Effect of Educational Program on Nurses Performance Regarding Care of Critical Burn and Patient's Outcomes

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Abstract

Background: Critical burns are potentially life threatening, disfiguring, and disabling, and requires immediate medical attention, the critical burns care nurse is responsible for treating and monitoring burn wounds. Patient outcomes are the results from care and treatments that critical burn patients have received in hospital. They focus on meeting the physical, social, and emotional needs of patients **The aim of this study** was to evaluate the effect of educational program on nurses performance regarding care of critical burn and patient's outcomes. **Research design**: A quasi-experimental research design was used. **The study subject** was convenience sample of available nurses (40) nurses and purposive sample of (40) patients with critical burn with inclusive and exclusive criteria. **The study was conducted at** hehia hospital, at Zagazig city, sharkia governate, Egypt. **Four tools of data collection** were used for collecting data : structured self-administered questionnaire that includes two parts : (personal characteristics of nurses, and nurse's knowledge assessment questionnaire), nurses' observational checklists procedure , structured nurse's attitude scales, and patient's outcomes scale that includes two parts, (socio-demographic characteristics of patients, and assessment patients' outcomes and complication).**Results**: Less than quarter (22.5%) of study nurses had satisfactory knowledge level regarding care of critical burn in preprogram phase increased to majority (85.0%) post program phase. A quarter of study nurses (25.0%) had competent practice level regarding care of critical burn in the preprogram phase increased post program phase. Less than half of study nurses (42.5%) had a positive attitude in the preprogram phase regarding critical burn. While increased post program phase. Most patient with critical burn (90%) had a complication preprogram decreased to about one third (35%) post program. **Conclusion:** satisfactory knowledge level, competent practice and, positive attitude in preprogram improved post program and flow up phase. Educational program had a positive effect in improving nurses' performance, knowledge, practices, and attitude as well as improving patient's outcomes. **Recommendations:** Identify barriers that hinder optimal nurse performance and facilitators that can enhance the quality of care of critical burn.

Keywords: *Care of Critical Burn, Educational Program, Nurses Performance, and Patient's Outcomes.*

Introduction

Burn is defined as damage caused by heat, electricity, or chemicals to the skin and underlying tissues. It is one of the critical health problems worldwide. Its mortality and non-fatal complications depend on several factors including age, sex, residency, cause, the extent of the burn, and time and level of care given **(Schuermann et al., 2023).**

Burn is described according to depth (first degree, second degree and, third degree, and fourth degree), TBSA (palmar surface, rule of nine and, Lund and Browder chart), severity (minor, moderate and, major). When assessing the depth of a burn, four factors must be considered: appearance, blanching to pressure, pain, and sensation **(Salakhiddinov et al., 2020).**

Critical burns are defined as first- or second-degree burns that cover more than 25% of an adult's body, or a third-degree burn of more than 10% BSA, high-voltage electrical burns, significant burns to the face, eyes, ears, joints, or genitalia. A critical burn requires immediate medical attention. These burns are potentially life threatening, disfiguring, and disabling **(Lasalvia et al., 2021).**

Critical burns are classified into five different causal categories/etiologies and depths of injury. The causes include injury from flame (fire), hot liquids (scald), contact with hot or cold objects, chemical exposure, and/or conduction of electricity. The first three induce cellular damage by the transfer of energy, which induces coagulative necrosis. Chemical burns and electrical burns cause direct injury to cellular membranes in addition to the transfer of heat **(Żwierełło et al., 2023).**

Critical burn contributes a significant proportion of the morbidity and mortality attributed to injuries throughout the world, incidence of critical burn was 31 million people that severe enough to require hospital outpatient presentation or an admission to hospital **(World Health Organization, 2025).**

Risk factors for critical burn include socioeconomic, race and ethnicity, age-related factors (children and the elderly), overcrowding; households where young girls have domestic roles; cooking with kerosene; generalized poor health; and poor safety practices **(Zhao et al., 2023).** Critical burn symptoms vary depending on how deep the skin damage, causes, location and total body surface area affected. These burns may be white and pliable, black, and charred, brown, and leathery, or bright red because of fixed hemoglobin in the subdermal region. Critical burn symptoms on the face, neck, hands, feet, any joints, or genitals include signs of stridor, respiratory distress, coughing, a sore throat, difficulty breathing, singed facial hair, swelling on laryngoscopy, upper airway trauma, altered mentation, hypoxia/ hypercarbia, and hemodynamic instability **(Townsend et al., 2023).**

Critical burns cause both systemic and local complications. The major factors contributing to systemic complications are breakdown of skin integrity, fluid loss, infection, or sepsis, breathing problems, bone, joint problems, dangerously low body temperature, low blood volume, scarring, and tetanus**.** Local complications include eschars and contractures and scarring **(Plaza et al., 2023).**

The nurse play important role in head-to-toe assessment of critical burn patient , stabilization procedures, a wound care plan is decided upon and implemented by the nurse, she collaboration with the burn physician, closely monitors the critical burn patient, which includes maintaining effective airway clearance and gas exchange, assessing the adequacy of fluid resuscitation, and monitoring adequate perfusion to vital organs and extremities ,pain and anxiety management, support throughout rehabilitation, and psychosocial community re-integration. Supportive care to the patient and family are key features of the nursing role currently **(Labuz et al., 2023).**

The initial nursing management of the critical burn patient has a significant impact on his/her ultimate outcome. Failure to adequately address airway or breathing problems can be devastating. Under- or over-resuscitation can be just as problematic. Insufficient resuscitation can lead to renal failure, burn depth progression, and even death **(Tammar et al., 2023).**

The patient outcomes are the results from care and treatments that critical burn patients have received due to improved understanding of resuscitation, enhanced wound coverage, better support of hypermetabolic response to injury, more appropriate infection control and improved treatment of inhalation injury, based on better understanding of the pathophysiologic responses after critical burn injury **(Mc Kittrick et al., 2023).**

Significance of the study:

Critical burn is one of the most catastrophic and devastating injuries. specifically in low- and middle-income countries. For those who survive, their lives are left with physical, mental, psychological, and social sequelae. There is also the stigma and discrimination related to the disability and disfigurement, especially the scars, may remain for several years, or even decades, and are considered the biggest problems for the patient, not to mention the extreme pain and suffering that affects the

patient quality of life **(Shen et al., 2023).**

Therefore, it is important to provide continuous education and update for nurses regarding evidence-based nursing practices about critical burn patients to perform their practice in a high quality, safe and in efficient way **(Ng et al., 2023).**

Aim of the study:

Was to evaluate the effect of educational program on nurses performance regarding care of critical burn and patient's outcomes.

Research Hypothesis:

H_1: The implementation of educational nursing program will increase mean scores of nurses' level of knowledge regarding care for patients with critical burn.

H_2: The implementation of educational nursing program will increase mean scores of nurses' practice level regarding care patients with critical burn.

H3: The implementation of educational nursing program will change in nurses' attitude regarding care for patients with critical burn.

H4: The implementation of educational program will improve patient's outcomes.

Research design: A quasi-experimental research design with pre-post test was conducted to achieve the aim of the study. Quasi-experimental research designs (QEDs), as the name suggests, use nonexperimental (or non-researcher-induced) variation in the main independent variable of interest, essentially mimicking experimental conditions in which some subjects are exposed to treatment and others are not on a random basis. QEDs improve our understanding of the causal effects of various educational policies and interventions by focusing on internal validity—did the policy or intervention being studied cause a significant change in the observed outcome **(Gopalan et al., 2020).**

Setting: The study was conducted at Hehia hospital, at Zagazig city, Sharkia governate, Egypt. (Burn, surgery, and emergency units). The hospital consists of three floor, surgery and emergency unite located on the first floor, the unite contain 2 beds, burn unit is located on the second and third floor it composed of 5 rooms in each floor, each room contains 2beds (10 for males in second floor and, 10 for females in third floor).

Subjects:

A-Nurses:

Convenience sample of available nurses (40) who were on duty in the mentioned hospitals in the study setting, and classified as following, 10 nurses from emergency and surgical unites and 30 nurses from burn unite.

B- Patients:

Purposive sample of (40) patients with critical burn according to sample size.

according to the following criteria:

Inclusion Criteria:

patient's age from 20-60 years old, in both genders, with 2th or 3th degree of burn in any part of body, with any burn causes, can be communicate and agree to participate in the study.

Exclusion Criteria:

Patients with chronic illness, third degree of liver cancer, liver cirrhosis, end stage of renal disease, congestive heart disease, diabetes mellitus, and chronic obstructive pulmonary disease.

Sample size:

For nurses:

The sample size was determined to be 40 nurses. Based on total number of nurses in burn, surgery, and emergency units (140 nurses). Using Epi Info (Epidemiological Information system) software version 6. Steve thompon equation was used to calculate the sample size, at 5% ∞ error (95.0% significance) and 20.0 β error (80.0% power of the study) **.**

For patients:

The sample size was determined to be 40 patients. Based on the estimated number of patients with critical burn in burn, surgery, and emergency units where (16 cases/month, therefore 200 cases/year). According to **(Elsayed et al., 2021) and (Daniel & Cross, 2018)** the sample size will be calculated by the following equation.

$$n = \frac{(z^2 * N * p * (1-p))}{[(N-1) * E^2 + Z^2 * p * (1-P)}$$

Where, N; is the population size (200), Z; is the Z-score corresponding to your desired level of confidence (1.96 for 95% confidence), P; is the estimated proportion of the population that exhibits the characteristic you are studying (we use 0.5 for a conservative estimate) and E; is the desired margin of error (E = 0.10).

Tools of data collection:

Four tools were used to collect data in this study. They were designed by the researcher after extensive review of the relevant literature.

Tool I: Structured Self-Administered Questionnaire: adapted from (Mohammed et al., 2021),

It included two parts:

Part I; Assess personal characteristics of nurse, five close ended questions such as (age, gender, qualification, years of experience, and attended courses on critical burn)

Part II; Nurses Knowledge assessment Questionnaire: To evaluate nurses' knowledge regarding critical burn injury and care provided to critical burned patients, it covered 78 multiple choice question consist of:

A- Information about the skin and burns covered 29 questions.

B- Information on nursing care for critical burn during the emergency phase covered 15 questions.

A- Information on nursing care for critical burn patients in the acute phase covered 34 questions.

Tool II-: Observational checklists for nurses: adapted from (word health organization,2024), it consists of three parts:

1-Critical burn wound dressing procedure: it was included 34 steps: preparation of patient and environment (fife steps), assessment (two steps), pre dressing medication/ pain relief (four steps), and critical burns wound care steps (23 steps) classified as: remove of previous dressing (nine steps), clean hydrotherapy (six steps), apply new dressing (eight steps).

2-Scar management procedure: it was included 17 steps: Massage (six steps), splints and stretching (fife steps) and, pressure garments (six steps)

3-Rehabilitations exercises according to their critical burn site: it was included 42 steps: stretching exercises (two steps), aerobic walk exercises(four steps), muscles strengthening exercises(two steps) and stretching exercises to help with tightness: face (fife steps), neck (four steps), chest (four steps), shoulders (two steps), elbows(one step), hands and arms (10 steps), knee and legs (fife steps), ankles (two steps) and, toes (one step).

Tool III: Structured nurse's attitude scale: adapted from (Mohammed et al., 2021),

It was used to assess nurses' positive or negative attitude regarding nursing care of critical burned patients.

Tool IV: Patient's outcomes scale: adapted from (Odondi et al., 2020).

It included two parts:

Part I; include:

A- Demographic Characteristics of patients with critical burn:

It was used to assess patient's demographic characteristics as age, sex, occupation, marital status, and residence.

B-Medical data such as diagnosis, vital signs, past medical history\ Presence of chronic diseases, critical burn mechanism, critical burn site, %TBSA burned, critical burn depth, length of stay (days) and wound healing.

Part II; Assessment patients' outcomes and complication:

Include 52 items, it was used to assess complication of patients with critical burn as infectious complications (four items), respiratory complications (three items), cardiovascular complications (three items), renal complications (two items), neurologic complications (four items), hematologic complications (two items), musculoskeletal complications (nine items), wound and dressing complication (three items), sleep and rest (four items), physical function (fife items), social interaction (four items), physiological interaction and image (four items), and emotional behavior (fife items).

Administrative and ethical consideration:

An official permission was obtained from the ethical committee in the faculty of nursing, Dean of Nursing faculty and the managers of hehia hospital. Then permission to carry out the study was obtained from the head of mentioned setting after explaining the purpose of the study and a verbal consent was obtained from nurses and patients for participation in the study and they were assured that the information would be used for research purposes only. After explaining its purpose, they were given an opportunity to refuse the participation, and they were assured that the information would be used for research purposes only. All ethical issues were taken into consideration during all phases of the study. The ethical research considerations in this study included the following: The research approval was obtained before intervention guidelines implementation, the objectives and the aims of the study were explained to the participants, the researcher confirmed the anonymity and confidentiality of subjects, and subjects were allowed to choose to participate or not and they had the right to withdraw from the study at any time without penalty. The researcher confirmed that the data and information

collected would be confidential and would be used only to improve the patients' health.

Pilot study:

A pilot study was carried out on four nurses and four patients (10%) of the total study sample to test clarity, applicability, relevance, and feasibility of the tools and to estimate the required time to fill in each form. Necessary modification was done according to the pilot study results. Pilot subjects were later excluded from the main study sample.

Field work*:*

Upon securing all necessary official permissions were obtained, the field work was lasted over a period of 12 month, starting from beginning of January 2025 to the end of December 2025. 2 months for pre-test from (beginning of January 2025 to end of February 2025), 7 months for implementation the program and immediately post-test from (beginning of March 2025 to the end of September 2025), 3 months after post-test follow up test was done from (beginning of October 2025 to the end of December 2025. The study was conducted in assessment, planning, implementation, and evaluation phases.

1- **Assessment phase:** The researcher visited the study setting, met with the directors and head nurses to explain the study aim and procedures, and to gain their approval and cooperation. It was conducted through one session (pretest). The information obtained served as baseline data and guided the researcher in the preparation of the educational program. Then, the researcher met with the nurses who fulfilled the eligibility criteria, explained to them the purpose of the study and its procedures as well as their rights, and invited them to participate. The interviews were done four days per week (Monday, Tuesday, Wednesday, and Thursday) during the morning and afternoon shifts from 9:00 am to 5:00 PM.

2- **Planning phase:** During this phase, the researcher designed the program based on review of the most recent and relevant literature, and under the guidance of the supervisors. The main goal was to evaluate the effect of educational program on nurses performance regarding care of critical burn and patient's outcomes.

The content of the program was developed based on this general aim in addition to specific objectives. It consisted of two main parts. The first part was theoretical concerning critical burn care, knowledge include (skin anatomy and physiology of the skin and, skin functions) , critical burn (definition of burn, causes of burn, pathophysiology of burn, classification of burn by depth and TBSA, phases of critical burn management (medical and nursing), and complication of critical burn). The second part was mainly practical. It involved critical burn wound dressing procedure, scar management procedure, rehabilitations exercise for critical burn patient, infection control and general nursing care.

3- **Implementation phase:**

The developed program was implemented in the form of sessions including theoretical, practical content, carried out in burn, surgery, and emergency units in Hehia hospital for nurses regarding care of critical burn. Each session started by a summary of the previous session, and objectives of the new one. Taking into consideration, the use of Arabic language that suits the level of the nurses. Emphasizing and reinforcement during session were used to enhance motivation.

The content of the program was distributed over 15 sessions. The first session was for orientation to clarify aim and contents of the program, its general objectives, the teaching methods, learner's activities, and evaluation methods as well as, number and time of theoretical and practical sessions, whereas the remaining sessions divided as follows: A total of nine sessions for the theoretical part, and 5 sessions for the practical part.

These sessions were conducted during the morning and afternoon shifts. Each session lasted one hour and started by a summary of the previous session and objectives of the new one. Nurses were divided into groups according to their shift and load of work, with average was attended 3-4 nurses in every class. The researcher used simple language to suit nurses' level, with motivation and reinforcement during sessions to enhance nurses' learning. The booklet was provided to each nurse on the first day of program implementation to use it as a future reference.

The researcher used various teaching methods which included lectures, group discussion, brainstorming, demonstration, and re-demonstration to attract nurses' attention and motivate them to participate. Various teaching media were used as photo, video-films, colored posters, illustrative pictures, and booklet. The researcher used observational checklists for patients' re-demonstration of each technique.

Nurses were allowed to ask any questions and encouraged to participate in the group discussion. The investigator was available all time to answer any questions and respond to any needs from nurses.

4- **Evaluation phase:**

After completing all sessions and ensure their competence, immediately post test to evaluate the effect of educational program on nurses performance regarding

care of critical burn and patient's outcomes, then follow up after 3 months, to identify differences, similarities and areas of improvement, as well as, defects.

Regarding patient outcome evaluation.

The researcher interviews the patient to explain purpose of the study and obtaining verbal consent to participate, then patient interview implemented to assess demographics of them and review of medical file to assess medical history, present illness, and patient outcome. The interview performed during implementation of the program then reassess after implementation of the educational program in synchronization with pre and post test.

The pre and post patient's groups are different in both groups because the patients involved in the preintervention phase were no longer hospitalized at the time of post-intervention data collection, either due to discharge or death. Therefore, a new patient group was selected six months later. resulting in two distinct patient samples.

Content validity and Reliability:

Content validity was used, the researcher prepared the data collection tools in their preliminary form. They were then presented to a panel of five experts for face and content validation. These included five (assistant prof) in Medical Surgical Nursing from Faculty of Nursing, Zagazig University. They reviewed the tools for clarity, relevance, comprehensiveness, feasibility, and ease of implementation. All recommended modifications were made. Reliability was established by Alpha Cronbach test which is used to measure the internal consistency (reliability of the used tool or instrument). The reliability scores of the tool as above 0.86, which indicates the high tool internal consistency of the used tool.

Statistical analysis:

All data were collected, tabulated, and statistically analyzed using SPSS 25.0 for windows. Quantitative data were expressed as the mean ± SD & (range), and qualitative data were expressed as absolute frequencies (number) & relative frequencies (percentage). Percent of categorical variables were compared using Chi square test ($\chi 2$) or Fisher's exact test when appropriate. Quantitative continuous data were compared Kruskal-Wallis tests. Spearman rank correlation coefficient was calculated to assess relationship between various study variables, (+) sign indicate direct correlation & (-) sign indicate inverse correlation, also values near to 1 indicate strong correlation & values near 0 indicate weak correlation. Also, multiple linear regression analysis was used to compare two classes. All tests were two sided. P-value < 0.05 was considered statistically significant (S), and p-value ≥ 0.05 was considered statistically insignificant (NS).

Results:

Table 1: displays frequency and percentage distribution of the studied nurses according to their demographic characteristics. It was found that more than two thirds (70%) of studied nurses' age was ≥30 years with the mean age 32.62± 4.78 and the majority (85%) of studied nurses were females. Regarding to studied nurses' qualification less than half (45%) had nursing technical institute and less than quarter (20%) bachelor's degree. Also, nearly two thirds (67.5%) had years of experience critical burns department unit <10 years and / more than half (55.0%) did not attain any training course related to critical burns management.

Table 2: displays frequency and percentage distribution between pre, post and follow up program phases according to total knowledge of studied nurses regarding critical burn injury. It was found that less than quarter (22.5%) of study nurses had satisfactory total knowledge level in preprogram phase with Mean± SD =45.85±11.26, while increased to the majority (85.0%) in post program phase with Mean± SD =64.27±6.50 and 82.5% in follow-up phase had satisfactory knowledge level with Mean± SD =63.27±5.85. Also, this table confirms that, there was a high statistically significant difference between pre/post and pre/follow up program phase as regarding to the total nurses' knowledge about care of critical burn with p value 0.001.

Table 3: displays frequency distribution of nurses' total level of practice regarding critical burn care throughout study phases. It was found that in preprogram phase less than one third (30.0 %) of study nurses had competent practice level regarding critical burn wound dressing increased post program phase to the most (95.0 %) and decelerated to the majority (87.5 %) of the studied nurses in follow up phase. Also, in preprogram phase less than quarter (27.5 %) of study nurses had competent practice level regarding critical burn scare management increased post program phase to the most (95.0 %) and decreased to the majority (82.5 %) of the studied nurses in follow up phase. Moreover, this table shows that, in preprogram phase less than quarter (20.0%) of study nurses had competent practice level regarding critical burn rehabilitation exercise increased to the most (95.0 %) post program phase and slightly decelerated to the majority (87.5 %) of the studied

nurses in follow up phase. Also, this table confirmed that, there was a highly statistically significant difference between pre / post and pre / follow up program phase regarding to the total score for nurses' practice (critical burn wound dressing, burn scare management and rehabilitation exercise) with p value 0.000.

Table 4: displays percentage distribution of studied nurses' level of total practice regarding critical burn care throughout study phases. It was found that in preprogram phase one quarter (25.0%) of study nurses had competent practice level. While increased post program phase to most (92.5%) and decreased to 80.0% in follow up phase. Also, there were high statistically significant differences between pre / post and pre / follow up program phase regarding to the total score for nurses' practice about critical burn care with p value 0.000.

Table 5: displays percentage distribution of studied nurses' total attitude regarding critical burn care throughout study phases. It was found that in preprogram phase less than half (42.5%) of study nurses had positive attitude. While increased post program phase to more than three quarters (77.5%) and decreased to more than two thirds (70.0%) of nurses in follow up phase. Also, this table clarifies, there was a highly statistically significant difference between pre / post and pre / follow up program phase regarding to the total score for nurses' attitude regarding critical burn care with p value 0.000.

Table 6: displays frequency and percentage distribution of studied critical burn patients according to their demographic characteristic. It was found that studied patients age was more than 30 years with the mean age 34.67 ± 12.66 and more than half of studied patients three fifths (60.0%) were males. Also, three quarters of studied patients (75.0%) were married. Moreover, nearly two thirds (65.0%) of studied patients were working. Finally, more than half (52.5%) of the studied patients were lived in rural area.

Table 7: displays frequency distribution of studied patients with critical burn according to medical data. It was found that most of the studied patients (90.0%) had abnormal vital signs; all studied patients (100.0%) had no chronic diseases. In relation to critical burn mechanism, more than half (55.0%) of patients was due to flame, and one quarter (25.0%) was due to scaled. Regarding to critical burn site, more than half of the patients (52.5%) were in trunk, less than half (45%) in head and neck, more than one quarter (27.0%) in lower extremity, about one quarter (25.0%) in upper extremity, (15.0%) in buttocks and (7.5%) in genitalia. Regards to percent of TSBA burned, this table shows that, three quarters (75%) were 10-20 TBSA, one eight (12.5%) were 20-30 TBSA, one eight (12.5%) were >30 TBSA. Concerning critical burn depth, one quarter (25%) of the patients were partial thickness, more than quarter (27.5%) were full thickness, less than half (47.5%) of the patients were mixed (partial and full thickness). also, Mean Length of hospital stay (days) ±SD =45.73 ± 12.35.

Table 8: displays comparison between incidence of total complications among studied patients throughout program phases. It was found that most patient (90.0%) with critical burn had a complication preprogram decreased to about one third (35.0%) post program, and there were high statistically significant differences in incidence of total complications among critical burn patients throughout the study phases (p< 0.001).

Table 9: show relation between total nurses' level of knowledge, total practice, and total patients' complications throughout study phases. It was found that there was high statistically significant relation between total nurses' knowledge and total nurses' practice in before and after the program. (p = 0.012). In the other hand there was a statistically significant difference between patients' total complication and total nurses' practice after the program at p<0.001.

Discussion:

Regarding personal characteristics of studied nurses, the present study showed that more than two thirds of studied nurses' age was ≥30 years and most of them were females. Regarding to studied nurses' qualification, less than half had nursing technical institute and less than quarter had bachelor's degree. Also, nearly two thirds had years of experience in critical burns department unit <10 years and more than half of did not attain any training course related to critical burns management.

This study was agreement with **(Abd El-Moneim et al., 2020)** who found that the majority of nurses were female, and approximately 70 of them were graduated from the technical nursing institute, this study was agreement with **(Aiken et al.,2021),** who found that less than half of study had nursing technical institute and higher educational preparation among nurses is strongly linked to improved patient outcomes, Also this study was agreement with **(Kumar et al.,2019),** who found that two third of nurses had years of experience in critical burns department unit <10 years and limited

experience may affect nurses' confidence and competency in managing critical burn patients particularly in emergency situations, also this study was disagreement with **(Mohamed & Ahmed ,2022)** , who found that two third of studied nurse didn't attain any training course related to critical burn management .

Concerning percentage distribution total knowledge of studied nurses regarding critical burn injury, the current study showed that less than quarter of studied nurse had satisfactory total knowledge level in preprogram phase, while most of them in post and follow-up program phase had satisfactory knowledge level. Also, this study confirms that, there was a high statistically significant difference between pre/post and pre/follow up program phase as regarding to the total nurses' knowledge about care of critical burn.

This study was in agree with **(Abd El-Moneim et al., 2020**), who showed that reported a significant improvement in total nurses' knowledge and skills following the implementation of a structured critical burn care training program.

Concerning the distribution of nurses' total level of practice regarding critical burn care, the current study reported that study nurses in preprogram phase had competent practice level regarding critical burn wound dressing, critical burn scare management, and critical burn rehabilitation exercise while increased post and follow up phase. Also, current study confirmed that, there was a highly statistically significant difference between pre / post and pre / follow up program phase regarding to the total score for nurses' practice (critical burn wound dressing, burn scare management and rehabilitation exercise).

This study was congruence with **(Ali et al.,2019),** who revealed that the educational or training interventions implemented had a positive impact on improving nursing practices regarding burn wound dressing, critical burn scare management, and critical burn rehabilitation exercise.

Concerning the distribution of studied nurses' level of total practice regarding critical burn care, the present study revealed that study nurses in preprogram phase had competent practice level while increased post and follow up phase. Also, current study confirmed that there were high statistically significant differences between pre / post and pre / follow up program phase.

This study was in correspondence with **(El-Sayed et al., 2021)**, who stated that marked improvements in nurses' practice regarding care of critical burn

Regarding the distribution of studied nurses' total attitude regarding critical burn care, the current study reported that study nurses had positive attitude in preprogram phase. While increased post program phase and follow up phase. Also, current study confirmed that there was a highly statistically significant difference between pre / post and pre / follow up program phase regarding to the total score for nurses' attitude regarding critical burn care.

This study was on the line with **(Sarfraz et al.,2021),** who found that improvement in nurses' attitudes toward critical burn care

Regarding demographic characteristic of studied patient, the present study revealed that patient's age was more than 30 and more than half of studied patients were males. Also, three quarters of studied patients were married. Moreover, nearly two thirds of studied patients were working. Finally, more than half of the studied patients were lived in rural area, and the mean hospital stay of 45.73 ± 12.35 days.

This study was on the line with **(WHO, 2018)** data who found that most patients were adults over 30 years old, predominantly male, and residing in rural areas. These findings correspond with indicating that adult males in rural areas are more exposed to flame-related critical burns due to occupational and domestic risks. The mean hospital stay of 45.73 ± 12.35 days is comparable to findings by **(Al-Mousa et al.,2019),** who noted that the duration of hospitalization correlates with critical burn depth and percentage of total body surface area (TBSA) burned.

Concerning medical data of studied patients, the current study reported that most of the studied patients had abnormal vital signs, all of them had no chronic diseases. In relation to critical burn mechanism, more than half of the studied patients was due to flame, and one quarter was due to scaled. Regarding to critical burn site, more than half of studied patients were in trunk, less than half in head and neck, more than one quarter in lower extremity, about one quarter in upper extremity. Regards to percent of TSBA burned, this study showed that, three quarters were 10-20 TBSA, one eight were 20-30 TBSA, one eight were >30 TBSA. Concerning critical burn depth, one quarter of the patients were partial thickness, more than quarter were full thickness, less than half of the studied patients were mixed (partial and full thickness).

This study was on the line with **(WHO, 2018)** data who found that in the mechanism of injury, flame burns were the most common cause among the studied

patients, followed by scald burns. In terms of burn site, the trunk and head/neck regions were most frequently affected.

This study was also in correspondence with **(Herndon, 2019**), who found that the total body surface area (TBSA) affected in most patients ranged between 10–20%.

Concerning the incidence of total complications among studied patients, the current study reported that there were high statistically significant differences in incidence of total complications among critical burn patients throughout the study phases.

This study was supported by **(Greenhalgh, 2019)**, who reported that there were high statistically significant differences in incidence of total complications among critical burn patients throughout the study phases.

Concerning relation between total nurses' level of knowledge, total practice and total patients' complications, the current study reported that there was high statistically significant relation between total nurses' knowledge and total nurses' practice in before and after the program. Also, the study shows that there was a statistically significant difference between patients' total complication and total nurses' practice after the program.

This study was congruence with **(Johnson et al., 2022**), who reported that high statistically significant relation between total nurses' knowledge and total nurses' practice in before and after the program. Also, there was a statistically significant difference between nurses' total complication and total nurses' practice after the program.

Conclusion:

According to the outcomes of the current study it can be concluded that, preprogram phase less than quarter of study nurses had satisfactory knowledge level regarding care of critical burn increased to most of them in post program phase. A quarter of study nurses had competent practice level regarding care of critical burn in the preprogram phase increased to the most in post program and follow up phase. Less than half of study nurses had a positive attitude in the preprogram phase regarding critical burn. While increased post program phase to more than three quarter and decreased to three quarter of nurses in follow up phase. Most patient with critical burn had a complication preprogram decreased to about one third post program. A positive correlation between nurses' total knowledge, practice, and attitude scores. Therefore, it can be concluded that educational program had a positive effect in improving nurses performance regarding care of critical burn as well as improving patient's outcome.

Recommendations:

1- Develop or upgrade a dedicated critical burn unit equipped with modern technology, isolation rooms, and intensive monitoring systems. Ensure availability of telemedicine consultation for rural or non-specialized centers.
2- Ensure the unit includes multidisciplinary teams (critical burn surgeons, nurses, anesthetists, physiotherapists, nutritionists, and psychologists).
3- Strengthen coordination with emergency departments and regional hospitals for rapid referral and transport patient with critical burn
4- Further studies are needed to identify barriers that hinder optimal nurse performance and facilitators that can enhance the quality of care of critical burn.

Table 1: Frequency and percentage distribution of the studied nurses according to their demographic characteristics (n=40).

Demographic Characteristics	No.	%
Age		
<30	12	30.0
≥30	28	70.0
Range	25.0 – 41.0	
Mean ± SD.	32.62± 4.78	
Gender		
Male	6	15.0
Female	34	85.0
Qualification		
Nursing Diploma	14	35.0
Nursing Technical Institute	18	45.0
Bachelor's Degree in Nursing	8	20.0
Years of experience critical burns department unit		
<10	27	67.5
≥10	13	32.5
Range	4.0 – 20.0	
Mean ± SD.	9.85± 5.08	
Training course		
Yes	18	45.0
No	22	55.0

Table 2: Frequency and percentage distribution between pre, post and follow up program phases according to total knowledge of studied nurses regarding critical burn injury (n=40).

Total knowledge	**Pre**		**Post**		**Follow up**		**χ2 (P- value) Pre/post**	**χ2 (P value) Pre/FU**
	No	**%**	**No**	**%**	**No**	**%**		
Satisfactory ≥ 75 %	9	22.5	34	85.0	33	82.5	31.427 (<0.001*)	28.872 (<0.001*)
Unsatisfactory <75	31	77.5	6	15.0	7	17.5		
Mean± SD	45.85±11.26		64.27±6.50		63.27±5.85		H=53.896	(<0.001*)

*** Statistically significant at p ≤ 0.05; (H) Kruskal Wallis test (χ2) chi square test**

Table 3: **Frequency distribution of nurses' total level of practice regarding critical burn care throughout study phases (n=40)**.

Items nurses' total level of practice	Total competent practice ≥ 75%						χ2 (P- value) Pre/post	χ2 (P value) Pre/FU
	Pre		Post		Follow up			
	No.	%	No.	%	No.	%		
Wound Dressing	12	30.0	38	95.0	35	87.5	36.053 (<0.001*)	27.286 (0.018*)
Mean± SD	25.05±8.02		35.35±4.41		32.55±3.68		H=43.884	(<0.001*)
Burn Scare Management	11	27.5	38	95.0	33	82.5	38.394 (<0.001*)	24.444 (<0.001*)
Mean± SD	9.80±3.14		14.02±1.36		12.97±2.39		H=36.720	(<0.001*)
Rehabilitation Exercise	8	20.0	38	95.0	35	87.5	46.036 (<0.001*)	36.656 (<0.001*)
Mean± SD	26.30±7.37		36.42±3.79		33.12±3.3		H=45.762	(<0.001*)

***Statistically significant at p ≤ 0.05; (H) Kruskal Wallis test (χ2) chi square test**

Table 4: percentage distribution of studied nurses' level of total practice regarding critical burn care throughout study phases (n=40).

Total Practice	Pre		Post		Follow up		χ2 (P- value) Pre/post	χ2 (P value) Pre/FU
	No.	%	No.	%	No.	%		
Satisfactory ≥ 75%	10	25.0	37	92.5	32	80.0	37.602 (<0.001*)	24.261 (<0.001*)
Un Satisfactory <75%	30	75.0	3	7.5	8	20.0		
Mean± SD	61.15±16.60		85.80±8.21		78.65±6.97		H=51.454	(<0.001*)

*** Statistically significant at p ≤ 0.05 (H) Kruskal Wallis test (χ2) chi square test**

Table 5: Percentage distribution of studied nurses' total attitude regarding critical burn care throughout study phases (n=40).

Total attitude	Pre		Post		Follow up		χ2 (P- value) Pre/post	χ2 (P value) Pre/FU
	No.	%	No.	%	No.	%		
Positive attitude ≥ 75 %	17	42.5	31	77.5	28	70.0	29.463 (<0.001*)	24.444 (<0.001*)
Negative attitude<75%	23	57.5	9	22.5	12	30.0		
Mean± SD	58.30±7.52		63.32±7.97		62.05±9.05		H=13.596	(0.001*)

*** Statistically significant at p ≤ 0.05 (H) Kruskal Wallis test (χ2) chi square test**

Table 6: Frequency and percentage distribution of studied critical burn patients according to their demographic characteristic (n =40)

Demographic characteristics	No.	%
Age		
<30	12	30.0
≥30	28	70.0
Mean ± SD.	34.67 ± 12.66	
(Range)	20-60	
Sex		
Male	24	60.0
Female	16	40.0
Marital status		
Single	10	25.0
Married	30	75.0
Occupation		
Working	26	65.0
Not working	14	35.0
Residence Rural Urban	 21 19	 52.5 47.5

Table 7: Frequency distribution of studied patients with critical burn according to medical data (n=40)

Medical data	No.	%
Vital signs		
Normal	4	10.0
Abnormal	36	90.0
Presence of chronic disease		
Yes	0	0
No	40	100.0
Critical burn mechanism		
Scaled	10	25.0
Electricity	2	5.0
Inhalation injury	3	7.5
Flame	22	55.0
Chemical	3	7.5
Critical burn site		
Head /neck	18	45.0
Trunk	21	52.5
Upper extremity	10	25.0
buttocks	6	15.0
Genitalia	3	7.5
Lower extremity	11	27.5
%TSBA burned		
<10 TSBA	o	0.0
10-20TBSA	30	75.0
20-30 TBSA	5	12.5
>30 TBSA	5	12.5
Critical burn depth		
Partial thickness	10	25.0
Full thickness	11	27.5
Mixed (partial and full thickness	19	47.5
Mean Length of hospital stay(days) ±SD	45.73 ± 12.35	

Table 8: Comparison between incidence of total complications among studied patients throughout program phases (n=40).

Complications	Pre		Post		χ2	P- value
	No.	%	No.	%		
Body system complication						
≥ 50% Complicated	28	70.0	8	20.0	20.202	<0.001*
< 50% Not complicated	12	30.0	32	80.0		
General complications						
≥ 50% Complicated	36	90.0	16	40.0	21.978	<0.001*
< 50% Not complicated	4	10.0	24	60.0		
Total complications						
≥ 50% Complicated	33	90.0	14	35.0	18.620	<0.001*
< 50% Not	7	10.0	26	65.0		

Table 9: Relation between total nurses' level of knowledge, total practice, and total patients' complications throughout study phases (n=40).

	Total Nurses' Practice							
	Pre				Post			
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory	
	No.	%	No.	%	No.	%	No.	%
Total Nurses' knowledge								
Satisfactory	6	15.0	3	7.5	34	15.0	0	15.0
Unsatisfactory	4	10.0	27	30.0	3	62.5	3	7.5
χ2(p)	10.753 (0.003*)				18.387(<0.001*)			
Total complication								
Complicated	10	5.0	23	10.0	11	12.5	3	2.5
Not complicated	0	47.5	7	47.5	26	65.0	0	0.0
χ2(p)	2.828 (0.161)				6.023(0.037*)			

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