The effects of facility-related factors on perinatal outcomes-a study of mothers attending antenatal services at public and non-public health facilities in Kisii County in the context of free maternity care services

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ABSTRACT

Background: To improve perinatal outcomes, many countries in Sub-Saharan Africa are introducing universal access to maternal and newborn care. In June 2013the government of Kenya introduced free maternity services in all public health facilities to increase skilled birth attendance. Facility-related determinants of perinatal outcomes in the context of free maternity care have not been well documented in the study area. **Methods**: Data based on biological variables, access to and quality of services was collected from mothers attending antenatal clinic (ANC) at the 1st visit, 2nd and 3rd visits (which coincided with the 1st, 2nd and 3rd trimesters) up to 2 weeks post-delivery. Some variables such as distance to the facility were measured only at baseline while biological variables were monitored in each of the subsequent visits. Enumerators for the study were midwives at the selected facilities. The primary outcome was the final perinatal outcome (i. uneventful pregnancy, delivery and puerperium or ii).An abnormal perinatal outcome (stillbirth, neonatal ill health, maternal death, maternal ill health, maternal disability, birth injuries & trauma, normal baby/neonate). The secondary outcome was weight at birth. Frequency of facility factors against normal vs abnormal perinatal outcomes was compared by χ^2 testing, the odds of perinatal outcome versus specific facility indicators were calculated using Logistic Regression tests and McNemar's tests were used to compare relative means (of numeric variables) of different factors at different ANC visits. **Results**: Data from 287 mothers who attended all the 3 follow-up ANC visits was analysed out of the 365 mothers recruited during the first visit. Out of the 287 study subjects, 65% (187) of were drawn from public health facilities (Oresi & Kenyenya) while 35% (100) were drawn from non-public facilities (Christamarriane/CMMH and Tabaka). McNemar's test statistic to check for the relationship between the distance to a facility and perinatal outcome show that perinatal outcomes were not with distance to facilities. No statistically significant differences were observed in public vs non-public hospitals among mothers who were served and delivered by skilled midwives and those who were attended to by non-skilled midwives (only 12 individuals were attended to by non-skilled midwives). Individuals who delivered at facilities with low midwife-client ratio had a 5% higher likelihood of having a normal perinatal outcome as compared to those delivering in facilities with high staffing ratios (OR =0.05, 95% CI 0.046-0.055, p=0.006)**Conclusion**: In free maternity care contexts, facility-level factors play a crucial role in positive perinatal outcomes. There is need to strengthen information dissemination by health workers, training and in-service support for midwives and ensure optimal staffing levels at health facilities.

Key Words: Public and Non-public Hospitals,, perinatal outcome, Skilled Birth attendance, , Caesarean section,

Introduction

To reduce under-five mortality by two thirds and reduce maternal mortality by three-quarters between

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1990 and 2015, United Nations member countries agreed to implement the Millennium Development Goals (MDGs) 4 and 5 [1,2].This was followed with some countries implementing universal free maternity care policies regardless of cardinal elements such as the effectiveness of care being offered at health facility level to reduce maternal and neonatal mortalities [3]. In

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Kenya free maternity care was considered necessary by the government because at the beginning of 2013, maternal, neonatal and infant mortalities were still high at 488/100,000; 26/1000; and 39/1000 respectively [4]. However, the health outcome of a pregnancy is potentially affected by the quality of service delivery received within a health facility ranging from competencies of service providers, staffing ratios to emergency response systems in the facility among other factors [5]. Most abnormal perinatal outcomes are caused by factors that can easily be prevented through skilled care during delivery and immediate neonatal period [6].Evidence also shows that timely referrals for emergency obstetric care (EmOC) and access to skilled birth attendance leads to better perinatal outcomes[7].Therefore, the longitudinal study in Kisii County in 2015/2016 delved into understanding how perinatal outcomes correlated with other determinants such as infrastructure and human resource in a context of free maternity services [8,9].

Methods

Study population and recruitment

The study was conducted in the highland equatorial area of Kisii County predominantly inhabited by the Kisii tribe whose population estimate in 2012 was1,226,873 persons; 650,982 males and 711,797 females. In 2014, the county had a Maternal Mortality Ratio of 500/100,000 livebirths which was above the national average. In this study, participants were recruited proportionate to facility deliveries 6 months prior to the study. In the year 2013, the county had16,824 mothers accessing skilled careout of the projected 54,071 deliveries [10].Outof the 16,824 deliveries conducted in health facilities in 2013there were 438 neonatal deaths. Written informed consent was obtained from mothers attending ANC at the participating study site, ethical approval obtained from the Kenya Medical Research Institute (KEMRI)'s Scientific and Ethics Review Unit (SERU).

Data and sampling at the facility

Demography

Data was collected from mothers attending ANC at the 1st visit, 2nd and 3rd visits (which coincided with the 1st, 2nd and 3rd trimesters) as well as 2 weeks post-delivery. Two public and two comparable non-public facilities were randomly sampled to represent the county's rural and urban sub-counties from an existing list of level four health facilities in Kisii County (Table 1- presents the number of pregnant women who accessed the health facilities in Kisii County for 6 months between January and June 2014). A sampling frame was developed at each facility based on the daily clients turnover multiplied by number of days planned to be in the field (study duration). Probability Proportional to Size (PPS) allocation was applied to distribute the sample size across the facilities as presented in Table 1.

Table 1: Sampling frame for Probability Proportional to Size (PPS) allocation for sampled public and non-public health facilities

Facility	N_i	w_i	N_i^2	p_i *	$(1 - p_i)$	$N_i^2 p_i (1 - p_i)/w_i$	Sample size
Oresi	758	0.20	574,564	24%	0.76	523,520	98
Kenyenya	686	0.18	470,596	24%	0.76	473,793	88
Iyabe	552	0.14	304,704	24%	0.76	381,244	71
Masimba	459	0.12	210,681	24%	0.76	317,013	59
RAM	479	0.12	229,441	6%	0.94	82,707	62
Tabaka	388	0.10	150,544	6%	0.94	66,994	50
Christamarrianne	515	0.13	265,225	6%	0.94	88,922	66
Total	3837	1				1,934,193	494

Where:

Pi = *the* proportion of individuals in the population that develop an outcome

Ni = the outcome target population size in stratum *i*(delivery load in preceding 6 months for each strata- 7 facilities)

N = the total outcome target size (i.e. the population proportion as a weighted average of the stratum-specific proportions, where the weights are the relative sizes of the strata)

p= Confidence interval level (95%)

d = Confidence limit (in this study it assumed to be 3.5 % of the true value)

w_i= Proportional allocation for the *i*th stratum.

n= sample size

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Study variables and statistical analysis

The exposure variables were any facility-related factors like cost of services in each visit, quality of customer care (privacy, client satisfaction with services in each visit, confidentiality), quality of care (partographing, diagnostic care, health education and skills building, infection prevention), duration of service delivery (time taken), infrastructure including equipment, counseling care, skills level of service provider (midwife), distance to nearest health facility among others. The primary outcome was the final perinatal outcome (i. uneventful pregnancy, delivery and puerperium or ii. an abnormal perinatal outcome (stillbirth, neonatal ill health, maternal death, maternal ill health, maternal disability, birth injuries & trauma, normal baby/neonate). The secondary outcome in the study was weight at birth and health status of the baby 2 weeks after delivery. Normal and abnormal outcomes were the main units of analysis. Facility level data were gathered from the questionnaire, perinatal outcome data from facility in-records and care givers. Data from the facilities was triangulated by reports in the DHIS 2 (the MOH central reporting platform) for accuracy and reliability. Frequency of facility factors against normal vs abnormal perinatal outcomes was compared by $\chi2$ testing. The odds of having a normal or abnormal perinatal outcome versus specific facility indicators were calculated using Logistic Regression tests. McNemar's tests were used to compare relative means (of numeric variables) of different factors at different ANC visits. Data were analyzed using IBM SPSS Statistics for Windows, Version 24.0. (IBM Corp., Armonk, N.Y., USA) and R (R Foundation, Wien, Austria). For all the analysis in this study, significance was at *p<0.05.*

Results

A total of 365 expectant mothers who sort antenatal care services at 2 public and 2 non-public health facilities were recruited at the start of the study. However, data from only 287 mothers who attended the 3 ANC visits was used for analysis in this paper. 65% (187) of the study population were drawn from public facilities while 35% were drawn from non-public facilities. Proportionately out of the 287 study participants recruited, non-public facilities (Tabaka and Christamarrianne) had 15% and 14%) of their subjects respectively reporting adverse perinatal outcomes, while public facilities (Kenyenya   and Oresi) respectively recorded 11% and 8% adverse perinatal outcomes among their as in Table 2 while the overall recruitment, referral and perinatal outcomes for the period Jan-Aug 2016 are documented in Table 3.

Table 2: Distribution of perinatal outcomes by facility (n=287)

Facility Name	Perinatal Outcome	
	Abnormal	Normal
Oresi	10 (8%)	116 (92%)
Kenyenya	7 (11%)	54 (89%)
CMMH	8 (14%)	51 (86%)
Tabaka	6 (15%)	34 (85%)

Facility demographics

Oresi health center had the lowest transition rate (39%) of clients booked at ANC to those that delivered at the same facility. Christamarrianne Mission Hospital (CMMH) had more clients delivering at the facility compared to those that had been initially booked (164%), probably because it is a referral facility for Oresi. In general, non-public facilities had higher transition rates tan public ones. Kenyenya Hospital and Tabaka MH had 82% and 65% transition rates respectively. Oresi HC and Tabaka had the highest referrals with each reporting 11% of total client deliveries being referred; Kenyenya Hospital recorded a 9%   referral rate while Christamarrianne had 0%. Out of all the cases of abnormal perinatal outcomes, 2% of them were from Tabaka while Kenyenya, Christamarrianne and Oresi facilities reported 11%, 10% and 8% abnormal outcomes respectively. There were no reported maternal deaths at all in the 4 facilities during the period of data collection (Table 3).

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Table 3: Facility ANC and perinatal outcome distribution Jan-Aug 2016

Deliveries Jan-Aug 2016	# of ANC clients booked	# of deliveries	# of referrals (MNCH)	# of Maternal deaths	# of Neonatal deaths	# of abnormal outcomes
Oresi HC	1739	681 (39%)	73 (11%)	0	8	54 (8%)
KenyenyaHosp	885	722 (82%)	63 (9%)	0	1	81 (11%)
Christamarrianne MH	295	483 (164%)	0 (0%)	0	0	46 (10%)
Tabaka MH	829	537 (65%)	57 (11%)	0	8	11 (2%)

The ratio of pregnant mothers to midwives at ANC in public health facilities (Oresi and Kenyenya) were 1:40 and 1:30 respectively while at non-public facilities (Tabaka and CMMH) were 1:15 and 1:30 respectively. At the point of delivery, the ratio of mothers to midwives in public facilities was 1:4 and 1:2 for Oresi and Kenyenya respectively while for non-public facilities, the ratio was 1:5 and 1:7 for Tabaka and CMMH respectively. A vast majority of the clients (85%) reported that the health facilities they attended ANC clinics at were less than 5 kms from their homes, 11% reported a distance of between 6-10 kms, and 4% reported an 11-20 km distance while 0.3% of the clients reported a distance of over 21 kms. The mothers were also asked about the means of transportation used to visit the ANC; 60% (113) and 49% (48) of mothers visiting public and non-public facilities respectively had used motorbikes; 23% of public attendants had walked while 17% of non-public clients had walked; 13% of mothers who went to public facilities had used public means compared to 29% who visited non-public facilities. Further, 59% of the study respondents cited motorbikes as the means of transport they had used to reach the ANC, 21% had walked, 19% had used public service vehicles and only 1% had used private/personal cars to the ANC clinic. McNemar's test statistic to check for the relationship between the distance to a facility and perinatal outcome show that perinatal outcomes were neither associated with individuals who stayed up to 5kms from a health facility or those who stayed further. Distance to the health facility was also not associated with the birth weight.

Quality of facility-provided services during 1ˢᵗ, 2ⁿᵈ and 3ʳᵈ visits

Table 4 shows responses to quality of services during the 1ˢᵗ, 2ⁿᵈ and 3ʳᵈ ANC visits. At the 1ˢᵗ visit, all study participants (both at public and non-public) reported that they had been attended to by skilled midwives, at the 2ⁿᵈ visit, 98% and 94% of mothers at public and

non-public facilities respectively reported being attended to by skilled midwives. At the 3ʳᵈ visit all (100%) mothers at public facilities were attended to by a skilled midwife while 92% at non-public facilities reported receiving services by a skilled midwife. At the 1ˢᵗ ANC visit, 98% and 96% of mothers at public and non-public facilities respectively knew their blood groups. 100% of the respondents reported that they had been attended to by a skilled midwife during their 1ˢᵗ visit, 97% at the 2ⁿᵈ visit and 95% at the 3ʳᵈ visit. Even though there wasn't a statistically significant difference in respondent feedback between the 1ˢᵗ and 2ⁿᵈ trimesters, McNemar's test statistics showed that a significant drop in the proportion of mothers attended by a skilled midwife was noted ($p<0.001$). 100%, 98% and 99% of the expectant mothers reported that abdominal assessment had been conducted at the 1ˢᵗ, 2ⁿᵈ and 3ʳᵈ ANC visits respectively. However, no statistically significant differences were observed in public vs non-public hospitals among mothers who were served and delivered by skilled midwives and those who were attended to by non-skilled midwives (only 12 individuals were attended to by non-skilled midwives). Between the 2ⁿᵈ (60%) and 3ʳᵈ (34%) trimesters, a significant number of respondents ($p<0.001$) noted that eligible vaccines had not been administered. Slightly more than half (51%) of the mothers also reported that they had been treated for adverse symptoms at the 1ˢᵗ visit, 44% at the 2ⁿᵈ visit and 51% at the 3ʳᵈ visit. All the mothers also reported being started on routine Fe++ and folate medication at the 1ˢᵗ visit while 98% reported being on the routine haematinics at the 2ⁿᵈ ANC visit. Further, a statistically significant drop in haematinics compliance was recorded between the 2ⁿᵈ and 3ʳᵈ trimester visits ($p=0.004$). Client confidentiality was noted by 99% of the respondents at the 1ˢᵗ visit and 95% of the respondents at the 2ⁿᵈ visit. Good documentation of the mother child booklet was cited by 97% and 99% of the respondents at the 2ⁿᵈ and 3ʳᵈ visits respectively

Table 4: Facility level service-related indicators (n=287)

	1st (Yes)	2nd (Yes)	*P-value*	3rd (yes)	*P-value*
Mother attended to by a skilled midwife	100%	97%	0.821	95%	<0.001
Abdominal assessment conducted	100%	98%	0.883	99%	0.5
Eligible vaccines administered	67%	60%	0.173	34%	<0.001
Mother on IPT regimen	16%	4%	0.327	10%	0.212
Mother treated for adverse symptoms present	51%	44%	0.142	51%	0.9999
Mother put on routine haematinics (Fe++,Folate)	100%	98%	0.999	-	-
Confidentiality was observed during care	99%	95%	0.289	-	-
Mother child booklet well documented	-	97%	-	99%	0.5
Haematinics compliance	-	98%	-	92%	0.004

Quality of facility information services during 1st, 2nd and 3rd visits.

Table 5 shows responses to questions relating to information dissemination during ANC visits. At the 1st and 2nd ANC visits, 96% and 95% of the respondents said they had received counseling on danger signs during pregnancy respectively and a further 89% reported counselling on danger signs at the 3rd visit-a significant drop in the proportion of mothers being counselled as per McNemar's comparative test (*p=0.004*).Even though only 1 of the 23 babies born whose mother had attended counseling had an abnormal perinatal outcome, there wasn't any statistically significant association between counseling and perinatal outcome.97%, 98% and 98% of the study participants reported getting feedback on their pregnancy status at the 1st, 2nd and 3rd visits respectively. Over 93% of the expectant mothers were also counselled on diet and skilled birth attendants at the 3 ANC visits respectively. Mothers were also provided with information regarding signs of labor, date of the next return, birth planning and personal hygiene. More mothers (98%) at public facilities reported receiving counseling on birth plan during their 1st visit compared to 83% from non-public facilities. 98% and 80% had received counseling on labor signs at public and non-public facilities. They were also provided with pre-conception counselling, their blood groups and Rh status as well as post-partum counselling.

Table 5: Facility level information-related indicators (n=287)

	1st (Yes)	2nd (Yes)	*P-value*	3rd (yes)	*P-value*
Mother counselled on danger signs	96%	95%	0.804	89%	0.004
Feedback on pregnancy status given	97%	98%	0.25	98%	0.25
Mother counselled on diet	97%	97%	0.999	94%	0.359
Mother counselled on skilled birth attendance	96%	97%	0.057	93%	0.307
Mother counselled on signs of labour	92%	94%	0.014	93%	0.418
Mother given the return date for next visit	100%	97%	0.996	98%	0.822
Mother counselled on birth planning	93%	-	-	-	-
Client counselled on personal hygiene	99%	-	-	-	-
Mother received pre-conception counselling	66%	-	-	-	-
Mother knows her blood group & Rh status	97%	93%	0.18	89%	<0.001
Mother child booklet well documented	-	97%	-	99%	0.5
Advised post-partum	-	-	-	96%	-

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In the current study, a logistic regression analysis of facility staffing ratios at delivery and final delivery outcome at health facilities show a statistically significant relationship between a low midwife to client ratio (average 1:3) and higher proportion of normal perinatal outcomes as compared to higher midwife to

client ratio (average 1:6). Individuals who delivered at facilities with low midwife-client ratio had a 5% higher likelihood of having a normal perinatal outcome as compared to those delivering in facilities with high staffing ratios (OR =0.05, 95% CI 0.046-0.055, p=0.006) as in table 6.

Table 6: Facility type, average staffing ratio and delivery outcome

Facility Type	Average staffing ratio-midwives to mothers	Delivery outcome		OR	95% CI	P value
		Abnormal	**Normal**			
Public	1:3	17 (9%)	170 (91%)	0.05	0.046-0.055	0.006
Non-public	1:6	14 (14%)	85 (86%)	0.27	0.261-0.279	0.163

Safe motherhood services

An assessment of availability of specific safe motherhood services was also conducted. All the mothers (100%) said that there were ANC, MCH and post-natal services at the facility where the interviews and follow ups were conducted while only 35% reported availability of caesarian section services. Further, a checklist of basic emergency obstetric and neonatal care services was provided to assess for availability of certain equipment/drugs. 36% of the respondents reported that BemOC equipment were fully (100%) available, 20% said that only 50% of the BemOC equipment were available while 44% said that BemOC equipment were mostly unavailable. 35% cited the facility they were attending as having fully skilled MNCH staff, 19% reported that only half the MNCH staff were skilled to provide BemOC services while 45% reported that skilled MNCH staff were mostly unavailable. 94% of the mothers reported that the emergency response system (including checklist) and a financial system were in place to avoid delayed referral were fully available at their ANC facility of choice. Half (50%) the respondents said that a fully available referral system was in place and was well known by staff.

Facilities that had BemOC equipment did not record any significantly different perinatal outcomes as compared to those that did not have BemOC equipment. McNemar's tests did also not show any differences between perinatal outcomes among mothers who were attended to by MNCH staff skilled in BemOC and those not trained either at public or non-public hospitals. The means of transport to the health facility were also analyzed to determine if they had any effect on the perinatal outcomes: the means of transport were grouped thus-motorbike use and private/public/personal/walking. McNemar's statistics did not show any difference in birth weight or perinatal outcomes between mothers who used motorbikes to attend ANC and those who used other means of

transportation. However given that 59% of the mothers were using motorbikes as a preferred mode of transport in all trimesters, there is need for further understanding if this poses any risks to pregnant women.

Discussion

In Kenya, there is need for evidence of the specific interventions that result in good perinatal outcomes and a clear understanding on whether altering one determinant (offering free maternity care) alone in resource constrained settings translates to improved perinatal care outcomes without addressing other potential determinants; social-economic, biological & cultural factors, distance to and capacity of health facilities as well as availability of skilled birth attendants among others improve perinatal outcomes.

A maternity fee waiver policy study in Nepal, found out that although this provided a relieve to households that could not afford user fee levied in health facilities, the universal free delivery service referred to as Aama programme led to low quality of antenatal and maternal care due to limited capacity of service providers in health facilities and lack of incentives for the increased technical and administrative workload [12].

Related studies from South Africa and Nigeria [13,14,15], demonstrate that quality of health care is not only pegged to the qualifications of caregivers but also a subject of staffing adequacy and availability of appropriate infrastructure to guarantee quality care. The latter study further proves that in free maternity care settings, utilization of services usually increases and this calls for an increase in the number of service providers to guarantee quality care. Specific public referral facilities based assessment of the quality of Free Maternity Services[16,17], found out that although mothers had access to basic utilities and resources such as linen and bathrooms, the key diagnostic infrastructure was lacking to guarantee quality care. The studies also found out that the staff

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members were highly demotivated due to lack of suppliers for care provision.

A rapid assessment of the devolved free maternity care services by the national government in Kenya[18], found out that caregivers were not only challenged by the inadequacy of the reimbursements, but they were also concerned by the standard of care that mothers were receiving. Quality of care had reduced and mothers were complaining of hidden costs in the free maternity care policy. Some of the referral facilities were reporting increased maternal mortalities due to handling of very complicated referral cases at the expense uncomplicated cases in the ward. At global level, Bangladesh is known to have implemented such free services for maternity care [19] but utilization of care suddenly plummeted after mothers started complaining of hidden costs. This is similar to the Kisii county study where 72% of the study subjects from public facilities were reported to have incurred an expenditure for various items especially diagnostics and curative care during antenatal clinic attendance, leaving a paltry 28% who received absolutely free services.

A study conducted in Ghana[20]on factors that influence health facility delivery found out that other than a mothers' social-economic status of a mother and being a member of a social insurance scheme, health providers played a major influence. The influence health providers play ranges from the quality of care they give and their attitude. The study established that personalized counselling of mothers does increase the uptake of health facility based services. Other related studies have also demonstrated that there is an inverse relationship between quality of care and theavailable human resource for health[21].

Conclusion

Facility-level factors play a crucial role in achieving of positive perinatal outcomes. There is need to strengthen personalized health education of mothers under free maternity care policy through optimal staffing of health facilities and strengthening access to continuous trainingof the service providers.

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