model empty of any explanatory variables and it represented variation in

the awareness of OBF. The second model (model II) comprised individual/household-level factors and the third model (Model III) comprised community-level factors. The last model, (Model IV), was the complete model that included factors at both the individual/household and community levels. Finally, in Model IV variables were considered statistically significant association with awareness of OBF when p-values were less than 0.05 with the 95% confidence intervals and Adjusted Odds Ratio (AOR).

All four MLLR models included fixed and random effects [21, 22]. The random effects revealed the degree of variation in the outcome variable dependent on PSU, which was assessed by Intra-Cluster Correlation (ICC), while the fixed-effect model demonstrated the relationship between the explanatory variables and the outcome variable [23]. The model ft. was assessed using the Akaike's Information Criterion (AIC) [24]. When individuals are randomly selected from two clusters (EAs), the median value of the odds ratio between the cluster with a high likelihood of awareness of OBF and the cluster at lower risk is used to quantify the variation or heterogeneity in awareness of OBF between clusters in terms of the odds ratio scale.

MOR = exp $\sqrt{(2 * \partial^2 * 0.6745)}$~ MOR = exp $(0.95*\partial)$ [25] ∂^2 indicates that cluster variance. We used "melogit" command to run the MLLR models. The analyses were performed using Stata version-14 software (Stata Corp, College Station, Texas, USA). We also followed the guidelines for Strengthening Observational Studies in Epidemiology (STROBE) [26].

Result

Background characteristics of respondents

A total of 14,845 reproductive-age women were included in this study. Above two-thirds of (34.17%), women were found in the age groups of 20–29 years followed by the age groups of 30–39 years 4169(28.1%); and most of the women (39.1%) had attained secondary education. More than half of women (54.02%) lived in urban areas, and the majority of women (78.88%) had media exposure **(Table 1).**

Awareness of obstetric fistula

The overall awareness of OBF among women of childbearing age in Nepal was 35.9% (95% CI 35.1% to 36.7%).

Factors associated with awareness of OBF among childbearing-age women in Nepal

In the multivariable mixed effect binary logistic regression model, a woman's age, women education status, current working, birth history, and media exposure significant individual factors while place of residence, and community-level media exposure were found to be statistically significant factors from community-level factors of awareness of OBF among Nepal childbearing age women. **(Table 2).**

This finding showed that women between 30 to 39 years old (AOR = 3.38, 95% CI = 1.35-8.93) and between 40 to 49 years old (AOR = 4.68, 95% CI =1.60-13.67) were more likely to be aware of OBF than those who were younger age group. The odds of awareness of OBF were higher among women who attended secondary (AOR = 1.65; 95% CI: 1.41, 3.03) and higher (AOR = 4.29; 95% CI: 1.14, 36.70) compared to those with primary level or less. Women who have currently worked were 1.85 times more aware of OBF than women who are not currently working. The odds of awareness of OBF were increased by 2.23 times among women who had a birth history than their counterparts. Women who had media exposure was1.54 times more likely to have awareness of OBF than women who had no media exposure [(AOR=1.54; 95% CI=1.07, 3.09)] **(Table 2).** Regarding community-level factors, we found the awareness of OBF among urban resident women was 1.99 times (AOR= 1.99, 95% CI=1.53, 2.87) higher than women who reside in rural. Higher odds of awareness of OBF among women from high community-level media exposure (AOR=2.05, 95% CI= 1.67, 2.64) compared to those from low community-level media exposure **(Table 2).**

Random effects (measures of variations) results

The random effect models of the individual/household and community level factors associated with awareness of OBF are shown in **Table 3**. We observed that the values of the AIC and Deviance decreased across the models, indicating the best-fitted model was chosen based on the lowest deviance value (562.0504) and AIC (616.0504). The ICC in the null model was 16.0%, indicating that 13.6% of the overall variability for awareness of OBF was related to variations between clusters/EA. In addition, the MOR for awareness of OBF in the null model was 2.54, indicating that there was variability between clusters. If we randomly selected an individual from two different clusters, those in the cluster with a high awareness of OBF had 2.54 times the odds

of having awareness of OBF compared to those in the cluster with a lower awareness of obstetric fistula. These estimates showed that the variations in the likelihood of awareness of OBF can be attributed to the variances in the clustering at the primary sampling units **(Table 3)**.

Discussion

OBF is a problem that is frequently disregarded in terms of human rights and public health. This study aims to reveal the prevalence and associated factors of OBF among reproductive-age women in Nepal. The overall prevalence of OBF among reproductive-age women was 35.9% (95% CI 35.1% to 36.7%). This finding is in line with other studies conducted in Burkina Faso 36% [27]. The implication of this study is to provide a clue for the clinicians and physicians that help them to deliver awareness creation programs for their clients. This finding can create huge implications for the policymakers to have different ceremonies related to creating awareness about obstetric fistula.

The finding of this study is lower than other studies conducted in Ethiopia 40.8% and 38% [9, 28], Nigeria 57.8% [3], and Sab-Saharan Africa 40.85% [6]. The probable reason of the association is might be a lower number of modern healthcare system and low educational status in Ethiopia [9, 28]. The other reason for the difference might be the effect of population and culture differences that might led to the difference in awareness of OBF [6]. In other words, this finding is higher than other studies conducted in the Gambia 12.9% [29], The reason for this discrepancy might be the effect of the difference in the population that women who have OBF may not know about potential treatment choices, which could cause them to live with the problem untreated at residence [29].

Regards to factors, higher age was one of the factors associated with awareness of obstetric fistula. This finding is in concordance with other studies conducted in Gambia [29]. The possible reason for the association might be the effect of the basic idea that a woman will have greater exposure to giving birth and dealing with the challenges that come with it as she grows older [29]. The other probable reason for this association could be the impact of the high education and changing unhealthy habits a formal education enables women to make better healthcare decisions.

A higher level of education is also another factor associated with awareness of obstetric fistula. This finding is in line with other studies conducted in Sub-Sharan Africa [7]. This is because of

formal education gives women the authority to choose their healthcare providers, like by going to maternal health education forums and obtaining obstetric counseling which raises their awareness of OBF [7]. Furthermore, compared to younger women older women are more likely to have completed higher education. Women who have more knowledge are more likely to use and have access to healthcare information [8].

Mass media exposure is one of the factors associated with awareness of obstetrics in Nigeria [30] Ethiopia[9], and Sub-Saharan Africa [7], likewise, it is associated with our study. The possible reason for this association might be the fact that the mass media plays a significant role in the distribution of information regarding OBF and treatment availability [30]. This is because media is the essential function in transferring knowledge including details about obstetric fistula, symptoms, and treatment modality [9]. The finding is most likely attributable to the media's crucial role in spreading information, including details about obstetric fistula, its symptoms, and where to get treatment [30]. The other factor significantly associated with OBF awareness was birth history. This finding is in concordance with other studies conducted in Ethiopia [28]. The possible reason for this association might be the effect of would be that more expertise in obstetrics and parenting correlates with increased parity [28]. Every delivery enhances women's knowledge by providing them with information concerning obstetric complications, including OBF [7]. Additionally, women who were single or living together had lower OBF knowledge rates than married women.

The other factor associated with OBF awareness was urban residence. This finding is in line with other studies conducted in Gambia [29] and Burkina Faso [27]. The probable reason for the association differs from several related studies which suggest that public knowledge is higher in urban residence [29]. However, women in rural areas might not have as much access to or experience with mass media, which could further limit their level of understanding and knowledge of medical issues [31]. The other possible reason for this association might be due to the effect of the urban participant's exposure to mass media and other information about the awareness of obstetric fistula. Having occupations is another factor that was associated with OBF awareness. This association is similar to other studies conducted in Ethiopia [28]. This is because one of the well-known venues where medical professionals offer health education regarding maternal health is the pregnant women's discussion forum [28].

Strengths and limitations of the study

One of the study's advantages was that it used data from a large nationwide survey, which gave it sufficient power to identify the real impact of the independent factors. Secondly, to obtain accurate estimates and standard errors, the sample weight was applied during the analysis. Furthermore, by examining the awareness of OBF at the household, and community levels, we were able to investigate hierarchical or clustered patterns that might have an impact on results. One weakness of the study is that it was cross-sectional; therefore, it was not possible to establish a causal relationship between the identified independent variables and the awareness of OBF. Because it depends on self-reported data, the DHS is vulnerable to recall bias.

Conclusion and recommendation

In this study, overall awareness of OBF among childbearing-age women in Nepal was 35.9%. Women's age, educational status, working status, birth history, and media exposure were significantly associated at the individual level; and also, media exposure and residence were found statistically significant associated factors from community-level factors with awareness of OBF among Nepal childbearing-age women. The findings of this study will assist policy-makers and public health programmers in understanding the magnitude of OBF awareness and the contributory factors. In addition, it will be useful to increasing awareness of OBF in the communities, and promoting primary prevention strategies through education and motivation efforts. Awareness creation and enhance the level of education is recommended form the Nepal government. It is also recommended that future researchers employ an advanced methodology that can provide practical indicative solutions for awareness of OBF.

Authors' contribution:

BMF conceived the idea. HAA, ZAA, AAA, YMN, BLS, and MM participated in the analysis process. BMF wrote the first draft of the manuscript. Writing review and editing were done by HAA, ZAA, AAA, YMN, BLS, and MM. All authors have read and agreed to the final version of the manuscript. BMF is the guarantor for the study.

Competing interests

All authors declare that they have no competing interests.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication

Not applicable

Ethics approval and consent to participate

All methods were performed according to the relevant guidelines and regulations. This study did not require ethical approval or participant consent because it was a secondary data analysis of publicly available survey data from the MEASURE DHS program. We have obtained permission to download and use the data from http://www.dhsprogram.com for this study. There are no names or addresses of individuals or households recorded in the datasets.

Availability of data and materials

Permission to get access to the data was obtained from the measure DHS program online request from http://www.dhsprogram.com website and the data used were publicly available with no personal identifier [20].

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Table 1: Distribution of the study population by socio-demographic and reproductive-related characteristics (n = 14,845)

Variables	Category	Weighted frequency	Percent (%)
Age	15-19	2643	17.80
	20-29	5072	34.17
	30-39	4169	28.09
	40-49	2961	19.94
Educational level	No education	3796	25.57
	Primary	4595	30.95
	Secondary	5798	39.06
	Higher	656	4.42
Residence	Urban	8,019	54.02
	Rural	6,826	45.98
Religion	Hindu	12374	83.36
	Buddhist	970	6.54
	Muslim	682	4.60
	Others	818	5.51
Marital status	Unmarried	3203	21.58
	Married	11641	78.42
Wealth index	Poorest	2628	17.70
	Poorer	2857	19.25
	Middle	3028	20.40

	Richer	3197	21.53
	Richest	3135	21.12
Currently working	No	6007	40.46
	Yes	8838	59.54
Sexual experience	Never had sex	3129	21.08
	Had sex	11716	78.92
Birth history	No	4252	28.65
	Yes	10592	71.35
Ever had a terminated pregnancy	No	12007	80.88
	Yes	2838	19.12
Media exposure	No	3135	21.12
	Yes	11710	78.88
Use internet	No	5672	38.21
	Yes	9172	61.79
Distance to health facility	Big problem	5520	37.18
	Not a big problem	9325	62.82
Covered by health insurance	No	13070	88.04
	Yes	1775	11.96
Community female education	Low	7618	51.53
	High	7165	48.47
Community media exposure	Low	7180	48.57
	High	7603	51.43
Community poverty	Low	7504	50.76
	High	7279	49.24
Residence	urban	8,019	54.02
	rural	6,826	45.98

Table 2: Multilevel analysis of factors associated with awareness of OBF among women of childbearing age in Nepal, 2022(N= 14,845)

Variables	Mode I	Model II	Model III	Model IV
Age				
15-19		Ref		Ref
20-29		1.38(1.20, 1.58)		2.19(0.94, 5.09)
30-39		1.70(1.44, 2.00)		**3.48(1.35, 8.93)**
40-49		2.17(1.81, 2.60)		**4.68(1.60, 13.67)**
Religion				
Hindu				
Buddhist		0.89(0.74, 1.06)		0.90(0.44, 1.81)

Muslim	0.98(0.74, 1.30)	1
Others	0.99(0.83, 1.17)	1.36(0.81, 2.26)
Education		
No education	Ref	Ref
Primary	1.35(1.21, 1.52)	0.93(0.46, 1.85)
Secondary	2.20 (1.92, 2.51)	**1.65(1.41, 3.03)**
Higher	3.03(2.38, 3.86)	**4.29(1.14, 36.70)**
Wealth status		
Poorest	Ref	Ref
Poorer	1.02(0.90, 1.16)	1.03(0.64, 1.68)
Middle	0.96(0.83, 1.10)	0.81(0.30, 2.11)
Richer	1.14(0.98, 1.33)	1.67(0.21, 13.23)
Richest	1.34(1.12, 1.60)	1()
Marital status		
Unmarried	Ref	Ref
Married	0.94(0.57, 1.55)	0.57(0.03, 9.35)
Currently working		
No	Ref	Ref
Yes	1.18(1.09, 1.29)	**1.85(1.04, 3.30)**
Sex of household head		
Male	Ref	Ref
Female	1.01(0.93, 1.09)	0.74(0.45, 1.22)
Ever had a terminated pregnancy		
No	Ref	Ref
Yes	1.16(1.05, 1.28)	1.08(0.57, 2.03)
Birth history		
No	Ref	Ref
Yes	1.13(0.96, 1.33)	**2.23(1.48, 4.10)**
Sexual experience		
Never had sex	Ref	Ref
Had sex	1.08(0.65, 1.77)	1.61(0.10, 24.98)
Media exposure		
No	Ref	Ref
Yes	1.41(1.27, 1.57)	**1.54(1.07, 3.09)**
Use internet		
No	Ref	Ref
Yes	1.29(1.18, 1.42)	1.56(0.94, 2.58)
Covered by health insurance		
No	Ref	Ref
Yes	1.28(1.13, 1.46)	1.67(0.65, 4.29)
Distance from health facility		
Big problem	Ref	Ref
Not a big problem	1.05(0.96, 1.14)	1.35(0.84, 3.15)

Residence		
Rural	Ref	Ref
Urban	1.01(0.57, 1.79)	**1.53(1.99, 2.87)**
Community female education		
Low		
High	0.91(0.59, 1.40)	1.02(0.64, 1.61)
Community media exposure		
Low		
High	1.00(0.66, 1.52)	**2.05(1.67, 2.64)**
Community poverty		
High	Ref	Ref
Low	0.96(0.64, 1.42)	1.01(0.66, 1.54)

Bold=p-value < 0.05; Ref= Reference

Table 3: Random effect results for awareness of OBF and its individual and community level factors: evidence from NDHS (N= 14,845)

Random effects	**MI**	**MII**	**MIII**	**MIV**
Log-likelihood	-9054.5333	-8738.2152	-302.06669	-281.0252
ICC (95%CI)	16.0(13.7, 18.4)			
AIC	18113.07	17526.43	616.1334	616.0504
BIC	18128.27	17716.46	641.1133	728.346
Deviance	18109.067	17476.43	604.13338	562.0504
MOR (95%CI)	2.54(1.17, 3.86)			

AIC: Akaike information criterion

BIC: Bayesian information criterion

ICC: Intra-class correlation coefficient

MOR: Median odds ratio

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.