CHANGES IN PATTERN OF MATERNAL NEAR MISS MORBIDITY AFTER INTRODUCTION OF FREE MATERNITY POLICY IN A COUNTY HOSPITAL IN KENYA: A QUASI EXPERIMENTAL STUDY

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Key words: Maternal mortality; Near-miss morbidity; free maternity services; Embu County and Referral Hospital; Quality of care

ABSTRACT

Background: The cost of healthcare is a major barrier to access of essential maternal services in the developing world. On 1st June 2013, Kenya introduced Free Maternity Services (FMS) in an effort to promote access and improve maternal outcomes. Subsequently, service utilization increased, resulting in pressure on existing resources, potentially compromising quality of care. The World Health Organization (WHO) maternal near-miss tool was used to evaluate maternal outcomes under FMS in a county referral hospital in Kenya. The objective was to compare the pattern of maternal near-miss morbidity before and after FMS.

Methodology:

Study design: Retrospective quasi-experimental (pre-post type).

Treatment group: Records of 186 women with near-miss morbidity after introduction of FMS. Post-period was June 2014 to May 2016.

Comparison group: Records of 185 women with near-miss morbidity before introduction of FMS. Pre-period was October 2010 to May 2013.

Setting: Embu County Referral Hospital in Eastern Kenya.

Study population: Women offered maternity services at Embu county referral hospital between during the pre- and post-periods.

Data collection and analysis: The data abstraction form was adopted from the World Health Organization (WHO) Maternal Near-Miss tool. Analysis used Statistical Package for Social Science (SPSS) version 24. Pierson Chi-square test of significance was applied.

Results: The commonest causes of maternal near-miss was severe post-partum hemorrhage (S.PPH) and severe preeclampsia. S.PPH increased (91.0% up from 80.0% p= 0.005), while that of severe preeclampsia reduced in the post-period (13.0% vs. 6.5%, p= 0.029). Anemia was the biggest contributory cause of near misses but reduced in the post-period (43.8% vs. 30.1%, p= 0.020). Use of blood products increased significantly in the post-period (68.2% vs 78.5%, p< 0.001).

Conclusion: S.PPH remains a threat to women after introduction of free maternity services. There's need to optimize care maternities so as to reduce the risk of maternal mortality.

INTRODUCTION

Timely access to essential services can reduce the high burden of maternal morbidity and mortality seen in Sub-Saharan Africa (1). High cost of healthcare is one of the main barriers to access (2). In 2008-09, the maternal mortality ratio (MMR) in Kenya was 488/100,000 live births, way above the millennium development goal 5 target of 147/100000 live births (3) In June 2013, the Government implemented free maternity services in all public health facilities through a presidential decree. This was an effort to improve access to maternity care and ultimately reduce maternal mortality. Under FMS, all fees for obstetric care were abolished, including all delivery related complications(4) Over time, uptake of maternity services increased. Two years after its implementation, the number of women receiving antenatal care and delivering in public health facilities increased by 50% and 26% respectively .This placed pressure on existing human resource and hospital resources, which were not immediately increased to match the increased utilization (5,6). This mismatch may compromise the provision of timely emergency obstetric care (7). Review of maternal near-misses has shown to be a good alternative to maternal death review in assessment of quality of care both at facility and health system level. The World Health Organization (WHO) Maternal Near-miss (MNM) tool provides a standard approach to assessment of quality of care. It enables comparability of findings over various periods and settings (8). A multinational study that utilized this tool found a global maternal near miss ratio (MNMR) of 8.3/1000 live births. Countries with high MMR had a MNMR of 13.3/1000 live births – two to three times higher than countries with low MMR. In both high and low maternal mortality settings, coverage of essential interventions was similar except for the timeliness in which they were offered (1). This emphasized the need for overall improvement in quality of care and emergency obstetric services over and above universal coverage of life-saving interventions. Unpublished data show that the MNMR in Kenya is 42/1000 live births (9) Kenya is divided into 47 counties, with a devolved healthcare system since the year 2012. This study utilized the WHO near-miss tool to compare the pattern of MNM morbidity among women delivering in a county referral hospital before and after introduction of the free maternity services policy in Kenya from 2010 to 2016. This would provide a comparative assessment of the quality of care between the two periods.

METHODS

Study design: A retrospective quasi-experimental study of the pre- and post- design using patient files. Treatment group was records of 186 women who had any near miss morbidity after the introduction of free maternity services. Comparison group was records of 185 women who had any near miss morbidity before the introduction of free maternity services. The pre-period was between October 2010 to May 2013 and the post-period between June 2014 to May 2016.

Study setting: Embu County Referral Hospital is the largest hospital in the Eastern region of Kenya, whose catchment area extends to the neighboring four counties. The maternity unit offers 24-hour comprehensive obstetric care. During the study period, there was one antenatal, one labor and two postnatal wards. There was one consistent maternity theatre available 24 hours a day with a second emergency theatre available on request. Staffing remained consistent during the study period- two Obstetricians, three Medical Officers, three Medical officer interns, three Clinical officer interns and 15 midwives. Deliveries conducted annually numbered 3500 in the pre-period and 4800 in the post period. The hospital also houses the regional blood bank. There were no critical care or dialysis services, therefore patients who required them were referred to tertiary facilities. Women with early complications of pregnancy and readmissions with postpartum complications were admitted to the acute gynecology ward, whose services were not covered under FMS.

Study population: Women offered maternity services at Embu County Referral Hospital between 1st Oct 2010 to 31st May 2016. Women who met the WHO maternal near miss criteria were included in the study. Contextual modifications made were: a) lower threshold of transfusion to two units – this was found to have a higher specificity for maternal near miss cases in the low resource setting where

blood availability is limited (10) b) since the facility did not have critical care and dialysis units, women who needed these services and were referred out were considered to have potentially life-threatening conditions. Women with gestation below the viability threshold of 28 weeks were excluded. This is because these patients were admitted to the acute gynecology ward, whose services are outside the scope of free maternity care. Also excluded were records of women who received care between July 2013 to May 2014, which was considered the period of transition.

Sample Size and Sampling Criteria:

Using the Fox et al formula (11) with $\alpha = 0.05$, $\beta = 0.2$, power of 80%, confidence interval of 95% and assuming severe maternal outcome frequency of 4.7% (12). The calculated sample size was 172 records of women with maternal near-misses, with a 10% contingency to compensate for incomplete records, giving a total of 189. Random sampling of months without replacement was done for each period. In the pre-period and post periods, 185 and 186 records were abstracted respectively.

Independent:
- Free Maternity Services

Dependent:
- Total number of deliveries
- Women with livebirths
- Women with near miss morbidity
- Women with any potentially life-threatening condition.
- Women who underwent or referred out for any critical intervention.

Box 1: Study Variables

Data Variables: The independent variable and dependent variables evaluated in this study are shown in Box 1, while the definition of terms used in maternal near-miss evaluation are shown in Box 2.

Data collection, management and analysis: Data were abstracted from patient files by the principal investigator and three trained assistants using a data abstraction form adopted from the WHO Maternal Near-Miss tool. Data were entered into an Excel sheet, cleaned and coded. They were then exported to SPSS version 24 for analysis. Relevant tests of statistical significance were applied, with a p value <0.05 being considered significant.

Maternal Near Miss: A woman who nearly died but survived a complication that occurred during pregnancy childbirth or within 42 days of pregnancy termination.

Potentially Life-Threatening Conditions (PTLCs): Category of clinical conditions including diseases that can threaten a woman's life during pregnancy and labor and after termination of pregnancy.

Maternal Near Miss Ratio (MNMR): Maternal Near Miss Cases/1000 live births. It's an indicator for the amount of care and resources that would be required in an area or facility

Critical Intervention: An intervention required in the management of PTLCs. Includes; blood transfusion, interventional radiology, and emergency laparotomy due to sever bleeding or infection.

Box 2: Definition of Terms used in Maternal Near Miss Evaluation

Ethics: Ethics and administrative approvals were obtained from the Kenyatta National Hospital/ University of Nairobi- Ethics Review Committee (P566/08/2016) and Embu County Referral Hospital respectively.

RESULTS

In total, 15,774 files were reviewed: 8,441 in the pre-period and 7,333 in the post- period. In the pre-period, 19 files were excluded, leaving 8,422 files, of which 8,166 were live births. In the post-period, a total of 7,333 files were reviewed, 16 files excluded leaving 7,317 files. Of these, 7070 were live births.

In the pre-period there were 435 records of women with PTLCs versus 481 in the post-period. Out of these, 185 in the pre- period versus 186 in the post-period were near misses (Figure 1).

The MNMR increased from 22.7/1000 livebirths in pre-period to 26.3/1000 live births in the post-period. The causes of maternal near-misses during the pre- and post- periods are shown in Table 1. Direct causes of MNM in the pre-period were: Severe postpartum hemorrhage (S.PPH) at 80.0%, severe preeclampsia (13.0%), ruptured uterus (8.1%), eclampsia (4.3%) and sepsis (2.2%) In the post period, S.PPH remained the leading cause of MNM with a significant increase (91.0% up from 80.0%; p-value 0.005). Ruptured uterus was second, with a non-significant increase (9.7% from 8.1%, p-value 0.523). Severe preeclampsia was third, having reduced significantly (13.0% vs. 6.5%, p-value 0.035). Eclampsia was the fourth (2.2%) and there were no recorded cases of

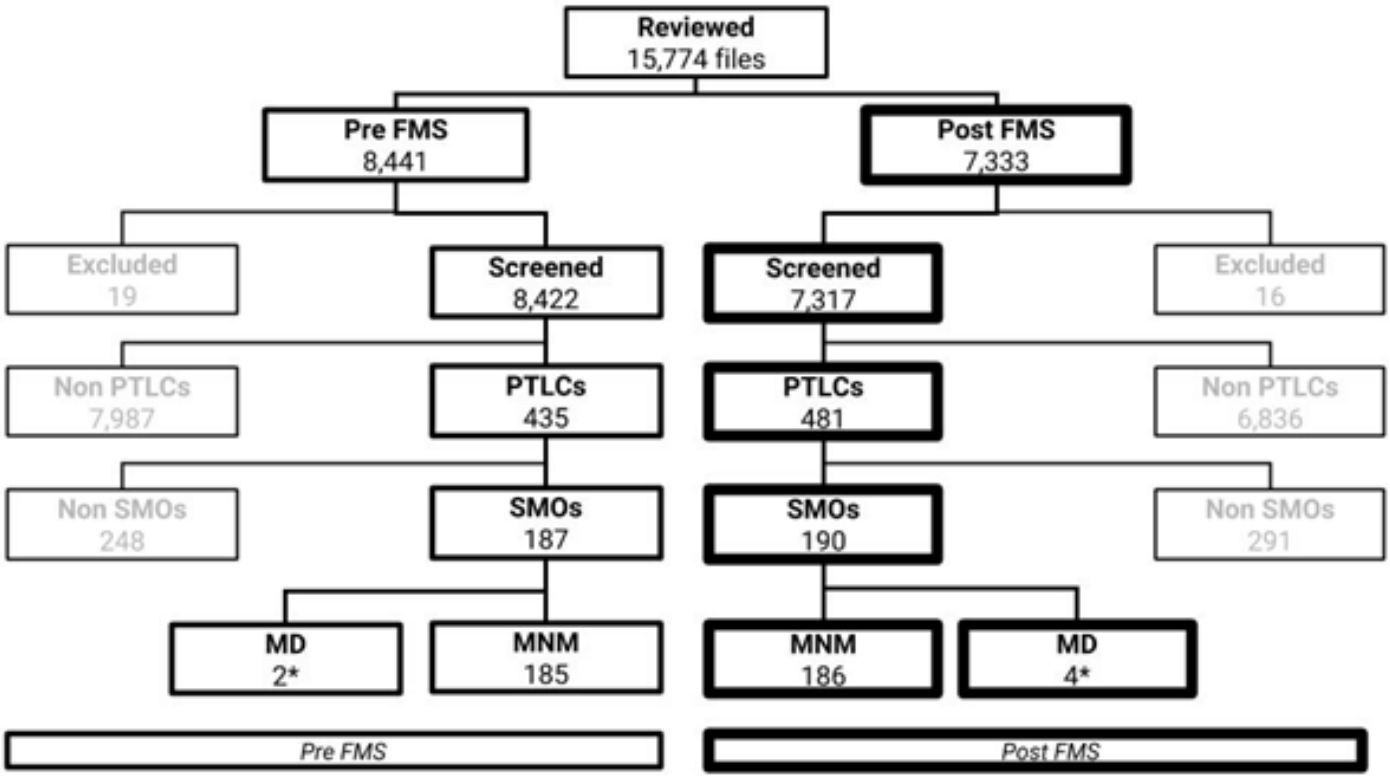

Figure 1: Flow chart of study participants before and after introduction of free maternity care in Embu County Referral Hospital

FMS- Free Maternity Services; PTLCs- Potentially Life-threatening Conditions; SMOs- Severe Maternal Outcomes; MNMs- Maternal Near Misses; MDs- Maternal Deaths

*MDs were not included in the final analysis as most maternal death files were missing

severe sepsis. Anemia was the major contributory cause of MNM, with a significant decline after introduction of free maternity services (43.8%% vs 30.1%; p-value 0.020). Previous caesarean section was the main contributory cause of MNM in the post-period, with no significant change (34.6% vs 34.4%; p-value 0.970) from the pre-period.

The utilization of critical interventions during the Pre- and Post- periods is shown in Table 2. The use of blood products increased significantly in the post-period (68.2% vs 78.5%; p-value <0.001) among women with potentially life-threatening conditions. This mirrors the increase seen in the proportion of women with severe PPH in this period. Laparotomy for ruptured uterus was also more in the post-period but this difference was insignificant (4.8% vs 4.1%; p-value 0.899) Number of patients referred out (for ICU care, dialysis and transfusion) was lower in

Table 1: Causes of Maternal Near Misses at Embu County Referral Hospital during the Pre-period (Oct 2010-June 2013) and Post-period (June 2014-May 2016) following Introduction of Free Maternity Services

Cause of Maternal Near Miss	Pre-Period N=185 n (%)	Post-period N=186 n (%)	P-value*
Direct Causes			
Severe PPH	148 (80)	170 (91.0)	0.005
Severe Preeclampsia	24 (13)	12 (6.5)	0.029
Ruptured Uterus	15 (8.1)	18 (9.7)	0.523
Eclampsia	8 (4.3)	4 (2.2)	0.523
Severe sepsis	4 (2.2)	0 (0.0)	N/A
Contributory Causes			
Anemia	81 (43.8)	56 (30.1)	0.017
Previous Caesarean Section	64 (34.6)	64 (33.4)	0.970
Obstructed labor	10 (5.4)	12 (6.5)	0.670
HIV/AIDS	7 (3.8)	8 (4.3)	0.800

Table 2: Use of Critical Interventions at Embu County Referral Hospital Pre (Oct 2010-June 2013) and Post (June 2014-May 2016) Introduction of Free Maternity Services

Critical Intervention	Pre- Period N= 435 n (%)	Post-Period N= 481 n (%)	p-value*
Use of blood products	296 (68.2)	375 (78.5)	<0.001
Laparotomy	18 (4.1)	18 (4.8)	0.899
Referrals out	5 (1.2)	4 (0.8)	0.0582

the post- FMS era (0.8% vs 1.2%). Similarly, this difference was not statistically significant (p-value 0.058). In the post-period, four women were referred out for critical care, dialysis and blood transfusion, compared with five in the pre-period.

DISCUSSION

Severe PPH was the main contributor to MNMs in both periods, comparable to global data (1). Studies within low-resource settings vary: in Uganda and Ethiopia, hypertensive disease was the main contributor, while in Rwanda, hemorrhage was the leading cause (13–15). Data from the Confidential Enquiry into Maternal Deaths (CEMD) in Kenya found PPH to be the leading cause of maternal death (39.7%), which correlates to these findings (16). Compared to the CEMD, the proportion found in our study (80.0% and 91.0%) was much higher, but this was attributable to the fact that this study did not include early pregnancy complications, as they were not covered under FMS. This resulted in a narrower range of complications. This was a limitation for this study, but the exclusion reduced information bias. The increase noted after introduction of free maternity services can be attributed to: i) The increase in number of women delivering at the facility may have overwhelmed the staff, compromising intrapartum and immediate post-partum care. A study done at Nakuru county referral hospital in Kenya found staff shortage to be a challenge after FMS introduction, leading to a compromise in quality of care offered (6). ii) Women with severe PPH who would otherwise have delivered at home or in lower level facilities accessed care at the county referral hospital after removal of the cost barrier. Most studies done on access of services after removal of user fees confirm increase in access to hospital deliveries(7). The proportion of women who were transfused increased in the post-period, which mirrored the increase in S.PPH. In Kenya, blood shortage contributes to one third of maternal deaths due to hemorrhage(16). This underscores the need to ensure adequate blood supplies in maternity units in order to optimize management of women with hemorrhage. Some of the challenges faced in adequate blood provision in Sub-Saharan Africa include poor set-up of blood centers, transport and laboratory systems as well as shortage of donors(17).

The reduced proportion of women with preeclampsia and anemia observed after introduction of free maternity services was attributed to an increase in ANC attendance (5,6). Blood pressure monitoring aids in early diagnosis of preeclampsia and referral for management before evolving into severe disease. Iron/folate supplementation, also done during ANC visit, is a well -known strategy for reducing anemia in pregnancy (18). This underscores the need to strengthen ANC services in the country, in order to sustain the benefits of improved uptake depicted in this study.

No cases of severe sepsis were found in the post-period. This is most likely because in this period women got discharged promptly postpartum due to the crowding in the wards. In case of readmission, it was to the acute gynecology ward which wasn't covered under FMS. We therefore recommend a follow up study looking into cases of severe sepsis.

The study found an increase in the MNMR in the post-period. According to WHO, MNMR is an estimate of the amount of care/resources needed to manage maternal complications (8). This confirms the previously demonstrated need to increase physical and human resources to match the increase in service

utilization after user fee abolishment (7, 18). The recent CEMD in Kenya found that health-care worker related factors contribute to three quarters of maternal deaths in Kenya (16). There is thus an urgent need to audit human resource in the maternity unit- skills, training, numbers, support structures, motivation and attitude. This will inform the specific aspects that need to be optimized in the setting of free maternity services.

CONCLUSION

To optimize obstetric care under the free maternity services program in Kenya, there is need develop strategies for prevention and management of severe PPH. National blood transfusion services also need to be strengthened in order to match the increased demand for blood. Human resource audit is also essential in order to identify specific areas that need to be enhanced.

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Conflict of Interest: None to declare

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POLICY BRIEF

FREE MATERNITY SERVICES IN EMBU COUNTY: WITH INCREASED ACCESS TO HOSPITAL DELIVERIES, WHERE ARE WE?

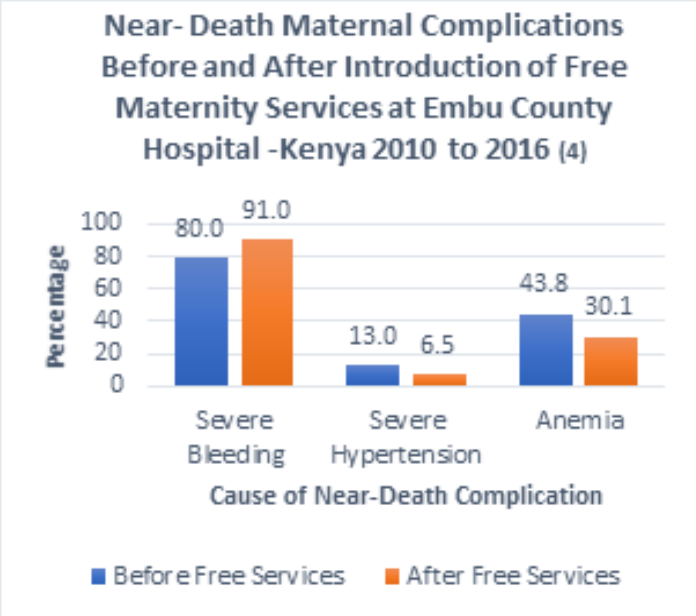
Removal of financial barriers has been consistently shown to improve access and ultimate utilization of maternal health services. Increase in service utilization in the setting of free services does not always lead to improvement in quality of care (1). As such, other concurrent interventions are required - such as optimization of human resource, the supporting infrastructure and supplies (2). Kenya introduced free maternity services in June 2013. At the time, the country was among 10 countries that contributed to over half of global maternal deaths. The free services led to a significant increase in hospital deliveries and antenatal care clinic attendance. On the other hand, resources in public hospitals- human resource and supplies were not increased to match the increase in demand (3). A study was carried out in Embu county referral hospital to assess the effect of free maternity services on maternal near-death events (Oct 2010 to May 2016), as a measure of quality of care (4).

PRIORITY ACTIONS

- **Audit barriers to quality service delivery in maternity units**
  - **Optimal human resource- numbers, right skills mix, availability, knowledge, training on evidence-based practices, positive attitude and well-motivated.**
  - **Ideal supporting infrastructure and supplies- maternity consumables, diagnostic tests, medication and critical care services.**
- **Adopt the use of existing guidelines on bleeding during childbirth and strengthen adherence to the same.**
- **Empower Blood Transfusion Services**
  - **Regular blood drives**
  - **Adequate resources for processing and storage**
- **Support Antenatal Care Clinics to Sustain the Reduction in pregnancy complications.**

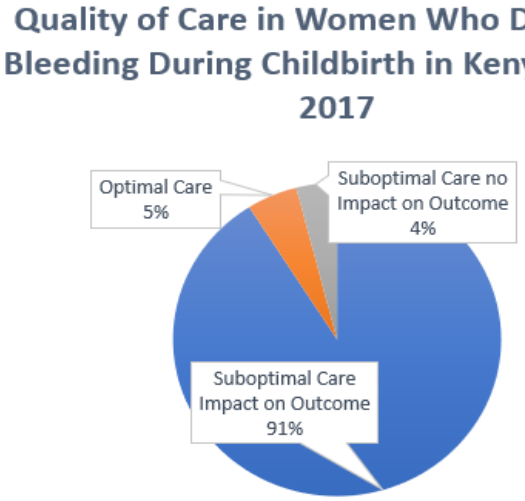
SEVERE BLEEDING A BIGGER THREAT TO WOMEN IN THE ERA OF FREE MATERNITY SERVICES

Severe bleeding (the leading killer of women during childbirth globally and locally) was the chief cause of near-death maternal complications before and after introduction of free services. Sadly, the proportion of women suffering from this grave complication increased during the era of free maternity services accounting for nine out of ten near-death complications. This was accompanied by an increase in blood transfusion by 15 for every 100 women with a severe complication. If no measures taken to reverse this, women will continue to risk their lives as well as that of their newborns while giving birth. This may make them not choose to deliver in hospital again, reversing the goal of instituting free maternity services. The hospitals will also bear needless cost of treating complications from severe bleeding and the staff will get demotivated from poor outcomes.



KEY FINDINGS

- ◊ Severe bleeding following childbirth remains the leading cause of near-death complications.
- ◊ More women suffer from severe bleeding after free maternity services introduction than before.
- ◊ Less Women Suffer from severe hypertension and anemia in pregnancy, after introduction of free maternity services.



Source: Saving Mothers Lives 2017, First Confidential Report into Maternal Deaths in Kenya

For every ten maternal deaths due to bleeding in Kenya (5):

- **Nine** occur due to poor quality of care offered at the health facility.
- **More than seven** occur due to health-care worker related causes.
- **Three** are due to lack of blood.

WHAT IS THE OVERALL GAIN?

Women

- Avert unnecessary suffering and possible death from birth-related bleeding.
- Allow mother to adequately take care of the newborn preventing poor health and possible death.
- Influence a positive attitude towards hospital deliveries and encourage good health seeking behavior in future pregnancies.

Health System

- Reduce the extra cost of treating complications arising from severe bleeding.
- Staff motivation through positive outcomes.

Political

- Lower the number of women dying during child birth therefore realizing the goal of Free Maternity Policy
- Healthier women and their families resulting in an overall increase in productivity of the nation.
- Realization of the Sustainable Development Goals.

"NO WOMAN SHOULD DIE GIVING LIFE" (UNFPA 2013)

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Improving health systems through research

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