Evaluating the Impact of a Care Model on Skilled Delivery Service Utilization among Women in Kandara, Murang'a County, Kenya

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Abstract

BACKGROUND

Addressing maternal and neonatal mortality rates in Kenya requires improving skilled delivery services, as unskilled deliveries contribute significantly to negative maternal and child health outcomes. This study aimed to evaluate the effectiveness of a model of care designed to enhance the utilization of skilled delivery services among women of reproductive age in the Kandara sub-county, Murang'a County, Kenya.

MATERIALS AND METHODS

Using a quasi-experimental study design, 154 pregnant women in their second trimester were equally assigned to test and comparison groups. The test group received tailored strategies promoting skilled birth attendance, while the comparison group received standard antenatal care. Data were collected continuously from the 28th week of gestation until delivery. Interventions for the test group included education on skilled delivery benefits and improved access to skilled attendants. All participants completed follow-up, achieving a 100% response rate.

RESULTS

Skilled birth attendance significantly increased in the intervention group compared to the comparison group. The intervention group had 98.7% skilled deliveries, while the comparison group had 85.7%. The overall proportion of skilled deliveries across both groups was 88%. Statistical analysis ($Z = 3.08$, $p = 0.002$) supports these findings, resulting in the rejection of the null hypothesis.

CONCLUSION AND RECOMMENDATIONS

The tested model of care proved effective, suggesting its potential for implementation in low-skilled delivery areas. Collaborative efforts involving the National and county governments through the health departments, NGOs, and community health workers are recommended to scale up implementation in maternal and neonatal care. Advocacy with policymakers is crucial for integrating the model into maternal healthcare systems and shaping supportive policies. Additionally, government and stakeholder research collaborations are recommended to evaluate the model's long-term impact and sustainability.

Keywords: *Skilled Deliveries, Testing of a Model, Utilization of Skilled Birth Attendance, Quasi-Experimental Study and Women of Reproductive Age*

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Introduction

The presence of a skilled birth attendant and a supportive delivery environment are crucial for maternal and neonatal health[1]. Inadequate care during antenatal and delivery periods contributes to high maternal and neonatal mortality rates, with approximately 303,000 maternal and 2.5 million neonatal mortalities globally in 2016[2]. While over 90% of births in developed countries occur in health facilities attended by skilled health providers, only 57% of births in sub-Saharan Africa are attended by skilled attendants[3-4.]

In Kenya, despite policies such as the Kenya Health Policy (2012-2030), the maternal mortality rate remains high at 342 deaths per 100,000 live births[3]. The government has launched initiatives such as the Linda Mama and Beyond Zero Campaigns to eliminate financial barriers to maternal healthcare access.[5-6] However, the percentage of deliveries attended by skilled birth attendants remains low at 62%[5.]

The decentralization of healthcare services in Kenya through the establishment of 47 new counties aimed to promote innovative interventions and equitable provision of healthcare7-8. The national government remains responsible for health policy, technical assistance, and management of national referral facilities7. The implementation of universal healthcare provides free healthcare delivery services in public facilities, further eliminating financial barriers to maternal healthcare access[6]. Despite initiatives and policies aimed at improving maternal healthcare access and reducing maternal mortality rates in Kenya, including decentralization of healthcare services and the implementation of universal healthcare, there remains a gap in effectively increasing the utilization of skilled delivery services. Despite efforts to eliminate financial barriers and promote equitable provision of healthcare, the percentage of deliveries attended by skilled birth attendants remains low at 62%.

The research study aimed to address this gap by evaluate the effectiveness of a model of care designed to enhance the utilization of skilled delivery services among women of reproductive age in the study area. The model, developed and validated based on a baseline study conducted from January to November 2022, is grounded on identifying gaps from baseline findings and reviewing existing literature. The study focuses on key components of the model of care, including inputs, activities, and outcomes as indicated in Figure 1.

Materials and Methods

Study design

The study utilized a Quasi-experimental design, employing a posttest-only nonequivalent groups approach. The intervention group received a model of care strategies, while the comparison group received standard ANC clinic care. Both groups were followed prospectively until delivery, with postnatal home visits conducted to assess the model's effectiveness. Due to academic and feasibility considerations, the model was tested on a limited number of clients. The baseline study conducted from January to November 2022 informed the development and validation of the model of care. Its components were then assessed on a small number of clients to evaluate effectiveness.

Study area

The study was conducted in Kandara Sub County, Murang'a County, Kenya. The sub-county has six administrative wards including Ng'araria, Muruka, Kagundu-Ini, Gaichanjiru, Ithiru, and Ruchu. Participants from the Ngararia ward constituted the "intervention group," while the Gaichanjiru ward formed the "comparison group."

Inclusion and exclusion criteria

Pregnant women at 28 weeks' gestation, residing in the area for a year, were included while women of unsound mind were excluded as they could not give consent.

Sample size determination

The sample size was determined using the formula by Wang *et al.* [10] for nonequivalent groups, given a projected total population (N) of 554 pregnant women. Zα/2 and Zβ were selected, representing critical values of the Normal distribution at α/2 (significance level) and β (probability of Type II error).

A significance level of 0.05 (95% confidence) ensured statistical significance, while a power of 80% (Z-value of 0.84) allowed for the detection of true differences.

P1 and p2 denoted expected sample proportions in the control and intervention groups, respectively. Based on prior knowledge and literature review, p1 = 0.65 (65%) for the control group and p2 = 0.85 (85%) for the intervention group, reflecting anticipated outcomes.

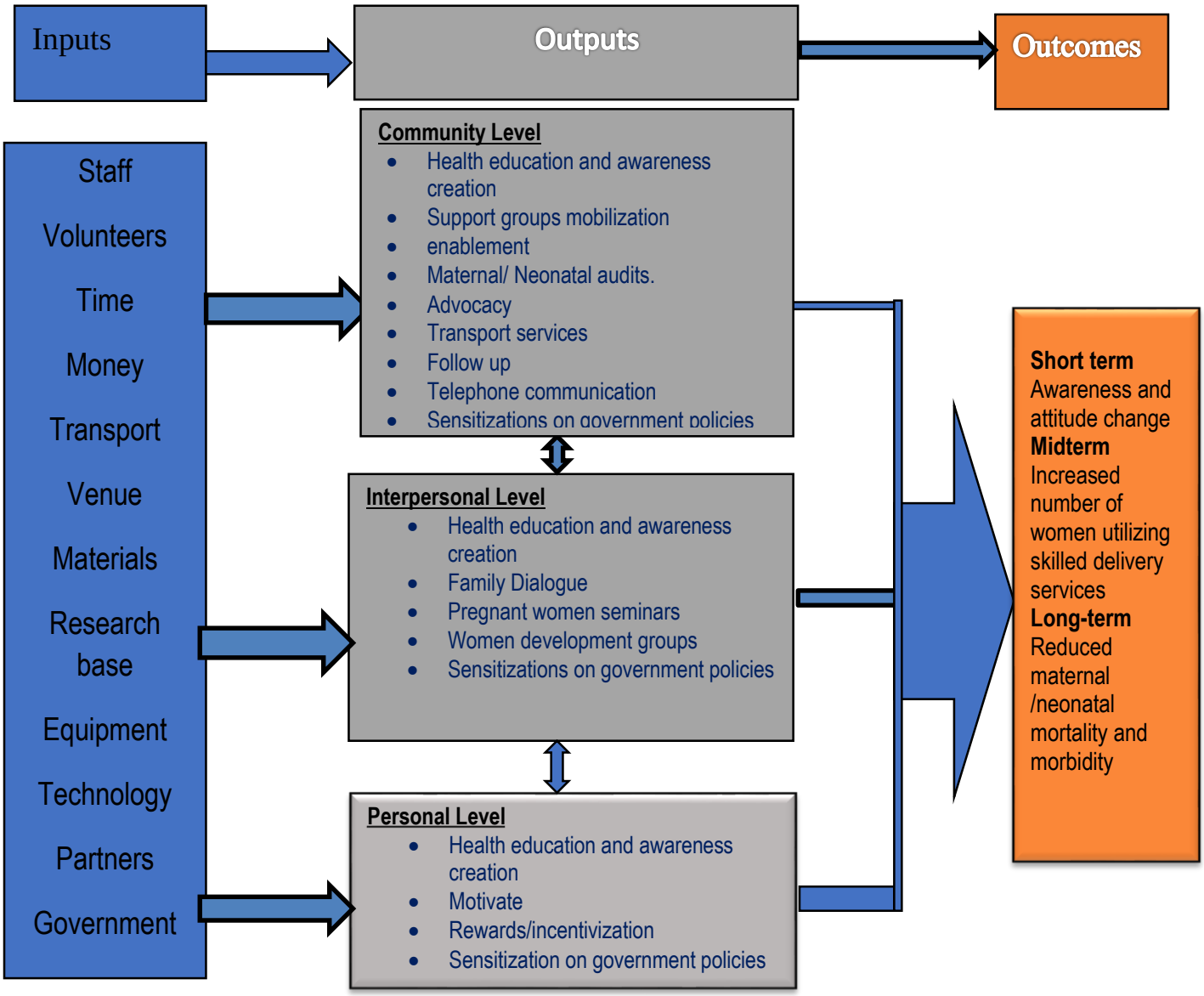

Figure 1:
Model of care (Muya, 2024)

The expected difference between groups (p1 - p2) represented the minimum meaningful difference the study aimed to detect, assumed to be clinically significant regarding skilled delivery service utilization.

A ratio of 1:1 for participants in each group was specified in the study design, ensuring equal allocation for balanced representation and facilitating comparison. This approach enhanced the study's validity by minimizing potential biases.

The number of participants per group required to detect a difference p1 − p2 in the proportions with significance level α and power 1 − β was given by:

$n = (Z_{\alpha/2}+Z_{\beta})^2 \times (p_1 (1-p_1) + p_2 (1-p_2)) / (p_1-p_2)^2$

Zα/2 = the critical value of the Normal distribution at α/2 (for a confidence level of 95%, α is 0.05) =1.96

Zβ = the critical value of the Normal distribution at β (for a power of 80%, β is 0.2) = 0.84

p1 = the expected sample proportion of pregnant women in the control group = 65% = 0.65

p2 = the expected sample proportion of pregnant women in the intervention group = 85% = 0.85

ratio1:1 (Intervention: control group)

Where:

$n = (Z_{\alpha/2}+Z_{\beta})^2 \times (p_1 (1-p_1) + p_2 (1-p_2)) / (p_1-p_2)^2$

$n= (1.96+0.84)^2*(0.85(1-0.85) +0.65(1-0.65))/0.85-0.65)^2$

n= 69.58

Table 1 below illustrates the sample determination

Sampling procedure

Following the baseline study, Ngararia and Gaichanjiru wards were selected purposefully due to their low skilled delivery rates, with 25 (23.6%) and 22 (20.75%) respectively. Ngararia was designated as the "intervention group," and Gaichanjiru as the "comparison group."

Initially, proportionate random sampling was employed to select Community Health Units (CHUs) within both wards. This method aimed to ensure the representation of the entire population within each ward by randomly selecting a proportionate number of CHUs based on their size relative to the total number in both wards. Subsequently, simple random sampling was utilized to identify households with third-trimester pregnant women (from 28 weeks) within the selected CHUs. Each household was assigned a unique identifier, and households were then randomly chosen from this list using a random number table or generator, ensuring equal chances of selection for every eligible household.

Table 1:
Sample Size Determiation

Sample size	
2-side significance level	0.05
Power (1-beta)	0.84
Ratio of sample size, intervention/comparison	1
Probability of event in the exposed group(p1)	0.85
Probability of event in the unexposed group (p2)	0.65
Result	
Sample Size – exposed group	70
Sample Size – Comparison group	70
The sample size for the two groups (n1+n2)	140
Attrition rate (10%)	14
Total sample size	154
Participants per wing (ratio of 1:1)	77

Pregnant women meeting the criteria of being in their 28th week of gestation from the selected households were purposefully recruited for the study. In cases where a pregnant woman declined participation, the researcher proceeded to the next sampled household until the required sample size was attained.

Data collection tools

A questionnaire was systematically developed and the research team ensuring its reliability and validity. Before distribution, the questionnaire underwent pretesting to ensure clarity and relevance, refined based on feedback from a small sample of participants. Reliability was assessed through internal consistency measures using Cronbach's alpha coefficient an alpha of 0.7 was deemed as acceptable.

Validity, including content, criterion, and construct validity, was then evaluated to ensure the questionnaire effectively measured intended variables.

Testing of the Model

The study followed the JBI critical appraisal checklist for quasi-experimental studies (non-randomized)[11] to evaluate causal relationships rigorously, minimizing bias and enhancing the reliability and validity of findings.

Criteria and applications

Clear temporal relationship. The study clearly outlined the intervention period (November 2022 to February 2023) and subsequent evaluation of its effectiveness, ensuring clarity in cause-effect sequencing.

Similar study participants. Both study groups reside in the same demographical area, with similar and comparable environmental infrastructure, social economic conditions and cultural factors, this enhanced the study's validity as it reduced selection bias.

Similar treatment. Both study groups received standard prenatal care, while the additional model of care strategies were applied to intervention group. This ensured reinforcement of causal inference in the study.

Presence of control group. participants in Gaichanjiru ward were used as an independent control group. This provided a baseline for authentic causal inferences, comparing with the participants in intervention group (Ngararia ward).

Multiple outcome measurements. Findings from baseline study (2022) allowed for evaluation of the effectiveness of the implemented interventions 12 months later after the study. This enabled comprehensive analysis and consideration of alternative explanations.

Complete follow-up. Diligent follow-up through various means, including home visits and phone calls, minimized alternative justifications for observed outcomes.

Consistent outcome measurement. The primary indicator was the number of skilled deliveries after intervention. This ensured consistency in outcome extent across the two study groups.

Reliable outcome measurements. Application of appropriate statistical techniques during sample size calculation using SPSS Version 27 data analysis, reinforced reliability in effect measurements and the validity of causal effects evaluation.

Appropriate statistical analysis

SPSS Version 27 was employed for z-score and p-value calculations, ensuring the identification of significant statistical differences and adherence to appropriate statistical analysis methods to mitigate errors in inferring causal relationships.

Application of the Model

The model of care strategies was applied to the intervention group, while the comparison group received standard antenatal care. The study implemented delivery methods across various levels: Personal, Interpersonal, and Community, utilizing inputs such as staff, volunteers, time, money, materials, and collaboration with partners and government support. Expected outcomes included increased awareness, attitude change

towards skilled delivery, increased support for pregnant women, financial independence, and higher skilled delivery utilization. The intervention focused on various stakeholders and levels in the community to setup a supportive environment that would promote the utilization skilled delivery services.

Personal Level: continuous Health education seminars aided to inform pregnant women on the need to seek skilled delivery services. Individual Motivation and offering incentives to praise women who sought to seek hospital delivery services. Joining local women groups (CHAMAS) also proved supportive to women in seeking skilled delivery services. Government policies allied to reproductive health and modes of healthcare payment were expounded. Reliable modes of transportation were availed. subsidization of Costs of laboratory and obstetric scans were provided for financial support. Client Follow up with Phone calls and WhatsApp messages encouraged and reminded study participants to follow the scheduled antenatal care visits, individual birth plans, expected date of delivery and to deliver at a health facility.

Interpersonal level. family Dialogue with antenatal women and their closest family members highlighted the need for family support during antenatal and labor and delivery period. Seminars and maternity open days enlightened women on the importance of seeking skilled delivery services. Women were encouraged to join women's development groups for socio-economic growth and financial independence. Sensitization on government policies continued at this level.

Community Level. Community health workers, volunteers, and family members were involved in health education and awareness creation. Support groups mobilized to assist pregnant women, and maternal/neonatal audits analyzed deaths and near-miss cases.

Table 2:
Meetings and Events

Type of Meeting	Participants	Activity	Indicators	Outcome
Chief Baraza Preliminary meeting 1	Chief, Assistant Chief, CHVS, CHAS, Community, Research assistants	Sensitization, Mobilization, Advocacy	Number of stakeholders reached and sensitized	Stakeholders sensitized
Health Worker Sensitization Preliminary meeting 2	Health Care Workers	Rolling down of model/standard ANC care	Number of health care workers sensitized on the model / standard care	Health workers sensitized
Contact Meeting 1	Health Care Workers, CHVs, ANC Mothers, Family Members	Introduction to study, ANC procedures(Model/ standard care)	Several health workers reached and ANC mothers enrolled	Health workers sensitized, Clients enrolled to the study
Contact Meeting 2	Health Care Workers, ANC Mothers	Follow-up on ANC procedures(Model/ standard care)	Number of women with ANC procedures (Model/ standard care)	Monitoring and evaluation of the program
Contact Meeting 3	Health Care Workers, ANC Mothers, Relatives	Review on ANC procedures, Birth preparedness	Number of women with ANC procedures, Assessment on birth preparedness	Monitoring and evaluation of the program
Contact Meeting 4 (Exit)	Women, Relatives	Data collection on place of birth	Number of women reached and data on where respondents delivered	Data on place of birth

Advocacy efforts emphasized the importance of community-owned transport and follow-up for pregnant women. Communication through WhatsApp groups and phone calls served as reminders. The community was sensitized about government policies related to reproductive health and healthcare payment. Stakeholders Involvement: Stakeholders were grouped based on healthcare roles, including Chiefs, NHIF claim officers, Health administration officers, health workers, and community members like CHVs and Chas Meetings and events were conducted to sensitize stakeholders, recruit participants, and monitor program progress, as shown in Table 2.

Ethical considerations

Ethical clearance was obtained from the JKUAT Ethics Review Committee (JKU/IERC/02316/0431, Nov 18, 2021), NACOSTI (303892, Jan 6, 2023), and the county Government of Murang'a (REF NO: MOH/GEN/MUR/VOL.V/58, Dec 14, 2021). Informed consent was sought from all participants, giving adequate time to process information and ask questions for clarity. Privacy and confidentiality were prioritized and autonomy respected with no coercion involved.

Results

Response rate

A total of 554 individuals were initially screened for their eligibility to participate in the research. From this pool, 154 participants were deemed suitable and were assigned to a study group. Each study group contained 77 participants who then underwent the designated intervention. All 154 participants completed the follow-up phase. For the main phase of the analysis, all 154 participants were included and assessed according to their respective study conditions as shown in Figure 2.

Outcome

The proportion of skilled deliveries in the intervention group was 98.7%, while in the comparison group, it was 85.7%. Overall, the proportion of skilled deliveries in both groups was 88%. As shown in table 3.

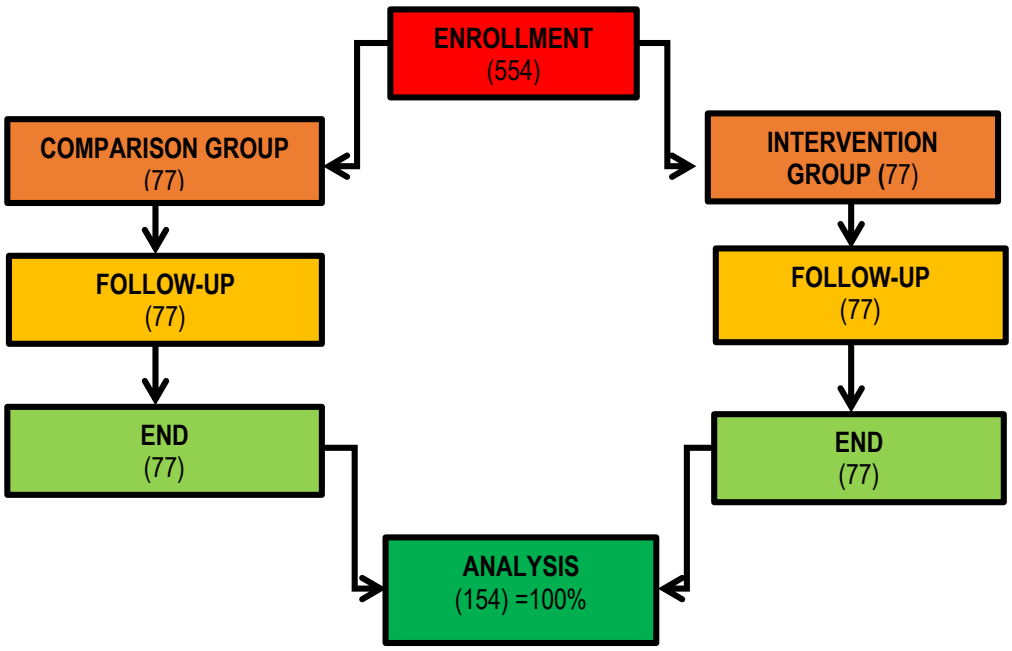

Figure 2:
Participant's Enrollment and Follow-up Flow

Statistical analysis of the Z-test

The z score (3.078363286) > critical value (1.959963985). The p-value (0.00208141) is < a (0.05).

Hypothesis testing

The testing results indicate a significant difference in skilled delivery service utilization between the intervention and comparison groups. With a Z score of 3.078363286 exceeding the critical value of 1.959963985, and a p-value of 0.00208141 therefore, $p<\alpha$ then we reject H0 and accept H1. This implies that the there was a positive impact on skilled delivery service utilization on application of the model strategies

Discussion

The study found that closely monitoring pregnant women and preparing them thoroughly for childbirth significantly increased the use of skilled birth services. This is supported by another study showing that well-prepared mothers during antenatal care were more likely to use health facilities for delivery[13].

Implementing the developed strategies of the model of care had a positive effect on the use of skilled delivery services, this aligned with findings from a study done in South Africa, in which service utilization tripled after implementation of a similar model [14]. Similarly, another study in Gambia exhibited that the implementation of the three-delay model enhanced utilization of the skilled delivery services[15].

This finding corroborated by research study carried out in West Ethiopia, that demonstrated the use of checklist-based Box System Interventions (CBBSI) was more effective in improving maternal health service use than when the routine care was used[16]. Teaching antenatal women about pregnancy, labor, and associated complications positively influenced their choice of place of delivery, consistent with study findings in Nepal and Pakistan proving that equipping pregnant women with knowledge on pregnancy and child birth empowered them to choose for a health facility-based delivery services [17,18].

Table 3:

Outcomes and Estimation of skilled deliveries (successes)in study groups

Group	Area	Sample size	Skilled deliveries (Success)	Proportionate of success	%
Intervention group	Ngararia ward	77	76	0.987	98.7
Comparison group	Gaichanjiru ward	77	66	0.857	85.7
Lost to follow-up		0	-	-	-
Total			142	0.880	88

Table 4:

z-Test: showing the Two Sample for Means

Mean	0.987012987	0.857142857
Known Variance	0.012987	0.12406
Observations	77	77
Hypothesized Mean Difference	0	
Z	3.078363286	
P(Z<=z) two-tail	0.00208141	
z Critical two-tail	1.959963985	

Educating antenatal women about government health payment policies, such as the "LINDA MAMA" program, encouraged them to seek skilled delivery services, echoing findings of a study in Cambodia on the effectiveness of use of health equity funds[19]. Health insurance played a crucial role in enabling antenatal women to access maternal care, as stated in study carried out in Togo [20.] Communication by se of mobile phones improved follow-up and skilled delivery service utilization, echoing results from study carried out in southern Nigeria[21]. Finally, women's support groups and seminars effectively educated women on the importance of skilled delivery, reflecting studies in South Asia that demonstrated similar improvements in service use through women's empowerment and support[21,]

Limitations and strengths of the study

The study had limitations, including financial constraints that confined testing to one ward, which may affect generalizability. Seasonal and terrain challenges also impacted data collection. However, the study's strengths were notable. It confirmed the model's effectiveness in enhancing skilled deliveries and improving maternal healthcare. The rigorous quasi-experimental design and statistical analysis, including a comparison group, ensured robust evaluation. Conducting the study in a real-world setting provided practical insights for healthcare practitioners and policymakers, enhancing the relevance and applicability of the findings.

Conclusion

Implications for Practice and Policy

The study's findings have key implications for maternal healthcare in Kandara Sub County. It shows that the developed care model effectively improves skilled delivery service utilization, suggesting it could address local challenges and be adapted for similar regions. The study highlights the need for community-specific interventions, emphasizing the value of tailoring approaches based on local insights. Incorporating community involvement and a multi-level strategy, as demonstrated by the model, can enhance awareness and utilization of skilled delivery services, leading to better maternal health outcomes.

Avenues for future research

The current study offers valuable insights, yet several avenues for future research could enhance understanding in this field. Longitudinal studies should be conducted to evaluate the long-term outcomes of the model of care on maternal health issues. Tracking the study participants for a longer time period could revealed a lasting behavior change and enhance utilization of skilled delivery services and this provide a deeper understanding of the effects of the interventions.

Looking into the sustainability and cost-effectiveness of the model of care through a comprehensive cost-benefit analysis would be valuable. Understanding the cost implications of implementing model interventions could guide in decision-makers in budgeting and policy development. Studying the generalizability of the model of care to varied geographic and socio-cultural settings is paramount. Testing its applicability in a more diverse and beyond the current context is key to inform the scalability of comparable interventions and contribute to more general and global maternal health initiatives.

Recommendations

Based on the research findings, the following recommendations are proposed: The local and central governments ought to scale up the adoption of model of care in collaboration with researchers, Ministry of Health officials, and local healthcare administrators. The two governments should Identifying areas with low-skilled delivery rates and come up with a phased implementation plan. Creating partnerships with local healthcare facilities for smooth integration is key. However, potential constraints like

resource and resistance from rigid local communities or healthcare providers may call for proactive communication and proper engagement strategies.

Training and capacity building for skilled birth attendants based on the model of care is key and necessitates collaboration among researchers, training institutions, and academic partners. Certification and ongoing professional development opportunities should be provided, with partnership sought from the necessary academic institutions for continuous education. Nevertheless, to ensure uniformity in training content and overcoming the resistance among diverse healthcare professionals may prove challenging due to lack of harmonization.

There is need to advocating for policy support by engagement with government ministries and presenting research findings to policymakers for adoption and implementation. It is essential to advocate for policy changes in collaboration with advocacy groups to be aligned with the objectives of the model However, navigating bureaucratic levels and processes to address the various conflicting individual interests among policymakers may pose a big challenge.

To ensure Community engagement much needs to be done including partnerships with community organizations, NGOs, and local leaders to develop outreach programs raising awareness about skilled deliveries. Training and deploying community health workers for disseminating information, along with ensuring culturally sensitive communication materials, are critical. Nonetheless, building trust with communities and ensuring culturally sensitive communication may require significant effort.

The integration of the model of care into existing healthcare systems at local and national levels should be assessed for feasibility. Factors like scalability, sustainability, and adaptability to different contexts need thorough assessment for successful integration and long-term impact. However, resource constraints is the major issue that may pose challenges to integration process.

Establishing a robust monitoring and evaluation framework involving key stakeholders is necessary to regularly collect and analyze data on skilled delivery rates and maternal health outcomes. Soliciting feedback from healthcare providers and communities for continuous improvement is essential. Yet, challenges such as resource constraints and ensuring accurate data collection may hinder comprehensive evaluation efforts.

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