



The Effectiveness of an Educational Intervention Program on the Quality of Nursing Care for Children with Burn Injuries at Azadi Teaching Hospital in Kirkuk City, Iraq: A Quasi-Experimental, Non-Randomized Study

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Abstract Background: Paediatric burn injuries require timely, safe and coordinated quality of nursing care because burn severity, fluid loss, wound infection, pain, scarring and psychological distress can affect recovery and long-term function. Structured education may help nurses translate burn quality nursing care guidelines into clinical care. The study assessed the effect of an educational programme on nurses' quality of care in the burn and plastic surgery centre in Kirkuk, Iraq. **Methods:** A quasi-experimental pre-post test study with a control group was conducted among 66 nurses at the Burn and Plastic Surgery Centre of Azadi Teaching Hospital in Kirkuk, Iraq. Nurses were recruited using a non-randomised purposive sampling method and allocated to an intervention group (n = 33) or a control group (n = 33). The intervention group received a structured two-week educational programme on quality nursing care for children with burn injuries. Data were collected at baseline, two weeks and two months after completion of the educational programme using a structured self-administered questionnaire. Knowledge was assessed using a total score ranging from 0 to 34, while practice was assessed using participant-level median scores across three predefined domains. Longitudinal changes were analysed using generalized estimating equations with group, assessment time and group × time effects to account for repeated measurements within participants. **Results:** Significant group × time interactions were identified for knowledge and all three practice domains (all Holm-adjusted p<0.001). Knowledge in the intervention group increased from 9.70±2.32 at baseline to 26.45±2.08 at the two-week assessment and remained at 21.24±3.08 at two months, compared with 11.48±3.86, 13.00±4.35 and 13.70±4.24, respectively, in the control group. The differential improvement was 15.24 points at two weeks (95% CI 14.25-16.23) and 9.33 points at two months (95% CI 8.12-10.55). Significant intervention-related improvements were also observed across all three practice domains. Practice outcomes showed a more sustained intervention effect, as the intervention group achieved higher scores across initial nursing care, nursing care documentation and burn wound nursing care at two weeks and two months. **Conclusion:** The educational programme was associated with a strong early improvement in nurses' knowledge and with higher self-reported paediatric burn nursing practice across both follow-up assessments. Knowledge gains declined by the two-month follow-up but remained greater than baseline and the corresponding control-group trajectory.

Key Words Burn, Clinical Competence, Child Burn, Nursing Management, Nursing Care, Guideline

INTRODUCTION

Paediatric burn injuries are a major public health concern that affects children physically, physiologically, psychologically and socially. Children have a higher risk of burn injury for their natural curiosity, limited danger awareness, small body size, thin skin and physiological immaturity, which reduce their ability to avoid hazardous

situations and tolerate tissue damage after injury. Socioeconomic status, domestic safety, family supervision, access to emergency care and the availability of prevention programmes further increase burn risk and burn outcomes. Evidence from low- and middle-income countries indicates that burn injuries are strongly linked to poverty, limited prevention measures and variable quality of care [1-3].

Burn injuries also represent a major source of preventable morbidity and mortality worldwide. The World Health Organization (WHO) reported that fire-related burns cause around 180,000 deaths each year, with low- and middle-income countries bringing a disproportionate share of this burden [4]. Child mortality from burns is also higher in low- and middle-income countries than in high-income countries, which reflects disparities in prevention, early response, referral systems and specialised care [4,5]. Iraq faces a similar issue, although precise epidemiological data are limited and scattered. However, the available work from Iraq suggests that burn injuries continue to cause substantial morbidity and mortality among citizens, which supports the need for stronger preventive and clinical strategies [6].

The causes and patterns of paediatric burns vary by age, setting and cause of injury. Scald injuries are commonly reported among younger children, while flame-related injuries occur more often among older children [7]. Burn injuries may also occur in the context of neglect or abuse, particularly when the history is inconsistent with the injury pattern or when burns affect specific anatomical sites such as the feet, buttocks, posterior legs, or hands [8-10]. Therefore, careful assessment is essential in quality of paediatric burn care, as effective management requires clear identification of the burn source, burn depth, anatomical site and any clinical or child-safety risks. Quality of burn care usually extends across emergency, acute and rehabilitative phases. Each phase requires accurate assessment, safe fluid resuscitation, wound care, pain control, infection prevention, nutritional support, documentation, family education, scar management and rehabilitation [11,12]. Severe burns may require an immediate transfer to specialised burn centres, critical care, skin grafting, dressing changes, pressure therapy, occupational therapy and long-term follow-up [13].

Burn wounds require consistent wound care, as disruption of the skin barrier increases infection risk and may delay healing. Wound cleaning, debridement, dressing selection, topical therapy, infection surveillance and pain control represent important components of burn nursing care. Procedural pain during dressing changes can intensify physical distress and psychological fear, particularly among children [14]. Skin grafting may be required when wounds cannot achieve satisfactory spontaneous closure [15]. Scar prevention and management are also important during long-term recovery, as hypertrophic scarring can affect appearance, mobility, comfort and quality of life [16].

Furthermore, severe burns produce systemic metabolic and inflammatory responses that extend beyond the wound site. The hypermetabolic response after major burns increases catabolism, inflammation and stress hormone activity, which persist for long periods after injury [17,18]. Severe burns among children cause growth disturbance, nutritional depletion and higher susceptibility to complications, especially when metabolic needs are not adequately addressed. Therefore, proper quality of nutritional care is important to enhance recovery and survival [19].

Nurses at quality paediatric burn care centres work around the clock to provide continuous burn assessment, implement prescribed treatments, monitor and prevent complications, besides documenting care practices and

communicating with children and their families. Therefore, nurses at paediatric burn management centres must combine high technical competence with good guideline-based decision-making, accurate observation, child-centred communication and family involvement. In contrast, providing poor early assessment, delayed resuscitation, inadequate wound care and weak documentation reduce care quality and increase the risk of complications [12,20,21].

Iraqi studies have established both the clinical burden of burn injuries and the need for stronger nursing preparation. For example, Obaid and Baiee [6] reported a substantial burn-related morbidity and mortality in Babylon Province, but their epidemiological study did not evaluate nursing education or changes in care practice. Kadhim and Hamza [22] later showed that an educational programme improved nurses' knowledge of burn management in Al-Najaf. However, the study focused on general burn care and assessed knowledge without examining paediatric-specific nursing practice. For paediatric burn nursing, Al-Sudani and Ali [23] reported improved nursing practice after an educational programme in Baghdad, although their evaluation used a single-group pre/post approach and focused mainly on practice outcomes. Albazoni and Al-Mosawi [24] subsequently demonstrated improved nurses' knowledge of pain management for children with burn injuries in Basra, but their pre-experimental study included only 30 nurses, had no concurrent control group and focused on one component of paediatric burn care. Collectively, the previous Iraqi studies support the value of burn-related nursing education, while leaving limited evidence from controlled studies that evaluate both broader knowledge and multiple domains of paediatric burn nursing practice across more than one post-intervention assessment.

Educational interventions are particularly important in settings where specialised paediatric burn care training is limited, where clinical routines may vary between staff members and where nurses need repeated exposure to guideline-based care. Despite the clinical importance of paediatric burn quality nursing care, limited work has examined structured educational programmes for nurses who care for burned children in Iraq. In this study, we evaluated the effect of a structured educational programme on nurses' knowledge and practices related to quality nursing care for children with burn injuries at the Burn and Plastic Surgery Centre of Azadi Teaching Hospital in Kirkuk City, Iraq. A controlled quasi-experimental design was used to compare the intervention and control groups at baseline, two weeks and two months after the programme, to allow the assessment of both early and short-term changes in knowledge and multiple domains of paediatric burn nursing practice.

METHODS

Design and Setting of the Study

A quasi-experimental design with a control group was used to examine the effect of an educational program on burn and plastic surgery centre nurses' knowledge and practices related to quality nursing care provided to admitted children with burn injuries at the Burn and Plastic Surgery Centre of Azadi Teaching Hospital in Kirkuk City, Iraq.

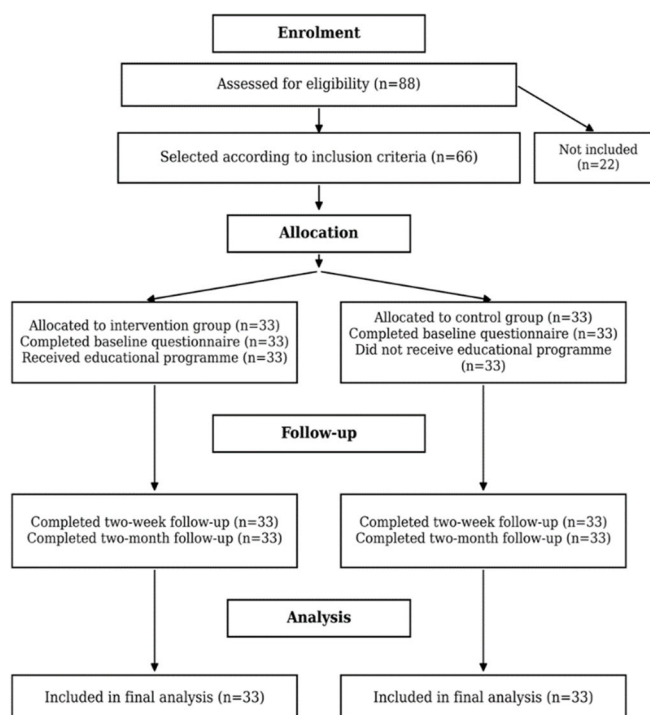


Figure 1: The Flow Diagram of the Enrolled Participants of the Study

The centre is the main burn centre that receives patients from urban and rural areas of Kirkuk City. Data were collected at baseline, two weeks and two months post-intervention. The study included nurses who had at least one year of experience and worked in the burn centre.

Participants and Sampling

The participant enrolment and allocation are presented in Figure 1. The study targeted 88 nurses working at the Burn and Plastic Surgery Centre. All nurses were assessed for eligibility according to the predefined inclusion and exclusion criteria. Twenty-two nurses were not included in the study (12 had less than one year of experience in the burn centre, six were unavailable during the study period because of extended leave and four declined participation). The final sample included 66 nurses who met the eligibility criteria and agreed to participate.

The required sample size was estimated using G*Power based on a medium expected intervention effect size ($f = 0.25$), a significance level of 0.05, statistical power of 80%, three assessment points and an equal 1:1 allocation between the intervention and control groups. The calculation indicated a minimum sample of 60 nurses. An additional 10% was allowed for possible attrition, which resulted in a target sample of 66 participants.

The 66 participating nurses were recruited using a non-randomised purposive sampling approach and assigned equally to the intervention and control groups, with 33 nurses in each group. Group allocation was based on nurses' work schedules and availability during the study period in coordination with the nursing manager to maintain clinical coverage during the educational programme. Nurses assigned to schedules that allowed participation in the

educational sessions formed the intervention group, while nurses working on the alternative schedules formed the control group. No random allocation procedure was used. All 66 participants completed the baseline assessment, the two-week follow-up and the two-month follow-up and all were included in the final analysis.

Data Collection and Study Instruments

Data collection took place from January to September 2025. After the study purpose had been explained and informed consent had been obtained, nurses in both the control and intervention groups completed a self-administered questionnaire. Completion of the questionnaire required approximately 15 to 20 minutes. Assessments for both groups were scheduled within the same predefined period to reduce delayed exchange of study-related information between participants. Because nurses in the intervention and control groups worked in the same burn centre, the possibility of information exchange between groups was recognised during study implementation. Educational sessions were delivered only to the intervention group and the control group received no study-related educational materials or formal instruction during the study period. Follow-up assessments for both groups were scheduled within the same predefined periods to reduce prolonged opportunities for exchange of intervention-related information.

Following baseline data collection, nurses in the intervention group completed the educational programme over two consecutive weeks. Each nurse attended five training sessions during this period, with each session lasting approximately 40 minutes and a total individual training exposure of approximately 200 minutes (3.33 hours).

Follow-up assessments were conducted two weeks and two months after completion of the programme. The effect of the educational program was assessed by comparing scores before and after the intervention.

Data collection relied on a structured self-administered questionnaire that was developed after a comprehensive review of the relevant literature. The questionnaire collected sociodemographic and occupational data and assessed nurses' knowledge and practice related to quality of nursing care for children with burns. The questionnaire contained 133 assessment items, including 34 knowledge items and 99 practice items. Each knowledge item was coded as 0 for an incorrect answer and 1 for a correct answer. The total knowledge score was calculated by summing the scores across the 34 items, resulting in a possible score from 0 to 34, with higher scores indicating greater knowledge of quality nursing care for children with burn injuries. Practice items were scored on a 5-point Likert scale, where 1 indicated poor practice and 5 indicated excellent practice. The 99 practice items were organised into three domains comprising initial nursing care (41 items), nursing-care documentation (21 items) and burn-wound nursing care (37 items). For each participant, the median score across all items within each practice domain was calculated. Domain scores ranged from 1 to 5, with higher scores indicating higher self-reported nursing practice. Each domain score represented the participant's median item response across all items within that domain and was not a summed or mean composite score. Knowledge scores were summarised using the mean and standard deviation, whereas practice-domain scores were summarised using the median and interquartile range because the practice data were non-normally distributed.

Content validity was assessed through review by a panel of 25 experts in nursing education and research. The experts examined the questionnaire for clarity, relevance and comprehensiveness and minor revisions were made according to their comments. A quantitative content-validity index was not calculated. Reliability was examined in a pilot study involving 10 nurses who were not included in the main study. Cronbach's alpha coefficient for the practice items was 0.9298. Internal consistency of the 34 dichotomously scored knowledge items was assessed using the Kuder-Richardson Formula 20 (KR-20) based on the baseline responses of the 66 study participants. The KR-20 coefficient was 0.44. The relatively low coefficient indicates limited internal consistency across the knowledge items and was considered when interpreting the knowledge-score findings.

Educational Program

An educational programme titled "Quality Nursing Care Guideline for Children with Burn Injuries" was developed after an extensive review of the literature and was validated before implementation. The programme was structured as a multicomponent intervention to improve the quality of nursing care for children with burns.

The programme content was based on an assessment of nurses' educational needs and relevant previous literature. The educational programme was reviewed and validated by

two professors and two assistant professors of nursing from Kirkuk University and Hawler Medical University.

Nurses assigned to the intervention group were temporarily relieved of clinical responsibilities and organised into eight training cohorts. Each cohort received the same programme content through five sessions delivered on five separate training days over two consecutive weeks, with two sessions in one week and three sessions in the other. Each session lasted approximately 40 minutes, with a total individual training time of approximately 200 minutes (3.33 hours). The same teaching materials, session duration and theoretical and practical components were used for all eight cohorts. Intervention-group participants were required to attend at least four of the five sessions. Attendance at each of the five sessions was recorded for every intervention-group participant and was used to assess adherence to the educational programme.

The educational programme used lectures, small-group workshops, independent learning and case-based discussions. Formative assessments were used to support learning throughout the programme. The control group received no education related to the guidelines during the study period.

Data Analysis

Data were analysed using JMP®, Version 18. JMP Statistical Discovery LLC, Cary, NC, USA. Descriptive statistics, including frequencies, percentages, means and standard deviations, were used to summarize the sample characteristics. The homogeneity of the study groups for sociodemographic characteristics was examined using the chi-squared test or Fisher's exact test, as appropriate.

Overall knowledge scores were presented as mean and standard deviation, whereas practice-domain scores were presented as median and interquartile range. Longitudinal changes in knowledge and practice were analysed using Generalized Estimating Equations (GEE) to account for the correlation among repeated measurements obtained from the same nurses. Separate models were fitted for knowledge and each practice domain using an identity link, an exchangeable working correlation structure and robust sandwich standard errors. Group, assessment time and the group $\times$ time interaction were included as model effects, with the control group and baseline assessment used as reference categories. The group $\times$ time interaction represented the primary assessment of the educational programme effect by determining whether changes from baseline differed between the intervention and control groups. Model-based contrasts estimated the differential changes from baseline to the two-week assessment and from baseline to the two-month follow-up, with corresponding 95% confidence intervals. Because baseline outcome levels differed between the study groups, secondary baseline-adjusted GEE models were fitted to the two post-programme assessments. The corresponding baseline knowledge or practice-domain score was included as a covariate in each model. Group, follow-up time and the group $\times$ follow-up time interaction were retained, with an exchangeable working correlation structure and robust sandwich standard errors. Adjusted contrasts were used to estimate the between-group difference at the two-week and two-month follow-ups after accounting for the corresponding baseline score. In the consideration of the multiple statistical testing used, the Holm procedure was applied separately to the four primary group $\times$ time

interaction tests, the eight model-based follow-up contrasts and the eight baseline-adjusted follow-up contrasts. Statistical conclusions were based on the multiplicity-adjusted p-values. Statistical significance was set at $p < 0.05$.

Ethical Approval

Ethical approval was granted by the Research Ethics Committee of the College of Nursing, Hawler Medical University, Erbil, Iraq (Approval No. 2418; 13 June 2024) and by the Research Committee of the Knowledge Management and Research Division, Kirkuk Governorate Health Department (Reference No. 502; 11 July 2024). The approvals permitted study implementation at the Burn and Plastic Surgery Centre of Azadi Teaching Hospital in Kirkuk, Iraq. Additional authorisations were obtained from the hospital administration and nursing manager. The approvals permitted intervention-group nurses to participate in the educational programme while being excused from clinical duties during training.

All participants provided verbal informed consent before enrolment in the study. The researchers informed participants about the study aims and procedures, possible risks and benefits, confidentiality safeguards, voluntary participation and their right to withdraw at any time without consequences. The Research Ethics Committee explicitly

reviewed and approved the use of verbal consent because the study involved minimal risk. The researchers performing the study documented consent using a standardised consent form. Participant confidentiality was maintained through coded questionnaires and no identifiable information was collected.

RESULTS

Characteristics of the Sample

A total of 66 nurses were enrolled in the study. Sociodemographic characteristics and professional background of nurses were collected from both study groups. Most nurses in both groups were aged 21-30 years and most participants had a professional diploma in nursing. More than half of the nurses had a monthly income of $\leq 600,000$ IQD, 1-5 years of service in the Ministry of Health and 1-5 years of experience in the burn centre. Previous participation in special paediatric burn nursing care training courses was reported by 30.30% of nurses in the control group and 15.15% of nurses in the intervention. No statistically significant differences were detected between the control and intervention groups in the measured sociodemographic and occupational characteristics (Table 1). However, the absence of statistically significant differences in these characteristics was not interpreted as evidence of baseline equivalence between the groups.

Table 1: Sociodemographic and Occupational Characteristics of the Control and Intervention Groups

Socio-demographic characteristics	Groups n (%)		p-value
	Control (n = 33)	Intervention (n = 33)	
Age			
21-30 years	20 (60.61)	26 (78.79)	0.1869
31-40 years	10 (30.30)	4 (12.12)	
41-50 years	3 (9.09)	3 (9.09)	
Gender			
Male	17 (51.52)	10 (30.30)	0.0797
Female	16 (48.48)	23 (69.70)	
Residence area			
urban	33 (100)	33 (100)	NA
Marital status			
Single	16 (48.48)	19 (57.58)	0.4594
Married	17 (51.52)	14 (42.42)	
Education level			
Nursing preparatory school	3 (9.09)	7 (21.21)	0.3494
Professional diploma of nursing	28 (84.85)	25 (75.76)	
Bachelor of nursing science	2 (6.06)	1 (3.03)	
Monthly income			
$\leq 600,000$ IQD	17 (51.52)	22 (66.67)	0.4402
601,000-900,000 IQD	14 (42.42)	10 (30.30)	
901,000-1,200,000 IQD	2 (6.06)	1 (3.03)	
Years of service in Ministry of Health			
1-5 years	19 (57.58)	26 (78.79)	0.2622
6-10 years	10 (30.30)	4 (12.12)	
11-15 years	2 (6.06)	1 (3.03)	
16-20 years	2 (6.06)	2 (6.06)	
Years of experience in burn centre			
1-5 years	24 (72.73)	30 (90.91)	0.1532
6-10 years	5 (15.15)	2 (6.06)	
11-15 years	4 (12.12)	1 (3.03)	
Participated in special training courses of paediatric burn nursing care			
No	23 (69.70)	28 (84.85)	0.2396
Yes	10 (30.30)	5 (15.15)	
Number of training courses			
1-3 courses	5 (50.00)	5 (100)	0.1009
4-6 courses	5 (50.00)	0 (0.00)	
Location of training courses			
National	10 (100)	5 (100)	NA

Data are presented as n (%). Chi-square or Fisher's exact test was used as appropriate. NA, not applicable

Table 2: Knowledge Scores across the Three Assessment Periods

Knowledge	Groups (mean $\pm$ SD)	
	Control	Intervention
Baseline	11.48 $\pm$ 3.86	9.70 $\pm$ 2.32
Two-week post-programme follow-up	13 $\pm$ 4.35	26.45 $\pm$ 2.08
Two-month post-programme follow-up	13.70 $\pm$ 4.24	21.24 $\pm$ 3.08

Knowledge scores range from 0 to 34, with higher scores indicating greater knowledge.

Table 3: Longitudinal Effects of the Educational Programme on Knowledge and Practice Outcomes

Outcome	Group $\times$ time Holm-adjusted p-value	Baseline to 2-week differential change (95% CI)	Holm-adjusted p-value	Baseline to 2-month differential change (95% CI)	Holm-adjusted p-value
Knowledge	<0.001	15.24 (14.25-16.23)	<0.001	9.33 (8.12-10.55)	<0.001
Initial nursing care	<0.001	2.73 (2.55-2.90)	<0.001	2.12 (1.87-2.37)	<0.001
Nursing-care documentation	<0.001	2.45 (2.25-2.66)	<0.001	1.91 (1.66-2.16)	<0.001
Burn-wound nursing care	<0.001	2.45 (2.27-2.64)	<0.001	1.91 (1.64-2.18)	<0.001

CI, confidence interval. Estimates represent the additional change in the intervention group relative to the corresponding change in the control group. P-values for the four group $\times$ time tests and the eight follow-up contrasts were adjusted for multiple testing using the Holm procedure within their respective test families. Knowledge scores range from 0 to 34. Practice outcomes represent participant-level median domain scores ranging from 1 to 5

Table 4: Baseline-Adjusted Effects of the Educational Programme at the Follow-Up Assessments

Outcome	Adjusted difference at two-week follow-up (95% CI)	Holm-adjusted p-value	Adjusted difference at two-month follow-up (95% CI)	Holm-adjusted p-value
Knowledge	14.99 (13.96-16.01)	<0.001	9.08 (7.81-10.34)	<0.001
Initial nursing care	2.77 (2.62-2.92)	<0.001	2.16 (1.95-2.38)	<0.001
Nursing-care documentation	2.74 (2.54-2.93)	<0.001	2.19 (1.97-2.41)	<0.001
Burn-wound nursing care	2.71 (2.54-2.87)	<0.001	2.16 (1.93-2.40)	<0.001

Estimates represent the adjusted difference between the intervention and control groups at each follow-up after accounting for the corresponding baseline outcome score. Positive estimates favour the intervention group. CI, confidence interval. P-values for the eight baseline-adjusted follow-up contrasts were adjusted using the Holm procedure

Intervention Adherence

All 33 nurses in the intervention group attended all five educational sessions, corresponding to 100% programme attendance. No participant fell below the predefined minimum attendance requirement of four sessions. Attendance was therefore uniform across the intervention group and an analysis of the association between attendance and study outcomes was not applicable.

Knowledge Scores of the Control and Intervention Groups

Table 2 presents the overall knowledge scores of the control and intervention groups across the three assessment periods. At baseline, the mean knowledge score was 11.48 $\pm$ 3.86 in the control group and 9.70 $\pm$ 2.32 in the intervention group. At the two-week assessment, the control-group mean increased to 13.00 $\pm$ 4.35, while the intervention-group mean increased markedly to 26.45 $\pm$ 2.08. At two months, the intervention-group score decreased from its two-week post-programme level to 21.24 $\pm$ 3.08 but remained substantially above baseline, whereas the control-group mean was 13.70 $\pm$ 4.24.

The GEE analysis identified significant group $\times$ time interactions for knowledge and all three practice domains (all Holm-adjusted $p < 0.001$), which indicates that the changes across the assessment periods differed between the intervention and control groups (Table 3). Knowledge showed the largest differential improvement at the two-week assessment, with an increase 15.24 points greater in the intervention group than in the control group (95% CI 14.25-16.23; Holm-adjusted $p < 0.001$). The differential improvement decreased to 9.33 points at the two-month follow-up but remained significant (95% CI 8.12-10.55;

Holm-adjusted $p < 0.001$). Practice showed a similar longitudinal pattern. The differential changes at two weeks were 2.73 points for initial nursing care, 2.45 points for nursing-care documentation and 2.45 points for burn-wound nursing care. Significant intervention-related improvements persisted at two months, with corresponding differential changes of 2.12, 1.91 and 1.91 points, respectively (all Holm-adjusted $p < 0.001$).

Baseline-adjusted analyses also supported the longitudinal findings (Table 4). After adjustment for baseline knowledge, the intervention group scored 14.99 points higher than the control group at the two-week follow-up (95% CI 13.96-16.01; Holm-adjusted $p < 0.001$) and 9.08 points higher at the two-month follow-up (95% CI 7.81-10.34; Holm-adjusted $p < 0.001$). Adjustment for the corresponding baseline practice-domain score produced similar findings for self-reported practice. Adjusted between-group differences at two weeks were 2.77 points for initial nursing care, 2.74 points for nursing-care documentation and 2.71 points for burn-wound nursing care. The corresponding adjusted differences at two months were 2.16, 2.19 and 2.16 points, respectively and all comparisons remained statistically significant (Holm-adjusted $p < 0.001$).

Practice Scores of the Control and Intervention Groups

Table 5 presents the participant-level median practice-domain scores across the three assessment periods. At baseline, the median initial nursing-care score was 2 in both groups, while the median nursing-care documentation and burn-wound nursing-care scores were also 2 in both groups, although greater dispersion was observed in the intervention group.

Table 5: Participant-Level Median Practice-Domain Scores across the three Assessment Periods

Practice domain	Control Med (IQR)	Intervention Med (IQR)
Baseline		
Initial nursing care	2 (0)	2 (0)
Nursing care documentation	2 (0)	2 (1)
Burn wound nursing care	2 (0)	2 (1)
Two-week post-programme follow-up		
Initial nursing care	2 (0)	5 (0)
Nursing care documentation	2 (0)	5 (0)
Burn wound nursing care	2 (0)	5 (0)
Two-month post-programme follow-up		
Initial nursing care	2 (1)	4 (1)
Nursing care documentation	2 (0)	4 (1)
Burn wound nursing care	2 (0)	4 (1)

Med, Median; IQR, Interquartile Range. Scores represent the participant-level median item response within each practice domain and range from 1 to 5, with higher scores indicating higher self-reported nursing practice

Table 6: Distribution of Participant-Level Median Practice-Domain Scores across Assessment Periods

Assessment	Group	Domain	Score 1 n (%)	Score 2 n (%)	Score 3 n (%)	Score 4 n (%)	Score 5 n (%)
Baseline	Control	Initial nursing care	3 (9.09)	24 (72.73)	6 (18.18)	0	0
		Documentation	4 (12.12)	28 (84.85)	1 (3.03)	0	0
		Burn-wound care	3 (9.09)	26 (78.79)	4 (12.12)	0	0
	Intervention	Initial nursing care	1 (3.03)	25 (75.76)	7 (21.21)	0	0
		Documentation	1 (3.03)	19 (57.58)	13 (39.39)	0	0
		Burn-wound care	0	19 (57.58)	14 (42.42)	0	0
Two weeks	Control	Initial nursing care	3 (9.09)	24 (72.73)	6 (18.18)	0	0
		Documentation	4 (12.12)	28 (84.85)	1 (3.03)	0	0
		Burn-wound care	1 (3.03)	28 (84.85)	4 (12.12)	0	0
	Intervention	Initial nursing care	0	0	0	3 (9.09)	30 (90.91)
		Documentation	0	0	0	6 (18.18)	27 (81.82)
		Burn-wound care	0	0	0	2 (6.06)	31 (93.94)
Two months	Control	Initial nursing care	2 (6.06)	22 (66.67)	9 (27.27)	0	0
		Documentation	2 (6.06)	27 (81.82)	4 (12.12)	0	0
		Burn-wound care	1 (3.03)	25 (75.76)	7 (21.21)	0	0
	Intervention	Initial nursing care	0	0	0	19 (57.58)	14 (42.42)
		Documentation	0	0	0	19 (57.58)	14 (42.42)
		Burn-wound care	0	0	0	17 (51.52)	16 (48.48)

Scores represent the median item response calculated separately for each participant across all items within the corresponding practice domain

At the two-week assessment, median scores increased to 5 across all three domains in the intervention group, while the corresponding control-group medians remained at 2. At two months, the intervention-group medians decreased modestly to 4 across the three domains but remained above their baseline levels, whereas the control-group medians remained at approximately 2.

The distribution of participant-level median practice scores showed substantial concentration at the upper end of the scale in the intervention group at the two-week follow-up (Table 6). For initial nursing care, 30 of 33 nurses (90.91%) had a median score of 5 and three (9.09%) had a score of 4. For nursing-care documentation, 27 nurses (81.82%) had a median score of 5 and six (18.18%) had a score of 4. For burn-wound nursing care, 31 nurses (93.94%) had a median score of 5 and two (6.06%) had a score of 4. At two months, the distributions became less concentrated at the maximum score. Median scores of 5 were observed in 14 nurses (42.42%) for initial nursing care, 14 (42.42%) for nursing-care documentation and 16 (48.48%) for burn-wound nursing care, while the remaining participants had median scores of 4.

DISCUSSION

The present study evaluated a structured educational programme for nurses providing quality nursing care for

children with burn injuries. The longitudinal analysis identified a significant group $\times$ time interaction for knowledge, indicating that the pattern of change across the three assessment periods differed between the intervention and control groups. Knowledge showed the largest differential improvement at the two-week post-programme follow-up. The intervention-group mean increased from 9.70 ± 2.32 at baseline to 26.45 ± 2.08 , whereas the control-group mean increased from 11.48 ± 3.86 to 13.00 ± 4.35 . The corresponding differential change was 15.24 points (95% CI 14.25-16.23; Holm-adjusted $p < 0.001$). However, the lower baseline knowledge score in the intervention group provided greater scope for improvement and should be considered when interpreting the magnitude of the early change.

The marked increase observed at the two-week follow-up represents an early post-programme knowledge improvement, but the non-randomised design does not permit the change to be interpreted as definitive evidence of causation. The educational programme provided protected learning time and combined lectures, workshops, self-directed study, case-based discussion and formative assessment, which may have contributed to the observed knowledge gain. Similar short-term improvements have been reported in previous burn-nursing education studies.

Instructional guidelines improved both knowledge and practice among nurses caring for burned children [25], while another designed burn-nursing guideline increased knowledge from a pre-test mean of 72% to a post-test mean of 89% [26]. Herein, the results extend this evidence by showing a differential longitudinal pattern between the intervention and control groups across more than one follow-up assessment.

Knowledge decreased in the intervention group to 21.24 ± 3.08 at the two-month follow-up, which indicates partial attenuation of the early improvement. However, the score remained above both the intervention-group baseline and the corresponding control-group mean of 13.70 ± 4.24 . The differential baseline-to-two-month change remained significant at 9.33 points (95% CI 8.12-10.55; Holm-adjusted $p < 0.001$). The control group also showed a modest increase in knowledge across the study period, which may reflect repeated exposure to the questionnaire, informal information exchange between nurses, shared clinical experience, or other time-related influences. The persistence of the group $\times$ time interaction and the baseline-adjusted findings suggests that the observed difference in trajectories was not explained solely by the initial knowledge imbalance, although residual confounding cannot be excluded in this non-randomised study.

Self-reported practice showed a clear differential longitudinal pattern between the intervention and control groups. Median scores across initial nursing care, nursing-care documentation and burn-wound nursing care increased from approximately 2 at baseline to 5 at the two-week follow-up in the intervention group and decreased to 4 at two months, while the control-group scores showed comparatively little change. Significant group $\times$ time interactions across all three domains indicate that the trajectories differed between groups and the baseline-adjusted analyses produced the same pattern after accounting for the corresponding baseline practice scores. The findings support an intervention-associated improvement in self-reported practice that persisted at the two-month follow-up, although the non-randomised design prevents attribution of all observed change solely to the educational programme.

The practice findings further suggest that the educational programme contributed to changes in reported nursing practice beyond the early improvement in knowledge. Significant group $\times$ time interactions were identified for initial nursing care, nursing-care documentation and burn-wound nursing care, while the intervention group retained higher median domain scores at the two-month follow-up. The decrease from 5 at two weeks to 4 at two months indicates partial attenuation of the early practice improvement, although the scores remained substantially above baseline. Repeated exposure to burn-care procedures and routine clinical activities may have contributed to the persistence of these reported practice changes.

The observed changes in self-reported practice are also relevant to established standards for paediatric burn nursing care. For example, the British Burn Association requires care givers to have burn-specific competencies and education, clinical guidelines knowledge, attend audit programmes and

ability to use data-collection systems for monitoring and timely observation [27]. Similarly, the Royal Children's Hospital (Melbourne, Australia) nursing guideline presents wound assessment, analgesia before dressing care and accurate care documentation management as key good quality practises in paediatric burn care [28].

The contrast between the rapid knowledge decay and sustained good practice improvement has direct implications for how burn centres should design paediatric burn nursing education. Burn care centres like the Burn and Plastic Surgery Centre of Azadi Teaching Hospital in Kirkuk need to have educational and awareness lectures more frequently. A stronger approach would use a competency-based training pathway that combines an initial structured educational programme, booster sessions, supervised bedside coaching and routine practice auditing. A first booster at approximately four to six weeks is a reasonable study-based inference because the knowledge obtained declined by two months. Short case-based refreshers, documentation drills, wound-care simulation and observed practice sessions could then be integrated into monthly or quarterly quality meetings.

Several design and measurement features limit the interpretation of the study findings. First, the non-randomised design and purposive sampling approach increase the possibility of selection bias, while baseline differences in knowledge and some practice outcomes indicate that the groups were not fully equivalent at study entry. Although the longitudinal and baseline-adjusted analyses accounted for measured baseline outcome differences, residual confounding from unmeasured participant characteristics cannot be excluded. Second, recruitment from a single burn centre and the relatively small sample of 66 nurses limit the generalisability and precision of the findings. Nurses from both groups also worked within the same clinical environment, which created opportunities for contamination through informal communication, shared clinical activities and common care practices. Third, repeated administration of the same questionnaire may have produced a testing effect and contributed to changes observed in both groups independently of the educational programme. Fourth, the two-month follow-up period was sufficient to examine early retention but was insufficient to establish the longer-term durability of knowledge and practice changes. Fifth, practice was assessed using a self-administered questionnaire and represents self-reported practice rather than independently observed bedside performance. Recall and social-desirability bias may consequently have influenced the reported scores and the study did not include objective clinical indicators, direct observation of nursing care, or patient-level outcomes to verify whether reported practice changes translated into changes in bedside care. Multiple outcomes and follow-up contrasts also increased the potential for type-I error; the Holm procedure was applied to the principal inferential test families to reduce this risk. The intervention-group practice scores showed a substantial ceiling effect at the two-week post-programme follow-up, with median domain scores of 5

observed in 90.91% of participants for initial nursing care, 81.82% for nursing-care documentation and 93.94% for burn-wound nursing care. The concentration of scores at the upper end of the scale may have reduced discrimination among participants with high reported practice and limited sensitivity to additional improvement. The ceiling effect was less pronounced at two months, when 42.42-48.48% of intervention-group participants retained a median score of 5. The questionnaire was reviewed by a large expert panel, although no quantitative content-validity index was calculated. Internal consistency of the knowledge items was relatively low ($KR-20 = 0.44$), while reliability of the practice instrument was estimated from a pilot sample of only 10 nurses, which limits the precision of the reliability estimate.

CONCLUSION

The structured educational programme produced a marked early improvement in nurses' knowledge and self-reported practice related to quality nursing care for children with burn injuries at the Burn and Plastic Surgery Centre of Azadi Teaching Hospital in Kirkuk City, Iraq. Knowledge declined from the two-week post-programme level by two months, although a substantial intervention-related improvement remained compared with both baseline and the control group. Self-reported practice decreased modestly between the two-week and two-month follow-ups but remained substantially above baseline and the longitudinal between-group analyses supported persistent differential improvement across initial nursing care, nursing-care documentation and burn-wound nursing care. The findings also support the integration of structured educational programmes in paediatric burn nursing into continuing professional development programmes and undergraduate nursing curricula. Burn centres should combine initial training with refresher sessions, supervised bedside application, competency assessment and routine practice audit. Future studies should use randomised or multicentre designs, longer follow-up and objective care indicators to confirm the durability of educational effects and determine whether improved nursing competence translates into safer paediatric burn care.

Authors' Contributions

Aram Najat Abdulrazzaq: Contributed to study conceptualisation, methodology, data curation, formal analysis, software use, investigation and drafting of the manuscript. Norhan Zeki Shaker: Contributed to study conceptualisation, methodology, project administration, validation, supervision and critical revision of the manuscript. Both authors reviewed and approved the final version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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Data Availability

Study data can be obtained from the corresponding author upon reasonable request.

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