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POST-PARTUM HEMORRHAGE IN DELTA STATE, NIGERIA: A LOGISTIC APPROACH

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ABSTRACT: *Postpartum Hemorrhage (PPH) is a leading cause of maternal morbidity and mortality relating to pregnancy especially in less developed and developing countries, as it accounts for about 44,000 - 60,000 death yearly (WHO 1991). This study is designed to extract the risk factor(s) associated with PPH. A logistic regression analysis was used to develop a model for predicting the likelihood of a patient (mother) developing PPH, significant risk factors associated with PPH were identified and suggestions on ways of reducing PPH occurrence were made. Risk factors such as Type of delivery, professionals who handled the delivery and maternal age were found to be significantly associated with PPH ($p < 0.05$), while other risk factors; foetal length, birth weight, head circumference, HIV status, parity e.t.c has p-value > 0.05 and hence not significant.*

KEYWORDS: Postpartum Hemorrhage; Maternal Morbidity,

INTRODUCTION

Traditionally, Postpartum Hemorrhage (PPH) has been defined as blood loss in excess of 500 mL after a virginal birth and over 1000 mL after a cesarean delivery (Andersen et al, 2008). It is considered the leading cause of pregnancy related deaths worldwide, with an estimated 140,000 women dying annually from this complication equating to 1 every 4 minutes (Kramer 1987, WHO 1991). Recently, several industrialized countries including Australia, United Kingdom, Canada and the United States have reported increasing incidence of postpartum hemorrhage, here in Nigeria, a-twelve-year analysis of mortalities in Ilorin Kwara State shows that PPH accounts for over twenty three percent (23.3%) of maternal mortality. (Oguntoyinbo et al 2006). Thus, it remains one of the leading causes of death in Africa. According to WHO (1991), 25% of all maternal mortality are due to postpartum hemorrhage, 99% of which occurs in developing countries. Besides death, PPH also is an important cause of pregnancy-related morbidity. It is well recognized that appropriate obstetric management and access to blood transfusion and, if necessary, hysterectomy, can prevent mortality and severe morbidity once PPH occurs (Luis Keith 2000). Although risk factors and preventive strategies are clearly documented, not all cases are expected or avoidable. Uterine atony is responsible for most cases and can be managed with uterine massage in conjunction with oxytocin, prostaglandins, and ergot alkaloids. Retained placenta is a less common cause and requires examination of the placenta, exploration of the uterine cavity, and manual removal of retained tissue. Rarely, an invasive placenta causes PPH and may require surgical management. Traumatic causes include lacerations, uterine rupture, and uterine inversion. Coagulopathies require clotting factor replacement for the identified deficiency. An international PPH collaborative group met and publish a summary of the recent evidence, as well as recommendations for future surveillance and research. Reasons speculated for the temporal increase include maternal obesity, previous caesarean session, multiple pregnancy and differences in the management of labour. Evidence supporting these possible

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explanations is extremely limited. Thus, we decided to take advantage of the hospital database of Federal Medical Centre Asaba, Federal Medical Centre Agbor, Ekpan Government Hospital Warri, Baptist Medical Centre Eku, and Mariere Memorial Central Hospital Ughelli., comprising 500 cases of deliveries which contains variables such as the maternal age, parity, smoking during pregnancy, history of infertility, previous history of spontaneous abortion, previous caesarean section, other uterine surgery, infant birth weight, foetal length head circumference, abdominal placentation, induction of labour, cervical or virginal trauma, pre-eclampsia which may as well contribute to or act as a risk factor for Postpartum hemorrhage. This paper therefore is aimed at extracting the significant risk factors associated with Postpartum Hemorrhage and, developing a model which could help to predict the chance of a patient (mother) developing Postpartum Hemorrhage.

METHODOLOGY

A hospital-based historical cohort study based on consecutive deliveries recorded in a perinatal record system was carried out. The study sample was restricted to deliveries that occurred between January 1, 2013 to December 31,2014. PPH was coded as "yes" or "no" on the basis of the delivering obstetrician's estimate of blood loss during and after delivery: > 500mL for vaginal deliveries and > 1000mL for Caesarean section. Descriptive statistics of the potential risk factors in the overall sample of deliveries over the study period were analyzed, binary logistic regression analysis was used to achieve the aim of this study.

Models reviewed and applied in this paper includes;

Logistic Regression Model

The Logistic model helps us in obtaining the Odds of PPH occurring giving a particular exposure. It is given as;

$$P = \frac{e^{\alpha + \beta_o + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots + \beta_i X_i}}{1 + e^{\alpha + \beta_o + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots + \beta_i X_i}}$$

Odds Ratio

To obtain a measure of association between an exposure and PPH, we apply the Odds ratio formular given by;

$$O.R = \frac{\pi_i}{1 - \pi_i}$$

Wald Test

To test for the significance of the parameters and/or coefficients we applied the Wald Statistics given as;

$$Z = \left(\frac{\hat{\beta}}{S.E}\right)^2$$

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which asymptotically follows a χ^2 distribution with **1** degree of freedom.

Hosmer - Lemeshow Goodness of Fit

To check if the observed event rate matched the expected event rate in subgroup of the modeled population, the Hosmer-Lemeshow test was applied. Giving by the statistic

$$H = \sum_{g=1}^{G} \left\{ \frac{(O_g - E_g)^2}{N_g \pi_g (1 - \pi_g)} \right\}$$

which asymptotically follows a χ^2 distribution with **G-2** degree of freedom.

where,

O_g is the Observed event rate
E_g is the expected event rate
N_g is the number of observations
π_g is the predicted risk in the g^{th} decile group
G is the number of groups

The Nagelkerke's R - Square

To measure the quality of the predicted model, we applied the Nagelkerke's R^2 given by the statistic;

$$R^2 = 1 - \left(\frac{L(0)}{L(\hat{\theta})}\right)^{2/n}$$

$$R^2_{max} = 1 - \left(L(0)\right)^{2/n}$$

$$R^2 \text{ (Nagelkerke)} = \frac{R^2}{R^2_{max}}$$

Data Analysis and Result

Table 1: Descriptive Summary for Categorical Variables.

Variables		No of cases	% of cases
Hemorrhage	No	364	72.8%
	Yes	136	27.2%
Delivery Type	CS	124	24.8%
	SVD	376	75.2%
Gravida	Gravida 1 - 3	329	65.8%
	Gravida ≥ 4	171	34.2%
HIV Status	Positive	125	25%
	Negative	376	75.2%

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Delivery Expert.	Midwives	264	52.8%
	Doctors	236	47.2%
Condition of Perineum	280	280	56%
	220	220	44%

Table 2: Descriptive Summary for Non Categorical Variables.

Variables	Mean	Standard deviation
Maternal Age (yrs)	30.12	4.21
Child birth weight (kg)	3.38	0.68
Foetal Length (cm)	51.11	3.26
Head Circumference (cm)	36.21	2.11

Table 3: Classification Analysis.

	Observed	**Predicted**		
		Hemorrhage		**Percentage Correct**
		No	**Yes**	
Step 1	**Hemorrhage**	340	24	94.3
	No	96	40	51.2
	Yes			93.6
	Overall Percentage			
Step 2	**Hemorrhage**	354	10	98.5
	No	106	30	46.5
	Yes			92.1
	Overall Percentage			
Step 3	**Hemorrhage**	331	33	92.1
	No	110	26	43.1
	Yes			96.1
	Overall Percentage			

Table 3 above shows that the third and final iteration, 96.1% of the cases were correctly classified as either hemorrhage (with a cut value of 0.500 for its predicted probabilities). Hence, the model is close to perfection.

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Table 4: Test of Model Fit (Hosmer and Lemeshow Test)

Step	Chi - Square	Df	Sig.
1	.000	0	
2	5.081	7	.165
3	4.641	8	.725

The Hosmer and Lemeshow goodness of fit statistic which is the appropriate test for model fit for the Logistic Regression shows that the model is well fitted. ***(χ^2 = 4.641, P-value = .725)***

Table 5: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	195.351[a]	.440	.524
2	176.617[b]	.523	.618
3	160.942[c]	.581	.792

Nagelkerke R Square suggests that the model roughly explains 79.2% of the variation in hemorrhage situation.

Table 6: Variable in the Equation

		β	**S.E**	**Wald**	**Df**	**Sig.**	**Exp (β)**
Step 1[a]	Dei_Type(1)	2.866	.702	16.668	1	.000	17.567
	Constant	-1.109	.209	28.160	1	.000	.330
Step 2[b]	Age	0.695	.098	50.294	1	.000	2.004
	Dei_Type(1)	3.101	.461	45.248	1	.000	22.220
	Constant	-2.361	.394	35.909	1	.000	.094
Step 3[c]	Age	1.017	.124	67.266	1	.000	2.765
	Del_Type (1)	4.866	.436	124.558	1	.000	129.801
	Del_Expert (1)	1.886	.401	22.120	1	.000	6.593
	Constant	-3.542	1.609	4.846	1	.002	.029

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The Fitted Model for prediction is:

ln (Odds) = -3.542 + 1.017(Age) + 2.156 (Del_Expert) + 4.866 (Del_Type

Table 7: Odds Ratio

Variable in the Equation	Exp (β)
Age	2.765
Del_Type(1)	129.801
Del_Expert(1)	8.637
Constant	.029

Age of the Mother: For every unit increase in the Age of the mother, the odds of Postpartum Hemorrhage occurring is 2.765 when all other independent variables are controlled.

Delivery Type: The odds of Postpartum Hemorrhage occurring is 129.801 times higher for C/S(Caesarean Section) as opposed to SVD(Spontaneous Vaginal Delivery) when all other independent variables are controlled.

Delivery Expert: The odds of Postpartum Hemorrhage occurring is 8.637 times higher for Midwives as opposed to Medical Doctors when all other independent variables are controlled.

Table 8: Ranking of Risk Factors for Postpartum Hemorrhage

S/N	Risk Factors	Wald Statistics	P - Value	Remark
1.	Delivery Type	128.558	.000	Significant
2.	Maternal Age	67.266	.000	Significant
3.	Delivery Expert	22.120	.000	Significant
4.	Birth Weight	2.410	.135	Not Significant
5.	Gravida	2.229	.128	Not Significant
6.	Foetal Length	2.086	.122	Not Significant
7.	HIV Status	2.007	.195	Not Significant
8.	Head Circumference	1.889	.211	Not Significant
9.	Condition of Perineum	1.351	.203	Not Significant

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CONCLUSION

Maternal Age, Type of Delivery, and professionals who handled the delivery process are the major risk factors associated with the occurrence of Postpartum Hemorrhage. Since an increase in maternal age increase the likelihood of PPH, hospital management are hereby advised to pay more attention to mothers above the mean age (30 yrs) during delivery. Also, sensitization programs should be organized for midwives, on the effect of Postpartum Hemorrhage, and deliveries which should be handled by midwives should be supervised by an experienced doctor to reduce/avoid delivery complications especially Postpartum Hemorrhage. Caesarean section being the leading risk factor of Postpartum Hemorrhage should be properly done by specialists to reduce the chances of PPH and more importantly, maternal mortality.

Note: Should there be any of the above suggestions which may lead to an adverse effect worse than that of the hemorrhage itself, it is suggested that the Ministry of Health, W.H.O, and other concerned bodies found a way of adjusting the suggestions made.

REFERENCES

Agresti. Alan "An introduction to Categorical Data Analysis," John Wiley And Sons Inc, 1996.

Kotogal, Ales, K., Druzin, M., and Santini, D, "Impact of Advanced Maternal Age on the Outcome of Pregnancy" Journal of Surgical Gynecology And Obstetrics, 171, 209-216, 1993

Oguntoyinbo A.E., Amole A.O.D and Aboyeji A.O. "Relationship between normally implanted placenta and estimated Postpartum blood loss." West African Journal of Ultrasound 2003.

Palei, S.K. and Das, S.K.. 2009. Logistic Regression model for Prediction.

Perry, L. "A Multidisciplinary Approach to the Management of Pregnant Patients." Journal Of Perinatal And Neonatal Nursing." 8, 12-19, 1994

Stafford, I; Dildy, G.A; Clark, S.L; "Visually estimated and calculated blood loss in vaginal and cesarean delivery." Am J Obstetric Gynecol.; 199:5E1-517E7, 2008

World Health Organization, Make every mother and child count. Geneva: WHO; 2005.

World Health Organization, Maternal Mortality in 2000; estimates developed by WHO, UNICEF, and UNFPA. Geneva: WHO; 2004.

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