

The Effectiveness of a Back Exercise and Education Program on Nurses Back Safety in Intensive Care Units

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Abstract

Background: Low back pain (LBP) is a common and costly health problem among ICU nurses, and it is one of the primary causes of disability. ICU nurses also work in one of the most dangerous occupational environments, which have a significant impact on nurses' safety and diminish the overall quality of health care provided to patients. As a result, ICU nurses require ongoing training and educational programs to ensure their back safety. This study aimed to examine the effectiveness of a back exercise and education program on ICUs nurses' back safety. **Materials & Method:** Design: quasi-training, one-group, pretest/posttest design was adopted. Setting: The study was conducted at ICUs of Mansura University Hospital, Egypt. Subjects: All bedside nurses (n=100) working in the previously mentioned study settings have participated in the study. Tools: Three tools for data collection were used. A tool I: ICUs Nurses Knowledge Questionnaire to assess ICUs nurses' knowledge about back pain and safety measures. Tool II: Back Pain Index Scale to assess back pain and Tool III: Nurses Compliance to Back Safety Measures Observational Checklist, which was developed to observe ICUs nurse's compliance to back safety measures includes using safe movement and body mechanics, safe sitting and standing, safe patients handling and lifting and safe transferring of equipment. Data collection was done pre and post-implementation from May 2021 to October 2021. **Results:** Results showed that there were highly statistically significant differences regarding total knowledge about back pain and back safety measures knowledge and performance pre-and post-program implementation ($p < 0.001$). Also, here was a highly statistically significant improvement of ICUs nurses' total compliance to follow all back safety measures pre- and post-program implementation at ($p < 0.001$). **Conclusion:** Back exercises and education can effectively prevent and reduce low back pain among ICUs nurses. Thus, we must highlight the importance of low-cost preventive strategies, like exercise and education programs carried out in hospital settings to promote safety among active nursing personnel. Recommendations: Following our recommended procedures will improve the safety aspect for nurses working in ICUs.

Keywords: Back exercise, Back Safety, Education program, Intensive care units, Nurses.

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I. Introduction

Nurses are largely considered the backbone of the entire healthcare system. In most healthcare settings, they represent an important aspect of clinical services and have primary responsibility for a significant proportion of patient care (18). Given the nature of nursing's working environment, responsibilities, and obligations, nurses and healthcare workers are on the front lines of several workplace hazards and are most vulnerable to occupational health risks in the workplace (22,38). Of all healthcare workers, nurses have the highest rates of back pain. The annual and lifetime prevalence in these groups is 40-50% (48, 52). A cross-sectional study conducted in 2014 investigated the prevalence of low back pain (LBP) in nurses in various countries and identified that Australia, England, and France had an annual LBP prevalence of 29%, 62% and 59% respectively. For comparison, in the Philippines, the one-year prevalence of LBP among nurses was 80% (40). The frequency of LBP in nurses in the United States was explored in research of 1163 nurses, and 47 percent of participants reported having experienced back problems within the last year (41).

Al-Amer; 2020 also conducted an investigation in Saudi Arabia for the weekly prevalence of LBP in healthcare professionals. The study found that the one-week prevalence of LBP was highest in nurses (57%), followed by physicians (50%) and physical therapists (36%). In Egypt, back pain affects 60 percent of the Egyptian population, and nurses have one of the highest rates of back work-related injuries of any professional category. Furthermore, ergonomic equipment and arrangements to prevent low back pain are not easily available. (20). Because nursing interventions encompass physical, personal, and ergonomic risk factors, nurses

have one of the highest incidence rates of work-related low back pain among professionals. As a result, thousands of nurses around the world work less efficiently, receive medical reports, and/or retire early due to low back pain caused by these risk factors, and remain under intense physical stress, which may promote chronic back pain and musculoskeletal disorders, particularly in intensive care units. (6, 31).

LBP was defined as discomfort in the spinal area (between the lower costal margins and gluteal folds) experienced at least once a month, with or without radiation into the leg to below the knee. It is categorized as acute, sub-acute, or chronic according to duration (13). Chronic low back pain is defined as a persisting pain that exists for more than 12 weeks and has several causes (23). Intensive care units (ICUs) have been viewed as highly complex areas; where nurses have to work with critically ill patients and sophisticated equipment that involve higher levels of risks than other hospital units. ICU nursing staff faces many challenges stemming from the complexity of patient care, intense patient needs, nursing shortage, limitation of time, working environment, and administrative duties that affected nursing staff safety. As a result, healthcare organizations must consider workplace safety as one of how their nursing staff can provide safe nursing care to their patients. (11, 55).

LBP is more common among ICU nurses for a variety of reasons, including delivering patient care while bending forward for long periods, over-forcing/over-loading particular body parts while repositioning patients, and dedicating more time to patient care. Overwork in intensive care units, poor body mechanics, a lack of training, and frequent repetition of body movements and tasks such as reaching up-forward, holding, lifting, and twisting all contribute to the onset of this condition (26, 25). The most prevalent symptoms among ICU nurses are back, neck, shoulder, and knee disorders. These issues are exacerbated by the growing number of obese patients in intensive care units (5, 4, and 34). LBP cause an enormous medical and economic burden on individuals, families, employers, and the healthcare system. It impacts more significantly on the nurses' quality of life, personal care, sitting, standing, sleeping, walking, social life, and job duties. In addition to absenteeism, work restrictions, the likelihood of transferring to another job or developing a disability than any other group of diseases, development of chronic pain, activity and efficiency restriction, missed work, loss of optimal performance, and burnout (7, 27).

Nurses' high risk for low back pain requires better prevention strategies, educational interventions, and safety training to help them to prevent, manage and reduce the low back pain that they can provide better support for their patients (52) As a result, the Occupational Safety and Health Administration (35) emphasized the primary prevention and management of workplace risk factors, particularly in critical care units with high patient acuity and excessive workloads. Back safety is a state of being well-adjusted as a result of modifying human behavior and/or designing an ergonomic environment to prevent or lessen the risk of back injuries or disability (45, 1). The Occupational Safety and Health Administration does not have a specific regulation for back safety, but training employees to lift safely is implied by the General Duty Clause of the Occupational Safety and Health Act of 1970. The law requires employers to provide employees with a workplace that is "free of recognized hazards (17). Back safety measures include exercise, safe movement, proper body mechanics, reduction or elimination of risk factors such as stress, obesity, and smoking, ergonomic arrangements, and the use of patient lifting devices (24, 32, 33). Training programs developed to protect back health and nurses' safety can be both efficient and inexpensive (42). Such programs become more important in countries where the use of lifting devices is not widespread. In addition, hospital assurance, risk management, and health promotion and prevention programs should be included in policies to address how to avoid nursing personnel from suffering serious and long-term injuries as a result of their daily job operations (21, 29).

Significance of the study

The work condition in ICUs such as high patient-care workload, longer work hours, and long-standing and walking per day are the most risk factors for LBP in nurses. Furthermore, an unsafe work environment may result in a high turnover of nurses, resulting in increased costs for recruiting new nurses, as well as financial and physical losses. To control these risk factors, occupational safety and regular education programs should be implemented. (37; 44).

The LBP and functional disability caused by it, is a challenge to provide the best care and it can harm nurses' quality of life as well as the quality of care provided to patients; yet, it is entirely preventable if the required precautions and education are taken. In addition, ICUs nurses need to protect and improve their health to be able to provide effective care and be more beneficial for the patients. (44; 39). Several studies carried out by (37, 22, and 49) showed that back exercise and safety programs are effective for prevention of LBP and functional disability, helps nurses on how to protect the spinal structures in daily activities work and improve their body posture. Education promotes self-awareness and self-defense, while safety compliance can lead to behavioral changes. Implementation of a combination exercise and education scheme could increase workplace safety for nurses if it is proven to be effective. Accordingly, researchers curiously wish to investigate the effectiveness of back exercise and education to promote back safety among ICUs nurses.

Research hypothesis:

- The knowledge and practice score of nurses about back pain prevention and safety measures immediately after implementing the educational program and during the follow-up periods will be higher than before implementing the educational program.
- Back exercises and education can effectively prevent low back pain and improve back safety among ICUs nurses after the intervention when compared to the reference one.

II. Material and method

Study Design: Quasi-training, a one-group, pretest/posttest study was designed to evaluate the effectiveness of a training program. A quasi-experiment is an empirical interventional study used to estimate the causal effect of an intervention on the target population (8).

Study Location: The study was conducted at ICUs of Mansoura University Hospitals, Egypt.

Study Duration: Beginning of May 2021 to the end of October 2021.

Subjects & selection method: The study subject was included all (n=100) bedside nurses working in the previously mentioned study settings and distributed as follows: Anesthesia ICU 20, Cardiac ICU 15, Chest ICU 15, Medical ICU 23, Neuro ICU 10, and Surgical ICU 17.

Inclusion criteria, the subjects were bedside nurses, working full time in the same unit, direct contact with patients for at least 6 months, with different ages, educational levels, and years of experience.

Exclusion criteria included nurses who did not provide direct patient care and who were unwilling to participate in the program.

Data collection tools:

Three different tools were used to collect data for this study. They included;

The tool I: ICUs Nurses Knowledge Questionnaire

The tool consisted of two parts as follows:

Part (1): Socio-demographic data was created by the researchers to collect the socio-demographic data of the entrant nurses (for example age, gender, work unit, marital status, numbers of children, level of education, years of experience, duration of working hours, wearing high heel shoes, presence of back pain, and attendance of previous training programs on back safety).

Part (2): This part was developed by the researchers next reviewing of related works of literature (48& 1) to assess ICUs nurses' knowledge about back pain and safety measures before the program, immediate post-program and three months follow up the program, including (50) questions constructed in either form of true & false or multiple choices. The questions scored as "1" for the true answer and "0" for the false answer. So, the scoring system represents varying levels of nurses' knowledge ranging from a poor level of knowledge (0-16), a fair level of knowledge (17-33), and a good level of knowledge (34-50). For a higher score, the higher knowledge of ICUs nurses about the back pain and safety principles.

The tool (II): Back Pain Index Scale (BPIS).

It involved two sections as the following:

Part one: Personal characteristic; which includes the data about characteristics of the ICUs nurses. Part two: which are self-reported structured questionnaires adopted by the researchers based on (12, 46 and 53) to assess the level of pain and its effect on daily activities among ICUs nurses. This scale is composed of 11 items; Pain intensity; Pain duration, Personal care; Lifting, Walking; Sitting; Standing; Sleeping; Changing the degree of pain; Social life; and Job duties. Each item with a score from 0 to 5, for a total score of 55, and then multiply with 2 to yield 110. A higher score indicates greater pain intensity and dysfunction.

The tool (III): Nurses Compliance to Follow Back Safety Measures Observational Checklist.

This tool developed by the researchers based on (9,3), and review of recent related literature to assess the practice of ICUs nurses in compliance to back safety measures; includes using safe movement and body mechanics (10) items, safe sitting and standing (8) items, safe patients handling and lifting (11) items, and safe transferring of equipment (6) items. The nurse's compliance to follow back safety measures was measured by three points Likert Scale ranging from (1-3): where always done = (3), sometimes done = (2), not done = (1). The total scores were ranged from (1- 105). The scores were converted into percent scores to assess the level of nurse's practice as follows: -

- Satisfactory level $\geq 75\%$
- Unsatisfactory level $> 75\%$
- All tools were used pre-program implementation, immediately post-program and after three months for follow-up.

Content Validity: A jury composed of five nursing fields experts to examine the validity of tools for relevance and appropriateness. The experts were 3 professors in Medical-Surgical Nursing and 2 professors in the Nursing

Services Administration Department, all of them are from the Faculty of Nursing, Mansura University. The experts' responses were represented in three points rating scale ranging from (3-1); 3=strongly relevant, 2= relevant, and 1= not relevant. The modifications are done accordingly. The values of content validity for tool I, tool II and tool III (86.49%, 88.61 and 89.34%) respectively.

Reliability analysis: All three tools were tested for reliability using the Cronbach Alpha Coefficient factor test to determine the internal consistency of each scale. It was 0.840 for the tool (1) 0.813 for a tool (2), 0.86 for a tool (3).

Procedure methodology

Ethical Considerations: Verbal approval was obtained from all entrant nurses before assembling any data. The data was gathered by the researchers after portraying the study aim to all participants. Anonymity and exclusiveness of participants' information were assured. All the nursing entrant personnel were informed about their rights to retreat from the yielded study at any period without giving any reason of obligation.

Pilot study: The pilot study was conducted on 10 nurses who were excluded from the study sample to test the clarity, feasibility, and applicability of the study tools. Based on the result of the pilot study, modifications and omissions of some details were done, and then the final forms were developed.

Educational program about back pain prevention and safety measures

This program was designed by the researchers to improve the ICUs nurses' knowledge and performance regarding back pain and safety measures during caring for the patients based on the related literature of (16), (1 and 42). Knowledge about back pain included basic anatomy and physiology of the spinal column, causes and risk factors, signs and symptoms, diagnostic measures, pharmacological and non-pharmacological management of LBP. Knowledge about safety measures included definitions and importance of safety measures, factors that affect nurse's compliance to follow safety measures, back safety measures including correct body alignment, body mechanics principles in sitting, standing, walking, bending, lifting, patients handling, and transferring equipment and the importance and types of exercises for prevention of LBP.

Procedures of the study

- Before data collection, the researchers obtained ethical approval from the authoritative bodies at Mansura University hospital to obtain their approval for conducting the study after explaining its purpose. The study was carried out for 6 months from the beginning of May 2021 to the end of October 2021 as the following:

(1) The pre-intervention phase took about one month from the beginning to the end of May 2021. The training strategy was developed based on the detected needs. As well as, schedule, teaching sessions, media included, and the handout were prepared.

(2) The intervention phase. First, all eligible nurses were invited to participate in the study. They were first asked to sign the informed consent and they completed the questionnaires (Tool 1&2) after a full explanation about the purpose of the study before beginning the training program. Each questionnaire sheet required 20–30 min to be completed. The questionnaire format was filled in the clinical area by the studied nurses in the presence of the researchers. This pre-study test was designed to allow the researchers to collect a baseline assessment of nurses' knowledge and pain intensity to compare it with immediate post and follow-up programs. The observation checklists (Tool 3) were filled out by the researchers who were available 3 days per week alternatively at morning or afternoon shifts in different study settings while the nurses were involved in patient care.

- After the questionnaires were completed, the education program was implemented by the researchers. The ICUs nurses were divided into six main groups according to the study setting. The duration of each session took approximately 45-60 minutes, sessions started according to nurses' spare time. The Arabic language was used to suit the nurses' level of understanding. Methods of teaching used were real situations, modified lectures, group discussion, and demonstration. An instructional media was used; it included a program handout and audiovisual materials.

- The theoretical and practical part of the program was conducted for nursing staff at their work units in the study hospital. Each researcher implemented the program with one group by using available resources, relevant content, and instructional strategies for each session.

(3) The post-intervention phase (Evaluation Phase): In this phase, the effect of the safety program and exercises was evaluated; it was carried out immediately post-program and after three months for follow-up. by using the same tools which were used before the program implementation.

Statistical analysis

Data was analyzed using SPSS version 18.0.23 Demographic and occupational information were presented as descriptive statistics. Data were reported quantitatively using mean \pm SD and qualitatively as percentage and frequency. Two-way repeated-measures ANOVA with Bonferroni correction was used to compare pain scores Intention-to-treat was used for missing data. A P-value $<$ 0.05 was selected as statistically significant.

III. Results

Table (1) illustrated the distribution of ICUs nurses according to their data. Most (23%, 20%, and 17%) of ICUs nurses were from Medical, Anesthesia, and Surgical ICU respectively, the rest from Cardiac, Chest, and Neurology ICU. More than half (55%) of ICUs nurses aged 30- < 40years with 10 - <20 years of experience. Around half of ICUs nurses were married and have from 1-3 children. A majority (73%) were female and the rest were male nurses. ICUs nurses (44%) work 12 hours, while (37%) work 6 hours and only (19%) work 18 hours per day. Less than half (45%) of ICUs nurses had a diploma of nursing followed by (35% & 20%) had Technical Nursing Institute and Bachelor degree respectively. A high percent (70% & 65%) of ICUs nurses had night work in the last year and wearing high heel shoes respectively. A majority (78%) of them had not previously attended training programs on back safety. Around half (50% & 40%) of nurses spent sitting and standing / for 6 hrs. per day and had back pain respectively.

Table (1): Distribution of ICUs nurses according to their data (N=100)

Characteristics	N	%		N	%
Working unit			Level of education		
- Anesthesia ICU	20	20	- Bachelor	20	20
- Cardiac ICU	15	15	- Technical Nursing Institute	35	35
- Chest ICU	15	15	- Diploma	45	45
- Medical ICU	23	23	Years of experience (years)		
- Neurology ICU	10	10	- <10	20	20
- Surgical ICU	17	17	- 10- <20	55	55
Age (years)			- 20 or more	25	25
- <30	20	20	Range	1-26	
- 30- <40	55	55	Mean±SD	8.38±4.89	
- 40 or more	25	25	Wearing high heel shoes		
Range	21- 46		- Yes	65	65
Mean±SD	32.74±6.3		- No	35	35
Marital status			Hours spent sitting / per day		
- Single	35	35	- 6	50	50
- Married	50	50	- >6 ≤ 8	35	35
- Other	15	15	- ≥ 9	15	15
Gender			Night work in the last year		
- Female	73	73	- Yes	70	70
- Male	27	27	- No	30	30
No. of children			Attend previous training programs on back safety		
- No children	27	27	- Yes	22	22
- 1 -3 Childs	45	45	- No	78	78
- > 3 Childs	28	28			
Number of daily working hours			Presence of back pain		
- 6	37	37	- Yes	40	40
- 12	44	44	- No	60	60
- 18	19	19			

Table (2) illustrated ICUs nurses' knowledge about back pain throughout the study. There was a highly statistically significant improvement immediate and three months post than pre-program about ICUs nurses' knowledge regarding all items of back pain at ($p < 0.001$).

Table (2): ICUs nurses' knowledge about back pain throughout the study (n = 100)

knowledge items about back pain	Pre-test				Immediate				Three-month post				X ² (P-value)
	Wrong answer		Correct		Wrong answer		Correct		Wrong answer		Correct		
	N	%	N	%	N	%	N	%	N	%	N	%	
- Basic anatomy and physiology of the spinal column.	63	63	37	37	1	1	99	99	5	5	95	95	88.327 (<0.001**)
- causes and risk factors	77	77	23	23	6	6	94	94	9	9	91	91	103.820 (<0.001**)
- signs and symptoms	53	53	47	47	8	8	92	92	10	10	90	90	47.765 (<0.001**)
- diagnostic measures	81	81	19	19	11	11	89	89	13	13	87	87	98.631 (<0.001**)
- pharmacological and non-pharmacological management of LBP	91	91	9	9	9	9	91	91	11	11	89	89	134.480 (<0.001**)
Total knowledge	73	73	27	27	7	7	93	93	11	11	89	89	90.750 (<0.001**)

Statistically significant at $p \leq 0.05$

Table (3) illustrated ICUs nurses' knowledge about back safety measures throughout the study. There was a highly statistically significant improvement immediate and three months post than pre-program about ICUs nurses' knowledge regarding all items of back safety measures at ($p = < 0.001$).

Table (3): ICUs nurses' knowledge about back safety measures throughout the study (n = 100)

Knowledge items	Pre-test				Immediate				Three-month post				X ² (P-value)
	Wrong answer		Correct		Wrong answer		Correct		Wrong answer		Correct		
	N	%	N	%	N	%	N	%	N	%	N	%	
- definitions and importance of safety measures	63	63	37	37	1	1	99	99	4	4	96	96	88.327 (<0.001**)
- factors affect nurse's compliance to follow safety measures	77	77	23	23	6	6	94	94	9	9	91	91	103.820 (<0.001**)
- correct body alignment	53	53	47	47	9	9	91	91	11	11	89	89	45.255 (<0.001**)
- body mechanics principles in sitting, standing, walking, bending, lifting, patient handling, and transferring equipment	81	81	19	19	7	7	93	93	10	10	90	90	111.120 (<0.001**)
- The importance and types of exercises for prevention of LBP.	73	73	27	27	8	8	92	92	9	9	91	91	87.665 (<0.001**)
Total knowledge	69	69	31	31	6	6	94	94	9	9	91	91	84.672 (<0.001**)

Table (4) illustrated a level of ICUs nurses' total compliance to follow back safety measures subscales throughout the study. There was a highly statistically significant improvement of ICUs nurses' total compliance to follow all back safety measures subscales pre-program, immediate post-program, and three months post-program at ($p < 0.001$).

Table (4): Level of ICUs nurses' total compliance to follow back safety measures subscales throughout the study (n = 100)

Items of ICUs nurses compliance	Pre-test				Immediate				Three-month post				X ² (P-value)
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory		
	N	%	N	%	N	%	N	%	N	%	N	%	
- Safe movement and body mechanics	41	41	59	59	87	87	13	13	79	79	21	21	45.920 (<0.001**)
- Safe sitting and standing	70	70	30	30	90	90	10	10	83	83	17	17	12.500 (<0.001**)
- Safe patient handling and lifting	59	59	41	41	94	94	6	6	82	82	18	18	34.070 (<0.001**)
- Safe transferring of equipment	42	42	58	58	85	85	15	15	80	80	20	20	39.888 (<0.001**)

Statistically significant at $p \leq 0.05$

Figure (1) shows levels of ICUs nurses' total knowledge about back pain & safety measures throughout the study. Preprogram minority (24%) of nurses showed a good level of total knowledge which increased to be 95% and 92% at immediate and three months post-program respectively.

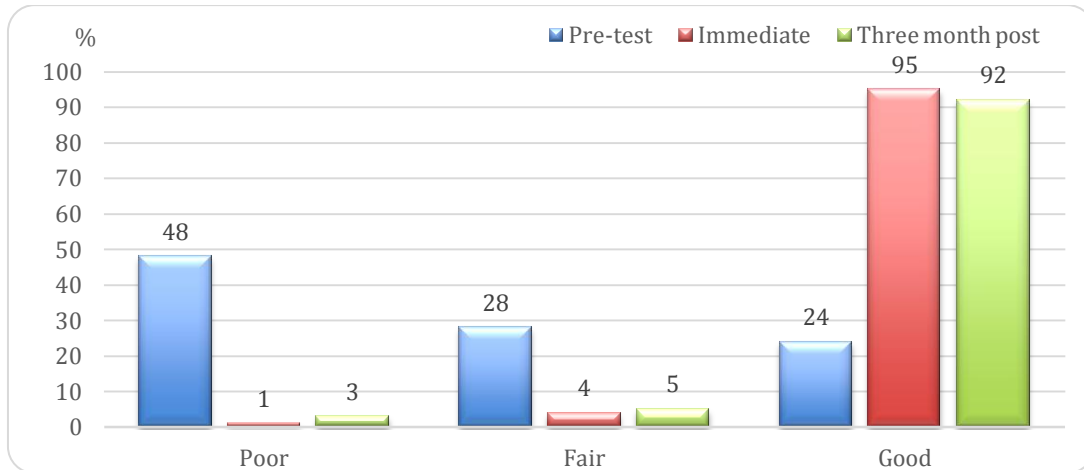


Figure (1): Levels of ICUs nurses' total knowledge about back pain & safety measures throughout the study (n = 100)

Figure (2) shows a Comparison between the ICUs nurses' according to back pain characteristics pre and post-program implementation. There were highly statistically significant differences regarding all back pain characteristics pre-and post-program implementation ($p < 0.001$). Preprogram the highest mean value of pain characteristics (1.75, 1.62, 1.60, 1.55, and 1.53) were for pain intensity, social life, pain duration, job duties, and changing the degree of pain respectively, changed to (0.42, 0.37, 0.35, 0.29 and 0.29) post-program respectively.

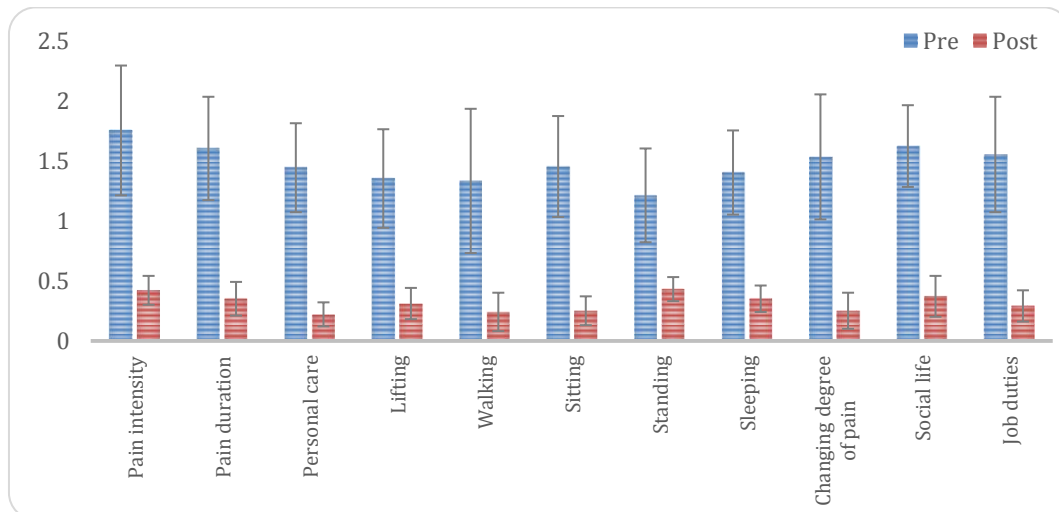


Figure (2): Level of total pain index subscales among ICUs nurses' pre and post-program implementation (n = 100)

Figure (3) shows a level of ICUs nurses' total compliance to follow back safety measures practice throughout the study. Preprogram around half (53%) of ICUs nurses had a satisfactory level of back safety practices, changed to be 89% and 81% immediately and three months post-program respectively with a highly significant difference at ($p < 0.001$).

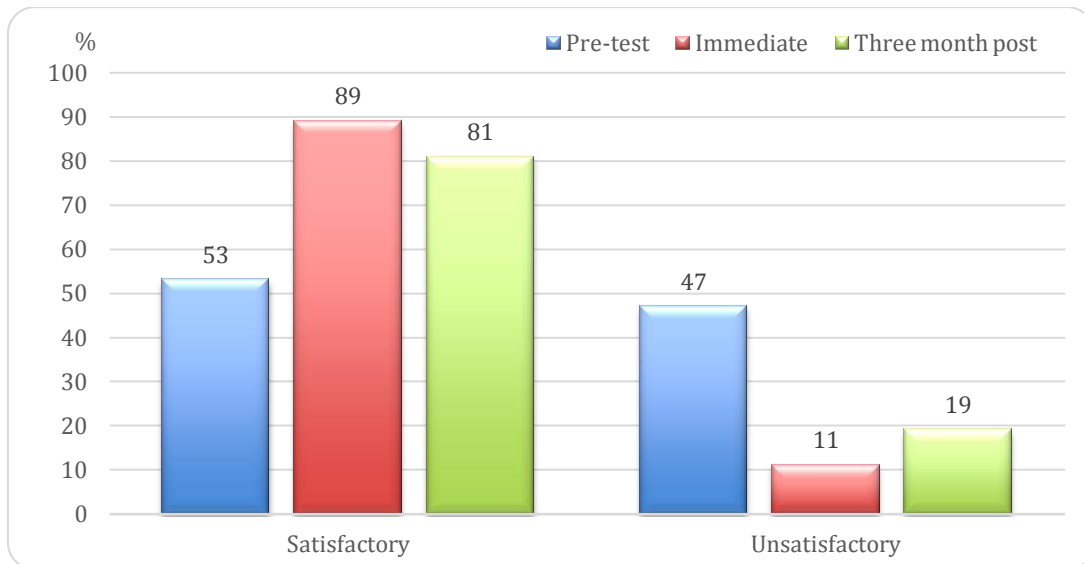


Figure (3): Level of ICU nurses' total compliance to follow back safety measures practice throughout the study (n = 100)

Figure (4) shows the correlation between ICU nurses' total knowledge and practices about back safety measures throughout the study. There was a statistically significant positive correlation between total knowledge and practices score of ICU nurses pre-program, immediate post-program, and three months post-program at ($p < 0.001$).

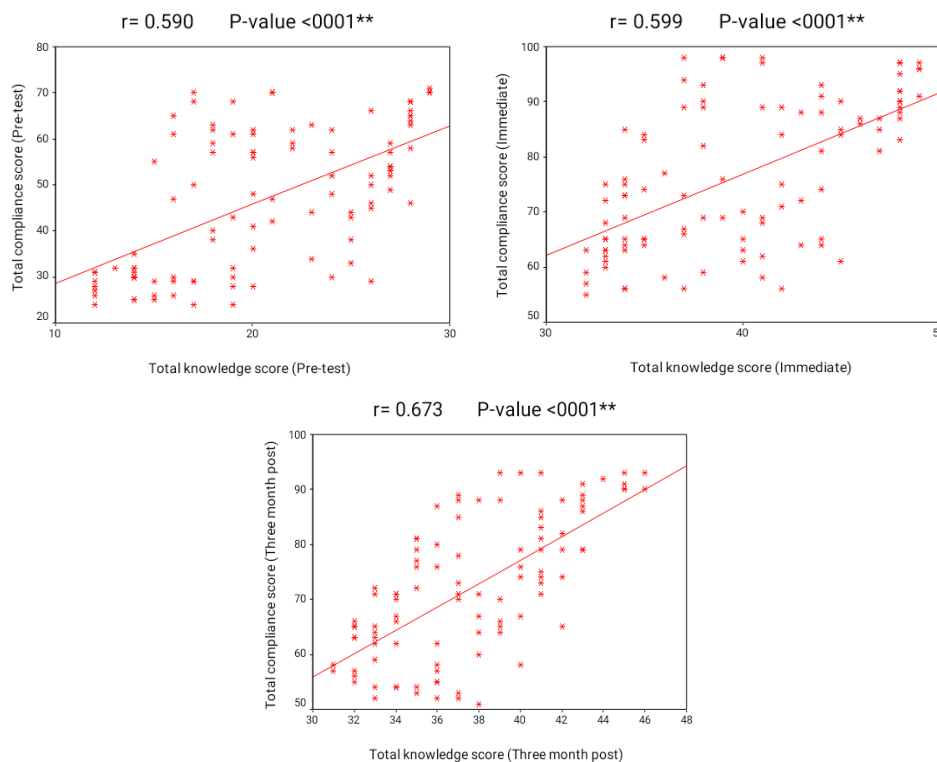


Figure (4): Correlation between ICU nurses' total knowledge and practices about back safety measures throughout the study (n = 100)

Table (5) illustrated the correlation between ICU nurses' characteristics and total knowledge & practice score. There was a statistically significant correlation between ICU nurses' age, level of education, years of experience, number of working hours, and total knowledge. Also, there was a statistically significant correlation between all characteristics of ICU nurses and total practice scores.

Table (5): Correlation between ICU nurses' characteristics and total knowledge & practice score (n=100).

nurses' characteristics	Total knowledge		Total practice	
	r	P-value	r	P-value
- Age	0.248	0.039*	0.356	<0.001**
- Gender	0.047	0.723	0.198	0.035*
- Marital status	0.240	0.064	0.230	0.004*
- Level of education	0.239	0.046*	0.377	<0.001**
- Years of experience	0.745	<0.001**	0.323	<0.001**
- Department	0.026	0.799	0.169	0.015*
- No of children	0.234	0.185	0.278	<0.001**
- No of working hrs	0.327	0.011*	0.356	<0.001**

IV. Discussion

The studies evaluating low back pain in nurses showed that low back pain rates were higher than the necessary protective measures. Nurses, who play an important role in protecting, maintaining, and improving individuals' health, should attach importance to applying protective and improving actions for their health so that they can provide nursing care quality, be productive, and administer patient care without interruption (54). In our study, most of the nurses worked in standing position for long durations, performed interventions that required bending forward, lifted and repositioned patients, and these nurses had higher average low back pain scores. Moreover, it was observed that the nurses who did not use any aiding equipment during interventions yet believed in the benefit of using it constituted the majority (43). This quasi-experimental study evaluated the effect of educational programs on the performance of Intensive Care nurses to decrease low back pain. In this study, majority of participants were female nurses and worked in intensive care unit ICU and all of them have low back pain, this is supported with (36) found that the prevalence of low back pain was 23% in Medical ICU nurses. Shortage of male nurses in this working inwards, that may enforce them to do more physical work and may explain the high prevalence of LBP.

More than three-quarters of the studied group (55.0%) age ranged from 30-40 years old. This is supported by (8) who found that the highest prevalence of low back pain was seen in those working less than 3 years (68.3%). A study that made by (14) found majority of the sample (55%) were with 10-20 years' experience and with age less than 30 years. Other studies, showed that with experience, nurses learn how to protect their backs, and by the time they become fit and make the right decision about their abilities (28). The studies that are showing low back complaints are increasing with age.

Concerning the level of education, majority of studied nurses had no training course on pain exercise. This was supported by (50) who found that the overwhelming majority of the individuals involved were 30-40 years of age and employed as hospital ward nurses suffering back pain. Concerning their level of education, it should be pointed out that a mere 0.239% of the nurses had completed only basic training. These results are in agreement with (47). This high prevalence of LBP among nurses in the Sydar region may reflect the unawareness of pain exercise and lack of back muscles fitness.

As regards the studied subjects' total knowledge score throughout the study phases, the results of the present study revealed that the majority of study subjects had unsatisfactory knowledge levels in preprogram phase (pretest), while the majority of them had satisfactory knowledge levels in the post-program phase and the most of them in follow up phase. Also, the results of the present study revealed that there was a highly statistically significant difference between the pre/post and pre/follow up program phase regarding the total score for studied nurses' knowledge about back pain. This indicates the improvement of subjects' knowledge based on educational programs about back pain. In the same line (51) in a study titled "Work-related musculoskeletal disorders among nurses in Ibadan, South-west Nigeria" reported that training in back pain and body awareness is effective in improving knowledge. As regards a total score for the studied nurses' knowledge throughout the study phases, the results of the present study revealed that there was a highly statistically significant difference between pre/post and between pre/follow up program phase regarding the total score for knowledge about applying back safety. This finding was in agreement with (19 and 10) who reported that nurses had unsatisfactory knowledge regarding back safety pre-intervention, while most of them had satisfactory practice post-intervention. Also, there were highly statistically significant differences regarding practice pre and post-intervention respectively.

Also, the result of the current study showed that there was a highly statistically significant difference between pre/post and pre/follow up program phase as regard to a total score for low back pain intensity of study subjects. These improvements might be attributed to the effect of the back exercise educational program, which emphasized practical training aimed to reduce aggravating activities of in nurses' work such as prolonged sitting

and standing, in addition to emphasizing correct lifting and handling techniques. More important is the knowledge acquired during the program, which turned out to be the most significant independent predictor of improvements in pain and disability scores of the nurses.

This finding was supported by (2) who identified that, statistically significant differences concerning the intensity, frequency, and duration of pain after using back exercise principles. This finding goes in the same line with (36) who found that nurses who had not received any education on back pain, remained standing for long periods, performed interventions that required bending forward, lifted and repositioned patients, and did not use any aiding equipment during interventions, experienced more pain and had higher average pain scores.

Also present study finding revealed that there was a statistically significant positive correlation between total knowledge and practices score of ICUs nurses' pre, post and three months' post program implementation. These results indicated that nurse's knowledge about back safety had a positive effect on improving the performance of nurses and reflected on their health. Moreover, nurses who are knowledgeable in protecting, maintaining, and improving their health, are more effective in applying protective and safety actions for their health, so that they can provide nursing care quality, be productive, administer patient care without interruption and minimize disability level. These findings were in agreement with (2) who found a highly statistically significant correlation between knowledge and practice scores among studies in pre, post and follow-up tests. This enhancement may be attributed to educational program and using back exercise by the study sample. This finding agreement (30) in a study titled "The correlation between low back pain knowledge and practice score among nurses in Kanombe Military Hospital" found significant correlation between knowledge and practice scores among nurses.

In addition, in our study results there was a significant association between practice scores among staff nurses and demographic variables. There was a statistically significant relation between satisfying practice and demographic data of study nurses including age in pre and post-program phases. On the other hand, there was a statistically significant relationship between the studied subjects' practice and their qualification as nurses and years of experience in the post-program phase. This fact may be related to the knowledge the nurse's gain due to their fraction with a medical team and the more experience they are exposed to in their work. This finding does not correspond with (15) who reported that there was no significant association between knowledge scores among staff nurses and demographic variables.

V. Conclusion

Most of the studied nurses had back pain pre-program implementation improved after implementation of exercise and safety measures program. There is a significant difference between knowledge and nurses' performance of back safety measures for studied nurses in pre and post-program implantation. Also, our results suggested that back exercise and education effectively relieved LBP and improved muscle function among nurses. Therefore, our proposed scheme for LBP prevention should be implemented in all hospitals in Egypt to improve both the safety and working conditions of the nursing staff.

Recommendation

The findings of the present study directed to recommend the following:

For hospital administration

- Attention to conducting regular meetings with nurse managers and head nurses to enforce their role to promote nurses' safety in each work shift.
- Safety policies and rules must be available in each ICU and be brought to the attention of all staff at their first encounter with work in ICUs.
- More staff nurses should be employed especially male nurses to reduce job-induced hazards like back pain among nurses.
- Prime importance job description for every nursing staff working in ICUs to reduce their exposure to work risks and overloads.
- Prime importance the existence of safety standards for nursing performance in each ICU.
- Hospital administrators and nursing faculties should work together hand in hand for improving nursing staff safety knowledge and skills. The prevention and safety strategies for musculoskeletal disorders should be included in the nursing students' curriculum.

For nurse Manager

- Orientation to newly posted nursing staff should include information about ICUs musculoskeletal disorders and how to protect them.
- In-service training programs should be conducted regularly for nursing staff to refresh their knowledge, skills, and experiences related to back pain and safety measures.
- Clinical guideline strategies must be designed for low back pain and included in routine hospital care to help to manage musculoskeletal disorders.

- Equipment and facilities to assist nurses in carrying out some of their strenuous activities like lifting, transferring patients, etc. should be adequately provided in the health facility.
- Encourage and stress nurses' safety, self-improvement, self-learning, and continuous updating themselves.
- Further studies with a larger group of nurses including staff of hospitals of different regions and sizes, would be useful for confirming the results of this study. Furthermore, to evaluate whether back pain prevention or reduction interventions can minimize this problem and improve nurses' safety.

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