

Determinants of Nurses' Professional Compliance with Standards of Care for Low Birth Weight Infants: A Multicenter Study

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ARMADA
JURNAL PENELITIAN MULTIDISIPLIN

e-ISSN: 2964-2981

ARMADA : Jurnal Penelitian Multidisiplin

<https://ejournal.45mataram.ac.id/index.php/armada>

Vol. 04, No. 09 September, 2026

Page: 5762-5773

DOI:

<https://doi.org/10.55681/armada.v4i9.4273>

Article History:

Received: Juli 08, 2026

Revised: Agustus 22, 2026

Accepted: September 19, 2026

Abstract : Low birth weight infants (LBWIs) have a high risk of complications and therefore require consistent and standardised care. Nurses' adherence to LBWI care standards plays an important role in maintaining service quality and patient safety. This study aimed to identify factors associated with nurses' adherence to LBWI care standards and determine the dominant factor in a multicentre setting. This quantitative analytical observational study used a cross-sectional design involving nurses providing care for LBWIs. Data were collected using a respondent characteristics questionnaire and an adherence checklist, then analysed using bivariate analysis and multiple linear regression. The results showed that the mean age of respondents was 38.53 ± 8.57 years, length of employment was 14.87 ± 8.86 years, and adherence score was 25.43 ± 2.05 . Age, length of employment, and clinical career level (PK/BP) were significantly associated with adherence ($p=0.001$), while education and LBWI training were not significant. Clinical career level was the dominant factor influencing adherence ($B=1.472$; $p=0.005$), with the model explaining 65.5% of adherence score variation (Adjusted $R^2=0.655$). Strengthening clinical career pathways, competency assessment, supervision, and continuous evaluation are required to improve consistent implementation of LBWI care standards.

Keywords : LBW Infants; Nurse Compliance; Clinical Career Level; Care Standards; Multicenter Study

Abstrak : Bayi berat badan lahir rendah (BBLR) memiliki risiko tinggi mengalami komplikasi sehingga membutuhkan perawatan yang konsisten dan terstandar. Kepatuhan perawat terhadap standar perawatan BBLR berperan penting dalam menjaga mutu pelayanan dan keselamatan pasien. Penelitian ini bertujuan mengidentifikasi faktor yang berhubungan dengan kepatuhan perawat terhadap standar perawatan BBLR serta menentukan faktor dominannya pada setting multicenter. Penelitian kuantitatif observasional analitik dengan desain potong lintang dilakukan pada perawat yang merawat bayi BBLR. Data dikumpulkan melalui kuesioner karakteristik responden dan checklist kepatuhan, kemudian dianalisis menggunakan uji bivariat dan regresi linear berganda. Hasil menunjukkan rata-rata usia responden $38,53 \pm 8,57$ tahun, lama bekerja $14,87 \pm 8,86$ tahun, dan skor kepatuhan $25,43 \pm 2,05$. Usia, lama bekerja, dan level PK/BP berhubungan signifikan dengan kepatuhan ($p=0,001$), sedangkan

pendidikan dan pelatihan tidak signifikan. Level PK/BP menjadi faktor dominan ($B=1,472$; $p=0,005$) dengan kontribusi model sebesar 65,5% ($\text{Adjusted } R^2=0,655$). Penguatan jenjang karier klinis, asesmen kompetensi, supervisi, dan evaluasi berkelanjutan diperlukan untuk meningkatkan kepatuhan perawatan BBLR.

Kata Kunci : BBLR; Kepatuhan Perawat; Level PK/BP; Standar Pelayanan; Multicenter

INTRODUCTION

Low birth weight (LBW) remains an important public health and neonatal care concern because infants born with a birth weight below 2,500 g are at substantially greater risk of morbidity and mortality than infants with normal birth weight. LBW may result from prematurity, intrauterine growth restriction, or a combination of both, and is associated with respiratory problems, feeding difficulties, impaired thermoregulation, infection, impaired growth, and adverse developmental outcomes. The World Health Organization (WHO) defines LBW as a birth weight below 2,500 g, regardless of gestational age, and recognizes LBW as an important indicator of maternal and child health as well as a determinant of neonatal survival and long-term health outcomes (WHO, 2026).

The vulnerability of LBW infants requires health services to provide standardized, continuous, and evidence-based care. Current WHO recommendations emphasize that the care of preterm and LBW infants should include preventive and promotive interventions, appropriate feeding, thermal care, respiratory support when indicated, infection prevention and management, family involvement, and kangaroo mother care (KMC). These recommendations are intended not only for individual clinical practice but also to inform national and subnational health policies, clinical protocols, health-service management, supervision, and health-worker training (Groupa, 2023; WHO, 2022). The implementation of these standards therefore represents not merely a technical clinical responsibility but also an issue of professional accountability, service quality, patient safety, and health-service governance.

Nurses have an important role in ensuring that standards of LBW care are consistently implemented because they are directly involved in continuous monitoring and the provision of essential neonatal care. Compliance with standards may include appropriate monitoring of vital signs, maintenance of body temperature, feeding support, infection prevention, observation of respiratory conditions, implementation of developmental care, and appropriate application of KMC according to the infant's clinical condition and institutional protocols. WHO specifically recommends KMC as routine care for preterm and LBW infants and emphasizes early initiation and prolonged skin-to-skin contact when clinically appropriate (Jebessa et al., 2021; Rahmawati et al., 2025). Consequently, the quality of neonatal services depends not only on the availability of clinical guidelines but also on the capacity and willingness of health professionals to translate those standards into consistent clinical behavior.

Compliance, however, is a complex phenomenon influenced by individual, professional, organizational, and environmental factors. Clinical competence is recognized as an important component of nursing practice because competent nurses are expected to integrate knowledge, technical skills, clinical judgment, decision-making, and professional behavior in providing safe and effective care (Fukada, 2018; Hui et al., 2023; Zaitoun et al., 2023). Evidence from a systematic review also indicates that nursing clinical competence is influenced by education and training, clinical experience, professional development, clinical judgment, decision-making, and communication (Almarwani & Alzahrani, 2023; Rahmah et al., 2021; Silitonga et al., 2026). Thus, differences in nurses' professional development and clinical career levels may potentially contribute to differences in their ability to consistently implement established standards of care.

One important aspect of professional development is the clinical career ladder or clinical career level. Clinical ladder systems are generally designed to recognize and facilitate nurses' professional development by defining different levels of clinical practice and competency. An integrative review of clinical ladder programs identified education and experience, competence

and critical thinking, professional development, and organizational culture as important components of successful clinical career development (Weng et al., 2015). In the context of neonatal nursing, a higher clinical career level may reflect greater clinical experience, competency assessment, professional responsibility, and exposure to complex patient-care situations. Nevertheless, clinical career level should not be regarded simply as an indicator of length of employment; rather, it represents a structured dimension of professional development and clinical competence.

The behavioral dimension of professional practice can also be understood through the Behavioral System Model developed by Dorothy E. Johnson. Johnson conceptualizes human behavior as an organized and integrated behavioral system consisting of interrelated subsystems. The model emphasizes the interaction between behavioral patterns and environmental stimuli and proposes that behavioral stability depends on the ability of the system to maintain balance and adapt to internal and external demands (Derdiarian, 1993b, 1993a). In nursing practice, this perspective provides a theoretical basis for understanding how professional behavior may be shaped by individual characteristics, environmental conditions, interpersonal relationships, achievement-oriented behavior, and the availability of support and resources.

Within the context of nursing care for LBW infants, the Behavioral System Model is relevant because nurses work in a highly demanding environment in which clinical decisions and actions must be performed consistently according to established standards. The achievement subsystem is particularly relevant to professional competence because it is associated with goal attainment, mastery, and control of the environment, while the dependency and affiliative dimensions may relate to professional support, supervision, teamwork, and interpersonal relationships within the clinical setting. The model therefore provides a conceptual perspective for understanding compliance not simply as an individual act of following a procedure but as a behavioral outcome arising from interactions between professional competence, individual characteristics, and the work environment.

Previous studies and theoretical discussions have demonstrated the importance of behavioral and professional factors in nursing practice; however, evidence specifically examining determinants of nurses' compliance with standardized LBW care remains limited. The research proposal underlying this study identified a particular gap in the application of the Johnson Behavioral System framework to neonatal and LBW care, as previous applications of the model have more frequently been discussed in other patient-care contexts. Moreover, studies concerning compliance with neonatal care standards have often focused on interventions, protocols, education, or organizational strategies rather than examining the relationship between nurses' professional characteristics and compliance within a multicenter setting.

This gap is important from a health-service governance perspective. The existence of clinical standards alone does not guarantee their consistent implementation. Hospitals require mechanisms for professional development, competency assessment, clinical supervision, monitoring, and quality improvement to ensure that standards are translated into everyday practice. In the present study, this issue is particularly relevant because the observed compliance score was relatively high but still varied among respondents, indicating that implementation of LBW care standards was not completely uniform. The study findings showed that age, length of employment, and clinical career level were significantly associated with compliance in the bivariate analysis, whereas education and previous LBW training were not significantly associated.

More importantly, after controlling for age, education, length of employment, and training through multiple linear regression, clinical career level remained significantly associated with nurses' compliance with LBW care standards ($B=1.472$; $p=0.005$). The regression model demonstrated an Adjusted R^2 of 0.655, indicating that approximately 65.5% of the variation in compliance scores could be explained by the variables included in the model, while the remaining variation may be related to other factors such as work environment, workload, supervision, organizational support, leadership, availability of resources, knowledge, skills, and psychosocial factors.

These findings strengthen the argument that compliance with LBW care standards should be viewed as part of a broader professional and organizational system rather than as an isolated individual behavior. From a health-service governance perspective, strengthening clinical career development and competency assessment may become an important strategy for improving the consistency of neonatal care. Such strategies should ideally be accompanied by regular clinical supervision, compliance audits, continuous education, feedback mechanisms, and organizational support. The study therefore contributes to the discussion of professional governance by connecting nurses' clinical career development with the implementation of standardized neonatal care. Based on this background, this study aimed to identify the factors associated with nurses' compliance with LBW care standards and to determine the dominant factor influencing compliance in a multicenter setting. The study specifically examined age, educational level, length of employment, clinical career level (PK/BP), and history of LBW training as potential determinants of compliance. The findings are expected to provide evidence for strengthening professional development, clinical competency management, supervision, and organizational policies aimed at improving the quality and consistency of LBW care.

METHODS

This study employed a quantitative observational analytic design with a multicenter cross-sectional approach. The multicenter design was used to obtain variation in the characteristics of respondents and clinical settings and to provide a broader representation of nurses providing care for low birth weight (LBW) infants. The study was conducted in neonatal/perinatology units of three hospitals: Santo Vincentius Hospital, Singkawang; , Ajibarang Hospital, Purwokerto; and Gambiran Hospital, Kediri. The hospitals were purposively selected based on the availability of a level II or III perinatology unit, routine LBW infant care services, and documented standard operating procedures for LBW care. The target population consisted of nurses working in perinatology units who were directly involved in the care of LBW infants. A total of 30 respondents participated in the study, consisting of 10 nurses from each participating hospital. The inclusion criteria were nurses with a minimum educational qualification of a Diploma III in Nursing, at least one year of work experience in a perinatology unit, and willingness to participate by signing an informed consent form. Nurses who were undergoing training outside the perinatology unit or whose health condition prevented them from participating in the study were excluded.

Data were collected using three instruments. The first instrument was a nurse behavioral questionnaire developed based on the Johnson Behavioral System Model, using a five-point Likert scale. The questionnaire was intended to assess behavioral aspects relevant to nurses' professional practice. The second instrument was a compliance observation checklist developed with reference to applicable LBW care standards in Indonesia and relevant World Health Organization guidelines. Direct observations were conducted by trained observers. The third instrument was a demographic questionnaire covering respondent characteristics, including age, sex, educational level, length of work experience, clinical career level, and history of LBW-related training. The validity and reliability of the research instruments were assessed before or during implementation. Content validity was assessed through expert judgment, while construct validity was evaluated using Confirmatory Factor Analysis (CFA). Instrument reliability was assessed using Cronbach's alpha, with a minimum acceptable reliability coefficient of 0.70. The compliance checklist had a reported Cronbach's alpha coefficient of 0.772.

Data collection was conducted after administrative approval and ethical clearance had been obtained. The research team first conducted research socialization and coordinated with the participating hospitals. Respondents were recruited voluntarily after receiving information about the study procedures, benefits, potential risks, confidentiality, and their right to withdraw from participation at any time. The respondents completed the questionnaire concerning their characteristics and behavioral aspects. Subsequently, trained observers directly assessed nurses' compliance with LBW care standards using the standardized observation checklist. Direct observation was used to assess the implementation of nursing practices rather than relying solely

on self-reported responses. Medical record documentation was also reviewed as part of the data triangulation process to support the validation of clinical practices and observations.

The dependent variable in this study was nurses' compliance with LBW care standards. The independent variables included age, educational level, length of work experience, clinical career level (PK/BP), and history of LBW-related training. Behavioral aspects were considered within the conceptual framework of the Johnson Behavioral System Model. Data analysis consisted of three stages. First, univariate analysis was performed using descriptive statistics to describe respondent characteristics and the distribution of study variables. Second, bivariate analysis was performed to examine the relationship between each independent variable and nurses' compliance. Pearson or Spearman correlation analysis was selected according to the characteristics and distribution of the data. Third, multivariable analysis was performed using multiple linear regression to identify the dominant factors associated with nurses' compliance with LBW care standards. Statistical significance was established at $p < 0.05$. This study obtained ethical approval from the Health Research Ethics Committee (KEPK) of Poltekkes Kemenkes Pontianak, ethical clearance number 012/KEPK-PK.PKP/IV/D/2026, issued on April 29, 2026. Participants received an explanation regarding the study objectives, procedures, benefits, confidentiality, and their right to withdraw from the study without consequences. Participant confidentiality was maintained by using anonymous identification codes rather than personal identifiers.

RESULTS AND DISCUSSION

Characteristics of Respondents and Compliance with Low-Birth-Weight Care Standards

A total of 30 nurses involved in the care of low-birth-weight (LBW) infants were included in this multicenter study. The mean age of the respondents was 38.53 ± 8.57 years, with an age range of 24–58 years. All respondents were female. Most respondents had a professional nursing education (Bachelor of Nursing/Professional Nurse), accounting for 19 respondents (63.3%), while 11 respondents (36.7%) had vocational nursing education. The mean length of work experience was 14.87 ± 8.86 years, ranging from 1 to 29 years. Regarding LBW training, only 6 respondents (20.0%) had previously participated in LBW-related training, whereas 24 respondents (80.0%) had never attended such training. In terms of clinical career level, the largest proportion of respondents were at PK II/BP II (46.7%), followed by PK III/BP III (26.7%), PK I/BP I (10.0%), PK IV/BP IV (10.0%), and pre-PK (6.7%). The mean compliance score with LBW care standards was 25.43 ± 2.05 , with scores ranging from 20 to 28.

Table 1. Characteristics of Respondents and Compliance with LBW Care Standards

Variable	n	% / Mean $\pm$ SD	Range
Age (years)	30	38.53 ± 8.57	24–58
Sex			
Female	30	100.0	–
Male	0	0.0	–
Education			
Vocational/Diploma	11	36.7	–
Bachelor/Professional Nurse	19	63.3	–
Work experience (years)	30	14.87 ± 8.86	1–29
Previous LBW training			
Yes	6	20.0	–
No	24	80.0	–
Clinical career level			
Pre-PK	2	6.7	–
PK I/BP I	3	10.0	–
PK II/BP II	14	46.7	–
PK III/BP III	8	26.7	–
PK IV/BP IV	3	10.0	–
Compliance score	30	25.43 ± 2.05	20–28

Source: Primary data, 2026.

The relatively high mean compliance score suggests that most respondents had generally good adherence to LBW care standards. Nevertheless, the range of 20–28 indicates that compliance was not completely homogeneous across respondents. This finding is important because LBW infants require consistent, evidence-based care due to their vulnerability to respiratory problems, hypothermia, feeding difficulties, infection, and other complications. The World Health Organization (WHO, 2022) emphasizes that standardized care for preterm and LBW infants should be implemented by competent health workers through evidence-based clinical protocols and appropriate quality-of-care systems. The relatively high compliance observed in this study may reflect the respondents' long clinical experience, with an average work experience of almost 15 years. Clinical experience can provide repeated opportunities to encounter neonatal conditions, develop clinical judgment, and become familiar with standardized procedures. However, experience alone should not be interpreted as sufficient to guarantee compliance. Clinical competence is influenced by multiple factors, including education, training, professional development, clinical judgment, workplace environment, and decision-making skills (Deligianni *et al.*, 2023; Forsetlund *et al.*, 2021).

From the perspective of Johnson's Behavioral System Model, nursing practice can be viewed as a behavioral system in which professional behavior develops through interactions between individual characteristics and the surrounding environment. Thus, compliance with LBW care standards is not merely a technical activity but also represents an observable professional behavior that must be maintained through appropriate environmental support, reinforcement, and professional development.

Bivariate Analysis of Factors Associated with Compliance

Bivariate analysis was conducted to examine the relationship between age, education, work experience, clinical career level, LBW training, and compliance with LBW care standards.

Table 2. Bivariate analysis of factors associated with compliance with LBW care standards

Independent Variable	Statistical Test	p-value	Interpretation
Age	Spearman correlation	0.001	Significant
Education	Mann–Whitney test	0.586	Not significant
Work experience	Spearman correlation	0.001	Significant
Clinical career level	Spearman correlation	0.001	Significant
LBW training	Mann–Whitney test	0.854	Not significant

The bivariate analysis demonstrated significant relationships between age, work experience, and clinical career level and compliance with LBW care standards ($p = 0.001$). In contrast, education ($p = 0.586$) and previous LBW training ($p = 0.854$) were not significantly associated with compliance in this sample. These findings are consistent with the results reported in the study source.

Age and compliance

Age was significantly associated with compliance in the bivariate analysis ($p = 0.001$). This finding suggests that age may be related to the development of professional behavior and clinical experience. Older nurses may have had greater opportunities to encounter complex clinical situations, repeatedly perform procedures, and develop more organized responses to clinical demands. However, age should not be interpreted as a direct determinant of compliance. Age is closely related to other professional characteristics, particularly length of work experience and clinical career development. (Almarwani & Alzahrani, 2023) reported that nursing clinical competence is influenced by several interacting factors, including experience, education, clinical training, professional development, clinical judgment, and decision-making.

This interpretation is also relevant to Johnson's Behavioral System Model. Professional behavior is not determined by a single personal characteristic but develops through interaction between the individual and the environment. In LBW care, mature professional responses may be reflected in consistent observation, accurate documentation, appropriate responses to changes in infant condition, and adherence to established procedures. The significant bivariate association therefore indicates that age is relevant at the individual level, but the finding needs to be interpreted

together with the multivariable analysis because age may overlap with work experience and clinical career level.

Education and compliance

Education was not significantly associated with compliance with LBW care standards ($p = 0.586$). Thus, no statistically significant difference in compliance was identified between respondents with vocational/Diploma education and those with Bachelor/Professional Nurse education. This finding may indicate that formal educational level alone does not necessarily determine whether a nurse consistently follows clinical procedures. Nurses working within the same clinical environment may be exposed to similar standard operating procedures, supervision systems, clinical protocols, and workplace expectations. Consequently, nurses with different educational backgrounds may demonstrate similar levels of procedural compliance. This interpretation is consistent with the broader literature indicating that clinical competence is multidimensional. Education is important for developing knowledge and clinical reasoning, but the translation of knowledge into practice can also depend on clinical experience, workplace conditions, professional development, organizational support, and available resources (Almarwani & Alzahrani, 2023).

Similarly, (Gallione et al., 2022) found that nurses' implementation of clinical practice guidelines is influenced by both intrinsic factors, such as knowledge and skills, and extrinsic factors, including workload, organizational environment, resource availability, and leadership support. Therefore, increasing formal educational qualifications may not automatically result in higher compliance if the clinical environment does not support the consistent implementation of standards.

Work experience and compliance

Work experience was significantly associated with compliance in the bivariate analysis ($p = 0.001$). The mean work experience of the respondents was 14.87 ± 8.86 years, indicating that many respondents had substantial exposure to clinical practice. Longer clinical experience may provide nurses with repeated opportunities to manage neonatal patients, recognize clinical changes, and become familiar with standard procedures. Experience may therefore contribute to the development of clinical competence and professional behavioral patterns. However, the subsequent multivariable analysis showed that work experience was no longer statistically significant after controlling for other variables, particularly clinical career level. This suggests that the apparent effect of work experience in the bivariate analysis may partly overlap with professional career development. Older and more experienced nurses may also be more likely to attain higher clinical career levels. This finding is important because it indicates that experience measured only as years of employment may be less informative than structured professional development and demonstrated clinical competence. (Almarwani & Alzahrani, 2023) similarly emphasized that nursing competence is influenced by experience in combination with education, professional development, clinical judgment, and other contextual factors.

Clinical career level and compliance

Clinical career level showed a significant relationship with compliance ($p = 0.001$). Most respondents were at PK II/BP II, followed by PK III/BP III. The distribution indicates that the study population was predominantly composed of nurses who had progressed beyond the initial stage of clinical career development. The relationship between clinical career level and compliance is theoretically plausible because progression through a clinical career pathway generally involves increasing clinical responsibility, competency assessment, professional autonomy, and development of specialized skills. Nurses at higher clinical levels may also function as role models for less experienced colleagues. This interpretation is supported by literature showing that clinical competence is associated with professional development and career stage. (Saiga et al., 2024), for example, reported that nursing competence varies according to career stage and is also influenced by the clinical work environment. Therefore, the association identified in this study may reflect not simply the duration of employment but the accumulation and formal recognition of clinical competencies.

LBW training and compliance

Previous LBW training was not significantly associated with compliance ($p = 0.854$). Only six respondents (20.0%) reported having attended LBW training, while 24 respondents (80.0%) had not. The absence of a statistically significant association should not be interpreted as evidence that training is unnecessary. The measurement of training in this study was based only on whether respondents had ever attended training. It did not capture the frequency of training, time since the last training, training duration, learning method, training content, or post-training competency assessment. Therefore, the variable may not fully represent the actual effect or quality of training. The finding is also consistent with evidence that educational interventions are often more effective when combined with other implementation strategies. (Cassidy *et al.*, 2021) found that implementation of nursing practice guidelines is influenced by multiple strategies, including education, facilitation, organizational changes, audit, and feedback. Similarly, (Gallione *et al.*, 2022) identified organizational support, resource availability, workload, and leadership as important factors influencing nurses' implementation of clinical guidelines. Thus, training may provide knowledge and skills, but sustained behavioral change requires reinforcement through the clinical environment.

Multivariable Analysis of Factors Associated with Compliance

Multiple linear regression was performed to identify the strongest independent factor associated with compliance after simultaneously controlling for age, education, work experience, clinical career level, and LBW training. The regression assumptions were reported as fulfilled, including normally distributed residuals, absence of multicollinearity, and absence of heteroscedasticity.

Table 3. Multiple linear regression analysis of factors associated with compliance

Variable	B	p-value
Age	-0.082	0.318
Education	0.845	0.094
Work experience	0.104	0.249
Clinical career level	1.472	0.005
LBW training	-0.180	0.748

Source: Primary data, 2026.

The regression equation was: Compliance score = $21.791 - 0.082(\text{Age}) + 0.845(\text{Education}) + 0.104(\text{Work experience}) + 1.472(\text{Clinical career level}) - 0.180(\text{LBW training})$. After adjustment for all variables, clinical career level was the only variable that remained statistically significant, with $B = 1.472$ and $p = 0.005$. This indicates that each one-level increase in clinical career level was associated with an estimated 1.472-point increase in the compliance score, after controlling for age, education, work experience, and LBW training. In contrast, age ($p = 0.318$), education ($p = 0.094$), work experience ($p = 0.249$), and LBW training ($p = 0.748$) were not statistically significant after adjustment. The disappearance of the significant effects of age and work experience after adjustment is particularly important. In the bivariate analysis, both variables were significantly associated with compliance. However, their effects were no longer statistically significant when clinical career level and the other variables were included in the same model. This may indicate that part of the apparent effect of age and work experience is explained by professional career progression. In practical terms, years of experience alone may not be the most important indicator of nurses' ability to comply with LBW care standards. Rather, the competencies that are developed, assessed, and recognized through clinical career progression may be more closely related to actual clinical performance.

Clinical Career Level as the Strongest Independent Factor

Clinical career level demonstrated the strongest independent association with compliance in the multivariable model, with $B = 1.472$ and $p = 0.005$. The study source also reports a standardized beta of 0.536, which was the largest among the independent variables.

Table 4. Summary of the regression model

Statistic	Value
R	0.845
R ²	0.714
Adjusted R ²	0.655
Standard Error of the Estimate	1.180
F	12.01
p-value	0.001

Source: Primary data, 2026.

The model produced an R of 0.845 and an R² of 0.714. After adjustment for the number of predictors, the adjusted R² was 0.655, indicating that approximately 65.5% of the variation in compliance scores in this sample was explained by the variables included in the regression model, while approximately 34.5% remained attributable to other factors not included in the model. The overall regression model was statistically significant ($F = 12.01$; $p = 0.001$). The strong role of clinical career level may be explained by the fact that higher clinical levels generally represent accumulated competence, greater clinical responsibility, and more extensive exposure to complex patient conditions. In neonatal care, particularly LBW care, nurses must be able to perform systematic assessment, recognize early deterioration, apply standardized interventions, and respond accurately to rapidly changing clinical conditions. WHO (2022) emphasizes that quality care for preterm and LBW infants requires health workers who are able to implement evidence-based recommendations through appropriate clinical protocols and quality-of-care systems. Therefore, a clinical career system that incorporates competency assessment may provide an important mechanism for ensuring that nurses are capable of consistently applying neonatal care standards (WHO, 2022).

The finding is also consistent with (Almarwani & Alzahrani, 2023), who identified experience, education, clinical training, professional development, clinical judgment, and decision-making as important components of nursing competence. Clinical career progression may integrate several of these components into a structured professional development pathway. From the perspective of Johnson's Behavioral System Model, a higher clinical career level can be interpreted as reflecting a more developed and stable pattern of professional behavior. The nurse's behavior is directed toward maintaining effective functioning within the professional environment. Compliance with LBW care standards may therefore represent an observable expression of an organized professional behavioral system. Nevertheless, the term "strongest factor" should be interpreted cautiously. The study was cross-sectional and involved only 30 respondents. Therefore, clinical career level should be described as the strongest independent factor or strongest statistical association in the present regression model, rather than as a proven causal determinant.

Interpretation of the Overall Regression Model

The overall regression model was statistically significant ($F = 12.01$; $p = 0.001$), indicating that the set of independent variables collectively demonstrated a statistically significant association with compliance. The adjusted R² of 0.655 suggests that the model accounted for a substantial proportion of the variation in compliance within this study sample. However, approximately 34.5% of the variation was not explained by the variables included in the model. This finding indicates that nurses' compliance with LBW care standards is likely influenced by additional individual, organizational, and environmental factors.

Potential factors include knowledge, clinical skills, workload, staffing, supervision, leadership, organizational support, availability of equipment, access to clinical guidelines, workplace culture, feedback mechanisms, and psychological factors. The importance of these factors is supported by (Gallione et al., 2022), whose systematic review found that guideline implementation by nurses is influenced by both intrinsic and extrinsic factors. Lack of resources was identified as an important barrier, whereas positive feedback and reinforcement from leaders and team members could facilitate guideline implementation. This finding is particularly relevant to neonatal care because compliance with LBW standards cannot be sustained solely through

individual motivation. The (WHO, 2022) recommendations emphasize the importance of health-system implementation, clinical protocols, trained health workers, supervision, and quality-of-care mechanisms. Therefore, hospital management should view compliance as a product of both individual competence and the organizational environment.

Implications for Nursing Management and Clinical Practice

The results have several implications for hospital management. First, clinical career development should be strengthened through systematic competency assessment and continuous professional development, particularly for nurses working with LBW and other high-risk neonates. Second, hospitals should not rely exclusively on one-time training as a strategy for improving compliance. Training should be integrated with clinical supervision, competency assessment, audit, feedback, mentoring, and continuous quality improvement. This approach is supported by evidence indicating that education alone may be insufficient to change clinical practice when organizational barriers remain (Cassidy et al., 2021; Gallione et al., 2022).

Third, periodic audits of LBW care standards are important because the relatively high mean compliance score observed in this study does not indicate that all procedures are performed consistently. Variation in compliance scores suggests that opportunities for improvement remain. Finally, the findings support the relevance of a behavioral perspective in understanding nursing compliance. Johnson's Behavioral System Model provides a useful conceptual framework for viewing nursing behavior as an organized response influenced by both individual characteristics and environmental factors. However, the present study primarily tested demographic and professional characteristics rather than the seven behavioral subsystems directly. Therefore, future studies should operationalize and measure the individual Johnson behavioral subsystems more explicitly to test the theoretical framework more comprehensively.

Study Limitations

Several limitations should be considered when interpreting these findings. First, the sample consisted of only 30 respondents, which limits statistical power and the generalizability of the findings. Second, the cross-sectional design does not permit causal conclusions; the identified relationships should therefore be interpreted as associations rather than causal effects. Third, LBW training was measured only according to whether respondents had ever participated in training. The analysis did not account for training frequency, recency, duration, content, learning methods, or competency outcomes after training. Fourth, the regression model included several predictors despite the relatively small sample size; consequently, the estimates should be interpreted cautiously and preferably confirmed in a larger multicenter sample.

Finally, although Johnson's Behavioral System Model was used as the theoretical framework, the statistical model did not directly measure all seven behavioral subsystems. Future research should develop more comprehensive instruments to measure behavioral-system dimensions, environmental influences, professional competence, and organizational factors simultaneously. Overall, the findings suggest that clinical career level is the strongest independent factor associated with nurses' compliance with LBW care standards in this sample. The findings also indicate that compliance should be understood as a multidimensional professional behavior that requires not only individual competence but also supportive organizational systems, supervision, feedback, and continuous professional development.

CONCLUSION AND RECOMMENDATIONS

This multicenter study found that nurses' compliance with standards of care for low birth weight (LBW) infants was significantly associated with age, length of work experience, and clinical career level in the bivariate analysis. However, after adjustment for other variables in the multiple linear regression model, clinical career level was the only factor that remained significantly associated with compliance ($B = 1.472$; $p = 0.005$). The regression model explained 65.5% of the variation in compliance after adjustment (Adjusted $R^2 = 0.655$). Clinical career level also demonstrated the strongest independent association with compliance, suggesting that structured professional development and competency progression may play an important role in supporting adherence to LBW care standards. Meanwhile, education and previous LBW training were not

significantly associated with compliance in the adjusted model. These findings support the use of the Johnson Behavioral System Model as a theoretical framework for understanding nurses' professional behavior and compliance with standards of care. However, the findings should be interpreted as associations rather than causal relationships because of the cross-sectional design and relatively small sample size.

Based on these findings, healthcare institutions are recommended to strengthen structured clinical career development programs, particularly competency-based assessment, supervision, mentoring, and continuing professional development for nurses providing LBW care. LBW training should also be designed not only based on participation but on the quality, relevance, recency, and competency outcomes of the training. Future studies should involve larger samples and consider additional factors such as knowledge, workload, work environment, leadership, supervision, availability of resources, and organizational support to provide a more comprehensive understanding of nurses' compliance with LBW care standards.

ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to all parties who provided moral and material support throughout the implementation of this study. The authors also gratefully acknowledge the participating hospitals and nurses who contributed their time and valuable information to this research. Their support and cooperation were essential to the successful completion of this study.

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