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Effect of an Upper Limb Exercise Training Program for Burned Children on Improving Nurses' Knowledge and Practice

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Abstract

Background: Burns are one of the most common forms of trauma in children. Hand function is one of the most important goals of burn rehabilitation and is consequently an important functional outcome, as it is strongly predictive of successful re-integration into life role**. Aim**: Evaluate the effect of an upper limb exercise training program on improving nurse's knowledge and practice. **Method**: A quasi experimental design was used. The study carried out in burn unit at Plastic, Reconstructive and Burn Surgery Center Mansoura and Mansoura New General Hospital at Mansoura city on a convenient sample of 55 nurses **Used two** tools were used to collect a structured interview sheet and observational checklists for nurses about upper limb exercise,. **Results:** More than three fourth of the studied nurses had an unsatisfactory levels of knowledge, as well as the minority of the studied nurses demonstrated competent level of practice before upper limb exercise training program implementation, which improved to a satisfactory knowledge and a competent practice after the program. **Conclusion:** The program had a positive effect on nurses' knowledge & immediately after and at follow up program implementation respectively. **Recommendation:** Develop regular and continuous training programs for nurses in burn units according to their needs aiming at refreshing their knowledge and improving their practice for pediatric burn.

Key words: Burn, Exercise, Knowledge, Nurses, Practice, Training program, Upper Limb.

Introduction:

Burn injuries have been described as one of the most devastating of all injuries, that have a great impact on the pediatric patients physically, physiologically and psychologically, which are accompanied by intense pain and often by longer-term illness that create suffering not only for the child but for the wider family and community, therefore burns are still one of the top causes of death and disability in the world (**Jahnke, Poston, Jitnarin and Haddock 2018).**Unfortunately, burns are relatively common especially within the pediatric age group, which are the fourth most common type of trauma worldwide, following traffic accidents, falls and interpersonal violence. Young children's natural curiosity, motor immaturity and/or incapability to recognize a dangerous situation and its consequences make that children form an important risk group for burn accidents**((Donna and Marlyn, 2019); Moehrlen et al., 2018).**

Child losses up to 54% function when he loses his hand function also, small joints of the hands are more vulnerable to form contractures which are very difficult to address during the treatment programs therefore, children with upper extremities burn need intensive medical care and life long physiotherapy rehabilitation program **(Young and Burd, 2014).**As mortality due to burn injury decreases, new challenges in burn rehabilitation arise. Burn injuries can cause severe muscle loss, muscle weakness, hypertrophic scars, and contractures, leading to lifelong physical impairments. Physical and occupational therapy, along with nutritional support, aid in the functional recovery of burn children. During the past years, progressive resistance exercise programs have become more common components of outpatient burn rehabilitation programs. Participation in structured exercise routines has been reported to yield multiple benefits, such as a reduced number of surgeries needed for scar release, improved muscle strength, and muscle mass accretion. The ultimate goal of burn rehabilitation is to assist in restoring functional capacity and independence in burned patients **(Diego et al., 2017).**

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The rehabilitation of pediatric patients with burn injuries starts from the day of injury, lasts for several months or years, and requires a multidisciplinary effort. A comprehensive rehabilitation program is essential to decrease the patient's post-traumatic effects and improve functional independence. Such a difference can be made to the long-term quality of life (QOL) of pediatric burn patients through the dedication of the individuals within the burn team, their commitment to caring for the patient, and their encouragement of the burned child participation and full engagement in rehabilitation**(Ohgi and Gu, 2017).**

Burns of the hand have devastating consequences not only for the functional outcome but also for the esthetic appearance. Deep burns may lead to severe scar contracture deformities owing to the unique anatomical structure of the hand. These deformities often have a devastating impact on patients' quality of life. Therefore, effective rehabilitation therapy for hand-burn patients is vital. Burns of the upper extremity may severely limit function by making job performance difficult or sometimes impossible. Ultimately, the quality of life (QOL) and functional outcomes of burn survivors can be severely affected. Pediatric patients may experience negative effects in almost all aspects of their daily functions, physical health, and psychological well-being. Therefore, this study conduct to determine the effect of an upper limb exercise training program for burned children on improving nurse's knowledge and practice.

Aim of the Study

Evaluate the effect of an upper limb exercise training program for burned children on improving nurse's knowledge and practice.

Research Hypothesis

Nurses' knowledge and practice about an upper limb exercise for burned children may improved after implementation of training program.

Subjects and Method

Research Design

A quasi - experimental research design was used to accomplish the study.

Study Setting

This study was carried out in the burn unit at Mansoura New General Hospital at Mansoura city and burn unit in Plastic, Reconstructive and Burn Surgery Center affiliated to Mansoura University.

Study subjects:

A convenience sample of all nurses (N= 55), who were available during the period of data collection in the previously mentioned two settings.

Tools of data collection:

Two tools were used in this study.

Tool 1: A Structured Interview Sheet (pre, post and follow up format)

It was designed by the researcher in a simple Arabic language after reviewing the related literature with the guidance of **(Ibrahim et al., (2018), Fleisher and Ludwigs, (2010); Lawrence, (2016);El Sherbiny, (2018)and Abd El-lateef, (2003).** It composed of 32 questions and it comprised of three parts as follows:

Part (1): Concerned with characteristics of the studied nurses (8 items)such as age, sex, level of education, marital status, years of experience in burn unit, and previous attendance of training program about upper limb exercise in burned children.

Part(2): Concerned with nurse's knowledge about burn, which covered the following (10 questions): Definition of burn, its causes, degree and types. Common type of burn affecting children, period of burns woundhealing, type of burn that doesn't left and left scar, causes of absence of pain in third degree burns and calculation of TBSA burn using Rule of Nines.

Part(3): Concerned with nurse's knowledge about burn of upper limb exercise in burned children, which covered the following (22 questions): Definition of burn rehabilitation, complications that may happen after hand burn injury and how to avoid it, importance of the therapeutic exercises and instructions during doing it. The rehabilitation treatment modalities, the upper extremities correct positions after burns and its benefits, types of therapeutic exercise used after burns.

Definition of goniometer scale, knowledge about massage therapy objectives, cautions and technique. Knowledge about splints objectives, technique and signs of poor splint fitness. Knowledge about pressure therapy its importance, wearing instructions and the instructions for prevention the formation of scars.

Scoring system

According to the answers collected from the burn care nurses; the studied nurses' answers were checked and compared with the pre designed model answer and accordingly. Their knowledge were categorized into; correct complete answer that was given a score two grades, while correct incomplete answer was given a score one grade and zero was given for incorrect, missed or unknown answer according to **(Youssef, Hassan, Abd El-Aziz and Mohammed ,2019)**.The total score of (41) were given for total nurses' knowledge. A higher score indicate better knowledge. All scores were transformed into score percentage as follow score percentage (the observed score / the maximum score) x 100.

The total level of knowledge (41 grades) divided into:

- **Satisfactory**: 75% and more (equal 30.75 grade and more).
- **Unsatisfactory**: less than 75% (equal less than 30.75 grades)

Tool II: Observational Checklists for Nurses about upper limb exercise (pre, post and follow up format)

This tool was developed by the researcher after reviewing recent national and international literatures **(Kowalske et al., 2015; Mohamed, 2014; Cho et al; El Sherbiny, 2018); University of Wisconsin Hospitals and Clinics Authority, 2013; shin and Bordeaux, 2012)** to evaluate nurses' practice of upper limb exercise for the burned children on this checklist consisted of 36 steps covering upper limb exercise skills: Anti-contracture position of the burned limb (8 steps 1:8). Therapeutic exercise which divided into four exercise categories (Early ambulation and walking, Range of motion exercise, resistive or strengthen exercise and Stretching exercise) (16 steps 9:24). Massages therapy technique (12 steps 25:36).

Scoring system

Scoring system for observational checklist for nurses about upper limb exercise:

Scores were estimated to evaluate nurse's performance level related to upper limb exercise care for burned children. According to (**Youssef, Hassan, Abd El-Aziz and Mohammed, 2019),**the scoring was calculated as the following: the total scores of nurses' practice were (72) for all the nursing skill items carried out for care of burned child (36 items for care provided to burned child). The nurses' practice was classified into either completely done (2), incompletely done (1), and not done (0). A higher score indicate better knowledge. All scores were transformed into score percentage as follow score percentage (the observed score / the maximum score) x 100.

The total nurses' practice level (36 items) (72 grade) divided into:

- **Competent**: 75% and more (equal 54 grade and more).
- **Incompetent**: less than 75% (equal less than 54 grades).

II - Operational design

1 –Preparatory phase

This phase included a review of past and current related literature and studies, using available appropriate books, periodicals, magazines, and articles to get acquainted with various aspects of the study research develop the study tools. The guiding booklet was prepared by the researcher. It was specially designed in a simple Arabic language to meet nurses' practical needs and knowledge deficits regarding upper limb exercise for burned children. The content validity of the study tools was assessed and revised by a panel of 5 experts in the field nursing from Mansoura faculty of nursing and no modifications were done. The internal consistency of the developed tool was tested by using Cronbach's alpha coefficient and the tool was Tool 1 was reliable as r = 0 .776 and tool II was reliable as r = 0.976.

2 - Exploratory phase:

a) Pilot study:-

A pilot study was carried out on 10% of the total subjects' size (6 nurses in burn unit) There were no significant modifications required in the study tool, therefore the pilot study were included in the study sample.

Fieldwork:

Data collection period:

Data collection extended over a period of six months period from first of October 2019 to the end of March 2020. The researcher started by introducing herself to the nurses giving them a brief idea about the aim and nature of the study.

Study framework:

The framework of the study was carried out according to 4 phases as the following:

Phase 1: preparatory phase:

- Each nurse was interviewed individually before applying the educational guidelines in order to collect nurses; data base line using the study tool(I) part(1)
- Assessment of nurses' knowledge about upper limb exercise was performed using a tool (I) part (2) and part (3)
- Assessment of nurses' practices about upper limb exercise was performed using a tool (II). Assessed in the morning by observing the child during sleep or when he or she confined to bed to assess anti-contracture position for upper limbs. While, therapeutic exercise and skin massage were observed during dressing change as bulk dressing interfere with appropriate exercise and skin massage. As the most of dressing change occurred in the morning shift.

Phase 2: planning phase

- Based on the findings of the assessment phase goals, priorities and expected outcomes were formulated to meet nurses' practical needs and knowledge deficits regarding upper limb exercise for burned children.
- In this phase, six sessions were planned by the researcher for nurses to provide them with knowledge and practice about upper limb exercise for burned children.
- **Phase 3: implementation phase**
- An illustrative colored bookletabout upper limb exercise training program for burned children was designed by the researcher to be distributed to each nurse in the study. It was planned for each nurse in a simple, easily understandable Arabic form according to each nurse level of education. The booklet was supplemented by photos and illustration to facilitate nurse' understanding of the content and enhance the learning process.
- Teaching methods were done for each nurse. It integrated lectures, role playing, group discussion, life real demonstration and return- demonstration
- Teaching materials included a Microsoft power point presentation (PPT), illustrated picture, videos and upper limb exercise training program booklet (handout).
- Each didactic sessions took about 30 minutes to discuss its items, taking into consideration attention span of nurses
- Each practical sessions took between 30 – 45 minutes to discuss its items, taking into consideration attention span of nurses
- Each session started at 10 am for morning and at 2.30 pm for afternoon shifts two sessions weekly for three weeks.
- The studied nurses were divided into ten groups; each one was consisted of four to six nurses.
- Guiding colored booklet about an upper limb exercise for burned children was given to each nurse after the assessment phase (during the first session) for attracting her attention, motivated her and help her for reviewing its content when needed.
- Brief, clear and simple words used during the session by the researcher. As well as at the end of each session, a brief summary was given.

Phase 4: evaluation phase:

The final step of data collection is evaluating the nurses response to the proposed training program and the extent to which burned children outcome have been achieved. The study was evaluated three times using the study tools. The first phase of evaluation (pre-test) was conducted using tool I part (2) and part (3) and tool

II. The second phase of evaluations (Immediate post - test (post 1)) was conducted using tool I part (2) and part (3) and tool II and the third phase of evaluation (Follow - up - test (post 2)) was conducted after 3 months using tool I part (2) and part (3) and tool II.

III - Administrative design.

An official approval was obtained from the research ethical committee of Mansoura Faculty of nursing to conduct the study.

An official letter was submitted from the Dean of Faculty to the heads of the both previously mentioned settings which affiliated to Mansoura New General Hospital at Mansoura city and burn unit in Plastic, Reconstructive and Burn Surgery Center affiliated to Mansoura University after explaining the purpose of the study.

Ethical considerations:

- An oral approval was obtained from each participant (nurses) before the start of the study after the explanation of the purpose of the study.
- The researcher emphasized that the study cause no physiological or psychological harm to the pediatric patients.
- Privacy and confidentiality of the collected data were assured throughout the whole study phases.

I V- Statistical design:

The collected data were coded and entered to the statistical package of social sciences (SPSS) version 24. After complete entry, data were explored for detecting any error, then, it was analyzed by the same program for presenting frequency tables with percentages. Qualitative data was presented as number and percent. Besides, Quantitative data were described as mean / SD as appropriate. The study data were tested for normality by Kolmogorov-Smirnov test. For normally distributed variables, paired t-test was used to indicate an actual difference between mean scores of the two related groups and RM-ANOVA for comparison of more than two related groups. For not normally distributed variables, Friedman test was utilized for comparison between more than two related groups. In addition to percent of change was used for comparison between two Michigan hand outcome values expressed in hundredths. A negative percent of change indicates a decrease from the original value to the second value. A positive percent of change indicates an increase from the original value to the second value. Spearman and Pearson correlation (r) was performed to measure the strength of relationship between key study variables. The Chi-Square, Monte Carlo and fisher's exact test were used to check whether the variables are independent of each other or not. The result considered significant when the probability of error is less than 5% ($p < 0.05$), highly significant when the probability of error is less than 0.1% ($p < 0.001$).

Result

Table (1) Illustrated that, most of the studied nurses (92.7%) were female, aged between 30 to less than 35 years, with a mean age 30.54 ± 4.98 years old (34.5%). Their educational level revealed that around half of them had nursing technical institute degree and were married (41.8%, 78.2% respectively).As regards nurses' years of experience, it was noticed about one third of the nurses (36.4%) had 5 to less than 10 years of experience, whereas 29.1% had less than 5 years of experience, with a mean experience 8.61±4.73 years

Table (1): Percentage distribution of socio-demographic characteristics of the studied nurses

Nurses' Socio-demographic characteristics		No=55	
		No.	**%**
Age in year	<25	12	21.8
	-25	12	21.8
	-30	19	34.6
	35 & more	12	21.8
	Mean ± SD =	30.54 ± 4.98	
Gender	Male	4	7.3
	Female	51	92.7
Educational level	Nursing diploma	12	21.8
	Nursing technical Institute	23	41.8
	Bachelor degree	20	36.4
Marital status	Married	43	78.2
	Divorce	1	1.8
	Single	11	20
Years of experience	<5	16	29.1
	- 5	20	36.4
	- 10	11	20
	15 -	8	14.5
	Mean ± SD =	8.61±4.73	
	live with others	5	9.1

Figure (1): Illustrated that, more than half of the studied nurses (54.5 %) attended one previous training course about burn, whereas the minority of them attended twice to three times previous training course (18.2%) for each.

Figure (1): Percentage distribution of the number of previous training programs about burn.

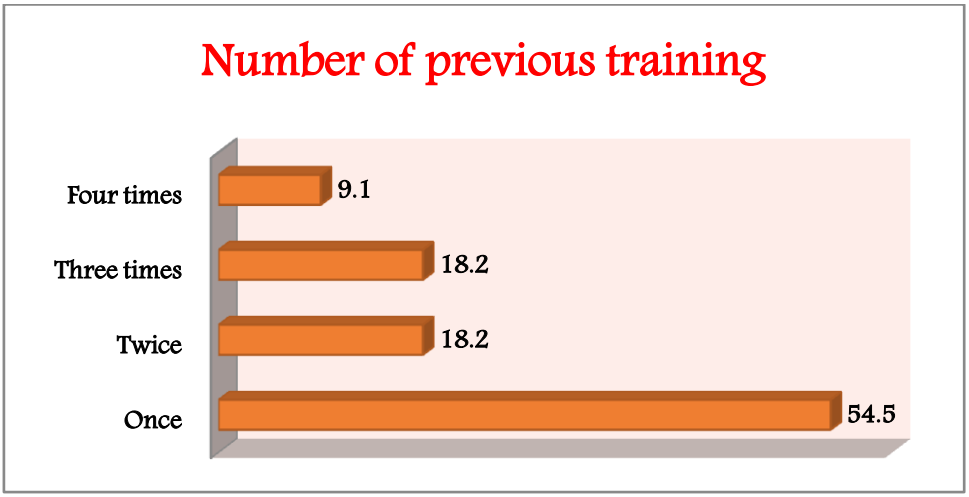

Table (2) Represented that; around half of the studied nurses didn't distinguish the massage cautions for burn scars, and technique of the massage performance for burn scars before the implementation of the training program (50.9%, and 43.6%, respectively). Immediately after the program implementation these percentages improved to 83.6% for each and 60% and 69.1% respectively after 3 months of the program with highly statistically significance improvements ***(P≤0.001).*** Concerning nurses' knowledge about sign of poor splint fitness, it is revealed from the table that there is a highly cumulative improvement of nurses' knowledge, as 43.6% of the nurses identified the correct and complete answer of it before the training application, while, immediate after program implementation this percent improved to 85.5% and 67.3%, after 3 months of the program application respectively with highly a significance differences ***(p≤0.001).***

Table (2): Percentage distribution of the studied nurses according to their knowledge about massage cautions and it's technique, importance of using hand splints and it's technique of care, signs of poor splint and knowledge about pressure therapy before, immediately after and post 3 months of the targeted program implementation

Knowledge's Item	Nurses No=55						
	Pre		Immediately after		Post 3 months		Test of significance
	No.	(%)	No	(%)	No	(%)	
The massage cautions for burn scars							
Correct answer	27	49.1	46	83.6	33	60	χ^2=13.47, p≤0.001
Incorrect answer/ don't know	28	50.9	9	16.4	22	40	
Technique of the massage performance for burn scars							
Correct answer	31	56.4	46	83.6	38	69.1	χ^2=8.45, p≤0.001
Incorrect answer/ don't know	24	43.6	9	16.4	17	30.9	
The importance of using hand splints after burns							
Correct answer	35	63.6	53	96.4	36	65.5	χ^2=19.18, p≤0.001
Incorrect answer/ don't know	20	36.4	2	3.6	19	34.5	
Technique of hand splint care							
Correct answer	40	72.7	50	90.9	36	65.5	χ^2=8.66, p≤0.013

Incorrect answer/ don't know	**15**	**27.3**	**5**	**9.1**	**19**	**34.5**	
Signs of poor splint fitness and need for reapplication							
Complete correct answer	**24**	**43.6**	**47**	**85.5**	**37**	**67.3**	χ^2=13.6, p≤0.001
Incomplete correct answer	**29**	**52.7**	**7**	**12.7**	**9**	**16.4**	
Incorrect answer/ don't know	**2**	**3.6**	**1**	**1.8**	**9**	**16.4**	
Knowledge about pressure therapy							
Correct answer	**29**	**52.7**	**53**	**96.4**	**40**	**72.7**	χ^2=28.86, p≤0.001
Incorrect answer/ don't know	**26**	**47.3**	**2**	**3.6**	**15**	**27.3**	

Table (3) illustrated the large effect size ***(η^2=0.303)*** of the training program on total nurses' knowledge items score throughout the program' phases. There was a highly statistically significance improvement in mean of the overall nurses' knowledge score before, immediately after the training program and after 3 months of the program implementation (***P≤0.001).*** Regarding the total knowledge level, it was noticed from these table and figure that, more than three fourth of the studied nurses (76.4%) had "unsatisfactory" levels of knowledge about burn and upper extremities exercise before the program implementation compared to 16.4% immediately after the program implementation and 43.6% by 3 months later.

Table (3): Percentage distribution of the studied nurses according to their total knowledge score about burn and upper extremities exercises before, immediately after and post 3 months of the targeted intervention implementation:

Items of Knowledge	Nurses No=55						
	Pre[a]		**Immediately after [b]**		**Post 3 months [c]**		**Test of significance**
	No.	**%**	**No.**	**%**	**No.**	**%**	*Repeated measure ANOVA within group*
The total score of knowledge (41 grade)							
Unsatisfactory knowledge	42	76.4	9	16.4	24	43.6	*F=23.52, p≤0.001, η^2=0.303*
Satisfactory knowledge	13	23.6	46	83.6	31	56.4	
Mean ± SD	26.81±6.54		37.49±5.11		31.16±11.24		
Significant difference within three observation *(Post hoc results)*	***A< B, C*** *Baseline assessment<Post1 and Post2*						

Table (4) demonstrates the differences in the studied nurses' observed practice regarding anti contracture positioning' before, immediately after, and after 3 months of the program implementation. The table show that there were highly statistical significance differences regarding nurses' practice of the above-mentioned anti-contracture procedure' steps ***(P≤0.001).*** **Table (4): Percentage distribution of the studied nurses' observed practice regarding anti-contracture positioning before, immediately after and post 3 months of the targeted intervention implementation**

Items	Pre N=55			Immediately after N=55			Post 3 months N=55			Test of significance
	Completely Done	Incompletely done	Not done	Completely Done	Incompletely done	Not done	Completely Done	Incompletely done	Not done	
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N(%)	N(%)	
anti-contracture positioning										
Lie on the back with head of bed flat.	7(12.7)	10(18.2)	38(69.1)	46(83.6)	6(10.9)	3(5.5)	29(52.7)	21(38.2)	5(9.1)	χ^2=68.23, p≤0.001

Extend all arm joint such as shoulder, elbow and wrist.	7(12.7)	10(18.2)	38(69.1)	46(83.6)	6(10.9)	3(5.5)	27(49.1)	23(41.8)	5(9.1)	χ^2=69.39, p≤0.001
Place forearm supinated with hand palm downward.	7(12.7)	10(18.2)	38(69.1)	46(83.6)	6(10.9)	3(5.5)	32(58.2)	18(32.7)	5(9.1)	χ^2=67.84, p≤0.001
Abduct arms away from body with pillow.	7(12.7)	10(18.2)	38(69.1)	46(83.6)	6(10.9)	3(5.5)	31(56.4)	19(34.5)	5(9.1)	χ^2=67.95, p≤0.001
Flex fingers slightly and put fingers away from each other.	7(12.7)	10(18.2)	38(69.1)	46(83.6)	6(10.9)	3(5.5)	31(56.4)	19(34.5)	5(9.1)	χ^2=67.95, p≤0.001
Thumb should be abducted away from fingers and rolled forward in front of fingers.	7(12.7)	8(14.5)	40(72.7)	45(81.8)	6(10.9)	4(7.3)	30(54.5)	20(36.4)	5(9.1)	χ^2=66.11, p≤0.001
Use small hand rolls or dressing to support fingers and thumb in functional position. '	7(12.7)	10(18.2)	38(69.1)	44(80)	8(14.5)	3(5.5)	29(52.7)	21(38.2)	5(9.1)	χ^2=65.58, p≤0.001
Elevate arms above heart level on a pillow.	7(12.7)	10(18.2)	38(69.1)	46(83.6)	6(10.9)	3(5.5)	30(54.5)	19(34.5)	6(10.9)	χ^2=68.08, p≤0.001

Table (5) revealed that, few percentages of nurses (12.7%) had "competent" levels of practice score about upper extremity exercises to care for children with burn before the program implementation. whilst, this level of practice was improved immediately after the program implementation to 83.6% and 54.5% after 3 months. Highly statistically significance differences were found among studied nurses practice score about upper extremity exercises to care for children with burn before, immediately after and post 3 months of the targeted program implementation **(P ≤ 0.001)**

Table (5): Percentage distribution of the studied nurses observed practice level about upper extremity exercises to care for children with burn before, immediately after and post 3 months of the targeted intervention implementation

Items of practice	Nurses No=55						
	Pre[a]		**Immediately after [b]**		**Post 3 months [c]**		**Test of significance**
	No.	**%**	**No.**	**%**	**No.**	**%**	
The total nurses' observed practice score (72 grade)							
Incompetent practice	48	87.3	9	16.4	26	47.3	***χ2 =76.88, df=2, p≤0.001, W= 0.70***
Competent practice	7	12.7	46	83.6	29	52.7	
Median(range)	0 (71)		72 (72)		63 (72)		
Significant difference within three observation	***A< B, C*** *Baseline assessment<Post1 and Post2*						

Competent practice: ≥75%, ***Incompetent practice***: < 75%, ***χ2:*** chi square***, df:*** degree of freedom***, W***: the Kendall's W value (the effect size for Friedman test), ***(*) Statistically significant at*** p ≤ 0.05.

Discussion

Burn is one of the most physical and psychologically devastating forms of trauma in children. It is also one of the most common household injuries, and thus an important cause of morbidity and mortality. In both developed and developing countries, burn injuries have a significant impact on pediatric patients and may affect a range of body systems**.** As it has the most expensive catastrophic injuries to treat, as they require long periods of hospitalization and may result in, physical, as well as the psychological squeal **(Hazrati , Vahedi , Shirzadc, and Khanderoy 2020; Mohamed, Bahgat, Elmelegy, and El-Ashry, 2019)**.

The result of the current study revealed that, as regards nurses' years of experience, it was notice that about one third of the nurses had 5 to less than 10 years of experience, with a mean experience 8.61±4.73 years **(Table 1)**. This result was in the same line with **Lam, Huong, and Tuan, 2018; Ahmed and Mohamed, 2016**, who concluded that, the large percent of the nurses had experience in burn care department ranged from 1 and 10 years. The current finding was in the same line with **EL Sayed, et al., (2015)** who stated that, "40% of their participants had 10-20 years of experience; followed by 35% with less than 10 years of experience, while 25% had more than 20 years of experience".

Concerning attendance of the studied nurses to burn training courses, the present study showed that, only one-fifth of the studied nurses had attended training courses about burn. While majority of them had not attend any training courses **(Figure 1).** This result could be due to high workload on nurses and shortage of staff, scarcity of training programs, and lack of specialized curriculum for nursing field. This result was in agreement with **Lam, Huong, and Tuan, 2018**; **Ahmed et al., 2017**, who mentioned that, less than one fifth of their participants had attended training courses about burn and its management. While, this finding conflicted with **EL Sayed, et al., (2015**) who cited that, 75% of their study sample attended one or two traing program about burn.

According to,the assessment results of nurses' knowledge and practices about burn and care of burned children regarding the upper extremity exercises before, immediately after and post three months of the targeted intervention implementation. This study demonstrated that, there was a highly statistically significant difference of the studied nurses' knowledge in post and after three months of program implementation as compared to preprogram **(Table 2)** . This result agreed with, **Ahmed et al., 2017**, which study entitled "Evaluation of Nursing Performance at Pediatric Burn Unit in Benha City: An Intervention Study", who revealed that, there was a highly statistical significant difference after the program compared to before regarding nurses' knowledge about burn care. This finding was consistent with **Choi, Armstrong and Panthaki, 2019) ,** who concluded that the knowledge of the nurses was insufficient before the educational program, which statistically improved after its implementation. In addition to, the study implemented by **Mussa and Abass (2014)** mentioned that "The nurses' knowledge about nursing care of burn, treatment and complication were moderately adequate at Azady hospital in compare to adequate knowledge at a western hospital".

Also, the study was conducted by **EL Sayed, et al., (2015)** cited that, periodical training program for nurses regarding burn care was efficacious and raised nurse's knowledge.

According to, studied nurses' knowledge about upper extremity exercises, the current study revealed that, there was statistically significant difference regarding total nurses' knowledge score of post burn exercises before, immediate after, and after 3 months of training program implementation **(Table 3)**. This finding is emphasized by **Schmitt, et al., 2011; Atiyeh and Janom, 2018** who stated that "Early and aggressive physical therapy can help counter the decreased range of motion and mitigate the severe contractures that can develop. Supervised resistance training and aerobic exercise programs have been shown to offer considerable benefits during outpatient rehabilitation."

Burn scar contractures are a major source of late morbidity, particularly in children that continue to grow long after burn healing has occurred; they may restrict normal growth resulting in secondary deformities. Consequently, our study focused on training pediatric nurses on anti-contracture positioning and therapeutic exercises, which showed highly statistically significance differences among studied nurses practice level immediately after and post 3 months of the targeted program implementation **(Table 4)**. This result was emphasized by **Sudhakar and Le Blanc, (2011**) who concluded that "Limiting the development of contractures by splinting and positioning is certainly the most appropriate and shortest path to achieve the best possible functional outcome."

The current study showed that, the implemented program on total nurses' observed practice showed highly statistical significance with large effect size throughout the program' phases**(Table 5).**This result was confirmed by Ahmed et al., 2017 who illustrated that "Competent level of nurse's performance before the program was ten meanwhile after program improved and become forty five". Likewise, **Mohamed, et al., (2019)** who agreed with the present study as they pointed that, there were statistical significant improvements regarding exercise before, immediately after, and post one month of the program implementation. Furthermore, **(Ahmed et al., 2017)** study was consistent with the current study finding, as it reported that "more than half of nurses showed greater improvement in their performance in pediatric burns management".

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Conflict of Interests

The authors state that there is no conflict of interests regarding this study.

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