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The Relationship between Knowledge, Education, and Parity with Kangaroo Care Method Practices in Mothers

Resi Muryati[1], Debora Paninsari[2*]
[1.2]PUI Gentle Baby Care, Prima Indonesia University, Medan
Email: deborapaninsari@unprimdn.ac.id

ABSTRACT

Preterm and low birth weight (LBW) infants are vulnerable to hypothermia and need special care. Kangaroo mother care (KMC) is recommended by the World Health Organization, but its implementation by mothers is still suboptimal. Knowledge, education, and parity are thought to influence KMC practice. This study aimed to analyze the associations of knowledge, education, and parity with KMC practice and to identify the variables most strongly associated with it. A quantitative analytic study with a cross-sectional design was conducted at an independent midwifery practice in Medan, Indonesia, in October 2026. Thirty mothers of preterm or LBW infants were recruited by total sampling. Knowledge, education, and parity were measured with questionnaires, and KMC practice was assessed by direct observation using a checklist. Data were analyzed with the Chi-Square or Fisher's Exact test and multiple logistic regression. Good knowledge was found in 43.3% of mothers, secondary education in 46.7%, and multiparity in 50.0%. Good KMC practice was shown by 46.7% of mothers. Knowledge was significantly associated with KMC practice ($p = 0.011$), while education ($p = 0.236$) and parity ($p = 0.215$) were not. In the multivariate model, knowledge was the variable most strongly associated with practice (AOR 7.45; 95% CI 1.23–45.03; $p = 0.029$). Maternal knowledge is therefore the factor most strongly associated with KMC practice. Early KMC education and mentoring, with material adapted to the mother's education and experience, are recommended. Larger multi-site studies are needed to confirm these findings.

Keywords: kangaroo mother care, knowledge, education, parity, preterm infants, low birth weight

INTRODUCTION

A premature baby is a baby born before 37 weeks of gestation, while a low birth weight (LBW) baby is a baby weighing less than 2,500 grams regardless of gestational age (Riska et al., 2023; World Health Organization [WHO], 2023). In both groups, the body's temperature regulation mechanisms are not fully developed. The large skin surface area compared to their body mass and limited fat reserves cause babies to lose heat quickly, making them susceptible to hypothermia (Riska et al., 2023). Therefore, these babies require special care and treatment from the beginning of life (Suryani, 2020; Sembiring, 2019).

The WHO (2023) estimates that approximately 13.4 million babies are born prematurely and more than 20 million babies are born with low birth weight (LBW) each year. Complications of premature birth are the largest direct cause of neonatal mortality (Mustikawati et al., 2022).

One of the recommended non-pharmacological measures for these babies is kangaroo care (KMC), where the baby is placed upright with skin-to-skin contact directly on the mother's chest (Ayele et al., 2023; Mustikawati et al., 2022). This method helps prevent heat loss and hypothermia, supports breastfeeding, and strengthens the mother-infant bond (Mustikawati et al., 2022). According to the WHO (2023), KMC can increase the survival rate of premature babies by up to one-third, reduce the incidence of infection, prevent hypothermia, and improve feeding and growth. The WHO recommends skin-to-skin contact for 8 to 24 hours per day starting immediately after birth, and WHO guidelines (2022) recommend KMC as routine care for every premature or low birth weight baby.

Despite its clear benefits, maternal implementation of KMC is far from optimal and varies widely across settings. At a referral hospital in the Amhara region of Ethiopia, only 56.9% of mothers had good knowledge and 41.3% practiced KMC well (Getie et al., 2022). In a village in Indonesia, 73.3% of mothers with low birth weight babies did not practice KMC (Riska et al., 2023), while in Tigray, Ethiopia, the practice rate reached 70.2% (Ayele et al., 2023). These differences suggest that KMC practice is influenced by maternal characteristics and the surrounding environment.

Maternal knowledge is the most frequently studied factor. Hanum et al. (2024) reported that knowledge and attitudes were associated with the implementation of PMK ($p = 0.006$). Riska et al. (2023) also found a relationship between knowledge and the implementation of PMK ($p = 0.001$), and Mustikawati et al. (2022) observed a positive correlation between knowledge and practice ($r = 0.53$; $p < 0.001$). Knowledge can also be improved: Nopitasari et al. (2023) showed that the level of knowledge of mothers of LBW infants differed significantly before and after receiving education about PMK.

Education can influence how well a mother receives and understands health information. Getie et al. (2022) found that mothers with a college education or higher were more likely to have good knowledge (AOR 6.1) and implement KMP well (AOR 2.3). Riska et al. (2023) argued that the higher the level of education, the greater the motivation and ability to understand health-related matters.

Parity reflects a mother's experience in caring for her baby. In a study by Ayele et al. (2023), mothers with two to four children (AOR 8.38) and mothers with five or more children (AOR 18.2) were more likely to practice KMC than first-time mothers. The authors suspect this is because multiparous mothers are more frequently exposed to neonatal care. To our knowledge,

research in Indonesia that simultaneously analyzes knowledge, education, and parity in relation to KMC practices is still rare.

Thus, the three variables in this study were chosen because they each represent distinct pathways. Knowledge reflects the mother's understanding of the goals and steps of KMC, education reflects her general capacity to absorb health information, and parity reflects her direct experience caring for her baby. Examining all three in a single model allows researchers to see whether one variable remains related when the other two are held constant, something that individual analyses cannot demonstrate. This information is useful for midwives in determining priorities when time and resources for maternal support are limited.

A preliminary survey at the Independent Midwifery Practice (PMB) in Medan recorded 25 premature or low birth weight (LBW) babies in the past three months, and 5 out of 10 mothers had not properly implemented PMK. Based on this background, this study aimed to analyze the relationship between knowledge, education, and parity and PMK practices among mothers of premature or low birth weight babies, and to identify the variables most closely associated with these practices.

METHOD

Research design

This study is a quantitative analytical study with a cross-sectional design, in which the independent variables (knowledge, education, and parity) and the dependent variable (KPM practices) are measured at the same time (Notoatmodjo, 2018; Sutriyawan, 2021). This design was chosen to examine the relationship between maternal characteristics and KPM practices in mothers of premature or low-birth-weight infants.

This research is reported by referring to the principles of reporting observational studies, namely explaining the place, time, subject criteria, operational definitions of variables, and analysis methods openly so that readers can assess the suitability of the method and repeat the research in other populations.

Participants, locations, and sampling techniques

The study was conducted at PMB Resi Muryati, Medan, in October 2026. The target population was all mothers who had premature or low birth weight babies and received services at the PMB during the study period, which was estimated to number 30 people based on a preliminary

survey (Sugiyono, 2019). The sampling technique was total sampling, so the entire population was sampled and 30 respondents were obtained.

Mothers were eligible if (1) their babies were premature (gestational age less than 37 weeks) and/or low birth weight (LBW) (less than 2,500 grams); (2) the baby was stable and fit to undergo PMK, without a mechanical ventilator; (3) the mother was healthy and could communicate well; and (4) the mother was willing to be a respondent and sign the consent form. Mothers were excluded from the study if their babies had severe congenital abnormalities, the mother experienced severe postpartum complications or mental disorders, the baby died or was referred elsewhere during the study, or the mother withdrew or did not complete the instrument. All 30 mothers met the criteria, and none were excluded.

Respondents' ages were recorded for descriptive purposes. Mothers ranged in age from 20 to 38, with a mean of 30.43 years (standard deviation 5.04). Age was not included in the inferential analysis because it was not a planned independent variable.

Data collection

After obtaining research permission, the research objectives were explained to potential respondents, who then signed informed consent. Education and parity were recorded using a respondent characteristics questionnaire, and parity was matched with medical records. Knowledge was measured using a questionnaire completed by mothers. The validity (calculated r greater than table r) and reliability (Cronbach's alpha of at least 0.6) of the knowledge questionnaire were tested before use (Notoatmodjo, 2018). PMK practices were not measured based on maternal reports; researchers directly observed each mother and assessed an observation sheet (checklist) compiled from PMK standard operating procedures and WHO recommendations (2022).

Ethical eligibility

Participation was voluntary, and each respondent provided written consent after receiving an explanation. Respondents' responses were kept confidential and used only for research purposes. [Include the name of the ethics committee and the ethics approval number here.]

Measurement

Knowledge encompasses mothers' understanding of KMC, including its definition, benefits, position, duration, and danger signs, and is categorized as good (76–100% of the maximum score), sufficient (56–75%), or poor (below 56%). Education is the last completed formal

education level, grouped into elementary (elementary–junior high school), secondary (high school/vocational high school), and higher (D3/S1/S2). Parity is the number of deliveries the mother has experienced, including the current delivery, with categories of primipara (one), multipara (two to four), and grandemultipara (five or more). KMC practice is the mother's accuracy in implementing KMC steps (preparation, position, skin-to-skin contact, duration, breastfeeding, and infant monitoring), which is divided into good (checklist score of at least 76%) and poor (below 76%).

Data analysis

Data were edited, coded, entered into SPSS, and tabulated. Univariate analysis described each variable in terms of frequencies and percentages. In bivariate analysis, each independent variable was tested against PMK practices using the Chi-Square test; if more than 20% of cells had an expected value less than 5, Fisher's Exact test or combined categories were used. A p-value below 0.05 at the 95% confidence level indicates a significant association. Variables with $p<0.25$ at the bivariate stage were entered into multiple logistic regression to determine the variables most associated with PMK practices, based on the adjusted odds ratio (AOR) and 95% confidence interval (CI).

Assumptions were checked before selecting each test. The expected cell values were examined in each cross-table, and when a three-category variable violated the Chi-Square requirement, adjacent categories were combined for conceptual reasons without excluding any respondents. Crude odds ratios were calculated from the resulting two-by-two tables. In the regression, all candidate variables were entered simultaneously (Enter method), and model fit was described using the omnibus test, the −2 log likelihood value, the Cox and Snell and Nagelkerke R^2, and a classification table with a cutoff value of 0.50. The Hosmer–Lemeshow test is not reported because the data only had eight covariate patterns for 30 respondents, making it less informative.

RESULTS

Respondent characteristics and PMK practices

All 30 eligible mothers were analyzed. Table 1 summarizes maternal characteristics and PMK practices. Good knowledge was reported by 43.3% of mothers, secondary education was the highest (46.7%), and half of the mothers were multiparous (50.0%). Good PMK practices were reported by 14 mothers (46.7%), while 16 mothers (53.3%) were less than satisfactory.

Table 1. Frequency distribution of respondent characteristics and research variables (n = 30)

Variables	Category	f	%
Knowledge	Good	13	43.3
	Enough	8	26.7
	Not enough	9	30.0
Education	Elementary (Elementary–Middle School)	7	23.3
	Secondary (SMA/SMK)	14	46.7
	High (D3/S1/S2)	9	30.0
Parity	Primipara	11	36.7
	Multipara (2–4)	15	50.0
	Grandemultipara (≥5)	4	13.3
PMK Practice	Good	14	46.7
	Not good	16	53.3

Note: PMK = kangaroo method care.

Bivariate analysis

Cross-tabulation of the three-category variables yielded more than 20% of cells with expected values less than 5 (66.7% of cells for knowledge and 66.7% for education). As per the analysis plan, the categories were combined into two groups: knowledge (good vs. sufficient/poor), education (high vs. basic/intermediate), and parity (multiparous/grandemultiparous vs. primiparous). The chi-square test with continuity correction was used when all expected values were at least 5, and the Fisher's exact test when any expected value was below 5. The results are presented in Table 2.

Among mothers with good knowledge, 10 (76.9%) performed PMK well and 3 (23.1%) poorly. Among mothers with sufficient or insufficient knowledge, 13 (76.5%) poorly and 4 (23.5%) well. This difference was significant ($p = 0.011$). Regarding education, 6 of 9 highly educated mothers (66.7%) performed PMK well, compared to 8 of 21 mothers with primary or secondary education (38.1%); Fisher's exact test yielded $p = 0.236$, indicating a non-significant relationship. Regarding parity, 11 of 19 multiparous or grandemultiparous mothers (57.9%) performed PMK well, compared to 3 of 11 primiparous mothers (27.3%); this difference was also non-significant ($p = 0.215$).

Before merging, the Pearson Chi-Square values for the three-category variables were 8.451 for knowledge ($df = 2$; $p = 0.015$), 4.458 for education ($df = 2$; $p = 0.108$), and 2.752 for parity ($df = 2$; $p = 0.253$), with 66.7%, 66.7%, and 33.3% of cells having expected values below 5, respectively. These tests without merging were therefore not used as a reference. After

merging, the crude odds ratios for knowledge were 10.83 (95% CI 1.96–59.84), for education 3.25 (95% CI 0.63–16.79), and for parity 3.67 (95% CI 0.73–18.33). The smallest expected values were 6.07 for knowledge, 4.20 for education (one cell, 25.0%), and 5.13 for parity.

Conclusions about significance do not depend on the test chosen. For knowledge, the uncorrected Pearson Chi-Square (p = 0.004), the continuity-corrected test (p = 0.011), and Fisher's Exact (p = 0.009) were all below 0.05. For education, the corresponding values were 0.151, 0.299, and 0.236, respectively, while for parity they were 0.105, 0.215, and 0.142, so these two variables did not exceed the 0.05 threshold in any of the approaches.

Table 2. Relationship between knowledge, education, and parity with PMK practices (n = 30)

Variables / categories	Good n (%)	Not good n (%)	Total n	Test	p-value	OR
Knowledge					0.011*	
Good	10 (76.9)	3 (23.1)	13	Chi-Square		10.83
Enough/insufficient	4 (23.5)	13 (76.5)	17			
Education					0.236	
Tall	6 (66.7)	3 (33.3)	9	Fisher		3.25
Elementary/intermediate	8 (38.1)	13 (61.9)	21			
Parity					0.215	
Multipara/grande	11 (57.9)	8 (42.1)	19	Chi-Square		3.67
Primipara	3 (27.3)	8 (72.7)	11			

*Note: Chi-Square using continuity correction. *p < 0.05. OR = crude odds ratio (comparator: sufficient/insufficient knowledge, primary/secondary education, primiparity).*

Multivariate analysis

All three variables had p < 0.25 and were entered into a logistic regression model (Table 3). The omnibus model test was significant ($\chi^2 = 10.962$; df = 3; p = 0.012). The −2 log likelihood value was 30.493, with a Cox and Snell R^2 of 0.306 and a Nagelkerke R^2 of 0.409. The model correctly classified 76.7% of cases (sensitivity 78.6%; specificity 75.0%).

After controlling for education and parity, only knowledge remained significantly associated with PMK practice. Mothers with good knowledge were 7.45 times more likely to implement PMK well (AOR 7.45; 95% CI 1.23–45.03; p = 0.029). Knowledge had the largest Exp(B) among the three variables and was therefore the most closely associated with practice. The wide confidence interval indicates that this estimate lacks precision.

Of the 16 mothers with poor practices, the model correctly identified 12 (75.0%), and of the 14 mothers with good practices, the model correctly identified 11 (78.6%). These figures indicate

that the three variables together provide moderate, but not yet strong, discrimination between good and poor practices.

Table 3. Multiple logistic regression of factors associated with PMK practices (n = 30)

Variables	B	SE	Wald	p-value	AOR (Exp B)	IK 95%
Knowledge (good)	2,008	0.918	4,788	0.029	7,451	1,233–45,026
Higher education)	0.973	1,034	0.886	0.347	2,645	0.349–20.061
Parity (multipara/grande)	1,291	1,046	1,523	0.217	3,636	0.468–28.256
Constant	−2,188	1,048	4,359	0.037	0.112	

Note: AOR = adjusted odds ratio; IK = confidence interval. Omnibus $\chi^2 = 10.962$; df = 3; p = 0.012; Nagelkerke $R^2 = 0.409$.

DISCUSSION

PMK Practice

This study aimed to analyze the relationship between knowledge, education, and parity with the practice of KD and determine the most closely related variables. Less than half of mothers (46.7%) performed KD properly. This figure is similar to the findings of Getie et al. (2022) in Ethiopia (41.3%), lower than Ayele et al. (2023) in Tigray (70.2%), and better than the findings of Riska et al. (2023), who found that 73.3% of mothers of LBW infants did not perform KD. This variation is in line with the view that KD practice depends on maternal characteristics and the environment. Given that WHO (2023) recommends skin-to-skin contact for 8 to 24 hours per day, the fact that more than half of mothers did not perform KD properly indicates the need for support from the beginning of care.

Because the observation sheets were assessed by researchers using standardized procedures, these figures reflect what mothers actually did, not what they said. This is important when comparing with studies that rely on self-reports, as self-reports tend to overestimate compliance. The results here are therefore a relatively cautious estimate of actual PMK implementation and emphasize that knowing about PMK and doing it are two different things.

It should also be noted that the good practice score in this study was obtained using a checklist score of 76%. A looser or tighter cutoff would certainly shift the proportion of mothers considered good, so comparisons between studies should consider how each study defines good practice.

PMK knowledge and practice

Knowledge was the only variable significantly associated with the practice of KMC, both in bivariate analysis (p = 0.011) and after control (AOR 7.45). This finding aligns with Hanum et al. (2024) who linked knowledge and attitudes to KMC implementation (p = 0.006), with Riska et al. (2023; p = 0.001), and with Mustikawati et al. (2022) who reported a positive correlation between knowledge and practice (r = 0.53; p < 0.001). Notoatmodjo (2018) views knowledge as a crucial domain in developing action. Mothers who understand the benefits, correct positioning, recommended duration, and danger signs of KMC are therefore more likely to carry out each step appropriately. Practically, mothers who know that babies should be held upright with prolonged skin-to-skin contact, and can recognize when a baby needs medical attention, are likely to be more confident in maintaining the practice.

Because knowledge can be improved through education (Nopitasari et al., 2023), structured KMC education from the beginning of care for premature or low birth weight infants appears to be the most promising approach to improving practice. However, the cross-sectional design makes the direction of the relationship uncertain. It is also possible that mothers who have already practiced KMC gain more knowledge through their experience.

The strength of the crude association (OR 10.83) was greater than the adjusted association (AOR 7.45), a pattern that is reasonable given that some of the apparent knowledge effect overlaps with education and parity. However, the association persisted after adjustment and was consistent across all three bivariate test variants. The very wide interval (1.23–45.03) is a reminder that the data support a positive association but cannot yet determine its magnitude. Studies with larger samples are needed to narrow this range before the odds ratio can be used for planning.

These results also provide guidance on what educational content should be prioritized. Because the knowledge in this study encompasses the definition, benefits, position, duration, and danger signs, educational materials can be structured around these five aspects, starting with why Knee-to-Skin Care protects babies from hypothermia, then how to position the baby safely, how long skin-to-skin contact should last, and when the mother should immediately call a health professional. This sequence helps mothers understand the purpose of each step, rather than simply memorizing it.

PMK education and practice

Education was not significantly associated with PMK practice (p = 0.236; AOR 2.65; 95% CI 0.35–20.06), although the proportion of mothers with good practices increased with each educational level (14.3% at primary, 50.0% at secondary, and 66.7% at tertiary). This trend is consistent with Getie et al. (2022) and Riska et al. (2023) who stated that higher education improves the ability to understand health information, although statistical significance was not achieved here. Possible reasons include the small sample size (n = 30), which resulted in low test power, and the wide confidence intervals indicating unstable estimates. The lack of significance should therefore not be interpreted as evidence that the relationship does not exist; this question needs to be retested in a larger sample.

The way education is grouped also needs to be considered. Mothers with primary and secondary education were combined to avoid sparse cells, and this may obscure the gradients seen in the three-level data. Furthermore, formal education is only a rough measure of health literacy; mothers with limited education who receive clear and repeated explanations from midwives may still understand KMC well, which also explains why education adds little to the mix after knowledge is entered into the model.

Parity and PMK practices

Parity was also not significantly associated with practice (p = 0.215; AOR 3.64; 95% CI 0.47–28.26). Good practice was more prevalent among multiparous and grandemultiparous mothers (57.9%) than primiparous mothers (27.3%), consistent with the findings of Ayele et al. (2023) who suggested that experience and exposure to neonatal care services explained why mothers with more children were more likely to practice KMC. The magnitude of the association in this study was smaller and far less definitive than in that previous report. Furthermore, only four respondents were grandemultiparous, requiring this category to be combined with multiparous mothers, precluding a separate study of mothers with more children.

Experience may also play a role in ways that parity alone cannot capture. Parity measures the number of births, but it doesn't indicate whether previous babies were premature, whether the mother received KD guidance, or how much support she had at home. These aspects could be examined in future research to clarify the contribution of experience.

The most related variables

Knowledge emerged as the dominant variable (AOR 7.45), while education and parity lost significance after controlling for each other. One interpretation is that the effects of education

and parity operate at least partly through knowledge: more educated or experienced mothers may know more about KMC and therefore practice it better. However, this design cannot test this pathway or demonstrate causality. The Nagelkerke R^2 of 0.409 also indicates that much of the variation in practice is explained by factors outside the model, such as maternal attitudes and family support.

The finding that knowledge outperformed demographic characteristics also offers a somewhat encouraging message for health services: education and number of children are attributes that health workers cannot change, while knowledge can be changed through education and training. In other words, the factors most closely related to practice in this study are also those most likely to be influenced by midwives' interventions.

Implications and directions for further research

For midwifery practice, these findings suggest that education and support for PMK should begin early in the care of premature or low birth weight infants. Material should be presented in simple language, supported by visual aids, reinforced with live demonstrations, and tailored to the mother's educational background and whether she is a new or experienced mother. For educational institutions, these results support emphasizing PMK skills and maternal counseling in courses on infant, toddler, and preschool care. Future research should involve larger samples from multiple facilities, include family attitudes and support as variables, and consider experimental designs that provide PMK education and then measure its impact on knowledge and practice.

At the individual practice level, a feasible approach is to combine a brief knowledge check with bedside support: the midwife assesses what the mother already knows, addresses gaps, then observes the KMC session using the checklist used in this study and provides feedback on positioning, duration, breastfeeding, and monitoring. Such a routine addresses the knowledge issue directly while also capturing practical errors that the questionnaire missed.

CONCLUSION

Of the 30 mothers with premature or low birth weight babies, 43.3% had good knowledge, and the most common education level and parity were secondary education (46.7%) and multiparity (50.0%). Good KMP practices were demonstrated by 46.7% of mothers. Knowledge was significantly associated with KMP practices ($p = 0.011$), while education ($p = 0.236$) and parity

(p = 0.215) were not. Knowledge was the variable most associated with practice after being controlled (AOR 7.45; 95% CI 1.23–45.03; p = 0.029).

These findings suggest that maternal knowledge is the most useful entry point for improving KD practices. Health workers are encouraged to provide KD education and support from an early age and to tailor the material to each mother's education and experience.

Although the association between education and parity was not statistically significant, both suggest a trend toward better practices among mothers with higher education and more children, and this study's sample size was likely too small to detect this. Their role should not be discounted based on this study alone.

This study provides a preliminary overview of one practice setting, and its findings should be viewed as a basis for larger studies and as practical input for maternal support programs at the primary care level.

LIMITATIONS

Several limitations should be acknowledged. First, the sample was small (n = 30) and derived from a single practice site. This limits the power of the test, which likely explains why the effects of education and parity, while in the expected direction, did not reach significance, and also limits generalizability to other settings. Second, the confidence intervals in the logistic model, particularly for knowledge (1.23–45.03), are wide, so the magnitude of the adjusted association should be interpreted with caution. Third, the cross-sectional design captures exposure and outcome at the same time, so causal or temporal sequence conclusions cannot be drawn. Fourth, categories had to be merged due to sparse cells, reducing the detail of the educational gradient and the condition of grandemultiparous mothers. Fifth, the multivariate model contained only three predictors and explained some of the variance (Nagelkerke R^2 = 0.409); unmeasured factors such as attitudes and family support may influence practice. Finally, the model was constructed with a small number of events per variable, increasing the risk of unstable estimates. These limitations are directly related to the study findings and suggest that the results be confirmed in a larger sample from multiple sites.

Furthermore, KMC practices were observed directly by researchers at a single point in time. Mothers who know they are being observed may act differently than usual (the observation effect), and a single session may not necessarily represent consistent KMC implementation across the care day. The checklist captures technique accuracy, but not the WHO-

recommended total hours of skin-to-skin contact per day, so duration is only partially reflected in practice scores. Future researchers could use repeated observations or mothers' diaries to address this gap.

Finally, the knowledge instrument was tested for validity and reliability before use, but the results of these tests are not reported in detail in this manuscript, and the observation sheets were scored by a single observer, so inter-rater agreement could not be calculated. Future research could involve two or more observers and report coefficients of agreement to further ensure the reliability of the practice measurements.

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