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Mentorship effect on healthcare providers' adherence to postpartum haemorrhage guidelines and maternal outcomes in Rwanda. A quasi-experimental study.

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ABSTRACT

Background: Postpartum hemorrhage (PPH) is a leading cause of maternal morbidity and mortality worldwide. Effective management of PPH heavily relies on adherence to clinical guidelines. Mentorship programs aim to enhance healthcare providers' (HCPs) knowledge, skills, and guideline adherence, but their impact on guideline adherence needs evaluation.

Objective: To evaluate the effect of a clinical mentorship program on HCPs' adherence to PPH clinical guidelines and patient outcomes at Muhima District Hospital (DH) and its associated health centers (HCs).

Methods: A quasi-experimental design was used to compare HCPs' adherence to clinical guidelines before and after mentorship. Maternal outcomes were also analyzed in relation to guideline adherence. Standardized medical records provided data, and consecutive sampling included cases sequentially from medical registers. The Wilcoxon test was used to assess the effect of mentorship on adherence to guidelines. Multivariate regression analysis was performed to explore the relationship between mentorship, guideline adherence, and maternal outcomes.

Results: The study included 384 women with PPH. Adherence to clinical guidelines before (96.4%) and after (95.8%) the mentorship program showed no significant change (P-value = 0.25). However, adherence to guidelines was significantly associated with better maternal outcomes (P-value < 0.001). Multivariate logistic regression indicated significantly lower odds of no complications in cases where guidelines were not followed. Adherence to guidelines (AOR = 0.061, 95% CI: 0.001- 0.026), prolonged labor (AOR = 187.25, 95% CI: 13.07- 2683.14), blood loss (AOR = 0.004 95% CI: 0.000 - 0.0008), and specific causes of PPH (AOR = 0.013, 95% CI: 0.000-0.068) had significant associations with maternal outcomes.

Conclusion: Adherence to clinical guidelines is critical for high-quality care and improved maternal outcomes in PPH cases. The study confirms the positive impact of guideline adherence on maternal outcomes, emphasizing the importance of promoting and strengthening adherence. While

the mentorship program supported high adherence rates among HCPs, it alone may not be sufficient to ensure adherence, suggesting the influence of additional factors, such as training from other institutions.

Keywords: Mentorship, Healthcare Providers, Postpartum Hemorrhage, Maternal Outcomes, Clinical Guidelines, Quasi-experimental Study

INTRODUCTION

A woman dies unnecessarily every two minutes due to preventable pregnancy and childbirth-related issues [1]. Though the world saw a remarkable 38% decline in maternal mortality between 2000 and 2017, the death toll continues to be dangerously high [2]. In 2020, the global maternal mortality ratio (MMR) was 223 deaths per 100,000 live births and in Rwanda the mortality rate was 203 deaths per 100 000 live births, with postpartum haemorrhage (PPH) being the primary cause of death [3,4]. PPH is the major contributor to maternal deaths, responsible for 27.1% of maternal deaths worldwide, with 44% of such deaths in the Sub-Saharan Africa region [5] and 22.7% in Rwanda [6]. PPH is excessive bleeding after childbirth, with blood loss of more than 500 millilitres (mL) for a vaginal delivery or 1000 mL for a caesarean section [7]. PPH is categorized as primary when it occurs within 24 hours of birth and secondary when it happens more than 24 hours after delivery up to 12 weeks postpartum [8]. The underestimation of the actual blood loss by healthcare providers was identified as problematic in diagnosing and managing PPH [8]. In addition to the high mortality, PPH is responsible for morbidities such as anaemia, complications from a blood transfusion, and hysterectomy, resulting in the loss of childbearing capacity [9]. Many factors contribute to the adverse outcomes of PPH in developing countries. Those factors comprise low socioeconomic status, limited access to healthcare, shortage of skilled healthcare professionals, and inadequate healthcare manifested by poor adherence to established evidence-based protocols [10]. Regarding the economic aspect, studies report that Women in low-income countries are at higher risk of dying during childbirth, with 1 in 45 deliveries in comparison to 1 in 5400 deliveries in developed countries [4].

In healthcare, evidence has shown that adherence to established guidelines can improve the standard of care and decrease mortality [11]. However, in spite of the availability of guidelines and protocols, adhering to them remains challenging in many developing countries [12].

Regular training and education for healthcare professionals on PPH guidelines and protocols can

help ensure they have the knowledge and skills to provide high-quality care [12]. Mentorship is an effective tool for capacity building of healthcare providers in diagnosing and managing diseases by improving their knowledge, skills, and confidence, resulting in better patient outcomes [13]. Clinical mentorship refers to knowledgeable and experienced healthcare professionals guiding and advising less experienced ones on diagnosing and managing medical conditions in their professional development [14].

The government of Rwanda has invested in training healthcare providers in managing PPH and other obstetric emergencies and has developed guidelines and protocols for managing PPH but there is a gap in information on whether mentorship improves healthcare providers practice [15,16]. This study assessed the impact of a clinical mentorship program on HCPs' adherence to PPH guidelines and maternal outcomes in Muhima District Hospital catchment area.

MATERIALS AND METHODS

Design and setting: A quasi-experimental non-equivalent before-and-after study was conducted in the maternity department of two health centers, Cornum and Rwampara in the Nyarugenge district of Kigali city. Nyarugenge District has the busiest maternity service facilities in Rwanda, with approximately 7000 births per year [17].

Population target: The population consists of women who gave birth and developed PPH in the study locations. The sample was divided into two groups: those assisted by staff without specific training in managing postpartum hemorrhage (pre-intervention) and those by staff after training (post-intervention).

Instrument: Medical records were used to collect socio-demographic (age, residence, health center, and insurance) and clinical data (medical history, physical examination, clinical management). A

checklist was used for evaluation at the postopography. The checklist highlighted key areas to assess for adherence to evaluate overall adhere to clinical guidelines The checklist had sections which included PPH prevention measures guidelines, PPH initial management measures and secondary management guidelines. Medical records of women with primary and secondary PH who gave birth in the study locations were included, missing or incomplete medical records or medical history records, physical examination, and clinical management were excluded.

Jhpiego-Rwanda tutoring program:

Jhpiego Rwanda is implementing a clinical mentorship program using a model called 'Low Dose High Frequency'. Low Dose High Frequency (LDHF) enhances clinical abilities by conducting brief and focused simulation-based learning sessions [18]. The project was implemented in seven district hospitals and 129 health centers, where two to four nurses and midwives per health center were selected to participate in the program. The training was conducted from January 2021 to April 2021. The training methods include one-on-one case management observation, analysis of patient monitoring data, discussions on clinical cases, bedside training, and clinical team meetings. One of the mentorship program's focuses is managing postpartum hemorrhage. The training sessions were given initially and were reinforced by monthly visits and evaluations by mentors in clinical settings to maximize the retention of knowledge and skills. The mentorship program is part of the Barame Maternal, Neonatal, and Child Health (MNCH) Project, funded by Enabel, the Belgium cooperation, and was initiated in December 2020 [19] and is meant to increase the competencies of nurses and midwives in adhering to clinical guidelines of PPH resulting in better maternal outcomes.

Measure(s)

The healthcare providers' adherence to clinical guidelines was determined using a checklist, by

evaluating the partographs. Each required action performed was given one point. A necessary action not performed was given zero. A total score was calculated and the corresponding percentage. An 80% and above percentage score was considered adherence, whereas a lower percentage was regarded as non-adherence, as 80% or more adherence is required for optimal therapeutic efficacy [20].

Maternal outcomes were extracted from health center registers, and grouped into good outcome, morbidity, and mortality. Mothers who were managed successfully, with no complications were considered to have good outcomes. Patients who had complications such as anemia, hemorrhagic shock, kidney injury, infections, and hysterectomy were classified as having morbidity. Mothers who died due to PPH had mortality as an outcome.

Data collection

Data collection started after approval from the Institutional Review Board (IRB) at the University of Global Health Equity (UGHE) and authorization from the Muhima DH and HCs administrations. We explored the health center registers to find patients who had PPH. For referred patients, their outcomes were found in Muhima DH registers and Health Management Information System (HMIS). Once a list of all patients with PPH was identified, then we audited their medical records to extract their socio-demographic characteristics (age, residence, health center, and insurance), their clinical characteristics (parity, cause of PPH, prolonged labor, estimated blood loss, concurrent illnesses, and referral) and the maternal outcomes. We assessed adherence to the partographs using a checklist. There was no direct contact with patients whose records were selected. The confidentiality and security of the personal information of the participants were respected. The pre-intervention and post-intervention groups were made as similar as possible by choosing them from the same healthcare facility and including the clinical clinics of the women treated by the same healthcare workers before and after the implementation of the mentoring program. The group of

women enrolled from 1 December 2018 to 1 December 2020 correspond to the pre-mentoring program sample, those from 1 May 2021 to 1 May 2023 correspond to the women assisted by personnel who have carried out the training (post-mentoring).

Data analysis

Descriptive statistics were used to summarize data in SPSS 26. The socio-demographic characteristics that were considered in this study were age, place of residence, health insurance and the type of health centre basing on the findings from the existing literature on similar studies. Similarly, the clinical characteristics that we considered were parity, causes of PPH, prolonged labour, estimated blood loss, concurrent illness and referrals. The chi-square test or Fisher's exact test were performed to evaluate significant differences in proportions or percentages between the two groups. Fisher's exact test was used where the chi-square test was not appropriate. Wilcoxon signed-rank test was used to test the association between adherence status (pre and post) and mentorship status, as well as the association between adherence status and maternal outcomes. We conducted a multivariate logistic regression analysis to examine the association between socio-demographic, clinical factors and maternal outcomes. Adjusted Odds ratio, Confidence Intervals, and p-values were reported. Finally, all tests with p-value (P) < 0.05 were considered significant.

Ethical considerations

The study was approved by the University of Global Health Equity Institutional Review Board (UGHE-IRB/2023/013) and Rwanda Ministry of Health (NHRC/2023/PROT/16).

RESULTS

Socio-demographic characteristics

A total of 384 women of which 192 were in the pre- group and 192 were in the post group were

reviewed in this study. Two hundred and four women (53.1%) were from Cornum Health Center and 180 (46.9%) from Rwampara Health Center (Table 1).

Socio-demographic characteristics		Before mentorship Frequency (%)	After mentorship Frequency (%)
Health center	Cornum Rwampara	102 (53.1%) 90 (46.9%)	102 (53.1%) 90 (46.9%)
Age	40-49 years 30-39 years 20-29 years 10-19 years	3 (1.6%) 40 (20.8%) 125 (65.1%) 24 (12.5%)	1 (0.5%) 47 (24.5%) 132 (68.8%) 12 (6.3%)
Residence	Urban Peri-urban	145 (75.5%) 47 (24.5%)	157 (81.8%) 35 (18.2%)
Insurance	Had insurance No insurance	188 (97.9%) 4 (2.1%)	186 (96.9%) 6 (3.1%)

Table 1. *Socio-demographic characteristics of samples*

Clinical characteristics

Regarding clinical characteristics of women with PPH as recorded in medical records, the majority of the women were multiparous. Most patients, (93%) had perineal tears and (97.1%) had blood loss between 500-1000 ml (Table 2).

Clinical characteristics		Before mentorship Frequency (%)	After mentorship Frequency (%)
Parity	Primiparity Multiparity Grand multiparity	77 (40.1%) 108 (56.3%) 7 (3.6%)	72 (37.5%) 115 (59.9%) 5 (2.6%)
Cause of PPH	Perineal tear Cervical tear Uterine atony Retained placenta Perineal tear and retained placenta	174 (90.6%) 5 (2.6%) 4 (2.1%) 7 (3.6%) 2 (1%)	183 (95.3%) 0 (0.0%) 5 (2.6%) 4 (2.1%) 0 (0.0%)
Prolonged labor	No Yes	184 (95.8%) 8 (4.2%)	192 (97.9%) 0 (0.0%)
Estimated blood loss	>1000 ml 500-1000 ml	6 (3.1%) 186 (96.9%)	5 (2.6%) 187 (97.4%)
Concurrent illness	None Preeclampsia	191 (99.5%) 1 (0.5%)	192 (100%) 0 (0.0%)
Referred to a higher level	No Yes	186 (96.9%) 6 (3.1%)	185 (96.4%) 7 (3.6%)

Table 2. *Clinical Characteristics*

Healthcare providers' adherence to clinical guidelines

The Wilcoxon signed-rank test was conducted to determine whether the intervention was had an overall significant effect on adherence to clinical guidelines. The null hypothesis (H_O) states that there is no difference in adherence scores before and after the intervention. With a p-value of 0.25, we fail to reject the null hypothesis at the 0.05 significance level (Table 3). This means there is not enough statistical evidence to conclude that the intervention led to a significant change in adherence to clinical guidelines. The same trend of results was realised at the individual sites which were Cornum health facility (P=0.25) and Rwampara (P=0.71) (Table 3).

Variable	N	Median Pre-Intervention	Median Post-Intervention	p-value	Positive Ranks Sum	Negative Ranks Sum
Adherence Score (overall)	192	83.7 (73.3-85.2)	82.9 (71.1-83.2)	0.25	3402	2246
Adherence score (Cornum)	102	83.9 (73.2-84.2)	82.9 (70.4-83.2)	0.25	1218	722
Adherence Score (Rwampara)	90	83.4 (82.14-83.24)	82.8 (80.33-83.24)	0.71	520	415

Table 3. *Adherence to clinical guidelines.*

Factors associated with maternal outcomes

There was a statistically significant association between adherence level and maternal complications (P<0.0001), Blood loss and maternal complications (P<0.0001), prolonged labor and maternal complications (P<0.00195) and causes of PPH with maternal complications (P< 0.0001) (Table 4). Conversely, there was no association between age category (P=0.19), place of residence (P=0.51), Health center (P=0.16), parity (P=0.53), concurrent illnesses (P=1.0) and maternal complications (Table 4).

Variables	Modalities	Complications n (%)	No complications n (%)	P-value (test)
Adherence level	Did not adhere Adhered	9 (64.3%) 5 (35.7%)	6 (1.6%) 364 (98.4%)	<0.0001* (F)
Age group	10-19 years 20-29 years 30-39 years 40-49 years	1 (7.1%) 8 (57.1%) 4 (28.6%) 1 (7.1%)	35 (9.5%) 249 (67.3%) 83 (22.4%) 3 (0.8%)	0.19 (F)
Residence	Urban Peri-urban	10 (71.4%) 4 (28.6%)	292 (78.9%) 78 (21.1%)	0.51 (F)
Health center	Cornum Rwampara	10 (71.4%) 4 (28.6%)	194 (52.4%) 176 (47.6%)	0.16 (F)
Insurance	No insurance Had insurance	1 (7.1%) 13 (92.6%)	9 (2.4%) 361 (97.6%)	0.31 (F)
Blood loss	500- 1000 ml >1000 ml	5 (35.7%) 9 (64.3%)	368 (99.5%) 2 (0.5%)	<0.0001* (F)
Parity	Primiparity Multiparity Grande multiparity	5 (35.7%) 8 (57.1%) 1 (7.1%)	144 (38.9%) 215 (58.1%) 11 (3.0%)	0.53 (F)
Prolonged labor	No Yes	11 (78.6%) 3 (21.4%)	365 (98.6%) 5 (1.4%)	0.00195* (F)
Concurrent illnesses	None Preeclampsia	14 (100%) 0 (0%)	369 (99.7%) 1 (0.3%)	1.0 (F)
Causes of PPH	Perineal tear Cervical tear Uterine atony Retained placenta Perineal tear and retained placenta	2 (14.3%) 2 (14.3%) 8 (57.1%) 2 (14.3%) 0 (0%)	355 (95.9%) 3 (0.8%) 1 (0.3%) 9 (2.4%) 2 (0.5%)	<0.0001* (F)
*=significant test, C=chi-square test; F= Fisher's exact test				

Table 4. *Factors associated with maternal outcomes.*

Logistic regression analysis on adherence to clinical guidelines and maternal outcomes

We conducted a multivariate logistic regression analysis to examine the association between clinical factors and maternal outcomes. Variables in bivariate analysis with a p-value <0.100 (Age group, Residence, Health Center, Insurance, Parity, Prolonged labor, Blood loss, Cuncurrent illness and Cause) were used in multivariate analysis. Multivariate regression analysis was done using the "enter" method. Adjusted Odds ratio, (AOR) Confidence Intervals, and p-values were reported. The variables found to have a statistically significant relation to maternal outcomes are, "Prolonged labor", "Blood loss," and "Causes of PPH". Adherence to guidelines reduced the odds of maternal complications by more than 99% (AOR = 0.0061, 95% CI: 0.001- 0.0264) (Table 5).

Logistic regression	Coefficient	Standard Error	AOR	CI at 95%	P-value
Adherence/maternal outcome	-6.80	0.005	0.0061	0.001- 0.0264	<0.0001*
Age/maternal outcome	0.08	1.77	1.13	0.05 – 24.31	0.94
Residence/maternal outcome	-0.50	0.73	0.42	0.01 – 13.00	0.62
HC/maternal outcome	-0.85	0.40	0.24	0.01 – 6.21	0.39
Insurance/ maternal outcome	-0.17	1.82	0.61	0.002 – 205.14	0.87
Parity/maternal outcome	-0.83	0.44	0.35	0.03 – 4.10	0.41
Prolonged labor/maternal outcome	3.85	254.35	187.25	13.07 – 2683.14	<0.0001*
Blood loss/ maternal outcome	-5.15	0.00	0.0004	0.000 – 0.008	<0.0001*
Concurrent illnesses/ maternal outcome	1				
Causes of PPH/maternal outcome	-3.32	0.017	0.013	0.000 – 0.168	0.001*
Constant	0.74	8722	942.30	0.00 – 7.14e+10	0.46
*=significant test; AOR=Adjusted odd ratio; CI= AOR confidence interval at 95%					

Table 5. *Logistic regression of independent variables and maternal outcomes.*

DISCUSSION

This present study aimed to investigate the effect of a mentorship program on healthcare providers' adherence to PPH clinical guidelines and the maternal outcomes of women who developed PPH Nyarugenge district.

With regards to socio-demographic characteristics, the results showed an increase in the 30-39 and 20-29 age groups of healthcare providers and a decrease in the older and youngest age groups suggesting that younger healthcare providers in Rwanda might be more receptive to joining midwifery and maternal departments (Table 1). Similar studies in Sub-Saharan Africa, have shown that younger health care providers are more likely to adopt new clinical guidelines after training and mentorship programs [21]. The increase in urban healthcare providers post-mentorship might be due to better access to resources, continuous professional development, and support systems. In Rwanda, urban areas often have better healthcare infrastructure, which can facilitate better

adherence to guidelines. Studies in similar settings have highlighted that urban health care providers are more likely to benefit from mentorship programs [22]. Access to health insurance can provide additional resources for training and support, but the minimal change in insurance status suggests that the mentorship program itself was the primary driver of improved adherence.

With regards to clinical characteristics, there was a slight decrease in primiparity and grand multiparity cases, with an increase in multiparity cases (Table 2). This suggests that the mentorship program might have improved the management and identification of multiparity cases, leading to better adherence to guidelines for this group. Studies in Rwanda and similar settings have shown that multiparity is often associated with higher risk of complications, and better management of these cases post-mentorship aligns with improved adherence to guidelines [23].

The increase in the identification of perineal tears and the decrease in cervical tears, retained placenta, and combined cases suggests improved diagnostic accuracy post-mentorship (Table 2). Accurate diagnosis and management of PPH causes, especially perineal tears, are critical. Improved diagnostic accuracy post-mentorship is consistent with findings from other mentorship programs in the region [23]. Similarly, there was a slight decrease in cases with estimated blood loss >1000 ml and an increase in 500-1000 ml cases suggesting an improved early intervention and management of blood loss (Table 2). Early intervention to manage blood loss is crucial, and the improvement seen here is consistent with other studies showing that mentorship programs enhance the ability of healthcare providers to manage PPH effectively [24].

Results also showed that all cases of concurrent illness (preeclampsia) were resolved post-mentorship, indicating better management and preventive measures (Table 2). Effective management of preeclampsia post-mentorship is significant, as similar studies have shown that training and mentorship programs are essential in improving the management of concurrent illnesses [25]. The complete elimination of prolonged labour cases post-mentorship indicates better intrapartum care, aligning with studies highlighting the importance of mentorship in improving

labor management [26].

Additionally, there was a slight increase in referrals to a higher level post-mentorship which could indicate better identification of cases requiring advanced care. Slightly increased referrals to higher-level care indicate better identification and management of complicated cases, which is a positive outcome seen in other similar settings [27].

With regards to healthcare providers' adherence to clinical guidelines, the overall adherence scores showed a slight decrease post-intervention, with the median dropping from 83.7 to 82.9 (Table 3). Our threshold level for adherence was 80%, as an adherence score of 80% or more is required for optimal therapeutic efficacy [19]. The Hypothesis was that mentorship improves healthcare providers' adherence to PPH clinical guidelines. The p-value of 0.25 indicates that this change is not statistically significant (Table 3).

These findings suggest that mentorship alone may not be the sole determinant of adherence to clinical guidelines, and other factors might play a role in influencing healthcare providers' adherence behaviours. Contrary to our finding, a study conducted in Rwanda on a mentorship program aiming to bridge the gap in nurses' knowledge and skills done in 21 health centres showed the program significantly improved clinical practice and quality of care delivered at rural HCs in Rwanda [20].

The lack of statistical significance in this study might be due to the short duration of the mentorship program or other contextual factors. Studies have reported varying impacts on adherence scores post-intervention, often depending on the specific clinical guidelines and the training's focus areas [25]. The slight decrease in scores in this study contrasts with some reports of increases, suggesting a need to review the mentorship program's content and delivery.

Our analysis also considered other key factors contributing to these results, such as the impact of Covid-19, as during the pandemic period, pregnancies increased, leading to increased deliveries [21]. Furthermore, other programs aimed at enhancing healthcare providers' skills could impede the

effectiveness of the current mentorship approach and adherence to established guidelines.

Another possible reason could be the fact that the documentation routine did not change after the mentorship program implementation. The lack of specific patient files for documentation may have limited the ability to observe a difference in adherence before and after the mentorship program. Without comprehensive and standardized documentation, it becomes challenging to accurately assess the level of adherence and track improvements over time. The reliance on only partographs, specific forms for monitoring labour progress, may not capture the full scope of adherence to PPH guidelines. In the context of postpartum haemorrhage (PPH) clinical guidelines, proper documentation is essential for assessing adherence to recommended protocols and ensuring optimal therapeutic efficacy [22].

The positive ranks sum is higher than the negative ranks sum, suggesting that more individuals improved their scores than those who did not (Table 3). The higher positive ranks sum in this study indicates that while the overall median adherence scores did not significantly improve, a notable number of individuals did show improvement. This is consistent with findings that mentorship programs can have differential impacts across different individuals and settings [23].

With regards to the factors associated with maternal outcomes, results showed a strong relationship between adherence to clinical guidelines and maternal outcomes. The odds of not having complications for women treated by healthcare providers who did not adhere to clinical guidelines were significantly lower than those managed by providers who adhered to guidelines (Table 5). Adherence to guidelines is associated with a higher likelihood of experiencing good maternal outcomes (Table 5). The results resonate with a post-hoc analysis study done in India on adherence to evidence-based practices during childbirth to prevent childbirth-related mortality and morbidity, where they found that adherence to WHO Safe Childbirth Checklist (SCC) during delivery was significantly associated with reduced odds of childbirth-related mortality and morbidity, and neonatal mortality [26].

The negative coefficient and very low AOR indicated a strong negative association between adherence to clinical guidelines and poor maternal outcomes (Table 5). The significant p-value (P<0.0001) confirms this relationship, suggesting that better adherence to clinical guidelines significantly improves maternal outcomes.(Table 5). Mugisha and others also found that adherence to clinical guidelines significantly reduced maternal mortality and morbidity, highlighting the importance of training and mentorship programs in ensuring guideline adherence [23]. Both studies underscore the critical role of adherence to clinical guidelines in improving maternal health outcomes, affirming the effectiveness of mentorship programs in reinforcing these practices.

Prolonged labor shows a strong positive association with poor maternal outcomes, with a very high AOR and a significant p-value (P<0.0001) and this indicates that prolonged labor significantly increases the risk of adverse maternal outcomes (Table 5). Numerous studies, including studies in sub-Saharan Africa have shown that prolonged labour is a major risk factor for adverse maternal outcomes, emphasizing the need for timely and effective interventions [28].The significant impact of prolonged labour across studies highlights the necessity for interventions targeting labour management within mentorship programs to improve maternal health

Severe blood loss is strongly negatively associated with maternal outcomes, with an extremely low AOR and a significant p-value (P<0.0001 and this indicated that increased blood loss significantly worsens maternal outcomes (Table 5). Blood loss greater than 1000 ml was significantly associated with higher complications, indicating the critical importance of managing blood loss during postpartum.The findings align with global research, including studies which demonstrate that severe blood loss (>1000 ml) is a critical risk factor for adverse maternal outcomes, stressing the importance of effective management of hemorrhage during the postpartum period [27].

Similar studies also found that managing blood loss effectively is crucial for improving maternal outcomes, reaffirming the importance of early detection and intervention [8].

Different causes of PPH are strongly negatively associated with maternal outcomes, with a very low

AOR and a significant p-value (P<0.001), indicating that proper identification and management of PPH causes significantly improve maternal outcomes (Table 5). Ssimilar studies also highlighted the importance of identifying and managing the specific causes of PPH to improve outcomes. The agreement across studies highlights the necessity for targeted training on PPH management within mentorship programs [26].

The results showed that most women had no complications (96.4%) (Table 4). This suggests that the healthcare providers and the healthcare system effectively managed PPH and ensured positive maternal outcomes for most cases. In cases where patients had complications, a more considerable proportion (64.3%) had poor adherence to guidelines, providing compelling evidence of the association between adherence to clinical guidelines and complications as the outcome (Table 4). The results align with a cross-sectional study conducted in South Australia, highlighted a correlation between lower adherence scores, significant avoidable complications, and adverse outcomes [23].

A study examining the trend of surgical site infections in paediatric patients with complicated appendicitis found that using clinical practice guidelines was associated with lower morbidity rates after appendectomy [24]. Another study compared the safety, efficacy, and cost-effectiveness of evidence-based clinical guidelines in treating acute low back pain in primary care and usual care, searching for evidence showing whether following guidelines results in better outcomes. It found that in the short term, evidence-based care shows only slight improvement compared to usual good care. However, evidence-based guidelines demonstrate substantial and meaningful advancements over an extended period, leading to fewer patients needing ongoing treatment and experiencing persistent pain [25]. Adhering to guidelines is vital in providing appropriate evidence-based care, improving outcomes, and reducing complications. Age showed a very weak and non-significant relationship with maternal outcomes (P= 0.94) (Table 5). This suggests that age, in isolation, may

not be a strong predictor of maternal outcomes, emphasizing the need to focus on other clinical and demographic factors.

Residence had a non-significant relationship with maternal outcomes (P=0.62 (Table 5). Rutayisire and others found mixed results, with some peri-urban areas showing worse outcomes due to limited access to healthcare services, but overall residence was not a significant predictor.Both studies indicate that while location may influence access to care, it is not a standalone predictor of maternal outcomes when other variables are considered [29].

The health center variable also showed a non-significant relationship with maternal outcomes (P=0.39)(Table 5). The AOR and confidence interval suggest a potential trend, but the results are not statistically significant (Table 5). This study's findings align with the idea that adequate training and mentorship can standardize care quality across different health centers, reducing outcome disparities

Insurance status shows no significant impact on maternal outcomes (P=0.87) (Table 5). A similar study reported non-significant associations between insurance status and maternal outcomes, suggesting that other factors such as quality of care and adherence to guidelines are more critical. Both studies highlight that while insurance improves access to healthcare, it does not directly translate to better maternal outcomes without high-quality clinical care [20].

Similarly, parity had a non-significant relationship with maternal outcomes (P=0.41) indicating that the number of previous births is less critical than the quality of care provided (Table 5). Similar studies have shown the same trend suggesting that parity may not be a primary concern in improving maternal outcomes compared to other clinical factors.

The logistic regression analysis highlights the significant impact of adherence to clinical guidelines, prolonged labor, blood loss, and causes of PPH on maternal outcomes. These findings underscore the critical importance of adhering to clinical guidelines, effectively managing prolonged labor and blood loss, and accurately diagnosing and treating the causes of PPH to improve maternal health.

CONCLUSION

The study results showed that though the clinical mentorship program had no significant effect in improving adherence levels to clinical guidelines for PPH, the high adherences rates observed among healthcare providers in this study contributed to positive maternal outcomes and to a reduction in the incidence of morbidity. Results suggest that mentorship programs and consistent on-job support may support maintenance of adherence behaviours among healthcare providers. However, mentorship alone may not be the sole determinant of adherence. Efforts to promote adherence should be emphasized to enhance delivery of evidence-based and standardized care for managing PPH.

Study Strengths

One advantage of this study is that it allowed us to make a temporal comparison of changes in adherence to clinical guidelines and maternal outcomes in the same facilities over time, pre- and post-mentorship. Additionally, the women in the sample were managed by the same healthcare providers before and after mentorship, with no staff turnover, reducing the effect of confounders. Moreover, using a quasi-experimental design helped us evaluate the mentorship program's implementation in a real-world setting, reflecting the practical challenges and constraints of the actual implementation, thereby enhancing the external validity and relevance of the findings. Another advantage is that we reached the number of PPH cases needed for the sample size at the time of the study. Information was obtained from standardized medical records rather than relying on maternal or healthcare providers' recall, thus minimizing recall bias. Another strength of the study is its long duration (4 years), which enables the implementation of changes in clinical practice and routines to be observed and analyzed. While our study cannot provide the same level of causal inference as experimental designs, we used various strategies to strengthen the causal inferences. These include careful selection and matching of comparison groups. We ensured that the medical

records of women who had PPH were from the same health centers and treated by the same healthcare providers before and after the mentorship. Statistical adjustments for potential confounding variables and rigorous data analysis were also applied.

Study Limitations

It is essential to acknowledge the limitations of this study. We observed limitations in recording among the two health centers included in our study due to a lack of patient files. The only records are from the patient partographs, which are not as detailed as typical patient files; hence, this could partially explain the lack of association between mentorship and adherence. The assessment of adherence to clinical guidelines also relied on documentation in medical records, which could introduce reporting bias. Additionally, the study was conducted in a distinct setting (Muhima DH catchment area), which may limit the generalizability of the results to other healthcare contexts.

Ethics considerations.

Ethics issues have been completely observed by authors.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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Authors' Contributions

Benjamin David Habikigeni: Development of the original manuscript

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