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### RESEARCH ARTICLE

#### PERINATAL RISK FACTORS ASSOCIATED WITH BIRTH ASPHYXIA AMONG TERM NEONATES AT COUNTY REFERRAL HOSPITAL, KENYA.

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#### Abstract

Despite the important advances in perinatal care in the past decades, asphyxia remains a severe condition leading to significant mortality and morbidity. Perinatal asphyxia has an incidence of 1 to 6 per 1,000 live full-term births, and represents the third most common cause of neonatal death (23%) after preterm birth (28%) and severe infections (26%). The objective of this study was to determine the risk factors associated with Birth asphyxia in order to develop preventive interventions to reduce neonatal morbidity and mortality. This was retrospective institutional based study which involved all neonates born at term diagnosed with and without birth asphyxia. Systematic sampling was utilized as the researcher was interested in neonates with and without birth asphyxia. Data for analysis was captured via SPSS version 19 and summaries such as means, percentages and standard deviations were generated. Out of total 422 neonates, 123 (29.1%) had birth asphyxia and rest 299 (70.9%) were normal. Significant socio-demographic risk factors were maternal age (OR 3.0 CI 95% 1.9 – 4.9, <0.0001), education level (OR 3.8259; CI 95% p-value <.0001) and parity (OR 1.81; CI 95% 1.08-3.02; p-value=0.0226). There are numerous risk factors that can be linked to sequence of birth asphyxia and they may vary from one context to another. Socio-demographic: risk factors of birth asphyxia included mother's age, education level and parity. The study recommends that more care to be given to younger mothers at the time of delivery because they are thrice at risk of birth asphyxia compared to older mothers. In addition, community health workers should be trained for emergency obstetric care, basic newborn care including preliminary resuscitation measures to provide skilled birth attendance and encourage early recognition and referral for early interventions.

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#### Introduction:-

Despite the important advances in perinatal care in the past decades, asphyxia remains a severe condition leading to significant mortality and morbidity. The term "asphyxia" is derived from the Greek and means "stopping of the pulse". Perinatal asphyxia is a condition characterized by an impairment of exchange of the respiratory gases

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(oxygen and carbon dioxide) resulting in hypoxemia and hypercapnia, accompanied by metabolic acidosis (Antonucci *et al.*, 2014).

Globally, hypoxia of the newborn (birth asphyxia) or the fetus (“fresh stillbirth”) is estimated to account for 23% of the 4 million neonatal deaths and 26% of the 3.2 million stillbirths each year. An estimated 1 million children who survive birth asphyxia live with chronic neurodevelopmental morbidities, including cerebral palsy, mental retardation, and learning disabilities (Lee *et al.*, 2008).

Birth asphyxia is a serious clinical problem worldwide and contributes greatly to neonatal mortality and morbidity. Each year approximately 24% of neonatal deaths occurred due to birth asphyxia with an equal number of survivors with serious neurological sequelae, such as cerebral palsy, mental retardation and epilepsy leading to detrimental long term consequences for both child and family (Aslam *et al.*, 2014). The three major causes of neonatal deaths worldwide are infections (36%, which includes sepsis/pneumonia, tetanus and diarrhea), pre-term (28%), and birth asphyxia (23%). There is some variation between countries depending on their care configurations (2010 to 2015 WHO report).

Most developing countries have witnessed substantial declines in under 5 mortality (UN Inter-Agency Group 2013). Neonatal deaths have remained stagnant with an estimated 3 million annual neonatal deaths occurring globally (Lawn *et al.* 2014). Recent estimates showed that annual reduction rate in neonatal mortality between 1990 and 2012 (2%) was much lower than that for children aged 1 - 59 months (3.4%). Birth asphyxia (BA) is one of the leading causes of newborn mortality (UN, 2013)

Three quarters of neonatal deaths occur within the first week of life and the highest risk of dying is within the first 24 hours. Almost all (99%) neonatal deaths occur in low and middle income countries. The top three causes of newborn death in Africa are severe infections (28%), Birth asphyxia (27%), and prematurity (29%) (KDHS, 2012). Birth asphyxia is a major cause of neonatal death especially in developing countries and is defined as the inability of the newborn to initiate and sustain adequate respiration after delivery (Ezechukwu, Ugochukwu, Egbuonu, & Chukwuka, 2004). Of the 130 million infants born every year globally, about four million die in the first four weeks of life- the newborn period (Lawn, Cousens, & Zupan, 2005). According to (KDHS 2014,) western Kenya is leading in infant mortality rate at 122.5 per 1000 live births in Kenya this is where the Kakamega county hospital fall in. Currently, there is no documented data on determination on perinatal risk factors on birth asphyxia in Kakamega county and referral hospital to the knowledge of the researcher; however the raw data in NBU shows that 50% of admissions in the unit of total admissions per month are due to BA.

#### **Statement of the Problem:-**

Globally, hypoxia of the newborn (birth asphyxia) or the fetus (“fresh stillbirth”) is estimated to account for 23% of the 4 million neonatal deaths and 26% of the 3.2 million stillbirths each year. An estimated 1 million children who survive birth asphyxia live with chronic neuro-developmental morbidities, including cerebral palsy, mental retardation, and learning disabilities (Lee *et al.*, 2008). Neonatal mortality is a very significant contributor of infant mortality in Kenya and also in the entire world. It accounts for 43% of the infant mortality in Kenya and has been shown to account for about 50% of the infant mortality in the developing world (Tommiska *et al.*, 2001; WHO, 2005). However, in developing countries accurate epidemiological data is scarce, and the exact burden of severe neurological disability is unknown. The causes of birth asphyxia are heterogeneous and most occur before or during labor and after delivery (Chiabi *et al.*, 2013). According to KDHS, 2014, Western Kenya is leading in infant mortality rate at 122.5 per 1000 live births in Kenya this is where the Kakamega County Hospital fall in. Currently, there is no documented data on asphyxia determination on perinatal risk factors on birth asphyxia in Kakamega county and referral hospital to the knowledge of the researcher. However, the raw data in NBU shows that 50% of admissions in the unit of total admissions per month are due to BA. The aim is to determine the risk factors associated with neonatal asphyxia in order to develop preventive interventions to reduce neonatal mortality and morbidity rate.

#### **Justification:-**

According to WHO, (2012), 4 million deaths yearly occurred due to birth asphyxia, representing 38% of all deaths of children under 5 years of age. In low-income countries 23% of all neonatal deaths occurred due to birth asphyxia. According to a survey conducted by WHO in 2005, it is also one of the leading causes of neonatal deaths within first week of life (Aslamet *al.*, 2014).

Perinatal asphyxia is a common clinical problem with a high morbidity and mortality rate and could lead to cerebral sequelae with a subsequent socio-economic burden on the families. It could be prevented to a large extent by informing and educating pregnant women on the follow-up of pregnancy and delivery, and appropriate management of pathological disorders during pregnancy and deliver (Chiabi *et al.*, 2013). With high infant mortality rate in western Kenya, probable occurring because of asphyxia this study would identify areas in which birth asphyxia can be minimized from antenatally until after delivery following the results of this study. The results will be utilized by the hospital, and Ministry of Health, where they may use it to review the management protocol on birth asphyxia.

**Objectives:-**

1. To determine the antepartum risk factors associated with birth asphyxia among term neonates at the County referral Hospital.
2. To evaluate intrapartum risk factors associated with birth asphyxia among term neonates at the County referral Hospital.
3. To determine neonatal risk factors associated with birth asphyxia among term neonates at the County referral Hospital.

**Methodology:-****Study Design:-**

The study design was retrospective institutional based study. The records of clients the mother and neonates were retrieved from records department.

**StudyArea:-**

The study site was done in Kakamega County General Hospital. The facility is a training institution for nurses, clinical officers, medical officers (for internship). The catchment population is approximately 100,000 persons; most occupants of this area are farmers, businessman and those employed in government and nongovernmental organization. The hospital is a 500 bed capacity; the study took place in maternity unit i.e. labor ward and newborn unit. The number of deliveries conducted in a month is averagely 700 per month .Deliveries are conducted by trained midwives and Doctors on obstetric emergencies who are competent in handling obstetric and neonatal emergencies. The newborn unit was well supplied with necessary equipment for resuscitation for instance Ambu bag, warm resuscitaire, face mask, oxygen and CPAP machine.

**Sampling Procedure:-**

Systematic sampling was used to determine the samples. This involved the selection of client records from an ordered sampling frame, progression through the list. The sampling started by selecting an element from the list at random and then every 18<sup>th</sup> element in the frame was selected.

**Sample Size Calculation:-**

A total of 422 records were reviewed

A pilot study was conducted at Webuye Sub county Hospital

**Inclusion riteria:-**

All normal neonates born during the study period.

**Exclusion Criteria:-**

1. Birth weight less than 1500 g pre-maturely.
2. Opium or Anesthesia related Low APGAR score.
3. Babies with lethal anomalies like hydrops, cyanotic congenital heart defects, congenital or chromosomal anomalies and congenital infection.
4. All newborn babies born outside Kakamega general hospital
5. Incomplete information in files

**Ethical Considerations:-**

Ethical approval from Masinde Muliro University Science & Technology Intuitional Research Ethics Committee, National Commission for Science, Technology and Innovation Kenya and Kakamega County referral hospital research and ethical committee was obtained. Confidentiality of the records reviewed was ensured.

**Results:-****Demographic Information:-**

The mean age of the mothers seeking health delivery services was  $34.7 \pm 7.90$  years. Those aged more than 30 years comprised of 77.9%. 22.0% of the neonates were babies born of mothers aged less than or equal 30 years. The youngest mother was aged 15 years while the eldest was aged 49 years. Higher proportions (76.8%) of the mothers were single. This was followed by those who were married at 14.5% while the rest were widowed (8.8%). Fifty-two-point-nine percent (52.9%) of the mothers who attended ANC had secondary or tertiary level of education. 47.1% of mothers were with none or primary education. 51.6% of mothers who sought delivery services had no formal employment (Table 1).

**Table 1:-** Socio-demographic Characteristics of Mothers.

Demographic Information	Category	Frequency	Percent
Age (years)	15-19	21	5
	20-24	39	9.2
	25-29	33	7.8
	30-34	109	25.8
	35-39	98	23.2
	40-44	58	13.7
	45-49	64	15.2
<b>Total</b>		<b>422</b>	<b>100</b>
Marital Status	Married	61	14.5
	Single	324	76.8
	Widowed	37	8.8
<b>Total</b>		<b>422</b>	<b>100</b>
Education Level	None	71	16.8
	Primary	128	30.3
	Secondary	129	30.6
	Tertiary	94	22.3
<b>Total</b>		<b>422</b>	<b>100</b>
Employment Status	Employed	64	15.1
	Unemployed	83	19.7
	Self employed	140	33.2
	Housewife	135	31.9
<b>Total</b>		<b>422</b>	<b>100</b>

**Demographic Information the Neonates:-**

During the study period (May 2015 to August 2016), 422 cases of the new born babies fulfilled the inclusion criteria. Out of these 422, male neonates were 225 (53.3%) and females were 197 (46.7%). With regard to birth weight, 320(75.8%) of the neonates weighted 2600-3500 gms and (24.2%) of the neonates weight 1500-2500gms. There was a higher proportion of the newborns whose birth ages were term (91.0%) compared those who were post-term (9.0%). Over seventy percent (70.9%) of the new borns had no birth asphyxia while the rest of 123 (29.1%) had asphyxia (Table 2).

**Table 2:-** Demographic Information the Neonates.

Demographic	Categories	Frequency	Percent
Gender	Male	225	53.3
	Female	197	46.7
Birth Weight	1500-2500gms	102	24.2
	2600-3500gms	320	75.8
Birth Age	Term	384	91.0
	Post term	38	9.0
Asphyxia Status	No Asphyxia	299	70.9
	Asphyxia	123	29.1
<b>Total</b>		<b>422</b>	<b>100.0</b>

**Socio-demographic risk factors:-**

Mothers aged more than 30 years were 3 times more likely to give birth to newborn babies with birth asphyxia than their younger counterparts (OR: 3.0; 95%CI: 1.9 – 4.9;  $p < 0.0001$ ) than those of mothers who were older. Mothers who has no or primary education were 4 times likely to give birth to newborn babies with birth asphyxia than their counterparts with at least secondary education (OR: 3.8; 95%CI: 2.4 – 6.0;  $p < 0.0001$ ).

There was a significant relationship between the parity of the mothers and birth asphyxia (OR 1.8, CI 95% 1.08-3.02,  $p = 0.02$ ), suggesting that neonates of mothers with a parity of 3 or less about two-fold more likely to deliver neonates who suffer from birth asphyxia compared with those of para 3 and above. Being employed (OR 1.31, CI 95% 0.86-2.00,  $p = 0.2$ ) and married (OR 1.3 CI 95% 0.70-2.45,  $p = 0.4$ ) were not significantly associated with risk of birth asphyxia since they reported almost similar frequencies (Table 4.3).

**Table 3:-** Socio-demographic risk factors of asphyxia.

Serial No	Category	Cases Asphyxia N = 299	No asphyxia N = 123	OR	95% CI	p-value
Age	Less or equal to 30yrs	45 (48.4%)	48(51.6%)	3.0	1.9 – 4.9	<0.0001
	More than 30 yrs	78 (23.7%)	251 (76.3%)			
Marital Status	Not Married	108(29.92)	253(70.08)	1.3091	0.7009-2.4452	0.3971
	Married	15(24.59)	46(75.41)			
Education level	None or primary	86(43.22)	113(56.78)	3.8259	2.4378-6.0044	<.0001
	Secondary orTertiary	37(16.59)	186(83.41)			
Employment	employed	58(32.40)	121(67.60)	1.3127	0.8602-2.0032	0.2066
	Not employed	65(26.75)	178(73.25)			
Parity	Less than or equal to 3	31(39.74)	47(60.26)	1.8067	1.0822-3.0161	0.0226
	More than 3	92(26.74)	252(73.26)			

**Antepartum risk factors:-**

Birth interval is significantly associated with birth asphyxia, with those mothers having a birth interval of over 2 years were four times more likely to deliver neonates with birth asphyxia(OR 3.83 CI 95% 2.44-6.00,  $p = <0.0001$ ) compared with their counterparts with birth interval of below 2 years. Gestation was highly associated with birth asphyxia (OR 1.8 CI 95% 2.20-9.40,  $p = <0.0001$ ) with those mothers with gestation period above 41 weeks two times more likely to give birth to neonates who were asphyxiated than those with gestation period less than 41 weeks. Past Incidences of still birth or live baby seemed not a significant factor to asphyxia (OR 1.35 CI 95% 0.43-4.23,  $p = 0.6$ ). Therefore, a history of still birth shouldn't be something to worry about. Medication (OR 1.24 CI 95% 0.33-4.66,  $p = 0.7484$ ) and place of delivery (OR 1.03 CI 95% 0.43-4.23,  $p = 0.9184$ ) were not a risk factor of asphyxia (Table 4.4).

**Table 4:-** Antepartum risk factors of Asphyxia.

Serial No	Category	Asphxia N = 299	No Asphxia N = 123	OR	95% CI	p-value
Abortion history	None	288(71.11)	117(28.89)	1.3427	0.4853-3.7148	0.5691
	Abortion	11(64.71)	6(35.29)			
Birth Interval	Less than 2years	186(83.41)	37(16.59)	3.8259	2.4378-6.0044	<.0001
	Above 2years	113(56.78)	86(43.22)			
Gestation	>37-41 weeks	81(19.19)	234(55.45)	1.8867	1.1748-2.9659	<.003
	>41 weeks	42(9.95)	65 (15.4)			
Birth history	Stillbirth_ or	13(76.47)	4(23.53)	1.3523	0.4321-4.2319	0.6029

	Live baby	286(70.62)	119(29.38)			
<b>Medication in pregnancy</b>	Medicated	9(75.00)	3(25.00)	<b>1.24</b>	0.3303-4.6649	0.7484
	None	290(70.73)	120(29.27)			
<b>Place of delivery</b>	Private	67(71.28)	27(28.72)	<b>1.03</b>	0.6190-1.7034	0.9184
	Public	232(70.73)	96(29.27)			

**Intrapartum risk factors:-**

There was significant association between the delivery mode and asphyxia (Chi-square = 24.95,  $p < 0.0001$ ), it is clear now that mode of delivery is a key significant risk factor of birth asphyxia. The foetus presentation, whether cephalic or breech was not a risk factor of asphyxia (OR 1.05 CI 95% 0.46-2.35,  $p < 0.9150$ ). Deliveries of mother's that were induced using Syntocinon or Prostaglandine were about seven times more likely to develop asphyxia than those that were not induced (OR 6.78 CI 95% 2.57-17.9,  $p < 0.0001$ ). Referral (OR 1.07 CI 95% 0.53-2.16,  $p = 0.8503$ ), duration of referral (OR 2.45 CI 95% 1.75-3.43,  $p = 0.0976$ ), duration of second stage of labour, condition in labour (OR 1.39 CI 95% 1.24-1.55,  $p = 0.5349$ ) were not a risk factor of asphyxia (Table 4.4). A Doctor who was a key informant reported use of syntocinon and poor partograph documentation to be key cause of birth asphyxia

**Table 5:-** Intrapartum risk factors of asphyxia.

Serial No	Category	Asphxia N = 299	No Asphxia N = 123	OR	95% CI	p-value
Delivery mode	Normal vaginal	213(64.9)	118(35.1)	<b>24.95</b>	0.081-0.368-	<.0001
	Ceaserian section	24(92.3)	2(7.7)			
	Assisted vaginal	62(91.2)	6(8.8)			
Foetus presentation	Cephalic	278(70.92)	114(29.08)	<b>1.05</b>	0.4646-2.3510	0.9150
	Breech	21(70.00)	9(30.00)			
Induction	Syntocinon	293(73.07)	108(26.93)	<b>6.78</b>	2.5656 - 17.9296	<.0001
	None	6(28.57)	15(71.43)			
<b>Labour duration</b>	Less equal 2 hours	114(0)	0(0.00)	<b>4.36</b>	2.7273-1.7041	<.0001
	More 12 hours	11(36.67)	19(63.33)			
<b>Referral</b>	Referral	31(72.09)	12(27.91)	<b>1.07</b>	0.5302 - 2.1592	0.8503
	Not refer	268(70.71)	111(29.29)		2.71 -12.39	
<b>Referral duration</b>	Lessequal 30mins	2(100)	0(0.0)	<b>2.45</b>	1.75-3.43	.0976
	Morethan 30mins	7(40.8)	29(59.2)			

**Fetal risk Factors:-**

Babies born with a birth weight of 1500-2500g were 3 times more likely to develop birth asphyxia than those with a higher weight of 2600-to >3500g (OR 2.10 CI 95% 1.21-3.65,  $p = 0.0073$ ) The sex of the neonate was not a risk factor (OR 1.35 CI 95% 0.88-2.06,  $p = 0.1681$ ) as was resuscitation (OR 1.29 CI 95% 0.68-2.46,  $p = 0.43$ ). Birth age was not significantly associated with birth asphyxia (OR 1.01 CI 95% 0.48-2.10,  $p = 0.9774$ ). (Tables 4.6). A nurse in new born unit reported delayed second stage, difficult delivery and use of syntocinon during labour were the most causes of birth asphyxia.

**Table 6:-** Fetal risk factors of asphyxia.

Serial No	Category	Asphyxia N = 299	No Asphyxia N = 123	OR	95% CI	p-value
<b>Birth weight</b>	w1500-2500g	83(81.37)	19(18.63)	<b>3.6478</b>	2.1033-1.2128	<b>0.0073</b>
	w2600-3500g	216(67.50)	104(32.50)			

<b>Sex</b>	Female	146(74.11)	51(25.89)	<b>1.3472</b>	0.8813 -2.0593	0.1681
	Male	153(68.00)	72(32.00)			
<b>Resuscitation</b>	No	268(71.47)	107(28.53)	<b>1.2927</b>	0.6792 -2.4605	0.4334
	Yes	31(65.96)	16(34.04)			
<b>Birth age</b>	Postterm	27(71.05)	11(28.95)		0.4847 -2.1074	0.9774
	Term	272(70.83)	112(29.17)			

### Logistic Regression Models:-

Significant risk factors for birth asphyxia were further analyzed by multiple logistic regression model. Factors that were independently associated with birth asphyxia included maternal age (OR: 3.0; 95% CI: 1.9 – 4.9; p <0.0001), education (OR: 3.8; 95%CI: 2.4 – 6.0; p <0.0001), parity (OR 1.8, CI 95% 1.08-3.02, p = 0.023), birth interval (OR 3.83 CI 95% 2.44-6.00, p = <0.0001), gestation (OR 1.8 CI 95% 1.17-2.96, p = <0.003), birth weight (OR 2.10 CI 95% 1.21-3.65, p = 0.0073) and mode of delivery (OR 5.80 CI 95% 2.72-12.4, p < 0.0001). These factors were modeled to give a complete equation that defined the relationship between the risk factors and the birth asphyxia. The table 4.6 depicts the results of the bivariate model.

**Table7:-** Model Summary for significant risk factors of Asphyxia.

Parameter	DF	Estimate	Standard	OR	CI	p-value
<b>Birth Weight</b>	1	0.7435	0.2809	<b>2.103</b>	0.274-0.825	0.0073
<b>Delivery mode</b>	1	-4.1334	0.7483	<b>0.016</b>	0.081-0.368	<.0001
<b>Induction of labor</b>	1	-2.9123	0.5329	<b>0.054</b>	0.056-0.390	<.0001
<b>Duration of labour</b>	1	-1.2363	0.4393	<b>0.290</b>	0.507-2.629	0.0049
<b>Birth interval</b>	1	-2.9566	0.3874	<b>0.052</b>	0.167-0.410	<.0001
<b>Gestation</b>	1	-3.6870	0.7130	<b>0.025</b>	2.201-9.398	<.0001
<b>Age of the mother</b>	1	1.0395	0.4348	<b>2.828</b>	0.205-0.535	0.0168
<b>Education level</b>	1	1.0687	0.3381	<b>2.912</b>	0.261- 0.460	0.0016

### Discussion:-

According to WHO, 4–9 million newborns develop birth asphyxia each year and at least the same number develop severe consequences such as epilepsy, cerebral palsy and developmental delay (Haida and Bhutta, 2006 ). Major manifestations of asphyxia are produced as a result from a combination of hypoxia and ischemia of the brain and other vital organs. It occurs due to combination of vasodilatation and vasoparalysis (Haider and Bhutta, 2006). To the knowledge of the researcher, this is the first study conducted to identify perinatal risk factors of birth asphyxia among newborns, conducted in rural resource limited settings in Kakamega county, where quality of care is inadequate to respond to emergency situations.

The study's objective was to evaluate the socio-demographic, antepartum, intrapartum and fetal risk factors of Birth asphyxia in Kakamega County and referral hospital. Socio-demographic risk factors were mother's age, education level and parity. Antepartum risk factors of birth asphyxia included birth interval and gestation while intrapartum risk factors were delivery mode of delivery, induction and labour duration. Fetal risk factors birth weight only emerged as a risk factor

### Social-Demographic:-

Risk factors of asphyxia of birth asphyxia in this study indicated that young mothers of less than 30 years were three times more likely to have increased cases of neonates with asphyxia than their older counterparts , which is supported in studies by Pitsawong and Panichkul, 2012, Lee *et al.*, 2008, and Onyearugha and Ugboma, 2012 .This findings is not inconsistent with other studies by (Shireen *et al.*, 2009) which reported that that maternal age was not significant risk factor this could be due to the methodology used or due to the sample size used or the nature of setting where the study was conducted. Most Mothers of that age bracket have either their first born or second born babies at that age most women uterus have tough uterine muscle whereby during labour the uterus contract strongly and vigorously predisposing the fetus to a lot of hypoxia which will lead to birth asphyxia.

Gestation also emerged as a risk factor in this study which showed that it was highly associated with birth asphyxia (OR 1.8 CI 95% 1.17-2.97,  $p < 0.003$ ) with those neonates with gestation period more than 41 weeks two times more likely to be asphyxiated than their counterparts between 37 and 41 weeks. Neonates above 41 weeks tend to have compromised circulation because most placentas will be highly calcified hence there will be compromised supply to the fetus therefore during labour the fetus will have compromised oxygen supply hence asphyxia. The outcome will depend on facilities interventions because with good interventions most neonates will improve. It was difficult however to confirm the gestation by age because last menstrual period which in most cases may not be accurate.

Education level of the mother also emerged as risk factor Mothers who has no or primary education were 4 times likely to give birth to newborn babies with birth asphyxia than their counterparts with at least secondary education (OR: 3.8; 95%CI: 2.4 – 6.0;  $p < 0.0001$ ). This concurs with studies by (Tabassum *et al.*, 2014), who indicated that maternal education was a risk factor to birth asphyxia, Similar patterns were reported by other studies conducted in rural areas of Southern Nepal and Mexico City by (Lee *et al.*, 2008),. Another hospital based study conducted in Bangladesh did not find association of maternal education with BA by (Shreen *et al.*, 2009). Maternal illiteracy is a very broad indicator of poor socio-economic conditions associated with consequent malnutrition, frequent pregnancies and also influences care seeking during antepartum period therefore with good education clients tend to seek health care services early, hence improving outcome during and after delivery.

There was a significant relationship between the parity of the mothers and birth asphyxia (OR 1.8, CI 95% 1.08-3.02,  $p = 0.02$ ), suggesting that neonates of mothers with a parity of 3 or less were about two-fold more likely to deliver neonates who suffer from birth asphyxia compared with those of their counterparts of para 3 and above, those mothers who delivered their first babies and subsequent pregnancies their babies suffered birth asphyxia which is supported by studies by Ogueh *et al.*, (2006), Rhoades *et al.*, (2006) and Ghi *et al.*, (1999). Most primigravida clients end up in induction hence expose the neonates to asphyxia, other reasons could be due to compression of nuchal cord which exposes the fetus to lack of oxygen in labour hence birth asphyxia In the Kenyan settings, most mothers have higher parities and past deliveries have taken place at home, which other studies found to be a risk factor for causing birth asphyxia (Rani *et al.*, 2012).

Reduction of the risk factors of causing birth asphyxia in rural Kenya and many developing countries may not be an easy task due to certain reasons as described by a key informant who indicated *uneducated young mothers who are also in most cases are not fast learners and tend to forget a lot the during health education offered in the department There is also the component of lack of awareness on the part of MOH to sensitize the mothers of child bearing age. In order to reduce the burden of birth asphyxia, Women need to be educated from preconception, antenatal, intrapartum and postnatally this would increase knowledge hence reduction in mortality rate (nurse in labor ward)*

The other aspect is single motherhood which is a new reality. The number of increasing mothers who are single is on the rise and indeed marital status was a risk factor of asphyxia. The study revealed that there were more cases of reported asphyxia in mothers who are not married than those who are married. There is still evidence of more cases of asphyxia in unemployed mothers despite the fact that it was not a significant risk factor of asphyxia in this study. Other studies like those of Tabassum *et al.*, (2014), quite indicated that income or employment is a risk factor and this seem to have been watered down by government interventions such as offering free maternity services to mothers (Lee *et al.*, 2008).

#### **Antepartum:-**

Birth interval is significantly associated with birth asphyxia, with those mothers having a birth interval of over 2 years were four times more likely to deliver neonates with birth asphyxia (OR 3.83 CI 95% 2.44-6.00,  $p < 0.0001$ ) compared with their counterparts with birth interval of below 2 years.

Short birth interval was found to be significantly associated with lower five minutes Apgar score in that study Gordon *et al.*, (2003). This may be due to the fact that the fetus may not be having good reserves due to depletion of maternal nutritional reserves and therefore easily became asphyxiated with rigours of labor which is consistent with study by (Geidam *et al.*, 2015) who noted that short birth interval was significantly associated with birth asphyxia, This may be due to the fact that the fetus may not be having good reserves due to depletion of maternal nutritional reserves therefore easily became asphyxiated with the rigors of labor though in this study low Apgar



score was not significant risk factor but it reflects the same outcome Longer birth interval, greater than 60 months is also associated with adverse perinatal outcome. This agree with other by (Norton., 2005) . This might be because pregnancies helps mothers gain growth supporting capacities, such as increase ,uterine blood and other physiological and anatomical adaptations of the reproductive system. After delivery these capacities may gradually decline and with prolonged birth interval women physiological characteristics may be similar to those of Primigravida with risk of caesarean section.

on contrary History of abortion, conditions in pregnancy, medications and place of delivery are risk factors to birth asphyxia but in this study it was not significant this could be because of study design, study setting of the study

#### **Intrapartum:-**

Regarding mode of delivery There was significant association between the delivery mode and asphyxia (Chi-square = 24.95,  $p < 0.0001$ ),it showed that most of the deliveries were delivered by normal vaginal delivery, this result was very much similar with the findings of two studies conducted in Pakistan, 2012 on same issue and(Bibi, 2012).In this case the study did not look at the relationships between several modes of delivery which would in one way compromise the outcome of the results

Labor duration was another important risk factor of asphyxia. Studied by Ugwu (2012), indicated that prolonged labor was the commonest cause of asphyxia. The study concurred with studies done by (Shireeni, Nahar, &Mollah, 2009) which reported that the major cause of asphyxia Neonatorum is prolonged labor. those mothers who had labor duration more than 12 hours, about three times more likely have neonates suffering from birth asphyxia that those mothers who have less than 12 hours. Prolonged labor is active labor with regular uterine contractions and progressive cervical dilatation, which lasts for more than 12 hours in both multiparas and primigravidas labor which go beyond 12 hours predisposes a mother to a lot of distress which brings about compromised oxygen supply to the fetus hence birth asphyxia. First stage management should be well managed using partograph so that early deviation are detected hence reducing chances of birth asphyxia.

Deliveries of mother's that were induced using Syntonicon were about seven times more likely to develop asphyxia than those that were not induced (OR 6.78 CI 95% 2.57-17.9,  $p < 0.0001$ ). .This finding is supported by (Tabassum *et al.*,2014) which reported Delivery augmented with medicine significantly predict increased chances of birth asphyxia mortality As indicated from the study findings, This was supported too by a key informant who said that *asphxia can be caused by irregular regulation of a drops of syntocinon by the midwife or accidentally running fast which will causes strong uterine contractions compromising the fetal status, this may lead to severe asphyxia and poor partograph documentation because it is difficult to diagnose deviations on time. (Medical Doctor Intern, maternity unit).*

Same information was reported by a nurse who was working in the newborn unit who mention induction with syntocinon being very key cause of birth asphyxia. Induction by syntocinon is a vasopressin in structure, and therefore has an antidiuretic effect when given in high dosages thus, water intoxication is a possibility in prolonged inductions. Uterine hyper stimulation and uterine rupture can also occur. prolong use or mismanagement during first stage brings about uteroplacental insufficiency and fetal hypoxia hence birth asphyxia

#### **Fetal characteristics risk factors of Asphyxia:-**

Babies born with a birth weight of 1500-2500g were 3 times more likely to develop birth asphyxia than those with a higher weight of 2600-to >3500g (OR 2.10 CI 95% 1.21-3.65,  $p = 0.0073$ ) this results are is consistent with studies done by (Aslam *et al.*, (2014) lee *et al.*, 2014) and (Tabassum *et al.*,2014). In low birth weight neonates posses same characteristics like the premature counterparts who are more prone to a lot of problems experienced by premature babies. Third world countries lack good equipment for managing the mother before, during and after delivery this leads to lack of sufficient care given to these neonates hence suffer a lot of asphyxia after birth. a key informant reported a differently from this findings and said:-

*most infants born with asphyxia are in most cases caused by delayed second stage of labour, difficult delivery and use of syntocinon in labour you will find infants very sphxyiated .(Nurse, new born unit)*

The study is in consistent with studies done by (Pitsawong and Panichkul P, 2012), this could be the fact that mother of low birth weight babies often related to complications such as maternal hypertension and diabetes that present

pre-conception or antepartum and not diagnosed, However in this study conditions during pregnancy were not significantly associated with birth asphyxia but in most cases women who get sick during antenatal period are likely to develop such complications especially if antenatal profile is missed or done during the last trimester without interventions.

However studies done by (Tabassum *et al.*, 2014) is inconsistent with the above findings he reported that small size at birth was associated with increased risk of birth asphyxia mortality (OR 2.5, 95% CI: 1.5 - 4.1) whereas being large at birth had twice more risk of mortality due to birth asphyxia (OR 4.1, 95% CI: 2.0 - 8.3).though in his findings he did not mention the weight, however, this findings could be true because being born large could be associated with other complications like neonates born of diabetic mothers.

One of the limitations of our study is that our study was conducted on limited and specified geographic settings that involved less resourced rural setup. Larger studies are required to demonstrate the true associations in the population. Other limitations include potential reporting bias of maternal, infant symptoms and recall bias in calculation of gestational age.

### Conclusion:-

Sequence of birth asphyxia varies from no ill effects to multiorgan complications and death. This could vary depending on severity and duration of asphyxia and it may be due to the presence of gaps in the field of research and technology in developing and low income countries. Age of mother, education level, parity, birth interval, and gestation reported as maternal risk factors. Intra partum risk factors are mode of delivery, induction of labor and duration of labor. Fetal risk factors are low birth weight. Majority of these factors may be manageable by means of good pre-natal care. There is an immediate need to develop strategies for identification and management of birth asphyxia by involving all pathways to survival, including women, families, communities, community health workers, health professionals and policy makers.

### Recommendation:-

1. There is an immediate need for the hospital to develop strategies for early identification and management of factors associated with birth asphyxia by involving stakeholders. on care of young mothers and those of low level education in labour as they are at more risk of asphyxia than their counterparts
2. Maternity unit of the hospital to provide health education to Mothers on effects of short and long birth interval span as they are more prone to birth asphyxia and other complications.
3. Low birth weights neonates should to be given much more attention compared o their counterparts whose birth weight are normal as they are prone to asphyxia.

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