# RISK FACTORS, ASCRIBED CAUSES AND EFFECTS OF OBSTETRIC FISTULA AMONG WOMEN IN NORTHERN GHANA: A CASE CONTROL STUDIES

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## Abstract

***Background:*** Obstetric fistula is a demoralizing maternal morbidity. In Ghana, majority of the fistula occur in the northern sector. This study sought to identify the risk factors, ascribed causes and effect of obstetric fistula.

***Methods*:** A matched case control study was conducted from April to June 2013. The fistula patients were taken from the Fistula Centre in Tamale whiles the controls were from the Tamale Teaching hospital. Eligible cases were confirmed fistula patients admitted for fistula repair while controls were women who have delivered but without obstetric fistula. Cases and controls were matched on year, region and district of index delivery.

***Results*:** the following factors were associated with obstetric fistula; age below 20 years, total labour duration more than 24 hours, height 150 cm and below, still birth, operative delivery, residence in a rural area and lack of formal education. Divorce rate among cases over the period was 55.3% while that among the controls was 2.3%. About 20% of cases were likely to be currently using alcoholic beverages compared to 6% in controls (OR=5.3, 95% CI= 1.4 – 19.7). 40% of cases currently have no living child compared to 2% of controls. Majority of fistula patients blame lack of health facilities and an act of God as a cause of fistula.

***Conclusions*:** Majority of women who suffer obstetric fistula are young, poor, of short stature, illiterate and resident in remote areas. There is widespread lack of understanding of the causes of Obstetric fistula among women.

***Keywords : Obstetric fistula, Risk factors, Ascribed causes, Vesico-vaginal fistula***

## Background

Obstetric fistula (OF) is a demoralizing and demeaning maternal morbidity.[1-7] It is associated with continuous leakage of urine or faeces or both into the vagina. The resultant effect of the leakage is a continuous and persistent offensive odour leading to social stigmatization and shunning of affected women.[8-11] It is a completely avoidable and eradicable.[12] However, it still remains a problem in Africa, majority of which are confined to the "fistula belt". [7,13]

In Ghana it is described as the most dreaded maternal condition [2,3] with poor support system available for patients with Obstetric fistula.[14] Some factors ascribed to obstetric fistula include lack of basic education, poverty and early marriage.[15]

Other factors include increased duration of labour for more than 24 hours at home before going to the hospital[14,16] and some biological or medical factors such as; young age, short stature, large fetus, malnutrition, mal-presentation and maternal medical diseases.

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Some studies show that, fistula patients have little or no knowledge about obstetric fistula. In such studies, women cite causes like curse, spiritual attack and punishment as the cause of obstetric fistula.[19] In a study conducted by Banger in Tanzania and Uganda, they found women testimony to be consistent with physical, socio-economic and cultural constraints, as well as health system failures, that led to fistula formation.[20]

Obstetric fistula greatly impact the life its victims. It is associated with stillbirth [21] and reduced quality of life.[22] Some studies have cited psychological problems such as depression[23] and suicidal ideation.[24,25] Some victims are shunned by their friends and family and are left to fend for themselves. Complicating the social problems is the sexual problems and frequent divorce that follow the fistula. The aim of the study is to determine the risk factors and ascribed causes of obstetric fistula among women in northern Ghana. Adequate information about the risk factors in our environment is key to strategies that would help reduce the incidence of Obstetric fistula in Ghana.

## Methods

### *Study design*

This was a matched case control study. In the study, patients from the Tamale fistula centre served as cases whiles controls were mothers without obstetric fistula who have delivered during the same time period as the cases. Controls and cases were matched on the region and district of index delivery. Cases and controls must

be seeking care in the Tamale metropolis at the time of the study. Controls were hospital controls from antenatal clinic in Tamale teaching hospital where as cases were from the Tamale fistula centre.

***Study area***

Data collection was from April to June 2013 in the Northern region of Ghana. The Tamale fistula centre is the only fistula centre providing free services to women with fistula from the three northern regions and the northern aspect of the Volta region of Ghana.

***Study Population***

The source population for this research was women seeking care in the Tamale metropolis. The study population in this study included all women who have delivered and are seeking care at the fistula centre in Tamale and matched controls seeking care in the Tamale Teaching hospital.

***Eligibility and matching criteria***

Eligibility criteria for the cases in the study were: the woman must be diagnosed as having obstetric fistula after a standard examination by a specialist/ consultant obstetrician gynaecologist. A fistula patient is eligible as a case if the fistula resulted from the index childbirth. Fistula patients that have gone through previous fistula repair were excluded from the research. The eligibility criteria for the controls were women who have delivered safely and without obstetric fistula. Cases and controls were matched on the following parameters; Cases and controls must deliver in the same year or within a year's interval. This was done to control for infrastructural and socioeconomic development over time that may confound the relationship. Also, cases and controls were matched on the region and district of last delivery in Ghana. The region and district of delivery was a matching criteria because: people from the same geographical area are usually likely to have the same taboos, socio-cultural practices and health seeking behaviour. Also, matching on region and district of delivery may control for socio-economic factors in the environment that are likely to confound the relationships.

***Sampling method***

All fistula patients admitted into the Tamale fistula centre during the period of the study were admitted into the study. A one case to two controls was the target. The controls were however selected following these research protocols so as to minimize bias. The investigator matched cases and controls. In the instance where more than two controls match the case, a ballot without replacement was carried out to identify the controls that would be admitted into the study as a matched-pair for that particular case. Data Analysis The data generated in the research were entered into Epidata 3.1 and exported into STATA/MP 11.0 (copyright 2004-2009) for analysis. The primary outcome in the study was the development of obstetric fistula. The background characteristics of the respondents were obtained by cross tabulation. Logistic regression was used to analyse the impact of certain factors on obstetric fistula patient. Multiple response analysis was carried out to identify the commonest ascribed causes of obstetric fistula between both groups of controls and cases. Also, logistic regression was used to analyse the risk factors for development of obstetric fistula. First, the association between each of the potential risk factor and the development of obstetric fistula was examined ignoring other variables. This analysis was important because it gave a fair idea as to which of the variables are strong predictors of obstetric fistula. Second to construct a model with risk factors that is independently associated with obstetric fistula, each of the independent variable was a candidate provided that the p-value was 0.05 or less. To investigate whether the relationship between obstetric fistula and a continuous covariate was non-linear, likelihood ratio test was used to compare the fit of the models when the continuous covariate was included as continuous or a categorical variable. Epimap 8 was used to display a case cluster of the distribution of obstetric fistula by district of index delivery.

***Ethical considerations***

Ethical review and approval was obtained from the Ethical Review Committee of the Ghana Health Service, Research and Development Division, Accra. Approval was also obtained from the Fistula Centre in Tamale and the Tamale Teaching hospital. Consenting to the study participants aged 18 years and above was given after fully explaining the aims, objectives and requirements of the study to the patients. Accent by participants less than 18 years and consent from caretakers were obtained for study participants less than 18 years. Written informed Consent was voluntary and each study participant had the right to withdraw at any stage of the study process. Uttermost privacy and confidentiality were maintained. No compensation or payments were made to any study participants. Data files were password protected. Hard copy and electronic data were stored in locked file cabinets.

## Results

***Background characteristics***

Fifty-one cases and 100 controls took part in the study as found in table 1. Of this, 98.04% are of the vesicovagina fistula type associated with leakage of urine per vaginam.

1.96% of cases have both vesico-vagina and rectovagina fistula type and therefore associated with leakage of both urine and faeces. The median age of fistula patients seeking care in the Tamale metropolis is 30 years (interquartile range=8 years). Fistula patients were more likely to have obtained the fistula at an age less than 20 years, MOR = 5.5 (p-value < 0.0001).

**Table 1:** Participant characteristics

| **Participants characteristics** | **Controls** | | **Cases** | | |
|---|---|---|---|---|---|
| | **N** | **(%)** | **N** | **(%)** | **$X^2$ (P-value)*** |
| Number of participants | 100 | | 51 | | |
| Employment status prior to index child | | | | | |
| Unemployed | 35 | 35 | 41 | 80.4 | 30.1 (<0.001) |
| Self-employed | 36 | 36 | 9 | 17.7 | |
| Employed | 29 | 29 | 1 | 2.0 | |
| Current Employment status | | | | | |
| Unemployed | 46 | 46 | 34 | 66.4 | 13.8 (<0.005) |
| Self-employed | 28 | 28 | 16 | 31.4 | |
| Employed | 26 | 26 | 1 | 2.0 | |
| Marital status at index child | | | | | |
| Married | 87 | 87 | 47 | 92.1 | 33.0 (<0.001) |
| Cohabiting | 13 | 13 | 1 | 2.0 | |
| Single, never married | - | - | 3 | 5.9 | |
| Widow | | | | | |
| Divorced | | | | | |
| Current marital status | | | | | |
| Married | 86 | 86 | 20 | 39.2 | 58.7 (<0.001) |
| Cohabiting | 11 | 11 | - | - | |
| Single, never married | - | - | 3 | 5.9 | |
| Widow | 1 | 1 | 2 | 3.9 | |
| Divorced | 2 | 2 | 26 | 51.0 | |
| Current self-ranked economic status | | | | | |
| Average rich - very rich | 62 | 62 | 16 | 31.4 | 12.7 (<0.001) |
| Extremely poor - poor | 38 | 38 | 35 | 68.6 | |
| Index delivery outcome | | | | | |
| Live baby | 85 | 85 | 8 | 15.7 | 68.6 (<0.001) |
| Still birth | 15 | 15 | 43 | 84.3 | |
| Number of children alive | | | | | |
| None | 2 | 2 | 21 | 41.2 | 40.2 (<0.001) |
| 1-2 | 49 | 49 | 16 | 31.2 | |
| 3 or more | 49 | 49 | 14 | 27.5 | |
| Current Alcohol use | | | | | |
| No | 94 | 94 | 41 | 80.4 | 6.6 (<0.05) |
| Yes | 6 | 6 | 10 | 19.6 | |
| Area of residence | | | | | |
| Urban | 52 | 52 | 9 | 17.7 | 16.6 (<0.001) |
| Rural | 48 | 48 | 42 | 82.4 | |
| Religion | | | | | |
| Christian | 44 | (44.0) | 33 | (64.7) | 6.2 (<0.05) |
| Islam | 50 | (50.0) | 17 | (33.3) | |
| Traditional | 6 | (6.0) | 1 | (2.0) | |
| Age at index delivery in years | | | | | |
| 20 and above | 96 | (96.0) | 44 | (46.3) | 19.8 (<0.001) |
| 19 and below | 4 | (4.0) | 7 | (13.7) | |

**$X^2$ (P-value) *: Chi-square (P-value)**

***Residency Factors related to OF***

Majority of women with fistula seeking care in the Tamale Metropolis had the fistula occurring in the Northern Region (82.4%). This was followed with the northern part of Volta Region (9.8%), the Upper East Region (5.9%) and Ashanti Region (1.96%). Figure 1 is a case cluster map displaying the geographic distribution of districts within which the fistula cases occurred.

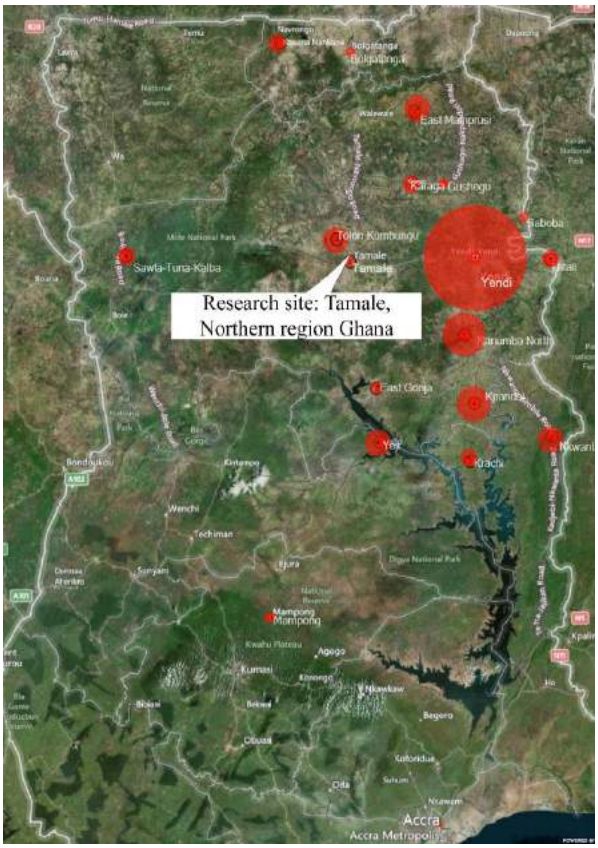


**Fig1** : Case cluster of the distribution of obstetric fistula cases by district of index delivery

Fistula patients were more likely to be resident in rural part of their districts (OR=5.5, 95%CI=2.2 - 13.5) as shown in table 2.

Also, fistula patients were more likely to be staying further away from the nearest hospital with capabilities for caesarean section compared to women without fistula (mean difference of 12.8 miles, p-value < 0.0001) and hence more likely to pay higher public transport fare to access care compared to controls (mean difference = 0.5 Dollars, p-value < 0.0005). Also, fistula patients lived in places where the available means of transport to the nearest hospital in time of emergency is most likely to be by motorcycle/tricycle/bicycle or walking (OR= 4.8, 95%CI =1.9 – 12.3). Fistula patients were more likely to have delivered in a hospital (home /TBA delivery appear to be protective OR =0.24, 95% CI=0.08 – 0.64) as shown in table 3.

**Table 2:** Crude odds ratio of Socio-demographic risk-factors at index child birth

| Risk factors | OR (95% CI) $^{+}$ | P-Value |
|---|---|---|
| Age at index delivery in years | | |
| 20 and above | | |
| 19 and below | 13 (3.0 – 57.7) | <0.005 |
| Area of residence | | |
| Urban | | |
| Rural | 5.5 (2.2 – 13.5) | <0.001 |
| Employment status | | |
| Employed | | |
| Non-employed | 13.2 (4.0 – 43.8) | <0.001 |
| Educational status | | |
| Formal education | | |
| No formal education | 13.1 (4.2 – 45.9) | <0.001 |
| Health insurance status | | |
| Insured | | |
| Not insured | 5.3 (2.4 – 11.8) | <0.001 |
| Legal Marital status | | |
| Married | | |
| Not Married | 2.6 (1.1 – 5.8) | <0.05 |
| Distance in Miles to Hospital | | |
| Up to 10 | | |
| Above 10 | 11.5 (4.0 – 33.1) | <0.001 |
| Access to means of transport to hospital | | |
| Car/ Ambulance | | |
| Bicycle/walking | 4.8 (1.9 – 12.3) | <0.005 |
| Self-Ranked Economic Status | | |
| Rich | | |
| Poor | 4.1 (1.8 – 9.3) | <0.005 |

OR (95% CI)$^{+}$: Crude odds ratio (95% Confidence interval)

***Personal Factors related to OF***

The median age of fistula patients seeking care in the Tamale metropolis is 30 years (interquartile range=8 years). Fistula patients were more likely to have obtained the fistula at an age less than 20 years, MOR = 5.5 (p-value < 0.0001) as shown in table 2. They carried the fistula for a median 4 years at the time of presenting for treatment (interquartile range= 6years) ranging from 3 months to 19 years. Fistula patients have greater odds of being primiparous (OR=2.5, 95% CI=1.1 - 5.8) as shown in table 2. Fistula patients were relatively shorter and were more likely to be of height less than 150cm (OR=11.8, 95% CI=4.1 – 33.9). They were more likely to be unemployed (OR = 13.2, 95% CI = 3.0 – 43.8) and of no formal education (OR =13.9, 95% CI =4.2 – 45.9) as shown in table 2. Also, fistula patients have higher odds of being without national health insurance (OR = 5.3, 95% CI =2.7 – 11.8), currently single or cohabiting (OR=2.3, 95% CI =1.2 – 5.8) however less likely to be Muslims (OR= 0.5, 95% CI = 0.2 – 1.0) even though the Muslim religion is the dominant religion within the area of study.

**Table 3 –** Crude odds ratio of Obstetric risk factors at index child birth

| Obstetric risk factors | OR (95% CI) * | P-value |
|---|---|---|
| Parity | | |
| Multiparous | | |
| Primiparous | 2.5 (1.1 - 5.8) | <0.05 |
| Height in cm | | |
| Above 150 | | |
| 150 and below | 11.8 (4.1 – 33.9) | <0.001 |
| Place of delivery | | |
| Hospital | 4.2 (1.6 – 11.4) | <0.01 |
| Home/ TBA | | |
| Diagnosed of disease/complications in pregnancy | | |
| Not diagnosed | | |
| Diagnosed | 0.08 (0.01 – 0.7) | <0.05 |
| Total duration of labour in hours | | |
| Up to 24 | | |
| More than 24 | 8.3 (3.7 – 18.8) | <0.001 |
| Delivery Mode | | |
| Spontaneous vagina delivery | | |
| Operational delivery | 9.2 (3.8 – 22.1) | <0.001 |
| Delivery outcome | | |
| Baby born alive | | |
| Still birth | 32.9 (7.9 – 136.7) | <0.001 |
| Baby weight | | |
| Baby weighs less than 4kg | | |
| Baby weighs 4kg and above | 3.2 (1.4 – 6.9) | <0.005 |
| Family Planning status | | |
| Never used family planning | 4.0 (1.3 – 12.0) | <0.05 |
| Used family planning | | |

**OR (95% CI) *:** odds ratio (95% confidence interval)

Fistula patients were more likely to have attended ante-natal clinic (OR= 0.9, 95% CI= 0.3 – 2.4), were less likely to be diagnosed of any medical disease/ complication of pregnancy during all trimesters of the pregnancy (diagnoses of medical condition in pregnancy is protective, OR=0.08, 95%CI=0.01 – 0.65) and were less likely to have used herbal concoctions with suspected uterotonic activity (kaligotim) during the pregnancy or labour period (OR=0.5, 95% CI=0.3 – 1.3). Fistula patients were more likely to have delivered by operative delivery (caesarean section, instrumental delivery) when compared to controls (OR=9.2, 95% CI=3.8 – 22.1) as shown in table 3. In most cases, the outcome of the index delivery is stillbirth (OR=32.9, 95% CI=7.9 – 136.7). Finally, fistula patients were less likely to have used a modern family planning method and more likely to rate themselves poor or extremely poor in a self-ranked economic status rating (OR=4.1, 95% CI =1.8 – 9.3).

***Labour duration Factors related to OF***

Fistula patients were more likely to have laboured longer hours compared to controls. Mean difference between total duration of labour in hours is 27.6 hours (95% CI 20.6-34.6 hours). They were also more likely to have spent more hours at home before getting to the hospital (mean difference=9.2 hours, 95% CI=4.5-13.9 hours). Time interval from delivery to onset of fistula ranges from one day to sixty days. The median however is 2 days (interquartile range=8 days). On the average, fistula cases had higher matched odds of being in labour for more than 24hours (MOR 5.4 CI=1.6 -18.1) as shown in table 4.

***Ascribed causes of Obstetric Fistula among women***

Table 5 displays ascribed causes of Obstetric fistula. Most of fistula patients blame lack of health facilities as the main cause of obstetric fistula (52.9%). Health workers related errors was ranked 3rd by both fistula and control women. Among the controls that have some ideas about obstetric fistula, 66.7% think God or the gods are responsible for the fistula. Overall test of significance shows that, there exist significant difference between the perception of fistula patients and controls with regard to the causes of cases (Pearson chi square 35, p-value < 0.05).

**Effect of Obstetric fistula**

Patients seeking care for obstetric fistula have carried the condition for a median 4 years before seeking care in the fistula centre (interquartile range= 6years). Duration of fistula ranged from 3 months to 19 years. They were more likely to be unemployed (OR = 13.2, 95% CI = 3.0 – 43.8). Also, they are more likely to have no formal education (OR =13.9, 95% CI =4.2 – 45.9). Also fistula patients have higher odds of being currently single or cohabiting (OR=2.3, 95% CI =1.2 – 5.8). In most cases, the outcome of the index delivery was a stillbirth (OR=32.9, 95% CI=7.9 – 136.7).

**Table 4:** Adjusted[#] Matched Odds ratio of independent risk factors

| Characteristics at index delivery | Adjusted MOR* | 95% CI | P-value |
|---|---|---|---|
| Area of residence | | | |
| Urban | | | |
| Rural | 13.3 | 2.6 – 67.3 | <0.005 |
| Employment status | | | |
| Employed | | | |
| Non-employed | 15.7 | 2.6 – 93.3 | <0.005 |
| Educational status | | | |
| Formal education | | | |
| No formal education | 16.7 | 2.8 – 101.0 | <0.005 |
| Health insurance status | | | |
| Insured | | | |
| Not insured | 6.6 | 2.1 – 21.2 | <0.005 |
| Distance in Miles to Hospital | | | |
| Up to 10 | | | |
| Above 10 | 10.6 | 2.8 – 41.0 | <0.005 |
| Access to means of transport to hospital | | | |
| Car/ Ambulance | | | |
| Bicycle/walking | 8.7 | 2.2 – 35.4 | <0.005 |
| Self-Ranked Economic Status | | | |
| Rich | | | |
| Poor | 3.3 | 1.1 – 10.2 | <0.05 |
| Place of delivery | | | |
| Hospital | | | |
| Home/ TBA | 6.2 | 1.4 – 27.3 | <0.05 |
| Diagnosed of disease/complications in pregnancy | | | |
| Not diagnosed | | | |
| Diagnosed | 12.7 | 1.3 – 121.9 | <0.05 |
| Total duration of labour in hours | | | |
| Up to 24 | | | |
| More than 24 | 5.7 | 2.0 – 16.0 | <0.005 |
| Delivery Mode | | | |
| Spontaneous vagina delivery | | | |
| Operational delivery | 6.2 | 1.9 – 20.0 | <0.005 |
| Delivery outcome | | | |
| Baby born alive | | | |
| Still birth | 24.1 | 4.6 – 127.0 | <0.001 |
| Baby weight | | | |
| Baby weighs less than 4kg | | | |
| Baby weighs 4kg and above | 3.3 | 1.0 – 10.7 | <0.05 |
| Artificial contraception use status | | | |
| Ever used | | | |
| Never used | 6.9 | 1.3 – 35.6 | <0.05 |

Adjusted[#]: Adjusting for age at index child birth and height; MOR*: Matched Odds Ratio; reporting for only significant values

**Table 5:** Multiple response analysis of what women perceive as cause of obstetric fistula

| | | Controls | Cases | All participants |
|---|---|---|---|---|
| Rank | Perceived cause | N (%) | N (%) | N (%) |
| 1 | God/ gods | 22 (66.7) | 26 (51.0) | 48 (57.1) |
| 2 | Lack of health facilities | 18 (54.6) | 27 (52.9) | 45 (53.6) |
| 3 | Health worker related errors | 18 (54.6) | 22 (43.1) | 40 (47.6) |
| 4 | Poverty | 11 (33.3) | 12 (23.5) | 23 (27.4) |
| 5 | Big Baby | 10 (30.3) | 11 (21.6) | 21 (25.0) |
| 6 | Spiritual problem | 9 (27.3) | 7 (13.7) | 16 (19.1) |
| 7 | Work of enemies | 8 (24.2) | 7 (13.7) | 15 (17,9) |
| 8 | Curses/ punishment | 6 (18.2) | 4 (7.8) | 10 (11.9) |
| 9 | Kaligotim* intake | 5 (15.2) | 2 (3.9) | 7 (8.3) |

Finally, fistula patients were more likely to rate themselves poor or extremely poor in a self-ranked economic status rating (OR=4.1, 95% CI =1.8 – 9.3).

Among women who were married prior to the index child, there was higher incidence of divorce among cases compared to that of controls.

Divorce rate among cases over the period was 55.3% while that among the controls was 2.3%. Chi square test showed a significant difference in the marital status among study groups (Chi square 32.2, p-value < 0.001). Among fistula patients who were cohabiting prior to index child, all were currently separated. Alcohol consumption had increased among cases compared to that of controls such that fistula women were more likely to be currently taking alcoholic drinks compared to controls. 19.6% of cases were likely to be currently using alcoholic beverages compared to 6% in controls (OR=5.3, 95% CI= 1.4 – 19.7). Still birth rate of index delivery was about 85% among cases while about 15% among controls. About 41.2% of cases currently have no living child whereas only 2% of controls have no living child. Health shopping was common among fistula patient. About 37.3% of women with fistula tried alternative treatment for their condition before going to the hospital. Of this number, 65% visited spiritual churches and prayer camps, 30% visited the herbalist and tried various concoctions and 5% visited the traditionalist for rituals.

## Discussion

This study found out that, most of women who suffer obstetric fistula are young and illiterate. Young age, particularly age less than 20 years was significantly associated with obstetric fistula in this study. Other studies report a bi-modal age distribution of obstetric fistula with peaks at teenage and an age within the third decade of life[3]. This bi-modal pattern was not immediately obvious in this study, rather what could be described as a tri-modal distribution with peaks at ages 19, 25 and 29 years.

Fistula patients were relatively shorter and were more likely to be 150Cm or less .(OR=11.77, 95% CI=4.08 – 33.94). A study among women in Ethiopia found the mean height of fistula patients to be 149 cm (SD=8Cm)[16]. In this study however, the mean height of fistula patients was 152.4 Cm (SD= 5.2Cm).

One unique characteristic of obstetric fistula in this study contrary to other works outside Ghana is the strong association of Obstetric fistula with skilled attendant at delivery. Key factors in published work done outside Ghana seem to be conclusive on the fact that, OF patients were more likely to have delivered at home with unskilled attendant at birth. This was not the case in the Northern sector of Ghana where OF patient were more likely to have delivered in a hospital (home /TBA delivery appear to be protective OR =0.24, 95% CI=0.08 – 0.64). Also OF patients were more likely to have delivered the index child through caesarean section. The national report on the burden of fistula in Ghana published in 2015 by the Ghana Health Service and UNFPA also found also found out that over half of deliveries among Fistula patients resulted in Caesarean section[27]. The plausible explanations to this observation may be because of the following factors: In the Northern sector of Ghana, there is usually a long journey to the nearest hospitals and considerable amount of challenges in obtaining means of transport to the nearest hospital at certain times of the day. Hence, most pregnant women would normally deliver at home/ TBA with the difficult obstructed labour cases transferred to the hospital. As a result, the women with difficult obstructed labour were more likely to have been transported to the hospitals and delivered in the hospitals. This gave the initial impression that delivery at home or TBA's place is protective compared to hospital delivery. However adjusting for mode of delivery (spontaneous vaginal versus operative), the place of delivery (home versus hospital place of delivery) became insignificant. Mode of delivery remains significant after adjusting for all other variables depicting higher odds of Obstetric fistula among women delivered by caesarean section compared to those delivered by spontaneous vaginal delivery[26]. It could be argued that most of the cases presenting for caesarean section might have stayed too long with obstructed labour prior to presentation at the referral centre where the operative delivery took place and hence, the fistula might occur even with or without caesarean section. Also, in such prolonged obstructed labour scenarios, it is possible that hypoxic tissues become delicate and are more prone to injuries. The skills of doctors performing these caesarean sections were however not ascertained in this study and as such intra-operative injuries cannot be rule out. Further studies in this area can make this clear.

Total labour duration for more than 24 hours was significantly associated with development of Obstetric fistula in this study. This agrees with other works that attributed labour more than 24 hours with significantly increased incidence of obstetric fistula[18]. The national report on the burden of fistula in Ghana published in 2015 by the Ghana Health Service and UNFPA however noted that 50% of fistula patient had total duration of labour less than 12 hours with only 36% having duration of labour more than 24 hours[27]. A systematic review reported average duration of labour at home to range from 2.5 to 4 days[19]. In this study however, duration of labour at home ranges from 1 hour to 72 hours. Fistula patients laboured on the average, nine hours more before delivery compared to controls. Some factors are known to directly contribute to increase total duration of labour. The three delays: delay in decision making, delay in getting to the hospital, delay in the hospital all play a part in the increased total duration of labour. Health seeking behaviour is a known factor that influences the decision-making process that result in delays at home before getting to the hospital. Rural residency, distance from the nearest hospital with capabilities for caesarean section, high transport fare more than 1 Dollar from home to the nearest hospital with capabilities for caesarean section as well as lack of ambulance or car in

case of emergency were found in this study to be significantly associated with increased duration of total labour in hours. Also lack of formal education, low socio-economic status was also associated with increase duration of labour at home. Fistula patients were more likely to be resident in rural part of their districts (OR=5.47, 95%CI=2.22 - 13.46). Residency in rural areas where there is lack of good access roads and health facilities contribute to the delays in getting to the hospital. This factor is not peculiar to this study group. Research done elsewhere has demonstrated that fistula patients were more likely to be resident in remote areas prior to the development of Fistula[13-17].

Another factor associated with obstetric fistula is the high rate of illiteracy [20-25]. High illiteracy has been associated with obstetric fistula and is believed to correlate well with low social role as well as low socio-economic power, which complexly influence delay at seeking care. In this study, OF patients had higher odds of no formal education (OR =13.9, 95% CI =4.21 – 45.88). A study conducted by Tebeu et al in 2009 found out that 50% of women reported that they had received no antenatal care. We found contrary to the above, findings suggesting that, antenatal clinic attendance is protective against obstetric fistula. OF patients in this study were more likely to have attended antenatal clinic compared to controls (OR= 0.88, 95%CI= 0.33 – 2.35). "*Kaligotim*" a local herbal concoction frequently consumed by pregnant women to self induce labour and also speed up labour was not found to be associated with increased risk of developing OF. Its usage was rather associated with shorter duration of total duration of labour. This supports its suspected uterotonic activity.

Median age of fistula patient was 30 years, meaning most of the fistula occurs in women in their prime, working age. This has consequence on the productivity of this women and their contribution to their nation. This study also found out that, the median duration of onset of fistula to seeking of treatment is 4 years (interquartile range= 6years) ranging from 3 months to 19 years. This may compare with other findings by Leye et al. (2012) in a study of women suffering from obstetric fistula in southeastern Senegal concluded that the average time between the occurrence of Obstetric fistula and the first consultation was 50.7 months.[28] Comparing the divorce rate among study participants over the same period of time, one could conclude that fistula has a strain on the marriages of its victims as this study noted a divorce rate of 55.3% among cases compared to 2.3% among controls over the same time period.

With regard to ascribed causes of Obstetric fistula, there was paucity of knowledge of women about obstetric fistula. 60% of controls have no knowledge about the causes of obstetric fistula. This suggests that about 60% of women who develop fistula have no idea what the causes are. It is suggestible that these unfortunate victims of fistula are caught unawares by a "strange phenomenon". Among those who claim to have knowledge about the causes, most of the answers were not accurate. Even among fistula women, the leading ascribed cause of Obstetric fistula was God/ gods. Even though some studies have reported adequate knowledge of women about the causes of obstetric fistula,[15,20] this study agrees with studies citing lack of adequate knowledge of women on causes of Obstetric fistula.[19]

There were some limitations inherent in some of the variables on which data was collected. Measures were taken to reduce their effects. First, distance from the nearest hospital was based on estimates and could not be precise. However, a proxy to distance considered in this study was the transport fare from participant's residence to the nearest hospital with capabilities for caesarean section. Even though distance and the transport fare described above correlated well with each other, the transport fare when used in the analysis resulted in insignificant p-values. Secondly, the National Health Insurance (NHI) status with regards to pregnant women was of no significance because of Ghana's free maternal health policy, which means all pregnant women without health insurance can access care for free. Hence data on the NHI status were not considered in the final analysis.

## Conclusions

Obstetric fistula development in northern Ghana is influenced by the following; age below 20 years, total labour duration more than 24 hours and height 150 cm and below. Other factors include: stillbirth, operative delivery, residence in a rural area and lack of formal education. OF affects the quality of life of its victims. The knowledge of women on the causes of obstetric fistula was inadequate.

## Competing interest

The authors declare that they have no competing interests

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