Practice of Blood Donation and Associated Factors among Adults of Gondar City, Northwest Ethiopia: Bayesian Analysis Approach

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Background: Blood transfusion is an essential part of modern healthcare. In Ethiopia, it had been planned to collect 202,000 units of blood in 2016–2017, but the actual amount collected was 169,744. The Bayesian approach has advantages in that estimation of model parameters is conducted based on posterior distributions. This study aimed to assess the practice of blood donation and associated factors among adults of Gondar city, northwest Ethiopia using Bayesian analysis.

Methods: A community-based cross-sectional study was conducted among 554 Gondar adults from February to March 2019. Bayesian binary logistic regression was conducted to assess the relationship between independent and dependent variables using Stata 15 with a 95% CI for statistical significance.

Results: A total of 326 were involved with a 97% response rate, among which 342 (66.4%) were females. Eighty (15.53%) and donated blood at least once in their lives. Men were more likely to donate blood (AOR 1.79, 95% CI 1.11–3.12), while those aged 18–24 years were 57% (AOR 1.43, 95% CI 0.15–0.89) less likely to give blood. Individuals with good knowledge (AOR 2.56, 95% CI 1.32–4.53) and favorable attitudes (AOR 1.86, 95% CI 1.03–3.36) were more likely to donate blood.

Conclusion: The majority of the participants did not donate blood. Male sex, age 18–24 years, good knowledge, and favorable attitudes were statistically significant factors in blood donation. Intervention with females and younger age-groups should be better administered. Health education is required to increase knowledge and create a favorable attitude among the community.

Keywords: practice, blood donation, Bayesian logistic regression, Gondar city

Background
Blood transfusion is an essential part of modern health care. It can save lives and improve health. Blood transfusion is needed for patients with severe anemia, sickle-cell disease, bleeding disorders, eg, hemophilia, or cancer. Blood transfusion and component therapies are an integral part of modern medical interventions. However, these therapies are not risk-free, with risk ranging from potentially fatal immunohypersensitivity reactions to potential transmission of blood-borne pathogens from donor to recipient. Most of the blood used for transfusions comes from whole-blood donations given by volunteer blood donors. A person can also have his or her own blood collected and stored a few weeks before surgery in case it is needed.
The availability of safe blood is a critical component in improving health care and preventing the transmission of infections. While blood provision and safety are often taken for granted in the industrialized world, the quality and safety of blood transfusion remain continuing concerns in developing countries, in which 82% of the world’s population lives.4

Globally, more than 530,000 women die each year during pregnancy, childbirth, or the postpartum period, and 99% of these are in the developing world. Severe bleeding during or after childbirth is commonest cause of maternal mortality, contributing up to 44% of maternal deaths in Africa, 31% in Asia, and 21% in Latin America and the Caribbean.2 In 2013, maternal hemorrhage was one of the leading causes of maternal death, constituting >13% of deaths in Ethiopia.5

In developing regions, maternal and neonatal mortality were responsible for 3 million deaths in 2013 and are important contributors to overall global mortality.6 It has been further estimated that 90,000 deaths in both sexes and all age-groups are due to iron-deficiency anemia alone.7 Blood supplies in Africa have never been able to meet demand. This is reflected in the high maternal- and child-mortality rates in the continent.4 The average blood-donation rate in Africa is 4.7 units/1,000 inhabitants. The Ethiopian National Blood Bank collects nearly 200,000 units of blood from donors annually, but the country requires 18,000 units of blood daily and the average daily amount collected is approximately 1,100 units, a shortfall of 7,943 L.8 According to the 2013–2016 Ethiopian Health Sector Transformation Plan report, 84 0.03% unit of blood was collected. In classical statistics, analysis of logistic regression is based on estimating parameters through maximum likelihood estimation (MLE), and given the asymptotic properties MLE in small samples encounters serious inferential problems. In such a case, the Bayesian approach has an advantage in that estimation of model parameters is conducted on the basis of posterior distribution, which is a combination of observed data and information from previous studies or personal experiences, known as prior distribution.10 This study aimed to assess practices of blood donation and associated factors among adults of Gondar to assess practices of blood donation. Gondar is 727 km from Addis Ababa, the capital of Ethiopia, and 180 km from Bahir Dar, the capital of Amhara Regional State. Gondar has a total area of 192.3 km².

Study Population and Sampling
All adults aged 18–65 years and residents of Gondar city were included. Critically ill individuals unable to give information were excluded. The sample size was calculated using a single-population proportion for the outcome variable and double-population proportion of factors. The final sample size was 554. To begin with, the subcities were randomly selected from six subcities using simple random sampling. Next, systematic sampling was employed to select households from each subcity. Interval values were calculated by dividing the total number of households of each selected subcity by its proportional sample size. The initial household to be interviewed was selected randomly by lottery.

Study Variables
The dependent variable was blood-donation practices, and independent variables were sociodemographic (age, sex, marital status, education, occupation, religion, monthly income, and ethnicity), knowledge of, attitudes toward, and barriers to blood donation.

Data Processing and Analysis
Data were collected with a pretested structured validated World Health Organization voluntary blood-donation questionnaire and other relevant literature.11,12

The questionnaire was initially prepared in English, translated into Amharic (local language), then retranslated back to English to check for any inconsistencies or distortions in the meaning of words and concepts. Pretesting was done on 5% of the total sample. Necessary amendments were made upon identification of ambiguity. Trained data collectors, supervisors, and the investigator checked and reviewed completed questionnaires daily.

Data Analysis
Data were entered into EpiData version 3.0 and transferred to Stata version 15 for analysis. Data were coded and cleaned for completeness and consistency. Descriptive analysis was done to observe frequency distribution.
Bayesian Binary Logistic Regression Model

The dependent variable ($Y_i$) was dichotomous: 1 for adults who donated blood and 0 for those who did not. A binary logistic regression model with Bayesian approach was adopted to examine the effect of the predictors on the response variable — blood donation.

For the binary response variable ($Y_i$), binary logistic regression model with logit-link function has the form:

$$\text{Logit}(p_{i}) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_p X_{pi}$$

where $p_i$ is the probability of the $i$th adult donating blood, $Y_i$ observed of blood donation status (yes/no) for the $i$th adult, $X_1, X_2 \ldots X_p$ independent variables and $\beta = (\beta_0, \beta_1, \ldots \beta_p)$ are vectors of unknown binary logistic regression parameters.

In a classical approach, analysis of a logistic regression model is based on estimating parameters of the model through MLE and calculating an estimate using the expectation-maximization algorithm. With this method, it is possible to evaluate the local maximum instead of the general MLE without calculating the convergence of the model. Furthermore, given asymptotic properties, MLE in small samples encounters serious inferential problems. However, in the Bayesian method, inference about model parameters is conducted on the basis of posterior distribution, which is the combination of the likelihood function of observed data and information from previous studies or personal experiences, known as prior distribution.

This approach was applied to a binary logistic regression model, taking account of uncertainty in the parameters, to identify the determinants of blood donation in Gondar. Furthermore, the idea of Bayesian statistics within the context of life-data analysis is to integrate prior knowledge, along with a given set of current observations, to make statistical inferences. The advantages of Bayesian inference are well known, and include elicitation of prior beliefs about experiences, avoidance of asymptotic approximations, and practical estimation of functions of parameters.

Bayesian inference assumes that the data are fixed and considers all unknown parameters as random variables. This method also allows detailed inference from parameters and can be obtained for any arbitrary sample size. To progress with Bayesian analysis, it is necessary to provide a likelihood function for the data and joint prior distribution over the parameter space. As such, for data from individual subjects that are assumed to be independent of one another, the likelihood function ($Y = [y_1, y_2 \ldots y_n]^T$) over a data set for $n$ subjects, the likelihood function for data is:

$$\text{prob}(y|\beta) = L(\beta|y) = \prod_{i=1}^{n} \left[ P_i^y (1 - P_i)^{(1-y_i)} \right]$$

Moreover, one of the preconditions in any Bayesian analysis is the prior choice, and the most common prior choice for logistic regression parameters is a normal distribution with mean $\mu$ and variance $\sigma^2$. In this case has the form:

$$\beta_i \sim N(\mu, \sigma^2)$$

Mathematically, the prior distribution of logistic regression parameters has the form:

$$f(\beta_i) = \frac{1}{\sqrt{2\pi \sigma_j^2}} \exp \left( -\frac{1}{2} \left( \frac{\beta_i - \mu_j}{\sigma_j} \right)^2 \right)$$

The most common choice for prior mean $\mu_j$ is 0 for all coefficients and large-enough prior variance $\sigma_j^2$. As such, in this paper, due to the lack of information for prior distribution of regression coefficients, noninformative normal prior distribution with prior-distribution parameters of mean 0 and variance 1,000 was considered. Then, for the choice of noninformative independent normal priors and likelihood function for the data, posterior distribution of model parameters, which is the product of equations 2 and 3, has the form:

$$P(\beta|y) = \prod_{i=0}^{p} \left[ P(\beta_i) \right] \times \prod_{i=1}^{K} L(\beta|y)$$

$$= \prod_{j=0}^{p} \frac{1}{\sqrt{2\pi \sigma_j^2}} \exp \left( -\frac{1}{2} \left( \frac{\beta_i - \mu_j}{\sigma_j} \right)^2 \right) \times$$

$$\prod_{i=1}^{K} \left[ \left( \frac{e^{\beta_i X_{1i} + \ldots + \beta_p X_{pi}}}{1 + e^{\beta_i X_{1i} + \ldots + \beta_p X_{pi}}} \right)^{y_i} \right] \left[ \left( 1 - \frac{e^{\beta_i X_{1i} + \ldots + \beta_p X_{pi}}}{1 + e^{\beta_i X_{1i} + \ldots + \beta_p X_{pi}}} \right)^{(1-y_i)} \right]$$

Clearly, this posterior distribution is a complex function of the parameters, and numerical methods are needed to obtain the marginal posterior distribution for each of the model parameters. The most popular method is simulation from a general posterior distribution using Markov chain Monte Carlo (MCMC) simulation. Therefore, in this study MCMC simulation with Metropolis–Hastings sampling was used for samples from the posterior distribution and implemented on Stata 15. The empirical results from a given MCMC analysis are not deemed reliable until the chain has
reached a stationary distribution. On account of this, the term convergence of an MCMC algorithm refers to whether the algorithm has reached its target distribution. Therefore, monitoring the convergence of the algorithm is essential for producing results from the posterior distribution of interest. Among several methods, the most popular and straightforward convergence-assessment — time series (history) plots, density plots, Monte Carlo SE, and Gelman–Rubin statistic — were used to assess whether the sample had reached stationary distribution or not. Summary statistics (posterior mean, SE of posterior mean, OR of posterior mean, and CI of posterior mean) were computed for each parameter. Finally, the importance of each of the explanatory variables is assessed by carrying out statistical tests of the significance of the regression coefficients (posterior mean) via 95% Bayesian CI of the posterior mean.

### Results

**Sociodemographic Characteristics**

A total of 515 participants were involved in the study with 97% response rate and 342 (66.4%) were women. A majority of the participants, 237, 46.02%) were married, and 228 (44.27%) had attended institutions following secondary school (Table 1).

### Knowledge of Blood Donation

Of total participants, 237 (46.02%) had good knowledge about blood donation. More than half (286, 55.2%) were correct regarding the age-range of blood donation. Participants were asked about the amount of blood an individual could donate each time, and 137 (26.6%) answered correctly, while only 128 (24.7%) were correct about the period for which blood was stored. A total of 279 (54.17%) reported that an individual was able to give blood every 3 months. A majority (417, 81%) reported blood was needed for patients with severe anemia (Table 2).

### Attitudes Toward Blood Donation

In sum, 205 (39.8%) participants had favorable attitudes toward blood donation. More than half (288, 55.7%) agreed that blood donation gave satisfaction to the donor, and 83 (46.02%) thought that blood donation could affect the health of the donor. Most participants agreed that by donating blood, it was possible to decrease deaths of mothers (62.33%) and children (62.14%). Blood donation was a pleasant activity for most (339, 65.83%), as shown in Table 3.

### Blood-Donation Practices

Gondar blood donors numbered 80 (15.53%, 95% CI 13%–19%). Of these 38 (7.38%) had donated once, 33 (6.41%) twice, and nine (1.75%) thrice and above. Respondents who did not donate blood mentioned different reasons. About 110 (25.29%) did not donate due to fear of needle pain, 55 (12.64%) having health problems, and 228 (52.41%) did not have adequate information about where and when blood is donated, among other reasons (Figure 1).

### Bayesian Logistic Regression Analysis

Bayesian logistic analysis was used to make an inference about the parameters of the logistic regression model. The Metropolis–Hastings algorithm was implemented with 116,000 iterations and 6,000 burn-in terms discarded, so

### Table 1: Sociodemographic Characteristics of Gondar City Adults

| Category                | n  | %    |
|-------------------------|----|------|
| Sex                     |    |      |
| Male                    | 173| 33.59|
| Female                  | 342| 66.41|
| Age, years              |    |      |
| 18–24                   | 143| 27.77|
| 25–34                   | 191| 37.09|
| 35–44                   | 133| 25.85|
| ≤45                     | 48 | 9.32 |
| Marital status          |    |      |
| Single                  | 219| 42.52|
| Married                 | 237| 46.02|
| Divorced                | 40 | 7.77 |
| Widowed                 | 5  | 3.69 |
| Religion                |    |      |
| Orthodox                | 45 | 88.35|
| Muslim                  | 5  | 9   |
| Protestant              | 5  | 1.75 |
| Ethnicity               |    |      |
| Amhara                  | 415| 80.58|
| Kimantar                | 88 | 17.09|
| Tigray                  | 12 | 2.33 |
| Occupation              |    |      |
| Government employee     | 157| 30.49|
| Private employee        | 174| 33.79|
| Student                 | 42 | 8.16 |
| No job                  | 83 | 16.12|
| Other                   | 59 | 11.46|
| Education               |    |      |
| None                    | 138| 26.8 |
| Primary                 | 35 | 6.8  |
| Secondary               | 114| 22.14|
| Above secondary         | 228| 44.27|
| Monthly income (Br)     |    |      |
| <500                    | 103| 20   |
| 500–1,000               | 113| 21.94|
| 1,001–1,500             | 40 | 7.77 |
| ≥1,500                  | 259| 52.29|
111,000 samples were generated from the full posterior distribution. We used normal priors with large variance (mean 0, variance $10^6$) for regression parameters. Before undertaking any inference from the posterior distribution, the convergence generated from Markov chains was verified by convergence-assessment plots (Annex 1).

Attitudes, sex, and age were statistically significant determinants of blood donation with 95% CIs (Table 4).

Keeping other variables constant, individuals with good knowledge increased odds of blood donation by 2.56 times over those with poor knowledge (AOR 2.56, 95% CI 1.32–4.53).

### Table 2 Knowledge of Adults on the Practice of Blood Donation and Associated Factors in Gondar City

| Conditions in which blood needed | n   | %    |
|---------------------------------|-----|------|
| Patients bleeding severely due to injury | 482 | 93.59|
| Heavy bleeding during childbirth | 483 | 93.79|
| Major surgery | 406 | 78.99|
| Severe anemia | 417 | 80.07|

| Which sex can donate blood | n   | %    |
|---------------------------|-----|------|
| Male | 35 | 6.80 |
| Female | 8 | 1.55 |
| Both | 441 | 85.63|
| Do not know | 31 | 6.02 |

| Age required to donate blood, years | n   | %    |
|-----------------------------------|-----|------|
| <18 | 12 | 2.33 |
| 18–65 | 286 | 55.53|
| >65 | 22 | 4.27 |
| Do not know | 195 | 37.86|

| Maximum volume donated at a time, mL | n   | %    |
|-------------------------------------|-----|------|
| 200 | 63 | 12.23|
| 350–450 | 137 | 26.60|
| 500 | 52 | 10.10|
| Do not know | 263 | 51.07|

| Frequency of donations | n   | %    |
|------------------------|-----|------|
| Every month | 47 | 9.13 |
| Every 3 months | 279 | 54.17|
| Every 6 months | 24 | 4.66 |
| Every year | 29 | 5.73 |
| Do not know | 136 | 26.91|

| Minimum body weight to donate blood, kg | n   | %    |
|---------------------------------------|-----|------|
| <45 | 14 | 2.69 |
| 45 | 17 | 3.36 |
| 50 | 52 | 10.10|
| 55 | 19 | 3.72 |
| Do not know | 210 | 40.78|

| Period of donated blood staying on shelf, months | n   | %    |
|-------------------------------------------------|-----|------|
| 1 | 30 | 5.83 |
| 2 | 128 | 24.85|
| 3 | 32 | 6.21 |
| 5 | 2 | 0.39 |
| Do not know | 310 | 60.19|

### Discussion

This study aimed to investigate the relationship between blood-donation practices of adults and sociodemographic variables, knowledge, and attitudes in Gondar using Bayesian analysis. According to this study, knowledge, attitudes, age, and sex of participants were statistically significant variables, with 95% Bayesian CIs.

The proportion of blood donors in this study was 15.5%. This is comparable with studies conducted in Debre Markos (16.1%) and another in Gondar (18.4%), but slightly lower than studies conducted in Mizan Aman, southwest Ethiopia (26.4%) and Harer (22.6%). It is believed that educated individuals are more likely to donate blood. As such, the proportion of literate participants in our study was lower than the aforementioned studies. Furthermore, knowledge of blood donation is related to giving blood, and the knowledge of our study participants was lower than previous research. These could be the possible reasons for the variation in blood-donation practices.

After adjustment of other covariates, individuals with favorable attitudes increased the odds of blood donation by 1.86 times over those with unfavorable attitudes (AOR 1.86, 95% CI 1.01–3.06).

Holding other covariates constant, the odds of blood donation decreased by 57% in respondents aged 18–24 years old compared to those aged >45 years (AOR 0.43, 95% CI 0.03–0.9). After adjustment for other covariates, male sex were increased the odds of blood donation by 1.79 times over female sex (AOR 1.79, 95% CI 1.11–3.12).

[Figure 1: Practice of blood donation among Gondar adults, northwest Ethiopia, 2019.]

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Men were 1.79 times more likely to donate blood than women. This result is supported by studies conducted in Eboni (Nigeria), Kampala, Harer, Addis Ababa, and Gondar.\textsuperscript{18,20–23} A possible explanation could be that women defer blood donation in particular due to menstruation, lactation, or other health-related problems.\textsuperscript{24}

On the other hand, age was significantly associated with blood donation. Those aged 18–24 years were 57\% less likely to donate blood than those aged >45 years. This finding is comparable with other studies.\textsuperscript{15,25} It might be that older adults are concerned about other individuals because most have spouses and children, so believe that donating blood might save their family’s life. Younger participants might be single and not bother about others’ health conditions.

The results of the current study revealed that those with good knowledge were 2.56 times more likely to donate blood than those with poor knowledge. This result is consistent with studies in Tigray, northern Ethiopia, Gondar University Hospital, and Tanzania.\textsuperscript{24,26,27} Having more knowledge about the importance of donations drives adults to donate blood.

The other factor significantly associated with blood donation in our study was attitudes. Respondents with favorable attitudes were 1.86 times as likely to donate blood than those with unfavorable attitudes. This finding is consistent with prior research.\textsuperscript{24,26–28} An explanation could be that if an individual feels that donating blood could decrease deaths of children and mothers, this gives satisfaction and believes had no problem on his/her health to the future s/he engage in blood donation.

### Table 3: Attitude of Adults Toward the Practice of Blood Donation and Associated Factors in Gondar city

| Attitude of Adults Toward the Practice of Blood Donation and Associated Factors in Gondar city | n  | %   |
|:---------------------------------------------------------------------------------------------|----|-----|
| Donating blood can save patients’ lives                                                      |    |     |
| Strongly disagree                                                                          | 3  | 0.58|
| Disagree                                                                                   | 17 | 3.30|
| Neutral                                                                                    | 68 | 13.20|
| Agree                                                                                      | 298| 57.86|
| Strongly agree                                                                             | 129| 25.05|
| Blood donation can affect the health of the donor                                          |    |     |
| Strongly agree                                                                             | 12 | 2.33|
| Agree                                                                                      | 83 | 16.12|
| Neutral                                                                                    | 167| 32.43|
| Disagree                                                                                   | 211| 40.97|
| Strongly disagree                                                                          | 42 | 8.16|
| Blood donation can decrease the rate of child death                                        |    |     |
| Strongly disagree                                                                          | 5  | 0.97|
| Disagree                                                                                   | 20 | 3.88|
| Neutral                                                                                    | 57 | 11.07|
| Agree                                                                                      | 320| 62.14|
| Strongly agree                                                                             | 113| 21.94|
| Blood donation can decrease maternal death                                                 |    |     |
| Strongly disagree                                                                          | 4  | 0.78|
| Disagree                                                                                   | 11 | 2.14|
| Neutral                                                                                    | 53 | 10.29|
| Agree                                                                                      | 321| 62.33|
| Strongly agree                                                                             | 126| 24.47|
| Blood donation gives satisfaction to donors                                                |    |     |
| Strongly disagree                                                                          | 3  | 0.58|
| Disagree                                                                                   | 21 | 4.08|
| Neutral                                                                                    | 98 | 19.03|
| Agree                                                                                      | 287| 55.73|
| Strongly agree                                                                             | 56 | 10.58|
| Blood donation is a pleasant activity                                                      |    |     |
| Strongly disagree                                                                          | 14 | 2.72|
| Disagree                                                                                   | 56 | 10.87|
| Neutral                                                                                    | 26 | 5.146|
| Agree                                                                                      | 265| 51.46|
| Strongly agree                                                                             | 74 | 14.37|

### Table 4: Multivariate Bayesian Logistic Regression of Blood-donation Practices Among Gondar adults

| Category                              | MCSE  | AOR       | 95% CI       |
|---------------------------------------|-------|-----------|--------------|
| Sex                                   |       |           |              |
| Male                                  | 0.74  | 1.79      | 1.11 3.12**  |
| Female (reference)                    |       |           |              |
| Age, years                            |       |           |              |
| 18–24                                 | 0.01  | 0.43      | 0.15 0.89**  |
| 25–34                                 | 0.03  | 0.31      | 0.12 0.61    |
| 35–44                                 | 0.03  | 0.36      | 0.13 0.71    |
| ≥45 (reference)                       |       |           |              |
| Marital status                        |       |           |              |
| Single (reference)                    | 0.01  | 1.12      | 0.63 1.84    |
| Married                               | 0.10  | 2.30      | 0.71 6.02    |
| Divorced                              | 0.05  | 19.96     | 0.05 39.74   |
| Widowed                               | 0.19  | 82.49     | 0.01 64.18   |
| Education                             |       |           |              |
| None                                  | 0.96  | 3.12      | 1.10 6.72    |
| Primary school                        | 0.24  | 1.96      | 0.35 5.32    |
| Secondary school                      | 0.18  | 1.81      | 0.46 3.77    |
| >Secondary school (reference)         |       |           |              |
| Religion                              |       |           |              |
| Christian (reference)                 | 0.03  | 0.94      | 0.24 1.34    |
| Muslim                                | 0.04  | 0.03      | 0.24 1.34    |
| Protestant (reference)                | 0.03  | 0.94      | 0.24 1.34    |
| Ethnicity                             |       |           |              |
| Amhara                                | 0.02  | 0.59      | 0.29 1.67    |
| Tigray (reference)                    | 0.21  | 3.41      | 0.93 8.76    |
| Kimante (reference)                   | 0.04  | 0.26      | 0.09 0.68    |
| Income                                |       |           |              |
| ≤500 (reference)                      | 0.04  | 0.78      | 0.24 1.83    |
| >500–1,000                            | 0.31  | 0.54      | 0.12 1.29    |
| >1,000–1,500                          | 0.05  | 1.13      | 0.78 1.86    |
| >1,500–3,000                          | 0.24  | 1.32      | 0.84 2.05    |
| Knowledge                             |       |           |              |
| Good (reference)                      | 0.06  | 1.26      | 1.06 1.47    |
| Poor                                  | 0.10  | 1.48      | 0.95 2.33    |
| Knowledge                             |       |           |              |
| Astute                                |       |           |              |
| Favorable (reference)                 | 0.05  | 1.86      | 1.01 3.06**  |
| Unfavorable (reference)               | 0.10  | 2.67      | 0.96 7.85    |

Notes: **statistically significant variables at 95\% credible interval.
Study Limitation
We did not assess reasons behind deferral among nondonors, so did not separate factors among donors and nondonors.

Conclusion
A minority of participants donated blood. Male sex, age 18–24 years, good knowledge, and favorable attitudes were significantly associated with blood donation. Therefore, interventions should target females and younger age-groups. Because the knowledge of these participants was less than their counterpart, health education is required to increase knowledge and create favorable attitudes in the community.

Abbreviations
MCMC, Markov Chain Monte Carlo; MCSE, Monte Carlo standard error; MLE, maximum likelihood estimation.

Availability of Data and Material
The data sets generated and/or analyzed during the current study are available at the University of Gondar, College of Medicine and Health Science, Institute of Public Health, and Gondar City Health Department in hard and soft copy (www.UoG.edu.et). They are also available from the authors upon reasonable request and with permission of the principal investigators (Ayenew Kassie, kassieaye-new@gmail.com).

Ethics Approval and Consent to Participate
Ethics approval for the study was obtained from the Institutional Review Board of the University of Gondar (IPH/180/2/2019). An official letter explaining the objectives of the study was sent to the Gondar City Health Department. They sent a note back, suggesting studying subcities as well. The objectives and benefits of the study were explained to subjects. Oral consent was obtained from each participant. The right of participants to withdraw from the study whenever they wanted was respected. An anonymous questionnaire was used to protect the identity and confidentiality of information obtained from participants.

Consent for Publication
This was not required, because our manuscript does not contain data from any person in the form of any individual details, images, or videos.

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Author Contributions
All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval to the version to be published, and agree to be accountable for all aspects of the work.

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Disclosure
The authors declare that they have no competing interests.

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