

Knowledge, Attitudes and Practices Toward Maternal Mental Health Among Nurses and Midwives in Neonatal Intensive Care Units in Rwanda: A Multicenter Cross-Sectional Study

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Abstract:

➤ *Background:*

Mothers of preterm and critically ill newborns admitted to neonatal intensive care units may experience anxiety, depression, and psychological distress. Nurses and midwives are well positioned to recognize maternal mental health difficulties and facilitate support and referral. However, evidence on their preparedness to provide maternal mental health support in Rwanda remains limited. This study assessed knowledge, attitudes, and practices regarding maternal mental health and factors associated with practice in selected Rwandan referral hospitals.

➤ *Methods:*

A multicenter analytical cross-sectional study was conducted among 123 nurses and midwives working in neonatal intensive care units of four Rwandan referral hospitals. A census approach was used, with 123 of 125 eligible participants providing analyzable data. Data were collected using a 54-item questionnaire. Knowledge was classified using an 80 percent threshold, while attitude and practice were classified using a 70 percent threshold. Internal consistency was assessed using appropriate reliability coefficients. Bivariate analyses were conducted using SPSS version 25, and multivariable logistic regression using R version 4.6.1. Firth penalized logistic regression was used for knowledge and practice models because of sparse data.

➤ *Results:*

Among 123 participants, 109 were female, 56 were aged 30 to 39 years, and 67 had more than five years of neonatal intensive care experience. Only 21 participants had received maternal mental health training, and 32 reported availability of maternal mental health guidelines. Overall, 101 participants demonstrated good knowledge and 97 had positive attitudes, whereas only 29 demonstrated good practice. In the adjusted practice model, workplace and mentorship were independently associated with good practice. Knowledge and attitude were not significantly associated with practice in bivariate analysis.

➤ *Conclusions:*

Nurses and midwives demonstrated good knowledge and positive attitudes toward maternal mental health, but these were not consistently reflected in practice. Strengthening maternal mental health care in Rwandan neonatal intensive care units may require structured mentorship, accessible guidelines, and supportive supervision.

Keywords: Attitudes; Knowledge; Maternal Mental Health; Midwives; Neonatal Intensive Care Unit; Nurses; Practice; Rwanda.

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I. INTRODUCTION

Maternal mental health is an important component of maternal and child health. Depression, anxiety, and psychological distress commonly occur during pregnancy and the postpartum period. Globally, mental health conditions affect approximately 10% of pregnant women and 13% of postpartum women, with depression and anxiety among the most common conditions (1). When unrecognized or untreated, maternal mental health problems can adversely affect maternal functioning, mother–infant bonding, breastfeeding, caregiving, adherence to neonatal care, and infant outcomes (2,3).

Mothers whose newborns are admitted to neonatal intensive care units (NICUs) are particularly vulnerable to psychological distress. Neonatal illness, prematurity, prolonged hospitalization, uncertainty about the infant's survival, separation from the newborn, and disruption of expected maternal roles can contribute to anxiety, stress, sadness, and depressive symptoms (4,5). A meta-analysis reported substantial levels of anxiety (51%), stress (41%), and depressive symptoms (31%) among mothers of hospitalized infants (6). NICU-related psychological distress may be situational and does not necessarily meet diagnostic criteria for depression; however, it can adversely affect breastfeeding, mother–infant attachment, caregiving ability, and adherence to neonatal treatment (2,3).

NICU nurses are well positioned to contribute to maternal mental health care because of their frequent and sustained contact with mothers during neonatal hospitalization. Their role may include recognizing signs of psychological distress, providing empathetic communication and emotional support, educating mothers, facilitating mother–infant interaction, supporting mental health screening, and referring mothers who require specialized care (7,8). Nurses' knowledge, attitudes, and practices are therefore important components of their capacity to integrate maternal mental health support into routine neonatal care (9–11).

The burden of maternal mental health problems among mothers of hospitalized or vulnerable newborns is particularly important in low- and middle-income countries (LMICs), where mental health services may be insufficiently integrated into routine maternal and primary healthcare. Evidence from LMICs has identified gaps in the availability of maternal mental health services, screening and referral mechanisms, as well as limitations in provider preparation and health-system capacity (12,13). Research from African settings has similarly identified inadequate preparation and training of healthcare providers, limited resources, high workloads, and organizational constraints as barriers to the early identification and management of perinatal mental health conditions (7,14).

Studies examining healthcare providers' knowledge and practices have also reported important gaps in their ability to recognize and respond to perinatal depression and other maternal mental health problems (9,15).

Rwanda also faces a substantial maternal mental health burden. In a study conducted among women receiving antenatal care in Southern Province, 26.6% had antenatal depressive symptoms (16). In another Rwandan study conducted among women in the antenatal and postnatal periods, 37.6% had symptoms indicating possible antenatal depression. In contrast, among postnatal women, 63.6% had symptoms of possible depression and 48.1% had symptoms of probable anxiety (17). Maternal mental health concerns may be particularly important among mothers of vulnerable newborns. In rural Rwanda, Abimana et al. (2020) found that 51.6% of mothers of children born preterm, with low birth weight or hypoxic-ischemic encephalopathy reported poor mental health. These findings demonstrate a substantial burden of maternal mental health problems across different Rwandan populations, including mothers of children with neonatal vulnerabilities (18).

Despite the need for maternal mental health support, its integration into neonatal care remains limited. Evidence indicates that inadequate training, limited screening skills, inconsistent referral pathways, and low confidence in recognizing and responding to maternal psychological distress may constrain healthcare providers' capacity to provide appropriate support (19). Organizational factors, including limited availability of guidelines, inadequate staffing, insufficient time for emotional support, and limited institutional support, may further constrain nurses' ability to translate knowledge and positive attitudes into routine practice (12,13). Addressing both provider-level and health-system barriers is therefore important for strengthening the integration of maternal mental health into neonatal care.

The integration of maternal mental health support into neonatal care may also be constrained by provider-level and organizational factors. Evidence from African and other LMIC settings indicates that inadequate training, limited knowledge and screening skills, low confidence, insufficient time and competing clinical demands can hinder healthcare providers' ability to identify and respond to maternal psychological distress (7,11,14). In neonatal settings specifically, nurses have described limited time for communication with parents, staffing-related constraints, and the need for continuing education and organizational support as factors affecting their ability to provide emotional support (8). These findings suggest that strengthening maternal mental health support in NICUs requires attention not only to nurses' knowledge and attitudes but also to the organizational environment in which care is delivered.

Existing Rwandan studies have primarily examined the prevalence, associated factors, and access to care for maternal mental health conditions, as well as healthcare providers' knowledge and practices regarding perinatal depression, rather than specifically examining the knowledge, attitudes, and practices of nurses providing care in NICU settings (16,17,19,20). Evidence specifically assessing NICU nurses' knowledge, attitudes, and practices toward maternal mental health in Rwanda remains limited. This evidence gap restricts the availability of context-specific information needed to inform healthcare-provider training, clinical guidelines, screening, referral pathways, and integration of maternal mental health into neonatal services.

Therefore, this study assessed nurses' knowledge, attitudes, and practices toward maternal mental health in NICUs of four selected Rwandan referral hospitals. Specifically, it examined nurses' knowledge of maternal mental health, attitudes toward supporting mothers, maternal mental health support practices, and factors associated with these outcomes.

II. MATERIALS AND METHODS

➤ *Study Design*

We used a quantitative, analytical, multicenter cross-sectional design to assess nurses' knowledge, attitudes, and practices (KAP) toward Maternal Mental Health (MMH) in neonatal intensive care units (NICUs) at selected Rwandan referral hospitals. This design was selected to measure the distribution of KAP outcomes at a single point in time and to examine associations between sociodemographic, professional, and organizational factors and these outcomes. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist for cross-sectional studies (21).

➤ *Study Setting*

The study was conducted in the neonatal intensive care units of four selected referral and teaching hospitals in Rwanda: Centre Hospitalier Universitaire de Kigali (CHUK), King Faisal Hospital Rwanda (KFH), Rwanda Military Referral and Teaching Hospital (RMARTH), and Centre Hospitalier Universitaire de Butare (CHUB). These hospitals were purposefully selected because they are primary national and regional referral centers for critically ill neonates, and they receive high-risk cases from district and provincial hospitals across the country. All four NICUs provide 24-hour specialized neonatal intensive care, including surgery, continuous positive airway pressure (CPAP), mechanical ventilation, phototherapy, and incubator care. At the time of the study, the estimated NICU bed capacity ranged from 8–12 beds at KFH to 20–40 beds at CHUK and RMARTH, and 15–20 beds at CHUB. These units are characterized by high patient turnover, prolonged neonatal hospitalization, and frequent mother–infant separation, all of which increase the risk of maternal psychological distress (22).

➤ *Study Population and Eligibility Criteria*

The study population comprises all registered nurses and midwives working (directly involved in neonatal care and

maternal support) in NICUs of the four selected hospitals. The accessible population consisted of 152 nurses and midwives working in these NICs during the study period.

Inclusion criteria: Participants were eligible if they (i) were a registered nurse or midwife, (ii) had worked in the NICU for at least six months, (iii) were directly involved in providing neonatal care and interacting with mothers, and (iv) provided informed consent.

Exclusion criteria: Nurses and midwives were excluded if they (i) worked outside the NICU, (ii) had less than six months of NICU experience, (iii) were on leave (annual, sick, or maternity) during the data collection period, (iv) declined to participate, or (v) submitted an empty questionnaire with no analyzable data.

After applying the above criteria to the source populations, 125 nurses and midwives met the eligibility criteria to participate in this study.

➤ *Sampling Strategy*

A census approach was used. All nurses and midwives who met the eligibility criteria in the four participating NICUs were invited to participate; therefore, no probability or non-probability sampling procedure was applied.

In this research, a census was considered appropriate because the eligible workforce within the participating NICUs was relatively small and accessible. Consequently, the study size was determined by the number of eligible nurses and midwives available during the study period rather than by a conventional sample-size calculation.

Two participants submitted completely blank questionnaires, resulting in a 98.4% response rate. The final participant distribution was 59 from CHUK, 27 from RMARTH, 21 from KFH, and 16 from CHUB. Because the blank questionnaires contained no substantive responses and could not contribute to any study variable, they were removed from the analytical dataset before analysis.

➤ *Variables and Measurement*

➤ *Dependent Variables*

The primary dependent variables were nurses' and midwives' knowledge, attitudes, and practices toward maternal mental health. In this research, each domain was measured using items adapted from previously validated instruments and the WHO Guide to Developing Knowledge, Attitude and Practice Surveys.

Knowledge was assessed using 14 true/false items covering recognition of maternal mental health problems, risk factors, consequences, screening tools (including the Edinburgh Postnatal Depression Scale [EPDS]), and appropriate nursing responses. Correct answers were scored 1 point and incorrect answers 0 points. Total knowledge scores ranged from 0 to 14 and were converted to percentages. Using Bloom's cut-off criteria, a score of $\geq 80\%$ was classified as good knowledge and a score of $< 80\%$ as poor knowledge.

Attitudes were assessed using 13 items measured on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). We reverse-scored negatively worded items (items 3, 7, and 12). Item scores were summed and converted to percentages. A score of $\geq 70\%$ was classified as a positive attitude and a score of $< 70\%$ as a negative attitude.

Practices were assessed using 12 items measuring the frequency of specific clinical actions (1 = Never to 5 = Always). Item scores were summed and converted to percentages. A score of $\geq 70\%$ was classified as good practice and a score of $< 70\%$ as poor practice.

➤ *Independent Variables*

Independent variables were selected based on the KAP theoretical framework and prior literature and included:

Sociodemographic factors: Age (20–29, 30–39, 40–49, ≥ 50 years), sex (male/female), and highest level of education (advanced certificate, undergraduate degree, postgraduate degree).

Professional factors: current role (nurse, midwife, senior nurse, senior midwife, nurse specialist), years of NICU experience (6 months– < 2 years, 2–5 years, > 5 years), and previous maternal mental health training (yes/no).

Institutional and organizational factors: availability of maternal mental health guidelines in the NICU (yes/no), availability of a mental health professional (psychologist, counsellor, or social worker) to support mothers (yes/no), perceived staffing adequacy (adequate/inadequate), sufficient time allocated for emotional support (yes/no), management support for maternal mental health activities (yes/no), and receipt of mentorship or supervision related to maternal mental health (yes/no).

➤ *Instrument Development and Validation*

The structured KAP questionnaire was adapted from a validated instrument developed by Nortey and Asampong (2024) for assessing nurses' knowledge, attitudes, and practices toward perinatal depression in Ghana (9). Items were also informed by the World Health Organization's Guide to Developing Knowledge, Attitude and Practice Surveys (23). Furthermore, adaptations were made to align the final questionnaire (Supplementary file 1) with the Rwandan NICU context and to include the specific organizational and professional factors relevant to referral hospitals in Rwanda. Also, permission to adapt the original instrument was obtained from the developers. The questionnaire consisted of 54 items organized into four sections:

- Section A: Sociodemographic and professional characteristics (14 items)
- Section B: Knowledge of maternal mental health (14 items)
- Section C: Attitudes toward maternal mental health (13 items)
- Section D: Practices related to maternal mental health support (12 items)

Before data collection, five experts in neonatal nursing, maternal mental health, and research methodology from the University of Rwanda independently assessed the questionnaire's content validity. The Content Validity Index (CVI) was 0.87, indicating acceptable content validity. Face validity was established through pilot testing with 12 NICU nurses and midwives from Kabutare District Hospital, who were not included in the main study sample. The pilot assessed clarity, comprehensibility, and flow of the questions, and minor refinements were made to the wording of three items based on pilot feedback. Internal consistency was assessed in the main study sample ($n = 123$). The knowledge subscale, which consisted of binary (True/False) items, was assessed using the Kuder-Richardson Formula 20 (KR-20), yielding a coefficient of 0.666 (14 items). The attitude subscale (13 items) and practice subscale (12 items) were assessed using Cronbach's alpha, yielding coefficients of 0.862 and 0.775, respectively. The final questionnaire was administered in English, the working language of nursing documentation and education in Rwanda, and was delivered electronically using KoboToolbox.

➤ *Data Collection Procedures*

Data were collected over two weeks between April and May 2026, one hospital at a time. Following hospital-level authorization, each eligible participant received a WhatsApp invitation containing study information and a secure KoboToolbox link. Participants first viewed an electronic information sheet and provided consent via a mandatory agreement item with programmed skip logic; only those who agreed proceeded to the questionnaire. The survey remained open for seven days per hospital. Participation was voluntary, and participants could skip any question without consequences or explanation. They were also informed of their right to withdraw from the study at any time. No financial incentives or reminders were provided. Two trained research assistants, under the supervision of the principal investigator, were available on site to address technical issues.

➤ *Data Management and Handling of Empty Questionnaires*

Data were exported from KoboToolbox into IBM SPSS Statistics version 25 for cleaning, descriptive analysis, reliability analysis, and bivariate analysis. Data cleaning involved checking completeness, coding consistency, duplicate records, and out-of-range values. Two completely blank questionnaires were identified and excluded before analysis. The final analytical dataset contained 123 participants.

For the remaining 123 participants, no missing data were identified for variables included in the multivariable models because the electronic questionnaire used mandatory fields. Consequently, complete-case analysis was used for the regression models.

➤ *Statistical Analysis*

➤ *Descriptive Analysis*

Frequencies and percentages were used to summarize participants' sociodemographic and professional characteristics, institutional factors, and item-level responses

for knowledge, attitudes, and practices. Knowledge, attitude, and practice scores were summarized using means, standard deviations, and ranges, and were categorized according to predefined cut-off points.

➤ Reliability Analysis

Internal consistency of the questionnaire subscales was assessed. The knowledge subscale consisted of binary (True/False) items and was assessed using the Kuder–Richardson Formula 20 (KR-20). The attitude and practice subscales consisted of Likert-type items and were assessed using Cronbach's alpha. The knowledge subscale demonstrated a KR-20 of 0.666 (14 items), the attitude subscale demonstrated a Cronbach's alpha of 0.862 (13 items), and the practice subscale demonstrated a Cronbach's alpha of 0.775 (12 items).

➤ Bivariate Analysis

Bivariate analysis was conducted to examine associations between each independent variable and the three study outcomes (knowledge, attitudes, and practices). The chi-square test or Fisher's exact test was used for categorical variables, as appropriate. Variables with a bivariate p-value < 0.05 were considered for inclusion in the multivariable models.

➤ Multivariable Analysis

Binary logistic regression was used to identify factors independently associated with knowledge, attitudes, and practices. Three separate models were constructed:

- Model 1: Good knowledge ($\geq 80\%$) vs. poor knowledge ($< 80\%$)
- Model 2: Positive attitude ($\geq 70\%$) vs. negative attitude ($< 70\%$)
- Model 3: Good practice ($\geq 70\%$) vs. poor practice ($< 70\%$)

Before multivariable modelling, multicollinearity among predictor variables was assessed using tolerance and variance inflation factor statistics. All predictors included in the models had acceptable collinearity diagnostics.

The events-per-variable ratio was calculated for each model. The knowledge model had an events-per-variable ratio of 7.3, the attitude model 13.0, and the practice model 4.8. Because the knowledge and practice models had relatively few outcome events per predictor, Firth penalized logistic regression was used for these models to reduce small-sample bias and address potential separation. Conventional logistic regression was retained for the attitude model.

For each model, variables with a bivariate p-value below 0.05 were entered simultaneously. Adjusted odds ratios with 95% confidence intervals were reported. Statistical significance was assessed at $p < 0.05$.

➤ Model Diagnostics

Model fit was assessed using the likelihood ratio test and the Hosmer–Lemeshow goodness-of-fit test. A p-value > 0.05 on the Hosmer–Lemeshow test indicated adequate fit. The knowledge model ($p = 0.990$), attitude model ($p = 0.517$), and practice model ($p = 0.578$) demonstrated adequate fit.

➤ Ethical Considerations

Before data collection, ethical approval was obtained from the University of Rwanda College of Medicine and Health Sciences Institutional Review Board (ref. CMHS/IRB/123/2026). Administrative authorization was obtained from each participating hospital: CHUK (14 April 2026), CHUB (April 2026), KFH (ref. KFH/2026/421/IRB, 27 April 2026), and RMRTM (March 2026). All participants provided informed consent electronically via a mandatory agreement item after reviewing an information sheet. Participation was voluntary, and participants could withdraw at any time without penalty. No identifying information was collected. Data were stored securely and will be retained for five years before permanent deletion. The study adhered to the Declaration of Helsinki and Rwanda's Data Protection Law (24).

➤ Patient and Public Involvement

Patients and the public were not involved in the design, conduct, or reporting of this study.

III. RESULTS

➤ Sociodemographic Characteristics

A total of 123 participants were included in the analysis. The sociodemographic characteristics of participants are presented in Table 1. Most participants were aged 30–39 years ($n = 56$, 45.5%), followed by those aged 40–49 years ($n = 47$, 38.2%). Participants aged ≥ 50 years accounted for 8.9% ($n = 11$), while those aged 20–29 years represented 7.3% ($n = 9$). No participants were in the 10–19 years age category. The majority of participants were female ($n = 109$, 88.6%), while males accounted for 11.4% ($n = 14$). Nearly half of the participants were recruited from CHUK ($n = 59$, 48.0%), while 22.0% ($n = 27$) were from RMTH, 17.1% ($n = 21$) from KFH, and 13.0% ($n = 16$) from CHUB.

Table 1 Sociodemographic Characteristics of Participants ($n = 123$)

Characteristic	Category	n	%
Age (years)	10–19	0	0.0
	20–29	9	7.3
	30–39	56	45.5
	40–49	47	38.2
	≥ 50	11	8.9
Gender	Male	14	11.4
	Female	109	88.6

Study hospital	CHUK	59	48.0
	RMTH	27	22.0
	KFH	21	17.1
	CHUB	16	13.0

➤ Professional and Institutional Characteristics

The professional and institutional characteristics of participants are presented in Table 2. Nurses constituted the largest professional group ($n = 91$, 74.0%), followed by senior nurses ($n = 12$, 9.8%), midwives ($n = 9$, 7.3%), nurse specialists ($n = 9$, 7.3%), and senior midwives ($n = 2$, 1.6%). More than half of participants ($n = 64$, 52.0%) held a bachelor's degree, 38.2% ($n = 47$) held an advanced diploma, and 9.8% ($n = 12$) held a master's degree.

More than half of participants ($n = 67$, 54.5%) had more than five years of NICU/neonatology experience, while 25.2% ($n = 31$) had 2–5 years and 20.3% ($n = 25$) had 6 months to less than 2 years of experience. Regarding maternal mental health preparedness, 17.1% ($n = 21$) reported having received maternal mental health training. Among those who received training, 12 had completed a formal course, 7 had attended an

in-service workshop, and 4 had received other types of training.

Maternal mental health guidelines or protocols were reported to be available in the NICU by 26.0% ($n = 32$) of participants, while 57.7% ($n = 71$) reported that a mental health professional was available. Only 26.8% ($n = 33$) reported adequate staffing during most NICU shifts. Among the 121 participants who responded to the workload item, 76.0% ($n = 92$) reported that workload limited their ability to provide emotional support to mothers. In addition, 39.8% ($n = 49$) reported having sufficient time to address mothers' emotional or psychological needs. Management support for maternal mental health activities was reported by 65.9% ($n = 81$) of participants, whereas 22.8% ($n = 28$) reported having previously received supervision, mentorship, or guidance related to maternal mental health in the NICU.

Table 2 Professional and Institutional Characteristics of Participants ($n = 123$)

Characteristic	Category	n	%
Current professional role	Nurse	91	74.0
	Midwife	9	7.3
	Senior Nurse	12	9.8
	Senior Midwife	2	1.6
	Nurse Specialist	9	7.3
Highest education level	Advanced Diploma	47	38.2
	Bachelor's degree	64	52.0
	Master's degree	12	9.8
NICU/neonatology experience	6 months to <2 years	25	20.3
	2–5 years	31	25.2
	>5 years	67	54.5
Maternal mental-health training	No	102	82.9
	Yes	21	17.1
Type of maternal mental-health training	In-service workshop	7	30.4
	Formal course	12	52.2
	Other	4	17.4
Maternal mental-health guidelines/protocols available in NICU	No	91	74.0
	Yes	32	26.0
Mental health professional available in NICU?	No	52	42.3
	Yes	71	57.7
Staffing level during most NICU shifts	Adequate	33	26.8
	Inadequate	90	73.2
Workload limits the ability to provide emotional support	No	29	24.0
	Yes	92	76
	Missing	2	-
Sufficient time to address mothers' emotional/psychological needs	No	74	60.2
	Yes	49	39.8
Management support for maternal mental-health activities	No	42	34.1
	Yes	81	65.9
Previous supervision, mentorship or guidance on maternal mental health	No	95	77.2
	Yes	28	22.8

- Note: Percentages for the type of MMH training are based on the 21 participants who reported receiving training. Two participants did not respond to the workload item; percentages for this item are based on $n = 121$.

➤ Knowledge Regarding Maternal Mental Health

Participants' responses to individual knowledge items are presented in Table 3. Knowledge was generally high across most items. All participants ($n = 123$, 100%) correctly identified that maternal mental health affects mother–infant bonding, and 95.9% ($n = 118$) recognised that a previous history of depression increases the risk of postpartum mental health problems. Similarly, 95.9% ($n = 118$) knew that NICU-related stress may trigger maternal depression, and 94.3% ($n = 116$) understood that poor maternal mental health affects infant feeding and growth.

However, important knowledge gaps remained. Only 65.9% ($n = 81$) correctly identified that the Edinburgh Postnatal Depression Scale (EPDS) is used to screen for perinatal maternal depression, while 34.1% ($n = 42$) incorrectly believed that EPDS is not a screening tool. Furthermore, 45.5% ($n = 56$) incorrectly believed that postpartum depression is rare among mothers with hospitalised neonates, and 17.9% ($n = 22$) incorrectly believed that only psychiatrists can identify mothers with mental health problems.

Table 3 Item-Level Knowledge of Maternal Mental Health Among NICU Nurses and Midwives ($n = 123$)

Item	Correct response	n	%
Maternal mental health problems can affect bonding between mother and baby	True	123	100.0
Postpartum depression is rare among mothers with hospitalized neonates	False	67	54.5
Mothers with a previous history of depression are at higher risk	True	118	95.9
Stress from having a sick or preterm baby in NICU may trigger maternal depression	True	118	95.9
EPDS is used to screen for perinatal maternal depression	True	81	65.9
Only psychiatrists can identify mothers with mental health problems	False	101	82.1
Poor maternal mental health can affect infant feeding and growth	True	116	94.3
Early recognition and support improve maternal recovery	True	118	95.9
Counselling and peer support can help mothers cope during NICU admission	True	118	95.9
Nurses play an important role in detecting maternal mental health problems	True	116	94.3
Maternal mental health refers to the emotional and psychological well-being of mothers	True	109	88.6
Persistent sadness and withdrawal are early signs of maternal mental distress	True	114	92.7
Separation, fear, and lack of support lead to poor maternal mental health in NICU mothers	True	114	92.7
Listening empathetically is an appropriate nursing action for a distressed mother	True	111	90.2

Using the 80% cut-off for knowledge classification, 82.1% of participants ($n = 101$) demonstrated good knowledge, while 17.9% ($n = 22$) demonstrated poor

knowledge (Figure 1). The mean knowledge score was 88.4% ($SD = 12.6$), with scores ranging from 21.4% to 100%.

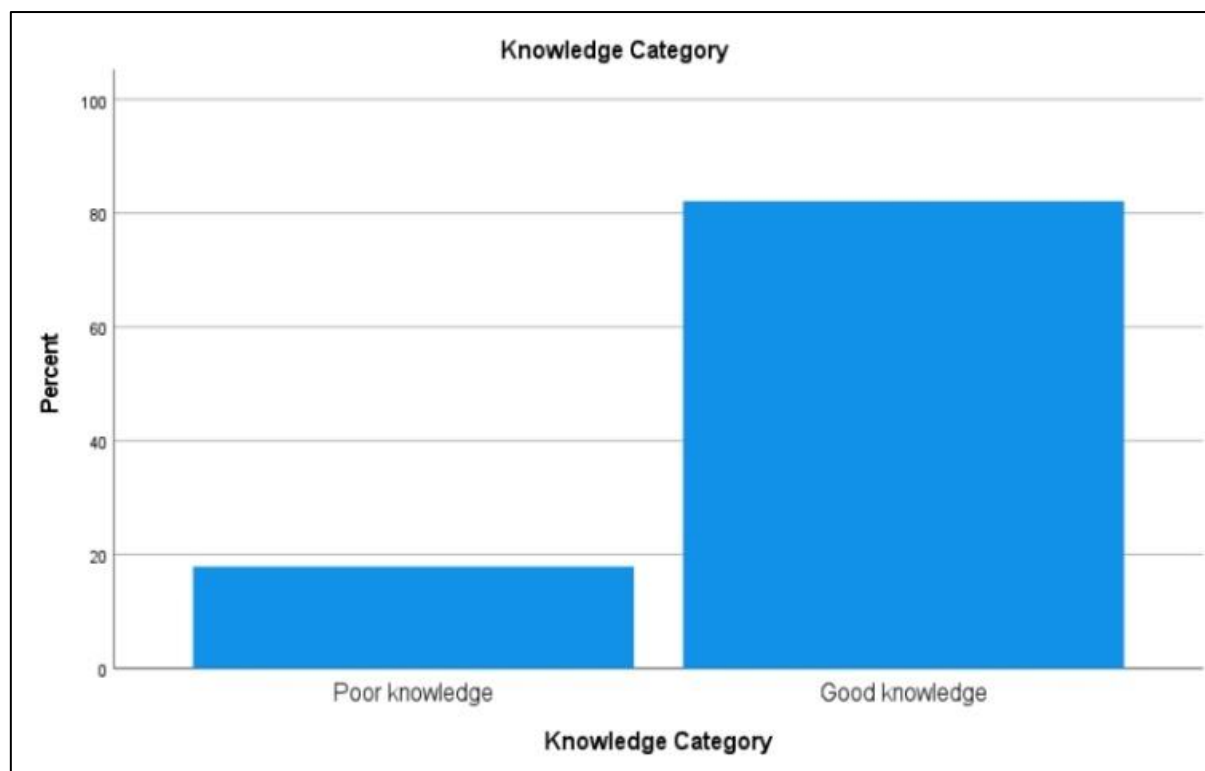


Fig 1 Overall Knowledge Regarding Maternal Mental Health Among NICU Nurses ($n = 123$)

➤ Attitudes Toward Maternal Mental Health

Table 4 presents participants' item-level attitudes toward maternal mental health. Attitudes were generally positive across most items. The highest levels of agreement were observed for the statement that maternal mental health training should be included in NICU programs (mean = 4.25, SD = 1.15), followed by the belief that maternal mental well-being improves neonatal outcomes (mean = 4.20, SD = 1.16), that nurses play a vital role in maternal psychological support (mean = 4.16, SD = 1.03), and that nurses should collaborate with mental health professionals (mean = 4.14, SD = 1.06). Participants also strongly agreed that maternal mental health is as important as physical health (mean = 4.11, SD = 1.12) and that emotional support is part of the NICU nurse's duty (mean = 4.06, SD = 1.21). Participants agreed that distressed mothers should be referred for counselling (mean = 4.02, SD

= 1.08) and that encouraging mothers to express feelings improves coping (mean = 4.03, SD = 1.09).

However, lower mean scores were observed for items related to routine screening responsibility (mean = 3.89, SD = 1.06) and comfort in discussing emotional issues with mothers (mean = 3.85, SD = 0.96). Furthermore, misconceptions persisted: the statement that frequent crying reflects weakness rather than illness had a mean of 3.02 (SD = 1.22), indicating that a substantial proportion of participants held this view. The statement that discussing maternal mental health makes nurses uncomfortable had a mean of 2.16 (SD = 1.17), indicating that most participants did not feel uncomfortable, although a minority did. Similarly, the statement that identifying maternal mental health problems is difficult had a mean of 2.72 (SD = 1.23), suggesting that a notable proportion of participants found identification challenging.

Table 4 Item-Level Attitudes Toward Maternal Mental Health in NICUs (n = 123)

Item	N	Minimum	Maximum	Mean	Std. Deviation
Maternal mental health is as important as physical health	123	1	5	4.11	1.115
Emotional support is part of NICU nurse duty	123	1	5	4.06	1.210
Discussing maternal mental health makes me uncomfortable	123	1	5	2.16	1.169
Distressed mothers should be referred for counseling	123	1	5	4.02	1.082
Maternal mental health training should be included in NICU programs	123	1	5	4.25	1.149
Maternal mental well-being improves neonatal outcomes	123	1	5	4.20	1.159
Identifying maternal mental health problems is difficult	123	1	5	2.72	1.232
Nurses should collaborate with mental health professionals	123	1	5	4.14	1.058
Nurses play a vital role in maternal psychological support	123	1	5	4.16	1.027
Maternal mental health screening should be a routine nursing responsibility	123	1	5	3.89	1.057
Comfortable discussing emotional issues with mothers	123	1	5	3.85	.958
Frequent crying reflects weakness rather than illness	123	1	5	3.02	1.224
Encouraging mothers to express feelings improves coping	123	1	5	4.03	1.086

Using the 70% cut-off for attitude classification, 78.9% of participants (n = 97) demonstrated a positive attitude, while

21.1% (n = 26) demonstrated a negative attitude (Figure 2). The overall mean attitude score was 3.93 (SD = 0.62).

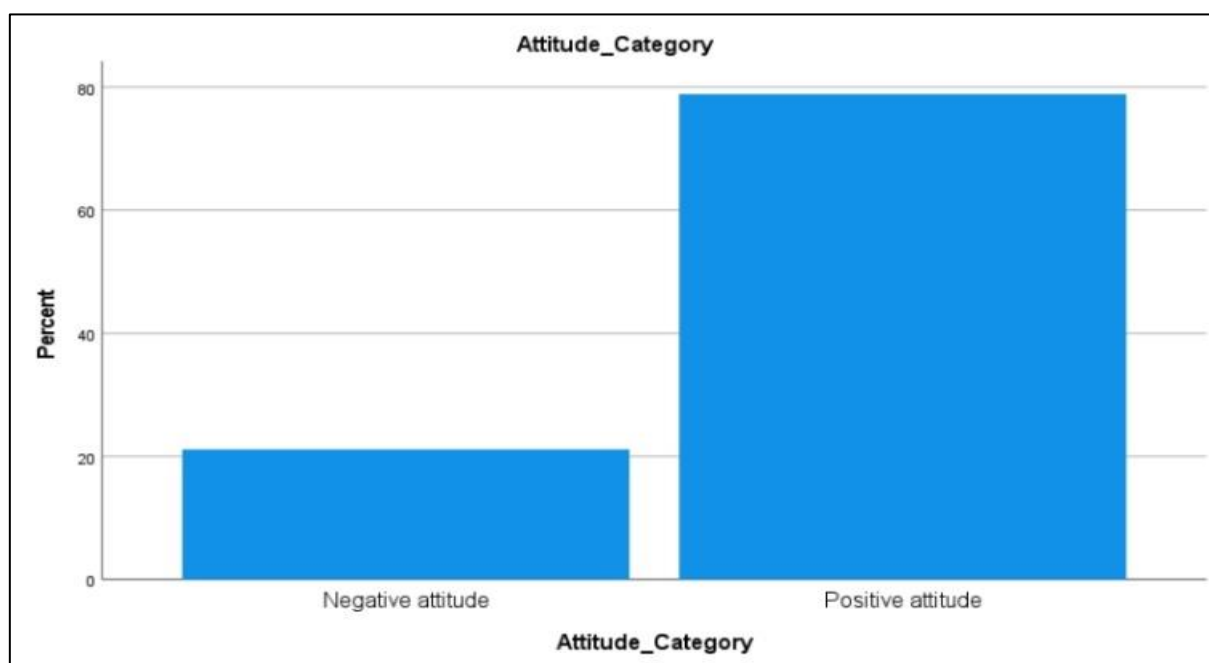


Fig 2 Overall Attitude Toward Maternal Mental Health Among NICU nurses (n = 123)

➤ Practices Toward Maternal Mental Health

The bivariate analysis of factors associated with practice is presented in Table 5. Good practice was significantly associated with working place ($\chi^2 = 18.461$, $df = 3$, $p < 0.001$), NICU experience ($p = 0.031$), maternal mental health training ($\chi^2 = 8.123$, $df = 1$, $p = 0.004$), availability of guidelines ($\chi^2 = 16.759$, $df = 1$, $p < 0.001$), mentorship received ($\chi^2 = 14.047$, $df = 1$, $p < 0.001$), and knowledge category ($p < 0.001$). Nurses from CHUK had the highest proportion of good practice (40.7%), followed by KFH (9.5%), RMTH (7.4%), and CHUB (6.3%). Nurses who had received maternal mental health training had a higher proportion of good practice (47.6%) compared with untrained nurses (18.6%). Similarly, nurses who reported availability of guidelines had a higher proportion of good practice (50.0%) compared with those without

guidelines (14.3%). Nurses with good knowledge had a higher proportion of good practice (27.7%) compared with those with poor knowledge (4.5%).

In contrast, attitude category was not significantly associated with practice ($\chi^2 = 0.346$, $df = 1$, $p = 0.557$). Nurses with a positive attitude had a similar proportion of good practice (24.7%) compared with those with a negative attitude (19.2%). Age ($p = 0.388$), gender ($p = 0.640$), current role ($p = 0.121$), education level ($p = 0.184$), availability of a mental health professional ($p = 0.588$), staffing level ($p = 0.123$), workload limiting support ($p = 0.515$), time for emotional support ($p = 0.135$), and management support ($p = 0.080$) were also not significantly associated with practice.

Table 5 Item-Level Practices Toward Maternal Mental Health in NICUs (n = 123)

Item	N	Minimum	Maximum	Mean	Std. Deviation
Observe and document mothers' emotional state	123	1	5	3.11	1.362
Provide reassurance and emotional support	123	1	5	3.86	1.111
Encourage mothers to talk about feelings	123	1	5	2.20	1.206
Provide education on coping strategies	123	1	5	2.23	1.329
Explain infant condition and care procedures clearly	123	1	5	2.24	1.522
Encourage mothers' participation in infant care	123	1	5	4.58	.950
Refer mothers with depression or anxiety for specialist support	123	1	5	3.67	1.347
Use screening tools for maternal mental health assessment	123	1	5	1.98	1.414
Collaborate with colleagues on maternal mental health concerns	123	1	5	4.00	1.215
Educate families on emotional support for mothers	123	1	5	2.14	1.196
Advocate for maternal mental health policies and resources	123	1	5	3.28	1.462
Participate in maternal mental health trainings/discussions	123	1	5	2.25	1.452

Using the 70% cut-off for practice classification, only 23.6% of participants (n = 29) demonstrated good practice, while 76.4% (n = 94) demonstrated poor practice (Figure 3).

The overall mean practice score was 59.2% (SD = 14.0), with scores ranging from 23.3% to 93.3%.

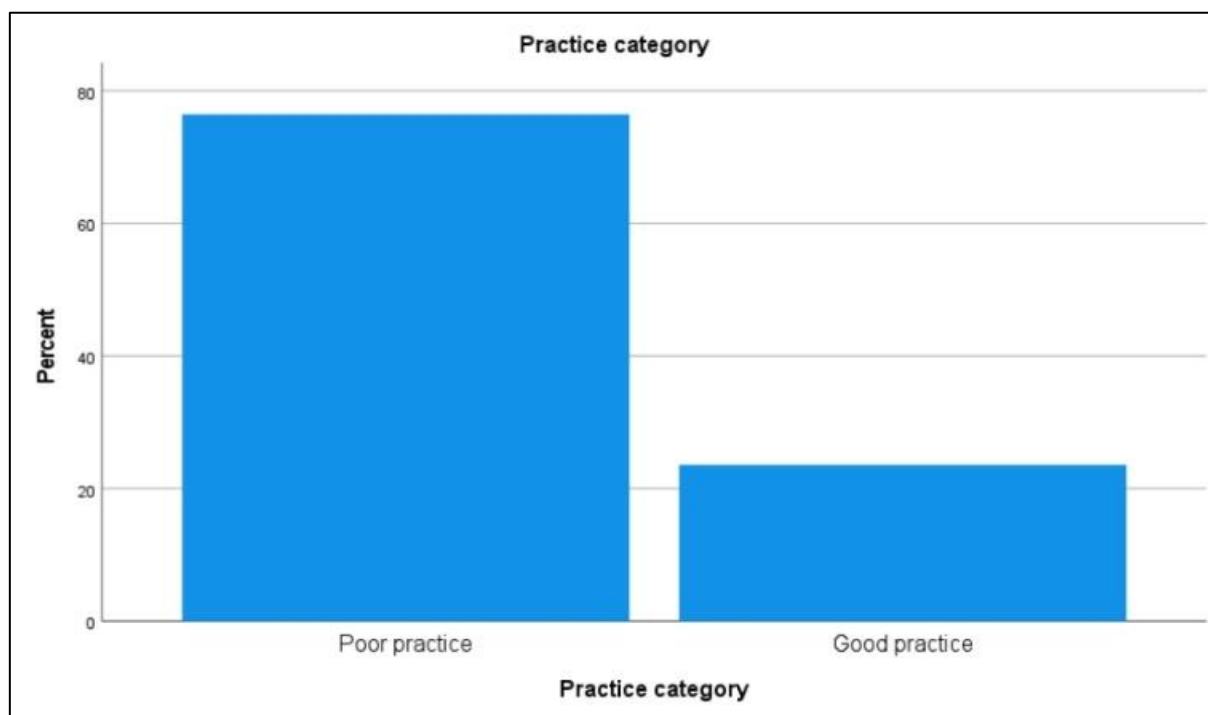


Fig 3 Overall Practices Toward Maternal Mental Health Among NICU Nurses (n = 123).

➤ *Factors Associated with Knowledge, Attitudes, and Practices*

• *Bivariate Analysis*

Bivariate analysis was conducted to examine associations between sociodemographic, professional, and institutional factors and the three outcome variables (knowledge, attitude, and practice). The chi-square test was used for categorical variables, with Fisher's exact test applied where expected cell counts were less than five. Statistical significance was set at $p < 0.05$.

• *Factors Associated with Knowledge*

The bivariate analysis of factors associated with knowledge is presented in Table 6. Maternal mental health training was significantly associated with knowledge ($\chi^2 = 4.114$, $df = 1$, $p = 0.043$), with 66.7% of trained nurses demonstrating good knowledge compared with 85.3% of untrained nurses. NICU experience showed a borderline association ($\chi^2 = 3.809$, $df = 2$, $p = 0.149$), with nurses having more than five years of experience demonstrating the highest proportion of good knowledge (79.1%). Age ($p = 0.294$), gender ($p = 0.064$), workplace ($p = 0.631$), current role ($p = 0.700$), education level ($p = 0.661$), availability of guidelines ($p = 0.882$), availability of a mental health professional ($p = 0.694$), and staffing level ($p = 0.265$) were not significantly associated with knowledge.

Table 6 Bivariate Analysis of Factors Associated with Knowledge (n = 123)

Variable	Category	Poor knowledge n (%)	Good knowledge n (%)	χ^2	p-value
Age group	20–29 years	1 (11.1)	8 (88.9)	3.711	0.294
	30–39 years	0 (0.0)	56 (100.0)		
	40–49 years	2 (4.3)	45 (95.7)		
	≥50 years	0 (0.0)	11 (100.0)		
Gender	Male	0 (0.0)	14 (100.0)	3.441	0.064
	Female	3 (2.8)	106 (97.2)		
Working place	CHUK	13 (22.0)	46 (78.0)	1.728	0.631
	RMTH	3 (11.1)	24 (88.9)		
	KFH	3 (14.3)	18 (85.7)		
	CHUB	3 (18.8)	13 (81.3)		
Current role	Nurse	15 (16.5)	76 (83.5)	2.197	0.700
	Midwife	2 (22.2)	7 (77.8)		
	Senior nurse	2 (16.7)	10 (83.3)		
	Senior midwife	0 (0.0)	2 (100.0)		
	Nurse specialist	1 (11.1)	8 (88.9)		
Education level	Advanced diploma	9 (19.1)	38 (80.9)	0.829	0.661
	Bachelor's degree	12 (18.8)	52 (81.3)		
	Master's degree	1 (8.3)	11 (91.7)		
NICU experience	6 months–<2 years	6 (24.0)	19 (76.0)	3.809	0.149
	2–5 years	2 (6.5)	29 (93.5)		
	>5 years	14 (20.9)	53 (79.1)		
MMH training	No	15 (14.7)	87 (85.3)	4.114	0.043
	Yes	7 (33.3)	14 (66.7)		
Guideline available	No	16 (17.6)	75 (82.4)	0.022	0.882
	Yes	6 (18.8)	26 (81.3)		
Mental health professional	No	10 (19.2)	42 (80.8)	0.155	0.694
	Yes	12 (16.9)	59 (83.1)		
Staffing level	Adequate	6 (18.2)	27 (81.8)	1.241	0.265
	Inadequate	16 (17.8)	74 (82.2)		

• *Factors Associated with Attitude*

The bivariate analysis of factors associated with attitude is presented in Table 7. None of the selected sociodemographic, professional, or institutional factors were significantly associated with attitude (all $p > 0.05$). Age ($p =$

0.471), gender ($p = 0.505$), working place ($p = 0.214$), current role ($p = 0.264$), education level ($p = 0.501$), NICU experience ($p = 0.556$), maternal mental health training ($p = 0.398$), availability of guidelines ($p = 0.700$), availability of a mental health professional ($p = 0.179$), and staffing level ($p = 0.627$) were not significantly associated with attitude.

Table 7 Bivariate Analysis of Factors Associated with Attitude (n = 123)

Variable	Category	Negative attitude n (%)	Positive attitude n (%)	χ^2	p-value
Age group	20–29 years	2 (22.2)	7 (77.8)	2.525	0.471
	30–39 years	10 (17.9)	46 (82.1)		
	40–49 years	13 (27.7)	34 (72.3)		
	≥50 years	1 (9.1)	10 (90.9)		
Gender	Male	2 (14.3)	12 (85.7)	0.445	0.505
	Female	24 (22.0)	85 (78.0)		
Working place	CHUK	17 (28.8)	42 (71.2)	4.485	0.214
	RMTH	3 (11.1)	24 (88.9)		
	KFH	4 (19.0)	17 (81.0)		
	CHUB	2 (12.5)	14 (87.5)		
Current role	Nurse	23 (25.3)	68 (74.7)	5.236	0.264
	Midwife	2 (22.2)	7 (77.8)		
	Senior nurse	0 (0.0)	12 (100.0)		
	Senior midwife	0 (0.0)	2 (100.0)		
	Nurse specialist	1 (11.1)	8 (88.9)		
Education level	Advanced diploma	10 (21.3)	37 (78.7)	1.384	0.501
	Bachelor's degree	15 (23.4)	49 (76.6)		
	Master's degree	1 (8.3)	11 (91.7)		
NICU experience	6 months–<2 years	5 (20.0)	20 (80.0)	1.175	0.556
	2–5 years	7 (22.6)	24 (77.4)		
	>5 years	14 (20.9)	53 (79.1)		
MMH training	No	23 (22.5)	79 (77.5)	0.713	0.398
	Yes	3 (14.3)	18 (85.7)		
Guideline available	No	20 (22.0)	71 (78.0)	0.148	0.700
	Yes	6 (18.8)	26 (81.3)		
Mental health professional	No	14 (26.9)	38 (73.1)	1.808	0.179
	Yes	12 (16.9)	59 (83.1)		
Staffing level	Adequate	6 (18.2)	27 (81.8)	0.236	0.627
	Inadequate	20 (22.2)	70 (77.8)		

• Factors Associated with Practice

The bivariate analysis of factors associated with practice is presented in Table 8. Good practice was significantly associated with working place ($\chi^2 = 18.461$, $df = 3$, $p < 0.001$), NICU experience ($p = 0.031$), maternal mental health training ($\chi^2 = 8.123$, $df = 1$, $p = 0.004$), availability of guidelines ($\chi^2 = 16.759$, $df = 1$, $p < 0.001$), mentorship received ($\chi^2 = 14.047$, $df = 1$, $p < 0.001$), and knowledge category ($p < 0.001$). Nurses from CHUK had the highest proportion of good practice (40.7%), followed by KFH (9.5%), RMTH (7.4%), and CHUB (6.3%). Nurses who had received maternal mental health

training had a higher proportion of good practice (47.6%) compared with untrained nurses (18.6%). Similarly, nurses who reported availability of guidelines had a higher proportion of good practice (50.0%) compared with those without guidelines (14.3%). Age ($p = 0.388$), gender ($p = 0.640$), current role ($p = 0.121$), education level ($p = 0.184$), availability of a mental health professional ($p = 0.588$), staffing level ($p = 0.123$), workload limiting support ($p = 0.515$), time for emotional support ($p = 0.135$), management support ($p = 0.080$), and attitude category ($p = 0.557$) were not significantly associated with practice.

Table 8 Bivariate Analysis of Factors Associated with Practice (n = 123)

Variable	Category	Poor practice n (%)	Good practice n (%)	χ^2	p-value
Age group	20–29 years	9 (100.0)	0 (0.0)	3.023	0.388
	30–39 years	42 (75.0)	14 (25.0)		
	40–49 years	35 (74.5)	12 (25.5)		
	≥50 years	8 (72.7)	3 (27.3)		
Gender	Male	10 (71.4)	4 (28.6)	0.219	0.640
	Female	84 (77.1)	25 (22.9)		
Working place	CHUK	35 (59.3)	24 (40.7)	18.461	<0.001
	RMTH	25 (92.6)	2 (7.4)		
	KFH	19 (90.5)	2 (9.5)		
	CHUB	15 (93.8)	1 (6.3)		
Current role	Nurse	70 (76.9)	21 (23.1)	7.294	0.121
	Midwife	8 (88.9)	1 (11.1)		
	Senior nurse	9 (75.0)	3 (25.0)		

	Senior midwife	0 (0.0)	2 (100.0)		
	Nurse specialist	7 (77.8)	2 (22.2)		
Education level	Advanced diploma	38 (80.9)	9 (19.1)	3.385	0.184
	Bachelor's degree	45 (70.3)	19 (29.7)		
	Master's degree	11 (91.7)	1 (8.3)		
NICU experience	6 months–<2 years	22 (88.0)	3 (12.0)	6.957	0.031
	2–5 years	23 (74.2)	8 (25.8)		
	>5 years	49 (73.1)	18 (26.9)		
MMH training	No	83 (81.4)	19 (18.6)	8.123	0.004
	Yes	11 (52.4)	10 (47.6)		
Guideline available	No	78 (85.7)	13 (14.3)	16.759	<0.001
	Yes	16 (50.0)	16 (50.0)		
Mental health professional	No	41 (78.8)	11 (21.2)	0.294	0.588
	Yes	53 (74.6)	18 (25.4)		
Staffing level	Adequate	22 (66.7)	11 (33.3)	2.382	0.123
	Inadequate	72 (80.0)	18 (20.0)		
Workload limits support	No	21 (72.4)	8 (27.6)	0.424	0.515
	Yes	72 (78.3)	20 (21.7)		
Time for emotional support	No	60 (81.1)	14 (18.9)	2.237	0.135
	Yes	34 (69.4)	15 (30.6)		
Management support	No	36 (85.7)	6 (14.3)	3.056	0.080
	Yes	58 (71.6)	23 (28.4)		
Mentorship received	No	80 (84.2)	15 (15.8)	14.047	<0.001
	Yes	14 (50.0)	14 (50.0)		
Knowledge category	Poor	21 (95.5)	1 (4.5)	12.892	<0.001
	Good	73 (72.3)	28 (27.7)		
Attitude category	Negative	21 (80.8)	5 (19.2)	0.346	0.557
	Positive	73 (75.3)	24 (24.7)		

• Multivariable Analysis

Variables with a bivariate p-value < 0.05 were entered into multivariable logistic regression models. Three separate models were constructed for knowledge, attitude, and practice. Due to the low events-per-variable (EPV) ratio in the knowledge model (EPV = 7.3) and practice model (EPV = 4.8), Firth's penalized maximum likelihood estimation was used to reduce small-sample bias and address potential separation. For the attitude model (EPV = 13.0), standard logistic regression was used. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) are reported. Model fit was assessed using the likelihood ratio test.

• Factors Associated with Knowledge

The Firth's penalized multivariable logistic regression model for knowledge is presented in Table 9. Neither maternal mental health training (AOR = 0.35, 95% CI: 0.13–1.00, p = 0.050) nor NICU experience (AOR = 0.97, 95% CI: 0.53–1.71, p = 0.917) was significantly associated with good knowledge. The model was not statistically significant overall (likelihood ratio test $\chi^2 = 3.83$, df = 2, p = 0.147).

Table 9 Multivariable Logistic Regression (Firth's Penalized) of Factors Associated with Good Knowledge (n = 123)

Predictor	AOR	95% CI	p-value
MMH training	0.35	0.13–1.00	0.050
NICU experience	0.97	0.53–1.71	0.917

✓ Note: Estimates were derived using Firth's penalized maximum likelihood estimation. Model: likelihood ratio test $\chi^2 = 3.83$, df = 2, p = 0.147.

nor availability of a mental health professional (AOR = 1.74, 95% CI: 0.72–4.25, p = 0.215) was significantly associated with positive attitude. The model was not statistically significant overall.

• Factors Associated with Attitude

The standard multivariable logistic regression model for attitude is presented in Table 10. Neither maternal mental health training (AOR = 1.60, 95% CI: 0.48–7.30, p = 0.487)

Table 10 Multivariable Logistic Regression of Factors Associated with Positive Attitude (n = 123)

Predictor	AOR	95% CI	p-value
MMH training	1.60	0.48–7.30	0.487
Mental health professional available	1.74	0.72–4.25	0.215

✓ Note: No significant predictors at $p < 0.05$. Model: null deviance = 126.88, residual deviance = 124.57, AIC = 130.57.

• *Factors Associated with Practice*

The Firth's penalized multivariable logistic regression model for practice is presented in Table 11. Workplace was significantly associated with good practice (AOR = 0.41, 95% CI: 0.20–0.75, $p = 0.002$), with nurses at CHUK having higher odds of good practice compared with other hospitals.

Mentorship received was also significantly associated with good practice (AOR = 4.43, 95% CI: 1.17–18.19, $p = 0.029$), with mentored nurses having more than four times higher odds of good practice. NICU experience (AOR = 1.62, 95% CI: 0.87–3.28, $p = 0.135$), maternal mental health training (AOR = 0.98, 95% CI: 0.24–3.55, $p = 0.975$), and availability of guidelines (AOR = 1.89, 95% CI: 0.55–6.27, $p = 0.305$) were not independently associated with practice. The model was statistically significant overall (likelihood ratio test $\chi^2 = 31.50$, $df = 6$, $p < 0.001$).

Table 11 Multivariable Logistic Regression (Firth's Penalized) of Factors Associated with Good Practice (n = 123)

Predictor	AOR	95% CI	p-value
Working place	0.41	0.20–0.75	0.002
NICU experience	1.62	0.87–3.28	0.135
MMH training	0.98	0.24–3.55	0.975
Guideline available	1.89	0.55–6.27	0.305
Mentorship received	4.43	1.17–18.19	0.029

• Note: Estimates derived using Firth's penalized maximum likelihood estimation. Bold indicates $p < 0.05$. Model: likelihood ratio test $\chi^2 = 31.50$, $df = 6$, $p < 0.001$.

mental health may be relatively well established, while knowledge of specific assessment and screening approaches remains less consistent.

IV. DISCUSSION

➤ *Principal Findings*

This multicenter cross-sectional study examined knowledge, attitudes, and reported practices related to maternal mental health among nurses and midwives providing neonatal care in four referral and teaching hospitals in Rwanda. Most participants demonstrated good knowledge (82.1%) and positive attitudes (78.9%) toward maternal mental health, but only 23.6% met the threshold for good reported practice. In the bivariate analysis, reported practice was significantly associated with workplace, NICU experience, previous maternal mental-health training, availability of maternal mental-health guidelines, mentorship, and knowledge. Attitude was not significantly associated with reported practice. After adjustment, workplace and mentorship remained independently associated with reported practice, whereas NICU experience, training and guideline availability did not. These findings indicate that relatively favorable knowledge and attitudes do not necessarily translate into consistent maternal mental-health practices in NICU settings.

➤ *Knowledge of Maternal Mental Health*

Most participants demonstrated good knowledge of maternal mental health. Nevertheless, important gaps remained in areas directly relevant to clinical assessment. Recognition of the Edinburgh Postnatal Depression Scale was less consistent, and some participants incorrectly considered postpartum depression uncommon among mothers of hospitalized newborns. A proportion also believed that only psychiatrists could identify maternal mental-health problems. These findings suggest that general awareness of maternal

This distinction is important in neonatal care because identifying maternal psychological distress requires more than awareness of mental-health concepts. Nurses and midwives may need to recognize emotional symptoms, initiate sensitive conversations, use appropriate screening approaches, and know when referral is indicated. Previous research among obstetric and neonatal nurses has similarly identified variation in knowledge and confidence regarding the management of maternal depression (25). Evidence from Ghana also indicates that nurses and midwives may recognize the importance of maternal mental health while requiring further professional development to translate this recognition into routine care (26).

In the present study, knowledge was significantly associated with reported practice in the bivariate analysis ($p < 0.001$). However, this association was not retained in the adjusted practice model. This difference between the unadjusted and adjusted analyses is important. It suggests that the observed relationship between knowledge and practice may partly reflect other characteristics of the participants or their working environments rather than knowledge alone. Therefore, the findings do not support interpreting knowledge as an independent predictor of reported practice in this sample.

➤ *Attitudes Toward Maternal Mental Health*

Attitudes toward maternal mental health were generally positive, with 78.9% of participants classified as having positive attitudes. Participants generally recognized maternal mental health as an important component of neonatal care and supported the role of health professionals in providing emotional support and working with mental-health

professionals. However, positive attitudes were not consistently accompanied by reported practice.

Attitude was not significantly associated with reported practice in the bivariate analysis ($p = 0.557$). Similarly, the multivariable attitude model did not identify significant independent associations with positive attitude. Maternal mental-health training and availability of a mental-health professional were not significantly associated with positive attitude, and the model explained little variation in the outcome. These findings suggest that attitudes were relatively favourable across the sample and that the factors distinguishing positive from negative attitudes may not have been adequately captured by the variables included in this study.

The findings also illustrate a limitation of assuming a simple progression from knowledge to attitude and then to practice. Although knowledge and attitudes may form an important foundation for maternal mental-health care, actual practice occurs within a clinical environment that can facilitate or constrain what providers can do. In NICUs, competing clinical priorities, time constraints, availability of guidance, staffing, and access to referral services may influence whether maternal mental-health activities are incorporated into routine care (26).

➤ *Knowledge–Practice Gap*

The most notable finding was the gap between the relatively high proportion of participants with good knowledge and positive attitudes and the much smaller proportion reporting good practice. Only 23.6% met the threshold for good practice. The lowest-rated activities included use of maternal mental-health screening tools, encouraging mothers to discuss their feelings, providing education on coping strategies, educating families about emotional support, and participating in maternal mental-health training or discussions.

This pattern is consistent with previous research showing that awareness of maternal mental health does not automatically result in systematic assessment or intervention. Sofronas et al. (2011), for example, identified differences between nurses' knowledge, attitudes, and reported approaches to maternal depression management. Similarly, qualitative evidence from Uganda has described limited specialized training, challenges in using standardized assessment approaches, and weaknesses in referral coordination among health workers providing maternal mental-health care (7).

The present findings therefore suggest that strengthening knowledge alone may not be sufficient to improve reported practice. The bivariate association between knowledge and practice indicates that knowledge remains relevant, but its loss of statistical significance after adjustment suggests that practice is also shaped by the wider clinical context.

➤ *Workplace and Organizational Context*

Workplace was significantly associated with reported practice in both the bivariate and multivariable analyses. In the descriptive analysis, the proportion reporting good practice

was highest among participants from CHUK (40.7%), compared with 9.5% at KFH, 7.4% at RMRT and 6.3% at CHUB. These differences should not be interpreted as evidence that one hospital provides better care than another, because the study was not designed to compare hospital performance and the observed differences may reflect differences in staffing, patient mix, resources, organizational procedures, training opportunities or other unmeasured factors.

The organizational findings provide additional context. Only 26.0% of participants reported that maternal mental-health guidelines were available in their units, 26.8% considered staffing adequate and 39.8% reported having sufficient time to provide emotional support. In addition, 22.8% reported having previously received mentorship, supervision, or guidance related to maternal mental health. These findings indicate that providers may work in environments where opportunities to apply maternal mental-health knowledge are limited.

Availability of guidelines, maternal mental-health training, and mentorship were all significantly associated with good practice in the bivariate analysis. Participants who reported receiving maternal mental-health training had a higher proportion of good practice than those without training (47.6% versus 18.6%), while good practice was also more common among those reporting guideline availability (50.0% versus 14.3%). However, neither training nor guideline availability remained statistically significant in the adjusted practice model. This indicates that the bivariate associations should not be interpreted as independent effects.

Mentorship was different. After adjustment, mentorship remained independently associated with good reported practice (AOR 4.43, 95% CI 1.17–18.19). The confidence interval was relatively wide, indicating uncertainty around the magnitude of the association. Nevertheless, the finding identifies mentorship as an important area for further investigation. Regular supervision and clinical guidance may provide opportunities for providers to discuss maternal mental-health concerns, receive feedback, and strengthen practical skills in communication, assessment, and referral.

➤ *Interpretation of the Regression Findings*

The multivariable findings require cautious interpretation because of the relatively small number of outcome events. The events-per-variable ratio was approximately 7.3 for the knowledge model and 4.8 for the practice model. Firth's penalized maximum-likelihood estimation was therefore used for these models to reduce small-sample bias and address potential separation. This approach is appropriate for sparse logistic-regression data, although it does not remove uncertainty associated with the sample size (27,28).

In the practice model, workplace and mentorship were independently associated with good reported practice. The overall practice model was statistically significant (likelihood-ratio test, $p < 0.001$). In contrast, NICU experience, maternal mental-health training, and guideline availability were not

independently associated with practice after adjustment. The difference between the bivariate and adjusted findings reinforces the importance of distinguishing crude associations from associations that remain after accounting for other variables.

The knowledge model did not provide evidence of statistically significant independent associations. Maternal mental-health training had an adjusted odds ratio of 0.35 (95% CI 0.13–1.00; $p = 0.050$), while NICU experience had an adjusted odds ratio of 0.97 (95% CI 0.53–1.71; $p = 0.917$). The overall knowledge model was not statistically significant (likelihood-ratio test, $p = 0.147$). The finding for training should not be interpreted as evidence that training reduces knowledge. Only 21 participants reported previous maternal mental-health training, and the observed association may reflect differences in the timing or content of training, selection of participants for training, residual confounding, or instability related to the small subgroup.

The attitude model also did not identify statistically significant independent associations. Maternal mental-health training and availability of a mental-health professional were not significantly associated with positive attitude. The model explained little variation in the outcome, with a Nagelkerke R^2 of 2.9%. These findings indicate that the measured professional and organizational characteristics did not adequately explain variation in attitudes in this sample.

➤ *Implications for Maternal Mental-Health Care in NICUS*

The findings have implications for both professional development and organization of neonatal services. The relatively high levels of knowledge and positive attitudes provide a useful foundation, but the low proportion of participants reporting good practice indicates that educational approaches need to be accompanied by practical and organizational support.

First, maternal mental-health activities could be incorporated more explicitly into routine NICU workflows. This may include clear procedures for recognizing mothers who require additional psychosocial support, standardized documentation, appropriate screening approaches, and defined referral pathways. WHO guidance supports integrating perinatal mental health into maternal and child health services rather than relying exclusively on separate specialist services (29).

Second, continuing professional development could move beyond isolated training sessions toward ongoing supervision and mentorship. The association between mentorship and reported practice does not establish that mentorship causes better practice, but it identifies mentorship as a potentially important area for service development and further research. Structured clinical mentorship could provide opportunities to discuss difficult cases, reinforce communication skills, and support appropriate assessment and referral.

Third, implementation should consider organizational readiness. The limited reported availability of guidelines,

adequate staffing, and sufficient time for emotional support suggests that providers may encounter structural barriers to applying their knowledge. Strengthening maternal mental-health care may therefore require attention to clinical guidance, staffing, time allocation, multidisciplinary collaboration and managerial support alongside individual capacity-building.

Finally, maternal mental health should be integrated within family-centered neonatal care. WHO recommendations on maternal and newborn care emphasize information, reassurance, and support for women and families as part of a positive postnatal experience (30). In the NICU, this approach can help ensure that the mother's psychological and emotional needs are considered alongside the clinical needs of the newborn.

➤ *Strengths and Limitations*

This study has several strengths. It included participants from four referral and teaching hospitals and used a census approach among eligible nurses and midwives, reducing the need for sampling from the eligible workforce. The study also examined knowledge, attitudes and reported practices alongside professional and workplace characteristics, allowing the practice findings to be considered within their clinical context. The use of Firth's penalized logistic regression for models with low events-per-variable ratios was another methodological strength.

Three limitations should be considered. First, the cross-sectional design does not establish temporal or causal relationships between the identified factors and reported practice. Second, practice was self-reported and may therefore have been affected by recall or social-desirability bias; the findings should be interpreted as reported rather than directly observed practice. Third, participants were recruited from referral and teaching hospitals, so the findings may not be directly generalizable to district hospitals, private facilities or lower-level neonatal care settings in Rwanda.

➤ *Conclusion*

This study found relatively high levels of knowledge and positive attitudes toward maternal mental health among nurses and midwives providing neonatal care in selected Rwandan referral and teaching hospitals, but substantially lower levels of reported good practice. Knowledge was associated with practice in the bivariate analysis but not after adjustment, while attitude was not significantly associated with practice. Workplace and mentorship remained independently associated with reported practice in the multivariable analysis.

The findings suggest that improving maternal mental-health care in NICUs requires more than increasing individual knowledge or promoting positive attitudes. Attention is also needed to the clinical environment in which care is delivered, including practical guidance, supervision and mentorship, referral processes and organizational support. Future research should examine these relationships using larger samples and, where feasible, longitudinal or intervention designs to determine how organizational and professional-development

strategies can strengthen the integration of maternal mental-health support into routine neonatal care.

V. CONCLUSION

This study found relatively high levels of knowledge and positive attitudes toward maternal mental health among nurses and midwives providing neonatal care in selected Rwandan referral and teaching hospitals, but substantially lower levels of reported good practice. Knowledge was associated with practice in the bivariate analysis but not after adjustment, while attitude was not significantly associated with practice. Workplace and mentorship remained independently associated with reported practice in the multivariable analysis.

The findings suggest that improving maternal mental-health care in NICUs requires more than increasing individual knowledge or promoting positive attitudes. Attention is also needed to the clinical environment in which care is delivered, including practical guidance, supervision and mentorship, referral processes and organizational support. Future research should examine these relationships using larger samples and, where feasible, longitudinal or intervention designs to determine how organizational and professional-development strategies can strengthen the integration of maternal mental-health support into routine neonatal care.

ABBREVIATIONS

AOR
Adjusted Odds Ratio
CI
Confidence Interval
CHUB
University Teaching Hospital of Butare
CHUK
University Teaching Hospital of Kigali
CVI
Content Validity Index
EPDS
Edinburgh Postnatal Depression Scale
IRB
Institutional Review Board
KAP
Knowledge, Attitudes, and Practices
KFH
King Faisal Hospital
MMH
Maternal Mental Health
NICU
Neonatal Intensive Care Unit
RMRT
Rwanda Military Referral and Teaching Hospital
SDG
Sustainable Development Goal
SPSS
Statistical Package for the Social Sciences
UR-CMHS
University of Rwanda – College of Medicine and Health Sciences
VIF

Variance Inflation Factor
WHO
World Health Organization

ETHICS AND DECLARATIONS

➤ *Ethics Approval and Consent to Participate*

This study received ethical clearance from the University of Rwanda - College of Medicine and Health Sciences Institutional Review Board (ref. CMHS/IRB/123/2026), with administrative authorization from each participating hospital. All participants provided informed consent: survey consent was obtained electronically via a mandatory agreement item after reviewing an information sheet.

➤ *Consent for Publication*

Not applicable. No person's identifying data, images, or videos are included in this manuscript.

➤ *Availability of Data and Materials*

The datasets generated and/or analyzed during the current study are not publicly available due to participants' confidentiality concerns, but are available from the corresponding author upon reasonable request.

➤ *Competing Interests*

The authors declare that they have no competing interests.

➤ *Funding*

This research has not received any funding.

➤ *Authors' Contributions*

LM conceptualized the study, designed the methodology, collected the data, conducted the data analysis, and drafted the original manuscript. VM contributed to data interpretation, provided clinical contextualization, and critically revised the manuscript. VB and AM supervised the study design, provided methodological guidance, validated the analysis, and critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

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➤ *Authors' Information*

- Not applicable.

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