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The effect of ena s free aternal health care policon the utiliation of health facilitdelierserices and aternal and neonatal ortalitin public health facilities

CMitobu [1] PBichangi [23] and OManda [4]

Abstract

Background: ena abolished delierfees in all public health facilit ies through a presidential directie effectie on une 1213 ith an aiof prooting health facilitdelierseric e utiliation and reducing pregnancrelated ortalitin the countrThis paper ais to proide a brief oerieof this polic s effect on health facilitdelierserice utiliation and aternal ortalitratio and neonatal ortalitrate in enan public health facilities

Methods: A tie series analsis as conducted on health facilitdelierserices utiliationaternal and neonatal ortalit2 ears before and after the policinterenti on in health facilities across 14 counties in ena

Results: A statisticallsignificant increase in the nuber of facilitbased delieries as identified ith no significant changes in the ratio of aternal ortalitand the rate of neonatal ortalit

Conclusion: The findings suggest that cost is a deterrent to health facilitdelierserice utiliation in ena and thus free deliersericesare an iportant strategto proote utiliation of health facilitdeliersericeshoeerthere is a need to siultaneousladdress other factors that contribute to pregnancrelated and neonatal deaths

eords: ree aternal health care policMaternal ortalitratioNeonatal ortalitrate and health facilitdelier serices utiliation

Background

The reduction and eliination of pregnancrelated or talitreain a challenge in ost loincoe countries [1]The aternal ortalitratio and the neonatal ortal itrate in ena hae been found to be 3621lie births and 221lie birthsrespectiel [2]ien that onl612of delieries in the countrare conducted in health facilitiespregnancrelated deaths hae been at tributed to delierithout skilled birth attendance [2] loballhigh ualithealth facilitdelierserices hae been recoended as a solution to preentable aternal and neonatal deaths [3]or this reasonanAfrican countries hae either reduced or eliinated delierfees to proote health facilitdelierserice utiliation [4] ena oined other African countries in the abolishent of delierfees in all public health facilities through a presidential directie signed into effect on une 1213 [5]Through this policpublic health facilities are rei bursed for costs incurred hile proiding deliersericesthrough a capitation fund proided bthe Ministrof HealthThis policproides eual reiburseent for both spontaneous aginal delieries and caesarean sec tionsThe aounts reibursed to health facilities are based on their capacitto anage pregnancand delier coplicationsAs such25ena shillings 25 S dol larsare reibursed for eerdelierconducted in leel 2 facilities health centersand leel 3 health facilities sub district hospitals5ena shillings 5S dollarsare reibursed for eerdeliercarried out in leel 4 health facilities district hospitalsand leel 5 health facilities

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proincial hospitalsand 15ena shillings 15 S dollarsare reibursed for eerdelierperfored in national referral health facilities [6]

hile eliinating delierfees is a coendable interentionpregnancrelated ortalitdue to the fol loing three delas reains a concern: delas in decid ing to seek skilled deliersericesdelas in arriing at health facilities and delas in receiing adeuate treat ent and referral Cost is not the onlfactor hinder ing the utiliation of health facilitdeliersericesIn enaaternal and neonatal deaths hae been attrib uted to other factorsincluding lack of transportlong distances to health centerspoorleuipped health facil itiesloualitof care in health facilities and trad itional and cultural practices Thereforehile eliination of delierfees in enan public health facil ities partialladdresses econoic barriers to aternal health care utiliationother econoic barriershealth sstegapsualitof health facilitdeliersericesand politicalsocialenironental and religious factors that ainfluence the utiliation and outcoes of a ternal health care in the countrhae not been ad dressed [1 15]

In additioninitial assessents of the ipleentation of this polichae identified arious gapssuch as drug and supplshortagesinsufficient fundingskilled health care orker shortageslack of skills aong health orkersstakeholder noninoleent in the policde signdelaed reiburseent of costs incurred hile pro iding free aternal health careheaorkloadshealth orker deotiationhealthcare orker attitudeslo priacleels in public health facilities and unaailabilit of abulances for eergencies occurring at counit leel [16 1] In light of these contetual gapsthis stud aied to inestigate the effects of the free aternal health care policin ena on health facilitdelier serice utiliation and aternal ortalitratio and neo natal ortalitrate in public health facilities

Methods

A tie series analsis as perfored ith the period of interest being 24 onths before policipleentation une 1211to Ma31213and 24 onths after pol icipleentation une 1213to Ma31215

The studas conducted in public health facilities selected fro14 counties in the Republic of enaAt the tie of data collectionena s public health care facilities ere organied in a hierarchical praidal structure co prising sileelsnaelleel 1 health facilities health centersleel 2 health facilities dispensariesleel 3 health facilities sub district hospitalsleel 4 health facil ities district hospitalsleel 5 health facilities proincial hospitalsand leel 6 health facilitieshich ere national referral hospitals [1] Caesarean sections are carried out in leel 45 and 6 health facilities and thereforehealth fa cilities in these three leels ere the studsitesThis hier archical praidal structure is epected to change fro sito four tiers once releant legislation is passed bthe national parliaent [1 22]

Deceased others and deceased neonates frothe se lected health facilities ere included in the assessent of aternal and neonatal ortalitMothers ho had deliered in the selected health facilities during the 4 ears under consideration ere included in the assess ent of health serice utiliation

ourteen of the fortseen counties in the Republic of ena ere selected for inclusion in the studafter singlestage cluster sapling and subseuent siple ran dosapling procedures ere applied [23]The 4 counties ere classified into high riskediurisk and lorisk aternal ortalitcategories based on their perennial aternal ortalitratiosOf these counties fie ith a high risk aternal death to feales popula tion ratio aboe 1fie ith a ediurisk a ternal death to feales population ratio beteen 12 and 13and four ith a loof risk ater nal ortalitaternal death to feales population ratio belo12ere included in the studthese studies ere selected ia siple randosaplingOf the health facilities eligible for inclusion in the studin 14 counties ere selected through stratified ultistage sapling ith the aternal ortalitriskcountiessta tus of health facilities and location being the strata [1] These health facilities ere one aternitnursing hoe euialent of a leel 5 health facilitin ters of infra structure and huan resource5leel 4 health facil ities1leel 5 health facilities and one leel 6 public health facilit

ritten consent as obtained froheads of health fa cilities included in the studas ell as frothe Director of edical sericesMinistrof Health enaHealth fa cilities ere assigned uniue identification codes hich are onlknon to the authors

The authors relied on priardata sources in eer health facilitaternitard registersaudited records of aternal deathsneonatal ard registers and death regis tersas opposed to DHIS records to ensure data accurac in the studThe instruents for data collection in this studere tabulated uestionnaire to capture onthlfig ures on neonatal ortalitrateaternal ortalitratio and health facilitdeliersericesutiliation in each of the health facilitiesThe da ta collection instruents ere pre tested at a leel 4 health facilitour research as sistantse recruitedtrained and used in data collection

The instruent used for data collection as a tabu lated uestionnaire designed to capture onthlneo natal ortalitratesaternal ortalitratios and health facilitdelierserice utiliation data for each of

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the health facilitiesSPSS IBM ersion 23as used for data analsisand the results ere stratified bgeo graphical location and health facilitleelInterrupted tie series analses of uarterl3onthaternal ortalitratiosneonatal ortalitrates and health fa cilitdelierserice nubers ere perfored using autoregressie integrated oing aerage ARIMA odelsand the leel of significance as set at p 5 Diagnostic tests ere perfored to assess the general fit of the odeland stationarRsuared and traditional Rsuared R ^{2}alues ere calculatedRoot Mean Suare Error RMSEhich is the standard deiation of the residuals prediction errorsas used to easure the spread out of residualsLastlLungBostatistichich is a function of the accuulated saple autocorrela tionsas used as a diagnostic tool to test the lack of fit of a tie series odel through autocorrelations of the residuals

Results

Health facilitdelierserice utiliation

A statisticallsignificant increase in the nuber of deli eries in the health facilities as identifiedthis nuber increased fro23461 before policipleentation to 335 after policipleentationrepresenting a 2 5increase p 5Table 1

The results of the analsis of uarterldelieries in the health facilities indicated a decreasing trend in deli eries slope – 13131 p during the 24 onths preceding ipleentation of the policThus during the 24 onths before the interentionno significant change as identified in the nuber of facilitbased delieries A significant increasehoeerin the uarterlnuber of facilitbased delieries slope 124 p 1in the health facilities as identified after policiple entation Table 2

Table 1 Total Delieries in the different leels of health facilities

ariable	ariable Description	Total Delieries PrePolic	Total Delieries PostPolic	P alue
Location	RuralBased facilities	1531123211		
	rbanBased facilities	1464411341		
acilit Leel	Maternit Nursing Hoe	32434115		
	Leel 4 facilities	113515561		
	Leel 5 facilities	63346466		
	Leel 6 facilit	26125621		
All facilities		234613351		

A closer look at the delierserice utiliation trends identified during the 6 onths before policipleenta tion indicates the presence of a decreasing trend in the utiliation of facilitbased delierserices slope – 124 p 2During the 6 onths after policipleen tationthis trend reersedand a significant increase in the nuber of delieries in health facilities as obsered slope 111 p 1

Both the stationarand the traditional R ^{2} tests ielded a alue of 3ipling that 3of the odel as eplained bthe policinterentionIn additiona root ean suare error RSMEalue of 3422 as identified suggesting that a large portion of the ariabilitobsered in the nuber of delieries could be eplained bthe predictie odelThe ean absolute percentage error MAPEalue of 25 indicated that the alues predicted using the policipleentation odel ereon aerage ithin 25of the actual alues Additional file 1

Both the stationarRsuared and traditional Rsuared alues for all health facilities ere 15 P 15 Additional file 2The stationarRsuared and traditional Rsuared alues aried fro31to 43across ari ous categories of health facilitiesThis finding indicated that although policipleentation resulted in a reark ablhigher nuber of facilitbased delieriesthis inter ention had a nonuniforeffect on delierserice utiliation across the health facilities p 15

Maternal ortalitratio

A nonsignificant decrease in the ratio of aternal or talitin the health facilities as identifiedith the ortalitratio decreasing fro2531lie births to 2311lie births p folloing polic ipleentation Table 3It is onlin the rural areas that a significant decline in aternal ortalitratio as recorded

The ARIMA odel paraeters for the preinterention slope that as calculated using data frothe health fa cilities shoed a nonsignificant decrease in the rate of uarterlaternal ortalitslope – 164 p 2 during the 24 onths preceding user fee reoalDuring the 24 onths after free aternithealth care serices ere first offereda significant increase in the rate of uar terlaternal ortalitas obsered in the health facil ities under consideration slope 34 p 1This finding indicated that the free aternal health care polic did not hae a significant effect on facilitbased aternal ortalitratios Table 4

Both the stationerRsuared and traditional R suared R ^{2}alues for the odel ere 126ipling that onl126of the ariance obsered in aternal ortalitratio could be eplained bthe free aternal health care policinterentionThe RSME alue of 112 6indicated that the interrupted tie series odel as

Table 2 Quarterly Patterns in Health Facility Delivery Service Utilization

	Slope 24 months pre-policy	Slope 12 months pre-policy	Slope 6 months pre-policy	Slope 3 months pre-policy	Slope 3 months post-policy	Slope 6 months post- policy	Slope 12 months post-policy	Slope 24 months post-policy
All 77 facilities	−13.13 ($p = 0.63$)	−13.13 ($p = 0.63$)	− 124.90 ($p < 0.05$)	− 13.13 ($p = 0.063$)	111.77 ($p < 0.05$)	111.77 ($p < 0.05$)	− 26.65 ($p = 0.18$)	124.90 ($p < 0.05$)
Urban-based facilities	− 17.37 ($p = 0.46$)	− 17.37 ($p = 0.46$)	−77.10 ($p < 0.05$)	−17.37 ($p = 0.46$)	59.74 ($p < 0.05$)	59.74 ($p < 0.05$)	111.77 ($p < 0.05$)	77.10 ($p < 0.05$)
Rural-based facilities	4.65 ($p = 0.44$)	4.65 ($p = 0.44$)	−47.34 ($p < 0.05$)	4.65 ($p = 0.44$)	51.99 ($p < 0.05$)	51.99 ($p < 0.05$)	59.74 ($p < 0.05$)	47.34 ($p < 0.05$)
Maternity hospital	−3.12 ($p = 0.87$)	−3.12 ($p = 0.85$)	23.54 (0.45)	−3.12 ($p = 0.87$)	−26.66 ($p < 0.052$)	− 26.66 ($p < 0.05$)	51.99 ($p = 0.0$)	− 23.54 ($p = 0.45$)
Level 4 facilities	18.79 ($p = 0.15$)	18.79 ($p = 0.15$)	−68.00 ($p < 0.05$)	18.79 ($p = 0.15$)	86.79 ($p < 0.05$)	86.789 ($p < 0.05$)	86.98 ($p < 0.05$)	68.00 ($p < 0.05$)
Level 5 facilities	−19.59 (0.13)	19.59 ($p = 0.13$)	−53.63 ($p < 0.05$)	− 19.59 ($p = 0.13$)	34.04 ($p < 0.05$)	34.04 ($p < 0.05$)	34.04 ($p < 0.05$)	53.63 ($p < 0.05$)
Level 6 facility	−0.75 ($p = 0.87$)	− 0.76 ($p = 0.09$)	− 0.76 ($p < 0.05$)	16.26 ($p < 0.05$)	16.26 ($p < 0.05$)	16.26 ($p < 0.05$)	16.26 ($p < 0.05$)	17.01 ($p < 0.05$)

Table 3 Maternal MortalitRatios

ariable	ariable Description	MMR PrePolic	MMR PostPolic	P alue
Location	RuralBased facilities	1521162		
	rbanBased facilities	32632443		
acilitLeel	MaternitHoe	4443152		
	Leel 4 facilities	1151261		
	Leel 5 facilities	25411611		
	Leel 6 facilit	1125334		
All facilities		253231		

reliable in predicting aternal ortalittrendsThe calculated MAPE indicated a 33ariation frothe odel prediction folloing the policinterention Additional file 3

Oerallthe LungBotest statistics ere not signifi cant for the health facilities p 54Significant LungBotest statistics ere identified for leel 5 health facilities onl364 p 5The stationarRsuared and traditional Rsuared alues indicated that onla inial decline in aternal ortalitratio occurred in the health facilities 1ith the greatest decline in aternal ortalitratio identified in the leel 6 health facilit56Additional file 4The aternal ortalit ratios deonstrated a decreasing trend in the health fa cilities but ehibited arked although not consistentl uniforseasonalitThusthe free aternal health care policinterention had a randoand nonsignificant ef fect on aternal ortalitratios across all health facilities

Neonatal ortalitrate

A nonsignificant decline in neonatal ortalitrates as identifiedith rates decreasing fro2331lie births to 221lie births p 14folloing polic ipleentation Table 5

The preinterention slope indicated a nonsignificant decreasing trend in the uarterlneonatal ortalit rates across all health facilities oer the course of the 24 onths preceding policipleentation slope – p 24Ipleentation of the policdid not sig nificantlaffect neonatal ortalitrates during the first 24 onths folloing policipleentation slope 12 p 1Table 6

Onl32of the inial and nonsignificant change obsered in the neonatal ortalitrates could be attrib uted to policipleentationThe RSME and MAPE alues for this odel ere 61and 16respectiel Additional file 5

The general fit of the odel for all health facilities as not significant p 6Both the stationarR suared and traditional Rsuared alues indicated that onl15of the ariation could be eplained bthe odelipling that policipleentation as associated ith onla inial difference in neonatal ortalitrates hen copared ith baseline figures Additional file 6

Discussion

A statisticallsignificant increase in facilitdelieries as obsered in ena folloing the ipleentation of the free aternal health care policin 213This result is siilar to obserations of the ipleentation of free aternal health care policies in other African countries 24 2 Appling user fees for delierserices in health facilities aliit the deandand thus eliin ation of user fees aiproe access to health facilit deliersericesThe increase in facilitbased delieries reained consistentlhigh oer the 2 ears postpolic ipleentationThis finding is in contrast ith other regional studiesin hich increased utiliation of deli ercare serices as docuented during the initial 3 onths folloing user fee reoal 2 2 The high utiliation of free delierserices oer a long period of tie in this studcreates an opportunitto reduce a ternal and neonatal ortalit

Ipleentation of the free aternal health care polic in enan public health facilities did not hae a signifi cant effect on aternal and neonatal ortalitThis ob seration is consistent ith results of other local and international studieshich hae shon user free health policies to hae liited or no effect on aternal and neonatal ortalit 2 32

A significant decline in aternal ortalitratio as noted in the rural based health facilitiesthe ena household health ependiture and utiliation sure shos that 66of the countr s population lies in rural areas and the rural population is ore likelto use pub lic health serices than the urban residents 33The ena household health ependiture and utiliation sur ealso shoed that those in the poorest uintile ere ore likelto use public health facilities than those in the richest uintileAlthough onl12of the change in aternal ortalitratio is attributed to the free ater nal health care policin enathe reduction in ater nal ortalitratio in rural based health facilities abe attributed to a high utiliation of free delierserices in rural areas here the largest population and poorer population reside

As pregnancrelated deaths abe attributed to de las in deciding to seek health facilitdelierserices delas in arriing at health facilities and delas in recei ing adeuate treatent and referralthe findings of this studephasie the fact that other factors acontrib ute to pregnancrelated deaths in enan public health facilities 34The serice readiness aailabilitapping in 213 hen the free aternal health care policas

Table 4 Quarterly Trends in Maternal Mortality Ratio

Facility	Slope 24 months pre-policy	Slope 12 months pre- policy	Slope 6 months pre-policy	Slope 3 months pre-policy	Slope 3 months post-policy	Slope 6 months post-policy	Slope 12 months post-policy	Slope 24 months post-policy
All 77 health facilities	−1.64 ($p = 0.20$)	−1.64 ($p = 0.20$)	−5.12 ($p < 0.05$)	−1.64 ($p = 0.20$)	3.486 ($p < 0.05$)	3.49 ($p < 0.05$)	3.48 ($p < 0.05$)	3.47 ($p < 0.05$)
Urban-based facilities	−1.92 ($p = 0.51$)	−1.92 ($p = 0.51$)	−7.00 ($p = 0.09$)	−1.92 ($p = 0.51$)	5.09 ($p = 0.08$)	5.09 ($p = 0.08$)	5.09 ($p = 0.08$)	5.09 ($p = 0.08$)
Rural-based facilities	−1.38 ($p = 0.40$)	−1.38 ($p = 0.40$)	−2.37 ($p = 0.31$)	−1.38 ($p = 0.40$)	0.99 ($p = 0.54$)	0.99 ($p = 0.54$)	0.99 ($p = 0.54$)	0.99 ($p = 0.54$)
Maternity hospital	−0.08 ($p = 0.94$)	−0.08 ($p = 0.94$)	−2.25 ($p = 0.17$)	−0.08 ($p = 0.94$)	2.17 ($p = 0.06$)	2.17 ($p = 0.06$)	2.17 ($p = 0.06$)	2.17 ($p = 0.06$)
Level 4 facilities	−2.61 ($p = 0.20$)	−2.61 ($p = 0.20$)	−6.85 ($p < 0.05$)	−2.61 ($p = 0.20$)	4.24 ($p < 0.05$)	4.24 ($p < 0.05$)	4.24 ($p < 0.05$)	4.24 ($p < 0.05$)
Level 5 facilities	−4.51 ($p = 0.06$)	−4.51 ($p = 0.06$)	−6.70 ($p = 0.05$)	−4.51 ($p = 0.06$)	2.19 ($p = 0.36$)	2.19 ($p = 0.36$)	2.19 ($p = 0.36$)	2.19 ($p = 0.36$)
Level 6 facility	8.50 ($p = 0.42$)	8.50 ($p = 0.42$)	11.05 ($p = 0.46$)	8.50 ($p = 0.42$)	−2.55 ($p = 0.81$)	−2.55 ($p = 0.81$)	−2.55 ($p = 0.81$)	−2.55 ($p = 0.81$)

Table 5 Neonatal MortalitRates

ariable	ariable Description	NMR Before Polic Ipleentation	NMR After Polic Ipleentation	P alue
Location	RuralBased facilities	1321		
	rbanBased facilities	35134245		
acilit Leel	Maternit Hospital	2422451		
	Leel 4 facilities	3661		
	Leel 5 facilities	262641		
	Leel 6 facilit	12314454		
All facilities		2332214		

ipleented in the countrshos that onlabout 2 of health facilities in the countrhad essential edicines for handling pregnancrelated eergencies ith 51 haing Otocin inectables26haing agnesiu sulphate inectables and 53haing gentaicin inect ables [35]The unaailabilitof these essential drugs points to the inabilitof health facilities to handle preg nancand child birth related coplicates hence no changes in aternal and neonatal ortalit

The adeuacof preeisting healthcare infrastructure huan resources for healthand supplof edical co odities ought to be addressed before aier of delier fees gien the high deand of serices that coes ith fees abolishent [36]As a signatorto the Abua Dec larationena coitted itself to allocating at least 15of the national budget to the health sectorHo eerclose to to decades after signing the declaration goernent funding for health care has reained con sistentlbeloof the national annual budget [3] The national reproductie health strategin ena notes that there are gaps in funding reproductie health ser ices in ena MOH216 [3] Loss of reenue due to abolishent of delierfees alead to poor ualit of serices despite the increase in health facilitdelier serices utiliationthis ould in turn result in shortages of inputs like drugs and other supplies necessarto aert pregnancrelated ortalities and deotiation of health care orkers [31]

Delas in utiliing free delierserices aoccur be cause of loleels of autonoloaareness of the aailabilitand iportance of health facilitdelierser ices and loperception of pregnancrisk factors in pregnant oenIn additionthe long distances fro health facilitiesunaailabilitand high costs of transport sericespoor roads and rugged geographaalso hin der accessibilitof free delierserices [34]Preious assessents in enan public health facilities hae re ported health sstes gaps in serice delier [3 3] These gaps include drug and supplshortagesinad euate health staff to proide care to a high nuber of others seeking deliersericeshealth orker deo tiationdelaed reiburseent of costs incurred hen proiding free aternal health care sericesapathre lated to free delierserices due to priacconcerns poor referral channels and poor ualitof care in gen eralThe interplabeteen these challenges and pregnancrelated ortalitneeds to be further analed and addressed

ser fees hae traditionallbeen seen as a aor source of incoe for health facilities [3] ien that the free aternal health care policreiburseents are proided bthe National Hospital Insurance und NHIhich also reiburses health facilities for pro iding general health serices to NHIebersthis double paent is not onlduplicatie but also ineffi cient and poorlunderstood bcounthealth anagers ho report that thedo not knoeactlhothe funds frothe free aternal health care policshould be uti lied [4] ith deolutionseeral changes hae oc curred regarding health care financing protocols in the counties [3] Before deolution of health sericesfacil ities kept user fee reenue in their on bank accounts but these funds are nodeposited at the countbank accountsas such not all health facilities keep the regular NHIreiburseents and the free aternal health care policreiburseentsIn ieof thisconcerns hae been raised oer diersion of the free aternal health care funds bcountgoernents and this too has a negatie iplication on the ualitof delierserices offered bthe counties [41]It is for this reason that stakeholders in health are adising that reiburseent for offering free aternal health care serices should be done through the Health Sector Serices und HSS channelThealso note that the current leel of co pensating health facilities for deliering free aternal health care serices is challenging gien that it faours facilities ith richer catchent areas thus reducing the facilitreenues in areas sering saller population groups hence coproised ualitof sericesSiilarl despite all health facilities conducting delieriesthe aounts reibursed aries per facilitleel

Liitations

Data used in the analses presented in this anuscript hae seeral notable liitations:

- ien that reiburseent of costs incurred in delierserices is based on the nuber of delieries conducted in each health facilitthe accuracof data prior to the policahae been

Table 6 Quarterly Trends in Neonatal Mortality Rate

Facility	Slope 24 months pre-policy	Slope 12 months pre-policy	Slope 6 months pre-policy	Slope 3 months pre-policy	Slope 3 months post-policy	Slope 6 months post- policy	Slope 12 months post- policy	Slope 24 months post-policy
All 77 health facilities	−0.09 ($p = 0.24$)	− 0.09 ($p = 0.24$)	−0.21 ($p = 0.05$)	− 0.09 ($p = 0.24$)	0.12 ($p = 0.10$)	0.12 ($p = 0.10$)	0.12 ($p = 0.10$)	0.12 ($p = 0.10$)
Urban-based facilities	−0.10 ($p = 0.48$)	− 0.10 ($p = 0.48$)	−0.41 ($p < 0.05$)	− 0.10 ($p = 0.10$)	0.32 ($p < 0.05$)	0.32 ($p < 0.05$)	0.32 ($p < 0.05$)	0.32 ($p < 0.05$)
Rural-based facilities	− 0.08 ($p = 0.10$)	− 0.08 ($p = 0.10$)	− 0.05 ($p = 0.49$)	− 0.08 ($p < 0.05$)	− 0.04 ($p = 0.48$)	− 0.04 ($p = 0.48$)	− 0.04 ($p = 0.48$)	− 0.04 ($p = 0.48$)
Maternity hospital	− 0.16 ($p = 0.24$)	− 0.16 ($p = 0.24$)	− 0.53 ($p < 0.05$)	− 0.161 ($p = 0.24$)	0.37 ($p < 0.05$)	0.37 ($p < 0.05$)	0.37 ($p < 0.05$)	0.37 ($p < 0.05$)
Level 4 facilities	− 0.09 ($p = 0.06$)	− 0.09 ($p = 0.06$)	− 0.12 ($p < 0.05$)	− 0.09 ($p = 0.06$)	0.09 ($p = 0.05$)	0.09 ($p = 0.05$)	0.09 ($p = 0.05$)	0.09 ($p = 0.05$)
Level 5 facilities	0.17 ($p = 0.27$)	0.17 ($p = 0.27$)	0.39 ($p = 0.07$)	0.17 ($p = 0.27$)	− 0.22 ($p = 0.14$)	− 0.22 ($p = 0.14$)	− 0.22 ($p = 0.14$)	− 0.22 ($p = 0.14$)
Level 6 facility	−0.15 ($p = 0.83$)	− 0.15 ($p = 0.83$)	− 0.64 ($p = 0.52$)	− 0.15 ($p = 0.83$)	0.50 ($p = 0.48$)	0.50 ($p = 0.48$)	0.50 ($p = 0.48$)	0.505 ($p = 0.48$)

poor hen copared to the post polic ipleentation data

- Although ost of the findings frothis studare consistent ith other local and international studies generaliation of findings to depict the national picture in the ipleentation of the free aternal health care policabe uestioned gien the shortcoings in eual sapling of the arious facilit leelsreligious dnaicsgeographical dnaics and other contetual factors affecting health facilit delierserices utiliation in the countr
- The free aternal health care polichas been ipleented in all public health facilities in ena This proided liitations in getting control groups public health facilities here the policas not ipleentedfor coparisons
- The studhas focused on the outcoes of the polic ipleentation during the first 2 ears of the polic interentionThe trends before 211 and the traectorof the outcoes after the 2 ears of consideration are unknonand it is ipossible to knohether the obsered trends continues after the 2 ears of policipleentation under consideration
- This studas based on retrospectie data based on aternal death audits oer a period of 4 earsThe ahae been confounded bpopulation dnaics and contetspecific factors in aternal auditsData on the eact tiing of seeking edical help b others as not aailable as such soe of the a ternal deaths ahae been as a result of late pres entation in health facilities

Conclusion

The eliination of user fees for delierserices in ena resulted in a significant increase in the nuber of delieries conducted in enan public health facil itiesthis result indicates that cost abe a ke deterrent to delierserice utiliationThis finding iplies that reoal of user fees for delierserices asere as an iportant strategto increase health facilitdelierserice utiliationHoeerthis pol icinterention appeared to hae no significant effect on aternal and neonatal ortalitThis lack of effect indicates that loutiliation of health facilit delierserices anot be the onlfactor contribut ing to pregnancrelated deaths in loincoe coun tries such as enaloualitof delierserices in health facilities could be a contributing factorIn addition to eliinating fees to iproe health serice accessthere is a need to siultaneousladdress other socialeconoicpolitical and contetual factors that are knon to contribute to pregnancrelated deaths

Additional files

Additional file 1: itness of health facilitdelierserices ModelThis additional file is deried froan analsis of the ean absolute percentage error MAPEon all health facilities delieriesDOC13 kb

Additional file 2: Model statistics of health facilitdelierserices generated through LungBoanalsis of all health facilities delieries DOC14 kb

Additional file 3: itness of aternal ortalitratio odelThis additional file is deried froan analsis of the ean absolute percentage error MAPEof aternal ortalitratio in all the health facilitiesDOC13 kb

Additional file 4: Model statistics of aternal ortalitratio generated through LungBoanalsis of aternal ortalitratio in the health delieriesDOC14 kb

Additional file 5: itness of aternal ortalitratio odelThis additional file is deried froan analsis of the ean absolute percentage error MAPEof neonatal ortalitrate in all the health facilitiesDOC13 kb

Additional file 6: Model statistics of neonatal ortalitrate generated through LungBoanalsis of neonatal ortalitrate in the health delieriesDOC1kb

Abbreiations

APHRC: Africa Population and Health Research CenterARIMA: Autoregressie Moing AeragesCS: Caesarean SectionD: Degrees of reedo HSS: Health Sector Serices undIBM: International Business Machines IDRC: International Deelopent Research CentreMAPE: Mean Absolute Percentage ErrorMBChB: Bachelor of Medicine and SurgerMD: Doctor of MedicineMMED: Master of Medicine in Obstetrics and necolog MMR: Maternal MortalitRatioNHI: National Hospital Insurance und NMR: Neonatal MortalitRatePhD: Doctor of PhilosophPMRCPath: Masters in Huan PathologRMSE: RootMeanSuare ErrorSE: Standard Error SPSS: Statistical Package for Social SciencesNITID: Institute of Tropical and Infectious DiseasesS: nited StatesHO: orld Health Organiation

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Aailabilitof data and aterials

All the data collection tools and data are in the custodof DrCosas Mugabi and are aailable on reuest

Authors contributions

All the three authors CMPBMOade substantial contributions to conception and design of the studacuisition of dataanalsis and interpretation of dataand thehae been inoled in drafting the anuscript or reising it criticallfor iportant intellectual contentand the hae gien final approal of the ersion to be publishedand thehae agreed to be accountable for all aspects of the ork in ensuring that uestions related to the accuracor integritof anpart of the ork are appropriatelinestigated and resoled

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Consent for publication

Not applicable

Copeting interests
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