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PATTERNS IN MATERNAL MORTALITY FOLLOWING THE IMPLEMENTATION OF A FREE MATERNAL HEALTH CARE POLICY IN KENYAN PUBLIC HEALTH FACILITIES

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## PATTERNS IN MATERNAL MORTALITY FOLLOWING THE IMPLEMENTATION OF A FREE MATERNAL HEALTH CARE POLICY IN KENYAN PUBLIC HEALTH FACILITIES

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### ABSTRACT

**Background:** Reduction of pregnancy related mortalities remains one of the greatest health challenges globally. For a long time, low utilization of maternal health care services has been attributed to the unaffordability of services. The government of Kenya waived delivery charges in public health facilities through a free maternal health care policy in June 2013 with an aim of encouraging facility based deliveries and subsequently reducing maternal deaths.

**Objectives:** To describe the causes of maternal mortality 2 years before the implementation of the free maternal health care policy in Kenya (June 2011-May 2013) and 2 years after the policy intervention (June 2013-May 2015).

**Design:** This study was of a quasi-experimental design.

**Setting:** The study was carried out in 77 public health facilities in Kenya.

**Subjects:** The study subjects for this study were 872 deceased mothers.

**Results:** The largest proportion of deaths was as a result of direct causes, 79.1% before the policy 74.9% after the policy intervention. Haemorrhage, hypertensive disorders, complications of abortion and sepsis/infections were the most common direct causes of maternal mortality pre and post policy intervention. There were no significant changes in the causes of maternal following the free maternal health care policy implementation ( $P>0.05$ ). The free maternal health care policy has not improved the chances of survival for mothers delivering in the 77 public health facilities (odds ratio=0.9722).

**Conclusion:** The implementation of the free maternal health care policy has not influenced the causes of maternal mortality in Kenyan public health facilities.

### INTRODUCTION

Despite numerous global efforts to curb maternal deaths, they remain disturbingly high in developing countries yet pregnancy related mortalities are almost always preventable through the attendance of

pregnancy and deliveries by skilled health care professionals in adequately supplied and equipped health facilities (1). It is estimated that approximately 303,000 women died worldwide, in the year 2015 as a result of pregnancy related causes (2). Maternal mortality has been shown to occur

as a result of direct obstetric causes (73.0%) and indirect causes (27.0%) with the major causes being haemorrhage (27.1%), hypertensive disorders (14.0%), sepsis (10.7%), abortion (7.9%) and embolism (3.2%) with these figures showing a substantial regional variation (3).

Kenya's progress towards reducing maternal mortality has been minimal. In the last 2 decades, the maternal mortality rate has only gone down from 584 to 362 per 100,000 live births (4). A key requirement for further advances in reduction of pregnancy and birth related deaths is effective maternal health care policy and programs implementation (3). Elimination of user fees has been shown to be a good intervention approach of promoting rapid facility based deliveries in Sub Saharan Africa (5,6). It is against this backdrop that Kenya implemented a free maternal health care policy through a presidential directive on 1st June 2013; under the policy mothers deliver in public health facilities for free (7).

However, maternal mortalities been attributed to the "three delays" namely; delays in making a decision to seek maternal health care services, delays in accessing and arriving at the health facilities and delays in receiving adequate treatment and referral(8).The free maternal health care policy partially eliminates delays in making a decision to seek delivery health services by eliminating delivery fees in health care facilities but does not address the delay in arriving at health facilities and the delays in receiving adequate medical care. In addition, preliminary assessments of the free maternal health care policy implementation in Malindi District of Kenya, established that the free maternal health care policy is faced numerous challenges (9).The challenges faced were shortage of trained health care workers, stock outs of drugs and other medical supplies necessary for service provision, heavy workloads among the few available health care workers, non-

involvement of stakeholders in maternal health and late reimbursement of the costs incurred in providing free maternal health care services hence service delivery constraints for subsequent clients.

Based on the assessments of a free maternal health care policy in Ghana, W.H.O. notes that with user free policy intervention, the expected pattern of change in maternal deaths should be a decline in deaths from direct causes and no change in death from indirect causes (10, 11). Most of the maternal deaths occur in the intrapartum and postpartum periods with an estimated 45% of postpartum deaths occur within 24 hours of delivery in which mothers delivering in health facilities are still under the care of skilled health care workers (12).Given that the free maternal health care policy provides a contact between a mother and a skilled health care worker, effective care and management of pregnancy related complications should be able to prevent or reduce deaths from some direct causes of maternal mortality such as postpartum haemorrhage, complications of abortions and infections (13-15).As such, analysis of comparative data sets on maternal mortality is necessary to help in the formulation and improvement of maternal health policies. This study was therefore undertaken to determine whether the free maternal health care policy had any impact on the causes of maternal mortality in Kenyan public health facilities.

## METHODS

**Study Design:** This study was of a quasi-experimental design, comparing the causes of maternal mortality in the 77 public health facilities pre and post free maternal health care policy intervention.

**Study set up:** The study was carried out in 77 Kenyan public health facilities in 14 counties where the free maternal health care policy was being implemented.

**Study population:** The study population was deceased mothers whose records were retrieved from the health facilities. Kenya's health public health care facilities are organized in a hierarchical-pyramidal outfit comprising five levels with the lowest being the Level 1 health facilities (village dispensaries), Level 2 health facilities (health centres), Level 3 health facilities (sub-district hospitals), Level 4 health facilities (district hospitals), Level 5 health facilities (provincial hospitals) and Level 6 health facilities which are the national referral hospitals (16). This hierarchical-pyramidal outfit in Kenya is expected to change with due to devolution of health services and the enactment of the Kenya Health Bill 2014 (17).

**Sample Size:** Based on a national maternal mortality ratio of 362/100,000 live births (5), a 95% confidence interval, a minimum of 355 maternal deaths before and 355 maternal deaths after the policy implementation were the required sample size for this study (4, 18). Upon review of health facility records a total of 802 audited maternal deaths were identified (374 pre policy implementation and 498 post policy implementation). All the maternal deaths were included in the study based on observations that in comparative studies which are not randomized clinical trials, there isn't a heterogeneity of variance and as such unequal sample sizes can be used (19, 20).

**Sampling:** Multistage cluster sampling was the sampling method used in this study. The first stage involved selection of 14 counties out of the 47 counties based on maternal mortality risk over the previous years (5 high risk maternal mortality counties, 5 medium risk maternal mortality risk counties and 4 low risk maternal mortality risk counties were selected). The second stage involved selection of the number of facilities from every county to be included in the study which was done through proportionate probability sampling.

The third stage involved selection of individual health facilities in every county which was based on location and facility level clusters. Seventy seven health facilities were selected amongst them a maternity nursing home, a national referral hospital, 58 Level 4 health facilities and 17 level 5 health facilities. After these steps all audited maternal mortality cases 2 years pre and post policy implementation were identified.

**Data management and Statistical analysis:** Four research assistants were trained on data collection and research ethics. Pre testing of the data collection tool was done at a level 4 health facility in Kiambu County which was not in the sampling frame. Data on every audited maternal death was extracted from maternal mortality audit reports books and recorded into prepared data capture forms. Records on individual maternal mortality cases were thereafter keyed into a Microsoft Excel (2013) spread sheet. Descriptive and inferential analyses were performed using SPSS (version 23) and Epi Info (version 7.2.0.1).

**Ethical Clearance:** Ethical approval was obtained from Kenyatta National Hospital and University of Nairobi Ethical Committee while administrative approval was obtained from the ministry of health headquarters in Kenya, County health officials and the health facility administrators.

## RESULTS

**Social Demographic Background of the Deceased Mothers:** There were 1,332 maternal deaths in the 77 health facilities during the period of interest. Of these, only 872 complete records of audited maternal deaths were available (374 pre policy implementation and 498 post policy implementation). The deceased mothers had delivered/were delivering through caesarean sections (44.4% before the policy

and 42.9% after the policy) and spontaneous vaginal deliveries (55.6% before the policy and 57.1% after the policy). The mean age for the deceased mothers was 27.5 years. The youngest mother was 12 years and the oldest was 47 years.

A higher proportion of the maternal deaths had happened in urban based facilities (51.9% before the policy and 70.1% after the policy) as compared to the mortalities in rural based facilities (48.1% before the policy and 29.9% after the policy).

The high risk maternal mortality counties accounted for 60% of all the maternal mortalities, medium and low risk maternal mortality counties recorded 32% and 8% of all the mortalities respectively. Of the total deaths, 42.9% had happened 2 years before the implementation of the free maternal health care policy while 57.1% were recorded 2 years after the implementation of the free maternal health care policy (Table 1).

**Table 1**  
**Facility Status and Periods for the Occurrence of the Maternal Mortalities**

	Before the Policy	After the Policy	Total
Maternity Nursing Hospital	4.5%(17)	3.6%(18)	4.0%(35)
Level 4 Health Facilities	61.5%(230)	50.2%(250)	55.0%(480)
Level 5 Health Facilities	16.3%(61)	20.5%(102)	18.7%(163)
Level 6 Health Facility	17.6%(66)	25.7%(128)	22.2%(194)
Rural Based Health Facilities	48.10%(180)	29.9%(149)	37.7%(329)
Urban Based Health Facilities	51.9%(194)	70.1%(349)	62.3%(543)
High Risk Zones	55.9%(209)	63.1%(314)	60.0%(523)
Medium Risk Zones	36.1%(135)	28.9%(144)	32.0%(279)
Low Risk Zones	8.0%(30)	8.0%(40)	8.0%(70)
All The 77 Health Facilities	42.9%(374)	57.1%(498)	100%(872)

**Table 2**  
**Timing of the Maternal Mortalities**

	Timing of the Mortality	Before the Policy	After the Policy	Total
Maternity Nursing Hospital	Antepartum	23.5%(4)	0.0%(0)	11.4%(4)
	Intrapartum	11.8%(2)	16.7%(3)	14.3%(5)
	Postpartum (Puerperium)	64.7%(11)	83.3%(15)	74.3%(26)
Level 4 Health Facilities	Antepartum	23.0%(53)	29.2%(73)	26.30%
	Intrapartum	13.0%(30)	8.8%(22)	10.8%(52)
	Postpartum (Puerperium)	63.9%(147)	62.0%(155)	62.9%(302)
Level 5 Health Facilities	Antepartum	31.1%(19)	37.3%(38)	35.0%(57)
	Intrapartum	16.4%(10)	13.7%(14)	14.7%(24)
	Postpartum (Puerperium)	52.5%(32)	49.0%(50)	50.3%(82)
Level 6 Health Facility	Antepartum	33.3%(22)	33.6%(43)	33.5%(65)
	Intrapartum	12.1%(8)	9.4%(12)	10.3%(20)
	Postpartum (Puerperium)	54.5%(36)	57.0%(73)	56.2%(109)
Rural based facilities	Antepartum	23.9%(43)	33.6%(50)	28.3%(93)
	Intrapartum	11.7%(21)	4.7%(7)	8.5%(28)
	Postpartum (Puerperium)	64.4%(116)	61.7%(92)	63.2%(208)
Urban based facilities	Antepartum	28.4%(55)	29.8%(104)	29.3%(159)
	Intrapartum	14.9%(29)	12.6%(44)	13.4%(73)
	Postpartum (Puerperium)	56.7%(110)	57.6%(201)	57.3%(311)
All the 77 health facilities	Antepartum	26.2%(98)	30.9%(154)	28.9%(252)
	Intrapartum	13.4%(50)	10.2%(51)	11.6%(101)
	Postpartum (Puerperium)	60.4%(226)	58.8%(293)	59.5%(519)

In the 77 health facilities visited, most of the maternal deaths happened in the postpartum period (59.5%) followed by antepartum deaths (28.9%) and intrapartum deaths (11.6%). This pattern was similar across all facilities, locations, before and after the policy implementation (Table 2).

ANC attendance and Mode of delivery by the deceased mothers who died at the intrapartum and postpartum Regarding ANC attendance by mothers who died intrapartum and postpartum, only 54.7% of

the deceased mothers had made at least one ANC visit (n=493). Of the 54.7% who had visited ANC clinics, only 40.9% had made at least 4 visits. There were significant increases in the number of mothers making 1 ANC visit and at least 4 ANC visits following the policy intervention ( $P < 0.05$ ). All the deceased mothers in the maternity nursing home had not made any ANC visit while level 4 health facilities recorded the fewest number of mothers visiting ANC clinics at least 4 times (Table 3).

**Table3**  
**ANC visits and Mode of Delivery by the Deceased Mothers**

\*\*\* ANC visit and mode of delivery figures on this table are exclusive of mothers who died in the antepartum period.

*Attendant at the time of death*

Variable	No. of ANC visits	Before the Policy	After the Policy	Total
Rural based facilities	No visit	44.9%(48)	52.3% (45)	48.2%(93)
	1 visit	6.5%(7)	4.7%(4)	5.7%(11)
	1-3 visits	38.3%(41)	25.7%(22)	32.7%(63)
	4 or more visits	16.8%(18)	22.1%(19)	19.1%(37)
Urban based facilities	No visit	56.3%(45)	47.1%(80)	50.0%(125)
	1 visit	5.0%(4)	5.3%(9)	5.2%(13)
	1-3 visits	21.3%(21)	28.8%(49)	27.8%(70)
	4 or more visits	17.6%(14)	24.2%(41)	22.0%(55)
Maternity Nursing Hospital	No visit	100.0%(6)	100.0%(5)	100.0%(11)
	1 visit	0.0%(0)	0.0%(0)	0.0%(0)
	1-3 visits	0.0%(0)	0.0%(0)	0.0%(0)
	4 or more visits	0.0%(0)	0.0%(0)	0.0%(0)
Level 4 Health Facilities	No visit	49.6%(66)	50.0%(77)	49.8%(143)
	1 visits	6.8%(9)	4.5%(7)	5.6%(16)
	1-3 visits	35.8%(47)	28.5%(44)	31.7%(91)
	4 or more visits	15.1%(20)	21.4%(33)	18.4%(53)
Level 5 Health Facilities	No visit	51.5%(17)	44.1%(26)	46.7%(43)
	1 visits	0.0%(0)	1.7%(1)	1.1%(1)
	1-3 visits	27.3%(9)	28.8%(17)	28.3%(26)
	4 or more visits	21.2%(7)	26.1%(16)	25.1%(23)
Level 6 Health Facilities	No visits	26.7%(4)	44.7%(17)	39.6%(21)
	1 visit	13.3%(2)	13.2%(5)	13.2%(7)
	1-3 visits	40.0%(6)	26.3%(10)	30.2%(16)
	4 or more visits	33.30%	28.90%	30.20%
All the 77 health facilities	No visits	44.9%(94)	45.6%(130)	45.4%(224)
	1 visit	55.1%(114)	54.4%(155)	54.7%(269)
	1-3 visits	66.0%(62)	54.2%(71)	59.1%(133)
	4 or more visits	34.0%(32)	45.8%(60)	40.9%(92)

The attendants at the time of death were mostly health care workers (97.7%) say for a 0.3% of the mothers who the records showed that they arrived in the health facilities late after attendance by traditional birth

attendants. In the level 6 health facility, 75% of all the mothers were attended to by a gynaecologist, one quarter of the mothers in rural based facilities and level 5 facilities were attended to by a nurse/ midwife while



86% of the mothers in the maternity home were attended to by a medical officer. There was an increased number of mothers being attended to by medical officers and multidisciplinary teams of health workers (P<0.05) following the policy intervention (Table 4). Traditional birth attendants are indicative of mothers who died on arrival.

**Table 4**  
**Attendant at the Time of Death**

Attendant	Rural Based Facilities	Urban Based Facilities	Level 4 Facilities	Level 5 Facilities	Level 6 Facility	Maternity Hospital	Before the Policy	After the Policy	Total
Clinical Officer	7.3% (24)	4.8% (26)	8.1% (39)	6.7% (11)	0.0% (0)	0.0% (0)	5.3% (20)	6.0% (30)	5.7% (50)
Gynecologist	29.8% (98)	44.4% (241)	28.1% (135)	33.1% (54)	74.7% (145)	14.3% (5)	38.0% (142)	39.6% (197)	38.9% (339)
Medical Officer	34.0% (112)	32.0% (174)	38.8% (186)	28.2% (46)	12.4% (24)	85.7% (30)	35.6% (133)	30.7% (153)	32.8% (286)
Nurse/Midwife	24.6% (81)	14.7% (80)	22.1% (106)	27.6% (45)	5.2% (10)	0.0% (0)	17.4% (65)	19.3% (96)	18.5% (161)
Surgeon	0.3% (10)	0.2% (1)	0.2% (1)	0.6% (1)	0.0% (0)	0.0% (0)	0.3% (2)	0.2% (1)	0.2% (3)
Traditional birth attendants	0.6% (2)	0.2% (1)	0.2% (1)	1.2% (2)	0.0% (0)	0.0% (0)	0.5% (2)	0.2% (1)	0.3% (3)
Multidisciplinary team	3.3% (11)	3.7% (20)	2.5% (12)	2.5% (4)	7.7% (15)	0.0% (0)	2.9% (11)	4.0% (20)	3.6% (31)

**Booking for delivery services by the deceased mothers:** Most of the deceased women (59.9%) were referral cases from other facilities/places while 35.9% were walk in patients and only 4.2% of the cases were booked for delivery in the facilities where they died. The highest number of referrals was in the level 6 health facility (81.3%) while the highest number of walk in cases were in the maternity nursing home (77.1%). This pattern of referral is replicated before and after the policy intervention as shown in Table 5.

**Table 5**  
**Booking for Delivery Services by the Deceased Mothers Cause of maternal mortality**

Variable	Booking Status	Before the Policy	After the Policy	Total
Rural Based Facilities	Booked	8.3%(14)	2.9%(4)	5.9%(18)
	Referral	53.0%(89)	56.2%(77)	54.4%(166)
	Walk In	38.7%(65)	40.9%(56)	39.7%(121)
Urban Based Facilities	Booked	2.2%(4)	3.6%(12)	3.1%(16)
	Referral	65.4%(119)	61.9%(205)	63.2%(324)
	Walk In	32.4%(59)	34.4%(114)	33.7%(173)
Maternity Nursing Home	Booked	0.0%(0)	5.6%(1)	2.9%(1)
	Referral	41.2%(7)	0.0%(0)	20.0%(7)
	Walk In	58.8%(10)	94.4%(17)	77.1%(27)
Level 4 Health Facilities	Booked	7.4%(16)	5.3%(12)	6.3%(28)
	Referral	51.9%(112)	54.4%(123)	53.2%(235)
	Walk In	40.7%(88)	40.3%(91)	40.5%(179)
Level 5 Health Facilities	Booked	1.8%(1)	1.0%(1)	1.3%(2)
	Referral	67.3%(37)	60.0%(60)	62.6%(97)
	Walk In	30.9%(17)	39.0%(39)	36.1%(56)
Level 6 Health Facility	Booked	1.6%(1)	1.6%(2)	1.6%(3)
	Referral	83.9%(52)	79.8%(99)	81.2%(151)
	Walk In	14.5%(9)	18.5%(23)	17.2%(32)
All the 77 Health Facilities	Booked	5.1%(18)	3.4%(16)	4.2%(34)
	Referral	59.4%(208)	60.3%(282)	59.9%(490)
	Walk In	35.4%(124)	36.3%(170)	35.9%(294)

Direct causes of maternal mortality accounted for 79.1% of the deaths before the policy and 74.9% of the deaths after the policy intervention while indirect causes were responsible for 23.3% of the deaths (20.9% pre policy and 25.1% post policy). The highest numbers of direct causes of deaths were recorded in the maternity home

(94.3%) while the highest numbers of indirect causes of deaths were recorded in the Level 6 health facility (32.5%). A chi square test shows no change in distribution of direct and indirect and indirect causes maternal mortality ( $P>0.05$ ) following the implementation of the free maternal health care policy (Table 6).

**Table 6**  
**Distribution of Direct and Indirect Causes of Maternal Mortality**

Variable	Causes of mortality	Before the Policy	After the Policy	Total
Rural Based Facilities	Direct	78.3%(141)	77.9%(116)	78.1%(257)
	Indirect	21.7%(39)	22.1%(33)	21.9%(72)
Urban Based Facilities	Direct	79.9%(155)	73.6%(257)	75.9%(412)
	Indirect	20.1%(39)	26.4%(92)	24.1%(131)
Maternity nursing home	Direct	94.1%(16)	94.4%(17)	94.3%(33)
	Indirect	5.9%(1)	5.6%(1)	5.7%(2)
Level 4 Health Facilities	Direct	81.3%(187)	78.0%(195)	79.6%(382)
	Indirect	18.7%(43)	22.0%(55)	20.4%(98)
Level 5 Health Facilities	Direct	77.0%(47)	74.5%(76)	75.5%(123)
	Indirect	23.0%(14)	25.5%(26)	24.5%(40)
Level 6 Health Facility	Direct	69.7%(46)	66.4%(85)	67.5%(131)
	Indirect	30.3%(20)	33.6%(43)	32.5%(63)
All the 77 Health Facilities	Direct	79.1%(296)	74.9%(373)	76.7%(669)
	Indirect	20.9%(78)	25.1%(125)	23.3%(203)

Haemorrhage accounted for 32.6% of all mortalities (22.5% from postpartum haemorrhage and 10.1% from antepartum haemorrhage) while eclampsia and pre-eclampsia were the causes of 13.8% of all the mortalities, abortion complications, sepsis/infections and other direct causes

were responsible for 10.1%, 7.8% and 12.7% of all mortalities respectively. A chi square of trend shows no significant changes in the distribution and causes of deaths ( $P>0.05$ ) before and after the free maternal health care policy implementation (Table 7).

**Table 7**  
**Specific Causes of Maternal Mortality**

Variable Description	Exact Cause of Maternal Death	Before the Policy Implementation	After the Policy Implementation	Total
Rural Based Health Facilities	APH	10.0%(18)	10.7%(16)	10.3%(34)
	PPH	26.1%(47)	21.5%(32)	24.0%(79)
	Complications of abortion	12.8%(23)	13.4%(20)	13.1%(43)
	Pre Eclampsia	1.7%(3)	1.3%(2)	1.5%(5)
	Eclampsia	8.9%(16)	10.7%(16)	9.7%(32)
	Sepsis/Infection	7.2%(13)	5.4%(8)	6.4%(21)
	Other Direct Causes	11.7%(21)	14.8%(22)	13.1%(43)
Indirect causes	21.7%(39)	22.1%(33)	21.9%(72)	
Urban Based Health Facilities	APH	12.9%(25)	10.0%(35)	11.0%(60)
	PPH	22.2%(43)	21.2%(74)	21.5%(117)
	Complications of Abortion	6.7%(13)	9.2%(32)	8.3%(45)
	Pre Eclampsia	3.1%(6)	2.0%(7)	2.4%(13)
	Eclampsia	15.2%(30)	11.5%(40)	12.9%(70)
	Sepsis/Infection	8.2%(16)	8.9%(31)	8.7%(47)
	Other Direct Causes	11.3%(22)	10.9%(38)	11.0%(60)
Indirect Causes	20.1%(39)	26.4%(92)	24.1%(131)	
Maternity Nursing Home	APH	11.8%(2)	11.1%(2)	11.4%(4)
	PPH	64.7%(11)	38.9%(7)	51.4%(18)
	Eclampsia	17.6%(3)	16.7%(3)	17.1%(6)
	Sepsis/Infection	0.0%(0)	5.6%(1)	2.9%(1)
	Other Direct Causes	0.0%(0)	22.2%(4)	11.4%(4)
Indirect Causes	5.9%(1)	5.6%(1)	5.7%(2)	
Level 4 Health Facilities	APH	10.4%(24)	10.4%(26)	10.4%(50)
	PPH	28.3%(65)	25.2%(63)	26.7%(128)
	Complications of Abortion	10.9%(25)	13.6%(34)	12.3%(59)
	Pre Eclampsia	2.2%(5)	1.2%(3)	1.7%(8)
	Eclampsia	10.9%(25)	9.2%(23)	10.0%(48)
	Sepsis/Infection	6.5%(15)	6.4%(16)	6.5%(31)
	Other Direct Causes	12.2%(28)	12.0%(30)	12.1%(58)
	Indirect Causes	18.7%(43)	22.0%(55)	20.4%(98)
Level 5 Health Facilities	APH	16.4%(10)	13.7%(14)	14.7%(24)
	PPH	11.5%(7)	16.7%(17)	14.7%(24)
	Complications of Abortions	13.1%(8)	7.8%(8)	9.8%(16)
	Pre Eclampsia	1.6%(1)	1.0%(1)	1.2%(2)
	Eclampsia	14.8%(9)	9.8%(10)	11.7%(19)
	Sepsis/Infection	4.9%(3)	8.8%(9)	7.4%(12)
	Other Direct Causes	14.8%(9)	16.7%(17)	16.0%(26)
	Indirect Causes	23.0%(14)	25.5%(26)	24.5%(40)
Level 6 Health Facility	APH	10.6%(7)	7.0%(9)	8.2%(16)
	PPH	10.6%(7)	14.8%(19)	13.4%(26)
	Complications of Abortions	4.5%(3)	7.8%(10)	6.7%(13)
	Pre Eclampsia	4.5%(3)	3.9%(5)	4.1%(8)
	Eclampsia	13.6%(9)	15.6%(20)	14.9%(29)
	Sepsis/Infection	16.7%(11)	10.2%(13)	12.4%(24)
	Other Direct Causes	9.1%(6)	7.0%(9)	7.7%(15)
	Indirect Causes	30.3%(20)	33.6%(43)	32.5%(63)
All the 77 Health Facilities	APH	11.5%(43)	10.2%(51)	10.8%(94)
	PPH	24.1%(90)	21.3%(106)	22.5%(196)
	Complications of Abortions	9.6%(36)	10.4%(52)	10.1%(88)
	Pre Eclampsia	2.4%(9)	1.8%(9)	2.1%(18)
	Eclampsia	12.3%(46)	11.2%(56)	11.7%(102)
	Sepsis/Infection	7.8%(29)	7.8%(39)	7.8%(68)
	Other Direct Causes	11.5%(43)	12.0%(60)	11.8%(103)
	Indirect Causes	20.9%(78)	25.1%(125)	23.3%(203)

The free maternal health care policy has not improved the chances of survival for mothers delivering in the 77 public health facilities (odds ratio=0.9722). Following the policy intervention, chances of survival are marginally high in the maternity nursing home (odds ratio=1.0320), the level 4 health

facility (odds ratio= 1.2914) and rural based health facilities (odds ratio=1.5393) while chances of survival are low in level 5 health facilities (odds ratio=0.7403), the level 6 health facility (odds ratio=0.6425) and urban based facilities (odds ratio=0.7262).



## DISCUSSION

The study shows that there were missed opportunities to prevent maternal deaths through ANC services. Antenatal care services are instrumental in prevention, early detection and management of pregnancy complications (21). Only 54.7% of the deceased mothers had made at least one ANC visit while 40.9% of the deceased mothers had made 4 or more ANC visits a figure which is far from the national figure of 57.6% (5). Similarly, unlike the national figures that indicate zero ANC attendance to be at 4% (4), the proportion of mothers who had not attended ANC clinics in this group was 45.4% (4). A higher number of mothers in urban areas (44%) were noted to have completed at least 4 ANC visits as compared to those in rural areas (37%), an observation that has been previously documented in the Kenya Demographic health survey (4). Increases in the number of mothers making 1 ANC visit and at least 4 ANC visits following the policy intervention were also noted; abolishment of delivery services through a pilot project in mission hospitals have demonstrated a 15% increase in the number of mothers making at least 1 ANC visit and a 12% increase in the number of mothers making 4 ANC visits (22).

Most of the maternal deaths (59.9%) were complications referred from lower facility levels; the national referral hospital, level 5 health facilities and the urban based health facilities were the highest recipients of referral cases (81.3%, 62.6% and 63.2% respectively). There was no difference in this pattern before and after the free maternal health care policy implementation. This may be attributed to the health facility staffing patterns and infrastructure norms in the country (14, 37 and 38). Previous assessments have shown an unequal distribution of health care workers with most health care workers being in urban based facilities as well as higher facility levels such as level 5

and 6 health facilities which are relatively well equipped (9, 23, 24). As such the cadre of health care workers attending the deceased mothers was reflective of the staffing norms across different facility levels in the country; it is for this reason that 3 out of every 4 deceased mothers in the national referral hospital were attended to by a gynaecologist.

The intrapartum period and immediate postnatal periods are very important to both new-borns and their mothers (25). The largest proportion of maternal deaths before and after the policy intervention (59.5%) occurred during the postpartum period which is consistent with other studies (26, 27). Given that 45% of all postpartum deaths occur within 1 day of delivery during which mothers are still in health facilities (12), these deaths should be reduced or eliminated through attendance by skilled health care workers but this is not happening. Challenges such as shortage of trained health care workers, heavy workloads among the few available health care workers, stock outs of drugs and other medical supplies necessary for effective maternal service provision and late reimbursement of the costs incurred in providing free maternal health care services (9, 27) may be hampering the policy interventions.

Abortion complications accounted for 9.6% of maternal deaths pre policy implementation and 10.4% of the maternal deaths post policy implementation figures which are slightly higher than the estimated global figure of 7.9% (3). Most abortions in Kenya have largely been shown to be due to unsafe abortions which are linked to inaccessibility of contraceptives among women to reduce unintended pregnancies, social barriers, cultural barriers, religious barriers and legal barriers that condemn abortion (28).

Direct causes of maternal mortality accounted for three quarters of all maternal

deaths during the period under review with haemorrhage, hypertensive disorders, sepsis and complication of unsafe abortion being the leading causes of maternal mortality in Kenyan public health facilities. This feature was consistent before and after the free maternal health care policy implementation. These findings are consistent with the global statistics (3). The success of a pregnancy is influenced by mother's decisions and environment, her basic health, the disease she faces, the status health care facilities and the health care workers in a health care system (29).

W.H.O. observes that direct maternal deaths arise as a result of pregnancy complications (ante-partum, intra-partum or post-partum), inappropriate interventions, omissions, incorrect treatment, or from a combination of the aforementioned factors which are all linked to the health care system (11). Utilization of facility delivery services should address direct causes of maternal mortality during intra-partum and post-partum phases of pregnancy (30). In addition, the free maternal health care policy has not improved the chances of survival for mothers delivering in the public health facilities (odds ratio=0.9722).

The gaps in the effectiveness of intervention targeting direct causes of deaths in the health facilities have implications on the policy success; the policy is meant to address causes such as post-partum haemorrhage, sepsis and complications of abortions among mothers who present themselves in health facilities but this does not seem to be happening unlike in Ghana (10, 11). This may be attributed to the aforementioned health system challenges facing the implementation of the policy (9, 27). Indirect causes of maternal mortality had no change following the policy implementation; this is consistent with the W.H.O. observations that an effective free delivery care policy should

reduce direct causes of maternal mortality with no effect on the indirect causes (11).

### **LIMITATIONS OF THE STUDY**

This study was based on retrospective data based on maternal death audits over a period of 4 years; they may have been confounded by population dynamics, bias, context-specific factors, problems of memory recall bias and attribution in maternal audits. Data on the exact timing of seeking medical help by mothers was not available as such some of the maternal deaths may have been as a result of late presentation in health facilities.

### **CONCLUSION**

The implementation of the free maternal health care policy is a commendable intervention but it does not seem to influence the causes of maternal mortality in Kenyan public health facilities. The free maternal health care policy has not improved the chances of survival for mothers delivering in the public health facilities. Moving forward, there is need to address health system challenges in public health facilities to ensure that they address direct causes of maternal mortality.

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### **REFERENCES**

1. Goodburn, E. and Campbell, O. Reducing maternal mortality in the developing world:

- sector-wide approaches may be the key. (2001). *British Medical Journal* 2001;322.
2. World Health Organization. Maternal mortality, Fact sheet N°348. (2016). [Online] Available at: <<http://www.who.int/mediacentre/factsheets/fs348/en/>>, Accessed on 23rd June 2016.
  3. Say, L., Chou, D., Gemmill, A., Tunçalp, Ö., Moller, A.B., Daniels, J., Gülmezoglu, M., Temmerman, M. and Alkema, L. Global causes of maternal death: a WHO systematic analysis. (2014). *Lancet Glob Health* 2014; 2: e323–33.
  4. Kenya National Bureau of Statistics. Kenya Demographic and Health Survey Report, 2013-2014. Ministry of Health, Kenya.(2015).Accessed on 28th April 2015 <<https://www.opendata.go.ke/Population/2014-Kenya-Demographic-and-Health-Survey/akqq-i5vn>>
  5. Boudreaux, C., Chanthala, P., Lindelow, M. Assessing the Elimination of User Fees for Delivery Services in Laos. (2014). *PLoS ONE* 9(3): e89784.Doi:10.1371/journal.pone.0089784.
  6. McKinnon, B., Harper, S., Kaufman, J.S. and Bergevin, Y. Removing user fees for facility-based delivery services: a difference-in-differences evaluation from ten sub-Saharan African countries. (2014).*Health Policy and Planning* .2014;1– 10 doi:10.1093/heapol/czu027.
  7. Ministry of Health Kenya. “Speech by H.E. Hon. Uhuru Kenyatta, C.G.H., President and Commander-in-Chief of the Defence Forces of the Republic of Kenya During the Madaraka Day Celebrations” (Nyayo National Stadium, June 1, 2013).(2013). Accessed on 24th March 2014< <http://www.statehousekenya.go.ke/>>
  8. McCarthy, J. and Maine, D. A framework for analyzing determinants of maternal mortality. (1992). *Stud Fam Plann* 1992, 23(1):23–33.
  9. Lang’at, E. and Mwanri, L. Healthcare service providers’ and facility administrators’ perspectives of the free maternal healthcare services policy in Malindi District, Kenya: a qualitative study.(2015).*Reproductive Health*201512:59: DOI: 10.1186/s12978-015-0048-1.
  10. Bosu, W., Bell, J., Armar-Klemesu, M. and Tornui, A. J. Effect of the delivery care user fee exemption policy on institutional maternal deaths in the Central and Volta regions of Ghana. 2007. *Ghana Med J.* 2007; 41: 118-24 pmid: 18470329.
  11. Cross, S., Bell, J.S., Wendy, J. and Graham, W.J. What you count is what you target: the implications of maternal death classification for tracking progress towards reducing maternal mortality in developing countries.2010.*Bulletin of the World Health Organization* 2010; 88:147-153. Doi: 10.2471/BLT.09.063537.
  12. Nour, N.M. An Introduction to Maternal Mortality. (2008). *Rev Obstet Gynecol*, 2008. Spring; 1(2): 77–81. PMID: PMC2505173.
  13. Bhutta, Z.A., Das, J.K., Bahl, R., Lawn, J.E., Salam, R.A., Paul, V.K., et al. Can available interventions end preventable deaths in mothers, newborn babies, and stillbirths, and at what cost? *Lancet* 2014;384:347–70.
  14. Fawole, B., Awolude, O.A., Adeniji, A.O., Onafowokan, O. WHO recommendations for the prevention of postpartum haemorrhage: RHL guideline (last revised: 1 May 2010). The WHO Reproductive Health Library; Geneva: World Health Organization.
  15. Khan, K.S., Wojdyla, D., Say, L., Gulmezoglu, A.M., Van Look, P.F.A. WHO analysis of causes of maternal death: a systematic review. *The Lancet* 2006;367:1066-1074
  16. Ministry of Health. National Health Sector Strategic Plan: 1999– 2004 (NHSSP). Nairobi: Ministry of Health, Health Sector Reform Secretariat; 1999. 9. (1999). Ministry of Health.
  17. Government of Kenya. The Health Bill 2014. (2014).[Online] Available at:<[http://www.cickenya.org/index.php/legislation/item/415-the-health-bill-2014#.V3ZAZ\\_krLIU](http://www.cickenya.org/index.php/legislation/item/415-the-health-bill-2014#.V3ZAZ_krLIU)>Accessed on 1st July 2016.
  18. Charan, J. and Biswas, T. How to Calculate Sample Size for Different Study Designs in Medical Research?(2013). *Indian J Psychol Med.* 2013 Apr-Jun; 35(2): 121–126. doi: 10.4103/0253-7176.116232
  19. Schulz, K.F. and Grimes, D.A. Unequal group sizes in randomized trials: guarding against guessing.(2002). *Lancet* 2002; 359: 966–70.
  20. Keppel, G. and Wickens, T. D. Design and Analysis Chapter 8: Effect Size, Power, and Sample Size. (1993). [Online]. Available on

- <<http://www.skidmore.edu/~hfoley/Handouts/K.Ch8.notes.pdf>> Accessed on 14th August 2016.
21. Manthalu, G., Yi, D., Farrar, S. and Nkhoma, D. The effect of user fee exemption on the utilization of maternal health care at mission health facilities in Malawi. (2016). *Health Policy and Planning*, 2016, 1–9, doi: 10.1093/heapol/czw050
  22. Belayneh, T., Adefris, M., and Andargie, G. Previous Early Antenatal Service Utilization Improves Timely Booking: Cross-Sectional Study at University of Gondar Hospital, Northwest Ethiopia. *Journal of Pregnancy*. (2014). Volume 2014 (2014), Article ID 132494.
  23. Wakaba, M., Mbindyo, P., Ochieng, J., Kiriinya, R., Todd, J., Waudo, A. et al. The public sector nursing workforce in Kenya: a county-level analysis. (2014). *Hum. Resour. Health*. 2014; 12: 6. PMID: PMC3913960. doi: 10.1186/1478-4491-12-6.
  24. Ndetei, D.M., Khasakhala, L., Omolo, J.O. (2008). 'Incentives for health worker retention in Kenya: An assessment of current practice,' EQUINET Discussion Paper Series 62. EQUINET with African Mental Health Foundation, University of Namibia, Training and Research Support Centre, University of Limpopo and ECSA-Regional Health Community, EQUINET: Harare.
  25. Lawn, J.E., Kinney, M., Lee, A.C.C., Chopra, M., Donnay, F., Paul, V.K., Bhutta, Z.A., Bateman, M. and Darmstadt, G.L.: Reducing intrapartum-related deaths and disability: can the health system deliver? (2009). *Int J Gynecol & Obs.* 2009, 107: S123-S142.
  26. Ronsmans, C. and Graham, W.J. Lancet Maternal Survival Series Steering Group., Maternal mortality: who, when, where, and why. (2006). *Lancet*, 2006. 368(9542): 1189–200.
  27. Kigenyi, O., Tefera, G.W., Nabiwemba, E. and Orach, C.G. Quality of intrapartum care at Mulago national referral hospital, Uganda: clients' perspective. (2013). *BMC Pregnancy and Childbirth*, 2013, 13:162. DOI: 10.1186/1471-2393-13-162.
  28. Mohamed, S. F., Izugbara, C., Moore, A. M., Mutua, M., Murage, E. W. K., Ziraba, A. K., Bankole, A., Singh, S. D., and Egesa, C. The estimated incidence of induced abortion in Kenya: a cross-sectional study. (2015). *BMC Pregnancy Childbirth*, 2015; 15: 185. PMID: PMC4546129.
  29. Pattinson, R.C. and Hall, M. Near misses: a useful adjunct to maternal death enquiries. (2003). *Oxford Journals, Medicine & Health, British Medical Bulletin* Volume 67, Issue 1 Pp. 231-243.
  30. Shah, P., Shah, S., Kutty, R.V. and Modi, D. Changing epidemiology of maternal mortality in rural India: time to reset strategies for MDG. 2014. *Tropical Medicine and International Health*, volume 00 no 00 doi:10.1111/tmi.12282.