*Paediatric and Neonatal Pain*

WILEY

ORIGINAL ARTICLE OPEN ACCESS

# Implementation and Evaluation of a Pediatric Pain Assessment Educational Program (PPAEP) for Nurses in a Resource-Limited Setting: A Pilot Study

Abigail Kusi Amponsah[1,2] | Charles Kumi Hammond[3,4] | Victoria Bam[1] | Douglas Gyamfi[5] | Jerry Armah[6] | Dorothy Wilson[1,7] | Faithful Annobil[8] | Daniel Ba-Eebu Badengo[9] | Charlotte Boachie Danquah[10] | Joana Kyei Dompim[11] | Anna Axelin[2] | Faith Nawagi[12] | Snighda Mukherjee[12]

[1]Department of Public Health Nursing, School of Nursing and Midwifery, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana | [2]Department of Nursing Science, Faculty of Medicine, University of Turku, Turku, Finland | [3]Department of Child Health, School of Medical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana | [4]Directorate of Child Health, Komfo Anokye Teaching Hospital, Kumasi, Ghana | [5]University of Maryland School of Nursing, Baltimore, Maryland, USA | [6]University of Florida, College of Nursing, Gainesville, Florida, USA | [7]Elisabeth DeLuca School of Nursing, University of Connecticut, Storrs, Connecticut, USA | [8]Living Waters Hospital, Ejisu, Ghana | [9]Elysium Healthcare, Brighton, UK | [10]University Hospital, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana | [11]Department of Midwifery, School of Nursing and Midwifery, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana | [12]Foundation for Advancement of International Medical Education and Research, Pennsylvania, USA

**Correspondence:** Abigail Kusi Amponsah (akamponsah.fahs@knust.edu.gh)

**Received:** 23 May 2025 | **Revised:** 7 February 2026 | **Accepted:** 14 March 2026

**Keywords:** children's pain | educational program | nurses | pain assessment | resource-constrained

## ABSTRACT

Nurses play a vital role in pediatric pain assessment and management. However, nurses' limited competencies in pain management have been identified as one of the barriers to optimal pediatric pain care. Therefore, this study aimed to implement and evaluate an educational program and changes in nurses' pediatric pain assessment knowledge and attitudes (PPAKA), self-efficacy, and the program's acceptability. Guided by Kirkpatrick's model of evaluation, a one-group pre-post study was conducted among 20 nurses working at the children's unit of the Kwame Nkrumah University of Science and Technology (KNUST) Hospital in Ghana. The pediatric pain assessment educational program (PPAEP) was delivered to the nurses by a pediatric pain nurse researcher in a one-time training session. Participants' pediatric pain assessment knowledge, attitudes, and self-efficacy were assessed before and after the educational program, whereas the program's acceptability was assessed only after the training session. Wilcoxon signed-rank test was performed to evaluate changes in knowledge, attitudes, and self-efficacy following the educational program. Acceptability was presented using descriptive statistics. A Wilcoxon signed-rank test revealed that nurses' PPAKA scores significantly increased after participating in the educational program ($z = -2.514$, $p = 0.012$). The standard PPAKA score increased from 63 at pre-test to 78 at post-test. Participants' self-reported efficacy in assessing pediatric pain was also significantly higher at post-test than at pre-test ($z = -3.967$, $p < 0.001$). The standard self-efficacy score increased from 58.6 at pre-test to 87.7 at post-test. Participants were satisfied and gave positive feedback on the program. A brief PPAEP is acceptable among nurses in a resource-constrained setting and is associated with improvement in pediatric pain assessment knowledge, attitudes, and self-efficacy. Future multi-site studies using larger samples and more rigorous designs, such as randomized controlled trials, are needed to evaluate the program's effectiveness.

## 1 | Introduction

Pain is a ubiquitous term that remains a major source of discomfort for hospitalized children, their caregivers, and healthcare providers. Children experience pain as a result of physical trauma, invasive medical procedures, and disease processes, among other factors [12]. Despite great strides in scientific knowledge and understanding of pain mechanisms, its assessment and management, current evidence suggests that pain in hospitalized infants and children remains poorly managed [1, 35]. Many pediatric patients in Ghana experience needless pain during hospitalization because of suboptimal pain management practices. Poorly managed pain has significant effects on children's health outcomes and overall quality of life [9, 27, 31, 36]. Inadequately managed pain in children can negatively affect their growth and development and serve as a source of stress to affected families, healthcare providers, and society at large [19, 27, 34]. Considering the effects of unrelieved pain on children's health, it is not surprising that effective pain management has been recognized as a fundamental human right of every child [28, 39].

Challenges in pediatric pain management persist partly because of difficulties encountered in assessing pain in this vulnerable group. Although self-reporting is considered the gold standard for pain measurement [37], this is not always feasible in infants and young children because of their age and level of cognitive development [1]. In such cases, clinicians rely on indirect indicators such as behavioral cues (e.g., facial expressions, body movements, crying), biological observations, and physiological signs (e.g., elevated temperature, heart rate, respiratory rate, and blood pressure) [3, 37]. However, these indirect methods may not fully capture the child's pain experience, potentially resulting in inadequate pain management. Therefore, effective pediatric pain management requires a comprehensive understanding of assessment tools and strategies and consideration of each child's developmental level and unique needs [27, 37].

Nurses remain key players in medical care and spend the most time with hospitalized children and their families. Thus, they are well-positioned to play a vital role in all aspects of children's pain assessment and management [3]. Nurses are therefore required to use appropriate strategies to assess and manage children's pain on the basis of their level of cognitive development and pain typology [7, 39]. However, nurses' limited competencies have been identified as one of the key impediments to optimal pediatric pain care for hospitalized children and their families. Studies in Ghana have revealed insufficient pediatric pain knowledge and training among nurses as barriers to optimal pediatric pain management [3, 39]. This trend has been attributed to a low focus on pediatric pain assessment and management in the nursing curricula and limited opportunities for continuous educational programs on pain after training [3].

Given the important role pain assessment plays in effective pain management [14], nurses must be equipped with the knowledge and skills to assess pain appropriately in children of all developmental stages. This will, in turn, result in better health outcomes for children and relieve the economic and psychological burden on families. It is against this backdrop that the present study was undertaken to implement and evaluate an educational program aimed at improving nurses' knowledge, attitudes, and self-efficacy regarding pediatric pain assessment, and to assess the program's acceptability.

## 2 | Methods

### 2.1 | Study Design

The study employed a one-group pre-post design to evaluate the acceptability of an educational intervention and associated changes in nurses' knowledge, attitudes, and self-efficacy regarding pediatric pain assessment. This study was designed as a pilot educational intervention without a control group because the small number of eligible participants and resource constraints made more rigorous designs, such as randomized or waitlist-controlled trials, less feasible.

### 2.2 | Study Setting

The study was conducted at the Kwame Nkrumah University of Science and Technology (KNUST) Hospital in Kumasi, Ghana. It is a 125-bed hospital that provides healthcare services to members of the university and residents of surrounding communities. The hospital offers both general and specialist medical services and includes several wards, among them the children's ward. This ward includes a neonatal intensive care unit (NICU) and a unit for children from 28 days to 14 years. The NICU has a capacity of nine beds, including incubators and cots, whereas the unit for older children has 19 beds. The main ward admits children with acute conditions as well as those with chronic conditions, such as sickle cell disease, who may be experiencing acute episodes. The NICU, on the other hand, admits preterm infants and other neonates requiring specialized care because of birth injuries or other medical complications. The roles of nurses on the ward with respect to pain care primarily involve assessing pain levels, administering prescribed analgesics, and using alternative approaches to relieve pain in children.

### 2.3 | Study Population

The study primarily targeted nurses who were providing care for pediatric patients in the children's ward at KNUST Hospital at the time of the study. Newly qualified midwives undertaking an internship in the unit were also included, as they were providing nursing care to children. Given that all participants were delivering nursing care and nurses constituted the majority of the sample (only two interns were midwives), the term “nurses” is used throughout this manuscript for clarity.

### 2.4 | Eligibility Criteria

Nurses and midwives (permanent staff or interns) assigned to the children's ward during the study period were eligible to

participate. Those who were on leave or absent because of illness at the time of the intervention were excluded.

### 2.5 | Sampling

A census sampling method was used, meaning all eligible nurses present and working in the children's ward during the study period were included. In total, 20 nurses participated in the study.

### 2.6 | Data Collection

Following administrative and ethical approval, the nurse-in-charge introduced the researchers to the nurses in the ward. The nurses were informed about the study scope, benefits, and risks and invited to participate. All participants provided written informed consent before participating in the study. A WhatsApp group was created by the researchers for all consenting participants. This served as a communication platform and was used to share educational materials before, during, and after the intervention. Participants were then invited to the educational sessions, which were held at the hospital. To accommodate participants' schedules, the program was delivered in three sessions on the same day, allowing nurses to attend at a time convenient for them.

Prior to the educational sessions, participants completed baseline online surveys (Google Forms) capturing demographic data, as well as measures of knowledge, attitudes, and self-efficacy related to pediatric pain assessment. These same measures were administered again immediately after the sessions, along with a survey assessing the acceptability of the training program.

An abridged form of the Pediatric Nurses' Knowledge and Attitudes Survey (PNKAS) regarding pain was used to assess knowledge and attitudes. The PNKAS, originally developed by R. C. Manworren [25] as a modification of the Nurses' Knowledge and Attitudes Survey Regarding Pain (NKARSP) developed by Ferrel and McCaffery in 1987 [24], is a 42-item instrument that assesses nurses' knowledge and attitudes toward pediatric pain assessment and management. It includes 25 True/False items, 13 multiple-choice questions, and two case studies comprising four multiple-choice items. For this study, only items 1, 5, 19, 35, and 37 were selected, as these items assess principles of pediatric pain assessment, including beliefs about the subjectivity of pain, children's self-report of pain, individual variability in pain perception, and misconceptions about pain expression. Selection of these items was guided by the content and objectives of the educational program, which focused on improving nurses' pediatric pain assessment knowledge. The versions of items 19 and 37 used in this study were amended on the basis of expert opinions in a previous study that evaluated the content validity of the tool in the Ghanaian context [23]. In the aforementioned study, the PNKAS demonstrated acceptable content validity in the Ghanaian context for educational and research purposes [23]. The internal consistency of the PNKAS has been assessed and reported with Cronbach's alpha values of 0.72 and 0.77 in two different studies [24]. Self-efficacy was assessed using a scale developed by Chiang et al. [10]. The tool consists of six items rated on a 5-point Likert scale ranging from (1 = Not confident at all; 5 = Extremely confident). This study used three items that focused specifically on pain assessment: "How confident are you that you could assess children's pain across developmental stages?", "How confident are you that you could choose appropriate pain assessment methods?" and "How confident are you that you could use the paediatric pain assessment tool for your patients?" Chiang et al. [10] reported Cronbach's alpha values of 0.88 at the pre-test and 0.91 at the post-test. The tool's content validity was previously established through expert review by three pediatric pain specialists [10].

Program acceptability was measured using an adapted version of the Iowa ESL (English as a Second Language) Regional Training Evaluation Form. The form includes 11 closed-ended items and 5 open-ended questions. The closed-ended items evaluate aspects such as instructor performance, training environment, materials, and learning activities. These items were rated on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

### 2.7 | Educational Program

The content of the educational program was informed by the *Assessment* component of the Core Content of the Pediatric Pain PRN Curriculum [26]. The researchers chose to focus on assessment in this pilot study because it is fundamental to guiding effective pain management strategies. The PPAEP was delivered in person by a pediatric pain nurse researcher to three groups of nurses in 1 day. The educational program was delivered in a single day because of financial and time constraints, as well as the need to minimize disruption to clinical duties. Although follow-up or reinforcement sessions were considered, these were not feasible within the available resources. Each session lasted approximately 45 min to 1 h and included 6 to 8 participants. The sessions covered the following topics:

- Definition of pain
- Importance of pain assessment in children
- Pain measurement strategies
- Parental or caregiver involvement in pain assessment.
- The "OPQRST" framework (Onset, Provoking factors, Quality, Radiation, Severity, & Timing)
- Pediatric pain assessment tools
- Recommended frequency of pain assessment and documentation practices

A multimedia approach was employed, including PowerPoint slides, printed handouts summarizing key concepts, and pictorial cards of pain assessment tools to aid visual learning. The sessions also allowed for brief discussions and questions to encourage active participation and reflection.

The content was contextually adapted to reflect the realities of pediatric pain management in the local setting. To ensure fidelity, the same facilitator used a structured presentation guide and followed a consistent format across all three sessions.

## 2.8 | Theoretical Framework and Study Outcomes

The evaluation of the educational program was guided by the Kirkpatrick model. The Kirkpatrick model involves four levels of evaluation [6, 22]: Reaction, Learning, Behavior, and Results (refer to Figure 1). This study focused on the first two levels of Kirkpatrick's model. Although the training evaluation form captured participants' self-reported intentions to apply the knowledge gained, no follow-up assessments were conducted to confirm actual behavior change in the workplace.

- **Level One (Reaction):** This level focuses on assessing participants' perceptions of the training, specifically its relevance, engagement, and overall reception (Kirkpatrick [30]). It involves obtaining direct participant feedback on elements such as the facilitator's effectiveness, the training environment, learning resources, and the overall organization of the program [32]. In this study, a training evaluation form was administered immediately after the program to gather participants' feedback on the relevance of the training, level of engagement and interaction, clarity and structure of the content, effectiveness of the facilitator, and the conduciveness of the learning environment.
- **Level Two (Learning):** This level assesses the degree to which participants acquire the intended knowledge, skills, attitudes, and confidence as a result of the training (Kirkpatrick [30]). In this study, learning was assessed through pre- and post-intervention surveys focused on changes in participants' knowledge, attitudes, and self-efficacy regarding pediatric pain assessment.

## 2.9 | Data Analysis

Data collected from the participants were collated into an Excel file, cleaned, and exported to IBM SPSS Statistics for analysis. With the aid of IBM SPSS Statistics Version 29.0, descriptive statistics such as means, standard deviations, frequencies, and percentages were used to present data on participant characteristics and scores. A Wilcoxon signed-rank test was performed to evaluate changes in participants' pediatric pain assessment knowledge, attitudes, and self-efficacy. This test was appropriate as Shapiro–Wilk test results showed significant deviation from normality in the distribution of knowledge and attitude scores (Pre-test: $W = 0.904$, $p = 0.050$; Post-test: $W = 0.809$, $p = 0.001$) as well as self-efficacy scores (Pre-test: $W = 0.673$, $p < 0.001$; Post-test: $W = 0.873$, $p = 0.013$). Standard scores were determined using the following equation: the average of correct scores/total score $\times 100$. The standard score is expressed on a 0–100 scale to make interpretation easier, with higher scores indicating better performance.

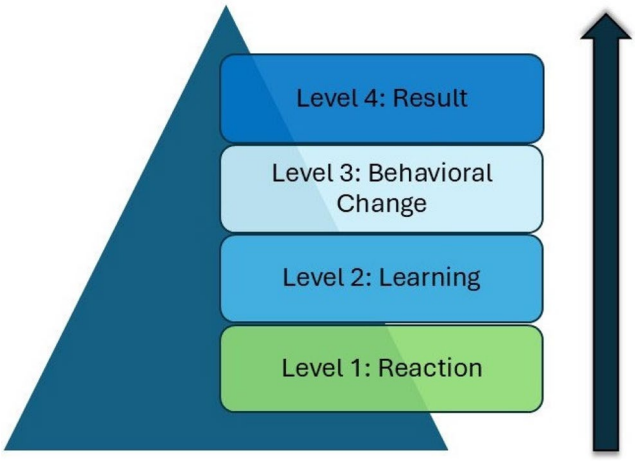


**FIGURE 1** | Kirkpatrick Model of Training Evaluation.

For the open-ended survey responses, content analysis was conducted using NVivo Version 20 to assess the acceptability of the educational program. All qualitative coding and analysis were conducted by a single researcher (DW). A codebook was developed on the basis of Kirkpatrick's model of evaluation to guide the coding process. Responses were read multiple times before coding to ensure a thorough understanding of the data. Codes were applied to data segments relevant to the research questions, guided by the codebook. Additionally, new codes were inductively generated throughout the analysis. After initial coding, related codes were grouped into clusters on the basis of similarity in meaning. These clusters were then organized into sub-themes; each was assigned an appropriate label. To quantify the prominence of key topics, frequency counts were conducted for each sub-theme.

Finally, the sub-themes were organized under four main themes, with the first three corresponding to the first three levels of Kirkpatrick's model. Level 3 was adapted and relabeled "Intended Behaviour Change", as participant responses reflected their anticipated application of knowledge gained, rather than actual observed behavior change.

## 2.10 | Ethical Considerations

Before the study's implementation, administrative and ethical approvals were obtained from the KNUST Hospital management and the Committee for Human Research, Publications and Ethics (CHRPE) of the Kwame Nkrumah University of Science and Technology (KNUST) School of Medical Sciences (Approval number: CHRPE/AP/101/22), respectively. Ethical principles such as informed consent, confidentiality, voluntary participation, autonomy, beneficence, nonmaleficence, and justice were ensured throughout the study period. Informed consent was obtained from all participants after a detailed explanation of the study's purpose and procedures. Additionally, the study contributed to improving participants' knowledge and confidence in pediatric pain assessment and did not expose them to any form of risk. Confidentiality and anonymity were ensured as research data were only accessible to the research team and did not contain any direct identifiers such as names, contact information, date of birth, photographs, among others.

# 3 | Results

## 3.1 | Demographic Characteristics of the Participants

The study achieved a 100% response rate, with all 20 participants completing the education sessions and survey. The participants' mean (SD) age was 30 (6.55) years, and more than half (55%) were

within the age range of 22–31 years. Over two-thirds were females ($n=14$, 70%), and 30% ($n=6$) had the rank of nursing officer.

The participants had generally worked in the nursing and midwifery professions for an average (SD) of 6 (5.0) years, and more than half ($n=11$, 55%) had worked in pediatrics for up to 5 years. They had also worked in the pediatric unit for an average (SD) of 3 (4.02) years (refer to Table 1).

### 3.2 | Pediatric Pain Assessment Knowledge and Attitudes (PPAKA)

Figure 2 presents participants' correct responses to items PPAKA before and after the training. There was a marked increase in correct responses from 45% ($n=9$) to 90% ($n=18$) for Question 4. There was also a slight increase in correct responses from 40% ($n=8$) to 55% ($n=11$) for Question 1 and from 80% ($n=16$) to 90% ($n=18$) for Question 5. For Question 3, all participants ($n=20$, 100%) responded correctly at the post-test, whereas 95% answered correctly at the pre-test. However, no difference was observed in the percentage of participants who answered Question 2 correctly at the pre-test and post-test. See Table S1 for item-level details, including question text, corresponding correct response frequencies, and percentages.

**TABLE 1** | Participants' Demographic Characteristics ($n=20$).

| Variables | Mean (Standard deviation) | Frequency (%) |
|---|---|---|
| **Age (years)** | 30.40 (6.55) | |
| 22–31 | | 11 (55.0) |
| 32–41 | | 9 (45.0) |
| **Gender** | | |
| Female | | 14 (70.0) |
| Male | | 6 (30.0) |
| **Rank** | | |
| Chief Nursing Officer | | 1 (5.0) |
| Principal Nursing Officer | | 3 (15.0) |
| Senior Nursing Officer | | 5 (25.0) |
| Nursing Officer | | 6 (30.0) |
| Staff Nurse | | 1 (5.0) |
| Newly Qualified Nurse | | 2 (10.0) |
| Newly Qualified Midwife | | 2 (10.0) |
| **General Working Years** | 5.65 (5.0) | |
| Up to 5 years | | 11 (55.0) |
| More than 5 years | | 9 (45.0) |
| **Pediatric Working Years** | 3.15 (4.02) | |
| Up to 5 years | | 15 (75.0) |
| More than 5 years | | 5 (25.0) |

The results of the Wilcoxon signed-rank test revealed a significant improvement in PPAKA scores following the educational program ($z=-2.514$, $p=0.012$). The standard knowledge and attitude score increased from 63 at the pre-test to 78 at the post-test. (refer to Table 2).

Data Source: Author's Data Collection at KNUST Hospital.

### 3.3 | Pediatric Pain Assessment Self-Efficacy

Table 3 presents participants' responses to the survey on self-efficacy. Following the educational program, a significant increase was observed in the self-efficacy scores ($z=-3.967$, $p<0.001$) as the standard score increased from 58.6 at the pre-test to 87.7 at the post-test (refer to Table 4).

### 3.4 | Evaluation of the Pediatric Pain Assessment Educational Program

Table 5 shows the results of the closed-ended responses for the training evaluation form.

Almost two-thirds of the respondents ($n=13$, 65%) strongly agreed that the objectives of the training were clearly defined. Also, 90% ($n=18$), of them strongly agreed that participation and interaction were encouraged during the training. Similar results were obtained when they were asked about the usefulness of the training for their work.

Concerning content organization and how easy it was to follow, 80% ($n=16$) of them strongly agreed. Furthermore, 75% ($n=15$) of the participants strongly agreed that the trainers were well prepared, and ($n=13$) strongly agreed that the meeting room and facilities were adequate and comfortable.

Four major themes and four sub-themes were generated from the analysis of the open-ended responses. The major themes include Reaction, Learning, Intended Behavior Change, and Future Training Needs.

### 3.5 | Reaction

This theme represents participants' responses on the aspects of the training they appreciated most, its relevance, their overall satisfaction, and suggestions for improvement.

#### 3.5.1 | Training Satisfaction

Participant responses reflect overall satisfaction with the educational program. Six (30%) participants expressed satisfaction

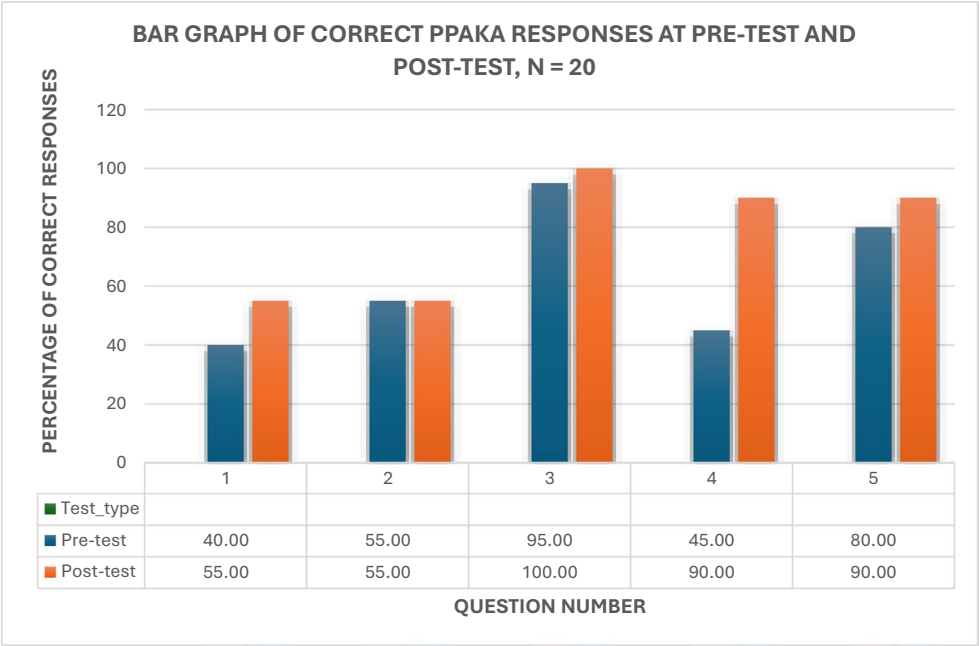


**FIGURE 2** | Bar Graph for Participant's PPAKA scores at Pre-test and Post-test.

**TABLE 2** | Changes in Participants' PPAKA Scores.

| Questions | Pre-test, M(SD) | Post-test, M(SD) | *Z*-value | *P*-value |
|---|---|---|---|---|
| 1. Observable changes in vital signs must be relied upon to verify a child's/adolescent's statement that he/she has severe pain (*False*) | 0.40 (0.503) | 0.55 (0.510) | −0.832 | 0.405 |
| 2. Comparable stimuli in different people produce the same intensity of pain (*False*) | 0.55 (0.510) | 0.55 (0.510) | 0.000 | > 0.999 |
| 3. Most children as young as 4 years of age can reliably report pain intensity using a developmentally appropriate self-report tool (*True*) | 0.95 (0.224) | 1.00 (0.000) | −1.000 | 0.317 |
| 4. The most accurate judge of the intensity of the child's/adolescent's pain is (*the child/adolescent*) | 0.45 (0.510) | 0.90 (0.308) | −3.000 | 0.003* |
| 5. Children generally over-report their pain | 0.80 (0.410) | 0.90 (0.308) | −0.816 | 0.414 |
| Total score | 3.15 (0.933) | 3.90 (0.788) | −2.514 | 0.012 |
| Standard score | 63 | 78 | | |

*Statistically significant variables. The significance level was set at ≤ 0.05.

with all aspects of the training, using phrases such as "happy with the training" and "everything was perfect." Others identified specific aspects of the training that they found most satisfactory: five (25%) participants mentioned the use of pain assessment tools, two (10%) commended the organization of the training, and one (5%) praised the trainer's presentation style.

Participants described their experiences as follows:

> How organized the training was together with how the presenter presented the information.

> Everything was perfect.

> Satisfied with all aspects.

### 3.5.2 | Suggestions for Improvement

Despite the positive feedback, some participants suggested areas for improvement. Two participants (10%) recommended enhancing the training materials by including videos demonstrating pediatric pain assessment, suggesting a desire for more dynamic content delivery. Additionally, three participants (15%) mentioned time constraints, although they did not elaborate on how the scheduling could be improved.

Participant comments included:

> The materials for the training, I think, must be improved.

**TABLE 3** | Pediatric Pain Assessment Self-Efficacy Scores.

| Questions | Not confident *n* (%) | Slightly confident *n* (%) | Somewhat confident *n* (%) | Fairly confident *n* (%) | Extremely confident *n* (%) |
|---|---|---|---|---|---|
| **Pre-test** | | | | | |
| 1. That you could assess children's pain across developmental stages? | 0 | 14 (70.0) | 4 (20.0) | 2 (10.0) | 0 |
| 2. That you could choose appropriate pain assessment methods? | 0 | 0 | 16 (80.0) | 4 (20.0) | 0 |
| 3. That you could use the pediatric pain assessment tool for your patients? | 0 | 0 | 16 (80.0) | 4 (20.0) | 0 |
| **Post-test** | | | | | |
| 1. That you could assess children's pain across developmental stages? | 0 | 0 | 2 (10.0) | 17 (85.0) | 1 (5.0) |
| 2. That you could choose appropriate pain assessment methods? | 0 | 0 | 0 | 11 (55.0) | 9 (45.0) |
| 3. That you could use the pediatric pain assessment tool for your patients? | 0 | 0 | 0 | 5 (25.0) | 15 (75.0) |

**TABLE 4** | Changes in Pediatric Pain Assessment Self-Efficacy.

| Questions | Pre-test, M(SD) | Post-test, M(SD) | *Z*-value | *P*-value |
|---|---|---|---|---|
| 1. That you could assess children's pain across developmental stages? | 2.40 (0.681) | 3.95 (0.394) | −3.841 | < 0.001* |
| 2. That you could choose appropriate pain assessment methods? | 3.20 (0.410) | 4.45 (0.510) | −3.987 | < 0.001* |
| 3. That you could use the pediatric pain assessment tool for your patients? | 3.20 (0.410) | 4.75 (0.444) | −4.041 | < 0.001* |
| Total score | 8.80 (1.281) | 13.15 (0.875) | −3.967 | < 0.001* |
| Standard score | 58.6 | 87.7 | | |

*Statistically significant variables. The significance level was set at ≤ 0.05.

- Videos of a child being assessed should be included.
- Time allocated.

## 3.6 | Learning

This theme represents participant responses related to the knowledge gained through the training.

### 3.6.1 | Improved Pain Assessment Knowledge

Participants' responses indicate that they perceived the training as effective in enhancing their knowledge of pediatric pain assessment. Four participants (20%) described the training as helpful, insightful, and educational. Two (10%) others expressed satisfaction with the knowledge gained over a short period. Additionally, three participants (15%) specifically mentioned learning how to use pain assessment scales and the OPQRST approach.

Examples of participant responses include:

- The knowledge gained over the short period.
- I learnt about how to use pain assessment scales.
- I learnt how to assess pain using the OPQRST, and it was very insightful.
- It was educative.

## 3.7 | Intended Behavior Change

This theme captures participants' intention to apply the knowledge acquired from the training in clinical settings.

### 3.7.1 | Intention to Apply Knowledge in Practice

Participants described various ways they planned to implement what they had learned. Most ($n = 7$, 35%) indicated their intention to incorporate pain assessment into routine vital sign

**TABLE 5** | Participants' Evaluation of the Training Program ($n = 20$).

| Questions | Strongly agree *n* (%) | Disagree *n* (%) | Neutral *n* (%) | Agree *n* (%) | Strongly agree *n* (%) |
|---|---|---|---|---|---|
| 1. The objectives of the training were clearly defined | 0 | 0 | 0 | 7 (35.0) | 13 (65.0) |
| 2. Participation and interaction were encouraged | 0 | 0 | 0 | 2 (10.0) | 18 (90.0) |
| 3. The topics covered were relevant to me | 0 | 0 | 0 | 2 (10.0) | 18 (90.0) |
| 4. The content was organized and easy to follow | 0 | 0 | 0 | 4 (20.0) | 16 (80.0) |
| 5. The materials distributed were helpful | 0 | 0 | 0 | 4 (20.0) | 16 (80.0) |
| 6. This training experience will be useful in my work | 0 | 0 | 0 | 2 (10.0) | 18 (90.0) |
| 7. The trainer(s) was/were knowledgeable about the training topics | 0 | 0 | 0 | 4 (20.0) | 16 (80.0) |
| 8. The trainer was well prepared | 0 | 0 | 0 | 5 (25.0) | 15 (75.0) |
| 9. The training objectives were met | 0 | 0 | 0 | 9 (45.0) | 11 (55.0) |
| 10. The time allotted for the training was sufficient | 0 | 0 | 4 (20.0) | 8 (40.0) | 8 (40.0) |
| 11. The meeting room and facilities were adequate and comfortable | 0 | 0 | 0 | 7 (35.0) | 13 (65.0) |

monitoring, referring to it as the *fifth vital sign*. Three other participants described plans to ensure proper documentation using the OPQRST approach ($n = 1$, 5%), to implement pain scaling ($n = 1$, 5%), and to provide more comprehensive pain management ($n = 1$, 5%).

Participants shared the following comments:

- Adding up pain assessment to my vital signs checking.
- Proper after assessment using the OPQRST.
- To incorporate every aspect of pain management in the care of children.

### 3.8 | Future Training Needs

Participants expressed interest in ongoing education on pediatric pain assessment and management. Two participants (10%) recommended that the pain education program be conducted regularly, highlighting a need for continuous professional development in this area.

Participants also identified specific topics they would like to be included in future training. The most frequently mentioned was pain management (both pharmacological and non-pharmacological approaches) ($n = 5$, 25%). The next most suggested topic was pain assessment in neonates ($n = 2$, 10%). Other suggested topics included explaining painful procedures to children ($n = 1$, 5%) and palliative care for patients with neurological conditions ($n = 1$, 5%).

Participants wrote:

- I think this training should be done continuously.
- Education on pain measurement for neonates.
- Palliative care for neurological clients.

## 4 | Discussion

### 4.1 | Pediatric Pain Assessment Knowledge and Attitudes (PPAKA)

This study evaluated the acceptability of a PPAEP and associated changes in nurses' knowledge, attitudes, and self-efficacy, guided by the Kirkpatrick model. Improvements in PPAKA were observed following the educational program, reflecting Level Two (Learning) of the Kirkpatrick model. Similar improvements in knowledge and attitudes following educational intervention have been reported in previous studies [11, 20, 21],

highlighting the potential benefits of such programs for pediatric pain management.

Despite these improvements, it is not possible to determine whether the observed gains in knowledge and attitudes translated into changes in clinical practice, as Levels Three (Behavioral Change) and Four (Results) of the Kirkpatrick models were not evaluated in this study. Moreover, the study did not assess whether the hospital adopted changes to pain assessment procedures, documentation, or institutional policy following the training. This study was designed as a pilot educational intervention focusing on acceptability and immediate learning outcomes, and follow-up assessments were not done because of time and resource constraints. Future studies will incorporate observational audits or chart reviews to evaluate the uptake and sustained use of pain assessment tools in clinical practice.

Although knowledge and attitude scores improved following the intervention, some misconceptions about pediatric pain persisted. Baseline responses and the persistence of these misconceptions may be partly explained by cultural and contextual beliefs and norms about pediatric pain that have been documented in previous studies among healthcare professionals in Ghana [3, 4].

At baseline, the majority of participants in the present study perceived that observable changes in vital signs must be relied upon to verify a child's or adolescent's report of severe pain. This perception persisted at post-test, with a substantial proportion of participants continuing to endorse this approach to pain assessment. These findings are consistent with a study including nurses and physicians in four hospitals in the Ashanti region, which reported that children were more likely to be perceived as being in pain when traditional vital signs were outside normal ranges [4].

Reliance on physiological indicators suggests that healthcare professionals in this context may conceptualize pain primarily through a biomedical lens, rather than a biopsychosocial perspective, which emphasizes the subjective and multidimensional nature of pain [8, 13, 16]. This orientation may have been reflected in the lack of improvement in the correct responses to Question 2, as a considerable proportion of participants continued to agree that comparable stimuli in different people would produce the same amount of pain. Such responses highlight persistent misunderstandings about the subjective nature of pain and underscore the need for targeted educational interventions to address these misconceptions.

Additionally, Amponsah, Oduro et al. [4] reported that healthcare providers often rely heavily on parents to determine the presence and cause of children's pain. However, caregivers themselves may lack adequate knowledge of pain cues, potentially limiting the accuracy of such reporting [4]. This reliance on family members' interpretation was evident at baseline in the present study, where 40% of participants identified the parent as the most accurate judge of a child's pain intensity. Following the intervention, this misconception was largely addressed, with the majority of participants correctly identifying the child as the most accurate judge of their own pain. However, two participants continued to hold this misconception.

Misconceptions regarding children's pain expression were also evident in responses that children may overreport pain. Although most participants correctly rejected this perception at baseline, a minority endorsed it both before and after the intervention. This finding aligns with previous research among nurses in Ghana, where participants verbalized that sometimes children "exaggerate that they are feeling pain" and also perceived that children might report pain in order to avoid or delay medical procedures [3]. Such perceptions may contribute to skepticism toward children's pain reports, potentially resulting in delayed or suboptimal pain management.

Taken together, these findings suggest that perceptions shaped by cultural and contextual norms may influence pediatric pain assessment practices and underscore the importance of educational approaches that address negative attitudes and misconceptions about children's pain, in addition to providing knowledge and assessment skills.

Additionally, the sample in this study was predominantly female, consistent with the gender distribution of the nursing workforce in Ghana [38]. Gender-related differences in pain perception reported in the literature may have influenced participants' perceptions of pediatric pain assessment, and findings may differ in studies with more gender-balanced samples [33].

### 4.2 | Pediatric Pain Assessment Self-Efficacy

The concept of self-efficacy refers to an individual's confidence in their ability to perform a specific action successfully [5].

In the present study, self-efficacy was assessed as a component of Level Two (Learning) of Kirkpatrick's model. The baseline standard score for self-efficacy was relatively low and may reflect insufficient training, limited availability of pain assessment tools, and infrequent use of available pain assessment tools; factors that have been cited as barriers to pediatric pain assessment in Ghana [3, 4].

Given these contextual factors, the large improvement in self-efficacy observed following the intervention may reflect increased confidence and motivation to assess pain resulting from exposure to knowledge and practical assessment tools. Previous studies have shown that nurses' ability to manage pain is influenced by their self-efficacy for pain management [18], and that knowledge serves as an important foundation for self-efficacy [10]. However, as self-efficacy was assessed immediately after the intervention using self-report measures, the observed increase may also reflect short-term enthusiasm rather than sustained confidence over time and may be influenced by factors beyond the program. Nonetheless, improvements in self-efficacy may support better pain assessment practices by enhancing nurses' confidence in using appropriate tools and strategies.

### 4.3 | Acceptability

Quantitative findings related to the acceptability of the program correspond to Level one (Reaction) of the Kirkpatrick model,

and reflect positive participant perceptions of the relevance, quality, and delivery of the training. Qualitative feedback organized according to the first three levels of the Kirkpatrick model (Reaction, Learning, and Behavior Change) indicated that the program was well-received and educationally beneficial to participants. Despite the positive feedback, participants suggested areas for improvement, including adjustments to time allocation and adding videos to training materials. Although participants did not provide specific details about the time allocation, these comments suggest that participants may have perceived the training duration as insufficient. Participants also proposed additional topics for future training sessions, particularly non-pharmacological pain management strategies, pain management for neonates, and palliative care for children with neurological conditions. Neurological conditions such as cerebral palsy, brain tumors, and migraines are associated with pain and disability, and reduced quality of life [2, 15, 17, 29]. Given the complex pain profiles of such children, holistic care is needed for effective pain and symptom management and improved quality of life.

Overall, the evaluation outcomes met expectations, and participant feedback reflected high levels of satisfaction with the program. These favorable reactions may be attributed to the participatory approach adopted during the training, which encouraged participants to interact and engage freely in discussions. Furthermore, the use of a messaging platform (WhatsApp) provided a convenient and low-cost means of communication and dissemination of educational materials, which may have supported participant engagement before, during, and after the training. However, the study did not evaluate participants' engagement with the platform or its contribution to learning outcomes. Future studies could explore the role of digital messaging platforms in reinforcing learning and supporting sustained behavior change.

### 4.4 | Limitations

This study has some limitations that should be noted. First, the use of a one-group pre-post design limits causal inference. Because of the lack of a control group and randomization, causal inferences cannot be made between the educational intervention and the observed improvements in participants' knowledge, attitudes, and self-efficacy. In the absence of a control group, it is difficult to rule out the potential influence of confounders or external factors such as prior experience, concurrent learning activities, or social desirability bias in self-reported measures.

Additionally, the use of a single-group design, the small sample, and the conduct of the study in a single hospital limit the generalizability of the findings to other nursing populations in Ghana. The findings may differ in larger or non-university hospital settings where staffing structures, workload, access to educational resources, and organizational support for continuing professional development may vary. These contextual differences may influence engagement with the educational program and the magnitude or sustainability of observed improvements.

Although census sampling was used, the sample was small, and participation in the training and evaluation was voluntary. It is therefore possible that nurses who were more motivated or had a greater interest in pediatric pain management were more likely to participate fully and report higher satisfaction. As a result, self-selection bias may have contributed to the favorable acceptability ratings observed.

The use of self-report measures for training evaluation and assessment of changes in knowledge, attitudes, and self-efficacy may have introduced social desirability bias, as participants may have responded in ways they perceived as favorable to the researchers. Evaluation of the training by an external or independent evaluator would have minimized bias.

Finally, the use of a five-item subset of the PNKAS limits the robustness of the findings; therefore, results should be interpreted at the item level rather than as scale-level estimates. Furthermore, this approach limits direct comparability with studies that have used the full PNKAS, and findings should be interpreted within the context of this abridged version.

Nevertheless, the study still provides valuable insights into the feasibility, acceptability, and potential impact of a brief pediatric pain assessment training for nurses and provides a foundation for future controlled studies.

## 5 | Conclusion

The educational intervention was associated with improvements in knowledge, attitudes, and self-efficacy among the nurses. These findings highlight the need for hospital administrators to prioritize pediatric pain assessment training as part of routine in-service education and continuing professional development. For nurse educators, these findings highlight the importance of giving more attention to the biopsychosocial model of pain during pre-service nursing education, to address persistent misconceptions about pain subjectivity and to better prepare future nurses for pediatric pain assessment in clinical practice.

Future studies conducted across multiple clinical settings, using larger samples and more rigorous designs such as randomized controlled trials, are needed to evaluate the program's effectiveness and sustainability. Future studies should also include follow-up assessments to evaluate the retention of knowledge and self-efficacy over time and to determine whether these improvements are translated into clinical practice.

#### Acknowledgments

We are grateful to the College of Health Sciences, KNUST, for providing the needed funding and to the hospital management for permitting us to conduct this study. Our heartfelt gratitude also goes to the nurses who devoted their time and effort outside of their work schedule to participate in the study.

#### Funding

This work was supported by the College of Health Sciences, KNUST.

#### Conflicts of Interest

The authors declare no conflicts of interest.

## Data Availability Statement

The data that supports the findings of this study are available in the Supporting Information of this article.

## References


1. K. Alotaibi, I. Higgins, and S. Chan, "Nurses' Knowledge and Attitude Toward Pediatric Pain Management: A Cross-Sectional Study," *Pain Management Nursing* 20, no. 2 (2019): 118–125, https://psycnet.apa.org/doi/10.1016/j.pmn.2018.09.001.

2. A. Alriksson-Schmidt and G. Hägglund, "Pain in Children and Adolescents With Cerebral Palsy: A Population-Based Registry Study," *Acta Paediatrica* 105, no. 6 (2016): 665–670, https://doi.org/10.1111/apa.13368.

3. A. K. Amponsah, E. F. Kyei, J. B. Agyemang, et al., "Nursing-Related Barriers to Children' s Pain Management at Selected Hospitals in Ghana : A Descriptive Qualitative Study," *Pain Research and Management* 2020 (2020): 7125060, https://doi.org/10.1155/2020/7125060.

4. A. K. Amponsah, E. Oduro, V. Bam, J. Kyei-dompim, C. K. Ahoto, and A. Axelin, "Dynamics on the Field : A Focused Study on the Culture and Context of Pediatric Pain Management at Four Ghanaian Hospitals," *BMC Pediatrics* 20, no. 529 (2020): 529, https://doi.org/10.1186/s12887-020-02399-w.

5. A. Bandura, "Self-efficacy," in *The Corsini Encyclopedia of Psychology*, ed. I. B. Weiner and E. W. Craighead (Wiley Online Library, 2010), https://doi.org/10.1002/9780470479216.corpsy0836.

6. R. Bates, "A Critical Analysis of Evaluation Practice : The Kirkpatrick Model and the Principle of Beneficence A Critical Analysis of Evaluation Practice : The Kirkpatrick Model and the Principle of Beneficence," *Evaluation and Program Planning* 27 (2004): 341–347, https://doi.org/10.1016/j.evalprogplan.2004.04.011.

7. A. Beltramini, K. Milojevic, and D. Pateron, "Pain Assessment in Newborns, Infants, and Children," *Pediatric Annals* 46, no. 10 (2017): 387–395.

8. G. Bendelow, "Chronic Pain Patients and the Biomedical Model of Pain," *Virtual Mentor* 15 (2013): 455–459, https://doi.org/10.1001/virtualmentor.2013.15.5.msoc1-1305.

9. C. T. Chambers, J. Dol, P. R. Tutelman, et al., "The Prevalence of Chronic Pain in Children and Adolescents: A Systematic Review Update and Meta-Analysis," *Pain* 165, no. 10 (2024): 2215–2234, https://doi.org/10.1097/j.pain.0000000000003267.

10. L. C. Chiang, H. J. Chen, and L. Huang, "Student Nurses' Knowledge, Attitudes, and Self-Efficacy of Children's Pain Management: Evaluation of an Education Program in Taiwan," *Journal of Pain and Symptom Management* 32, no. 1 (2006): 82–89, https://doi.org/10.1016/j.jpainsymman.2006.01.011.

11. A. R. Dongara, S. M. Nimbalkar, A. G. Phatak, D. V. Patel, and A. S. Nimbalkar, "An Educational Intervention to Improve Nurses' Understanding of Pain in Children in Western India," *Pain Management Nursing* 18, no. 1 (2017): 24–32, https://doi.org/10.1016/j.pmn.2016.10.003.

12. S. Dowden, J. Stinson, and A. Twycross, *Managing Pain in Children: A Clinical Guide for Nurses and Healthcare Professionals* (Wiley-Blackwell, 2014).

13. G. L. Engel, "The Need for a New Medical Model: A Challenge for Biomedicine," *Science* 196 (1977): 129–136, https://doi.org/10.1126/science.847460.

14. R. Fink, "Pain Assessment: The Cornerstone to Optimal Pain Management," *Proceedings (Baylor University Medical Center)* 13, no. 3 (2000): 236–239, https://doi.org/10.1080/08998280.2000.11927681.

15. GBD 2016 Disease and Injury Incidence and Prevalence Collaborators, "Global, Regional, and National Incidence, Prevalence, and Years Lived With Disability for 328 Diseases and Injuries for 195 Countries, 1990-2016: A Systematic Analysis for the Global Burden of Disease Study 2016," *Lancet* 390, no. 10100 (2017): 1211–1259, https://doi.org/10.1016/S0140-6736(17)32154-2.

16. A. M. D. Gornitzky, "Coping Skills in Children: An Introduction to the Biopsychosocial Model of Pain Control as a Tool to Improve Postoperative Outcomes," *Journal of the Pediatric Orthopaedic Society of North America* 3, no. 1 (2021): 211, https://doi.org/10.55275/JPOSNA-2021-211.

17. A. Harvey, N. Smith, M. Smith, K. Ostojic, and C. Berryman, "Chronic Pain in Children and Young People With Cerebral Palsy: A Narrative Review of Challenges, Advances, and Future Directions," *BMC Medicine* 22, no. 238 (2024): 238, https://doi.org/10.1186/s12916-024-03458-0.

18. S. J. Heo, J. S. Kim, and H. Kim, "Factors Influencing Pain Management Practice in Pediatric Nurses," *Child Health Nursing Research* 22, no. 4 (2016): 279–288, https://doi.org/10.4094/chnr.2016.22.4.279.

19. R. F. Howard, "Chronic Pain Problems in Children and Young People," *Continuing Education in Anaesthesia Critical Care & Pain* 11, no. 6 (2011): 219–223, https://doi.org/10.1093/bjaceaccp/mkr042.

20. M. M. Huth, T. L. Gregg, and L. Lin, "Education Changes Mexican Nurses' Knowledge and Attitudes Regarding Pediatric Pain," *Pain Management Nursing* 11, no. 4 (2010): 201–208, https://doi.org/10.1016/j.pmn.2009.11.001.

21. C. C. Johnston, A. Gagnon, J. Rennick, et al., "One-On-One Coaching to Improve Pain Assessment and Management Practices of Pediatric Nurses," *Journal of Pediatric Nursing* 22, no. 6 (2007): 467–478, https://doi.org/10.1016/j.pedn.2007.07.004.

22. D. L. Kirkpatrick, "Evaluation of Training," in *Training and Development Handbook: A Guide to Human Resource Development*, ed. R. L. Craig (McGraw Hill, 1976).

23. A. Kusi Amponsah, V. Bam, M. Stolt, J. Korhonen, and A. Axelin, "Evaluating the Content Validity of Two Versions of an Instrument Used in Measuring Pediatric Pain Knowledge and Attitudes in the Ghanaian Context," *PLoS One* 15, no. 11 (2020): e0241983, https://doi.org/10.1371/journal.pone.0241983.

24. R. Manworren, "Development and Testing of the Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain," *Paeditric Nurs* 27, no. 2 (2001): 151–158, http://www.ncbi.nlm.nih.gov/pubmed/12962251.

25. R. C. Manworren, "Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain," *Pediatric Nursing* 26, no. 6 (2000): 610–614.

26. R. C. B. Manworren and M. Basco, "Effectiveness and Dissemination of the Interprofessional Pediatric Pain PRN Curriculum," *Journal of Continuing Education in the Health Professions* 42, no. 2 (2022): 135–143, https://doi.org/10.1097/CEH.0000000000000410.

27. L. Mathews, "Pain in Children: Neglected, Unaddressed and Mismanaged," *Indian Journal of Palliative Care* 17 (2011): S70–S73, https://doi.org/10.4103/0973-1075.76247.

28. D. L. Olmstead, S. D. Scott, and W. J. Austin, "Unresolved Pain in Children: A Relational Ethics Perspective," *Nursing Ethics* 17, no. 6 (2010): 695–704, https://doi.org/10.1177/0969733010378932.

29. A. Palmieri, L. Valentinis, and G. Zanchin, "Update on Headache and Brain Tumors," *Cephalalgia* 41, no. 4 (2021): 431–437, https://doi.org/10.1177/0333102420974351.

30. K. Partners, "The Kirkpatrick Model," (2024), https://www.kirkpatrickpartners.com/the-kirkpatrick-model/.

31. J. A. Rabbitts, E. Fisher, B. N. Rosenbloom, and T. M. Palermo, "Prevalence and Predictors of Chronic Postsurgical Pain in Children: A

Systematic Review and Meta-Analysis," *Journal of Pain* 18, no. 6 (2017): 605–614, https://doi.org/10.1016/j.jpain.2017.03.007.

32. D. N. Rouse, "Employing Kirkpatrick's Evaluation Framework to Determine the Effectiveness of Health Information Management Courses and Programs," *Perspectives in Health Information Management* 8 (2011): 1c.

33. A. Samulowitz, I. Gremyr, E. Eriksson, and G. Hensing, ""Brave Men" and "Emotional Women": A Theory-Guided Literature Review on Gender Bias in Health Care and Gendered Norms Towards Patients With Chronic Pain," *Pain Research and Management* 2018 (2018): 6358624, https://doi.org/10.1155/2018/6358624.

34. F. Schwaller and M. Fitzgerald, "The Consequences of Pain in Early Life: Injury-Induced Plasticity in Developing Pain Pathways," *European Journal of Neuroscience* 39, no. 3 (2014): 344–352, https://doi.org/10.1111/ejn.12414.

35. B. J. Stevens, J. Yamada, C. Estabrooks, et al., "Pain in Hospitalized Children: Effect of a Multidimensional Knowledge Translation Strategy on Pain Process and Clinical Outcomes," *Pain* 155, no. 1 (2014): 60–68, https://doi.org/10.1016/j.pain.2013.09.007.

36. E. P. M. van Meijel, M. R. Gigengack, E. Verlinden, et al., "The Association Between Acute Pain and Posttraumatic Stress Symptoms in Children and Adolescents 3 Months After Accidental Injury," *Journal of Clinical Psychology in Medical Settings* 26, no. 1 (2019): 88–96, https://doi.org/10.1007/s10880-018-9567-6.

37. D. Wong, "Pain Assessment in Children," *Anaesthesia & Intensive Care Medicine* 26, no. 3 (2025): 139–142, https://doi.org/10.1016/j.mpaic.2024.12.008.

38. World Health Organization, "Nursing Personnel by Sex (%). The Global Health Observatory," (2026), https://www.who.int/data/gho/data/indicators/indicator-details/GHO/nurses-by-sex-.

39. N. L. Yombei, V. N. Yakong, and K.-H. T. Boateng, "Nurses Knowledge and Attitudes on Pain Management in Children at the Tamale West Hospital," *Asian Journal of Research in Nursing and Health* 4, no. 4 (2021): 240–250, https://www.researchgate.net/publication/357713889_Nurses_Knowledge_and_Attitudes_on_Pain_Management_in_Children_at_the_Tamale_West_Hospital.

## Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** Supporting Information. **Data S2:** Supporting Information. **Table S1:** PPAKA Scores at Pre-test and Post-test ($n = 20$).