



Perinatal Outcomes of Newborns by Women Presenting with Maternal Complications in Pregnancy at a County Referral Hospital in Lower Eastern Kenya

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Summary

BACKGROUND

Maternal complications during pregnancy and labor have been the leading cause of maternal and neonatal death globally. The aim of the study was to observe and compare the differences in the perinatal outcomes of newborns born to women with maternal complications to those born to women without complications.

MATERIALS AND METHODS

This was a prospective hospital-based paired cohort study. A total of 510 pregnant women were followed up and their newborns' outcomes recorded. 102 had complications and 408 did not have complications.

RESULTS

Thirteen percent (n=17) of women with complications and 9% (n=34) of women without complications were aged between 13 to 19 years. Forty five percent n=45 of the respondents were followed for maternal care related to fetus and amniotic cavity and possible delivery-related complications.

CONCLUSION

Teenagers and women aged above 34 years in pregnancy were at a higher risk of presenting with maternal complications. Women referred from hard to reach constituencies of the county were more likely to present with complications in pregnancy. Maternal care related to amniotic fluid cavity complications was the leading maternal complications in pregnancy followed by edema with proteinuria complications.

RECOMMENDATIONS

Governments and non-governmental organizations should put more emphasis on youth friendly services to reduce maternal complications associated with teenage pregnancy. There should also be more investment on infrastructure to make referral systems easy and avoid the second delay among women with maternal complications.



Moreover, women presenting with maternal complications in pregnancy at all levels of care should be closely followed up to avert cases of intra-uterine fetal deaths before and during labor.

Keywords: *Perinatal Newborn Outcomes, Maternal Complications in Pregnancy, Exposed Newborns, Unexposed Newborns*

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Introduction

Maternal complications during pregnancy and labor have been the leading cause of maternal and neonatal deaths globally (Meshdaghinia et al., 2013). They pose a serious challenge to the achievement of the worldwide strategy for maternal, children and adolescent health by the year 2030. They have time and again been linked to both economic and socio demographic factors of the women involved (WHO, 2017). The global number of still births is approximately eight million and approximately fifty million women who experience maternal complications during pregnancy and delivery (Bener, Salameh, Yousafzi, & Saleh, 2012). Maternal complications are life-threatening to both the mother and the unborn fetus. They can occur during pregnancy, labor and at birth. The World Health Organization has done a list of five life threatening complications which many countries have adopted and report monthly. These include hemorrhage both antepartum and postpartum, severe pre-eclampsia, sepsis inclusive of severe systemic infections and ruptured uterus. Other contributing factors include conditions such as anemia, epilepsy and immune-suppression due to human immunodeficiency virus infection (World Health Organization, 2011).

The obstetric factors are key determinants of newborn outcomes. A study conducted by Blomberg *et al.*, 2014 in a Swedish study revealed that children born to primi-paras teenagers had little likelihood of

showing fetal distress and meconium aspiration despite having incidences of Apgar score less than seven in five minutes compared to children born to multiparas women. They were also not more prone to being still born or small for gestation compared to the women of the reference group.

In the United Kingdom there were higher chances of admission to the neonatal intensive care unit for the children born by women who had died due to complications compared to those who had survived. It was evidenced by peri-mortem results of those who had died in which 14% of those who had died 26% had still born babies (Nair, Knight, and Kurinczuk, 2016). At Semmelweis University Hungary, there was a higher risk in having fetal complications among newborns from the case group in contrast with control group. There was un-expected increase of threatened preterm delivery in both groups which is a rare occurrence in many studies (Banhidly, acs, Puho, & Czeizel, 2010).

According to a confidential inquiry into maternal deaths in Kenya, of the 374 who died after childbirth 33.2% had a still birth which means there is still more effort needed to have a better outcome for women with maternal complications. The aim of this study was to observe and compare the differences in the perinatal outcomes of newborns born to women with maternal complications to those born to women without complications.



Materials and Methods

A prospective hospital-based and paired cohort study design was conducted at the antenatal clinic, antenatal ward, maternity ward and postnatal ward at a county referral hospital in Kenya. Women with and without maternal complications, according to the ICD 10 classification, in their third trimester were followed up from 28 weeks gestation up to 28 days post-delivery. Sample Size was determined by use of Hulley (2007).

$$N = \frac{r+1}{r} \times \left(\frac{Z_{1-\alpha/2} + Z_{1-\beta}}{p_1 - p_2} \right)^2 \times \bar{p} \times (1 - \bar{p})$$

$$= \frac{5}{4} \times \left(\frac{1.96 + 0.84}{0.40 - 0.25} \right)^2 \times 0.37 \times (1 - 0.37)$$

$$= 102$$

N=102 (The number of participants who presented with complications in their third trimester)

r= r was the ratio of women who presented with complications compared to those without complications

p₁ = 40% was the proportion of newborns who had low Apgar score among women with complications

p₂ = 25%, was the proportion of those children who presented with low Apgar score among women without complications

$$\bar{p} = \frac{(r \times p_1 + p_2)}{r + 1},$$

$$\bar{p} = \frac{(4 \times 0.40 + 0.25)}{4 + 1}$$

$$\bar{p} = 0.37$$

Based on preliminary data from this referral hospital, approximately 19% of the participants delivering had complications and 81% of the participants did not have complications (KCRH statistics 2018). Thus it appeared that for every single participant presenting with complications, eight participants

did not present with complications. But for statistical feasibility four participants without complications were sampled for every case presenting with a complication. That is why r was equal to 4 in the formula above.

Given that the number of women presenting with complications was to be 102. Then the number of women without complications in this study was to be 408 making a total of 510 participants.

SPSS Version 21 was used to analyze data. Chi squares and risk ratios were used to analyze data from both groups. 396 women without complications were followed up until 28 days post-delivery out of which 32 women were allowed to cross-over, leaving a total of 364. 100 women with complications were followed up until 28 days post-delivery making a total of 132 women.

Sampling, recruitment and consenting procedures

Consecutive sampling technique was used for both complications and non-complications groups. Two research assistants were trained on use of the data collection tools before pretest was done

Pretest was done at Makueni County Referral Hospital in which 11 women in exposed group and 41 un-exposed group were interviewed and the details for the next of kin were included in data collection to necessitate follow-up. Respondents from both groups were recruited to study and followed up until 28 days post-delivery. Respondents who developed complications after recruitment and in labor were allowed to cross over to the complications group

Data collection tools

A Semi structured researcher administered questionnaire was used. The questions on obstetric factors were adopted from



the preliminary literature while questions on complications were adopted from the ICD 10 classification of diseases. The tool had four sections, Section A; demographic characteristics Section B; obstetric history of the respondents Section C; newborn delivery outcomes and Section D; Follow-up up to 28 days. Data was collected between October 2019 and March 2020.

Data management

Association between the exposure (Perinatal Outcomes of newborns by women with Complications) and categorical variables were assessed using Pearson's Chi square test.

The relationship between perinatal outcomes to demographic data and obstetric factors were analyzed using logistic regression model.

The strength of association between perinatal outcomes and maternal complications were measured using relative risk.

Ethical considerations

The study was approved by the Kenyatta National Hospital-University of Nairobi (KNH/UON) Research and ethics Committee (Approval Number 301/04/2019) and National Commission for Science and technology (License Number NACOSTI/P/20/3727).

The respondents were requested to give consent both verbal and written consent after they were made aware of the study implications.

Results

Socio-demographic characteristics

Most of the respondents with complications 46% (n=61) (n=50) and without complications 51% (n=186) were aged 20-26. On Chi square test, the results showed a significant difference between women with

complications and women without complications (P-value 0.028, χ^2 210.8936) as shown in table 1.

Figure 1 shows that majority of respondents (59%, n=78) with complications and (59%, n=277) without complications were from the region of Kitui Central and the minority (3%, n=11) without complication from Kitui East and finally (3%, n=4) with complications were from Kitui South. All the women from Kitui South, Mwingi North and Mwingi West had complications, while none of the women from Mwingi Central had complications.

On Chi square test, the results showed a significant difference between women with complications and women without complications (P-value 0.001, χ^2 247.8894).

The findings showed that (4%, n=5) women with complications and (2%, n=1) women without complications had nursery school level education, (28%, n=37) women with complications and (29%, n=105) women without complications had primary school education, (29%, n=38) women with complications and (41%, n=148) women without complications had secondary school education. 27% (n=36) women with complications and (26%, n=96) women without complications had college education, (10%, n=13) women with complications and (4%, n=13) women without complications had university education.

Only (2%, n=3) women with complications had had other education levels specified. On Chi square test, there was a significant difference between women with complications and women without complications (P-value 0.001, χ^2 226.4452).



Table 1: Distribution of Age, Education, Occupation and Religion Participants

Variable	Complications group	Non Complications group	χ^2	P-values
Age in Years				
13 to 19	17(12.88)	34(9.34)	10.8936	0.028
20 to 26	50(37.88)	186(51.1)		
27 to 33	61(46.21)	142(39.01)		
34 to 40	2(1.52)	1(0.27)		
41 to 49	2(1.52)	1(0.27)		
Education				
Nursery	5(3.79)	2(0.55)	26.4452	0.001
Primary	37(28.03)	105(28.85)		
Secondary	38(28.79)	148(40.66)		
College	36(27.27)	96(26.37)		
University	13(9.85)	13(3.57)		
Others	3(2.27)	0(0)		
Occupation				
Employed	37(28.03)	55(15.11)	10.7411	0.005
Unemployed	81(61.36)	266(73.08)		
Self	14(10.61)	43(11.81)		
Religion				
Christian	128(96.97)	353(96.15)	3.1	0.685
Muslim	3(2.27)	5(1.37)		
Atheist	0(0)	4(1.1)		
Others	1(0.76)	2(0.55)		

As shown in figure 2, majority of the respondents (70%, n=93) with complications and (79%, n=287) without complications were Married, (28%, n=37) with complications and

(20%, n=72) without complications were single, (2%, n=2) with complications and (1%, n=2) without complications were divorced.

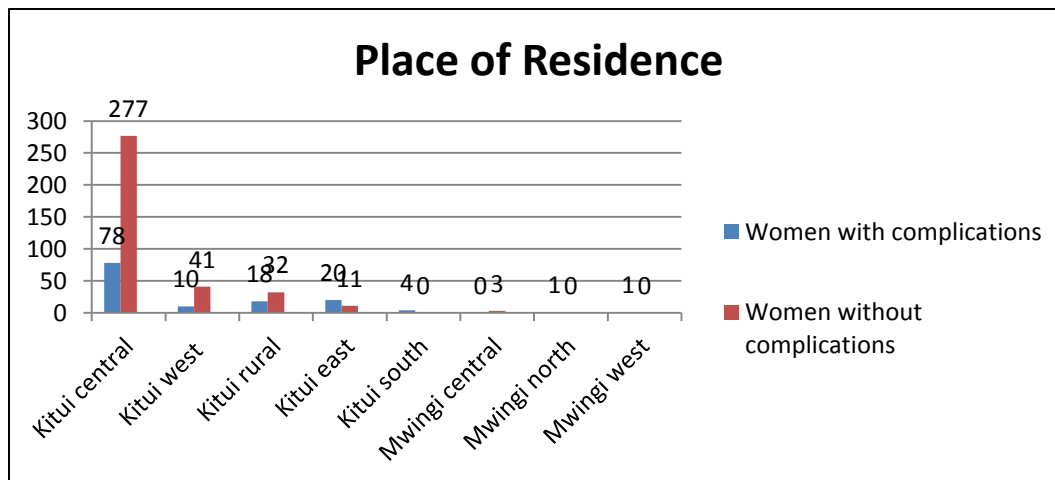


Figure 1: Comparison of Women with and Without Complications Based on Area of Residence

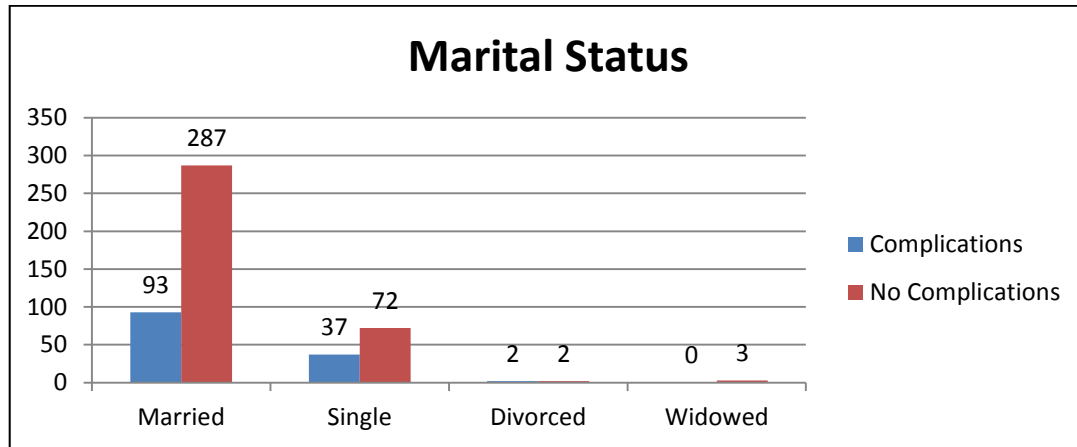


Figure 2: Comparing Marital Status of Women with and Without Complications

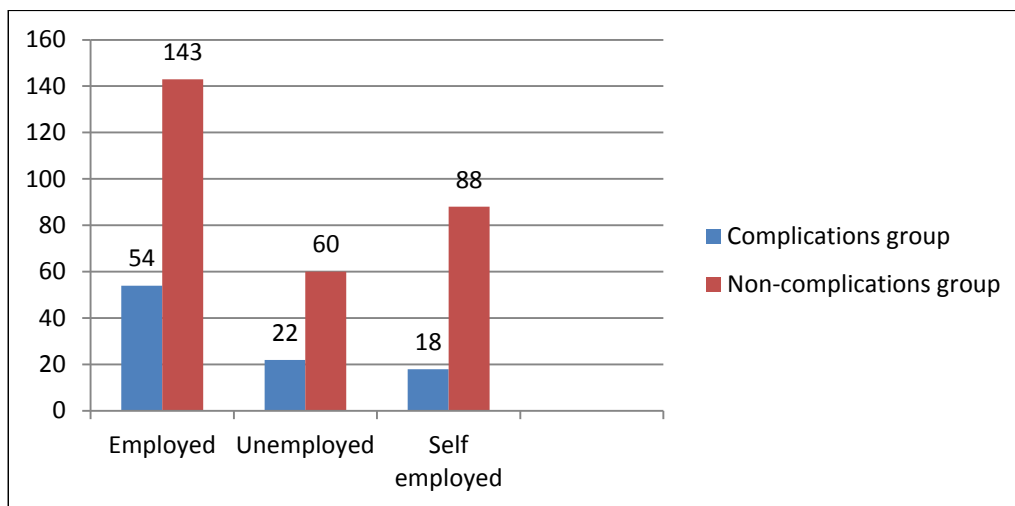


Figure 3: Occupation of the respondent's spouse

One percent (1%, n=3) of women without complications were widowed. There were no widowed women with complications. On Chi square test, there was no significant difference between women with complications and women without complications (P-value 0.107, $\chi^2=6.0988$).

The findings depict that majority of the respondents (61%, n=81) with complications and (73%, n=266) without complications were

un-employed, (28%, n=37) with complications and (15%, n=55) without complications were employed, (11%, n=14) with complications and (12%, n=43) without complications were self-employed. On Chi square test, the results showed that there was significant difference between women with complications and women without complications (P-value, 0.005, $\chi^2=10.7411$) as indicated in table 4.3.5.

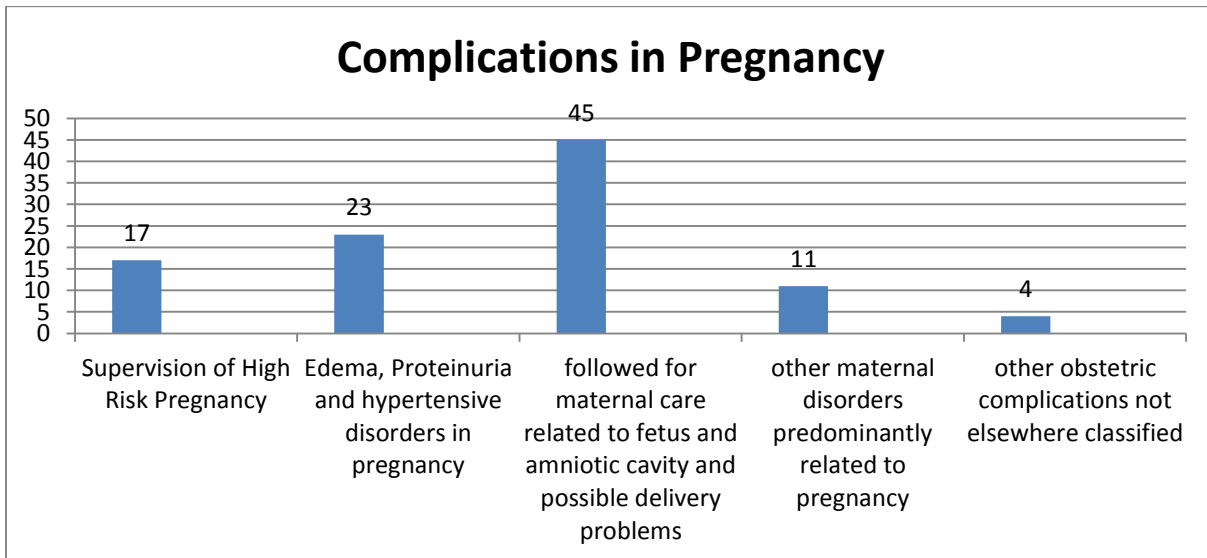


Figure 4: Complications in Pregnancy

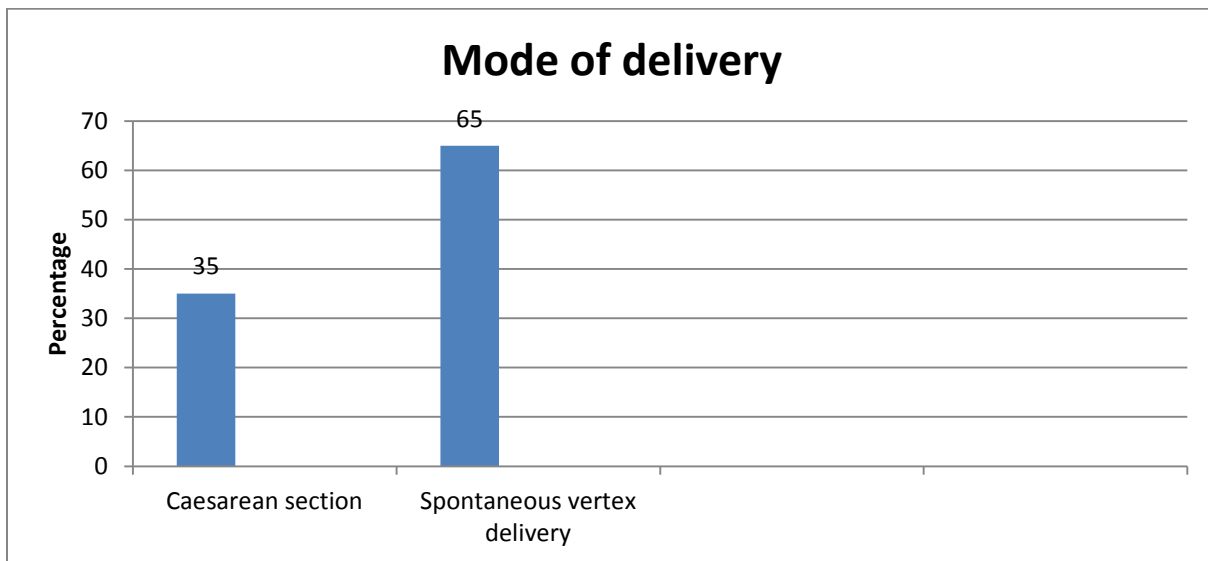


Figure 5: Mode of delivery

As shown in figure 3, (41%, n=54) women with complications and (39%, n=143) without complications were employed, (17%, n=22) women with complications and (16%, n=60) without complications were un-employed and (14%, n=18) with complications and (24%,

n=88) without complications were self-employed.

On Chi square, there was significant difference between complications group and non-complications group (P-value 0.038, $\chi^2=8.4025$).



Table 2: Mode of Delivery versus Admission to NBU

Mode of delivery	Admission to NBU				df	χ^2	P-value
	Yes	No	Dead	Total			
Caesarean Section	7	26	2	35	2	2.138	0.343
Spontaneous vertex delivery	16	40	9	64			
Total	23	66	11	100			

Majority of the respondents from both groups, (97%, n=128) with complications and (96%, n=353) without complications were Christians, (2%, n=3) with complications and (1%, n=5) without complications were Muslims, (1%, n=1) exposed and (1%, n=2) un-exposed belonged to other religions. There were no

atheists among the complications group while the non-complications group had (1%, n=4). On Chi square test, there was no significant difference between complications group and non-complications respondents (P-value 0.685, $\chi^2_{23.1}$).

Table 3: Duration of Death, Apgar Scores, Newborn Admission, NBU Admission and Reason for Admission

Indicator	Frequency	Percentage
Duration of death		
Before Labor	6	55
During Labor	5	45
Total	11	100
Apgar score		
1-4	2	2.3
5-7	9	10.1
8-10	78	87.6
Total	89	100
Newborn Maturity		
Term Babies	61	69
Premature Babies	28	31
Total	89	100
NBU Admission		
Yes	23	26
No	66	74
Total	89	100
Reason for Admission		
Prematurity	10	43.5
Birth Asphyxia	6	26.1
Jaundice	3	13
Sepsis	3	13
Respiratory distress syndrome	1	4.3
Total	23	100

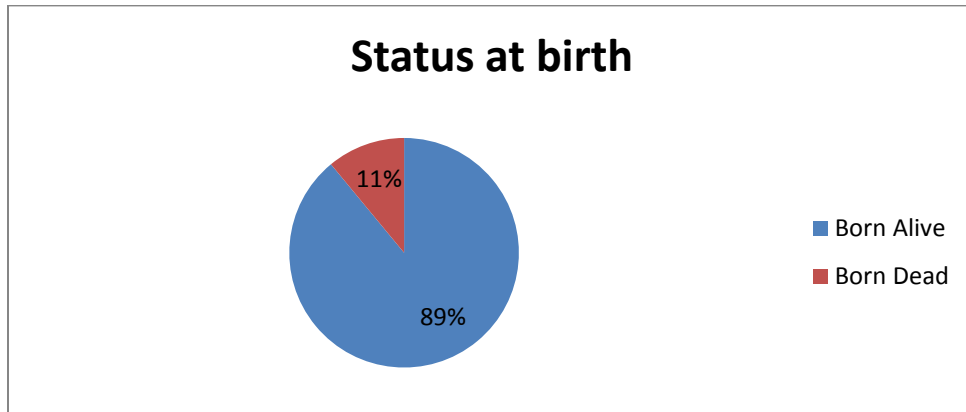


Figure 6: Status at Birth

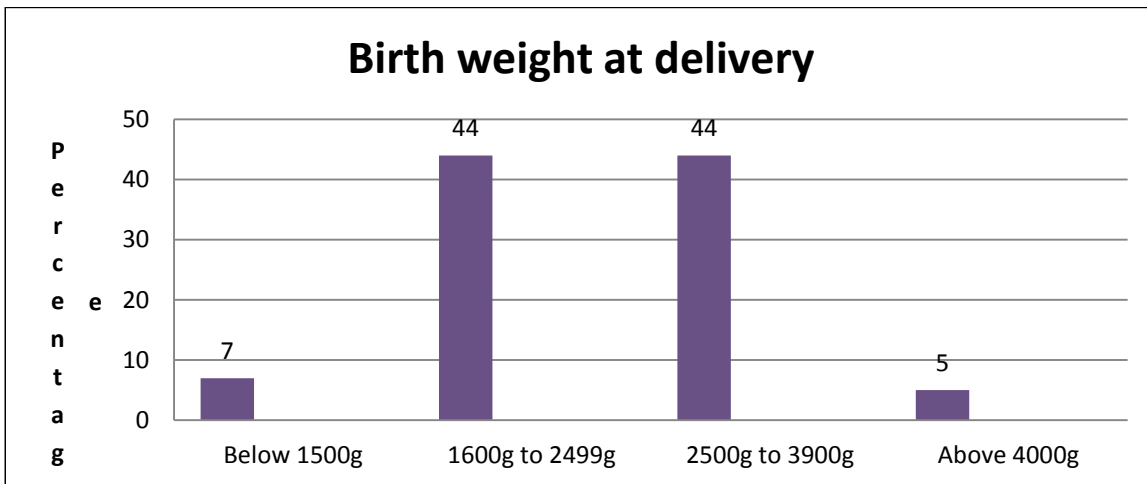


Figure 7: Birth Weight at Delivery

Complications in pregnancy

As shown in figure 4, (45%, n=45) of the respondents were followed for maternal care related to fetus and amniotic cavity and possible delivery problems related complications, (23%, n=23) Edema, Proteinuria and Hypertensive disorders in pregnancy, childbirth and peuperium, (17%, n=17) Supervision of High Risk Pregnancy, (11%, n=11) other maternal disorders predominantly related to pregnancy and (4%, n=4) other obstetric complications not elsewhere classified.

Mode of delivery

Majority of the newborns (65%, n=65) were born through spontaneous vertex delivery while (35%, n=35) were born through caesarean section as shown in figure 5.

There was no association between mode of delivery and admission to the newborn unit (P-value-0.343, χ^2 -2.138, df-2). Children born via SVD had odds ratio of 0.4 while children born via caesarean section had odds ratio of 0.3 as shown in table 3.

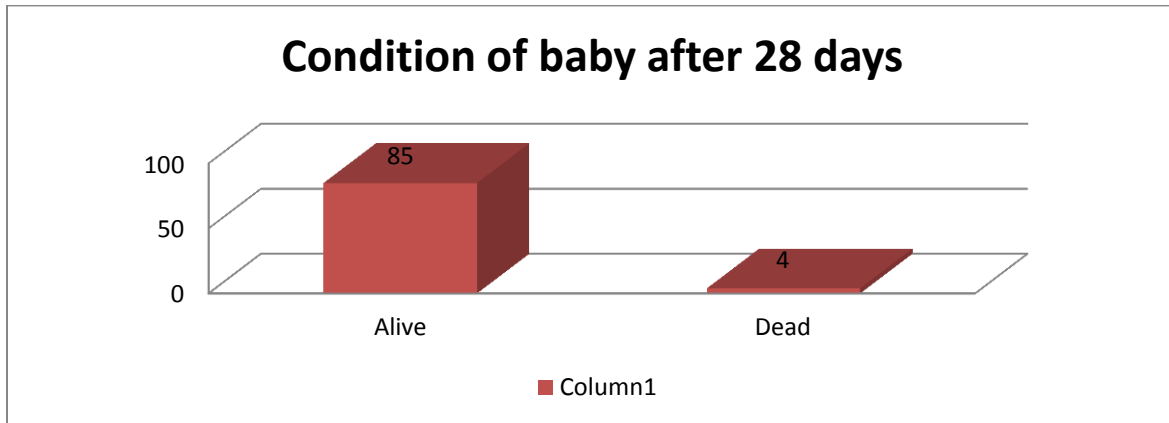


Figure 8: Condition of Baby after 28 days

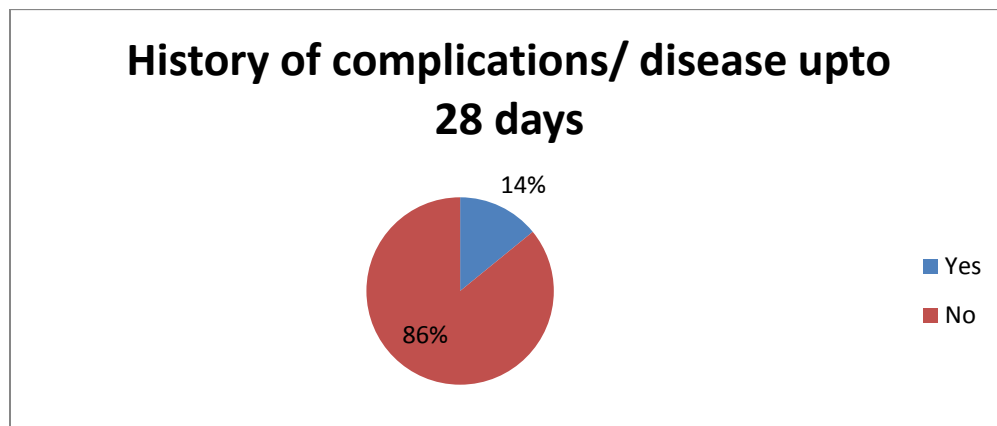


Figure 9: History of complications/ disease up-to 28 days

Majority of the newborns (89%, n=89) were born alive while (11%, n=11) were born dead as shown in figure 6. Majority of the newborns (55%, n=6) died before labor while (45%, n=5) died during labor.

Majority of the newborns born alive (87.6%, n=78) had an Apgar score of 8-10, (10.1%, n=9) had an Apgar score of 5-7 and 2.3% (n=2) score 1-4 in one minute (Table 3). Majority of the newborns, (44%, n=44) had a birth weight of 1600-2499 and 2500-3900 grams while (7%, n=7) had weight below 1500g and

(5%, n=5) had birth weight of above 4000g as illustrated in figure 7.

Majority of the newborns (69%, n=61) were term babies while (31%, n=28) were born premature as shown in table 3. Majority of the newborns (74%, n=66) were not admitted while (26%, n=23) were admitted to the newborn unit after delivery.

Most of the newborns (43.5%, n=10) were admitted due to prematurity, (26.1%, n=6) had birth asphyxia, (13%, n=3) had Jaundice and sepsis and (4.3%, n=1) had respiratory distress syndrome.

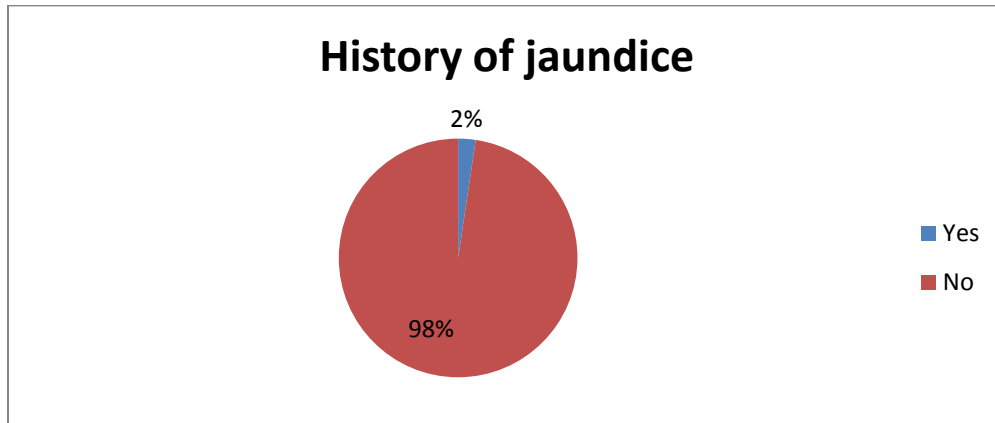


Figure 10: History of Jaundice

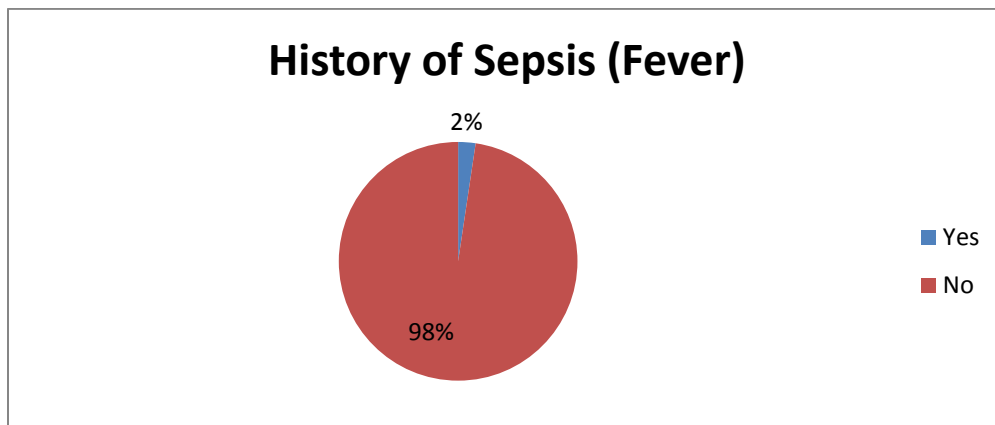


Figure 11: History of sepsis within 28 Days post-delivery

Majority of the babies (95%, n=85) were alive on follow-up after 28 days post-delivery while (5%, n=4) were reported to have died as illustrated in figure 9. Majority of the newborns (86%, n=73) did not have any complications/diseases while, (14%, n=12) were reported to have had complications/diseases within 28 days post-delivery.

Majority of the newborns (98%, n=83) were not reported to have suffered jaundice while only (2%, n=2) had a positive report on having suffered physiological jaundice as shown in figure 4.5.13. Majority of the newborns (98%, n=83) did not suffer from sepsis while only (2%, n=2) reported to have had sepsis as illustrated in figure 11.

Discussion

The findings in this study showed a significant age difference between women with complications and women without complications. Teenagers and women aged above thirty four years to forty nine were likely to present with maternal complications. The study results were in agreement with Blomberg *et al.*, 2014 in a study done in Indonesia in which there was a significant difference between younger and older women.

There was a significant difference in terms of respondent's area of residence. This was attributed to women being referred from the far places that included Kitui rural and Kitui East which agrees with Anggondowati *et al.*,



2017 who reported increased risk of poor perinatal outcomes among children born by women referred from rural areas due to maternal complications.

The study found significance in level of education where women with very low education and high education were likely to present with complications.

The study findings revealed a significant difference in women's occupational status. Employed women were more likely to present with maternal complications compared to the un-employed which is in disagreement with Saranya (2017) who found that women who were working as laborers had seven point four times higher chances of giving birth to low birth weight.

Perinatal outcomes of newborns by women with maternal complications

This study found that majority of the respondents were followed for maternal care related to fetus and amniotic fluid cavity complications followed by women presenting with edema and proteinuria. The study results disagrees with Angodowatti *et al.*, 2017 who reported in a prospective study done on maternal attributes and obstetrical difficulties impact on Indonesian neonatal outcomes that the most prevalent complications on admission were: Premature rupture of membranes at twenty six percent, severe pre-eclampsia/ eclampsia at eleven percent, postpartum and antepartum hemorrhage and mal-presentation at twenty one point six percent.

The study findings indicate that, majority of the babies were born through spontaneous vertex delivery. No significant difference was found after a cross-tabulation between mode of delivery and admission to the newborn unit. The results disagrees with

Angodowatti *et al.*, 2017 in a prospective study done on maternal attributes and obstetrical difficulties impact on Indonesian neonatal outcomes who reported that a good percentage of 41.5% of the admitted women was delivered by caesarean section, 80.7% of the mothers experienced near miss and 60% of their children were admitted in the newborn unit with birth asphyxia.

Majority of the newborns (89%) were born alive while 11% were born dead out of which majority died before labor with remaining 45% dying during labor. This is in disagreement with Figuaroa-damian & Arredondo, (2012) who reported increased cases of fetal mortality among women with tuberculosis.

The study found out that majority of the newborns who were born alive had a good Apgar score of eight to ten and a small portion of them with poor Apgar score in one minute which disagrees with Angodowatti *et al.*, 2017) whose results brought out that women with maternal complications were at a higher risk of experiencing shoulder dystocia, difficult second stage and poor Apgar score in one minute.

Majority of the newborns were underweight on delivery weighing between 1600-2499g at 44%; those with normal weight between 2500-3900g were 44% with the remaining being very low birth weight. Maternal complications in pregnancy were therefore attributed to delivery of newborns with low and very low birth weight which agrees with Fatemeh & Nazanin, 2012 who while studying Pregnancy complications and outcomes in women with epilepsy in Karaman University in Iran found that eighteen percent of the most fetal complications were due to preterm labor and ten percent intra-uterine growth retardation.

The study found that only twenty six percent were admitted with majority of them being admitted due to prematurity followed by



birth asphyxia. Maternal complications in pregnancy were therefore linked to admission of newborns to the newborn unit after delivery. The study results however differs with Berner *et al*, 2012 who reported that there were higher rates of newborn intensive care unit admission among newborns by women presenting with maternal complications compared to women presenting with Gestational diabetes.

After newborn follow up to twenty eight days post-delivery, majority at eighty five percent were alive with five percent being reported to have died, very few cases who reported complications and diseases like jaundice and sepsis. The findings therefore disagrees with Figuroa-damian & Arredondo, (2012) who reported that there was increased risk for perinatal deaths, cases of jaundice post-delivery perinatal, small for gestation and low births weight among newborns to women who presented with tuberculosis.

Conclusions

Teenagers and women aged above 34 years in pregnancy at a higher risk of presenting with maternal complications. Women referred from hard to reach constituencies of the county were more likely to present with complications in pregnancy. Low education level was associated with maternal complications in pregnancy.

Maternal care related to amniotic fluid cavity complications was the leading maternal complications in pregnancy followed by edema with proteinuria complications. Death before labor was the leading timing of death followed by death during labor sitting a gap in both antenatal and obstetric care. Underweight was the leading delivery outcome among women who had presented with complications in pregnancy.

Recommendations

- Governments and non-governmental organizations should put more emphasis on youth friendly services to reduce maternal complications associated with teenage pregnancy.
- There should more investment on infrastructure to make referral systems easy and avoid the second delay among women with maternal complications.
- Women empowerment should be given more attention through education for all programs to enable them make timely decisions concerning their sexual reproductive health.
- Women presenting with maternal complications in pregnancy at all levels of care should be closely followed up to avert cases of intra-uterine fetal deaths before and during labor.

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Conflict of Interest

No conflict of interest.

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