Effect of Educational Training Program on Nurses ' Performance Regarding Splinting and Range of Motion Exercises among Children with Hand Burn

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Abstract

Background: Burns are one of the most serious injuries; which have a great impact on children. The most important goal of burned hand is to regain its function during rehabilitation. **Aim:** To identify the effect of educational training program on nurses' performance regarding splinting and range of motion exercises among children with hand burn. **Design:** A quasi- experimental design (Pre & Post Test) was used. **Setting:** The study was conducted at the burn unit and in the outpatient, physiotherapy and plastic clinics at the Reconstructive Surgery and Burn Hehia Center at Hehia Central Hospital in Hehia city, as well as at Burn unit &outpatient clinic of Al-Ahrar Educational Hospital at Zagazig city. **Subject:** A convenience sample of 100 nurses and 60 children with hand burn at the previously mentioned settings were included in the study. **Tools:** Three tools were used to collect data. Tool I: Structured Interview Questionnaire to assess nurses´ knowledge about splinting and range of motion Exercises. Tool II: Observational Checklists to assess nurses' practice about splinting and range of motion exercises. Tool III: Children Burn Assessment to assess the burned hand wound. **Results:** The majority of studied nurses had unsatisfactory level of knowledge and practice regarding range of motion exercises pre training program that reduced to one fourth post program, as well as nearly three quarter of studied nurses had unsatisfactory level of practice related to splinting before intervention that improved after implementation of the program , also there was high positive correlation between total knowledge & practice scores pre & post training program with p value ≤ 0.01. **Conclusion**: Educational training program regarding splinting and range of motion exercises had a positive effect on nurses' performance. **Recommendation:** The study recommended that providing educational posters, guidelines, pamphlets, manuals and in service training programs will improve nurses performance about splinting and range of motion exercise for children with hand burn.

Keywords: Hand burn, educational training program, Nurses' performance, Splinting, and Range of Motion Exercise.

Introduction

Hands are one of the most common burn sites and hand burns account for nearly 80% of all locations of burns. Hand burns affect fewer than 5 % of the total body surface area and are classified to be severe injuries, which entail treatment in an expert burn center. While hand burns do not play a main role in relation to mortality rate; they are main factors for a successful rehabilitation into society and accomplished life after hospital discharge **(Lotfi et al., 2019).**

Scar contractures are the obsessive outcome of excessive scarring and continuing scar contraction and a well-known complication after burn. Scar contractures damage joints range of motion (ROM), so this may limit children' ability to perform activities of daily living. Significant clinical and research effort has gone into inhibiting the management of scar contractures which including positioning, splinting, exercise, and surgical adjustment **(Oosterwijk et al., 2017).**

Range of motion exercise and splinting after hand burn injuries are very essential in preventing edema, contracture, dysfunction, deformity, emotional problems and other distresses due to burns. Moreover, it helps in preserving ROM, practical recovery, avoiding development of keloids, increase muscle force

as well as satisfactory cosmetic results **(Rrecaj et al., 2015).**

Combining the therapeutic exercises with the comprehensive rehabilitation plan could help nurses in preventing the formation of deformity contractures and maintain the strength of the affected and unaffected limbs, especially the upper limbs, as the treatment and rehabilitation of the upper limbs are often ignored. In the acute phase, ignoring to treat the upper unaffected limbs could conducive the patients to the intensive care to treat the other parts of the body **(Landolt et al., 2019).** Therefore, upper limb rehabilitation should include exercise, splinting, positioning, various massage techniques and scar treatment for better function and to achieve the goals of the rehabilitation plan **(Moore et al., 2019).**

Rehabilitation should begin proximately after the burn has occurred. Rehabilitation nurses should coordinate between physicians and therapists' rehabilitation and support the rehabilitation knowledge, offer guidance for positioning, ADL training and to assist children achieving the rehabilitation goal within short time **(Mohammed et al., 2019).**

Also, nurses should offer guidance and observation for the convention of exercises and splints. Moreover, they should identify children' psychological variations and refer them to physicians, rehabilitation therapists and psychotherapists for advanced management and care. Rehabilitation nurses play an essential connecting role between the children, their families and the rehabilitation team **(Cen et al., 2015).** One of the main nursing care goals is the primary objectivity and recommencement of children to the pre-burn lifestyle. Early beginning of physical therapy, splinting, passive exercises, topical treatment, early excision, and grafting are the best main treatment principles **(Sridhar & Hariharan, 2017).**

The pediatric nurses show a vital role in the whole managing children with burn. They must be well proficient with the available protocols that could be used to reasonably manage a given situation. The nurse is responsible for administrating the general care and organizing activities with other disciplines, such as physical, occupational therapist, social and nutritional services as well with the pharmacies **(Serghiou et al., 2019).**

The greatest essential point regarding the physical therapy is to have an appropriate learning program which is easy to be implemented. While teaching to children with burn has progressive effect on the clinical enhancement and complications caused by burn, but individuals who take care of children chiefly are nurses plays an active role in physical therapy education for children with burned hands **(Ardebili et al., 2015).**

Significance of the study

Hands are one of the greatest common burn sites among children. Hypertrophic scar contractures in hands after wound curing result in diminution of children hand range of motion (ROM), motility and fine motor activities. In addition, the loss of hand function after burn could have a critical effect on the activities of daily living (ADL). Functionally, hand contractures may distress one's ability to perform ADL, such as dressing, eating, and priming as well as fine motor skills such as typing, writing, and occupational activities. Communal complications after hand burns could lead to joint deformities, sensory impairment and scar contracture.

Due to pervasive and everlasting complications of burn, education to nurses about exercises and splint has affirmative effect on clinical enhancement trend and complications affected by burn, as well as on the function development of hands. Therefore, this study was main aim is to identify the effect of educational training program on nurses ' performance regarding splinting and range of motion exercises among children with hand burn.

Aim of the study

This study aims to identify the effect of educational training program on nurses ' performance regarding splinting and range of motion exercises among children with hand burn, through:

1- Assessing nurses ' knowledge regarding the effect of splinting and range of motion exercises on the burned hand of the children.

2- Evaluating nurses ' performance of splinting and range of motion exercises on the burned hand of the children

3- Designing, implementing, and evaluating nursing educational training program about splinting and range of motion exercises on the burned hand of the children.

Research Hypothesis

1. Nurses who receive educational training program will have better knowledge regarding splinting and range of motion exercises among children with hand burn.
2. Nurses ' performance regarding splinting and range of motion exercises among children with hand burn will be improved after implementation of the nursing educational training program.

Subjects and Methods

The methodology was presented under the following four designs: -

1. Technical design.

2. Operational design.

3. Administrative design

4. Statistical design.

I. Technical design:

The technical design of this study included description of the research design, study setting, subjects, sample, and tools for data collection.

A. Research design:

A quasi- experimental design (Pre &Post) was utilized in the present study to estimate the effect of educational training program on nurses' performance regarding splinting and range of motion exercises among children with hand burn.

B. Setting:

The study was conducted at the following settings:

1. Burn unit, Outpatient, Physiotherapy and Plastic Clinics at Reconstructive Surgery and Burn Hehia Center at Hehia Central Hospital at Hehia city
2. Burn unit & Outpatient clinic at Al-Ahrar Educational Hospital in Zagazig city.

C-Subject:

This study was carried out on a convenience sample composed of two groups:

1- Group I: 100 nurses who are actually provide direct care for children with hand burn at the previous settings and fulfill the following criteria:

- Give direct care to children with hand burn.
- Possess nursing diploma certificate.
- Accept to participate in the study.

2- Group II: All available children with hand burn in the previous settings at the study period.

The sample size calculated based on a study carried out by **AL-Sudani & Ali, 2017**. By estimating an effect size 0.52, based on the mean nurses' knowledge pre intervention was 1.31 (0.17) and post intervention was 1.78 (0.22) and statistical power of 90%, level of confidence (1-Alpha Error): 95%, Alpha 0.05, Beta 0.1. The sample size determines as91nurse. Considering 10% sample attrition (9nurses), the final sample size in the group is 100nurses. Sample size calculates using test comparing two means through **Kane SP. Sample Size Calculator. ClinCalc (Rosner, 2015).**

D- Tools of data collection:

Three tools were used by the researchers to collect the necessary data.

Tool (I): Structured Interview Questionnaire

A Structured Interview Questionnaire was developed by the researchers after appraisal of the literature and consists of the following seven parts:

Part I: Characteristics of the studied nurses such as age, marital status, years of experience, training courses and qualifications.

Part II: Nurses' knowledge about hand anatomy such as number of hand bones, main

parts of hand and hand functions (pre and post assessment).

Part III: Nurses' knowledge about the burn such as definition, causes and degrees of burn (pre and post format).

Part IV: Nurses' knowledge about care of children with hand burn such as care of first , second, third degree of hand burn and care of chemical hand burn (pre and post assessment).

Part V: Nurses' knowledge about complications of hand burn and care provided to prevent complications (pre and post assessment).

Part VI: Nurses' knowledge about splinting of burned hand such as importance, indication, contraindication, precautions, and consideration of splinting as well as technique of splinting(pre and post assessment).

Part VII: Nurses' knowledge about range of motion exercise of burned hand such as importance, purpose, when to start, general principle, care of nurse to prevent hand contracture, precaution and consideration as well as how to perform range of motion exercises (pre and post assessment).

Scoring system

Scoring system of nurses' knowledge about splinting and range of motion exercises was developed by researchers. Each right answer scored 1 mark and zero for wrong one. The total score was **50 marks** distributed as follows:

Nurses' knowledge about hand anatomy	7 marks
Nurses' knowledge about types and degrees of burn	5 marks
Nursing care of children with hand burn	12 marks
Complications of burn and methods of prevention	10 marks
Nurses' knowledge about splinting	9 marks
Nurses' knowledge about range of motion exercise	7 marks

The total score of nurses' knowledge was categorized as follows:

- **Satisfactory > 70%**
- **Unsatisfactory ≤ 70 %**

Tool II: An Observational Checklist

An observational checklist was designed by the researchers to evaluate nurses' performance regarding splinting and range of motion exercises among children with hand burn such as burn assessment, care of first, second & third degree of hand burn, care of chemical hand burn, dressing change, splinting and range of motion exercise. As guided by [**(Zatriqi et al (2014); Rrecaj et al (2015); Kowalske et al (2015); National Institute of Health (2016); Agency for Clinical Innovation (2017); Lotfi et al (2019); Evans & Roslyn (2019)].**

Scoring system:

Scoring system of nurses' performance about splinting and range of motion exercises was developed by researchers. Each observed itemwas checked as done or not done. Each correct step was given 1 mark and zero was given to not done. The total score of practice was **56 marks** distributed as follows:

Burn assessment	6 marks
Care of first-degree hand burns	4 marks
Care of second-degree hand burns	4 marks
Care of chemical hand burns	4 marks
Dressing change	17 marks
Splinting	6 marks
Range of motion exercises of hand burns	15 marks

The total score of nurses' practice was categorized as follows:

- **Satisfactory > 70%**
- **Unsatisfactory ≤ 70 %**

Tool III: Children Burn Assessment

Children burn assessment designed by the researchers to assess hand burn wound that included age, sex, burn site (unilateral or bilateral hands), causes, degree, severity of burn and any associated illnesses or injuries.

II- Operational design

The operational design included the study validity and reliability, pilot study and fieldwork.

Validity and reliability

The structured interview questionnaire and the observational checklist were developed after a comprehensive review of the related literature and then revised by 5 experts (one professor of pediatric nursing, one professor of plastic surgery, one professor of pediatric medicine, one professor of physiotherapist as well as one professor of medical surgical nursing). Experts reviewed the content for clarity, relevance, applicability, comprehensiveness, understanding and ease for implementation. The reliability of tools was tested by using of Cronbach's alpha test. Reliability coefficient for tool I was **(0.812)** and tool II was **(0.906).**

Administrative Design

To carry out the study in the selected settings, an official agreement was gained from the directors of the previously mentioned settings.

Ethical consideration

The acceptance for involvement of subjects was taken after explaining the aim of the study. They were given chance to refuse to participate, they were informed that they could withdraw at any stage of the research; also they were sure that data would be confidential and used for research purpose only.

Pilot study

A pilot study was carried out on 10 nurses to evaluate the content of the tools, their clarity, feasibility, arrangement, applicability of its items, as well as to estimate the time needed for filling in the data. No modifications were made. Nurses participating in the pilot study were included in the study.

Field work

After finding the subjects who fulfilled the criteria of the study, the researchers started with clarified the aim and process of the study concisely and acquired oral consent from every nurse. The researchers also, determined the place of meeting and timetable. They were met by the researchers at the morning shift from 9.00 a.m. to 2.00 p.m. The researchers attended the study settings 3 days /week (Saturday, Monday, and Thursday) for data gathering and application of the program (post- test) was done directly after educational training program.

(I) Assessment Phase

The educational training program was partly constructed based on the assessment of nurses' knowledge and practice. The assessment was performed by interviewing each nurse individually to assess their knowledge and practice (pre-test) by using tool I & tool II after explaining the aim of the study to the nurses and get their approval to participate in the study.

(II) Planning Phase

Based on the results attained from the questionnaire interview and the observational checklist during (the pre-assessment phase) as well as revising the related literature the educational training program was developing by the researchers. Based on the identified nurse’s needs the content of the educational training program was developed in form of a booklet.

Contents of the program were designated on the base of nurse’s needs (knowledge and skills). Several teaching methods were selected to suit the teaching in small groups in a form of lectures, group discussion, role play, demonstration, and reinforcement. Teaching media were prepared as handout (booklet), colored posters, as well as video CD that covered the needed theoretical and practical information.

Educational training program:

It was established to improve nurses' performance regarding splinting and range of motion exercises for children with hand burn.

General objectives of the program

The educational training program aimed to improve nurses' performance regarding splinting and range of motion exercises among children with hand burn.

Specific objectives of the program

At the end of this educational training program, nurses well be able to

1- Identify anatomy of hand
2- List types and degrees of burn.
3- Reported the complications of burn and its prevention.
4- Apply the appropriate/needed nursing intervention for children with hand burn
5- Demonstrate how to perform splinting for children with hand burn
6- Practice range of motion exercises for children with hand burn
7- Evaluate the effect of training educational program on performance of nurses providing care for children with hand burn

(III) Implementation Phase

The educational training program implemented through seven sessions in which nurses distributed into small groups sessions to facilitate the learning process. The length of each session varied according to the content and nurses' responses. It was ranged from 30 – 40 minutes.

The educational intervention was in forms of (face-to-face and displaying videos). The nurses were first face-to-face explained about the primary notes and then presented educational videos that covered theoretical and practical information.

Each session started with a summary of the preceding session and objective of the new one taking into consideration the use of the Arabic language and some English expressions that outfits the level of nurses' education. Motivation and reinforcement during a session were used to improve nurses' learning process.

Session I: The first session in the program involved an acquaintance between researchers and nurses and brief justifications about program aim, numbers of sessions, meeting time, program guidelines, predictable outcomes, and the benefits of participation in the program.

Session II: The second session in the program involved information about anatomy of hand, definition of burn, causes, types and degrees of hand burn.

Session III: In the third session of the program, the researchers provided studied nurses with information about burn complications and its prevention as well as nursing care that should be provided to children with hand burn.

Session IV: The researchers provided studied nurses with the adequate knowledge about splinting of burned hand including importance, indications, contraindication, precautions, and considerations as well as technique of splinting.

Session V: The researchers displayed educational videos then perform hand splinting during and after dressing change either in burn unit or in the outpatient clinics.

Session VI: The researchers provided studied nurses with the needed knowledge about range of motion exercise of burned hand such as importance, purpose, when to start, general principle, care of nurse to prevent hand contracture, precautions, and considerations as well as how to perform range of motion exercises.

Session VII: The researchers displayed educational videos then trained studied nurses on range of motion exercises on studied children during and after dressing change either in burn unit or in the outpatient clinics.

(IV) Evaluation Phase

- In this phase each nurse of the studied sample was interviewed individually immediately after implementation of the educational training program to assess their knowledge (post-test) by re-answering the questionnaires (using tool I) and assess performance by observing their practice (using tool II).

- At the end of the training session (after performing the post-test), the booklet / handout was provided to the studied nurses.
- This study was carried out in 6 months from the beginning of April 2019 to the end of September 2019.

IV- Statistical Analysis

Data composed from the studied sample was reviewed, coded and entered using Personal Computer (PC). Computerized data entry and statistical analysis were achieved using the Statistical Package for Social Sciences (SPSS) version 22. Data were offered using descriptive statistics in the form of frequencies, percentages and Mean SD. A correlation coefficient "Pearson correlation" is a numerical measure of some type of correlation, meaning a statistical relationship between two variables. Linear regression is a linear approach for modeling the relationship between a scalar response and one or more explanatory variables. Chi-square used to compare between pre and post intervention.

Significance of the results:

- Highly significant at p-value < 0.01.
- Statistically significant was considered at p-value <0.05.
- Non-significant at p-value ≥ 0.05.

Results

Table (1) showed that mean age of studied nurses was 36.15(4.89) years old, 74% were married, 23% had bachelor's degree in nursing. Also, 74% of studied nurses were working at burn unit. Moreover, mean years of experience were 8.28(2.19) years and 77% didn't attend any training courses.

Table (2) revealed that mean age of studied children was 4.13(1.16) year sold, 76.7% were males, and 68.3% suffered from unilateral burn. Also, 65% had burn due to hot fluids, 48.3% suffered from second burn degree. In addition, 55% suffered from moderate burn, 66.7% admitted at the burn unit and 75% had no associated illness.

Table (3): showed that there was highly significant difference between nurses' knowledge pre and post the intervention in relation to type and degree of burn, care for burned hand, complications, and its prevention methods, as well as splinting and range of motion exercises of burned hands at p value <0.01**.

Figure (1) showed that only 21% of the studied nurses had satisfactory knowledge level before implementation of the training program. This percentage increased to 80% after implementation of the training program.

Table (4) presented that there was highly statistically significant difference between nurses' practice pre and post the intervention in relation to burn assessment, care of first-degree burned hand, as well as care of second-degree burned hand, care of chemical burned hand, dressing change, splinting, and range of motion exercises of burned hand at p value s=<0.01**.

Figure (2) illustrated that 76% of the studied nurses had unsatisfactory total practice score before implementation of the educational training program. This percentage decreased to 22% after the implementation of the educational training program.

Table (5) illustrated that high significant model detected through F test value as 12.061 with p value. 000. This model explains that 68% of the variation in total knowledge detected through R^2 value = 0.68. Also, explained that attended training courses and university education had high frequency positive effect on nurses' knowledge with p value = <0.01**. While, nurses who had an experience and/or working in burn unit showed slightly positive effect on nurses' knowledge with p value=<0.05*.On other hand, nurses' age had slightly frequency negative effect on nurses' knowledge with p value = <0.05*.

Table (6) stated that high significant model detected through F test value was 13.447 with p value = 000. This model explains that 62% of the variation in total practice detected through R^2 value = 0.62. Also, explained that university education, working at burn unit, and years of experience had high frequency positive effect on nurses' practice with p value <0.01**. While, attended training courses had slight positive effect on nurses' practice with p value <0.05*.On other hand, nurses' age had slight frequency negative effect on nurses' practice with p value <0.05*.

Table (7) reported that there was high positive correlation between total knowledge & practice pre the intervention with p value =<0.01**, Also there was high positive

correlation between total knowledge & practice post the intervention with p value =<0.01**.

Table (1): Characteristics of studied nurses (n=100)

Characteristics	N	%
Age in years:		
20 - <30	22	22
30 - <40	41	41
40 – 50	37	37
Mean (SD) 36.15(4.89)		
Marital status:		
Single	23	23
Married	74	74
Divorce	1	1
Widow	2	2
Qualification:		
Nursing Diploma	8	8
Technical health institute	67	67
Bachelor's degree in nursing	23	23
Postgraduate Study	2	2
Working unit:		
Outpatient clinic	8	8
Physiotherapy clinic	4	4
Plastic surgery clinic	4	4
Burn unit	74	74
Years of experience:		
<5 years	20	20
5 – 10 years	47	47
>10 years	33	33
Mean (SD)8.28(2.19)		
Training courses:		
Yes	23	23
No	77	77

Table (2): Characteristics of studied children (n=60)

Characteristics	n	%
Age:		
1-<4	30	50
4-8	18	30
>8	12	20
Mean (SD). 4.13(1.16)		
Gender:		
Male	46	76.7
Female	14	23.3
Burn site:		
Bilateral	19	31.7
Unilateral	41	68.3
Cause of burn:		
Flames	18	30
Hot fluids	39	65
Chemicals	1	1.7
Electricity	2	3.3
Burn degree:		
First	14	23.3
Second	29	48.3
Third	17	28.4
Burn severity:		
Mild	17	28.4
Moderate	33	55
Severe	10	16.6
Admission unit:		
Burn unit	40	66.7
Outpatient clinic	20	33.3
Associated illness:		
Yes	15	25
No	45	75

Table (3): Distribution of studied nurses in relation to their knowledge pre and post the intervention (n=100)

Nurses´ knowledge	Pre				Post				Chi-square p. value
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory		
	N	%	N	%	n	%	N	%	
Hand anatomy	22	22	78	78	82	82	18	18	**10.897 <0.01****
Types and degrees of burn	19	19	81	81	79	79	21	21	**9.760 <0.01****
Care for hand burn	28	28	72	72	85	85	15	15	**11.222 <0.01****
Complications and its prevention	32	32	68	68	88	88	12	12	**13.012 <0.01****
Splinting	11	11	89	89	76	76	24	24	**9.761 <0.01****
Range of Motion Exercises	9	9	91	91	74	74	26	26	**10.543 <0.01****
Total level of knowledge	21	21	79	79	80	80	20	20	**13.002 <0.01****

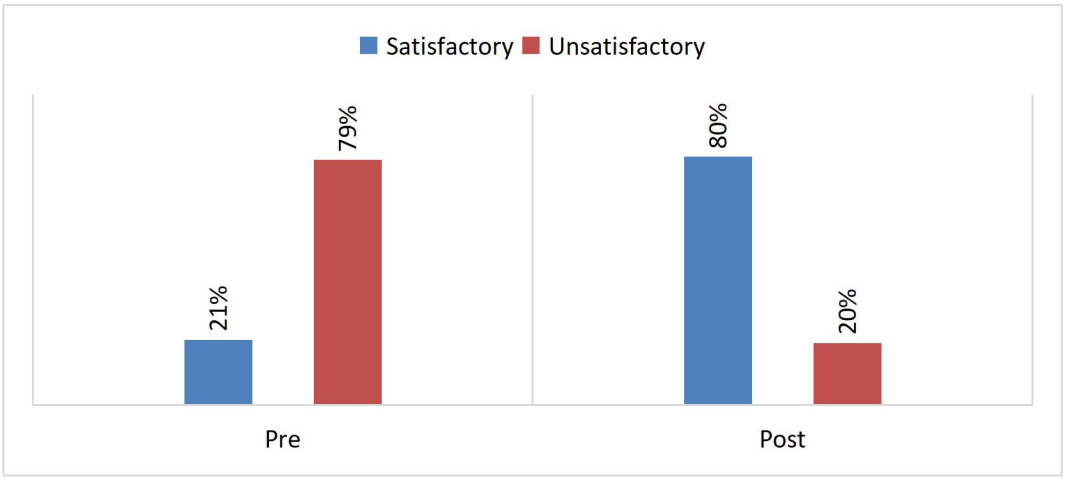

Figure (1): Distribution of studied nurses related to their total knowledge pre and post the intervention (n=100)

Table (4): Distribution of studied nurses in relation to their practice pre and post the intervention (n=100)

Nurses practice	pre				Post				Chi-square p. value
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory		
	N	%	n	%	N	%	N	%	
Burn assessment	26	26	74	74	83	83	17	17	**13.672 <0.01****
Care of first-degree hand burns	30	30	70	70	79	79	21	21	**14.555 <0.01****
Care of second-degree hand burns	27	27	73	73	81	81	19	19	**11.303 <0.01****
Care of chemical hand burns	30	30	70	70	85	85	15	15	**13.900 <0.01****
Dressing change	33	33	67	67	87	87	13	13	**12.220 <0.01****
Splinting	28	28	72	72	79	79	21	21	**14.671 <0.01****
Range of motion exercises of hand burns	9	9	91	91	72	72	28	28	**12.151 <0.01****
Total practical level	**24**	**24**	**76**	**76**	**78**	**78**	**22**	**22**	**14.628 <0.01****

Figure (2): Distribution of studied nurses in relation to their total practice pre and post the intervention (n=100)

Table (5): Multiple Linear regression model for nurses' knowledge pre the intervention (n=100).

Items	Unstandardized Coefficients		standardized Coefficients		
	B		**B**	**T**	**P. value**
Age	-.256		.197	5.112	**<0.05***
Qualification "university"	.366		.301	7.883	**<0.01****
Working unit (Burn unit)	.242		.186	4.976	**<0.05***
Years of experience	.265		.201	3.994	**<0.05***
Training courses	.399		.246	5.107	**<0.01****
Model	**R^2**		**F**	**P. value**	
Regression	**0.68**		12.061	.000**	

a. Dependent Variable: **Total knowledge**

b. Predictors: (constant): **Age, Qualifications "university", working unit (Burn unit), Years of experience, Training courses**

Table (6): Multiple Linear regression model for nurses' practice pre the intervention (n=100).

Items	Unstandardized Coefficients		standardized Coefficients		
	B		**B**	**T**	**P. value**
Age	-.206		.132	3.998	**<0.05***
Qualifications "university"	.397		.323	6.701	**<0.01****
Working unit (Burn unit)	.380		.319	5.448	**<0.01****
Years of experience	.324		.276	4.116	**<0.01****
Training courses	.304		.245	4.258	**<0.05***
Model	**R^2**		**F**	**P. value**	
Regression	**0.62**		13.447	.000**	

a. Dependent Variable: **Total Practice**

b. Predictors: (constant): **Age, Qualifications "university", working unit (Burn unit), Years of experience, Training courses**

Table (7): Correlations between studied variables pre and post the intervention

Items		**Scores**
Total knowledge & practice pre the intervention	r. p	0.524 <0.01**
Total knowledge & practice post the intervention	r. p	0.498 <0.01**

Slight significant <0.05 **high significant if p value <0.01**

Discussion

Children with major burns need long-term care and long period of rehabilitation **(Mayer &Werman, 2019).**The primary goal of burned hands rehabilitation plan, is to maximize ROM of the affected area. Inadequate rehabilitation time or delayed in starting the rehabilitation plan is an imperative factor for impairing hand's function and adverse consequences resultant from it (**Ardebili & Bozorgnejad, 2014).**

The current study revealed that nearly about half of studied nurses had 5 to less than 10 years of experience, with a mean experience equal 8.28 (2.19) years. This result was nearly in the same line with **Ahmed & Mohamed (2017)** who carried out study about "Evaluation of Nursing Performance at Pediatric Burn Unit in Benha City: An Intervention Study" as they found that, the majority of the nurses had experience in burn care department ranged from 1 and 10 years.

The present study showed that nearly one quarter of studied nurses attended training courses about how to care for patients with burn. This result could be due to the high

workload on nurses and shortage of staff, scarcity of training programs, and lack of specialized curriculum in the nursing field. This result is in the same line with a study done by **Abdallah (2013)** who conducted study about First Aid and hospital care provided to burned children and the expected outcomes as mentioned that, less than one fifth of their participants had attended training courses about how to care for patients with burn and its management. While this finding conflicts with a study done by **EL Sayed et al., (2015)** titled“ Nurses’ Knowledge and Performance for Prevention of Infection in Burn Unit at a University Hospital: Suggested Nursing Guidelines”, as they mentioned that, three quarters of their participants attended one or two training program about how to care for patients with burn.

Concerning the educational level of the studied nurses, the present result explained that more than two thirds possess technical health institute diploma. This finding emphasizes the fact that high degree nurses recruited to care for critical care setting patients. This result contradicts with **Tilley et al., (2017)** who conducted a study about rehabilitation of the burned upper extremity and found that most of the participant possessed nursing diploma.

It is clear from the current study that more than three quarter of the studied nurses had unsatisfactory total knowledge scores regarding burn pre- intervention that reduced to one fifth post intervention. From researcher point of view. This result may be due to the effect of educational program in refreshing nurse's knowledge. Nearly the same finding is reached by **Ibrahim et al., (2018)** who conducted Current Nursing Practices for Managing Children with Burn Injuries in burn unit at Mansoura International Hospital and found that more than three quarter of the studied nurses had poor knowledge regarding burn and its management. This finding disagrees with **Mussa &Abass (2014)** who carried out study about assessment of Nurses’ Knowledge regarding nursing care for patients with burn and revealed that the nurses’ knowledge about burn and nursing care as well were moderately adequate at Azady hospital compared to adequate level of knowledge at the western hospitals.

The result of the present study clarified that the majority of the studied nurses had unsatisfactory level of knowledge regarding range of motion exercises before implementation of the educational program that reduced to one fourth after program implementation. From the researcher point of view, this result may be due to training program was very important for nursing staff and improved their information. This study was agreement with **Meschial, & Oliveira, (2017)** who conducted entitled "Initial care for burned patients in academic nursing education" and found that majority of nurses had unsatisfactory knowledge regarding burn.

Conversely, this study was disagreement with **Carrougher, et al., (2018)** who conducted entitled "Burn nurse competencies: developing consensus using E-Delphi Methodology" and found that majority of nurses had satisfactory knowledge regarding burn.

Also, it was found that the majority of studied nurses had unsatisfactory knowledge regarding splinting among children with hand burn before implementation of program and this result improved after implementation. This might be due to the positive effect of the educational training program on improving nurses’ knowledge. From the researcher point of view, all nurses' working in burn units learning from each to other, there was no guide or international program to support their knowledge and help them to improve them and their nursing care provided to burned children. This finding is supported by **AL-Sudani & Ali (2017**), who conducted a study about Effectiveness of an educational program on the nurses’ knowledge for children with burn injuries attending the Burns Specialist Hospital in Baghdad City and reported that, all items of nurses knowledge at the pre-test was fail, while in the post-test one and two their knowledge was pass.

The present study showed that majority of the studied nurses had unsatisfactory practice level about range of motion exercise for children with burned hand before implementation of program and that percentage was improved post program. This also could be attributed to the improvement of nurses’

practice after implementation of the educational training program especially after displaying educational video films. This finding goes in harmony with **Diego et al., (2013)** who studied "Exercise training after burn injury" and reported that three quarter of the studied nurses had unsatisfactory practice level about finger stretch exercise.

The current study revealed that nearly three quarter of studied nurses had unsatisfactory level of practice related to splinting before intervention that improved after implementation of the program. This reflects the effectiveness of the educational training program in updating nurses' professional knowledge and nurses' performance regarding care of children with burn. This finding is in the same line with **Ibrahim, et al., (2018)** who showed that the majority of studied nurses had incompetent practice regarding care of burned children. On the contrary, **Youssef et al., (2019)** conducted study about "Nurses' Care Provided to children with burn at Assiut Hospitals" and found that two thirds of the studied nurses had competent level of practice about care of children with burn.

Regarding the relation between nurses' knowledge and their personal characteristics, the current study showed that there was a statistically significant relation between nurse's knowledge and their age, qualifications, experiences, training on burn care and illustrated that university education had slightly positive effect on nurses' knowledge. This result may be due that increasing nurses´ age and years of experience lead to increase nurses' level of knowledge and acquiring new data. This study goes in line with **Lam et al., (2018)** who conducted a study entitled "Nurse Knowledge of emergency management for burn and mass burn injuries" and found that there is a statistically significant relation between nurse's knowledge and their qualifications and training on burn care.

On the other hand, this finding disagrees with **Mamashliet al., (2019)** who carried out study about "The effect of self-care compact disk-based instruction program on physical performance and quality of life of patients with burn at-dismissal" and found that there was no statistically significant relation between nurses' knowledge and their characteristics data.

Regarding the relation between nurses' performance and their personal characteristics, the current study showed that there was a statistically significant relation between nurse's practice and their age, qualifications, experience and training on burn care and revealed that university education, working at burn unit and years of experience had high frequency positive effect on nurses' practice. From researcher point of view. This finding could be due to improving of performance associated with the increase in the experience period and level of education. The current study finding is consistent with **Abd-Elalem et al., (2018)** who conducted study about "The effect of self-care nursing intervention model on self-esteem and quality of life among patients with burn" and found that there was a statistically significant relation between nurse's practice and their ages, experiences in burn department and training on burn care.

Conversely, this result is in incongruity with **Ghezeljeh, et al., (2019)** who conducted study entitled "Investigating the psychosocial empowerment interventions through multimedia education among patients with burn "and found that there is highly statistically significant relation between nurse's knowledge and their gender.

Concerning correlation between total nurses' knowledge and practice scores, the current study displayed that there was a positive correlation between nurses' total knowledge and practice scores pre and post the intervention program. This may be related to nursing staff looking for improving their performance with patients that suffering from burn injury. This result in agreement with **Melo, & Lima (2017)** who performed a study about "Cost of nursing most frequent procedures performed on severely burned patients" and found that there was a positive correlation between nurses' total knowledge and their practice. Conversely, this study disagrees with **Ardebili, et al., (2017)** who done a study about "Effect of multimedia self-care education on quality of life among patients with burn" and found that there was negative

correlation between nurses' total knowledge and their practice.

Conclusion

The present study concluded that studied nurses had unsatisfactory levels of knowledge and practice regarding splinting and range of motion exercises pre training program that improved post program. Educational training program regarding splinting and range of motion exercises had a positive effect on improving nurses' performance.

Recommendation

The following recommendations are suggested

1. Providing educational posters, guidelines, pamphlets, manuals and performing in service training programs for nurses about splinting and range of motion exercise for children with hand burn.
2. Nurses should attend films and audiovisual conferences about practical procedures to increase their awareness about the recent approaches in caring patients with burn.
3. Post burn programs should be introduced to the multidisciplinary team and continued after discharge to provide education and the preventive measures against complications for pediatric children with burn
4. Providing continuous education and update nurses performance regarding evidence-based nursing practices about care of children with burn
5. Providing supplies and equipment for the burn unit that assist nurses to perform their practice safely and efficient.
6. Nurses practice should be adequately supervised by head nurses and appropriate feedback be directed.

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