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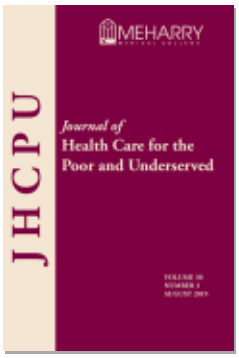

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ORIGINAL PAPER

Effect of Implementation of Free Maternity Policy on Selected Maternal and Newborn Health Indicators in Gem Sub-County, Siaya County, Western Kenya

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Abstract: **Introduction**. Kenya introduced free maternity services in June 2013. The main study objective was to investigate the effect of this intervention on maternal and newborn health and specifically to determine differences in 4th antenatal care visits, facility deliveries, post-abortion care, and occurrence of facility-based maternal and neonatal deaths two years pre-and-post intervention. **Methods**. The study site was Gem Sub-County, Kenya. The study design was an interrupted time series (ITS). Longitudinal data from the District Health Information Software (DHIS2) were analyzed by the Chow test and segmented linear regression. **Results**. In the post-intervention period, 4th antenatal care visits decreased by .6% (p = .839); facility deliveries decreased by 1.6% (p = .616); post-abortion care uptake increased by 54.4% (p = .000); maternal deaths increased by 10.1% (p = .192) whereas neonatal deaths decreased by .1% (p = .466). **Conclusion**. The intervention had a significant influence on the uptake of post-abortion care.

Key words: Free maternity services, policy intervention, maternal and newborn health, pre-and-post intervention.

The World Health Organization (WHO) defines maternal death as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management (from direct or indirect obstetric death), but not from accidental or incidental causes.[1] The most recent published maternal mortality estimates indicate that in 2015, 303,000 women globally died from complications related to pregnancy and childbirth.[2] Low- and middle-income countries account for 99% of these maternal deaths.[3] The sub-Saharan Africa region has the highest maternal mortality ratio (MMR) (500/100,000).[4] This is about 42 times higher than the MMR in high-income countries, which is 12/100,000.[2] In sub-Saharan Africa, the neonatal mortality rate is 29/1,000, one-and-a-half times the global neonatal mortality rate of

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19/1,000.[5] Globally, the MMR fell by nearly 44% over the past 25 years, to an estimated 216/100 000 live births in 2015, from an MMR of 385/100,000 in 1990.[2] However, in Kenya there was an 18% increase in the MMR from 414/100,000 in 1990 to 488/100,000 in 2008[6] before declining to 362/100,000 in 2014.[7]

The increase in MMR has been attributed to insufficient coverage levels of key interventions due to the tough economic conditions that Kenya was facing, insufficient number of health facilities, and a grossly inadequate health workforce. The situation was exacerbated by a severe HIV/AIDS crisis that itself had a devastating effect on maternal health.[8] In low- and middle-income countries, neonatal mortality is a major health burden and accounts for approximately 45% of under-five deaths.[5] In 2015, Kenya recorded 34,000 newborn deaths, translating into a neonatal mortality rate of 22/1,000.[9]

Siaya, one of the counties in western Kenya,[10] has a high burden of maternal and neonatal deaths. In 2014, Siaya County, with MMR of 691/100,000, was ranked positions one and six in MMR in western Kenya and nationally, respectively.[11] In 2013, the neonatal mortality rate in Siaya County was 39/1,000,[12] an increase from 32/1,000 live births in 2011[13] and about double the national rate of 22/1,000.[9] Gem Sub-County is one of the six sub-counties in Siaya County.

Though neglected for decades, maternal and newborn health has been an area of key concern in global health policy since the launch of the Safe Motherhood Initiative in 1987.[14] The Millennium Development Goals (MDGs) 4 (child health) and 5 (maternal health), and their corresponding targets in 2000 were an attempt to focus and track progress on maternal and child health.[15] In 2015, new goals and targets for maternal and newborn health were incorporated in the Sustainable Development Goals (SDGs).[15] The WHO has listed 11 indicators for evaluating maternal and newborn health, namely:[16] maternal mortality ratio; under-five child mortality, with the proportion of newborn deaths; children under five who are stunted; proportion of demand for family planning satisfied (met need for contraception); antenatal care coverage (at least four times during pregnancy); antiretroviral prophylaxis among HIV-positive pregnant women to prevent HIV transmission and for mother's own health; skilled attendant at birth; postnatal care for mothers and babies within two days of birth; exclusive breastfeeding for six months (0–5 months); three doses of combined diphtheria-tetanus pertussis (DTP3) immunization coverage (12–23 months); and antibiotic treatment for suspected pneumonia.

The abolition of user fees for maternity care and the provision of financial incentives have been identified as some of the promising strategies to avert maternal deaths by increasing skilled deliveries.[4] In June 2013, a policy which was aimed at preventing and reducing maternal deaths by removing cost as a barrier to accessing to maternity services was introduced by the government of Kenya through a presidential directive.[17] According to the directive, the following services were to be offered without any charges in all public health facilities:[17] antenatal care visits; maternity services; delivery (including caesarean sections); post-abortion care and post-delivery care, including all complications related to delivery.

The overall objective of the present study was to investigate the effect of the introduction of free maternity services on selected maternal and newborn health indicators in Gem Sub-County. The specific objectives were to determine differences in a) 4th

antenatal care visits, b) uptake of facility deliveries, c) utilization of post-abortion care, and d) occurrence of facility-based maternal and neonatal deaths two years before and two years after the introduction of the free maternal health care program.

Methods

Site of the study. The study was conducted in Gem Sub-County, which covers an area of 405 km^2 and lies between latitudes 0° 3′ South–0005′ North and longitudes 34° 22′–34° 33′ East, at an average altitude of 1,400m above sea level. Administratively, Gem Sub-County is divided into six administrative regions known as wards, which are further sub-divided into 39 sub-locations.[12] These sub-locations are sub-divided yet further into villages, which the form the lowest administrative units. By 2013, the population of Gem Sub-County was projected to be 174,756,[12] with children aged under one year estimated at 6,068. The women of reproductive age were projected to be 40,511, and 7,139 were estimated to be pregnant annually. The estimated number of deliveries per year was 7,139, of which about 714 (10%) resulted into emergency obstetric complications.[12]

The Sub-County has 28 public health facilities (one Sub-County Hospital, nine Health Centres, and 18 Dispensaries). It was assumed that all these facilities began providing free maternity services in June 2013 as directed by the government policy. The MMR in the sub-county was estimated most recently at 740/100,000 between 2003 and 2008.[18] However, no published data were found on the neonatal mortality rate for the same sub-county.

Study design. This was an interrupted time series (ITS) study design in which changes in selected maternal and newborn health indicators were assessed by obtaining routinely collected health facility data stored in the District Health Information Software 2 (DHIS2). The ITS design can provide a robust method of measuring the effect of an intervention when randomization or identification of a control group are impractical. [19] It has been used to assess the consequences of a variety of policy issues in various fields, but is new in health.[20] This study employed the ITS design to determine the effect of the free maternal health care policy intervention on selected maternal and newborn indicators two years post-intervention.

Data collection. Data were obtained from the Ministry of Health (MOH) 711 (Integrated Reproductive Health, HIV/AIDS, Malaria, Tuberculosis, and Nutrition) dataset available online in the DHIS2 hosted at the Kenya Health Information System website.[21] The MOH collects health facility data on a routine basis and all data collected by specific MOH monthly summary forms are available on the DHIS2. Data were extracted from the following data subsets in MOH 711: 4th antenatal care visits, safe delivery (which includes data elements on neonatal deaths occurring within seven days of delivery and facility-based maternal deaths) and post-abortion care services. Monthly data on 4th antenatal care visits, deliveries (i.e., normal deliveries, caesarean sections, breech deliveries, and assisted vaginal deliveries), post-abortion care, and maternal and neonatal deaths were downloaded into MS Excel format. The data extraction was restricted to two time periods (June 2011 to May 2013 [two years pre-intervention] and June 2013 to May 2015 [two years post-intervention]).

Data analysis. A series of data can often contain a structural break, due to a change in policy or a sudden shock in the operating environment.[22] Such structural breaks in time series data can be detected by the Chow test.[22] The null hypothesis (H_0) in the Chow test is stated this way: There is no structural break in the trend before or after the intervention, with the confidence interval set at 95%. We performed the Chow test on time-series data for the variables under investigation.

Longitudinal monthly data on 4th ANC visits, facility deliveries, post-abortion care, and maternal and neonatal deaths were analyzed in STATA 13.1 by StataCorp LP[23] using segmented linear regression analysis, with the significance level set at .05. This statistical analysis is suitable for longitudinal data collected at regular intervals before and after an intervention. The analysis technique controlled for secular trends and adjusted for potential serial correlation of the time series data.[20]

The segmented linear regression was applied to determine both the magnitude and direction of change in the time series data.

Ethical considerations. Permission to extract data from the DHIS2 was obtained from the MOH. The data stored in DHIS2 are aggregated and do not have personal identifiers, hence the procedure also did not violate any ethical norms.

Results

The raw data on 4th antenatal care (ANC) visits, facility deliveries, post-abortion care, facility-based maternal deaths and neonatal deaths two years pre-and-post intervention are shown in Table 1. The results for each variable are presented below.

4th antenatal care visits. Table 2 shows the Chow test results on 4th ANC visits.

In Table 2, the p-value for the intervention group is .531; hence, the null hypothesis is accepted (i.e., the intervention did not contribute to a structural break in the trend). Similarly, time as a variable did not contribute to a structural break (p = .525). Overall, there was no statistically significant structural break in the 4th ANC visits trend before or after the intervention (p = .806).

In Table 3, the results indicate that at the beginning of the period of observation, there were on average 211.79 4th ANC visits in the sub-county. Immediately after the intervention was introduced in June 2013, 4th ANC visits decreased by 13.3% or 26.499 visits per month (p = .398) (Table 3). This effect was sustained in the two-year post-intervention period in which 4th ANC visits decreased by .6% or .585 visits per month (p = .839).

Figure 1 shows the raw data and the fitted results after correcting for autocorrelation.

Facility delivery. Table 4 shows the Chow test statistical outputs on facility delivery.

In Table 4, the p-value for the intervention group is .491, hence the null hypothesis is accepted (i.e., the intervention did not contribute to a structural break in the trend). Similarly, time as a variable also did not contribute to a structural break (p =.505). Overall, there was no statistically significant structural break in facility delivery trend before or after the intervention (p = .780).

In Table 5, the results indicate that there were on average 232.32 facilities at the beginning of the period of observation. Immediately after the intervention was intro-

Table 1.

RAW DATA

Period	Month/Year	4th antenatal care visits	Facility deliveries	Post-abortion care	Facility-based maternal deaths	Facility-based neonatal deaths
Pre-Intervention	Jun-11	197	240	1	2	0
	Jul-11	213	235	2	1	3
	Aug-11	239	267	2	0	5
	Sep-11	238	262	4	0	4
	Oct-11	240	248	4	0	1
	Nov-11	232	241	3	0	1
	Dec-11	208	230	4	0	3
	Jan-12	235	251	4	1	7
	Feb-12	212	231	3	0	1
	Mar-12	237	234	5	0	1
	Apr-12	264	252	3	0	11
	May-12	260	297	3	0	2
	Jun-12	227	272	4	0	1
	Jul-12	208	298	1	0	2
	Aug-12	254	266	3	0	1
	Sep-12	227	293	1	1	0
	Oct-12	255	308	4	0	1
	Nov-12	238	253	3	0	2
	Dec-12	205	274	5	0	5
	Jan-13	249	303	5	0	2
	Feb-13	233	279	14	1	1
	Mar-13	228	310	12	0	0
	Apr-13	240	274	4	0	0
	May-13	265	328	10	0	2

(*continued on p. 1137*)

Table 1. (*continued*)

Period	Month/Year	4th antenatal care visits	Facility deliveries	Post-abortion care	Facility-based maternal deaths	Facility-based neonatal deaths
Post-Intervention	Jun-13	224	332	11	1	0
	Jul-13	262	288	21	0	1
	Aug-13	275	323	14	1	1
	Sep-13	272	344	11	0	1
	Oct-13	262	344	20	0	1
	Nov-13	223	319	20	0	0
	Dec-13	189	241	10	0	3
	Jan-14	202	288	16	0	0
	Feb-14	216	295	16	0	2
	Mar-14	217	343	8	0	1
	Apr-14	299	339	10	0	2
	May-14	279	335	9	0	0
	Jun-14	311	301	7	0	0
	Jul-14	339	378	16	0	1
	Aug-14	325	341	5	0	1
	Sep-14	320	418	4	0	0
	Oct-14	276	353	3	0	0
	Nov-14	255	339	3	0	0
	Dec-14	243	316	1	0	0
	Jan-15	249	369	3	0	1
	Feb-15	239	305	3	0	6
	Mar-15	238	360	0	0	0
	Apr-15	302	346	6	0	0
	May-15	292	363	6	2	0

Table 2.

RESULTS OF CHOW TEST ON 4TH ANTENATAL CARE VISITS

	df	F-statistic	p-Value
Intervention group	1	0.40	.5312
Time	1	0.41	.5247
Chow test statistic	2	0.22	.8061
Residual	44		

Table 3.

RESULTS OF SEGMENTED LINEAR REGRESSION ON 4TH ANTENATAL CARE VISITS (AFTER CORRECTING FOR AUTOCORRELATION)

Independent Variables	Estimates	Standard Error	p-Value
Constant, β0	211.7873	35.49037	.000
Time, β1	1.860281	2.195821	.397
Intervention, β2	–26.49919	31.3694	.398
Postslope, β3	0.5855701	2.886618	.839

duced, facility deliveries increased by .4% or 3.82 facility deliveries per month (p = .836) (Table 5). However, facility deliveries decreased by 1.6% or .765 per month in the two-year post-intervention period (p = .616) (Table 5).

Figure 2 shows the raw data of facility deliveries and the fitted results after correcting for autocorrelation.

Post-abortion care. Table 6 shows the Chow test statistical outputs on post-abortion care. In Table 6, the p-value for the intervention group is .000, hence the null hypothesis is rejected (i.e., the intervention contributed to a structural break in the trend). Similarly, time as a variable also contributed to a structural break (p = .000). Overall, there was a statistically significant structural break in post-abortion care model trend before and after the intervention.

In Table 7, there were on average 1.03 women seeking post-abortion care services at the beginning of the observation period. When the intervention was introduced in June 2013, there was an immediate increase of 808% or 10.7 women per month seeking post-abortion care services (p = .000) (Table 7). However, the initial very high increase was not sustained in the two-year post-intervention and there is a decreasing trend, although the uptake of post-abortion care is still significantly higher (by 54.4%) than in the pre-intervention period (p = .000) (Table 7).

Figure 3 shows the raw data of post-abortion care and the fitted results after correcting for serial autocorrelation.

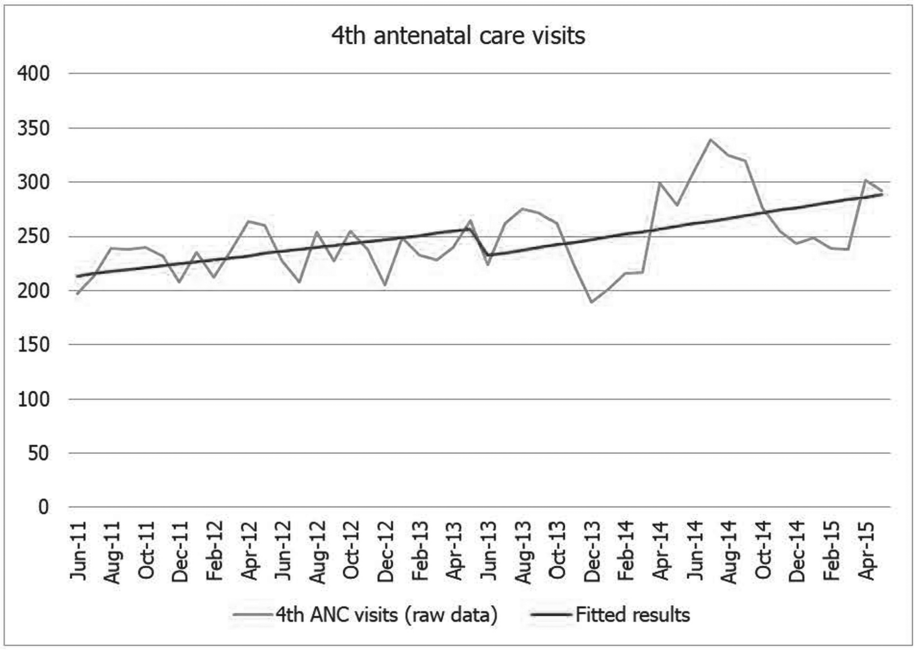

Figure 1. Raw series of 4th ANC visits, and the fitted results after correcting for data auto-correlation.
Note: ANC = Antenatal Care.

Table 4.

RESULTS OF CHOW TEST ON FACILITY DELIVERY

	df	F-statistic	p-Value
Intervention group	1	0.48	.4913
Time	1	0.45	.5047
Chow test statistic	2	0.25	.7795
Residual	44		

Table 5.

RESULTS OF SEGMENTED LINEAR REGRESSION ON FACILITY DELIVERIES (AFTER CORRECTING FOR AUTOCORRELATION)

Independent Variables	Estimates	Standard Error	p-Value
Constant, β0	232.3241	18.97359	.000
Time, β1	2.902172	1.208968	.016
Intervention, β2	3.822727	18.46293	.836
Postslope, β3	–0.7653683	1.526567	.616

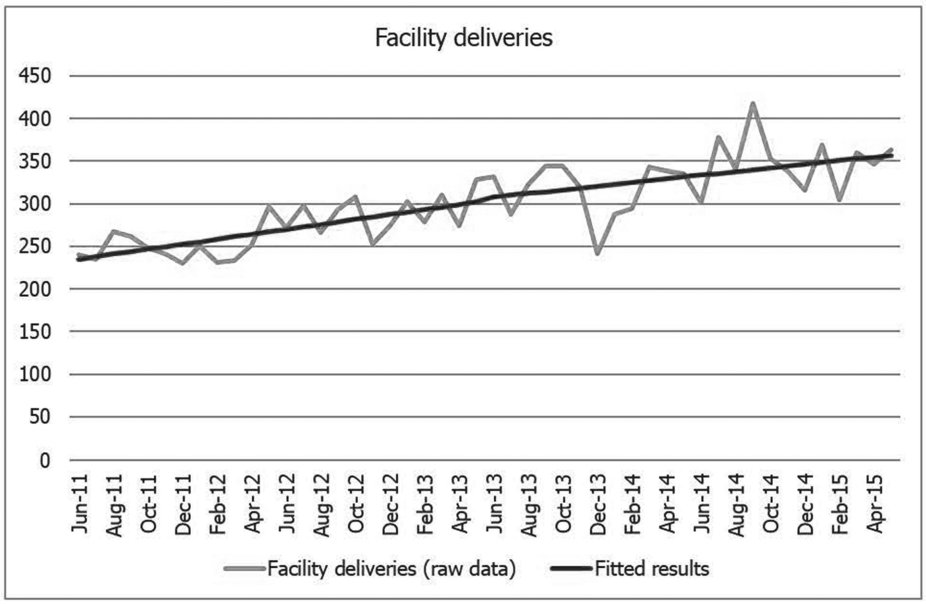

Figure 2. Raw series of facility deliveries, and the fitted results after correcting for data auto-correlation.

Table 6.

RESULTS OF CHOW TEST ON POST-ABORTION CARE

	df	F-statistic	p-Value
Intervention group	1	70.99	.000
Time	1	45.79	.000
Chow test statistic	2	36.16	.000
Residual	44		

Table 7.

RESULTS OF SEGMENTED LINEAR REGRESSION ON POST-ABORTION CARE (AFTER CORRECTING FOR AUTOCORRELATION)

Independent Variables	Estimates	Standard Error	p-Value
Constant, β_0	1.027943	3.653173	.778
Time, β_1	.2640255	.1969834	.180
Intervention, β_2	10.70728	1.772485	.000
Postslope, β_3	.9663243	.2056468	.000

Facility-based maternal deaths. Table 8 shows the Chow test statistical outputs on facility-based maternal deaths. In Table 8, the p-value for the intervention group is 0.473, hence the null hypothesis is accepted (i.e., the intervention did not contribute to a structural break in the trend). Similarly, time as a variable did not contribute to a structural break (p = .254). Overall, there was no statistically significant structural break in facility-based maternal deaths trend before or after the intervention (p = .442).

The results in Table 9 indicate that there were on average .588 maternal deaths at the beginning of the period of observation. There was an increase of 40.1% or .198 maternal deaths per month immediately after the intervention was introduced (p = .532) (Table 9). In the two-year post-intervention period, maternal deaths increased at a lower rate of 10.1% or .03 per month (p = .192) (Table 9).

Figure 4 shows the raw data of maternal deaths and the fitted results after correcting for autocorrelation.

Facility-based neonatal deaths. Table 10 shows the Chow test statistical outputs on

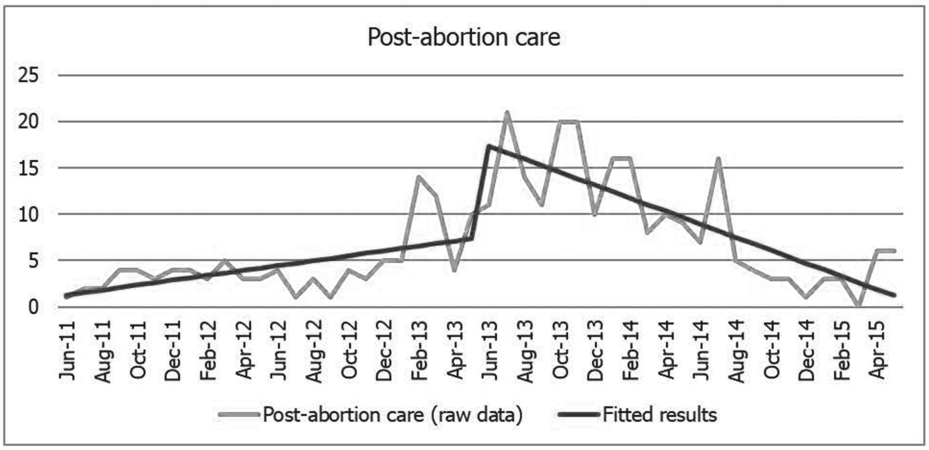

Figure 3. Raw data series of post-abortion care, and the fitted results after correcting for data auto-correlation.

Table 8.

RESULTS OF CHOW TEST ON FACILITY-BASED MATERNAL DEATHS

	df	F-statistic	p-Value
Intervention group	1	.52	.4730
Time	1	1.33	.2543
Chow test statistic	2	.83	.4424
Residual	44		

Table 9.

RESULTS OF SEGMENTED LINEAR REGRESSION ON FACILITY-BASED MATERNAL DEATHS (AFTER CORRECTING FOR AUTOCORRELATION)

Independent Variables	Estimates	Standard Error	p-Value
Constant, β0	.5877819	.2488206	.018
Time, β1	–.0267431	.014699	.069
Intervention, β2	.1981932	.3172713	.532
Postslope, β3	.0300318	.0230007	.192

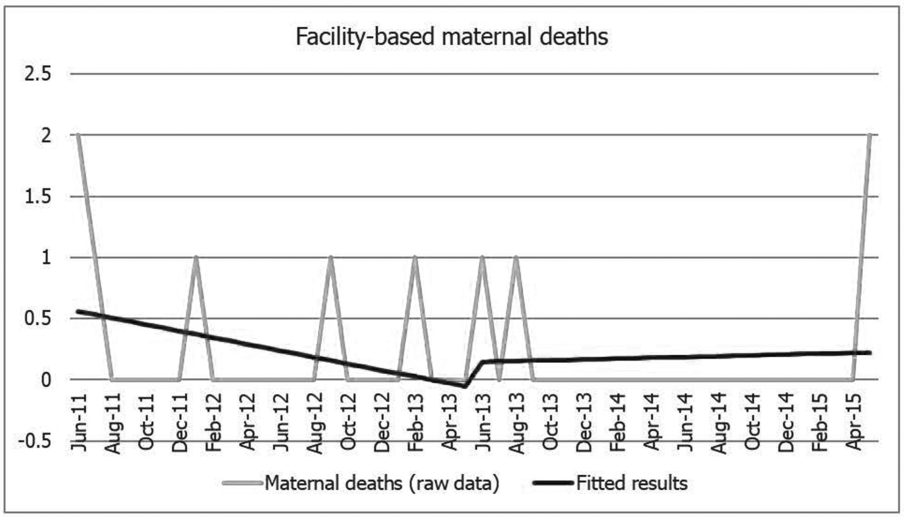

Figure 4. Raw data series of maternal deaths, and the fitted results after correcting for data auto-correlation.

facility-based neonatal deaths. In Table 10, the p-value for the intervention group is .316, hence the null hypothesis is accepted (i.e., the intervention did not contribute to a structural break in the trend). Similarly, time as a variable did not contribute to a structural break (p = .338). Overall, there was no statistically significant structural break in facility-based neonatal deaths trend before or after the intervention (p = .593).

In Table 11, the results indicate that there were on average 3.45 neonatal deaths at the beginning of the period of observation. Immediately after the intervention was introduced, neonatal deaths decreased by 9.3% or .4 neonatal deaths per month (p = .849) (Table 11). In the two-year post-intervention period, neonatal deaths continued to decrease at a lower rate (.1% or .086 neonatal deaths per month, p = .466) (Table 11).

Figure 5 shows the raw data of neonatal deaths and the fitted results after correcting for autocorrelation.

Table 10.

RESULTS OF CHOW TEST ON FACILITY-BASED NEONATAL DEATHS

	df	F-statistic	p-Value
Intervention group	1	1.03	.3162
Time	1	.94	.3376
Chow test statistic	2	.53	.5925
Residual	44		

Table 11.

RESULTS OF SEGMENTED LINEAR REGRESSION ON FACILITY-BASED NEONATAL DEATHS (AFTER CORRECTING FOR AUTOCORRELATION)

Independent Variables	Estimates	Standard Error	p-Value
Constant, β0	3.451413	.7601019	.000
Time, β1	–.0889912	.0641406	.165
Intervention, β2	–.4007418	2.107388	.849
Postslope, β3	–.0863693	.1183741	.466

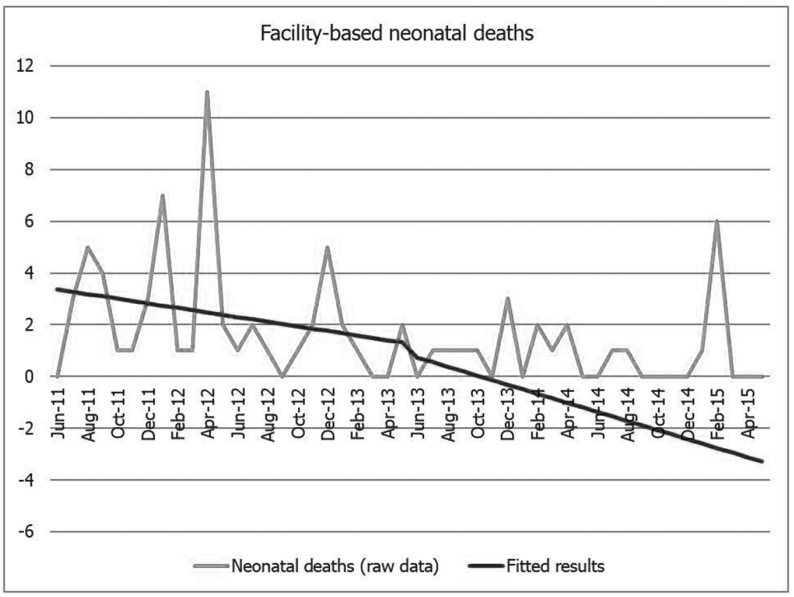

Figure 5. Raw data series of neonatal deaths, and the fitted results after correcting for data auto-correlation.

Discussion

This study found that although 4th ANC visits decreased by 13.3% immediately after the introduction of free maternity services and thereafter by .6% in the two-year post-intervention period, these changes were not statistically significant. This finding is consistent with those of a study in South Africa that reported a sustained insignificant decline in total antenatal care visits after user fee removal,[24] but in contrast to those of a study in Afghanistan, which found that there was a sustained significant decrease in ANC visits following user fee removal.[25] Rapid implementation led to inadequate stakeholder engagement and confusion about the free maternity policy.[26] While the free maternity policy was meant to cover antenatal care visits, deliveries, and post-delivery care, it was observed that in practice the policy only covered deliveries.[26] Given the poor public engagement by policymakers and implementers, this might explain why the intervention did not have a significant influence on 4th ANC visits. In addition, it has been found that most women in three sub-Saharan African countries (Ghana, Kenya, and Malawi) begin their first ANC visit late in the second or third trimester, making it impossible to complete the recommended four visits before childbirth.[27]

This study found that facility deliveries decreased by 1.6% in the post-intervention period. Similar observations have been reported in other studies in which the uptake of facility deliveries either remained the same or declined after free maternity policies were introduced. For example, a study in Machakos County (Kenya) reported that there was no increase in facility deliveries in a seven-month post-intervention period.[28] Other studies conducted in Ghana reported that there was no difference in the utilization of skilled delivery between intervention and control groups in two districts[29] and normal facility deliveries decreased by 2.5% following the fee exemption policy in the country.[30] In contrast, other studies have reported increases in facility deliveries following the introduction of free maternal health care services, with the magnitude of change ranging from 2%–29% depending on the region.[31–36]

Challenges affecting the implementation of the free maternity services policy (e.g., inadequate staffing) were identified in one referral hospital in another county.[37] In this study, the majority of health facilities studied were dispensaries, which are mostly staffed by one or two nurses who work full days on all weekdays (i.e., Monday to Friday). Since these dispensaries are closed at night, deliveries that occur at night are rarely attended to at the dispensary. This is also true of deliveries that occur on weekends. In addition, due to the high levels of social interaction in the study site, women who attend health facilities for delivery but encounter perceived negative experiences also quickly pass word to other women around the community, and this can be a disincentive to utilize skilled delivery. These behavioural factors might explain why facility deliveries declined in the two-year post-intervention period.

In 2012, about half of all pregnancies in Kenya were unintended and an estimated 462,000 (41%) of these ended in abortion, translating into an abortion rate of 48 per 1,000 women aged 15–49, and an abortion ratio of 30 per 100 live births,[38] which is high. In striking contrast to other sub-Saharan African countries such as Tanzania and Malawi in which the abortion ratios are 21 and 23 per 100 live births respectively, the abortion ratio in the Nyanza/Western region studied here is even higher at 39 per 100

live births.[39] This implies that post-abortion care is a major health care need among women of reproductive age in the region. Indeed, this study found an increase of 808% in post-abortion care uptake in the first month following the intervention. Although there is a declining trend in the two-year post-intervention period, the uptake of post-abortion care increased significantly, by a margin of 54.4%.

It is important to note that the average cost of a typical treatment for unsafe abortion complication stands at Kenya Shillings 4,943 or 58 U.S. dollars (US$) with a range from Kenya Shillings 3,264 (US$39) for mild complications and Kenya Shillings 4,362 (US$52) for moderate complications to Kenya Shillings 9,133 (US$108) for severe complications.[38] In a country in which 46% of the population lives below the poverty line,[40] such costs are undoubtedly high. The increase in uptake of post-abortion care can therefore be attributed to the elimination of financial barriers by the free maternity programme, making it more accessible to women with unintended pregnancies.

Furthermore, the inclusion of misoprostol (the drug of choice in post-abortion care) in the essential medicines list that are routinely supplied to all public health facilities by the Kenya Medical Supplies Agency contributed to increased availability of post-abortion care services. Misoprostol is highly acceptable to women of reproductive age seeking post-abortion care services and they would readily recommend it to a friend.[41] The close social interactions among rural women in the study area might have increased awareness of the availability of a popular intervention for post-abortion care, which was also provided free of charge, leading to increased utilization.

Our study found a non-significant increase of 10.1% in facility-based maternal deaths in the two-year post-intervention period. This finding is a pointer to the quality of childbirth care being provided. Indeed, a confidential inquiry by the Ministry of Health found that nine out of 10 maternal deaths were due to substandard quality of medical care.[42] Since the free maternity policy was implemented rapidly,[26] the skills and competencies of health care workers were not upgraded prior to the intervention, a majority of them may have been less competent in handling life-threatening childbirth complications that can result in maternal deaths. Similarly, if the requisite medical supplies, equipment, and facilities for managing childbirth complications were inadequate or nonexistent in the study site, as has been reported in one county referral hospital outside the study area,[37] the risk of maternal deaths would be high. Among the health facilities studied, there was only one comprehensive emergency obstetric and newborn care facility and, coupled with a poor referral network, there would be an increased risk of maternal deaths in the event of obstetric emergencies. The increase in maternal deaths in the study site is inconsistent with findings from 14 other Kenyan counties, Mali, and Ghana, where facility-based maternal deaths decreased, though not significantly, after the introduction of the free delivery policy.[29,35,43] There was a decline of 10%–34% in maternal deaths the Central and Volta regions of Ghana.[29]

Despite gains in child health in Kenya especially due to a new era of policymaking with a strong focus on children under five and a specific interest by donors in this group in the past 15 years,[8,44] facility-based neonatal deaths marginally decreased by .1% in the two-year post-intervention period. This study speculates that there was no improvement in the quality of newborn care in the post-intervention period due to factors such as acute shortage of health care workers, under-resourced government

health facilities, and inadequate training of health care workers in life-saving skills such as newborn resuscitation. This finding is consistent with those of another study which also observed a non-significant decline in neonatal deaths in 14 other Kenyan counties.[35] Farther away, in West Africa and South America, declines in neonatal deaths were reported in Mali and Ecuador following the introduction of free maternal health care services.[43,45]

This study has mixed results on the success of the free maternity policy on increasing utilization of specific maternal health care services and reducing facility-based maternal and neonatal deaths. These findings are consistent with the observation that interventions aimed at improving the health of communities do not always result into the desired changes.[46]

Conclusion. The free maternity programme launched in Kenya in June 2013 has been successful in significantly increasing the uptake of post-abortion care services in the two years following its implementation in a high-burden environment of maternal and neonatal deaths. Since unsafe abortions increase the risk of maternal deaths, increasing access to post-abortion care services would contribute to the overall decline in maternal deaths over time. However, the intervention did not have significant influences on increasing the uptake of 4th antenatal care visits and facility deliveries and reducing maternal and neonatal deaths. Based on these findings and Kenyans' constitutional right to access health care services, including reproductive health care and in the spirit of universal health coverage, we recommend that as a matter of urgency the free maternity programme be strengthened and sustained by anchoring it into law, resourcing it adequately and removal of all implementation bottlenecks.

Current knowledge on this topic. The effect of free maternity programmes on the uptake of facility delivery is known. It varies from region to region. Sometimes, free maternity programmes do not automatically translate into increased uptake of maternity services due to various contextual issues.

- The effect of free maternity programmes on the occurrence of facility-based maternal deaths is known. There is usually a decline in maternal deaths, though not significant.
- The effect of free maternity programmes on the occurrence of facility-based neonatal deaths is known—neonatal deaths usually decline.

New knowledge this study adds. The study documents the effect of the free maternity programme on the occurrence of facility-based maternal and neonatal deaths in a high-burden environment. Previous studies did not necessarily focus on high burden environments. We suppose that high-burden areas provide suitable environments for studying the effects of such programmes.

- The study also documents the effect of the free maternity programme on the uptake of post-abortion care services. So far, there has been no published research on this area.

Study limitations. The free maternity programme was simultaneously implemented in all counties in Kenya. This made it impossible to have a control group for comparison. Secondly, the interrupted time series study design cannot account for the possibility

that some other factor occurred at the same time as the intervention, for example, there was a countrywide nurses' strike, lasting two weeks in December 2013.

Competing interests

The authors declare no competing interest.

References

1. Centers for Madicare and Medicaid Services (CMS). the ICD-10 transition: an introduction. Baltimoree, MD: CMS, 2011. Available at: https://www.cms.gov/Medicare/Coding/ICD10/Downloads/ICD10Introduction20140819.pdf.
2. World Health Organization (WHO). Trends in maternal mortality: 1990 to 2015: estimates by WHO, UNICEF, UNFPA, World Bank group and the United Nations Population Division. Geneva, Switzerland: World Health Organization, 2015:1–38. Available at: https://apps.who.int/iris/bitstream/handle/10665/194254/9789241565141_eng.pdf?sequence=1.
3. Ng'anjo Phiri S, Kiserud T, Kvale G, Byskov J, Evjen-Olsen B, Michelo C, et al. Factors associated with health facility childbirth in districts of Kenya, Tanzania and Zambia: a population based survey. BMC Pregnancy Childbirth. 2014 Jul 4;1:219. https://doi.org/10.1186/1471-2393-14-219 PMid:24996456 PMCid:PMC4094404
4. Chinkhumba J, De Allegri M, Muula AS, et al. Maternal and perinatal mortality by place of delivery in sub-Saharan Africa: a meta-analysis of population-based cohort studies. BMC Public Health. 2014 Sep 28;14:1014. https://doi.org/10.1186/1471-2458-14-1014 PMid:25263746 PMCid:PMC4194414
5. World Health Organization (WHO). World health statstics 2016: monitoring health for the SDGs. Geneva, Switzerland: World Health Organization, 2016.
6. Wanjira C, Mwangi M, Mathenge E, et al. Delivery practices and associated factors among mothers seeking child welfare services in selected health facilities in Nyandarua South District, Kenya. BMC Public Health. 2011 May 21;11:360. https://doi.org/10.1186/1471-2458-11-360 PMid:21599994 PMCid:PMC3112141
7. Kenya National Bureau of Statistics (KNBS). Kenya: demographic and health survey, 2014. Nairobi, Kenya: KNBS, 2015. Available at: https://dhsprogram.com/pubs/pdf/fr308/fr308.pdf.
8. Keats EC, Ngugi A, Macharia W, et al. Progress and priorities for reproductive, maternal, newborn, and child health in Kenya: a countdown to 2015 country case study. Lancet Glob Health. 2017 Aug;5(8):e782–95. https://doi.org/10.1016/S2214-109X(17)30246-2
9. United Nations Children's Fund (UNICEF). Levels and Trends in Child Mortality. New York, NY: UNICEF, 2015. Available from: https://www.unicef.org/publications/files/Child_Mortality_Report_2015_Web_9_Sept_15.pdf.
10. Odhiambo FO, Laserson KF, Sewe M, et al. Profile: The KEMRI/CDC health and demographic surveillance system-Western Kenya. Int J Epidemiol. 2012;41(4):977–87. https://doi.org/10.1093/ije/dys108 PMid:22933646

11. National Council for Population and Development (NCPD). Reducing maternal deaths in Kenya. Nairobi, Kenya: NCPD, 2015. Available at: http://www.ncpd.go.ke/wp-content/uploads/2016/11/Policy-Brief-46-Maternal-Deaths-in-Kenya-1.pdf.
12. Republic of Kenya. Siaya county integrated development plan (CIDP) 2013–2017. Nairobi, Kenya: Republic of Kenya, 2014.
13. Kenya National Bureau of Statistics. Multiple Indicator Cluster Survey (MICS) 2011: Siaya County. Nairobi, Kenya: Kenya National Bureau of Statistics, 2013.
14. Maine D, Rosenfield A. The safe motherhood initiative: why has it stalled? Am J Public Health. 1999 Apr;89(4):480–2. https://doi.org/10.2105/AJPH.89.4.480 PMid:10191784 PMCid:PMC1508874
15. United Nations. Good health and wellbeing. New York, NY: United Nations, 2018. Available at: https://www.un.org/sustainabledevelopment/health/.
16. World Health Organization (WHO). Recommendation 2: health indicators. Geneva, Switzerland: World Health Organization, 2012. Available at: https://www.who.int/woman_child_accountability/progress_information/recommendation2/en/.
17. Pyone T, Smith H, van den Broek N. Implementation of the free maternity services policy and its implications for health system governance in Kenya. BMJ Glob Health. 2017 Nov 12;2(4):e000249. https://doi.org/10.1136/bmjgh-2016-000249 PMid:29177098 PMCid:PMC5687545
18. Desai M, Phillips-Howard PA, Odhiambo FO, et al. An analysis of pregnancy-related mortality in the KEMRI/CDC Health and Demographic Surveillance System in Western Kenya. PLoS One. 2013 Jul 16;8(7):e68733. https://doi.org/10.1371/journal.pone.0068733 PMid:23874741 PMCid:PMC3712942
19. Grimshaw J, Mcauley LM, Bero LA, et al. Systematic reviews of the effectiveness of quality improvement strategies and programmes. Qual Saf Heal Care. 2003 Aug;12:298–303. https://doi.org/10.1136/qhc.12.4.298 PMid:12897365 PMCid:PMC1743751
20. Lagarde M. How to do (or not to do)...assessing the impact of a policy change with routine longitudinal data. Health Policy Plan. 2012 Jan;27(1):76–83. Epub 2011 Jan 27. https://doi.org/10.1093/heapol/czr004 PMid:21278077
21. Kenya Health Information System (KHIUS). KHIUS aggregate. Nairobi, Kenya: Ministry of Health, 2019. Available at: https://hiskenya.org/dhis-web-commons/security/login.action.
22. Svoronos T. Evaluating health interventions over time : empirical tests of the validity of the single interrupted time series design. Cambridge, MA: Havard University, 2016. Available at: https://dash.harvard.edu/handle/1/33840674.
23. StataCorp. Stata statistical software: release 13. College Station, TX: SataCorp LP, 2013.
24. Wilkinson D, Gouws E, Sach M, et al. Effect of removing user fees on attendance for curative and preventive primary health care services in rural South Africa. Bull World Health Organ. 2001;79(7):665–71.
25. Steinhardt LC, Aman I, Pakzad I, et al. Removing user fees for basic health services: a pilot study and national roll-out in Afghanistan. Health Policy Plan. 2011 Nov;26 Suppl 2:iii92–103.

https://doi.org/10.1093/heapol/czr069
PMid:22027924 PMCid:PMC3247786
26. Tama E, Molynuex S, Waweru E, et al. Examining the implementation of the free maternity services policy in Kenya: A qualitative process evaluation. Int J Heath Policy Manag. 2017 Nov 25;7(7):603–13.
https://doi.org/10.15171/ijhpm.2017.135
PMid:29996580 PMCid:PMC6037504
27. Pell C, Meñaca A, Were F, et al. Factors affecting antenatal care attendance: results from qualitative studies in Ghana, Kenya and Malawi. PLoS One. 2013;8(1):e53747.
https://doi.org/10.1371/journal.pone.0053747
PMid:23335973 PMCid:PMC3546008
28. Tomedi A, Stroud SR, Maya TR, et al. From home deliveries to health care facilities: establishing a traditional birth attendant referral program in Kenya. J Heal Popul Nutr. 2015 Jul 16;33:6.
https://doi.org/10.1186/s41043-015-0023-z
PMid:26825288 PMCid:PMC5026053
29. Bosu W, Bell JS, Armar-Klemesu M, et al. Effect of delivery care user fee exemption policy on institutional maternal deaths in the central and volta regions of Ghana. Ghana Med J. 2007 Sep;41(3):118–24.
https://doi.org/10.4314/gmj.v41i3.55278
30. Asante F, Chikwama C, Daniels A, et al. Evaluating the economic outcomes of the policy of fee exemption for maternal delivery care in Ghana. Ghana Med J. 2007 Sep;41(3):110–7.
https://doi.org/10.4314/gmj.v41i3.55277
31. Perkins M, Brazier E, Themmen E, et al. Out-of-pocket costs for facility-based maternity care in three African countries. Health Policy Plan. 2009 Jul;24(4):289–300. Epub 2009 Apr 3.
https://doi.org/10.1093/heapol/czp013
PMid:19346273 PMCid:PMC2699243
32. Witter S, Garshong B, Ridde V. An exploratory study of the policy process and early implementation of the free NHIS coverage for pregnant women in Ghana. Int J Equity Health. 2013 Feb 27;12:16.
https://doi.org/10.1186/1475-9276-12-16
PMid:23446355 PMCid:PMC3599129
33. Witter S, Khadka S, Nath H, et al. The national free delivery policy in Nepal: early evidence of its effects on health facilities. Health Policy Plan. 2011 Nov;26 Suppl 2:ii84–91.
https://doi.org/10.1093/heapol/czr066
PMid:22027923
34. Ir P, Horemans D, Souk N, et al. Using targeted vouchers and health equity funds to improve access to skilled birth attendants for poor women: a case study in three rural health districts in Cambodia. BMC Pregnancy Childbirth. 2010 Jan 7;10:1.
https://doi.org/10.1186/1471-2393-10-1
PMid:20059767 PMCid:PMC2820432
35. Gitobu C, Gichangi PB, Mwanda WO. The effect of Kenya's free maternal health care policy on the utilization of skilled delivery services and maternal and neonatal mortality rates in public health facilities. BMC Pregnancy Childbirth. 2018 Mar 27;18(1):77.
https://doi.org/10.1186/s12884-018-1708-2
PMid:29580207 PMCid:PMC5870237

36. Rob U, Rahman M, Bellows B. Using vouchers to increase access to maternal health-care in Bangladesh. Int Q Community Health Educ. 2009–2010;30(4):293–309. https://doi.org/10.2190/IQ.30.4.b PMid:21273164
37. Wamalwa EW. Implementation challenges of free maternity services policy in Kenya: the health workers' perspective. Pan Afr Med J. 2015 Dec 16;22:375. https://doi.org/10.11604/pamj.2015.22.375.6708 PMid:27047616 PMCid:PMC4796785
38. Mohamed SF, Izugbara C, Moore AM, et al. The estimated incidence of induced abortion in Kenya: A cross-sectional study. BMC Pregnancy Childbirth. 2015 Aug 21;15:185. https://doi.org/10.1186/s12884-015-0621-1 PMid:26294220 PMCid:PMC4546129
39. Republic of Kenya Ministry of Health. Incidence and complications of unsafe abortion in Kenya: key findings of a national study. Nairobi, Kenya: Republic of Kenya Ministry of Health, 2013. Available at: http://aphrc.org/wp-content/uploads/2013/11/Incidence-and-Complications-of-Unsafe-Abortion-in-Kenya-Key-Findings-of-a-National-Study.pdf.
40. UNICEF. Kenya at a glance. Nairobi, Kenya: UNICEF Kenya Country Office, 2018. Available at: https://www.unicef.org/kenya/overview_4616.html.
41. Makenzius M, Oguttu M, Klingberg-Allvin M, Gemzell-Danielsson K, Odero TMA, Faxelid E. Post-abortion care with misoprostol—equally effective, safe and accepted when administered by midwives compared to physicians : a randomised controlled equivalence trial in a low-resource setting in Kenya. BMJ Open. 2017 Oct 10;7(10): e016157. https://doi.org/10.1136/bmjopen-2017-016157 PMid:29018067 PMCid:PMC5652492
42. Republic of Kenya Ministry of Health. Saving mothers lives: confidential enquiry into maternal deaths in Kenya. Nairobi, Kenya: Republic of Kenya Ministry of Health, 2017. Available at: https://cmnh.lstmed.ac.uk/sites/default/files/content/centre-news-articles/attachments/CEMD%20Main%20Report%20Sept%203%20FINAL-%20Full%20Report.pdf.
43. El-Khoury M, Hatt L, Gandaho T. User fee exemptions and equity in access to caesarean sections: an analysis of patient survey data in Mali. Int J Equity Health. 2012 Aug 29;11:49. https://doi.org/10.1186/1475-9276-11-49 PMid:22931249 PMCid:PMC3480938
44. Keats EC, Macharia W, Singh NS, et al. Accelerating Kenya's progress to 2030: understanding the determinants of under-five mortality from 1990 to 2015. BMJ Glob Health. 2018 May 24;3(3):e000655. https://doi.org/10.1136/bmjgh-2017-000655 PMid:29862055 PMCid:PMC5969726
45. Chiriboga SR. Incremental health system reform policy. J Ambul Care Manage. 2009 Apr–Jun;32(2):80–90. https://doi.org/10.1097/JAC.0b013e3181994306 PMid:19305220
46. Friis RH, Sellers TA. Epidemiology for public health practice (5th ed.). Burlington, MA: Jones & Bartlett, LLC; 2014.