

The Effect of an Educational Program on Self-Care Practice for Patients with External Skeletal Fixation

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Abstract:

Background: External Fixation is an effective treatment modality for complex fractures without increasing soft tissue damage. Patients with external fixator have limited ability to perform activities of daily living and self-care practices. **Aim of the study** was to evaluate the effect of an educational program on self-care practice for patients with external skeletal fixation. **Design:** A quasi-experimental research design was used. **Setting:** The study was carried out at the orthopedic department and orthopedic outpatient clinics at Nasser Institute for Research and Treatment. **Subjects:** A purposive sample of (90) adult patients from both genders with external skeletal fixation. **Tools:** Three tools were used in the study included: Patients' structured interview questionnaire, patients' self-care practices checklist and Barthel Index for patients' activities of daily living. **Result:** There was a highly statistically significant relation regarding total patients' knowledge between pre, post and follow-up (after one month) of the educational program implementation, there was a significant improvement in all patients' self-care practices towards external skeletal fixation and Barthel index for patients' activities of daily living with a highly statistically significant difference. **Conclusion:** There was a highly statistically significant correlation between total patients' knowledge, total patients' self-care practices and total Barthel Index score for patients' activities of daily living at pre, post and follow-up (after one month) implementation of the educational program. **Recommendations:** The educational intervention should be included in the routine nursing care.

Keywords: Educational program, External fixation, Self-care practice.

Introduction:

The most common cause of musculoskeletal injury is a traumatic event resulting in fracture, dislocation, subluxation, and soft tissue injury. Accidents are one of the top three causes of death for persons ages 1 to 64 years (Hagler, 2023). External fixation is a versatile alternative that allows a swift application in emergency settings. External fixation is the gold standard for treating open fractures because of their soft tissue coverage and stable internal stabilization (Banerjee, 2023).

External fixation is a system of maneuvering, aligning, and immobilizing fracture fragments to a reasonable alignment by percutaneous insertion of pins or wires under tension and held together by external framework of bars or rings (sen, 2022). The sites where the pins or wires enter the skin are commonly referred to as pin sites (Tarkin et al., 2022).

External fixation is increasingly being used not only in fracture treatment, but also in the repair of deformities, extremity lengthening, nonunion osteomyelitis, or tumors and prevents further soft tissue damage, and allows treatment of complex fractures and periarticular injuries while having no negative effect on systemic complications in patients with multiple injuries (El-Sebaie Badr, et al., 2021).

However, the external fixator's long-term and intrusive nature may exacerbate serious side effects including infection of pin site, osteomyelitis, loosening of frame or pin, soft tissue impalement, non-union, neurovascular injuries, and compartment syndrome. Furthermore, external fixation may have a detrimental effect on a patient's social, emotional, and physical wellbeing (Xing et al., 2020; Hadeed et al., 2022). Patients with external fixation device have limited physical mobility, when disability occurs, action is necessary to adjust ways of performing self-care activities, to modify self-image, to revise the activities of daily living, and to cope with the effects of the health deviation (Khorais et al., 2018).

The World Health Organization (WHO, 2020) defines self-care as "the ability of individuals, families and communities to promote health, prevent disease, maintain health, and to cope with illness and disability with or without the support of a health-care provider". Nursing care for patients with external fixator can be time-intensive and both physically

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and emotionally draining for both the patient and carers through assessment and education. Self-care education gives patients the knowledge needed to successfully reintegrate into the community and live as independently as possible and promote their self-care abilities to carry out activities of daily living (Clarke & Drozd, 2023; Hartweg & Metcalfe, 2022).

The nurse plays a crucial role in promoting self-care practices among patients and helping patients to feel empowered and motivated to take an active role in their own care to enhance their self-care abilities (Ribeiro et al., 2023). Before discharge, the nurses educate patients about signs and symptoms of infection, restrictions needed to protect the affected limb, pin site care, drug self-administration, and individual exercise plans, helps the patient become mobile within the prescribed weight-bearing limits to minimize the chance of loosening of the pins (Sayed et al., 2019).

Significance of The Study:

Every year, around 1.3 million people worldwide die in road traffic accidents (RTAs). Egypt is one of countries having the highest world's RTAs rate (WHO, 2021).

Patients with external fixators need specialized education regarding complication management including pin tract infection and disability and self-care deficit when performing activities of daily living (Mohamed et al., 2023). Effective patient education may improve patient outcomes. Through education about the peri-operative procedures and self-care practices, it is supposed that patients will be less anxious, shorten the hospital stay, have early functional improvement, enhance independence, and decrease postoperative complication (Goldchmit et al., 2021).

The most common complication is pin site infection which may harm soft tissue, delay fracture healing, and increase pain, the chance of secondary procedure, and the length of hospital stay. Thus, the patient needs to be involved in pin site and frame care (Olasinde & Jones, 2023).

Aim of The Study:

The aim of the current study was to evaluate the effect of an educational program on self-care practice for patients with external skeletal fixation through:

- Assessing patients' level of knowledge regarding external skeletal fixation pre-implementation of an educational program.
- Assessing patients' level of practices regarding external skeletal fixation pre-implementation of an educational program.
- Developing an educational program for patients with external skeletal fixation based on their needs assessment.
- Implementing an educational program for patients with external skeletal fixation.

Evaluating the effectiveness of an educational program on patient's level of knowledge regarding external skeletal fixation pre, post and follow up the implementation of the educational program.

Research Hypotheses:

H1: At the end of the study, the patients' level of knowledge will be improved positively after the implementation of an educational program regarding self-care of patients with external skeletal fixation.

H2: At the end of the study, the patients' practices will be improved positively after the implementation of an educational program regarding self-care of patients with external skeletal fixation.

Subjects and Methods:

Research design:

A quasi-experimental research design was utilized in this study.

Setting:

The study was conducted in the orthopedic department and orthopedic outpatient clinics at Nasser Institute for Research and Treatment, Cairo, Egypt.

Subjects:

A purposive sample of (90) adult patients from both genders with external skeletal fixation and their age ranged from 18 to 60 years old was involved in this study from the above-mentioned setting who was accepted to participate in the study.

Tools of data collection:

Three tools were utilized to collect study data:

1st Tool: Patients' Structured Interviewing Questionnaire.

This tool was developed by the investigator and translated into Arabic language after reviewing recent related literature and scientific references (Morsy et al., 2021) to assess self-care practice for patients with external skeletal fixation. It included the following three parts:

Part (1): Patients' Personal Characteristics:

It included patients' age, gender, marital status, educational level, and occupation and residence.

Part (2): Patients' Medical and Surgical History.

It was included past medical and surgical history, patient's diagnosis, and pain characteristics.

Part (3): Patients' Knowledge Related to Self-Care Practice:

It was included patients' Knowledge about fractures, external skeletal fixation, and self-care practices. It was composed of 25 closed-ended questions.

Scoring system:

The questionnaire contained 25 questions, the total score of the questionnaire was 25 grades, the correct answer was scored as one degree and incorrect answer was scored as a zero. These scores were summed up and were converted into a percentage score. Total knowledge score was classified into 2 categories:

Satisfactory level if the score $\geq 75\%$. (19-25 grades)

Unsatisfactory level if the score from $<75\%$. (0-18 grades).

2nd Tool: Patients' Self-Care Practices regarding pin site care Checklist.

It was adapted from (Khadka et al.,2012; Morsy et al., 2021) to assess patients' practices regarding pin site care. The checklist included (19) steps related to pin site care.

Scoring system:

The scale was contained of 19 items, the total scores of the scale were 19 grades, each item was evaluated as "done" was scored as one degree and "not done" was scored as a zero. These scores were summed up and were converted into a percentage score. It was classified into 2 categories:

Competent level if score $\geq 75\%$ (15-20 grades).

Incompetent level if score $<75\%$ (0-14 grades).

3rdTool: Barthel Index for Activities of Daily Living.

It was adopted from (Loewen, 1990) to assess patient's self-care activities and dependency level of activities of daily living regarding feeding, bathing, grooming, bowels, bladder, toilet use, transfer, mobility, and stairs on scale of 0 to 100 (0 = complete dependent and 100 = independent).

Scoring system:

The total scores of the scale were (0-100) grades, the higher scores were reflected the higher independence level. It was categorized as the following:

- **Full independent** if score 100 grades.
- **Mildly disabled** if score from 75-95 grades.
- **Moderately disabled** if score from 50 -70 grades.
- **Severely disabled** if score from 25-45 grades.
- **Very Severely disabled** if score from 0-20 grades.

The educational program for patient with external skeletal fixation:

Based on patients' needs, the self-care program was designed by the investigator and written in simple Arabic language using illustrated pictures based on related recent literatures. It was adapted from (Morsy et al., 2021; Gulanick et al., 2021 & Khorais et al.,2018). It aimed to improve patients' knowledge and practice related to self-care regarding external skeletal fixation. It includes the following items (anatomy and function of musculoskeletal system, definition, causes, risk factors, types and treatment of fractures, definition, types, purposes, advantages, disadvantages, complication, and principles of external fixation, activities of daily living, exercises after operation, non-pharmacological measures to deal with pain, pin site care steps, the importance of nutrition, how to manage negative thoughts, discharge instructions and follow-up (after one month).

Tools Validity and Reliability:

Validity:

The content validity was fulfilled for comprehensiveness, relevance, simplicity, clarity, and ambiguity through a jury of five experts from medical surgical nursing department, Faculty of Nursing, Helwan University (two assistant professor and three lecturer), and all recommended modifications were done.

Reliability:

Reliability was testing statistically to assure that the tool was reliable before data collection and to determine the extent to which the questionnaire items were related to each other. Alpha Cronbach for knowledge was 0.835%, for patients' self-care practices was 0.921% and for Barthel Index was 0.883%.

Pilot study:

A pilot study was carried out on 9 patients (10% of the sample) at orthopaedic department and outpatients' clinics to examine the clarity of questions and time needed to complete the study tools as well as to identify any possible obstacles that may impede data collection. Patients included in the pilot study were excluded from the study sample, because some modifications were done in the tool after conducting the pilot study.

Field work:

Fieldwork includes the following:

- Approval was obtained from the Scientific Ethical Committee of the Faculty of Nursing at Helwan University.
- An official permission to conduct the proposed study was obtained from the director of Nasser Institute in which the study was conducted.
- A written informed consent was obtained from each participant prior to the data collection after explaining the aim of the study.
- Data collection was performed and completed over a period of six months from the beginning of February ,2023 till the

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end of July 2023. The investigator attended the clinical setting three days per week during morning and afternoon shifts and interviewed each patient.

- The study was conducted on three phases: Assessment phase, implementation phase and evaluation phase as following:

Assessment phase:

Assessment shed light on current knowledge and self-care activities level to detect the deficit regarding patients' knowledge and practice about external skeletal fixation. The assessment was performed before the implementation of the educational program by interviewing each patient. It took around 30-45 minutes.

implementation phase:

The educational program implementation was conducted in five sessions to improve knowledge about self-care practice regarding external skeletal fixation. Each session lasted about 20-30 minutes according to its contents as well as the patient's response. The investigator divided the patients into groups, each group (2-6) patient and each group took five sessions: three sessions for theory, two sessions for practice. Each session started with a summary about what had been given through the previous session, then the objectives of the new topics, taking into consideration the use of simple language to suite the level of all patients' education. All patients were cooperative with the investigator and at the end of each session the patients participated in discussion to correct any misunderstanding and allowed to ask questions.

Evaluation phase:

Evaluating the effect of applying the educational program on knowledge and self-care practice of the patient by comparing the results of the pre, post, follow-up (after one month) of the implementation of the educational program. Evaluation was done immediately post implementation of the educational program, and follow-up (after one month) when attending the outpatient's clinic for follow-up or by phone calls. Follow-up was carried out after one month of the implementation of the program, because the external fixator may be removed within three to twenty weeks, depending on the complexity of the fracture.

Ethical Considerations:

An official permission to conduct the proposed study was obtained from the Scientific Research Ethical Committee at Faculty of Nursing Helwan University (Committee number was thirty-two, it was on 22 November 2022). Participation in the study was voluntary and subjects were given complete full information about the study and role before signing the informed consent. The ethical considerations were included explaining the purpose and nature of the study, stating the possibility to withdraw at any time, confidentiality of the information where it was not be accessed by any other party without taking permission of the participants. Ethics, values, culture, and beliefs were respected.

Data Analysis:

The statistical analysis of data was done by using the computer software of Microsoft Excel Program and Statistical Package for Social Science (SPSS) version 25. Data were presented using descriptive statistics in the form of frequencies and percentage for categorical data, the arithmetic mean (X) and standard deviation (SD) for quantitative data. Qualitative variables were compared using the chi square test (X^2). Quantitative variables were compared using paired t test and One Way Anova test. In addition, R- tests were used to identify the correlation between the study variables.

Degrees of significance of results were considered as follows:

- P-value > 0.05 Not significant (NS)
- P-value < 0.05 Significant (S)
- P-value < 0.01 Highly Significant (HS).

Result:

Table (1) reveals that 67.8% of the studied patients were in the age group of 31-40 years old, with a mean age of 38.97 ± 5.61 years. Regarding gender and marital status, 66.7% and 58.9% of them were males and married, respectively. Also, 46.7% of them had intermediate education. Moreover, 45.6% of them had manual work and 65.6% of them were from urban areas.

Table (2) shows that, there was a significant improvement in total patients' knowledge after implement-ting the educational program with a highly statistically significant difference at ($P = < 0.00$). As evidence, 5.6% of the studied patients had satisfactory level of total knowledge at pre implementing the program which changed to 90.0% after implementing the program and 84.4% at follow up of the implementing the program.

Table (3) displays that, there was a significant improvement in total patients' self-care practices after implementing the educational program with a highly statistically significant difference at ($P = < 0.01$). As evidence, 7.8% of the studied patients were competent regarding self-care practices towards external skeletal fixation at pre implementing the program which changed to 88.9% after implementing the program and 83.3% at follow up of the implementing the program.

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Figure (1) reveals that, 71.1% of the studied patients were moderate disabled at pre implementing the program. While 65.6% of them were mild disabled after implementing the program and 88.9% of them were mild disabled at follow up of the implementing the program.

Table (4) explains that there was a highly statistically significant correlation between total patients' knowledge, total patients' self-care practices and total Barthel Index for patients' activities of daily living at pre, post and follow-up (after one month) implementation of an educational program at ($p < 0.01$).

Table (1): Frequency distribution of the studied patients according to their personal characteristics (n=90).

Personal characteristics	No.	%
Age		
18-<30 yrs.	10	11.1
30-<40 yrs.	61	67.8
40-<50 yrs.	8	8.9
50-< 60 yrs.	11	12.2
Mean SD	38.97±5.61	
Gender		
Male	60	66.7
Female	30	33.3
Marital status		
Single	22	24.5
Married	53	58.9
Widow	13	14.4
Divorced	2	2.2
Educational level		
Illiterate	7	7.8
Read& write	13	14.4
Intermediate education	42	46.7
University education	27	30.0
Post-graduate education	1	1.1
Occupation		
Manual work	41	45.6
Retired	14	15.6
Official work	21	23.3
Not Work	14	15.5
Residence		
Rural	31	34.4
Urban	59	65.6

Table (2): Comparison between the studied patients regarding total knowledge at pre, post and follow-up (after one month) implementation of the educational program (n=90).

Knowledge subscales	Pre- program				Post program				Follow up				(p1)	(p2)	(p3)
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory				
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			
Fractures	5	5.6	85	94.4	82	91.1	8	8.9	74	82.2	16	17.8	$X^2=121.8$ $P=0.000^*$	$X^2=3.07$ $P=0.079$	$X^2=165.4$ $P=0.000^*$
External skeletal fixation	4	4.4	86	95.6	80	88.9	10	11.1	75	83.3	15	16.7	$X^2=118.8$ $P=0.000^*$	$X^2=1.16$ $P=0.281$	$X^2=165.8$ $P=0.000^{**}$
Self-care practices	6	6.7	84	93.3	83	92.2	7	7.8	76	84.4	14	15.6	$X^2=121.8$ $P=0.000^*$	$X^2=2.64$ $P=0.104$	$X^2=169.5$ $P=0.000^{**}$
Total knowledge score	5	5.6	85	94.4	81	90.0	9	10.0	76	84.4	14	15.6	$X^2=118.5$ $P=0.000^*$	$X^2=1.24$ $P=0.264$	$X^2=167.3$ $P=0.000^{**}$

Mean ± SD	8.42±4.65	23.50±2.43	21.50±4.19	t=25.58 P=0.000*	t=29.13 P=0.089	f=400.3 P=0.000**
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P₁: p value for comparing between pre and post program. P₂: p value for comparing between post and Follow-up (after one month) program. P₃: p value for comparing between the three sessions.

Table (3): Comparison between the studied patients regarding total self-care practices towards external skeletal fixation at pre, post and follow-up (after one month) of the implementation of the educational program (n=90).

Total self-care practices	Pre- program		Post program		Follow-up (after one month)		(p ₁)	(p ₂)	(p ₃)
	No.	%	No.	%	No.	%			
Competent	7	7.8	80	88.9	75	83.3	X ² =115.10	X ² =1.161	X ² =153.98
Incompetent	83	92.2	10	11.1	15	16.7	P=0.000**	P=0.281	P=0.000**
Mean ± SD	5.55±4.41		16.4±2.82		16.78±2.10		t=18.70 P=0.000**	t=0.899 P=0.370	f=346.20 P=0.000**

X²: Chi-square test. t=Paired t. test. f= One Way Anova Test. P= p-value Highly statistically significant at p ≤ 0.01.

P₁: p value for comparing between pre and post program. P₂: p value for comparing between post and Follow-up (after one month) program. P₃: p value for comparing between the three sessions.

Figure (3): Percent distribution of total Barthel Index score for patients' activities of daily living at pre, post and follow-up (after one month) implementation of an educational program (n=90).

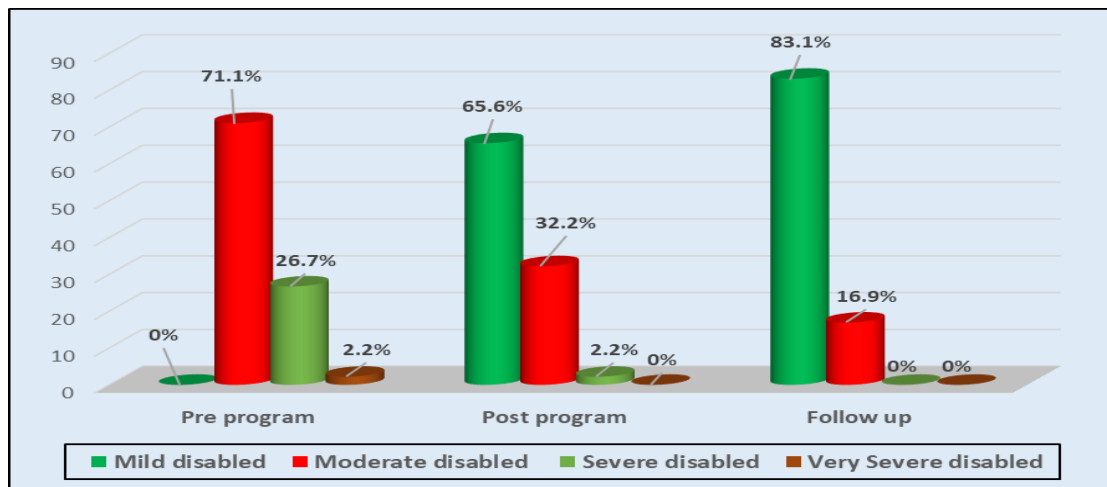


Table (4): Correlation between total patients' knowledge, total patients' self-care practices and total Barthel Index score for patients' activities of daily living at pre, post and follow-up (after one month) implementation of the educational program (n=90).

Variables		Total patients' knowledge			Total Barthel Index for patients' activities of daily living		
		Preprogram	Post program	Follow up	Preprogram	Post program	Follow up
Total patients' knowledge	R				0.244	0.283	0.572
	P				0.020*	0.007**	0.000**
Total patients' self-care practices	R	0.506	0.436	0.432	0.256	0.271	0.487
	P	0.000**	0.001**	0.001**	0.018*	0.007**	0.000**

Discussion:

Regarding patient's personal data, about more than two-thirds of the studied patients were aged between 30 - 40 years old, with mean SD (38.97±5.61 years). These results were in same line with **El-Sebaie Badr et al., (2021)** who reported that the highest percentage of patients in the study group were in the age group of 30 to less than 40 years. On the other side **Meyer et al., (2023)** who revealed that the average age of the studied patients was 55.3 years. From the investigator's point of view, this result may be related to the relation between this age group (30-40years) and fractures as they spent most of their time out of homes and are vulnerable to risky behaviors and accidents.

Regarding gender, the present study revealed that more than two thirds of the studied patients were males. These results were corroborated by **Zhang et al., (2023)** who reported that more than two thirds of the studied patients were males. On the other side, these findings disagreed with **Xing et al., (2020)**, who documented that more than half of the patients were females. From the investigator's point of view, this result might be related to relation between male gender and fractures, as males are more liable to road traffic accidents and work accidents due to their nature of work and activities than females.

Regarding marital status, the present study showed that more than half of the studied patients were married. These results were in same line with **Mohamed et al., (2023)** who reported that above half of both groups were married. On the other side, this finding disagreed with **Chen et al., (2017)** who reported that majority the examined patients were single. Pertaining to occupation and educational level, the results of the present study showed that more than two fifths of the patients had secondary education and manual workers.

These results were congruent with **Emara et al., (2023)** who found that more than one third of patients had secondary education and showed that above half of the patients had manual work. On the other side, this finding disagreed with **Zuccarino et al., (2020)** who reported that over half of the patients had a high level of education. Also, **Manwana et al., (2018)** who mentioned that more than one third of the patients were employees. From the investigator's point of view, this result might be due to the nature of the manual work which leads them to be more liable to work accidents, trauma, and various fractures. In Egypt those with secondary education usually work manual and craft works. Unfortunately, they are vulnerable to occupational injuries if safety standards are not met.

Regarding total patients' knowledge at pre, post and follow-up (after one month) implementation of an educational program. The present study displayed that there was a significant improvement in total patients' knowledge after implementing the educational program with a highly statistically significant difference between pre, post and follow-up (after one month) implementation of an educational program. As evidence, the minority of the studied patients had satisfactory level of total knowledge at pre implementing the program which shifted the majority of them after implementing the program and most of them at follow up of the implementing the program.

These results were in same line with **Abouelala et al., (2023)** who found that there statistically significant for all knowledge subitems in post and follow up phase after implementation of the self-management protocol. This finding was consistent with **Konda (2020)** who confirmed that there were a highly statistically significant differences in relation to total mean score regarding overall the studied group knowledge post guidelines implementation.

The present study revealed that there was a significant improvement in all patients' self-care practices (pin site care) towards external skeletal fixation after implementing the educational program with a highly statistically significant difference post and follow-up (after one month) implementation of an educational program compared pre-implementation.

The majority of studied patients were competent regarding self-care practices (pin site care) towards external skeletal fixation after implementing the educational program, this result reflected the success of an educational program on improvement of pin site care practices of studied patients and promoting health of patients. Consistent to the study finding, a study conducted by **El-SebaieBadr et al., (2021)** who noticed that there was an improvement of pin site-care practices of studied patients after implementing the health educational program that made a great emphasis on how to keep pin site clean and keep it away from infection with statistically significant difference. On the other side, this finding disagreed with **Encinas-Ullán et al (2020)** who reported that pin infection is the most common complication, which occurs in thirty of cases and recommend a daily treatment with a disinfectant and providing education to patients regarding pin care to prevent infections.

The present study displayed that there was a significant improvement in patients' Barthel index of activities of daily living with a highly statistically significant difference between pre, post and follow-up (after one month) implementation of an educational program. These results were similar to **Abu El-Kass et al., (2022)** who found highly statistically significant between all items of activities of daily living among both groups post educational program implementation immediately post and after one month.

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On the other side, this finding disagreed with **Dyer et al., (2017)** who noted that one year after hip fracture, approximately one third of the patients had still unable to walk independently and more than half of the patients require assistance at least for doing one the basic of activities of daily living.

Owing to correlation between total patients' knowledge, total patients' self-care practices and total patients' Barthel Index of activities of daily living. The present study reported that there was a highly statistically significant correlation between total patients' knowledge, total patients' self-care practices and total Barthel Index for patients' activities of daily living at pre, post and follow-up (after one month) implementation of the educational program. These findings were in accordance with a study conducted by **Morsy, et al., (2021)** who revealed that there was high significant statistical positive correlation between patients' knowledge, reported practice, level of independency and pain at pre and post implementation of guidelines. Also, these results were in same line with **Mohamed et al., (2023)** who reported that there was a highly statistically significant correlation between knowledge, self-care practice and safety measures.

Conclusion:

In the light of the findings of the current study, it can be concluded that patients' level of knowledge, self-care practices and Barthel Index of activities of daily living regarding external skeletal fixation improved post and follow up of the implementation of the educational program compared with pre implementation of an educational program with a highly statistically significant difference.

Recommendations:

In the light of the results of this study, the following recommendations were suggested:

Recommendations for education:

- Educational intervention and patient's psychosocial support should be included in routine nursing care as a protocol before and after external fixation surgery.
- Increase patients' awareness about the importance of pin site care and periodic check up to prevent developing any complications which can affect their quality of life.

Recommendations for further research:

- Further research is to be carried out on the effect of limited physical activity for patients with external fixation on their quality of life.
- Replication of the study on a large probability sample acquired from different geographical area in Egypt to figure out the main aspects of this problem.

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