Journal of Biometrics & Biostatistics

Getachew et al., J Biom Biostat 2015, 6:3
DOI: 10.4172/2155-6180.1000242

Review Article Open Access

Survival Analysis of Time to Recovery from Obstetric Fistula: A Case Study at Yirgalem Hamlin Fistula Hospital, Ethiopia

Tesfaye Getachew[1]*, Ayele Taye[2] and Shibiru Jabessa[3]

[1]*Department of Statistics, College of Natural Science, Jimma University, Jimma, Ethiopia*
[2]*Department of Statistics, School of Mathematical and Statistical Modelling, Hawassa University, Hawassa, Ethiopia*
[3]*Department of Statistics, College of Natural Science, Walaga University, Walaga, Ethiopia*

Abstract

Kaplan-Meier estimation method, Cox proportional hazard model and parametric regression model were applied. The Cox proportional hazard analysis indicated that older ages at first marriage, weight <50 kg, height of >150 cm, follow up of antenatal care, delivery at health center, duration of labour for <2 day, vaginal delivery, length and width of fistula <5 cm and intact of urethra significantly contribute to shorter stay in hospital to treated and physically cured. The result from Weibull regression analysis showed that older age at first marriage (adjusted HR=1.00), weight<50 kg (HR=0.409), height of >150 cm (Adjusted HR=1.00), follow up of antenatal care (adjusted HR=0.263), delivery at health center (adjusted HR=1.00), duration of labour (adjusted HR=0.127 for <2 day), vaginal delivery (adjusted HR=0.241), length of fistula (adjusted HR=0.342 for <2 cm, HR=0.426 for 3-5 cm), width of fistula (adjusted HR=0.147 for <2 cm, HR=0.356 for 3-5 cm) and intact of urethra (adjusted HR=0.439) significantly contribute to a shorter recovery time of a patient. In conclusions: The finding of this study showed that age at first marriage, height, antenatal care, weight, place of delivery, mode of delivery, duration of labour, length and width of fistula, and status of urethra were major factors affecting recovery time of obstetric fistula patient at Yirgalem Hamlin Fistula Hospital. It is recommended to make interventions based on these risk factors.

Keywords: Obstetric fistula; Physically cured; Kaplan-Meier; Cox proportional hazard; Weibull regression model

Introduction

Obstetric Fistula is a medical condition that involves an opening or perforation between the vagina and the bladder or the vagina and the rectum. In the developing world, obstetric fistula is a gynecological complication leading to urinary/fecal incontinence resulting mainly from prolonged obstructed labor. Even though there might be minor inter-country differences, the complication is mainly due to adolescent pregnancy from early marriage exacerbated by lack of access to emergency obstetric care [1,2].

Obstetric fistula victims are thought to come mainly from rural areas where no proper education on maternal health and related reproductive rights that could halt early marriage is available. As young women and girls are denied their reproductive rights, they are forced un-willingly into sexual relations that routinely lead to unwanted pregnancy and mostly obstetric fistula [3].

An effective fistula treatment should be comprised of healing the wound and accompanied by psychosocial therapies to assist women in regaining their self-esteem and to facilitate possible socio-economic reintegration. Ethiopia is one of the developing country with, poor maternal health care that leads over 100,000 girls and women living with a fistula, and further 9000 cases develop annually (WHO, 2006). The maternal mortality ratio estimated for Ethiopia is 673 per 100,000 live births [4].

Obstetric fistula affects numerous girls and women. Women affected by obstetric fistula have to suffer not only the consequence of losing their children, physical, psychological and but also subjected to social humiliation, shame and embracement. They become outcasts due to pungent smell and wetness from urinary incontinence [1].

The recovery time for obstetric fistula patients depends on different factors, such as socio- demographic and health condition factors. In this paper, we needs to assess risk factors and estimate and compare survival probabilities of time to recovery of obstetric fistula for levels of various risk factors. Obstetric fistula remains a major public health problem for many women in Ethiopia and other developing countries around the world. The incidence rate of obstetric fistula in countries with high mortality rate could be as high as 2 to 3 cases per 100 women and 4% of the women in Ethiopia aged 15-49 reported having obstetric fistula [5].

Despite the high incidence of fistulas in Ethiopia many women do not seek medical help promptly; findings suggest that delay in the decision to seek care may be caused by different factors. Lack of understanding of complications, the low status of women, socio-cultural barriers and physical barriers such as mountains, rivers and lack of transport added to the delay in reaching care [6].

Methodology

The data was taken from one of Ethiopia regional hospital at Yirgalem Hamlin fistula center, which is found in Sidama zone of SNNPR. In this study secondary data from hospital's registry was used to retrieve data on obstetric fistula and patient's initial date of entry to follow up. The Cochran [7] formulas were adopted to determine the sample size which is used in the study. A total of 360 patients were included in the study.

Survival Data Analysis: is a branch statistics which deals with data

***Corresponding author:** Getachew T, Department of Statistics, College of Natural Science, Jimma University, Jimma, Ethiopia, Tel: +251 47 111 1458; E-mail: tesfayegetachew65@yahoo.com

Received July 16, 2015; **Accepted** July 28, 2015; **Published** August 04, 2015

Citation: Getachew T, Taye A, Jabessa S (2015) Survival Analysis of Time to Recovery from Obstetric Fistula: A Case Study at Yirgalem Hamlin Fistula Hospital, Ethiopia. J Biom Biostat 6: 242. doi:10.4172/2155-6180.1000242

related to time to an event [8]. The survival distribution and Kaplan-Meier survival function estimation which are used for the estimation of the distribution of survival time from all of the observations available [9]. The Kaplan-Meier estimator of the survivorship function (or survival probability) S(t)=P (T ≥ t) is defined as:

$$\hat{S}(t) = \prod_{t_i<t}\left(\frac{n_i - r_i}{n_i}\right) = \prod_{t_i<t}\left(1 - \frac{r_i}{n_i}\right) \quad (1)$$

with the convention that $\hat{S}(t) = 1$ if $t<t_i$

where $r_{(i)}$ is the number of individuals who experience the recovery at $t_{(i)}$ and n_i is the number of individuals at risk right before $t_{(i)}$. After providing a description of the overall survival experience in the study, we usually turn our attention to a comparison of the survivorship experience in key subjects in the data.

Cox proportional hazard regression model

Cox proportional hazard regression model took a different approach to standard parametric survival analysis and extended the methods of the parametric Kaplan-Meier estimates to regression. Cox handled this by making no assumptions about the baseline hazard of individuals and only assumed that the hazard functions of different individuals remained proportional and constant over time. It is generally given by:

$$h_i(t, \mathbf{X_i}, \boldsymbol{\beta}) = h_0(t)\exp(\boldsymbol{\beta}'\mathbf{X_i}) \quad (2)$$

where $h_0(t)$ is the baseline hazard function that characterizes how the hazard function changes as a function of survival time, X_i is the vector values of n × 1 the explanatory variables for the ith individual at time t and, β is the vector of (p+1) × 1 unknown regression parameters that are assumed to be the same for all individuals in the study, which measures the influence of the covariate on the survival experience. The survival time of each member of the sample is assumed to follow its own hazard function.

Fitting Cox proportional hazard model

The likelihood function is a mathematical expression which describes the joint probability of obtaining the data actually observed on the subjects in the study as a function of the unknown parameters (the β's) in the model being considered. The formula for Cox model likelihood function is actually called a partial likelihood function rather than a (complete) likelihood function, as it considers only for those subjects who recover, and not for those subjects censored. The likelihood for right censored data includes both survival and hazard functions and is given by:

$$L(\boldsymbol{\beta} \mid data) = \prod_{i=1}^{n} h_i(t, \mathbf{X_i}, \boldsymbol{\beta})^{\delta_i} S_i(t, \mathbf{X_i}, \boldsymbol{\beta}) \quad (3)$$

Assumption of Cox proportional hazard model: Though the Cox model is nonparametric to the extent that no assumptions are made about the form of the baseline hazard, there are still a number of important issues which need to be assessed before the model results safely applied. Those are, the hazard ratio depends on covariates but not on time t, the hazard functions for two individuals with different predictor values does not vary with time.

Parametric Regression Models

The basis of this method was to avoid having to specify the hazard function completely. A parametric survival model assumes that the survival time follows a known distribution. Three most common distributions are used here: exponential, Weibull and lognormal [10].

The exponential regression model

Considering the time data is skewed to the right, distribution of the time is taken to be exponential. Then time of survival is called accelerated failure time, is expressed as:

$$T = \exp(\boldsymbol{\beta}'\mathbf{X} + \epsilon)$$

$$lnT = \boldsymbol{\beta}'\mathbf{X} + \epsilon^* \quad (4)$$

where, ϵ^* is the error component

The survivorship function can be obtained by expressing in terms of time as:

$$S(t, \mathbf{X}, \boldsymbol{\beta}) = \exp[-t\exp(-\boldsymbol{\beta}'\mathbf{X})] \quad (5)$$

And the hazard function of the exponential regression model is:

$$h(t, \mathbf{X}, \boldsymbol{\beta}) = \exp[-(\boldsymbol{\beta}'\mathbf{X})] \quad (6)$$

For the exponential regression survival models the hazard ratio for the dichotomous covariate is HR(x=1, x=0)=exp($-\beta_1$)

The Weibull Regression Model: Survival time t is a positive random variable, and we assumed to have Weibull probability density function expressed as:

$$f(t;\mu,\alpha) = \frac{\alpha}{\mu}\left(\frac{t}{\mu}\right)^{\alpha-1}\exp\left(\left(-\frac{t}{\mu}\right)^{\alpha}\right) \quad (7)$$

where, μ>0 and α>0 and the baseline hazard function of the distribution becomes:

$$h_0(t;\mu,\alpha) = \frac{\alpha}{\mu}\left(\frac{t}{\mu}\right)^{\alpha-1} \quad (8)$$

This yields the following survivor function.

$$S(t) = \exp\left[-\left(\frac{t}{\mu}\right)^{\alpha}\right] \quad (9)$$

And the cumulative hazards function becomes:

$$H(t) = \left(\frac{t}{\mu}\right)^{\alpha} \quad (10)$$

Depending on the value of α, the hazard function can increase or decrease with increasing survival time. Hence the Weibull model can yield an accelerated failure time model. Independent observations (t_i, δ_i), i= 1,...,n with survival time t_i and censoring indicator δ_i which has value of one if ith observation is not censored and zero when the ith observation is censored and Let β be the unknown parameter. The likelihood function is

$$L(\boldsymbol{\beta} \mid data) = \prod_{i=1}^{n}\left\{f(t_i)^{\delta_i}\left(s(t_i)\right)^{1-\delta_i}\right\} = \prod_{i=1}^{n}\left\{\left(\frac{f(t_i)}{s(t_i)}\right)^{\sigma_i} s(t_i)\right\}$$

$$= \prod_{i=1}^{n}\left\{\left(\frac{\alpha}{\mu}\left(\frac{t}{\mu}\right)^{\alpha-1}\right)^{\delta_i}\exp\left[-\left(\frac{t}{\mu}\right)^{\alpha}\right]\right\} \quad (11)$$

Reparameterizing the Weibull distribution using λ=μ−α, the baseline hazard function equation (8) becomes $h_0(t)=\lambda\alpha t^{\alpha-1}$. Now incorporate covariates X in the hazard function, the Weibull regression models become:

$$h(t;\mathbf{X},\boldsymbol{\beta}) = \lambda \alpha t^{\alpha-1}\exp(\boldsymbol{\beta}'\mathbf{X}) \tag{12}$$

The model assumes that individual i and j with covariates X_i and X_j have proportional hazard function of the form:

$$\frac{h(t;X_i)}{h(t;X_j)} = \frac{\exp(\beta' X_i)}{\exp(\beta' X_j)} = \exp(\beta'(X_i - X_j)) \tag{13}$$

The quantities $\exp(\boldsymbol{\beta})$ can be interpreted as hazard ratios. A different parameterization is used with intercept ν and scale parameter δ and covariate effects γ_j having relationship with original parameterization as $\beta_j = \frac{-\gamma_j}{\delta}$, $\alpha = \delta^{-1}$ and μ=exp(ν).

The Lognormal Regression Model: The log-normal model may take censored time de- pendent variable that allows the hazard rate to increase and decrease [8]. The log-normal model assumes that $\epsilon \sim N(0,1)$. Let h(t) be the hazard function of T when β=0 i.e $\beta_0=\beta_1=...=\beta_p=0$. Then, it can be shown that h(t) has the following functional form:

$$h(t) = \frac{\phi\left(\frac{log(t)}{\delta}\right)}{\left[1-\Phi\left(\frac{log(t)}{\delta}\right)\right]} \tag{14}$$

where, $\phi(t) = \frac{1}{\sqrt{2\pi}}\exp\left(\frac{-t^2}{2}\right)$ is the probability density function, and $\Phi(t) = \int_{-\infty}^{t}\frac{1}{\sqrt{2\pi}}\exp\left(\frac{-u^2}{2}\right)du$ is the cumulative distribution function of the standard normal distribution. Then, the log-hazard function of T at any covariate value X can be expressed as:

$$logh(t \mid \mathbf{X}) = logh_o te - \boldsymbol{\beta}'\mathbf{X} - \boldsymbol{\beta}'\mathbf{X} \tag{15}$$

Obviously we no longer have a proportional hazards model. If the baseline hazard function is desired, it can be obtained from equation (14) by setting x=0. The survival function S(t|X) at any covariate X can be expressed as:

$$S(t \mid \mathbf{X}) = \phi\left[\beta_0^* + \beta_1^* x_1 + \ldots + \beta_p^* x_p - \alpha log(t)\right] \tag{16}$$

where, $\alpha = \frac{1}{\delta}$, $\beta_j^* = \frac{\beta_j}{\delta}$ for j=0,1,...,p. This the final survival model with intercept depending with t.

Model Selection: To select the model that can predict the survival time of obstetric fistula patients, we used Akaikie information criterion (AIC) statistic to compare different models and/or models with different numbers of parameters Akaikie (1974). For each model the value is computed as:

$$AI\,C=-2log(likelihood)+2(p+k) \tag{17}$$

Where p denotes the number of covariates in the model without including the constant term and k is the number of parameters in the distribution, i.e. k=1 for the exponential regression model and k=2 for Weibull and lognormal regression models. According to the criterion, a model with small AIC value was considered as a best fit to the data.

Results

Total of 360 of obstetric fistula patients considered, 81.7% of them were physically cured while the rest 18.3% were censored. The average time of a patient stay in the hospital to treated and physically cured is 4.64 weeks. Using Kaplan-Meier survivor estimates and Log-rank (Breslow) tests for the age at first marriage below fifteen years had taken more time to physically cure than those who married between sixty to twenty years and above twenty years.

Comparing the survivor functions between follow up of antenatal care and no follow up of antenatal care of obstetric fistula patients, patient who have follow up of antenatal care had slightly shorter recovery time compared with patient who have no follow up of antenatal care service (Table 1, log-rank and Breslow tests shows P<0.001). Patient who had delivered at institutional had lower recovery time than those who delivered at home (p<0.001).

The recovery time for duration of labour based on Kaplan-Meier survivor estimates and Log rank test (Table 1) shows that patients who labour for <2 day were takes shorter time to cured (p<0.001). Patients with length and width of fistula hole <2 cm were faster to be physically cured than those who have greater than >2 cm. Patients With intact bladder neck and urethra were fast to recover (p<0.001). Kaplan-Meier survivor estimates and Log- rank (Breslow) tests for the non vaginal delivery had taken more time to physically cured than those who vaginal delivery. Based Kaplan-Meier and log rank test patients with height >150 cm have shorter recovery time than patient with <150 cm height (P<0.001).

From multiple covariates analysis, the hazard rate for being physically cured of a patient with age at first marriage<15 years 54.6% higher than patients those age at first marriage >20 years (adjusted HR=1.546, CI: 1.09, 2.19). The hazard rate for those patients were age at first marriage between 16 to 20 was 1.559 times greater than those whose age at first marriage above 20 years (adjusted HR=1.559, CI: 1.06, 2.28) this indicates that the physically cured for older age marriage were shorter recovery time than early marriage. Looking at the effect of weight of a patients with <50 kg after adjusting other confounding variables, the hazard rate for being physically cured of a patients with weight <50 kg was 0.699 times the hazard of those with weight ≥ 50 kg (adjusted HR=0.699, CI: 0.53, 0.91) this indicating that the recovery time was reduced by 30.1%.

The hazard rate of the patients with height <150 cm was 1.314 times that of patients with height ≥ 150 cm (95% CI: 1.01, 1.70) which means that the recovery time of patients with height <150 cm was extended by 31.4% when compared with height ≥ 150cm patients. After adjusting other covariates, the hazard rate for being physically cured of a patients having follow up of antenatal care, has been lowered by 32.8% as compared to the those who do not have follow up of the service (adjusted HR=0.672, CI: 0.51, 0.88). Place of delivery is the other covariate which has a significant impact on the physically cured of a patients, the hazard rate of patients who delivered at home was 1.481 times greater than those who delivered at institutional (adjusted HR=1.481, CI: 1.12, 1.96) which means that the recovery time of patients who delivered at home was extended by 48.1% when compared with who delivered at health center.

Looking at duration of labour, after adjusting other covariates, patients who had laboured for <2 day were found to be associated with shorter survival time within their pain, those hazard rate was 0.481 times that of patients who labored >4 day (adjusted HR=0.481, CI: 0.29. 0.79) this shows the recovery time of patients who laboured for <2 day was decreased by 51.9% and the decrement could be as high as 71% and as low as 21%. Similarly, the hazard rate of a patient whose were laboured 2-4 day was 0.670 times that of patients who had been labored >4 day (adjusted HR=0.670, CI: 0.49, 0.90). This indicates that hazard rate increases as duration of labour increases. Similarly, the hazard rate for being physically cured of patient who was vaginal delivered were

		Test of Equality over Groups					
Variables	**mean recovery time (in week)**	**Log Rank (Mantel-Cox)**			**Breslow (G.Wilcoxon)**		
		Chi-Square	**Df**	**sig.**	**Chi-Square**	**Df**	**sig.**
Age at marriage: <15	9.6						
<15	9.6						
15-20	4.989	19.65	2	0.001	13.225	2	0.001
>21	5.7						
Weight (kg)							
<50	5.55						
≥ 50	6.541	2.893	1	0.089	2.737	1	0.098
Height							
<150	6.583						
≥ 150	4.449	13.06	1	0.001	12.904	1	0.001
Marital status							
Not married	4.187						
Married	6.059	0.296	2	0.862	0.381	2	0.827
Divorced and							
widowed	5.765						
Educational status							
Not formal	6.227						
Some formal	5.423	0.16	1	0.689	0.053	1	0.818
Antenatal care							
Yes	4.045						
No	6.836	54.22	2	0.001	50.514	2	0.001
Place of delivery							
Home	7.067						
Institutional	4.188	29.34	1	0.001	20.483	1	0.001
Duration of labour							
<2 days	4.696						
2-4 days	5.634	20.2	2	0.001	18.644	2	0.001
>4 days	9.54						
incontinence							
≤ 3	6.743						
7 Apr	5.196	6.38	2	0.041	6.006	2	0.05
>7	5.698						
Mode of delivery							
Vaginal	4.421						
Others*	7.778	21.53	1	0.001	17.92	1	0.001
length of fistula(cm)							
≤ 2	4.384						
3-5	6.6	62.107	2	0.001	54.11	2	0.001
>5	12.174						
Width of fistula(cm)							
≤ 2	4.09						
3-5	5.894	69.019	2	0.001	51.836	2	0.001
>5	15.842						
Status of bladder							
Intact	3.816						
Partially damaged	6.195	77.685	2	0.001	57.509	2	0.001
Complete destructed	12.158						
Status of urethra							
Intact	3.766						
partially damaged	8.013	76.968	2	0.001	57.507	2	0.001
Complete destructed	12.946						
Over all mean	4.64						

*include like assisted vaginal and abdominal

Table 1: Comparison of survival time to recovery experience on obstetric fistula patients using demographic and health variables (at Yirgalem Hamlin Fistula Hospital, during 2011-2012).

0.541 times that of patients who had non-vaginal delivered (adjusted HR=0.541, CI: 0.39, 0.73).

Length of fistula hole is another covariate which has a significant impact on the recovery of a patients, the hazard rate of a patient's 0.512 (adjusted HR=0.512, CI: 0.31, 0.86) and 0.913 (adjusted HR=0.913, CI: 0.67, 1.25) who have length of fistula hole ≤ 2 cm and 3-5 cm, respectively. For which hazard rate is increases with length of fistula. Moreover, after adjusting other confounding variables, the hazard of patients having width of fistula hole ≤ 2 cm was 0.343 (adjusted HR=0.343, CI: 0.17, 0.67) times the hazard of those having width of fistula hole >5 cm. And the hazard of those patients having width of fistula 3-5 cm is 25.4% lower than those patients who have >5 cm (adjusted HR=0.746, CI: 0.55, 1.00), implies as width of fistula hole increases the hazard rate also increase.

Finally, the status of urethra has also a significant effect on the physical cured of obstetric fistula patient. The hazard rate for being physically cured of obstetric fistula patient with intact urethra were 0.544 times the hazard of those urethra complete destructed (adjusted HR=0.544, CI: 0.40, 0.73), this implies the recovery time of patient with intact of urethra was 45.6% lower when we compared with complete destructed of urethra. Whereas, the hazard rate for being physically cured of a patient with partially damaged urethra was 0.585 times that of complete destructed urethra (adjusted HR=0.585, CI: 0.33, 1.04). This indicates that partially damaged of urethra have shorter recovery time compared to complete destructed (Table 2).

Variables	β	SE	Wald	Df	sig.	HR	95% CI for HR
Age at marriage							
≤ 15	0.436	0.179	5.929	1	0.014	1.546	(1.09, 2.19)
16-20	0.444	0.195	5.185	1	0.022	1.559	(1.06, 2.28)
>20 (R)	0	1					
Weight							
<50 kg	-0.357	0.136	6.843	1	0.009	0.699	(0.53, 0.91)
≥ 50 kg (R)	0	1					
Height							
<150 cm	0.272	0.133	4.207	1	0.04	1.314	(1.01, 1.70)
≥ 150 cm (R)	0	1					
Antenatal care							
Yes	-0.397	0.136	8.509	1	0.003	0.672	(0.51, 0.88)
No (R)	0	1					
Place of delivery							
Home	0.392	0.142	7.651	1	0.006	1.481	(1.12, 1.96)
Institutional (R)	0	1					
Duration of labor							
<2 day	-0.397	0.151	6.869	1	0.008	0.481	(0.29, 0.79)
2-4 day	-0.727	0.249	8.474	1	0.003	0.67	(0.49, 0.90)
>4 day (R)	0	1					
Dur. of incontinence							
≤ 3 month	0.489	0.151	10.452	1	0.001	1.631	(1.17, 2.23)
4–7 month	0.501	0.176	2.852	1	1.60E-05	1.65	(1.21, 2.19)
>7 month(R)	0	1					
Mode of delivery							
Vaginal	-0.615	0.154	15.904	1	6.66E-05	0.541	(0.39, 0.73)
Others (R)	0	1					
Length							
≤ 2 cm	-0.908	0.16	0.32	1	0.571	0.512	(0.31, 0.86)
3-5 cm	-0.667	0.263	6.426	1	0.011	0.913	(0.67, 1.25)
>5 cm (R)	0	1					
Width							
≤ 2 cm	-0.293	0.152	3.717	1	0.053	0.343	(0.17, 0.67)
3-5 cm	-1.069	0.345	9.61	1	0.002	0.746	(0.55, 1.00)
>5 cm (R)	0	1					
Status of urethra							
Intact	-0.609	0.151	16.402	1	5.12E-05	0.544	(0.40, 0.73)
Partially damaged	-0.537	0.294	3.327	1	0.068	0.585	(0.33, 1.04)
Compl. destructed (R)	0						
AIC	2805.54						

SE: Standard Error; Df: Degree of freedom; HR: Hazard Ratio; CI: Confidence Interval; R: Reference

Table 2: The parameter estimates, standard errors and the hazard ratios of the Cox proportional hazards model of obstetric fistula patients (at Yirgalem Hamlin Fistula Hospital, during (2011-2012).

Parametric Regression Analysis

The Weibull Regression Analysis Results presented in Table 3 indicate the parameter estimates of coefficients $\hat{\beta}$ for the covariates in the final Weibull regression model along with the associated standard error, covariate effects (γ_j), significance level, hazard ratio and 95% confidence interval for the hazard ratio.

From the Weibull regression model, after fixing other coefficients, the hazard rate of a patient with age at first marriage ≤ 15 years were 50.8% higher than the hazard rate of a patient with >20 age at first marriage. And the hazard rates of first marriage with 16-20 years were 1.733% times that of a patient with age at first marriage >20 years. From result below, the hazard rate decreases for patients who had weight less than fifteen kilogram. The hazard rate of patients with height <150 cm were 2.399 times that of patient height ≥ 150 cm. The hazard rate of a patients who had follow up of antenatal care were 0.263 times that of patients who had no follow up of the service. Considering place of delivery of patients, the hazard rate of a patients who had delivered at home were 39.9% greater than that of who delivered at health center.

Looking at duration of labour, the hazard rate increase for patients who had labored <2 day (exp=0.127) to those patient who laboured for >4 day. Moreover, by letting other covariates constant, the hazard rate of a patients who delivered with vaginal were 0.241 time that of who delivered non-vaginal. As well the hazard rate increase for patients with fistula length and width becomes large and large. Finally keeping other covariates constant, the hazard rate of patients with intact urethra were 0.439 times that of complete destructed of urethra. And the hazard rate of a patient with partially damaged urethra was 0.558 times that of patient whose urethra was complete destructed.

Discussion

This study tries to estimate and compare the survival time to recovery probability with a given time of obstetric fistula patients

Variables	covariates effects((γi))	$\hat{\beta}$	SE	Wald	sig.	$\exp(\hat{\beta})$	95% CI for $\exp(\hat{\beta})$
Age at marriage							
≤ 15	-0.1484	0.411	0.451	0.83	0.17	1.508	(0.83, 2.71)
16-20	-0.1985	0.55	0.754	0.532	0.06	1.733	(0.73, 4.06)
>20 (R)	0	1					
Weight							
<50 kg	0.3212	-0.892	0.122	53.457	0.003	0.409	(0.23, 0.74)
≤ 50*kg*(*R*)	0	1					
Height							
<150cm	-0.3151	0.875	0.832	1.106	0.012	2.399	(1.21, 4.73)
≥ 150cm (R)	0	1					
Antenatal care							
Yes	0.48	-1.333	0.096	192.804	0	0.263	(0.13, 0.54)
No (R)	0	1					
Place of delivery							
Home	0.3302	-0.917	0.177	26.841	0.039	1.399	(0.96, 1.76)
Institutional(R)	0	1					
Duration of labour							
<2 day	0.7404	-2.056	0.055	1397.4	0	0.127	(0.05, 0.29)
2-4 day	0.9228	-2.562	0.05	2427.45	0	0.077	(0.02, 0.27)
>4 day (R)	0	1					
Mode of delivery							
Vaginal	0.5124	-1.423	0.093	234.122	0	0.241	(0.11, 0.51)
Others (R)	0	1					
Length							
≤ 2 cm	0.386	-1.072	0.153	49.092	0.017	0.342	(0.14, 0.83)
3-5 cm	0.3072	-0.853	0.192	19.737	0.058	0.426	(0.17, 1.03)
>5 cm (R)	0	1					
Width							
≤ 2 cm	-0.0493	0.137	0.414	0.109	0.704	0.147	(0.16, 1.33)
3-5 cm	0.3719	-1.033	0.196	27.777	0.061	0.356	(0.12, 1.05)
>5 cm (R)	0	1					
Status of urethra							
Intact	0.2956	-0.821	0.156	27.697	0.021	0.439	(0.22, 0.88)
Partially damaged	0.2099	-0.583	0.297	3.853	0.274	0.558	(0.19, 1.58)
C.destructed(R)	0	1					
AIC	1153.8						

SE: Standard Error; R: Reference

Table 3: The parameter estimates, standard errors and the hazard ratios in the final Weibull regression model of obstetric fistula patients (at Yirgalem Hamlin Fistula Hospital, during (2011-2012).

and to determine major predictive factors on the recovery time of obstetric fistula patients. The Cox's proportional hazard model fitted using complete case analysis found eleven variables that can serve as predictive factors on the recovery of obstetric fistula patients. These are age at first marriage, weight, height, follow up of antenatal care, duration of labour, place of delivery, mode of delivery, duration of incontinence urine, length, width of fistula and status urethra. The parametric regression models also included in this study which do not assume constant baseline hazard except for exponential regression models.

One of the factors that affect recovery from obstetric fistula is the patient's age at first marriage. The hazard of a patient who had married early before fifteen years was higher as compared to patient who had married after twenty years. This result is in accordance with the study in Ethiopia by Muleta (2004) [11]. Weight of a patient is an important predictor for the recovery of obstetric fistula patient. This study shows that the hazard rate of a patient with weight <50 kg is higher as compared to those whose weight ≥ 50 kg. This indicates that smaller weight increases the chance of recovery as compared to higher weight.

Height of a patient is a prognostic factor that significantly predicts the recovery time of obstetric fistula patient. The hazard rate of a patient with height was <150 cm were much higher. That is, taller patient is more likely to recover than shorter one. The result is comparable with earlier study [1,12,13]. For antenatal care use, the study revealed that the hazard rate of a patient who had no follow up of antenatal care is higher than those who had antenatal care service. Use of antenatal care service improves the chance of recovery. These results confirm the result obtained from the previous studies in Ethiopia [14].

Duration of labour is an important predictor for the recovery of obstetric fistula patient. This study shows that the hazard rate of a patient who had laboured for >4 day is higher than those who laboured for <2 day. That is, a shorter time of obstructed labour is more likely to recover than long time laboured patient. The result is comparable with the earlier study in [15-17]. Similarly, place of delivery is the stronger predictor for recovery time of obstetric fistula patient. The hazard rate of home delivery is 1.481 and 1.339 times greater than those who delivered at institutional in Cox and Weibull regression model respectively. Which means, patient who delivered at health center have more chance to recover than patient who delivered at home. This result is in accordance with the studies from Niger by Haroun et al. [18].

The mode of delivery is another prognostic factor that significantly predicts the recovery time of obstetric fistula patient. The result obtained from this study indicates the hazard rate of non-vaginal delivery (like assisted vaginal and abdominal) is about 45.1% and 75.9% higher than those who delivered vaginally using both methods. This shows that the recovery time for vaginal delivery of a patient is shorter than non-vaginal delivery. These results confirm the result obtained from the previous studies [19-21].

The length and width of fistula has been found to be significant predictor for recovery of obstetric fistula patient. This indicates that smaller size of length and width of fistula in-creases the chance of recovery as compared to large size of length and width of fistula hole. The result is comparable with earlier study [22-24]. In addition to those factors, status of urethra also had a significant effect on the recovery time of obstetric fistula patient. The finding illustrate that the hazard of recovery due to obstetric fistula patient is higher for patients who had complete destructed of urethra than those who had intact and partially damaged of urethra [25-29].

Conclusions

The objective of the study was to identify significant risk factors that affect recovery time of obstetric fistula patients who have been under follow-up at Yirgalem Hamlin Fistula Hospital. For determining the risk factors of physically cured of obstetric fistula patients and modeling the survival time, a total of 360 patients were included in the study out of which 81.7% were physically cured and the rest 18.3% were censored. Patient involved in risk of demographic factors indicators are early marriage and those of height was <150 cm. Similarly, patients with poor health indicators like no follow up of antenatal care, at home delivery, laboured for >4 day, non-vaginal delivery (like assisted vaginal and abdominal delivery), weight of <50 kg, incontinence of urine, length and width of fistula >5 cm and complete destructed of urethra, were less likely to physically cured. It recommended that awareness have to be given for the society on those risk factors.

References

1. Wall LL, Karshima JA, Kirschner C, Arrowsmith SD (2004) The obstetric vesicovaginal fistula: characteristics of 899 patients from Jos, Nigeria. Am J Obstet Gynecol 190: 1011-1019.
2. Muleta M, Hamlin C, Fantahun M, Kennedy RC Tafesse B (2008) Health and Social Problems Encountered by Treated and Untreated Obstetric Fistula Patients in Rural Ethiopia. International Journal of Obstetrics and Gynecology 112: 1328-1330.
3. UNFPA, Engender Health (2003) Obstetric Fistula Needs Assessment Report: Findings from Nine African Countries, New York.
4. Central Statistical Agency (2008) Summary and Statistical Report of the 2007 Population and Housing Census; population Size by Age and Sex. Addis Ababa, Ethiopia, FDRE Population Census Commission. P 113.
5. Sunil T, Sagna M (2009) Analysis of Obstetric Fistula in Ethiopia. Journal of Family and Reproductive Health 3: 109-114.
6. Kijugu D (2009) Analysis of Factors that Contribute to High Number of Maternal Deaths in Singda Region Tanzania. Royal tropical institute.
7. Cochran G (1977) Sampling Technique. John Wiley and Sons, New York.
8. Aalen O, Borgan O, Gjessing HK (2008) Survival and Event History Analysis, Springer publications.
9. Elisa TL, Wang JW (2003) Statistical Methods for Survival Data Analysis (2ndedn.) Wiley-Interscience.
10. Steve S (2008) Survival Analysis for Epidemiologic and Medical Research.
11. Muleta M (2004) Socio-demographic profile and obstetric experience of fistula patients managed at the Addis Ababa Fistula Hospital. Ethiop Med J 42: 9-16.
12. Arrowsmith S, Hamlin EC, Wall LL (1996) Obstructed labor injury complex: obstetric fistula formation and the multifaceted morbidity of maternal birth trauma in the developing world. Obstet Gynecol Surv 51: 568-574.
13. Creanga AA, Ahmed S, Genadry RR, Stanton C (2007) Prevention and treatment of obstetric fistula: Identifying research needs and public health priorities. Int J Gynaecol Obstet 99 Suppl 1: S151-154.
14. Gessessew A, Mesfin M (2003) Genitourinary and rectovaginal fistulae in Adigrat Zonal Hospital, Tigray, north Ethiopia. Ethiop Med J 41: 123-130.
15. Cisse CT, Faye EO, de Bernis L, Dujardin B, Diadhiou F (1998) [Cesarean sections in Senegal: coverage of needs and quality of services]. Sante 8: 369-377.
16. Van DJ, Stekelenburg J, Schutte J, Walraven G, Roosmalen J (2007) The use of Audit to Identify Maternal Mortality in Different Settings: Is it just a Difference Between the Rich and the Poor. Healthc Q 10: 133-138.
17. Tebeu PM, Ngassa P, Mboudou E, Kongnyuy E, Binam F, et al. (2008) Neonatal survival following cesarean delivery in northern Cameroon. Int J Gynaecol Obstet 103: 259-260.
18. Haroun AY, Seidou A, Maikano S, Djabeidou J, Sangare A (2001) La Fistula Vesico-Vaginal De Cause Obstetricale: Enquete Aupres De 52 Fimes Admises Au Village Des Distuleuses. Med Afr N 48: 55-59.

19. Jonas U, Petri E (1984) Genitourinary Fistulae. In Stanton SL Ed. Clinical Gyneco- logic Urology. St Louis CV Mosbey 238-255.

20. Symmonds RE (1984) Incontinence: vesical and urethral fistulas. Clin Obstet Gynecol 27: 499-514.

21. Lee RA, Symmonds RE, Williams TJ (1988) Current status of genitourinary fistula. Obstet Gynecol 72: 313-319.

22. Moghimi-Dehkordi B1, Safaee A, Pourhoseingholi MA, Fatemi R, Tabeie Z, et al. (2008) Statistical comparison of survival models for analysis of cancer data. Asian Pac J Cancer Prev 9: 417-420.

23. AbouZahr C (2003) Global burden of maternal death and disability. Br Med Bull 67: 1-11.

24. Cox DR, Oakes D (1984) Analysis of Survival Data. Chapman and Hall, London.

25. Ockrim JL, Greenwell TJ, Foley CL, Wood DN, Shah PJ (2009) A tertiary experience of vesico-vaginal and urethro-vaginal fistula repair: factors predicting success. BJU Int 103: 1122-1126.

26. Kaplan EL, Meier P (1958) Nonparametric Estimation from Incomplete Observations. J Am Stat Assoc 53: 457-481.

27. Vangeenderhuysen C, Prual A, Ould el Joud D (2001) Obstetric fistulae: incidence estimates for sub-Saharan Africa. Int J Gynaecol Obstet 73: 65-66.

28. Wall LL, Arrowsmith SD, Briggs ND, Browning A, Lassey A (2005) The obstetric vesicovaginal fistula in the developing world. Obstet Gynecol Surv 60: S3-3S51.

29. [No authors listed] (1994) World Health Organization partograph in management of labour. World Health Organization Maternal Health and Safe Motherhood Programme. Lancet 343: 1399-1404.