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The impact of Kano State Contributory Healthcare Management Agency on Emergency Obstetric Care and Maternal Health: Insights from the Comprehensive Emergency Maternal and Newborn Care implementation in northern Nigeria

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Abstract

Maternal mortality is still a major public health issue in northern Nigeria. In order to improve access to care, to strengthen financial protection and to move towards Universal Health Coverage (UHC), the Kano State Contributory Healthcare Management Agency (KSCHMA) introduced Comprehensive Emergency Obstetric and Newborn Care (CEmONC), a programme launched by the National Health Insurance Authority. The present study examines the impact of CEmONC on access to services, maternal health outcomes and financial protection.

Methods: An implementation science study was carried out applying the RE-AIM framework in 32 pilot sites in Kano State. The data, which were collected on a monthly basis during the 18 months both before and after implementation, were analysed with segmented linear regression in order to examine the immediate and long-term changes in maternal mortality and out-of-pocket expenditure (OOPE). Qualitative data consisted of 28 interviews with key informants (KIIs) involving health administrators, facility managers and providers as well as 12 focus group discussions (FGDs) with CEmONC beneficiaries.

Results: Reach: Over the 18-month period during which CEmONC was implemented, 2,457 pregnant women enrolled and had services provided to them, which amounts to about 57% of the eligible target population. **Effectiveness**: Prior to the intervention, maternal mortality rose by 0.42 deaths per 100,000 live births each month, a difference that was not statistically significant. After the implementation of CEmONC by KSCHMA, there was an immediate drop of 84.5 deaths per 100,000 live births per month ($p < 0.001$) and a significant monthly reduction of 2.15 deaths per 100,000 live births ($p = 0.004$). The mean OOPE fell immediately by ₦32,500 ($p < 0.001$). **Adoption**: All 32 facilities (100%) adopted the programme, with 50.3% of the target staff taking part. **Implementation**: The average level of protocol fidelity was 76.7%, reimbursement delays, commodities running out of stock, and unreliable electricity being the main obstacles. **Maintenance**: Ongoing implementation was supported by state legislative financing through the 1% Equity Fund, although reimbursement delays posed a threat to sustainability.

Conclusion: The KSCHMA CEmONC programme showed great reach, was widely adopted, and had promising potential for reducing maternal mortality and the financial burden. For its successful scale-up and for long-term sustainability it will be necessary to strengthen the reimbursement systems, staffing, the availability of commodities, the infrastructure, and to secure sustained financing.

INTRODUCTION

Emergency obstetric and newborn care services are set of life-saving interventions and services for pregnant women and their newborns, received during pregnancy, childbirth and postpartum period when women or their newborns are experiencing complications. [1] Maternal mortality is still a major public health concern, more than 300,000 maternal deaths occur every year.[2] A large number of these deaths happen in Sub-Saharan Africa, the region being responsible for 86% of the global burden.[3] This is primarily because families suffer a severe financial burden when seeking obstetric care, bringing about catastrophic health expenses and, as a result, delaying the important decisions that need to be made and preventing access to life-saving interventions in emergency cases of obstetric complications (this is referred to as the "Three Delays" model). [4]

In August 2024, the National Health Insurance Authority (NHIA) launched the CEmONC programme with the aim of making sure that women who are experiencing complications during pregnancy, childbirth, or the postnatal period get timely and life-saving treatment. [5, 6] The programme includes a range of emergency obstetric care services such as caesarean sections, the management of eclampsia, severe bleeding, obstructed labour, and the treatment of infections. It has been very successful, having provided care for over 32,000 women at more than 250 facilities

across 36 states and the Federal Capital Territory of Nigeria. KSCHMA has been at the forefront of implementing the CEmONC programme and has set up CEmONC centres in all 44 Local Government Areas of Kano State. This wide geographical coverage is part of a deliberate strategy to ensure that women in the most remote areas as well can access emergency obstetric care. [7]

Although the CEmONC pilot programme was strategically launched in Kano State and KSCHMA had an important role in implementing it, there is still a clear lack of empirical evidence regarding the programme's impact on access to emergency obstetric care, maternal health outcomes, and financial protection for pregnant women in Kano State.

To systematically assess the real-life clinical and operational performance of this policy pilot, the present study uses the RE-AIM framework [8], which provides a formal approach for evaluating clinical efficacy, population reach, organisational adoption, operational fidelity, and long-term sustainability. Although similar evaluations have been conducted for CEmONC interventions in complex health systems within low- and middle-income countries (LMICs) [9–11]. However, this is first study that combined RE-AIM and interrupted time series to revealed structural effect of policy intervention pre- and post-implementation.

Conceptual Frameworks:

RE-AIM alignment

The evaluation was based on the five RE-AIM domains as shown in Table 1.

Table 1
The application of the RE-AIM framework to the KSCHMA CEmONC evaluation.

RE-AIM Dimensions	Implementation definition	Numerator	Denominator	Primary Metrics / Data Indicators	Data source
REACH	- Penetration of emergency maternal services among target population	- Number eligible pregnant women beneficiaries of CEmONC. -Coverage of vulnerable populations,	-Broader population of eligible pregnant women enrolled in KSCHMA - Geographic distribution of enrollees across LGAs	-Cumulative proportion and demographics of pregnant women enrolled in KSCHMA and benefited from CEmONC	-Facility HMIS logs, -KSCHMA enrollment record -Population estimates
EFFECTIVNESS	- Impact of intervention on clinical and financial risk protection outcomes	-Proportion of maternal deaths - Quality of care - Catastrophic health expenditure incidence	- Population of live births per 100,000	Population level impact evaluation ITS Institutional Maternal mortality rate (IMMR) among CEmONC beneficiaries Mean out-of-pocket expenditure (OOPE in ₦)	-Clinical register -Patient discharge billing logs -KSCHMA Claims-data analysis
ADOPTION	Absolute number, proportion, and representativeness of settings and intervention agents who are willing to initiate a program	-Number of eligible healthcare facilities offering CEmONC services -Number healthcare providers trained in CEmONC	Total healthcare facilities enrolled in KSCHMA	- Proportion of accredited sites by level (Secondary, Tertiary) -proportion of staff trained on CEmONC	KSCHMA provider registry -staff surveys
IMPLEMENTATION	-Fidelity of service readiness, supply chain, and administrative mechanics	-Fidelity of CEmONC clinical protocol -Availability of equipments, medicine and supplies -operational adaption -Data reporting completeness	Reimbursement turnaround time	- Essential drug stockout duration (days/months); Claims turnaround time (days)	-KCHMA claims data KIIs n = 28

RE-AIM Dimensions	Implementation definition	Numerator	Denominator	Primary Metrics / Data Indicators	Data source
		-Barriers and facilitators			
MAINTENANCE	Sustainability and long-term trajectory of outcomes post-launch	-Integration of CEmONC in the KSCHMA services -Sustainability of funding -Policy and regulator support -Long-term health outcomes		18-months post implementation trend slope for IMMR, OOPE and reimbursement lag.	36-months facility panel datasets Policy document review FGDs of n = 12 beneficiaries

- **Reach**: The ratio of the number of eligible pregnant women who have been enrolled in the CEmONC programme to the total number of pregnant women.
- **Effectiveness**: In terms of clinical and financial risk protection, this includes reduced facility-based maternal deaths, decreased out-of-pocket expenditure per admission, and improved quality of care.
- **Adoption**: The way in which and the proportion of healthcare facilities are accredited at secondary and tertiary levels.
- **Implementation will involv**e fidelity and quality of delivery, accessibility of essential drugs and services, and the time taken to process claims.
- **Maintenance**: A review of the outcomes over 18 months after implementation to evaluate institutionalisation and enduring sustainability.

METHODS

Study Setting and Design

The study was carried out in 32 accredited health facilities in Kano State, northern Nigeria, covering both urban metropolitan and rural Local Government Areas (LGAs). We used a longitudinal panel design, monitoring the facility-level health management information system (HMIS) records, the administrative claims logs, and the facility readiness assessments over 36 months (the 18 months before the pilot: (March 2023 to August 2024 and the 18 months after the pilot: September 2024 to February 2026). Qualitative data were obtained from n = 28 key informant interviews (KIIs) involving health administrators, facility managers and health providers, and from n = 12 focus group discussions (FGDs) with women who were beneficiaries of the CEmONC programme.

Facility Sampling and Eligibility

We selected the facilities through stratified purposive sampling across different tiers of healthcare.

- **Secondary Level of Care**: 30 General Hospitals across 10 Local Government Areas each from the 3 senatorial districts in Kano State accredited for CEmONC.

- **Tertiary Level of Care**: 2 state-owned tertiary hospitals: Murtala Muhammad Specialist Hospital (MMSH) and Muhammad Abdullahi Wase Teaching Hospital (MAWTH), Kano.

Facilities were required to have continuous operational data over a 36-month evaluation window and active accreditation status under KSCHMA.

Data Analysis

Quantitative Analysis

The data we collected were stored securely on password-protected computers and analysed using IBM SPSS version 26 (IBM Corp. USA). Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarise participant and facility characteristics, as well as key implementation indicators,

An Interrupted Time-Series (ITS) analysis was carried out on monthly facility-level data, including the 18 months before and the 18 months after implementation of CEmONC, using segmented linear regression. This approach permitted the model to estimate the baseline level (β_0) the pre-intervention trend ($\beta_{1)}$)he immediate level change following implementation (β_2), and the change in the post-intervention trend (β_3). The main outcomes relating to effectiveness were facility maternal mortality and out-of-pocket expenditure (OOPE) per CEmONC admission. We examined and accounted for autocorrelation and possible seasonality. The effect estimates were given together with 95% confidence intervals and p-values < 0.05 were considered statistically significant.

Qualitative Analysis

The transcripts of the KIIs and FGDs were translated, transcribed and then analysed thematically using NVivo. Using a deductive method, the data were coded in accordance with the RE-AIM constructs. At the same time, inductive coding identified barriers, facilitators, and background factors not captured by the frameworks. Combining the qualitative and quantitative findings during interpretation explained how and why the CEmONC programme achieved the implementation and clinical outcomes observed.

RESULTS

During a 36-month study period, 32 accredited CEmONC facilities were assessed, and results were presented using the RE-AIM dimensions.

Adoption: Facility and Institutional Profile

- KSCHMA implemented CEmONC in 30 secondary healthcare facilities (93.8%) and 2 state-owned tertiary healthcare facilities (6.2%).
- The facilities involved were public institutions, 32 (100.0 per cent), and there were no private providers (0.0 per cent), p < 0.001.
- Of the facilities participating at the metropolitan level, there were n = 12 (37.5%), and those in rural and semi-urban areas amounted to n = 20 (62.5%), p < 0.001.
- CEmONC was fully accredited (n = 32; 100%).

Interrupted Time Series (ITS) Outcomes

The Institutional Maternal Mortality Ratio (IMMR)

During the 18 months before the intervention, the baseline trend in IMMR reported a non-significant monthly increase of + 0.42 deaths per 100,000 live births ($\beta_{1)}$, p = 0.58). When the KSCHMA pilot was introduced at month 19, IMMR decreased immediately and significantly (a drop of 84.50 per 100,000 live births, β_2, p < 0.001) Over the following 18 months of post-intervention monitoring, the trend continued with a significant negative slope (a reduction of -2.15 per 100,000 live births per month, β_3, p = 0.004), showing cumulative long-term reductions in maternal mortality as a result of the policy, as illustrated in Fig. 1 below.

Out-of-Pocket Expenditure

For the period before Month 19, the average amount spent by users on emergency obstetric services increased by ₦4,500 each month (p = 0.021). When the intervention was launched, there was an immediate drop in expenditure of -₦32,500 (p < 0.001). The slope of the trend after implementation became = -₦210 per month (p = 0.076), which effectively flattened the user costs during the 18-month follow-up period as illustrated in Table 2.

Table 2
Out-of-Pocket Expenditure (OOPE)

Segmental Regression Parameter	**Mean OOPE (₦ Estimate 95% (Confidence interval)**	**p-value**
Baseline (β_0)	₦42, 100(39,200 – 45,000)	**< 0.001**
Baseline trend (β_1)	+₦4,500(750–85,00)	**0.021**
Level change at month 19 (β_2)	-₦32,500(-36,100–28,900)	**< 0.001**
Trend change post month 19 (β_3)	-₦210(-440–200)	0.076

Table 3
Implementation fidelity on adherence to CEmONC protocol at its peak (Month 24): Judgmental analysis for KSCHMA enrollees

Indicator	**E**	**O**	**W**	**S**	**A**	**J**
Proportion of Clients whom blood transfusion was done according to protocol	457	380	4	3.2	80%	Good
Proportion of Clients whom caesarean delivery was performed according to WHO safety checklists	654	456	5	3.5	70%	Good
Proportion of Clients who assisted vaginal delivery was performed according to algorism	562	492	4	3.5	88%	Good
Proportion of Clients whose neonates received neonatal resuscitation based on algorism	482	433	4	3.6	90%	Good
Proportion of Clients whom retained products of conception were performed based on appropriate indication	635	457	5	3.6	72%	Good
Proportion of Clients who received parenteral antibiotics based on indication	1465	879	4	2.4	60%	Fair
Proportion of Clients who received uterotonics drugs according to algorism	1109	998	4	3.6	90%	Good
Proportion of Clients who received parenteral anticonvulsants based on algorism	988	716	4	2.9	73%	Good
Proportion of Clients who had manual evacuation of placenta according to algorism	785	628	5	4	80%	Good
Overall adherence to protocol fidelity			**39**	**26.7**	**78.1%**	**Good**

E-*Expected*, **O**- *observed*, **W**- *weight*, **S**- *Score= (***O × W/E***)*, **A**-*Achievement in %=* **S/W** *(%)*,

J- *Judgment*

Table 4
Implementation fidelity on adherence to CEmONC protocol post-implementation (Month 36): Judgmental analysis for KSCHMA enrollees

Indicator	E	O	W	S	A	J
Proportion of Clients whom blood transfusion was done according to protocol	573	459	4	3.2	80%	Good
Proportion of Clients whom caesarean delivery was performed according to WHO safety checklists	765	543	5	3.5	70%	Good
Proportion of Clients who assisted vaginal delivery was performed according to algorism	562	492	4	3.5	88%	Good
Proportion of Clients whose neonates received neonatal resuscitation based on algorism	487	390	4	3.2	80%	Good
Proportion of Clients whom retained products of conception were performed based on appropriate indication	635	457	5	3.6	72%	Good
Proportion of Clients who received parenteral antibiotics based on indication	1465	879	4	2.4	60%	Fair
Proportion of Clients who received uterotonics drugs according to algorism	1358	1209	4	3.6	90%	good
Proportion of Clients who received parenteral anticonvulsants based on algorism	988	716	4	2.9	73%	Good
Proportion of Clients who had manual evacuation of placenta according to algorism	785	516	4	2.6	65%	Fair
Overall adherence to protocol fidelity			**38**	**28.5**	**75.3**	**Good**
E-*Expected*, **O**- *observed*, **W**- *weight*, **S**- *Score= (***O × W/***E)*, **A**-*Achievement in %=* **S/W** *(%)*,						
J- *Judgment*						

RE-AIM Implementation Evaluation

Reach

Over 18 months post-implementation, 2,457 pregnant women who were part of the KSCHMA programme in Kano received the CEmONC intervention, representing 57% of the estimated eligible target population across the catchment areas. Feedback from qualitative studies indicated that community-level sensitisation through local ward development committees helped achieve high enrolment rates, especially among rural women who had previously avoided deliveries in health facilities because of cost concerns.

P $_{7}$ *– Personally, I always delivered at home but attended the hospital this time because our Iman educated us on the importance of hospital delivery, and it's free now (***CEmONC beneficiary***)*
"P $_{3}$ *- With the introduction of CEmONC, I became comfortable about going to the hospital since it was free. We do not need to sell our property in an emergency (***CEmONC beneficiaries***)."*

Effectiveness

- **Clinical outcomes**: Showed that the **i**nstitutional maternal mortality rate among the pilot facilities fell from 492 per 100,000 live births before the intervention to 407 per 100,000 live births after the intervention ($p < 0.001$). This result is consistent with the qualitative findings, as many facility managers reported the same underlying themes.

P *13 - Since the implementation of this programme, we noticed a drastic reduction in maternal deaths in this facility due to the availability of essential supplies to attend to any obstetric emergency (***Matron in charge-ward manager***)*

P *25 – With CEmONC implementation, we noticed a downward trend in monthly maternal deaths from many facilities across Kano State (***Health administrator***)*

- **Financial Protection**: The mean OOPE for pregnant women decreased by ₦32,500. Qualitative feedback from managers and providers indicated that the interval between the decision to proceed with emergency cesarean deliveries and the actual treatment was permanently reduced, dropping from 120 to 160 minutes (before implementation) to about 60 to 90 minutes during the 18 months implementation.

P *9 – To be honest, this is one of the best government policies that I have strongly valued, since it provides genuine free maternal services with prompt improvements in maternal outcomes. I have said this because when it comes to deciding on women who need caesarean deliveries, we act quickly without hesitation, and as a result, lives are usually saved (***Doctor–Healthcare provider***).*

P 15 – *We hardly takes more than an hour to decide and operate on women with obstetric emergencies as we don't usually wait any payment. However, sometimes delays may be associated with lack of power. (***Facility manager***)*

- **Care-Seeking Timeliness**: The average time between arriving at the facility and the start of emergency surgery decreased from 145 minutes to 60 minutes, mainly because the requirement to pay cash in advance before receiving treatment was removed. This was also supported by the qualitative latent themes identified among the beneficiaries.

P 11 **–** We received quick attention and services with this new programme as we didn't need to make payment before service as we experienced before (**CEmONC Beneficiary**)

P *23 – Honestly, the service delivery time had improved as we don't pay upfront, but still the healthcare provider's attitude towards us, the patients, is inadequate (***CEmONC Beneficiary***)*

Adoption

The facility adoption stayed at 100% (n = 32). Staff coverage was 50.3%. Qualitative comments emphasised the need for more staff training, in-service training, and administrative reviews.

P *17 – Since CEmONC implementation, there is a sudden increase in the number of patients attending this facility with obstetric emergencies even from neighbouring states, but the manpower has not been significantly increased (***Health provider***)*

P 21 – Government has done well with this policy implementation, but we are overworked 'smiled' (**Health provider**)

P *19 – So far so good; however, I strongly believe we need to do more with staff employment and refresher courses for successful CEmONC state-wide further implementation (***Health administrator***)*

Implementation

Long-term tracking over 36 months showed that implementation fidelity peaked at month 24 (78.1% adherence to the protocol, as shown in Table 3) but then saw a slight drop by month 36 (75.3%, as shown in Table 4). Nevertheless, the qualitative findings pointed to the following as the main implementation bottlenecks;

- **Claims reimbursement delay**: Facility managers stated that reimbursements from KSCHMA were delayed by an average of 45 to 90 days, which strained the hospital's operational funds.
- **Essential supplies out of stock**: Because of the extended processing of claims, there were temporary shortages of certain surgical supplies and blood products, which caused healthcare facilities to ask patients to buy the items themselves from time to time.
- **The power supply is erratic**: a 24-hour power outage affects obstetric emergencies that require emergency surgical intervention.

P *18 – We noticed an upward surge in maternity clients' attendance of over 200 clients per day; with the manpower shortage, it is difficult for us to implement the CEmONC services according to the recommended guidelines, but we are trying 'Smiled' (***Health provider***)*

P *14 – When we started, compliance to protocol was not much; nonetheless, it picked up months after* (**Facility manager***)*

P28 – Since claiming reimbursement takes over a month, we have had to ask patients to buy some drugs themselves because they are out of stock (**Facility manager** *).*

Maintenance

The policy level of institutional maintenance was maintained through the Kano State Government allocating the 1% Consolidated Revenue Equity Fund Share. However, by the end of the 36 months, facility-level operational maintenance came under threat because of delayed reimbursements and dwindling cash reserves for essential obstetric commodities, which sometimes forced facilities to resort to temporary out-of-stocks or make direct out-of-pocket purchases of emergency surgical consumables.

I am optimistic that CEmONC will prove sustainable given the 1% allocation from the Equity Fund and the current level of political will from the government. We merely hope that the difficulties we are currently encountering, particularly at the facility operational level due to delayed reimbursements, will be honestly addressed (**Health administrator** *).*

DISCUSSION

This study shows that the 36-month evaluation offers long-term, practical evidence based on empirical data demonstrating that removing monetary barriers at the point of care through KSCHMA considerably enhances access to emergency obstetric care and reduces institutional maternal mortality in northern Nigeria.[12] The study combines an Interrupted Time Series design with the RE-AIM framework to isolate the structural effect of KSCHMA from pre-existing trends, showing that the clinical advancements observed were directly caused by the policy intervention between Months 19 and 36.

Nevertheless, the long-term qualitative and fidelity data point out systemic friction points which endanger the ongoing maintenance of the programme and its overall sustainability. This finding is also noted in other studies carried out in low- and middle-income countries. [9, 13] Consequently, coordinated action is therefore required from all stakeholders, including the government, facility managers and healthcare providers. As has been found in the implementation of health insurance schemes in LMICs, delays in receiving payment from providers directly affect facility-level drug supply chains. If health facilities face cash flow problems, the unintended result is a reversion to informal out-of-pocket charges, which undermines community trust and reduces long-term reach. [9, 14–15]. Using the RE-AIM framework to assess the KSCHMA CEmONC pilot provides a complete understanding of how subnational health financing translates into clinical and operational impact in northern Nigeria.

Reach and Effectiveness

The pilot programme carried out by the KSCHMA achieved a penetration rate of more than 50%. It resulted in a meaningful decrease in IMMR (a reduction of 2.15 per 100,000 live births per month), together with an immediate drop of ₦32,500 in OOPE, which shows that exemptions from user fees at the point of care successfully deal with Thaddeus and Maine's "Second Delay" and "Third Delay" [16]. Discontinuing direct cash payments at the emergency counter led people to seek prompt care. These results align with implementation evaluations of Ghana's NHIS and Rwanda's Mutuelles de Santé [17–18].

Implementation and Adoption Disparities

Although demand-side reach was strong, with 100% of facilities having adopted the programme, semi-rural and rural local government areas accounted for the largest share (62.5%) compared to metropolitan local government areas (37.5%). This shows that the scheme has achieved greater coverage among the most vulnerable rural populations as required. [12]

The RE-AIM framework identifies key supply-side implementation bottlenecks, such as a workforce shortage, with only 50.3% of the required staff available, as well as irregular power supply in many facilities. This is the reason why tertiary facilities had significantly higher maternal survival odds than secondary facilities. Moreover, drug out of stocks exceeding seven days per month indicate that demand-side financing without adequate supply-side integrity leads to a failure of implementation fidelity, which then declined slightly from 78.1% to 75.3% by the 36th month. This fidelity level is below the WHO implementation recommendation (19) but is similar to the 75.5% fidelity found in Ethiopia. [9] To achieve optimal nationwide scale-up, the KSCHMA must digitise claims processing to shorten turnaround times to under 30 days and improve linkages between health insurance funds and state drug management agencies.

Maintenance and Policy Sustainability

The results of the study show great promise for institutional maintenance with (1% Consolidated Revenue Equity Fund) allocation. However, prompt reimbursement of claims is essential to prevent healthcare facilities from reverting to charging informal fees or suffering out-of-stock syndrome due to liquidity problems; recruiting and deploying additional staff, along with improving power supply, will also be necessary to ensure the programme's sustainability. This point has been consistently found in studies conducted in similar LMICs. [15, 21]

Conclusion and Recommendations

During the 36-month implementation in Kano State, the KSCHMA CEmONC pilot substantially reduced both maternal deaths and financial obstacles. By combining segmented linear regression modelling with the RE-AIM framework. The study showed that the programme sustained clinical effectiveness while identifying key supply-chain vulnerabilities. Addressing reimbursement delays through automated claims processes that take less than 14 days will be essential to maintain health facilities' liquidity. Also, to protect the supply chain by limiting out-of-stocks, equip facilities with solar-powered backup systems, and provide manpower through employment and training if the long-term maintenance of the health system is to be secured before the programme is expanded statewide.

Abbreviations

CEmONC
Comprehensive Emergency Obstetric and Newborn Care

HREC
Health Research Ethics Committee
HMIS
Health Information Management System
IMMR
Institutional Maternal Mortality Ratio
ITS
Interrupted Time Series
KSCHMA
The Kano State Contributory Healthcare Management Agency
LMICs
Low-and Middle-Income Countries
MAWTH
Muhammad Abdullahi Wase Teaching Hospital
MMSH
Murtala Muhammad Specialist Hospital
NHIA
National Health Insurance Authority
OOPE
Out-of-Pocket Expenditure
RE
AIM-Reach, Effectiveness, Adoption, Implementation, Maintenance

Declarations

Ethics Approval and Consent to Participate

The Health Research Ethics Committee (HREC) of the Kano State Ministry of Health approved this study (approval number: NHREC/17/03/2018). We secured administrative clearance from KSCHMA and the managers of the participating health facilities. We combined data extracted from the facility HMIS logs and the administrative claims databases and fully anonymised it before analysis. Additionally, we obtained informed consent from individual health providers, facility managers and CEmONC beneficiaries.

Consent for Publication

Not applicable.

Clinical Trial Number

Not applicable

Competing Interests

The authors declare no competing interests.

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Author Contribution

RAM, ZA – Research conceptualisation, proposal writing, securing proposal approval

ZA, AYH, USA – Data collection and analysis

RAM, ZA, ALO, IUH – Manuscript writing, review and final approval

Every author agrees to the final publication.

Data Availability

Data collected will be available on reasonable request from the corresponding author after securing approval from KSCHMA and Kano State Ministry of Health

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Figures

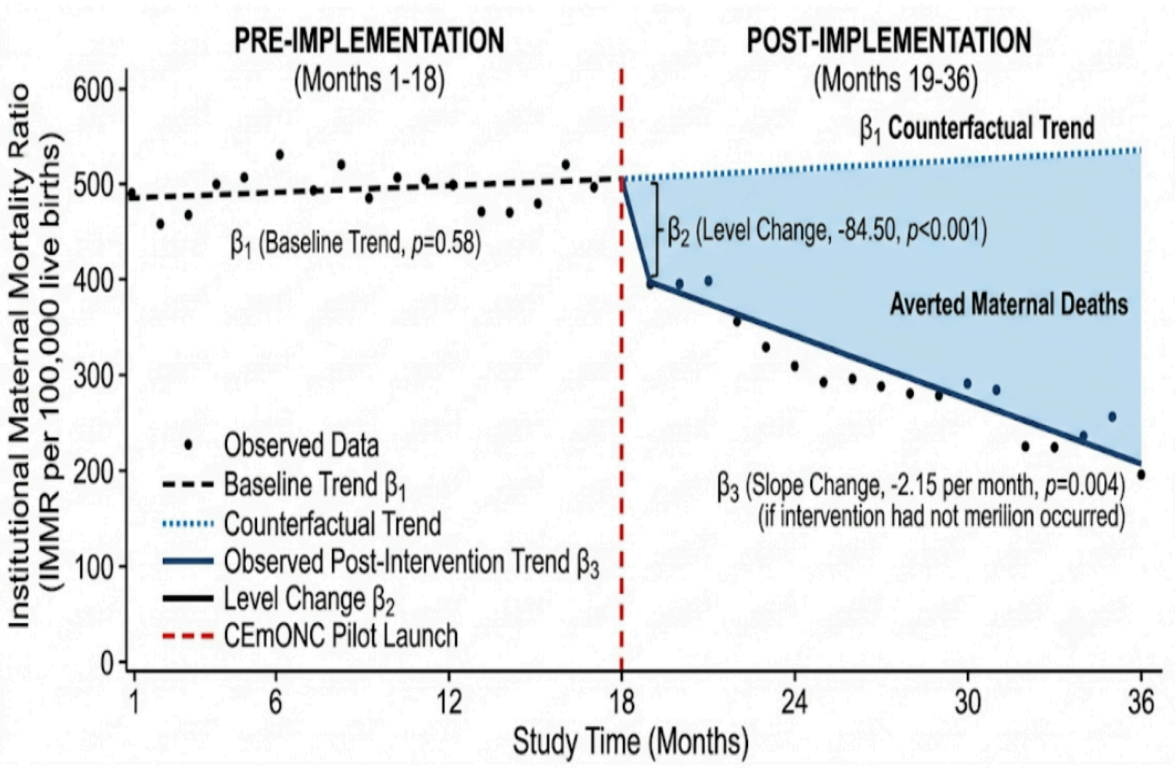


Figure 1

A time series analysis of the institutional maternal mortality ratio before and after the implementation of the CEmONC pilot.

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