Occupational Health Program for Nurses to Reduce Musculoskeletal Injuries by Using Body Mechanics

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Abstract

The aim of the study was to evaluate the effect of occupational health program for nurses on reducing musculoskeletal injuries- to evaluate the effect of occupational health program on nurse's knowledge and performance of body mechanics. **Abstract:** nurses require application of the body mechanics principle to avoid physical harm decreases the risk of damage to the body, fatigue, and increase practice satisfaction **Design:** A quasi-experimental study design. **Setting:** The present study was carried out in the Physical Medicine and Rehabilitation Center affiliated to the Military Army force, in Al Helmia district, in Cairo governorate. **Sample:** all nurses in the Rehabilitation Center with total number of 30 nurses. **Tools:** two tools were used for data collected: **First tool:** *Questionnaire Sheet:* to collect data about Socio-demographic characteristics of the studied nurses - To assess nurse's knowledge Pre-post program implementation regarding Body Mechanics principles and musculoskeletal health hazards. To assess nurse's pre-post musculoskeletal pain. **Second tool** *Observational Checklist:* to assess nurses' performance of Body mechanics pre -post program. **Results:** The findings of the study clarified that, Nurses' performance of Body Mechanics improved after application of the program about proper body mechanics in the performance of standing and setting with statistical significance and improved in lifting technique with no statistical significance. **Conclusion:** The findings of this study provide that, some of the nurses did not performed techniques of body mechanics correctly. Nurses' body mechanics improved after application of occupational health program about proper body mechanics. There is a no statistical relation between nurse's knowledge and performance of body mechanics. There is an improvement in nurse's musculoskeletal compliance regarding pain after program implementation with no statistical significance. **Recommendations:** It is suggested that: 1- Creation of continuous, planned and efficient in-service occupational health programs for nurses on body mechanics. 2-Enough supply the health facilities of patient-lifting devices which have been shown to be effective in decreasing costs and workdays lost to back injuries and pain among nurses.

Key words: Body Mechanics, Mechanical Low Back Pain, Occupational Health, occupational musculoskeletal hazards.

Introduction

Work-related musculoskeletal complaints cause considerable economic losses to individuals as well as to the community (e.g., pain medications, conventional and alternative therapies, as well as absenteeism and job turnover, etc.) **(Najenson et al., 2015).** The Bureau of Labor Statistics of the Department of

Labor (2007) defines musculoskeletal disorders (MSDs) as musculoskeletal system and connective tissue diseases and disorders when the event or exposure leading to the case is bodily reaction (e.g., bending, climbing, crawling, reaching, twisting), overexertion, or repetitive motion. MSDs do not include disorders caused by slips, trips, falls, or similar incidents. Examples of MSDs include (Sprains, strains, and tears, Back pain, Carpal tunnel syndrome, Hernia) **(The Bureau of Labor Statistics of the Department of Labor, 2105).**

Occupational health refers to the identification and control of the risks arising from physical, chemical, and other workplace hazards in order to establish and maintain a safe and healthy working environment. Training and education programs were designed to protect workers and their communities, This includes safety and health training for workers The practice focuses on promotion and restoration of health, prevention of illness and injury, and protection from work-related and environmental hazards **(National institute of environmental health sciences, 2015), (American association of occupational health).**

Body mechanics refers to the method of efficiently using the body when making movements, such as bending the body, lifting a heavy object or person, stretching an arm, sitting, standing, or lying while performing tasks **(Kang Se-Won, 2017)**. Body mechanics is the utilization of correct muscles to complete a task safely and efficiently, without undue strain on any muscle or joint **(McCannon et al., 2004).**

Education and training are essential elements in improving nurse's performance and skills required for patient management **(De Marco and Sinatra 2000)**. Direct observation of on-the-job performance is the best method to evaluate the skills of health care professionals **(Homan, 2002)**. Education in areas such as body mechanics and lifting techniques has proven to reduce the recurrence of musculoskeletal injuries in the work place. An increase in body mechanics knowledge not only can diminish the possibility of recurrence of injuries, but can also contribute to decreasing labor absenteeism, which can result in a cost-effective practice for organizations **(McCannon et al., 2004)**. Therefore, it is important to know which situations cause excessive loads and how to use proper body mechanics to reduce the risk of injury *(**Tavafian et al., 2011**).

Nurses constitute about 33% of the hospital workforce there are 19.3 million nurses and midwives according to the World Health Organization's World Health Statistics Report, 2011, **(World Health Organization' Statistics, 2013).** No direct patient care specialty area of nursing is protected from the risk of musculoskeletal injury due to manual patient handling, such injuries result in harm not only to the individual but also to the organization from lost work time, burnout, and recruitment and retention **(Tinubu et al., 2010)** and **(Menzel et al., 2007).** Rehabilitation nurses play a key role in providing and facilitating rehabilitative care **(Fabunmi et al., 2008).**

Nurses are in an occupational group, which experiences more serious back injuries and occupational back pain than most other professions. Nurses experience a high prevalence of WRMSC in the lower back **(Alexopoulos et al., 2011)**, neck, and shoulders **(Hoe et al., 2012).** Pain and discomfort caused by WRMSC might significantly impact the nurse's work and private life. Changing practice habits, work settings, or even leaving the profession due to WRMSCs have been reported **(Nirel et al., 2012).**

However, nurses among health professionals, care for patients and have to help the individuals who are not able to perform their daily activities **(James, 2008).** They routinely perform activities that require lifting heavy loads, lifting patients, working in awkward postures, and transferring patients out of bed and from the floor, inadequate staff, incorrect use of body mechanics, lack of occupational health program in additional to nursing shortages **(Tavafian et al., 2011).**

Work related musculoskeletal disorders constitute a serious occupational health problem among nurses all around the world **(Master et al., 2017).** The Bureau of Labour Statistics ranked nursing among the occupations with the highest frequency of suffering from Work related musculoskeletal disorders, with reported annual prevalence at any of body region varying between 40%-85% among both Asian populations and Western populations **(Amin et al., 2014).**

Significance of the study

In Egypt, numbers of nurse's is about 250,000 as a health care work force serving a population over 100 million **(Comps records, 2018).** In a self-reporting survey of students' nurses in El Mansoura Teaching Hospital, in Egypt about 74% of the working students had musculoskeletal complaints, occurred mostly in low back (74.5%), neck (38.1%), and knees (31.1%) **(Abou-Elwafa et al., 2017).** The consequences of work-related musculoskeletal injuries among nurses are substantial. Along with higher employer costs due to medical expenses, disability compensation, and litigation, nurse injuries also are costly in terms of chronic pain and functional disability, absenteeism, and turnover (**United States Department of Labor)** (https://www.osha.gov/SLTC/healthcaref acilities/safepatienthandling.html)

Nurses are the main hospital staff in frequent close contacts with patients, they are often required to carry out work activities in an upright posture for many hours in a row, transfer patients (depending on the patients' level of consciousness), and move medical devices, all of which require application of the body mechanics principle to avoid physical harm and to effectively use the body while nursing **(Kang Se-Won, 2017).**

The Aim of the study

To evaluate the effect of occupational health program for nurses on reducing musculoskeletal injuries and to evaluate the effect of occupational health program on nurse's knowledge and performance of body mechanics through:

• Assessing of nurses' knowledge and performance to detect their training needs.

• Designing and implementing occupational health program for nurses according to their needs on reducing musculoskeletal injuries.

• Evaluating nurse's knowledge and performance related to body mechanics.

Research hypothesis:

1- Occupational health program of nurses will positively affect their knowledge and performance of principals of body mechanics.

2- Occupational health program of nurses will reduce musculoskeletal pain among Nurses by using body mechanics principals

Subject and Methods

Design: A quasi-experimental study design.

Setting:

The present study was carried out in the Physical Medicine and Rehabilitation Center affiliated to the Military Army force, in Al Helmia district, in Cairo governorate; providing sport medicine rehabilitation services to all military personnel and their families.

Sampling:

The sample of the study targeted all nurses in the Rehabilitation Center who are currently assigned and provide care for patients (n = 30). Nurses with a history of traumatic road or work accidents with major musculoskeletal injuries, pregnant or working less than a year were excluded from the study.

Data collections:

Data was collected by the researcher using two tools:

First tool:

Part I *Nurse's Assessment Questionnaire Sheet:*

To collect data about Socio-demographic characteristics of the studied nurses such as age, gender, educational level, previous working experience, years of experience in rehabilitation nursing and received occupational health program. It was developed by the researcher based on review of recent literature, experts' opinion,

Part II: *Pre-post Assessment* Questionnaire Sheet: Used to

1- Assess nurse's knowledge pre-post occupational health program, regarding Body mechanics and musculoskeletal health hazards.

For basic knowledge scoring, one was given for incorrect or incomplete answer, two grades was given for correct complete answer and total scores less than 75% was considered not satisfactory knowledge and score more than 75% or equals was considered satisfactory knowledge.

PART III: *Assess nurse's Musculoskeletal pain:*

Modified Nordic Questionnaire **(Najenson *et al.,* 2015),** was used for data collection regarding pain, aches or discomfort which has prevented normal activity by (body map) to indicate musculoskeletal problems of nine symptom sites (neck, shoulders, upper back, elbows, low back, wrist/hands, hips/thighs, knees and ankles/feet), lasting for a day or longer during the last 12 months. Participants completed a questionnaire again 3 months after occupational health program implementing. Completion is aided by a body map to indicate nine sites.

Second tool:

Observational Check list:

It was adapted from **(Karahana and Bayraktar, 2013)** modified by the researcher based on review of the recent literature, experts' opinion, it was used to assess nurses' performance of Body mechanics individually, applied pre and post occupational health program. to assess nurses' body mechanics during patient-handling tasks (lifting and pulling patients to the side of the bed, putting patients in a lateral position, pulling patients up in bed), sitting and standing.

Scoring system

Two grads was given for correct and done completely, One grade was given for done incorrectly or not done and

total scores less than 75% was considered not satisfactory performance and score more than 75% or equals considered satisfactory performance.

Validity test

Tools were tested for content validity by five experts in the field of community health nursing and medical specialty to ascertain relevance and completeness.

Preparatory phase:

The preparatory phase was carried out. Reviewing of the past and current available literature was done relevant to the various theoretical aspects of the problem by using books, articles, periodicals and magazines.

Pilot study

A Pilot study was done on 10 nurses, to examine and test applicability of the study tools and test the suitability and feasibility of the setting, availability of the study population (nurses) the researcher found that, the observational chick lists for nurses were performed in about 20 minutes for each skill for each nurse. Modification of the tools was done based on the findings of the pilot study. Some questions and items were omitted, added, or rephrased, and then the final form was developed, the subjects included in the pilot study were excluded from the study sample.

Field work

Data were collected through direct observation and interviews; the instrument was distributed to participants during working hours. Participants answered individually and returned the test to the researcher immediately.. Nurses were observed individually by the researcher by direct observation three times on different days in order to evaluate their body mechanics. The observation hours were chosen to be between 08.0 am and 3.0 pm. Researcher observed the pre-determined performance of the nurse and recorded on the observation checklist. After the observations, each nurse was interviewed using the questionnaire sheet. in different times covering 3 months.

Occupational health program constructed through 3 phases:

The first phase:

Pre assessment phase; where the pretest questions were given to the nurses and assessment of the nurses' performance through observation.

- Assess nurse's Musculoskeletal pain to indicate musculoskeletal problems of nine symptom sites (neck, shoulders, upper back, elbows, low back, wrist/hands, hips/thighs, knees and ankles/feet), lasting for a day or longer during the last 12 months.

The second phase:

Planning and implementing phases: the program was developed with the general objective to improve the nurse's knowledge and performance regards body mechanics, the content was revised and modified according to the related literature. It consisted of detailed knowledge about proper body mechanics during lifting, standing and sitting, objective improve nurses body mechanics to reduce musculoskeletal injuries.

The third phase:

It was for evaluation phases, achieved by reassessment of the nurse's:

• Knowledge and performance by using the same preprogram format. It started after 3 months of their last occupational health program session.

- Assess nurse's Musculoskeletal pain to indicate musculoskeletal problems of nine symptom sites (neck, shoulders, upper back, elbows, low back, wrist/hands, hips/thighs, knees and ankles/feet), lasting for a day or longer, 3 months after implementing the occupational health program.

Statistical Design:

Data analysis: data were statistically analyzed using the SPSS computer program. Description of qualitative variables was done in the form of frequency and percentage and for quantitative variables as mean and standard deviations. Differences between variables were done using chi squar

Results

Table (1): Distribution of Nurses According to their Socio-Demographic Characteristics and Previous Work Experience.

Socio Demographic Data	No =30	%
Age in years:		
• 20 yrs : < 30	26	86.7%
• 30 yrs and above	4	13.3%
Mean age /years	27.30 SD ± 4.0 yrs	
Education:		
• Nursing School Diploma	15	50%
• Technical Nursing Institute	15	50%
Years of experience in general Nursing:	12	40.0%
• 2 to < 7 yrs	14	46.7%
• 7 to < 12 yrs	4	13.3%
• 12: 17 yrs		
Mean /years of experience	7.13 SD ± 4.76	
	18	59.9%
	2	6 .8%
	10	33.3%
Years of experience in Rehabilitation Nursing:		
• 1 to < 4 yrs	4.6 SD ± 3.16 yrs	
• 4 to < 7yrs		
• 7 to 10 yrs		
Mean/years	18	59.9%
	0	0%
	10	30.3%
Health habites:		
• Regular physical activity		
• Smoking		
• Previous sick leave due to musculoskeletal symptoms		

Table(1) : showed that, the mean age of nurses was 27.30 SD ± 4.0 years, only 86.7%of them were above 20 and under 30 years, the mean years of experience in rehabilitation nursing filed was 4.6 SD ± 3.16 years. 46.7% of nurses were working from 7 to

11 years in general nursing meanwhile; 59% of them work as a nurse for 1year to less than 4years.

Figure (1): Distribution of Nurses According to Pre-Post Program knowledge score level Regarding Body Mechanics and Occupational Musculoskeletal Hazards.
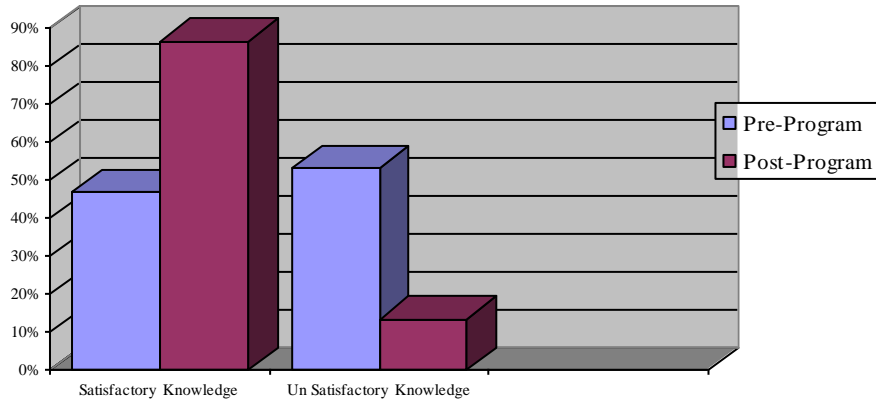
Figure (1):, Illustrated that, 46.7% of nurses had satisfactory knowledge score level as regards body mechanics and occupational musculoskeletal hazards in pre-program assessment, raised to 86.7%; after receiving occupational health program, the differences observed were statistically highly significant ($1X^2 = 10.8$ at $P < 0.05$).

Figure (2): showed that, correct nurses performance score level of lifting technique; was 30% pre-program, raised to 93.3% after the program, the differences observed were statistically highly significant ($Z=5.04$ at $P < 0.05$). meanwhile, correct nurses performance score level of sitting and standing techniques were, 30% and 56.7% pre-program respectively, raised to 73.3% and 90.0% after program, the differences observed were statistically highly significant ($Z= 3.36$ at P Value < 0.05 and $Z= 2,92$ at $P < 0.05$ respectively).
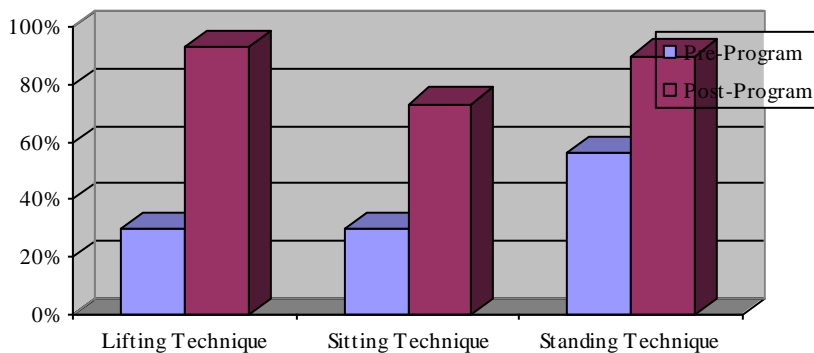
Figure (2): Distribution of Nurses According to Their correct observed performance score level of Body Mechanics Pre-Post Program during lifting, sitting and standing technique (no.=30).

Table(2): the findings of this study showed that, the differences observed were statistically significant between nurse's performance score level of standing, sitting post-program and nurse's knowledge score level post- program (Fisher's exact test = 0.0475 at P Value < 0.05 and Fisher's exact test = 0.0394 at P < 0.05 respectively). Meanwhile, differences observed were statistically insignificant between post-program satisfactory knowledge and nurses performance of lifting technique pre-program (Fisher's exact test = 0.2529 at P >0.05).

Table (2): The Relation between Post-Program Nurse's Knowledge score level of body mechanics, Occupational Musculoskeletal Hazards and Post-Program Nurse's Performances score level of Sitting, Standing and Lifting Techniques (n=30).

Nurses' performance Post-Program (n=30)	Nurse's Knowledge Post-Program (n=30)				Total		Fisher's exact test P Value
	Satisfactory		Un satisfactory				
	No	%	No	%	No	%	
1-Sitting: Done correctly Not Done or Done incorrectly	21	70 %	1	3.3%	22	73.3%	0.0475 not sig.
2-Standing: Done correctly Not Done or Done incorrectly	5	16.7%	3	10 %	8	26.7%	0.0394
3-Lifting: Done correctly Not Done or Done incorrectly	25	83.3%	2	6.7%	27	90% 10 %	0.2529
	1	3. 3%	2	6.7 %	3		
	25	83.3%	3	10 %	28	93.3%	
	1	3. 3%	1	3.3%	2	6.6%	

Table (3): indicated that, 36.7% of nurses knowledge level regards body mechanics technique and occupational musculoskeletal hazards was correct pre-program with nurses having less than 4 years of working experience, raised to 56.7% after program; yet the differences observed were statistically insignificant ($2X^2 = 0.75$ at P > 0.05).

Years of Experience	Nurses' Knowledge score level			
	Pre-Program (n =30)		Post-Program (n =30)	
	Correct		Correct	
	No	%	No	%
1 to ≥ 4 yrs < 4 yrs	11 3	36.7% 10 %	17 9	56.7% 30%
Total	14	46.7%	26	86.7%
2 X² = 0.75 P Value= 0.38536 not significant				

Table (3): Relation between Nurse's years of Experience in Rehabilitation Nursing and their Pre-Post Program Knowledge score level regards Body Mechanics and occupational musculoskeletal hazards (n=30).

Table (4): indicated that, 43.3% of nurses performance score level of standing technique was correct pre-program with age less than 30 years raised to 63.3% after-program; yet the differences observed were statistically insignificant ($2X^2 = 0.2$ at P > 0.05).

Age	Nurses' score level of performance of standing			
	Pre-Program (n=30)		Post-Program (n=30)	
	Done correctly		Done correctly	
	No	%	No	%
20 to <30	13	43.3%	19	63.3%
30 to < 40	4	13.3%	8	26.7%
Total	17	56.6%	13	90.0%
2 X² = 0.2 P Value = 0.6582 not significant				

Table (4): The Relation between Nurse's age and Nurses Performances score level of Standing Technique Pre -Post Program **(n=30).**

Table (5): revealed that, 16.7% of nurses performance score level of sitting technique was correct pre- program with age less than 30 years, raised to 56.7 % after program implementation; yet the differences observed were statistically insignificant ($2X^2$= 1.46 at P Value > 0.05).

Age	Nurses' score level of performance of sitting			
	Pre-Program (n=30)		Post-Program (n=30)	
	Done correctly		Done correctly	
	No	%	No	%
20 to <30	5	16.7%	17	56.7%
30 to < 40	4	13.3%	5	16.7%
Total	9	30%	22	73.4%
2 X^2 = 1.46 P Value = 0.2266 not significant				

Table (5): The Relation between Nurse's age and Pre -Post Program Nurses Performances score level of Sitting Tech unique (n=30).

Table (6): displayed that, 53.3% of nurses performance score level of lifting technique was correct pre-program with age less than 30 years, raised to 70.0% after occupational health program; yet the differences observed were statistically insignificant ($2X^2$= 4.25 at P > 0.05).

Age	Nurses' score level of performance of lifting			
	Pre-Program (n=30)		Post-Program (n=30)	
	Done correctly		Done correctly	
	No	%	No	%
20 to <30	16	53.3%	21	70.0%
30 to < 40	6	20.0%	1	3.3%
Total	9	30%	22	73.3%
2 X^2 = 4.25 P Value = 0.03932 not significant				

Table (6): The Relation between Nurse's Knowledge score level body mechanics and Occupational Musculoskeletal Hazards post-Program and Nurse's Performances score level of lifting Technique Post-Program (n=30).

Table (7): showed that, the frequency of low back pain was the highest (63.3%), followed by neck (49.3%), shoulder (46%), knee and/or elbow (30%), ankles/feet pain(23.3%) Upper back (20%) followed by Hips/Thighs pain (16.7%) and the lowest percentage was regarding wrist /hand pain (13.3%). Nurses complains of musculoskeletal pain was improved post-program implementation (three months) as the low back pain still the highest (56.7%), followed by neck (20%), shoulder (30%), knee (26.7%) and elbow 30%), Upper back, ankles and/ or feet pain (16.7%) followed by Hips/Thighs pain (13.3%) and the lowest percentage of nurse's of musculoskeletal pain was regarding wrist /hand pain (6,6%). The differences observed were statistically insignificant (**Z** = 0.53, 0.33, 0.81, 0.65, 0.29, 0.86, 0.00 and 0.36) respectively at P > 0.05 meanwhile, the differences observed were

almost statistically significant regard nurses' of musculoskeletal pain in neck, pre and post-program (Z = 1.94 and $2X^2$ = 0.597 at P < 0.05).

Table (7): Percentage distribution of nurses' musculoskeletal pain, pre- post (three months) program implementation (n = 30).

Body region Site of pain:	Nurse's pain				**Z**	**P Value**
	Pre-Program(no=30)		Post-Program (n=30)			
	No	%	No	**%**		
Low back	19	63.3%	17	56.7%	0.53	0.5982
Upper back	6	20 %	5	16.7%	0.33	0.7386
Neck	13	49.3%	6	20%	1.94	0.0521
Shoulder	12	46 %	9	30%	0.81	0.4168
Wrists/Hands	7	23.3%	5	16.7%	0.65	0.5186
Knees	9	30 %	8	26.7%	0.29	0.7745
Ankles/Feet	4	13.3%	2	6.6%	0.86	0.3894
Elbow	9	30 %	9	30%	0.00	1.0000
Hips/Thighs	5	16.7%	4	13.3%	0.36	0.7177

Discussion

Since incorrect body mechanics has a close relation with nurses suffering from muscular pain and disorders, the incidence of back pain among nurses is as great as that among industrial manual workers because of the performance of incorrect body mechanics (**Hartvigsen** *et al.,* **2004**). Nurses routinely perform activities, which are repetitive, labour intensive and involve direct contact with patients. Such activities have been shown to be risk factors for the development of work-related musculoskeletal disorders. The prevalence of these conditions among nurses in Egypt is not well established. Adequate teaching about maintaining the proper body position can minimize the problem and reduce the suffering of the nursing staffs (**Jaromi** *et al.,* **2012).** Educational interventions such as body mechanics can be offered as a primary prevention alternative through body mechanic techniques (**McCannon** *et al.,* **2004),** the scope of body mechanics involves the knowledge on how certain muscles are utilized and explanations of its exploitation mainly to prevent and avoid musculoskeletal strain, injuries to staff members, injuries to clients and extreme fatigue (**Stacy** *et al.,* **2010).**

According to The socio-demographic characteristics of the studied nurses, the finding of the present study showed that, most of the nurses their age were between 20 and 30 years old, the mean years of experience was 4.6 years SD ± 3.16 years in rehabilitation nursing and near three fifth of them practice physical activities regularly about 20 minutes/day as polices and regulation of the studied center (Table 1).

Regarding nurses knowledge near half of the nurses had satisfactory knowledge score level as regards body mechanics and occupational musculoskeletal hazards in Pre-program assessment improved for most of nurses after-program implementation, the differences observed were statistically highly significant (2X2=1.8 at P < 0.05) (Figure 1). The results of the present study supported by **Abd El-Rasol and Abd El Rahman (2018)** in a quas-experimental study included 50 nurses in Damanhour National Medical Institute,

Egypt, the study aimed to assess the effect of implementing a body mechanics and ergonomics-training program on nurse's knowledge and practices their results revealed that, (74%) of nurses had poor knowledge, regarding body mechanics and ergonomics pre-program compared to 78% had good knowledge after intervention. all the observed body mechanics and ergonomics practices were highly significant differences between pre and after program implementation; except in lifting which was significant only

This finding also agreed with **Akhtar et al., (2015),** in a descriptive study of 216 nurses, at Punjab institute of cardiology to assess knowledge and practices of body mechanic techniques among nurses who found that, 65% of the nurses had good knowledge about body mechanic technique. The results of the present study also agreed with **Sandhya et al., (2015),** in a descriptive study conducted on knowledge of nurses about body mechanic technique at college of nursing in India, who found that, 41.7% of nurses had good knowledge on body mechanic technique. Moreover, this result goes in the same line with **Tinubu et al., (2010),** in a study to determine the prevalence of work-related musculoskeletal disorders among nurses at the University Teaching Hospital, in Lusaka, Zambia, who identified that, occupational health program in body mechanics and body awareness has been shown to be effective in improving knowledge of the nurses.

The current study found that, about two-thirds of the nurses had unsatisfactory performance pre-program regard lifting and sitting, meanwhile more than half of them had unsatisfactory performance regard standing technique pre-program where the unsatisfactory performance decreased after program implementation, The findings demonstrated a strong positive correlation between pre-program correct nurses performance score level and post-program performance (Figure 2)**.** These results were supported by **Richard et al., (2005),** who found that, 30% of the nurses had satisfactory scores with respect to knowledge and performance of body mechanics techniques, they clarified that, nurses who know the right way but performed body mechanics incorrectly state their reasons as habit or because of emergency situations of the work or unsuitable environmental conditions and the insufficient number of staff.

In addition, these results were in agreement with the findings of **Kochitty (2015),** who showed that, most of the nurses had poor practices regarding body mechanics and ergonomics; the majority of them had proper knowledge and practices concerning body mechanics practices, after attending a structured teaching program.

These findings were also supported by the results of **Karahana, and Bayraktar (2013),** in another study to evaluate the effectiveness of program implementation to prevent low back pain among nurses conducted in four hospitals in Turkey, who found that, the mean performance scores of body mechanics of the nurses increased after the program compared to the pre-program, with statistically significant difference.

The findings of the present study were in contrast to **Karahana, and Bayraktar, (2004),** in a study to identify the usage of body mechanics in clinical settings and the occurrence of low back pain in 56 nurses' in Turkey, who found, 53.6% and 58.7%) of the nurses performed sitting and standing correctly respectively. However, 57.1% of the nurses performed lifting technique incorrectly. The present study result might be due to absence of hospital policy and guidelines for body mechanics

performance principles and ergonomics. Other reasons might be increased workload or number of patients, and unavailability of conducting such program in the hospital program plan.

Concerning the relation between nurses' knowledge of body mechanics and occupational musculoskeletal hazards, regard nurses performance of correct body mechanics. The results of the present study revealed that, more than two-thirds of nurses performance score level of lifting, sitting and standing techniques, were correct post-program implementation with satisfactory knowledge, although differences observed were statistically insignificant where there were no statistical relation between nurse's knowledge post-program and nurses performance post-program (Table 2). The present study results agreed with **McCannon *et al.,* (2004)**, in a study conducted in USA on 30 nurse, to determine the effectiveness of training on the work performance of body mechanics, where they demonstrated performance of body mechanics techniques for nurses, the results obtained in their study showed that, there was an increase in nurse's body mechanics knowledge and performance of standing, sitting and lifting, after program implementation, they explained that, nurses might retain information about body mechanics and might adopt alternating movements, which through practice could be expected to become automatic during the performance of physical activities.

The results of the present study supported by **Ali (2018),** in a quasi-experimental study of 42 nurses aimed to evaluate the effect of body mechanics training for nurses to reduce back pain conducted at Tanta University Hospital and at Tanta Cancer Institute who found that, the majority of the studied nurses had unsatisfactory performance and knowledge regarding body mechanics pre intervention, improved post intervention, but the results of the present study

contradicting with this study in the point of the statistical relation between nurse's knowledge and nurse's performance where there was a highly statistically significant differences regarding nurses performance pre and post intervention and highly statistically significant difference regarding nurses knowledge about body mechanics and nurses performance. The present study results might be attributed to nurses" unawareness due to inadequate basic education, unavailability of pre-service and in-service occupational health program, absence of continuous supervision and evaluation.

The results of the present study also disagreed with **(Ibrahim and Elsaay, 2015),** in a quasi- experimental study to evaluate the effect of body mechanics training program for 40 intensive care nurses to reduce back pain conducted at Tanta University Hospital, in a comparison between total knowledge and total performance scores among studied sample who found that, there is highly significance difference regarding pre- program immediate post program and three months post program.

The results of the present study were contradicted with **Engkvist *et al.,* (2001)** in a study in Sweden, who mentioned that, training of nurses in body mechanics and body awareness has been shown to be ineffective, they stated that, although knowledge is an important part of a health promotion program, simple understanding of the need does not frequently translate into permanent performances.

The results of the present study were in contrast to **Stacy et al., (2010)** in a study to undertake a systematic review of the literature examining the effectiveness of different approaches to training in manual handling, who stated that, nurses tend to revert to previous habits if occupational health program is not reinforced. In health care, there is

evidence supporting the idea that, the principles taught during training are not applied in the working environment an increase in nurse's knowledge was not necessarily translated into improvement in performance and practice of their body mechanics.

The results of the present study indicate that, there were no statistically significant differences between nurses working experience and their pre and post program knowledge regard body mechanics and occupational musculoskeletal hazards (Table 3).

This results agreed with **Rawat et al., (2017),** in a cross sectional survey to assess the level of knowledge on use of Body mechanics and safety measures among 100 ward attendants working in a hospital in Himalayan, Dehradun, Uttarakhand. It was found that, no statistical association between levels of knowledge with nurses selected demographic variables, such as age, gender, working experience and education status.

The results supported by **Karahana and Bayraktar, (2013),** in a study to evaluate the effectiveness of a training program to prevent low back pain among nurses conducted in four hospitals in Turkey, who found that, the mean scores of knowledge after training compared to the scores before training increased more among nurse who had worked 5 years or less compared to those who had worked longer, illustrated that, 78% of nurses' knowledge score related to body mechanics and ergonomics were good immediately after program implementation compared to (74%) of them, who had poor knowledge pre program implementation. This may be related to the attendance of the interventional occupational health program and the emphasis on psychomotor skills application both

during and after the program implementation; unavailability of positional orientation and in-service occupational health program, absence of continuous supervision and guidance, increase in number of patients, shortage of the nurses and increase workload, which negatively impact their performance.

In addition, the present study displayed that, less than the half of nurses' their performance score level of standing technique was correct pre-program implementation with age less than 30 years, it was raised to about two-thirds after- program implementation; yet the differences observed were statistically insignificant (table 4). This might be due to curiosity and strong welling of younger nurses to learn and their body weight and level of their fitness comparing with older nurses.

The study results revealed that, less than one-fifth of nurse's performance score level of sitting technique was correct pre-program implementation with age less than 30 years, improved to be more than half with correct performance after program; yet the differences observed were statistically insignificant (Table 5). Also about half of nurse's performance score level of lifting technique was correct pre-program with age less than 30 years; it was raised to improve for more than two-thirds of them after program for the same age; yet the differences observed were statistically (table 6). The results of the present study supported by **Zyada, (2017),** in a descriptive research included 80 nurses in surgical units of Damanhur National Medical Institute El-Behaira Governorate, Egypt to assess Nurses' knowledge and practices of body mechanics. Who found that, there was no significant correlation between nurses 'knowledge about body mechanics and their age, working area, qualifications, and years of experience.

Moreover, there was no significant correlation between nurses 'performance about body mechanics and their age, qualifications, years of experience.

Concerning nurses' musculoskeletal pain, pre-program, the results of the present study revealed that, the frequency of low back pain was the highest it was near two-thirds of the nurse followed by neck and shoulder where it was near the half, knee and/or elbow were about one-thirds, ankles/feet pain were less than one-thirds upper back were one fifth followed by Hips/Thighs pain near one fifth and the lowest percentage was regarding wrist /hand pain was less than one fifth. Nurses complains of musculoskeletal pain was improved post program of body mechanics program implementation (three months) as the low back pain still the highest followed by neck, shoulder, knee and elbow, upper back, ankles and/ or feet pain followed by Hips/Thighs pain and the lowest percentage of nurse's musculoskeletal pain was regarding wrist /hand pain. The differences observed were statistically insignificant (Table7).

This result supported by **Tinubu *et al.,* (2010),** in a study to determine the prevalence of work-related musculoskeletal disorders among nurses at the University Teaching Hospital, in Lusaka, Zambia, who found that, prevalence rates of MSDs was highest in the low back (44.1%), followed by the neck (28.0%) and then knees (22.4%) but least in the hips/thighs (3.4%). The results of this study goes with **(Najenson *et al.,* 2015),** in a cross-sectional study in (Haifa) and other surrounding towns, to compare the prevalence of those complaints in nurses working in rehabilitation departments and nursing homes. Rehabilitation nurses reported significantly higher prevalence of both low back pain and neck-shoulder pain (52.8% and 56%). Among nurses, the incidence of MSDs was in the low back,

followed by the neck, shoulder, wrist/hand and knee.

The results of this study also agreed with **(Owen, *et al.,* 2001)** in a five-year follow up study in USA to determine the impact of an ergonomic program on perceived stress ratings, injury rates and patient care for controlled and experimental sample. Who concluded that, eighteen months after ergonomic interventions, the back and shoulder injuries were reduced, Five years after the implementation, the back and shoulder injuries continued to decrease. At the control sample, the back and shoulder injury rates, the lost workdays, and the restricted days remained stable throughout the study period.

However, The study results were not in congruence with **(Hartvigsen, *et al.,* 2004),** in a study to evaluate the effectiveness of an intensive educational and low-tech ergonomic intervention program aimed at reducing low back pain (LBP) among nurses and nurses' aids in Denmark, where nurses divided into intervention group and control group within two year prospective controlled study suggest that, an intensive educational and low-tech ergonomic program is no more effective than a minimal educational effort in reducing or preventing LBP.

Conclusion

Based on the findings of the current study, the following can be deduced:

Before program 46.7% of nurses had satisfactory knowledge score level as regards body mechanics, it raised to became 86.7%; after program with a statistically significance differences.

Concerning nurses performance score level of setting and standing techniques, 30% and 56.7% were correct before program respectively, raised after

program to become 73.3% and 90.0%, showing a significant statistical differences Pre-post program. Regarding nurses performance score level of lifting technique; 30% of them were correct before program implementation raised to become 93.3% after program, however insignificant statistical differences were found before and after program implementation.

Also this study revealed that, insignificant statistical differences were found before and after program between nurse's years of experience in Rehabilitation Nursing and nurses' knowledge score level regards body mechanics Pre-post program implementation. On the other hand, this study showed that, insignificant statistical differences were found before and after program implementation between nurse's age and nurses' performances, score level regards lifting, sitting and standing techniques Pre-post program.

Findings of the present study displayed that, the differences observed were statistically significant between nurses performance score level of lifting, sitting and standing techniques after program with nurse's knowledge.

Limitations

There are some limitations of our study. Firstly, the study had a short time frame. A longer follow up period may either demonstrate a reduction in musculoskeletal pain, as has been reported in other studies using different methodologies or may show that, nurses come back to their previous ways of performing their jobs because they perceive no benefit following the prescribed changes.

Recommendations

According to the results of the current study the following recommendations are suggested:

1- Creation of continuous, planned and efficient in-service occupational health programs for nurses on body mechanics.

2- Enough supply the health facilities of patient-lifting devices which have been shown to be effective in decreasing costs and workdays lost to back injuries and pain among nurses.

3- Farther researches on musculoskeletal injuries due to occupational health Body Mechanics for nurses involving sufficiently large samples and long-term follow-up.

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