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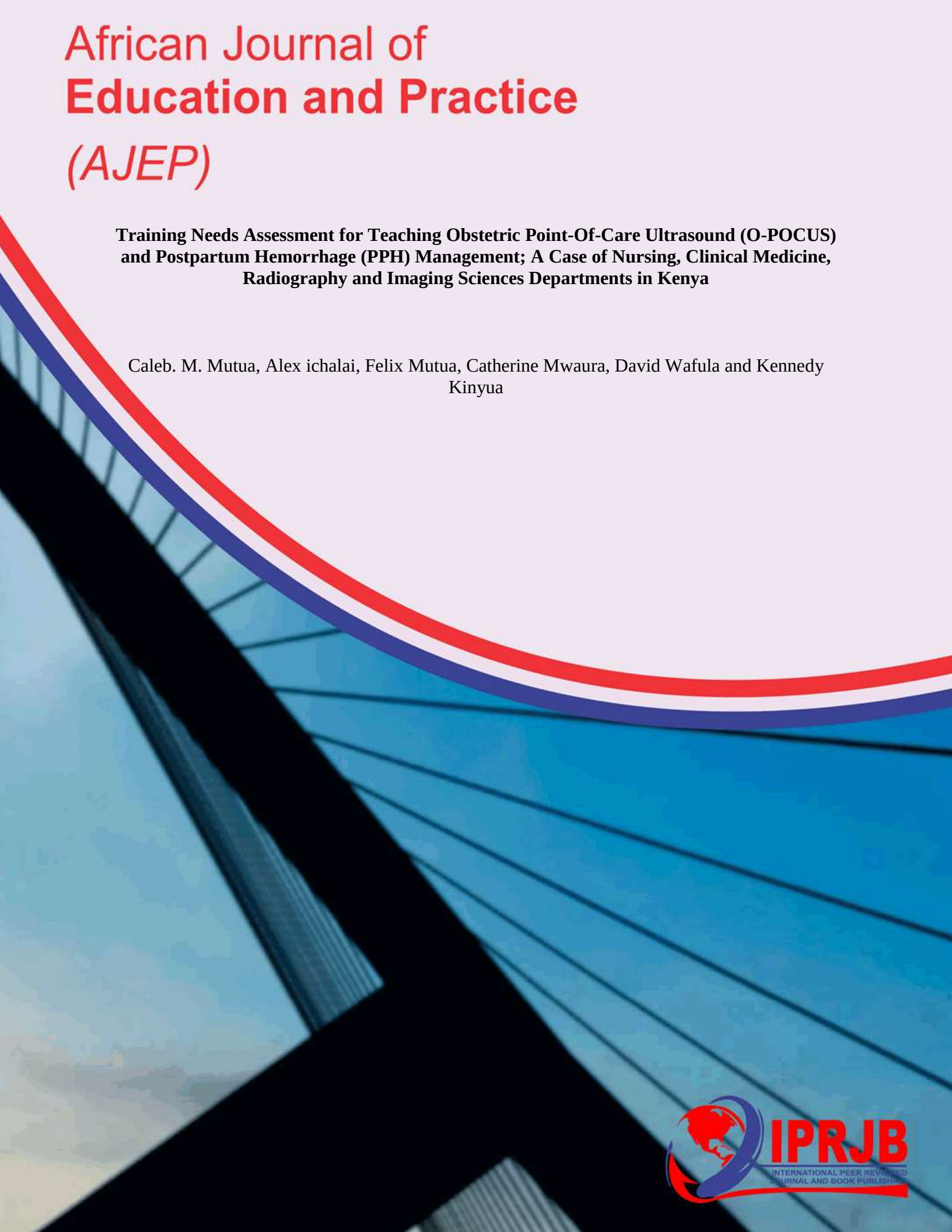

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Training Needs Assessment for Teaching Obstetric Point-Of-Care Ultrasound (O-POCUS) and Postpartum Hemorrhage (PPH) Management; A Case of Nursing, Clinical Medicine, Radiography and Imaging Sciences Departments in Kenya

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Abstract

Purpose: This study aims to assess the preparedness of faculty in the Nursing, Clinical Medicine, and Radiography and Imaging Sciences departments in Kenya to teach Obstetric Point-of-Care Ultrasound (O-POCUS) and Postpartum Hemorrhage (PPH) management, in light of the 2024 National Guidelines requiring structured training in these areas. The purpose is to identify training gaps among educators and propose solutions to improve maternal health outcomes.

Methods: A descriptive cross-sectional design with a quantitative approach was employed to gather data from health educators using a structured self-administered questionnaire. The survey targeted tutors and clinical instructors across the three departments. The questionnaire, aligned with the 2024 O-POCUS guidelines, covered areas such as training gaps, resource availability, teaching methods, and institutional readiness. Data were analyzed using SPSS, with descriptive statistics and chi-square tests used to identify relationships between various factors.

Findings: The study revealed significant gaps in faculty training and resources. In the Nursing and Clinical Medicine departments, over 80% of educators had not received training in O-POCUS, and 60% in PPH management. The Radiography and Imaging Sciences department showed a similar trend, with 89% of respondents reporting a lack of training in both areas. Additionally, limited access to ultrasound machines and teaching materials hindered effective teaching. Respondents favored hands-on workshops, mentorship, and simulation-based scenarios as the most effective teaching methods. Curriculum inclusion of O-POCUS and PPH management was inadequate across all departments, with many respondents uncertain or unaware of its integration.

Unique Contributions to Theory, Policy and Practice: The study concluded that faculty members in the Nursing, Clinical Medicine, and Radiography and Imaging Sciences departments are inadequately trained to teach O-POCUS and PPH management, leading to gaps in student preparedness. Despite strong leadership support, there is insufficient resource allocation and curriculum integration of these critical topics. This lack of preparation impacts the quality of maternal healthcare education and hinders the implementation of effective practices in obstetric emergencies. To address these gaps, it is recommended that a comprehensive faculty development program be implemented, focusing on both theoretical knowledge and hands-on training in O-POCUS and PPH management. Curricula across all departments should integrate these topics with clear guidelines and balance between theory and practical application. Institutions must prioritize resource allocation, including the provision of portable ultrasound machines, phantoms, and standardized teaching materials.

Keywords: *Training Needs Assessment, Obstetric Point-Of-Care Ultrasound (O-POCUS), Postpartum Hemorrhage (PPH), Nursing, Clinical Medicine, Radiography and Imaging Sciences*

JEL Codes: *I10, I29, I21, J24, O33*

INTRODUCTION

Quality maternal healthcare is a key indicator of a country's health system performance. Frontline health workers must be equipped to deliver timely, evidence-based interventions during obstetric emergencies, which significantly affect maternal and neonatal outcomes. With task-sharing expanding, there is growing demand for healthcare providers, especially nurses, clinical officers, and imaging technologists, to acquire advanced clinical and diagnostic skills.

One life-saving intervention is Obstetric Point-of-Care Ultrasound (O-POCUS), which enables immediate assessment of complications such as Postpartum Haemorrhage (PPH), the leading cause of maternal mortality. Globally, over 287,000 women die annually from pregnancy-related complications, with PPH responsible for more than 27% of these deaths (WHO, 2023). Early ultrasound-supported diagnosis and rapid response significantly reduce preventable maternal deaths (Britton et al., 2019).

In sub-Saharan Africa, maternal mortality remains high due to weak infrastructure, limited technology, and inadequate clinical training (Gunawardena et al., 2018; Osoro, 2018). While O-POCUS training exists, many programs suffer from poor standardization and underprepared educators (Onyiego et al., 2020). In Kenya, with a maternal mortality ratio of 342 per 100,000 live births (KNBS, 2022), the 2024 National Guidelines on O-POCUS recommend 180 hours of structured training. This project proposes a Training Needs Assessment (TNA) tool to identify gaps in educator preparedness, aiming to improve practice and policy implementation (Markaki et al., 2021).

Despite the existence of O-POCUS training programs in Kenya, many suffer from poor standardization and underprepared educators (Onyiego et al., 2020). No study in Kenya has systematically evaluated O-POCUS teaching readiness across multiple health training departments, including Nursing, Clinical Medicine, and Imaging Sciences, despite national policy mandates. This gap in readiness presents a significant challenge to the effective implementation of the national guidelines and to improving maternal health outcomes in Kenya.

Statement of the Problem

Maternal mortality remains a major public health concern in Kenya, with Postpartum Hemorrhage (PPH) as the leading direct cause of maternal deaths. The Kenya Demographic and Health Survey (2022) reports a maternal mortality ratio of 342 per 100,000 live births, far above the global target of 70. Globally, PPH accounts for 27% of maternal deaths and timely diagnosis using Obstetric Point-of-Care Ultrasound (O-POCUS) has been shown to significantly reduce these deaths (Britton et al., 2019).

In 2024, the Kenyan Ministry of Health introduced O-POCUS and PPH protocols in national guidelines, recommending 180 hours of structured training. However, many tutors and clinical instructors in Nursing, Clinical Medicine, and Medical Imaging are unprepared to teach and supervise this content (Matiang'i et al., 2024; Onyiego et al., 2020). The gap exists in several areas, including knowledge, teaching competence, hands-on skills, and evaluation methods. This lack of preparedness compromises the quality of training and, by extension, the quality of maternal health services.

Despite national policy changes, no standardized Training Needs Assessment (TNA) tool exists to evaluate educators' readiness to implement these guidelines across different health training departments. Existing studies have highlighted the need for faculty training, but they rarely assess these needs systematically within the Kenyan context. This study developed and validated a comprehensive TNA tool to guide faculty development and address these gaps, thereby enhancing maternal health outcomes in Kenya.

LITERATURE REVIEW

Theoretical Review

This study utilizes three interrelated theories to guide the development and application of the Training Needs Assessment (TNA) tool: Human Capital Theory, Systems Theory, and the Human Performance Technology (HPT) Model.

Human Capital Theory, developed by Gary Becker (1964), emphasizes that investing in individuals' knowledge and skills enhances their productivity and contributes to overall system performance. In the context of this study, the TNA tool uses this theory to identify competency gaps among tutors and clinical instructors involved in O-POCUS and PPH training. By assessing these gaps, the tool aims to ensure that educators possess the necessary skills, knowledge, and practical experience to improve training outcomes. The focus is on investing in faculty training to enhance teaching effectiveness, which ultimately improves maternal health outcomes and addresses the skills gap in critical healthcare delivery.

Introduced by Ludwig von Bertalanffy (1968), Systems Theory views institutions as interconnected systems, where deficiencies in one element can affect the entire system. In this study, the TNA tool applies Systems Theory through its contextual analysis, job/task analysis, and curriculum review. These components ensure that the TNA not only identifies gaps in educator competencies but also considers the broader educational and healthcare ecosystem. For example, the tool examines how interdisciplinary collaboration between departments (such as Nursing, Clinical Medicine, and Imaging Sciences) impacts the overall effectiveness of O-POCUS training. This holistic approach ensures that the tool's design promotes integration across departments, fostering collaboration and a unified effort in addressing training needs.

The HPT Model, developed by Thomas Gilbert (1978), emphasizes diagnosing performance gaps by considering both individual and environmental factors. This model informs the study's feasibility analysis, the distinction between needs and wants, and the target group analysis. In particular, the HPT model helps ensure that the TNA tool differentiates between the critical training needs required for effective O-POCUS teaching and non-essential desires that might detract from key objectives. By carefully analyzing the performance gaps among educators, the TNA tool ensures that the proposed interventions are necessary, practical, and suitable for the intended audience, ensuring that training efforts address real issues rather than peripheral concerns.

While models such as Kirkpatrick's Training Evaluation and Knowles' Andragogy are widely recognized in educational settings, they were not used in this study. Kirkpatrick's Training Evaluation Model is focused on assessing the effectiveness of training programs after they have been implemented, whereas the aim of this study is to identify training needs and prepare educators

before the training begins. Thus, Kirkpatrick's model, which is more appropriate for post-training evaluation, is not suitable for the pre-assessment stage of educator readiness. On the other hand, Knowles' Andragogy focuses on adult learning principles, which are helpful for designing the training itself but do not specifically address the assessment of educator competencies or systematic identification of training gaps. Given that the primary focus of this study is to assess training needs and gaps in educator preparedness, theories like Human Capital Theory, Systems Theory, and the HPT Model were more aligned with the study's objectives.

2.2 Empirical Review

The importance of adequately trained educators in maternal health has been widely documented. Matiang'i et al., (2024), in their assessment of O-POCUS training in Kenya, found that less than 30% of clinical educators had prior hands-on experience with obstetric ultrasound, citing limited training opportunities and lack of equipment. Similarly, Onyiego et al. (2020) observed that many midwifery tutors in Kenyan colleges lacked both the theoretical background and practical competencies to effectively teach obstetric imaging.

Research also demonstrates the impact of O-POCUS training on clinical effectiveness. A systematic review by Britton et al., (2019) showed that targeted ultrasound education significantly improved diagnostic accuracy and emergency response times in low-resource settings. In Uganda, Shah et al. (2020) found that integrating POCUS training into midwifery curricula led to a 38% reduction in delayed diagnoses of PPH. Gunawardena et al. (2018) further emphasized the link between structured ultrasound education and adherence to clinical protocols, warning that untrained staff often skipped critical steps in obstetric emergencies.

Despite this evidence, most training programs across sub-Saharan Africa lack structured assessments to inform their development. Markaki et al., (2021), define a Training Needs Assessment (TNA) as a strategic process for identifying gaps between current and desired performance. Matlakala (2021) argue that TNAs help align training with organizational goals, but note that in the health sector, they are underutilized. In Kenya, Kajwang (2022) reports a lack of TNA tools targeting educators, making it difficult to evaluate readiness to implement policy-driven content such as the 2024 O-POCUS guidelines.

In light of Kenya's new national directive requiring 180 hours of structured O-POCUS training, the disconnect between policy and practice is evident. Shikuku et al. (2024) found that most institutions had not updated their maternal health curricula to reflect these guidelines. Onyiego et al. (2020) and Matiang'i et al., (2024) both highlight the absence of standardized tools to evaluate faculty preparedness.

Despite this evidence, several gaps remain in the literature. Many studies are cross-sectional and lack long-term impact assessments of O-POCUS training. Additionally, standardized TNA tools for evaluating educator preparedness are lacking in many African countries, including Kenya, where TNA tools targeting educators are insufficient (Kajwang, 2022). Moreover, there is a disconnect between policy and practice, as most institutions have not updated their curricula to reflect national guidelines (Shikuku et al., 2024).

Future studies could focus on longitudinal evaluations of O-POCUS training, regional comparisons across sub-Saharan Africa, and the development of faculty training models for low-resource settings. Additionally, examining institutional barriers to curriculum integration could provide valuable insights. This study addresses these gaps by proposing a context-specific TNA tool to inform curriculum design, faculty development, and maternal health outcomes improvement.

METHODOLOGY

This study adopted a descriptive cross-sectional design using a quantitative approach to assess the training needs of health educators delivering content on Obstetric Point-of-Care Ultrasound (O-POCUS) and Postpartum Hemorrhage (PPH). A cross-sectional design was appropriate for capturing a snapshot of knowledge, skill levels, and institutional readiness at a specific point in time (Setia, 2018) and is commonly used in health workforce assessments due to its cost-effectiveness and ability to handle large samples (Kajwang, 2022). The study targeted tutors and clinical instructors in Nursing, Clinical Medicine, and Medical Imaging from pre-service and in-service training institutions across Kenya, as these educators were directly responsible for delivering maternal and reproductive health curricula and were key agents in implementing competency-based O-POCUS training (Matiang'i et al., 2024; Onyiego et al., 2020). A stratified purposive sampling technique was employed to ensure balanced representation across different roles and departments, accounting for variations in teaching responsibilities and exposure to O-POCUS and PPH content, which enhanced the reliability and representativeness of the findings (Hirose & Creswell, 2023). Data were collected using a structured self-administered questionnaire, based on training needs assessment models (Markaki et al., 2021), and aligned with Kenya's 2024 O-POCUS guidelines, including closed-ended items on performance, knowledge and skills, curriculum coverage, feasibility, and contextual factors. The data were cleaned and analyzed using SPSS version 26, with descriptive statistics (frequencies, means, and standard deviations) used to summarize respondent characteristics and training gaps. The findings were presented in tables and charts to support interpretation and policy recommendations.

FINDINGS

Background Information

In the Nursing Department, most respondents were Tutors (98.7%) with 31.6% having 5.1 to 10 years of teaching experience. A significant portion (60.5%) had not received training in Postpartum Hemorrhage (PPH) and O-POCUS, and notably, all respondents reported no prior training in O-POCUS, highlighting a critical training gap. In the Clinical Medicine Department, 96.1% were Tutors, and 37.7% had 10.1 to 20 years of experience. However, 80.5% had not received training in PPH and O-POCUS, and 98.7% had no training in O-POCUS, indicating a need for targeted training. In the Radiography and Imaging Sciences Department, most respondents were Tutors (97.3%) with 35.1% having 5.1 to 10 years of experience. A majority (89.2%) had not received training in PPH and O-POCUS, and while 81.1% had no training in O-POCUS, 18.9% reported having received it. These findings underscore the need for comprehensive faculty development in PPH and O-POCUS across all departments to enhance teaching and clinical supervision.

Table 1: Background Information

Group	Nursing Department	Clinical Medicine	Radiography and Imaging Sciences
Tutor	75 (98.70%)	74 (96.10%)	36 (97.30%)
Clinical Instructor	1 (1.30%)	3 (3.90%)	1 (2.70%)
Years of Teaching/Clinical Supervision Experience			
0 – 2	12 (15.80%)	9 (11.70%)	4 (10.80%)
2.1 – 5.0	8 (10.50%)	11 (14.30%)	5 (13.50%)
5.1 – 10.0	24 (31.60%)	24 (31.20%)	13 (35.10%)
10.1 – 20.0	26 (34.20%)	29 (37.70%)	11 (29.70%)
20.1 – 30.0	5 (6.60%)	4 (5.10%)	1 (2.70%)
30 and above	1 (1.30%)	0	3 (8.10%)
Received training in PPH and/or OPOCUS [PPH]			
No	46 (60.50%)	62 (80.5)	33 (89.20%)
Yes	30 (39.5%)	15 (19.5)	4 (10.80%)
Received training in PPH and/or OPOCUS [OPOCUS]			
No	76(100%)	76 (98.70%)	30 (81.10%)
yes	0	1 (1.30%)	7 (18.90%)

Training Gaps

The table highlights significant gaps in students' competencies across three departments; Nursing, Clinical Medicine, and Radiography and Imaging Sciences particularly in areas related to Postpartum Hemorrhage (PPH) and Obstetrics Point-of-Care Ultrasound (O-POCUS). For early PPH identification, 36% (Nursing), 29.9% (Clinical Medicine), and 54.1% (Radiography) report a "significant gap." In the use of O-POCUS for fetal position and placental assessment, 86% (Nursing), 80.5% (Clinical Medicine), and 35.1% (Radiography) report a "significant gap." For image acquisition in obstetric emergencies, 76% (Nursing), 81% (Clinical Medicine), and 32% (Radiography) see a "significant gap." Similar gaps are seen in applying WHO PPH management algorithms, with 76% (Nursing), 31.2% (Clinical Medicine), and 70.3% (Radiography) reporting major challenges. Recognition of abnormal O-POCUS findings is a significant issue across departments, with 75% (Nursing), 72.7% (Clinical Medicine), and 45.9% (Radiography) identifying gaps. Additionally, 64% (Nursing), 58.4% (Clinical Medicine), and 32.4% (Radiography) report gaps in confidence to teach O-POCUS concepts. Finally, 82% (Nursing), 87% (Clinical Medicine), and 27% (Radiography) report significant gaps in students' ability to perform focused obstetric ultrasound scans, underscoring the need for enhanced training in these critical areas.

The differences in training gaps across departments stem from structural factors. Nursing faces challenges due to its larger student load, limiting personalized instruction, particularly in areas like PPH identification and teaching O-POCUS. Radiography struggles with equipment availability, as 95% of respondents reported no access to portable ultrasound machines, hindering practical training. Clinical Medicine is moderately equipped but faces curriculum integration challenges due to resource constraints and the lack of standardized guidelines. These structural factors highlight the need for tailored training strategies for each department.

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Table 2: Training Gaps

	Nursing Department	Clinical Medicine	Radiography and Imaging Sciences
The perceived gap among your students [Early identification of PPH risk factor]			
No Gap	8 (11%)	3(3.9%)	1(2.7%)
Some Gap	41(54%)	50(64.9%)	15(40.5%)
Significant Gap	27 (36%)	23(29.9%)	20(54.1%)
I don't know	0	1(1.3%)	1(2.7%)
The perceived gap among your students [Use of OPOCUS for fetal position and placental assessment]			
No Gap	1 (1%)	1(1.30%)	2(5.4%)
Some Gap	10 (13%)	12(15.6%)	22(59.5%)
Significant Gap	65 (86%)	62(80.5%)	13(35.1%)
I don't know	0	2(2.6%)	0
The perceived gap among your students [Image acquisition and interpretation in obstetric emergencies]			
No Gap	2 (3%)	1(1%)	3(8%)
Some Gap	16 (21%)	13(17%)	22(60%)
Significant Gap	58 (76%)	62(81%)	12(32%)
I don't know	0	1(1%)	0
The perceived gap among your students [Application of WHO PPH management algorithms]			
No Gap	2 (3%)	6(7.8%)	1(2.7%)
Some Gap	16 (21%)	47(61%)	10(27%)
Significant Gap	58 (76)	24(31.2%)	26(70.3%)
The perceived gap among your students [Recognition of abnormal O 'POCUS findings indicating PPH risk]			
No Gap	4 (5%)	1(1.3%)	3(8.1%)
Some Ga	15 (20%)	19(24.7%)	17(45.9%)
Significant Gap	57 (75%)	56(72.7%)	17(45.9%)
I don't know	0	1(1.3%)	
The perceived gap among your students [Confidence in teaching O 'POCUS concepts to students]			
No Gap	3(4%)	3(3.9%)	7(18.9%)
Some Ga	24(32%)	29(37.7%)	17(45.9%)
Significant Gap	49(64%)	45(58.4%)	12(32.4%)
I don't know	0	0	1(2.7%)
The perceived gap among your students [Effective integration of O 'POCUS into clinical case discussions]			
No Gap	3(4%)	2(2.6%)	1(2.7%)
Some Gap	20(26%)	26(33.8%)	16(43.2%)
Significant Gap	53(70%)	49(63.6%)	20(54.1%)
The perceived gap among your students [Student ability to perform a focused obstetric ultrasound scan]			
No Gap	2(3%)	2(2.6%)	3(8.1%)
Some Ga	11(14%)	7(9.1%)	24(64.9%)
Significant Gap	62(82%)	67(87%)	10(27%)
I don't Know	1(1%)	1(1.3%)	0
The perceived gap among your students [Student adherence to maternal emergency protocols in simulations]			
No Gap	6(8%)	4(5.2%)	20(54.1%)
Some Gap	38(50%)	28(36.4%)	17(45.9%)
Significant Gap	32(42%)	45(58.4%)	0

Inclusion of O-POCUS and PPH Management in the Curriculum

The table summarizes the inclusion of O-POCUS and PPH management in the curricula of three departments: Nursing, Clinical Medicine, and Radiography and Imaging Sciences. In the Nursing Department, 30 respondents (17.4%) confirmed inclusion, while 94 (54.7%) reported it was not

included, and 48 (27.9%) were uncertain. In Clinical Medicine, 14 respondents (18.9%) confirmed inclusion, 29 (45.3%) said no, and 34 (38.7%) were uncertain. In Radiography and Imaging Sciences, only 1 respondent (2.7%) confirmed inclusion, 2 (5.4%) were uncertain, and the majority, 34 respondents (91.9%), reported no inclusion. These findings highlight a significant gap in the integration of O-POCUS and PPH management across the departments, with many respondents either unaware or not teaching these essential topics.

Table 3: Inclusion of O-POCUS and PPH Management in the Curriculum

Included (Yes/No)	Nursing Department	Clinical Medicine	Radiography and Imaging Sciences
Yes	30	14	1
No	94	29	2
Not certain	48	34	34

Descriptive Statistics

Importance of Different Actions for Effective O-POCUS and PPH Instruction

The respondents were asked to rate the importance of different actions for effective O-POCUS and PPH instructions. Respondents rated the actions on a scale from "Not Important" to "Critical." The results for each department were presented below;

Importance of Different Actions for Effective O-POCUS and PPH Instruction from the Nursing Department

The table summarizes the perceived importance of various actions for effective O-POCUS and PPH instruction. For each action, the majority rated them as "Very Important" or "Critical," with mean scores ranging from 4.54 to 4.64. The highest ratings were for actions like "Interpretation of POCUS findings in PPH" and "Integration of PPH protocols into clinical teaching," both scoring 4.64. The standard deviations, ranging from 0.897 to 0.944, suggest that responses were fairly consistent, indicating strong agreement on the importance of these areas for effective teaching.

Table 4: Importance of Different Actions for Effective O-POCUS and PPH Instruction from the Nursing Department

Statement	Not Important	Slightly Important	Moderately Important	Very Important	Critical	Mean	Std. Dev
Knowledge of obstetric ultrasound physics and safety	2.60	2.60	7.90	11.80	75.00	4.54	0.944
Skill in acquiring standard obstetric ultrasound views	2.60	2.60	3.90	14.50	76.30	4.59	0.897
Interpretation of POCUS findings in PPH	2.60	2.60	5.30	6.60	82.90	4.64	0.905
Use of simulation to teach maternal emergencies	3.90	1.30	3.90	9.20	81.60	4.63	0.936
Integration of PPH protocols into clinical teaching	3.90	1.30	3.90	7.90	82.90	4.64	0.934

Importance of Different Actions for Effective O-POCUS and PPH Instruction from the Clinical Medicine Department

The table highlights the importance of various actions for effective O-POCUS and PPH instruction in the Clinical Medicine department. "Interpretation of POCUS findings in PPH" received the highest rating, with 68.8% marking it as "Critical" and a mean score of 4.39. Other actions such

as "Knowledge of obstetric ultrasound physics" and "Skill in acquiring ultrasound views" also received strong ratings, with means ranging from 4.32 to 4.36. Overall, the mean scores suggest broad agreement on the importance of these actions, with standard deviations between 0.995 and 1.053 indicating some variation in responses but consistent support for these key areas in clinical education.

Table 5: Importance of Different Actions for Effective O-POCUS and PPH Instruction from the Clinical Medicine Department

Statement	Not Important	Slightly Important	Moderately Important	Very Important	Critical	Mean	Std. Dev
Knowledge of obstetric ultrasound physics and safety	2.6	1.3	18.2	15.6	62.3	4.34	.995
Skill in acquiring standard obstetric ultrasound views	2.6	3.9	15.6	14.3	63.6	4.32	1.044
Interpretation of POCUS findings in PPH	3.9	1.3	15.6	10.4	68.8	4.39	1.053
Use of simulation to teach maternal emergencies]	4	18	0	14	64	4.34	1.034
Integration of PPH protocols into clinical teaching	2.6	2.6	15.6	14.3	64.9	4.36	1.012

Importance of Different Actions for Effective O-POCUS and PPH Instruction from the Radiography and Imaging Sciences Department

In the Radiography and Imaging Sciences department, respondents rated various actions for effective O-POCUS and PPH instruction. The highest-rated action was "Integration of PPH protocols into clinical teaching," with 56.8% marking it as "Critical" and a mean score of 4.24. "Skill in acquiring standard obstetric ultrasound views" and "Interpretation of POCUS findings in PPH" also received strong ratings, with means of 4.16 and 4.14, respectively. "Knowledge of obstetric ultrasound physics and safety" and "Use of simulation to teach maternal emergencies" both received significant support, with means of 4.14 and 4.19. The mean scores ranged from 4.14 to 4.24, showing broad agreement on the importance of these areas, while standard deviations between 1.004 and 1.159 reflect some variability in responses.

Table 6: Importance of Different Actions for Effective O-POCUS and PPH Instruction from the Radiography and Imaging Sciences Department

Statement	Not Important	Slightly Important	Moderately Important	Very Important	Critical	Mean	Std. Dev
Knowledge of obstetric ultrasound physics and safety	2.7	5.4	10.8	37.8	43.2	4.14	1.004
Skill in acquiring standard obstetric ultrasound views	5.4	5.4	8.1	29.7	51.4	4.16	1.143
Interpretation of POCUS findings in PPH	5.4	5.4	10.8	27	51.4	4.14	1.159
Use of simulation to teach maternal emergencies	3	5.4	14	27	51	4.19	1.05
Integration of PPH protocols into clinical teaching	2.7	8.1	8.1	24.3	56.8	4.24	1.09

Availability of Materials/Machines

The data reveals significant resource shortages for effective teaching of O-POCUS and PPH management across the Nursing, Clinical Medicine, and Radiography and Imaging Sciences departments. Portable ultrasound machines were reported as unavailable by 95% (Nursing), 94.8% (Clinical Medicine), and 67.6% (Radiography) of respondents. Similarly, ultrasound phantoms/simulators were almost entirely unavailable, with 99% (Nursing), 96.1% (Clinical Medicine), and 75.7% (Radiography) reporting no access. SOPs/checklists for O-POCUS and PPH were also lacking in most institutions, with 87% (Nursing), 88.3% (Clinical Medicine), and 94.6% (Radiography) indicating their unavailability.

On a more positive note, access to clinical sites for practice was reported as available by 82% (Nursing), 87% (Clinical Medicine), and 89.2% (Radiography), providing valuable hands-on learning opportunities. However, faculty development materials were lacking for 67% (Nursing), 64.9% (Clinical Medicine), and 59.5% (Radiography) of respondents, and student learning materials were not available for 55% (Nursing), 48.1% (Clinical Medicine), and 56.8% (Radiography). Finally, the MOH O-POCUS guidelines were unavailable for 86% (Nursing), 71.4% (Clinical Medicine), and 70.3% (Radiography), highlighting the need for standardized teaching materials.

These findings emphasize the critical need for improved infrastructure, including better access to equipment, standardized guidelines, and faculty development to enhance the quality of O-POCUS and PPH training across all departments.

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Table 7: Availability of Materials/Machines

	Nursing Department	Clinical Medicine	Radiography and Imaging Sciences
Portable ultrasound machines			
Not Available	72 (95%)	73 (94.8%)	25 (67.57%)
Available	4 (5%)	4 (5.2%)	12 (32.43%)
Ultrasound phantoms/simulators			
Not Available	75 (99%)	74 (96.1%)	28 (75.68%)
Available	1 (1%)	3 (3.9%)	9 (24.32%)
SOPs/checklists for O 'POCUS & PPH			
Not Available	66 (87%)	68 (88.3%)	35 (94.59%)
Available	10 (13%)	9 (11.7%)	2 (5.41%)
Access to clinical sites for practice			
Not Available	14 (18%)	10 (13%)	4 (10.8%
Available	62 (82%)	67 (87%)	33 (89.2%)
Faculty development materials			
Not Available	51 (67%)	50 (64.9%)	22 (59.46%)
Available	25 (33%)	27 (35.1%)	15 (40.54%)
Student Learning Materials			
Not Available	42 (55%)	37 (48.1%)	21 (56.76%)
Available	34 (45%)	40 (51.9%)	16 (43.24%)
A copy of the MOH O-POCUS guidelines (Hard or soft)			
Not Available	65 (86%)	55 (71.4%)	26 (70.27%)
Available	11 (14%)	22 (28.6%)	11 (29.73%)

Top Three Methods of Instruction to Adopt in Addressing the Identified Gaps

The table highlights the preferred methods of instruction across the Nursing, Clinical Medicine, and Radiography departments. Hands-on workshops (live scanning practice) were the most preferred method in all departments, with 71.1% (Nursing), 70.1% (Clinical Medicine), and 81.1% (Radiography) selecting it as their top choice. Simulation-based scenarios also received significant support, with 65.8% (Nursing), 67.5% (Clinical Medicine), and 56.8% (Radiography) ranking them first. Mentorship/coaching (one-on-one guidance) was highly favored, particularly in Radiography (64.9%) and Nursing (63.2%), emphasizing the value of personalized instruction. Case-based discussions and peer-learning groups were also popular, with around 50-60% of respondents selecting them as the most preferred methods. In contrast, eLearning modules and blended learning were less favored, with Nursing (21.1%) and Clinical Medicine (28.6%) giving them lower preference. These results align with Wynne et al. (2024) and Mohamed et al. (2024), who emphasize the effectiveness of hands-on learning in clinical training, as well as Rees et al. (2021) and Kim et al. (2024), who highlight the importance of mentorship and simulation in enhancing clinical skills. The findings underscore a preference for interactive, practical learning methods over theoretical or online formats.

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Table 8: Top Three Methods of Instruction to Adopt in Addressing the Identified Gaps

Methods of Instruction	Nursing Departmen	Clinical Medicine	Radiography and Imaging Sciences
Didactic lectures (theoretical background)			
Most Preferred	40 (52.6%)	35 (45.5%)	18 (48.6%)
Second Preferred	21 (27.6%)	17 (22.1%)	11 (29.7%)
Third Preferred	10 (13.2%)	13 (16.9%)	5 (13.5%)
No Response	5 (6.6%)	12 (15.6%)	3 (8.1%)
Hands-on workshops (live scanning practice)			
Most Preferred	54 (71.1%)	54 (70.1%)	30 (81.1%)
Second Preferred	7 (9.2%)	9 (11.7%)	2 (5.4%)
Third Preferred	9 (11.8%)	8 (10.4%)	6 (13.5%)
No Response	6 (7.9%)	6 (7.8%)	0
Simulation-based scenarios (high-fidelity case drills)			
Most Preferred	50 (65.8%)	52 (67.5%)	21 (56.8%)
Second Preferred	13 (17.1%)	15 (19.5%)	11 (29.7%)
Third Preferred	3 (3.9%)	5 (6.5%)	5 (13.5%)
No Response	10 (13.2%)	5 (6.5%)	0
eLearning modules (self-paced online)			
Most Preferred	16 (21.1%)	22 (28.6%)	9 (24.3%)
Second Preferred	28 (36.8%)	21 (27.3%)	15 (40.5%)
Third Preferred	18 (23.7%)	22 (28.6%)	8 (21.6%)
No Response	14 (18.4%)	12 (15.6%)	5 (13.5%)
Mentorship/coaching (one-on-one guidance)			
Most Preferred	48 (63.2%)	44 (57.1%)	24 (64.9%)
Second Preferred	13 (17.1%)	17 (22.1%)	4 (10.8%)
Third Preferred	6 (7.9%)	10 (13%)	4 (10.8%)
No Response	9 (11.8%)	6 (7.8%)	5 (13.5%)
Peer-learning groups (study circles)			
Most Preferred	41 (53.9%)	33 (42.9%)	12 (32.4%)
Second Preferred	14 (18.4%)	24 (31.2%)	16 (43.2%)
Third Preferred	13 (17.1%)	14 (18.2%)	4 (10.8%)
No Response	8 (10.5%)	6 (7.8%)	5 (13.5%)
Case-based discussions (problem-solving sessions)			
Most Preferred	44 (57.9%)	47 (61%)	23 (62.2%)
Second Preferred	18 (23.7%)	14 (18.2%)	6 (16.2%)
Third Preferred	6 (7.9%)	9 (11.7%)	3 (8.1%)
No Response	8 (10.5%)	7 (9.1%)	5 (13.5%)
Blended learning (combination of online and in-person)			
Most Preferred	33 (43.4%)	37 (48.1%)	20 (54.1%)
Second Preferred	25 (32.9%)	18 (23.4%)	8 (21.6%)
Third Preferred	5 (6.6%)	12 (15.6%)	3 (8.1%)
No Response	13 (17.1%)	10 (13%)	6 (16.2%)

Institutional Readiness in Addressing the Gaps

The data from Table 7 reveals varying levels of institutional readiness to integrate O-POCUS and PPH training across the Nursing, Clinical Medicine, and Radiography departments. Leadership commitment is generally high, with significant percentages rating it as "Very High" (31.6% in Nursing, 37.7% in Clinical Medicine, and 32.4% in Radiography). However, some respondents (Nursing: 18.4%, Clinical Medicine: 9.1%, Radiography: 2.7%) rated leadership as "Very Low," indicating inconsistencies in support, which aligns with Britton et al. (2019), who stress that leadership commitment is key for successful program implementation.

Regarding curriculum flexibility, most respondents rated it as "Flexible" or "Very Flexible" (54% in Nursing, 57.2% in Clinical Medicine, 66.4% in Radiography). However, 26.3% (Nursing),

19.5% (Clinical Medicine), and 30.1% (Radiography) viewed the curriculum as rigid or slightly rigid. The results are supported by Matiang'i et al. (2024), who noted that curriculum rigidity hinders the integration of new technologies into healthcare education.

For resource allocation, 26.3% (Nursing) and 24.7% (Clinical Medicine) rated resources as "Neutral," with 19.7% (Nursing) and 16.9% (Clinical Medicine) rating them "Rigid." The Radiography department reported better allocation (29.7% neutral). These findings align with Onyiego et al. (2020), emphasizing the need for better resource distribution to enhance training outcomes. Markaki et al. (2021) also highlight the importance of adequate resources and faculty development for effective training

Table 9: Institutional Readiness in Addressing the Gaps

Institutional Readiness Dimension	Nursing Department	Clinical Medicine	Radiography and Imaging Sciences
Leadership Commitment to Integrating O-POCUS/PPH Training (1 = Low, 5 = High)			
Very Low	14 (18.4%)	7 (9.1%)	1 (2.7%)
Low	9 (11.8%)	15 (19.5%)	1 (2.7%)
Moderate	17 (22.4%)	16 (20.8%)	8 (21.6%)
High	12 (15.8%)	10 (13.0%)	15 (40.5%)
Very High	24 (31.6%)	29 (37.7%)	12 (32.4%)
Curriculum Flexibility: Ability to Include New Modules Within Existing Programs (1 = Rigid, 5 = Flexible)			
Rigid	10 (13.2%)	6 (7.8%)	1 (2.7%)
Slightly Rigid	10 (13.2%)	9 (11.7%)	2 (5.4%)
Neutral	15 (19.7%)	18 (23.4%)	9 (24.3%)
Flexible	16 (21.1%)	10 (13.0%)	9 (24.3%)
Very Flexible	25 (32.9%)	34 (44.2%)	16 (43.2%)
Resource Allocation: Availability of Budget and Human Resources (1 = None, 5 = Fully Allocated)			
Rigid	15 (19.7%)	13 (16.9%)	6 (16.2%)
Slightly Rigid	12 (15.8%)	22 (28.6%)	8 (21.6%)
Neutral	20 (26.3%)	19 (24.7%)	11 (29.7%)
Flexible	15 (19.7%)	12 (15.6%)	7 (18.9%)
Very Flexible	14 (18.4%)	11 (14.3%)	5 (13.5%)

Why should this Training Gap be Addressed Now

The results highlight the key reasons for addressing the O-POCUS and PPH training gap across the Nursing, Clinical Medicine, and Radiography departments. In all three departments, better service provision was identified by 35% (Nursing), 35% (Clinical Medicine), and 32% (Radiography) of respondents as a priority, emphasizing the need for improved training to enhance healthcare delivery. Similarly, UHC priorities were identified by 35% (Nursing), 34% (Clinical Medicine), and 42% (Radiography), showing alignment with global goals of Universal Health Coverage, which requires well-trained professionals to provide comprehensive care (World Bank, 2021). Finally, current trends in technology were cited by 30% (Nursing), 31% (Clinical Medicine), and 26% (Radiography), highlighting the importance of keeping up with technological advancements like O-POCUS to improve diagnosis and treatment in obstetrics (Britton et al., 2019).

These findings underscore the necessity of integrating targeted training in O-POCUS and PPH management to align with service improvements, UHC goals, and technological trends. These priorities reflect a broad, global call to enhance maternal healthcare education and training, as

highlighted by Anyanwu et al. (2024) and Luo et al. (2022), who stress the need for continuous professional development to improve clinical outcomes in maternal health.

Table 10: Why should this Training Gap be Addressed Now

	Nursing Department	Clinical Medicine	Radiography and Imaging Sciences
Better service provision	61 (35%)	69 (35%)	23 (32%)
UHC priorities	61 (35%)	66 (34%)	31 (42%)
Current trends technology	53 (30%)	61 (31%)	19 (26%)

Behavior or Outcome is Expected after Integrating this Content

The data from Figure 4 reveals that the majority of respondents across the Nursing, Clinical Medicine, and Radiography departments expect the integration of O-POCUS and PPH management training to primarily reduce maternal morbidity and mortality, with 70 (Nursing), 74 (Clinical Medicine), and 30 (Radiography) respondents identifying it as the top expected outcome. This highlights the critical role of early detection and intervention in improving maternal health outcomes, consistent with research by Onyiego et al. (2020), who emphasized the importance of timely diagnosis in reducing complications. The second most emphasized outcome is the early diagnosis and referral of PPH cases, with 61 (Nursing), 63 (Clinical Medicine), and 23 (Radiography) respondents highlighting its importance in preventing life-threatening hemorrhages, reflecting global health priorities (WHO, 2021). Finally, while the use of O-POCUS in triage and emergency obstetrics was considered important by 62 (Nursing), 63 (Clinical Medicine), and 23 (Radiography), it received relatively less focus, suggesting that while its potential benefits are recognized, it may not yet be fully integrated into emergency care curricula. This finding aligns with studies by Shikuku et al. (2024), emphasizing the need for early intervention in obstetric emergencies.

Table 11: Behavior or Outcome is Expected after Integrating this Content

	Nursing Department	Clinical Medicine	Radiography and Imaging Sciences
Reduced maternal morbidity and mortality	70	74	30
Early diagnosis and referral of PPH cases	61	63	23
Use of O-POCUS in triage/emergency obstetrics	62	63	23

CONCLUSION AND RECOMMENDATIONS

Conclusion

The findings across the Nursing, Clinical Medicine, and Radiography and Imaging Sciences departments highlight critical gaps in faculty training, curriculum integration, and resource allocation for O-POCUS and PPH management. In Nursing, the lack of trained faculty and comprehensive curriculum updates calls for urgent faculty development programs. In Clinical Medicine, despite positive leadership and curriculum flexibility, the absence of essential training in O-POCUS and PPH management highlights the need for targeted faculty development. For Radiography, the integration of these critical topics is hindered by a lack of resources and practical training opportunities, underscoring the importance of hands-on learning approaches such as workshops and mentorship. Addressing these gaps is essential to ensure that healthcare providers

are well-prepared to manage obstetric emergencies and contribute to improving maternal health outcomes.

Recommendations

To address the identified gaps, immediate actions should focus on faculty upskilling workshops that combine theoretical knowledge with hands-on training in O-POCUS and PPH management. Ultrasound simulators and low-cost training tools should also be introduced to ensure practical experience for both faculty and students, especially where equipment availability is limited.

In the medium term, institutions should integrate O-POCUS and PPH management into their curricula across Nursing, Clinical Medicine, and Radiography, with an emphasis on practical application. Additionally, it is crucial to procure portable ultrasound machines to enable hands-on training for students, particularly in Radiography and Imaging Sciences, where equipment shortages are a challenge.

For the long term, a national accreditation framework for O-POCUS training should be established in collaboration with the Ministry of Health and academic institutions. This framework should be complemented by continuous professional development (CPD) programs to ensure educators stay current with advancements in maternal health training and teaching methods.

Key stakeholders, including the Ministry of Health, the Nursing Council of Kenya, and academic institutions, must work together to implement these changes. Monitoring the effectiveness of these interventions through competency assessments, OSCEs, and maternal health outcome tracking will help assess the long-term impact of these training improvements.

Limitations

This study has several limitations that should be considered. First, it was conducted at a single institution, limiting the generalizability of the findings to other healthcare or educational settings, particularly outside of Kenya. Second, the study relied on self-reported data from tutors and clinical instructors, which could introduce self-reporting bias; participants might overestimate their competencies or the effectiveness of existing training programs. Lastly, the study's focus on a Kenyan context restricts the ability to generalize the results to other countries with different healthcare systems, educational structures, or resources, making the findings less applicable in settings with significant contextual differences.

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