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Effectiveness of nurse-led training on the e-motive treatment bundle for management of postpartum hemorrhage among staff nurses in selected hospitals of Kanpur, Uttar Pradesh: a pre-experimental one-group pre-test–post-test study

Abhanshi Dwivedi[1], Akanksha[1], Akanksha Nishad[1], Akanksha Singh[1], Akanksha Singh[1], Jasmi Johnson[2*]

[1]B.Sc. Nursing Students, Faculty of Nursing, Rama University, Kanpur, Uttar Pradesh, India
[2]Principal and Dean, Faculty of Nursing, Rama University, Kanpur, Uttar Pradesh, India

Abstract

Introduction

Postpartum hemorrhage (PPH) remains a leading cause of maternal death. The E-MOTIVE approach combines early, objective detection of blood loss with a first-response bundle of uterine massage, oxytocic drugs, tranexamic acid, intravenous fluids, examination and escalation of care. This study evaluated the effectiveness of nurse-led training on staff nurses' knowledge of the E-MOTIVE treatment bundle in selected hospitals of Kanpur, Uttar Pradesh.

Methods

A quantitative pre-experimental one-group pre-test–post-test design was used. Sixty staff nurses working in labour rooms, obstetric wards and obstetric emergency units of three hospitals were recruited by non-probability convenience sampling. Knowledge was measured with a 24-item structured questionnaire before and five days after a single 20-minute nurse-led audio-visual training session (6–13 April 2026). Data were analysed using descriptive statistics, the paired t-test and the chi-square test ($\alpha = 0.05$).

Results

At pre-test, 18 (30.0%) nurses had inadequate and 42 (70.0%) moderate knowledge; none had adequate knowledge. At post-test, 48 (80.0%) had adequate and 12 (20.0%) moderate knowledge. The mean score increased from 12.40 ± 1.14 to 21.06 ± 2.10 (mean difference 8.66; 95% CI 8.04–9.28; $t(59) = 28.12$; $p < 0.001$). Pre-test knowledge was significantly associated with previous PPH-management training but not with age, gender, qualification, experience or working area.

Conclusion

A brief nurse-led audio-visual training session significantly improved staff nurses' short-term knowledge of the E-MOTIVE treatment bundle for the management of PPH.

Recommendation

Hospitals should incorporate structured E-MOTIVE training into the induction and routine in-service education of all nurses posted in maternity units, reinforced by periodic refresher sessions and simulation drills. Controlled studies with longer follow-up are recommended to assess knowledge retention, clinical practice and maternal outcomes.

Keywords: Postpartum hemorrhage; E-MOTIVE; treatment bundle; nurse-led training; staff nurses; maternal health
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Corresponding author: Prof. (Dr.) Jasmi Johnson
E-mail: johnsonjasmi@gmail.com
Principal and Dean, Faculty of Nursing, Rama University, Kanpur, Uttar Pradesh, India

Introduction

Postpartum hemorrhage (PPH) is an obstetric emergency and one of the leading direct causes of maternal death worldwide. In a World Health Organization (WHO) systematic analysis, hemorrhage accounted for 27.1% of maternal deaths globally, with the majority attributable to postpartum bleeding [1]. A systematic review and meta-analysis estimated that PPH (blood loss ≥500 mL) complicates about 6% of births and severe PPH (≥1000 mL) about 1.9%, with wide regional variation that reflects differences in the definitions used, the methods of measuring blood loss and the populations studied [2]. WHO estimates that PPH affects approximately 14 million women each year and causes about 70,000 maternal deaths, most of them in low- and middle-income countries and most of them preventable [3].

Definitions of PPH vary between professional bodies. The American College of Obstetricians and Gynecologists defines PPH as cumulative blood loss of 1000 mL or more, or blood loss accompanied by signs or symptoms of hypovolemia, within 24 hours of birth irrespective of the route of delivery [4]. The Royal College of Obstetricians and Gynaecologists defines primary PPH as a loss of 500 mL or more from the genital tract within 24 hours of birth, classified as minor (500–1000 mL) or major (>1000 mL)

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[5]. The causes are conventionally grouped as the "four Ts": *tone* (uterine atony, the most frequent cause), *trauma* (lacerations of the cervix, vagina or uterus), *tissue* (retained placenta or membranes) and *thrombin* (coagulation disorders) [6].

In India, hemorrhage was identified as the single largest cause of maternal death (38%) in the national Sample Registration System analysis of maternal mortality [7], and PPH together with pre-eclampsia/eclampsia accounts for about 40% of maternal deaths [8]. Gaps in provider preparedness persist: in a cross-sectional assessment of public and private facilities in northern Karnataka, only 37.7% of providers would assess uterine tone in a PPH test case and only 40% correctly defined early PPH [8].

A key barrier to effective care is delayed or inaccurate recognition of bleeding. Visual estimation of blood loss frequently underestimates the true volume, so treatment is often started late and its components are given sequentially rather than together [3,9]. The E-MOTIVE approach addresses this through **E**arly detection of PPH with a calibrated blood-collection drape, followed by a first-response treatment bundle comprising uterine **M**assage, **O**xytocic drugs, **T**ranexamic acid, **I**ntravenous fluids, and **V**aginal and genital tract examination with **E**scalation of care when bleeding continues [9]. The bundle is not a single drug or step but a set of actions that are initiated together as soon as PPH is diagnosed [3,9].

The international E-MOTIVE cluster-randomised trial, conducted in 80 secondary-level hospitals across Kenya, Nigeria, South Africa and Tanzania and including 210,132 women giving birth vaginally, showed that the composite of severe PPH, laparotomy for bleeding or maternal death from bleeding fell from 4.3% with usual care to 1.6% with the intervention (risk ratio 0.40). PPH detection increased from 51.1% to 93.1%, and use of the treatment bundle from 19.4% to 91.2% [9]. The intervention was cost-effective [10], and its mixed-methods process evaluation showed high fidelity, acceptability and feasibility when the bundle was supported by training, simulation, local champions, and audit and feedback [11]. On the basis of this evidence, WHO issued recommendations on the objective assessment of postpartum blood loss and the use of a first-response treatment bundle for PPH [3].

The success of a bundle, however, depends on the people who deliver it. Staff nurses monitor women during labour and the immediate postpartum period, are usually the first to recognise abnormal bleeding, initiate first-line measures, administer prescribed uterotonics and fluids, monitor vital signs and summon help. Qualitative evidence shows that health workers find it difficult to interpret blood loss accurately and that quantifying blood loss is a substantial change of practice for many of them [12]. The availability of a protocol alone therefore does not guarantee its correct use; knowledge gaps, limited practical exposure, staffing constraints and inconsistent adherence to guidelines all affect implementation [11,12].

Nurse-led, in-service education is a practical and sustainable way of strengthening this knowledge. Short, facility-based, competency-oriented training such as *Helping Mothers Survive: Bleeding after Birth* has improved the knowledge and confidence of birth attendants in India and Africa [13], and simulation-based education has improved nurse-midwives' knowledge and skills in PPH management [14]. Nevertheless, there is limited evidence on the effect of nurse-led training focused specifically on the E-MOTIVE treatment bundle among staff nurses in India, and no such evidence from Kanpur. The present study was therefore undertaken to evaluate the effectiveness of a nurse-led training programme on the knowledge of staff nurses regarding the E-MOTIVE treatment bundle for the management of PPH in selected hospitals of Kanpur, Uttar Pradesh.

Objectives

1. To assess the baseline (pre-test) knowledge of staff nurses regarding the E-MOTIVE treatment bundle for the management of PPH in selected hospitals of Kanpur.
2. To evaluate the effectiveness of nurse-led training on the knowledge of staff nurses regarding the E-MOTIVE treatment bundle by comparing pre-test and post-test knowledge scores.
3. To determine the association between the pre-test knowledge of staff nurses and selected demographic variables.

Hypotheses (tested at the 0.05 level of significance)

- **H_1:** The mean post-test knowledge score of staff nurses regarding the E-MOTIVE treatment bundle will be significantly higher than the mean pre-test knowledge score.
- **H_2:** There will be a significant association between the pre-test knowledge of staff nurses and their selected demographic variables.
- **H_{01} and H_{02}** are the corresponding null hypotheses of no significant difference and no significant association, respectively.

Methods and materials

The study is reported in accordance with the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) statement [15].

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Research approach and study design

A quantitative evaluative research approach was adopted, using a pre-experimental one-group pre-test–post-test design (O_1 X O_2) [16]. The key components of the design were as follows. (i) *Single group:* all enrolled staff nurses formed one group, and no concurrent control or comparison group was used. (ii) *Pre-test (O_1):* baseline knowledge of every participant was measured with the structured knowledge questionnaire immediately before the intervention. (iii) *Intervention (X):* each participant then received one 20-minute nurse-led audio-visual training session on the E-MOTIVE treatment bundle. (iv) *Post-test (O_2):* on the fifth day after the session, the same questionnaire was administered again to the same participants under the same conditions. (v) *Comparison:* each nurse served as her or his own control, and the effect of the intervention was estimated from the within-person change between O_1 and O_2. The independent variable was the nurse-led training programme; the dependent variable was knowledge regarding the E-MOTIVE treatment bundle; and the attribute variables were age, gender, professional qualification, years of experience, current working area and previous attendance of training on PPH management.

Study setting

The study was conducted in three hospitals of Kanpur, Uttar Pradesh, India, that provide round-the-clock obstetric care: AHM Dufferin Hospital (a government women's hospital), Rama Devi Medical Centre and M. Kashiram Hospital. These hospitals were selected because of their high volume of deliveries, the availability of labour rooms, obstetric wards and obstetric emergency services staffed by registered nurses, the feasibility of conducting the study within the available time, and the willingness of the hospital authorities to permit the study.

Population

The *target population* comprised staff nurses involved in the management of women with PPH. The *accessible population* comprised staff nurses posted in the labour rooms, obstetric and gynaecological (OBG) wards, obstetric emergency and other maternity-related areas of the three selected hospitals during the data-collection period.

Eligibility criteria

Inclusion criteria

Staff nurses who (a) were registered with the State or Indian Nursing Council; (b) were working in the labour room, OBG ward, obstetric emergency or another area where they were involved in the care of women during and after childbirth; (c) were available on all days of data collection; and (d) gave written informed consent.

Exclusion criteria

Staff nurses who (a) had previously received formal training specifically on the E-MOTIVE bundle; (b) were posted in the intensive care unit, high-dependency unit, paediatric or orthopaedic units; or (c) were unwilling to participate. Nurses who had attended general PPH-management training (for example, as part of skilled-birth-attendance or emergency obstetric care programmes) were not excluded, and this exposure was recorded as a demographic variable.

Sample size

The sample size was estimated for the primary outcome, the within-person change in knowledge score, analysed with a two-tailed paired t-test. Because no previous estimate of the variability of change scores for E-MOTIVE knowledge was available, a conservative moderate standardised effect size (Cohen's $d_z = 0.5$) was assumed. With $\alpha = 0.05$ and a power of 80%, the minimum required sample size was 34 participants (G*Power 3.1, matched-pairs t-test) [17]. To allow for an anticipated attrition of up to 20% between pre-test and post-test (required $n \approx 43$), to permit the chi-square analysis of association with demographic variables, and considering the number of eligible nurses who could be reached in the three hospitals within the one-week data-collection period, the final sample size was fixed at 60 staff nurses. This sample exceeds the minimum requirement and provides more than 95% power to detect a moderate effect.

Recruitment of participants and sampling technique

A non-probability convenience sampling technique was used. After written permission had been obtained from each hospital, the investigators met the nursing superintendent and the in-charge nurses of the eligible units, who provided the duty rosters of staff nurses posted in those units. The investigators then visited the units during each shift (morning, evening and night) from 6 to 8 April 2026 and approached every staff nurse who was on duty and available. The purpose, procedure, duration and voluntary nature of the study were explained individually, and each nurse was screened against the eligibility criteria. Eligible nurses who agreed to participate signed the informed-consent form and were enrolled consecutively until the target of 60 participants was reached across the three hospitals. Because enrolment depended on availability on duty during the recruitment period, rather than on random selection from a sampling frame, the sample was a convenience sample.

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Data-collection instrument

A self-structured instrument was developed by the investigators after a review of the WHO recommendations on PPH [3], the E-MOTIVE trial publications [9,11] and standard obstetric nursing texts. It contained 30 items in two sections.

Section A – Demographic profile (6 items): age, gender, professional qualification, years of experience, current working area, and previous attendance of training related to PPH management.

Section B – Structured knowledge questionnaire (24 items): multiple-choice questions, each with one correct answer among four options, covering the definition and classification of PPH, its causes (four Ts) and risk factors, recognition and objective measurement of blood loss, each component of the E-MOTIVE bundle (uterine massage, oxytocic drugs, tranexamic acid, intravenous fluids, examination and escalation of care), and the nurse's responsibilities in monitoring, documentation and referral.

Each correct response in Section B was awarded one mark and each incorrect or unanswered item zero, giving a total score of 0–24. The percentage score was calculated as (obtained score ÷ 24) × 100. Knowledge was categorised as *inadequate* (0–11; ≤45.8%), *moderate* (12–18; 50.0–75.0%) or *adequate* (19–24; ≥79.2%) (Table 1). The content validity of the tool was established by subject experts in obstetric and gynaecological nursing and obstetrics, and their suggestions were incorporated before data collection.

Table 1: *Criterion Used to Classify Knowledge Regarding the E-MOTIVE Treatment Bundle*

Level of knowledge	Score range (maximum 24)	Percentage score
Inadequate	0–11	0.0–45.8%
Moderate	12–18	50.0–75.0%
Adequate	19–24	79.2–100.0%

Note. Percentage score = (obtained score ÷ 24) × 100.

Intervention: nurse-led audio-visual training programme

Content and key message. The training programme was developed by the investigators under the supervision of the nursing faculty and was based on the WHO recommendations on the assessment of postpartum blood loss and the use of a treatment bundle for PPH [3] and the E-MOTIVE trial protocol [9]. Its central message was that PPH must be detected early and objectively and that, once detected, all first-response actions of the bundle should be started together, without delay, rather than one after another. The 20-minute session was organised in five segments: (1) magnitude of PPH, its definition, classification and causes (four Ts) and risk factors (3 minutes); (2) early detection — the limitations of visual estimation, use of a calibrated blood-collection drape, the trigger thresholds for diagnosing PPH (blood loss ≥300 mL with at least one abnormal clinical sign, or ≥500 mL) and monitoring of pulse, blood pressure, uterine tone and vaginal bleeding [3,18] (4 minutes); (3) the MOTIVE bundle — uterine massage, oxytocic drugs, tranexamic acid, intravenous crystalloid fluids, and examination of the genital tract and placenta, with the timing and sequence of each action and the nurse's role in preparing and administering prescribed drugs (8 minutes); (4) escalation of care — when and how to call for senior help and transfer, communication within the team, and documentation (3 minutes); and (5) recapitulation of key points and clarification of participants' questions (2 minutes).

Mode of delivery and equipment. The programme was delivered face to face by the student investigators (B.Sc. Nursing students) under the supervision of the nursing faculty, using a structured PowerPoint presentation containing illustrations, flow charts of the E-MOTIVE pathway and short embedded demonstration clips. The presentation was projected from a laptop computer onto a screen with a liquid-crystal display (LCD) projector, and audio was played through external speakers so that all participants could see and hear clearly. The same presentation and lesson plan were used for every group to ensure uniform delivery.

Place and environment. Sessions were conducted in the seminar or demonstration room, or in a quiet room adjoining the maternity units, of each hospital. The rooms were well lit and ventilated, seating was arranged so that every participant had an unobstructed view of the screen, and interruptions were minimised by scheduling the sessions with the unit in-charges so that patient care was covered by non-participating staff.

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Number and duration of sessions. Each participant was intended to receive, and received, one session of 20 minutes. Sessions were held in small groups of participants recruited from the same hospital and shift, immediately after the pre-test, and were repeated as often as necessary over 6–8 April 2026 until all 60 participants had been trained.

Measures to promote adherence. No monetary or material incentives were offered. Adherence was promoted by obtaining the support of the nursing superintendents and unit in-charges, scheduling sessions within working hours at the change of shift, conducting the pre-test and training in a single sitting so that no participant missed the intervention, and personally reminding participants on the day before the post-test. Attendance was recorded for every session.

Data-collection procedure

Data were collected from 6 to 13 April 2026. On the day of enrolment (6–8 April 2026), after informed consent had been obtained, each participant completed Sections A and B of the instrument as a self-administered pre-test in about 20–25 minutes under the supervision of an investigator; participants were asked not to consult one another, books or mobile phones. The completed questionnaires were collected immediately, and the training session was then delivered. On the fifth day after the session (11–13 April 2026), the same knowledge questionnaire was administered to the same participants as the post-test under similar conditions. Each participant was given a unique code so that pre-test and post-test responses could be matched without recording names on the questionnaires.

Assignment method

The unit of assignment was the individual staff nurse. Because the design included only one group, all enrolled nurses were assigned to receive the intervention; no random allocation was carried out. Although the training was delivered in small groups for practical reasons, these groups were formed by hospital and shift availability and were not units of assignment. No blocking, stratification or minimisation was used.

Blinding

Blinding was not feasible in this single-group design. The participants knew that they were receiving the training, and the investigators who delivered the training also administered the questionnaires. Measurement bias was reduced by using an objective multiple-choice instrument with a predetermined answer key, scoring every questionnaire against the same key, and identifying questionnaires only by participant codes during scoring.

Unit of analysis

The unit of analysis was the individual staff nurse. Each nurse contributed one pre-test score and one post-test score, which were analysed as paired observations.

Statistical methods

Data were coded and entered into Microsoft Excel and analysed with IBM SPSS Statistics (IBM Corp., Armonk, NY, USA). Demographic variables and knowledge levels were summarised with frequencies and percentages, and knowledge scores with means and standard deviations (SD). Because the pre-test and post-test scores were repeated measurements on the same individuals and are therefore correlated, the primary outcome was analysed with the paired t-test, which accounts for within-person correlation by analysing the difference score for each participant. The mean difference was reported with its 95% confidence interval (CI), and the standardised effect size was expressed as Cohen's dz (mean difference ÷ SD of the differences). The association between pre-test knowledge level and each demographic variable was tested with Pearson's chi-square test; Fisher's exact test was planned where expected cell frequencies were below five. All tests were two-tailed, and $p < 0.05$ was considered statistically significant. Clustering of participants within the three hospitals was not modelled because of the small number of clusters.

Ethical considerations

The study protocol was approved by the Institutional Ethics Committee, Faculty of Nursing, Rama University, Kanpur before the commencement of data collection. Written administrative permission was obtained from the authorities of AHM Dufferin Hospital, Rama Devi Medical Centre and M. Kashiram Hospital, Kanpur. The purpose and procedure of the study were explained to each nurse, and written informed consent was obtained before data collection. Participation was voluntary, participants were free to withdraw at any time without any consequence for their employment, and anonymity and confidentiality were maintained by using codes in place of names. The data were used only for research purposes. The study was conducted in accordance with the principles of the Declaration of Helsinki.

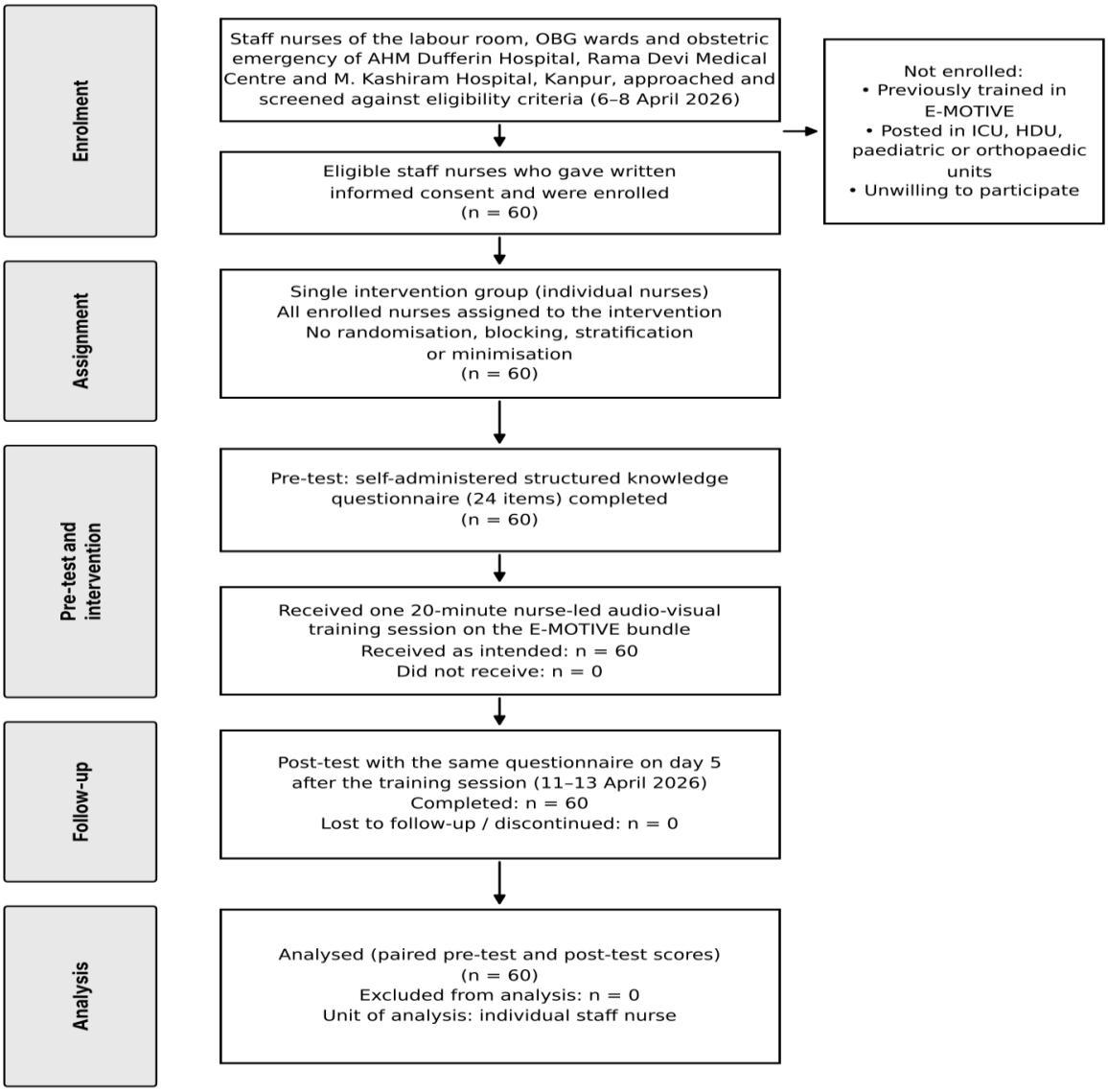
Results

Participant flow

All 60 staff nurses who were enrolled completed the pre-test, received the 20-minute training session as intended and completed the post-test on day 5; there were no losses to follow-up or exclusions, and all 60 participants were included in the analysis (Figure 1).

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Figure 1: *Flow of Participants Through Each Stage of the Study*



Note. Adapted from the TREND flow diagram for non-randomised evaluations [15]. E-MOTIVE = Early detection, Massage, Oxytocic drugs, Tranexamic acid, Intravenous fluids, Examination and escalation; HDU = high-dependency unit; ICU = intensive care unit; OBG = obstetrics and gynaecology.

Demographic profile of participants

The largest age group was 25–30 years (40.0%), and 70.0% of participants were female. More than half held the General Nursing and Midwifery (GNM) diploma (58.3%). Nearly half had less than one year of experience (48.3%), 38.3% were working in the labour room, and 73.3% reported previous attendance of training related to PPH management (Table 2).

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Table 2: *Demographic Characteristics of the Staff Nurses (N = 60)*

Variable	n	%
Age		
25–30 years	24	40.0
Other age groups	36	60.0
Gender		
Female	42	70.0
Male	18	30.0
Professional qualification		
GNM	35	58.3
B.Sc. Nursing	9	15.0
Post Basic B.Sc. Nursing	13	21.7
M.Sc. Nursing	3	5.0
Experience		
Less than 1 year	29	48.3
1 year or more	31	51.7
Current working area		
Labour room	23	38.3
OBG ward, obstetric emergency and other maternity areas	37	61.7
Previous attendance of training on PPH management		
Yes	44	73.3
No	16	26.7

Note. GNM = General Nursing and Midwifery; OBG = obstetrics and gynaecology; PPH = postpartum hemorrhage. Percentages may not total 100 because of rounding.

Pre-test and post-test levels of knowledge

Before the training, 18 nurses (30.0%) had inadequate knowledge and 42 (70.0%) had moderate knowledge; none had adequate knowledge. After the training, no participant remained in the inadequate category, 12 (20.0%) had moderate knowledge and 48 (80.0%) had adequate knowledge (Table 3).

Table 3: *Distribution of Staff Nurses by Level of Knowledge Regarding the E-MOTIVE Treatment Bundle Before and After Training (N = 60)*

Level of knowledge	Pre-test n	Pre-test %	Post-test n	Post-test %
Inadequate (0–11)	18	30.0	0	0.0
Moderate (12–18)	42	70.0	12	20.0
Adequate (19–24)	0	0.0	48	80.0
Total	60	100.0	60	100.0

Note. Values in parentheses are knowledge-score ranges (maximum score 24).

Effectiveness of the nurse-led training programme

The mean knowledge score increased from 12.40 (SD 1.14; 51.7% of the maximum score) at pre-test to 21.06 (SD 2.10; 87.8%) at post-test. The mean gain of 8.66 points (95% CI 8.04–9.28) was statistically significant ($t(59) = 28.12$, $p < 0.001$), and the effect size was very large (Cohen's $dz = 3.63$) (Table 4). The calculated t value exceeded the critical value of 2.00 at 59 degrees of freedom; H_{01} was therefore rejected and H_1 was accepted.

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Table 4:*Comparison of Pre-Test and Post-Test Knowledge Scores Regarding the E-MOTIVE Treatment Bundle (N = 60)*

Assessment	M	SD	Mean %	Mean difference [95% CI]	t(59)	p
Pre-test	12.40	1.14	51.7			
Post-test	21.06	2.10	87.8	8.66 [8.04, 9.28]	28.12	< .001

Note. Maximum possible score = 24. Mean % = (mean score ÷ 24) × 100. CI = confidence interval; M = mean; SD = standard deviation. Paired t-test, two-tailed; critical t(59) at α = .05 = 2.00. Cohen's dz = 3.63.

Association between pre-test knowledge and demographic variables

Pre-test knowledge level was significantly associated with previous attendance of training related to PPH management ($p < 0.05$). No significant association was found with age, gender, professional qualification, years of experience or current working area ($p > 0.05$) (Table 5). H_2 was therefore accepted for previous PPH-management training and rejected for the other demographic variables.

Table 5:*Association Between Pre-Test Knowledge Level and Selected Demographic Variables (N = 60)*

Demographic variable	Test	p	Inference
Age	χ^2	> .05	Not significant
Gender	χ^2	> .05	Not significant
Professional qualification	χ^2	> .05	Not significant
Experience	χ^2	> .05	Not significant
Current working area	χ^2	> .05	Not significant
Previous attendance of training on PPH management	χ^2	< .05	Significant

Note. Pre-test knowledge level (inadequate vs. moderate) was cross-tabulated against each variable; no participant had adequate knowledge at pre-test. χ^2 = Pearson's chi-square test; PPH = postpartum hemorrhage.

Discussion

This study found that a single 20-minute nurse-led audio-visual training session was associated with a substantial improvement in staff nurses' knowledge of the E-MOTIVE treatment bundle. Before training, no nurse had adequate knowledge and almost one-third had inadequate knowledge; five days after training, four-fifths had adequate knowledge, and the mean score rose by 8.66 of a possible 24 points, an effect that was both statistically significant and large.

The baseline findings are consistent with earlier reports of gaps in PPH-related knowledge among Indian maternity-care providers. Jayanna et al. reported that fewer than two-fifths of providers in northern Karnataka would assess uterine tone in a PPH scenario and only 40% could correctly define early PPH [8], and Varghese et al. recorded a mean baseline obstetric-emergency knowledge score of 49% among providers in Karnataka secondary-level facilities [19]. The mean pre-test score in the present study (51.7%) is of a similar order. The absence of adequate knowledge at baseline, despite nearly three-quarters of nurses having attended some PPH training, suggests that the bundled, time-critical logic of E-MOTIVE — objective detection followed by simultaneous first-response actions — was not part of their previous training. The bundle is relatively new; WHO incorporated it into its recommendations only in 2023 [3].

The improvement after training is in line with previous educational studies on PPH. Evans et al. reported significant gains in knowledge and confidence among

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skilled and semi-skilled birth attendants in India, Malawi and Zanzibar after a single-day, simulation-based *Helping Mothers Survive: Bleeding after Birth* course [13]. Faustine et al. reported significant improvement in knowledge and skills among Tanzanian student nurse-midwives after simulation-based education on PPH prevention and management [14], and Varghese et al. observed a significant increase in providers' obstetric knowledge (from 49% to 57%) after a skills-and-drills intervention in Karnataka [19]. Mobile simulation workshops in India [20] and the PROMPT multi-professional programme in Australia [21] were also associated with improved knowledge, teamwork and earlier recognition of PPH. The larger gain in the present study is plausibly explained by the narrow focus of the training on a single, clearly structured protocol, the close alignment between the training content and the questionnaire, and the short interval of five days between training and post-test.

The significant association between pre-test knowledge and previous attendance of PPH-management training indicates that earlier in-service education leaves a measurable foundation on which E-MOTIVE-specific training can build, a finding in keeping with the better performance of trained cadres reported by Jayanna et al. [8]. In contrast, age, gender, qualification, experience and working area were not associated with knowledge, suggesting that structured training rather than seniority or academic qualification determines familiarity with newer evidence-based protocols. This supports offering E-MOTIVE training to all nurses in maternity units rather than to selected cadres.

Knowledge is a necessary but not sufficient condition for improved care. In the E-MOTIVE trial, the large reduction in severe bleeding outcomes was achieved when the bundle was supported by calibrated drapes, simulation training, champions, and audit and feedback [9,11], and Varghese et al. showed that improved provider knowledge and skills alone did not translate into better diagnosis and management of complications when health-system barriers such as staff shortages and supply-chain gaps persisted [19]. Brief nurse-led training should therefore be regarded as one component of a broader implementation package that also ensures the availability of calibrated drapes, oxytocics, tranexamic acid and intravenous fluids, and clear escalation pathways.

Generalizability

The participants were staff nurses with a wide range of qualifications (GNM to M.Sc. Nursing) and experience, drawn from both government and private hospitals of a large city in northern India, and the training required only a laptop, a projector and 20 minutes of staff time. The findings are therefore likely to be applicable to nurses and nurse-midwives working in labour rooms and maternity wards of comparable secondary- and tertiary-level hospitals in Uttar Pradesh and other Indian states, and in other low- and middle-income settings where PPH is a major cause of maternal death and in-service training resources are limited. Generalisation should nevertheless be cautious. The sample was selected by convenience from three hospitals in one city, nurses already trained in E-MOTIVE were excluded, and facility characteristics such as delivery load, staffing and drug availability differ widely between settings. The results may not apply directly to primary health centres, to auxiliary nurse-midwives or other cadres, to nurses with substantially different baseline training, or to settings where the bundle has already been implemented. Confirmation in multicentre studies with probability sampling in diverse settings is needed.

Strengths and limitations

The strengths of the study include the use of a brief, low-cost and reproducible intervention based on current WHO recommendations, standardised delivery, complete follow-up of all participants, and analysis of paired data with estimation of the CI and effect size. Its limitations should also be considered. First, the absence of a control group means that the improvement cannot be attributed to the training with certainty; testing effects from repeating the same questionnaire, discussion among colleagues and other concurrent learning may have contributed. Second, convenience sampling from three hospitals in one city limits representativeness. Third, neither participants nor assessors were blinded. Fourth, the post-test was conducted after only five days, so long-term retention could not be assessed. Fifth, the study measured knowledge only; clinical skills, adherence to the bundle in practice and maternal outcomes were not evaluated. Finally, clustering within hospitals was not accounted for in the analysis.

Conclusion

Nurse-led audio-visual training was effective in improving staff nurses' knowledge of the E-MOTIVE treatment bundle for the management of PPH. The proportion of nurses with adequate knowledge rose from 0% to 80%, and the mean knowledge score increased significantly from 12.40 to 21.06 out of 24. Previous PPH-management training was the only demographic factor associated with baseline knowledge.

Recommendations

1. Hospital and nursing administrators should include structured E-MOTIVE training in the induction and annual in-service education of all nurses posted in labour rooms, obstetric wards and obstetric emergency units, irrespective of qualification or experience.
2. Knowledge-based sessions should be reinforced with regular simulation drills on objective blood-loss measurement, uterine massage, administration

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of the bundle drugs, and escalation, together with the provision of calibrated drapes and bundle supplies.

3. Nursing educational institutions should incorporate the E-MOTIVE approach into the midwifery curricula of GNM, B.Sc. and post-graduate nursing programmes.
4. Future research should use quasi-experimental or randomised designs with control groups, probability sampling, larger multicentre samples and longer follow-up to evaluate knowledge retention, skills, bundle adherence in clinical practice and maternal outcomes.

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List of abbreviations

ACOG – American College of Obstetricians and Gynecologists
B.Sc. – Bachelor of Science
CI – Confidence interval
E-MOTIVE – Early detection of PPH, uterine Massage, Oxytocic drugs, Tranexamic acid, Intravenous fluids, and Examination and escalation of care
GNM – General Nursing and Midwifery
HDU – High-dependency unit
ICU – Intensive care unit
LCD – Liquid-crystal display
M – Mean
M.Sc. – Master of Science
OBG – Obstetrics and gynaecology
PPH – Postpartum hemorrhage
PROMPT – Practical Obstetric Multi-Professional Training
RCOG – Royal College of Obstetricians and Gynaecologists
SD – Standard deviation
SPSS – Statistical Package for the Social Sciences
TREND – Transparent Reporting of Evaluations with Nonrandomized Designs
WHO – World Health Organization
χ^2 – Chi-square

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Conflict of interest

The authors declare that they have no conflict of interest.

Data availability

The de-identified dataset generated and analysed during the current study and the data-collection instrument are available from the corresponding author on reasonable request. The data are not publicly available in order to protect participant confidentiality.

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