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Effect of Multidimensional Interventions on Back Pain Reduction among Intensive Care Unit Nurses

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Abstract: *Back pain is the sixth cause of nurses' days off from their job around the world. The most common anatomical site exposed to back pain is lower back. Low back pain is multi-factorial cause among nursing staff, especially intensive care nurses. Multidimensional interventions can reduce nurses back pain as nurses' training about body mechanics; and providing them with scientific knowledge about wearing comfortable shoes heel, eating a balanced meal, weight control, and importance of physical activities.* ***The aim of the study:*** *to examine the effect of multidimensional interventions on back pain reduction among Intensive Care Unit nurses.* ***Methodology:*** *Quasi experimental design was used to achieve the aim of the study.* ***Subjects:*** *The total study number was 120 nurses, they divided into 60 nurses from each setting.* ***Setting:*** *Menoufia University hospital Shibin Elkom, Egypt and Ibn Sina specialized hospital, Khartoum, Sudan.* ***Tools:*** *The tools of study divided into four tools; Tool I: it was a structured interview questionnaire; which included three parts socio-demographic, pain characteristics, nurse knowledge; tool II: it was an observational checklist for the practical part of interventions; Tool III: Visual Analogue Pain Scale; used to assess pain severity; Tool IV: BMI: Measure weight and height and calculate the body mass index (BMI).* ***The results:*** *there was no statistically significant difference between both setting regarding predisposing factors, low back pain characteristics. Improvement in mean nurses' knowledge and practice during post 1 and post 2 than pre-of interventions in both settings; so, the low back pain severity decreased within both settings. There was statistically significant difference between pre, post1 & post 2 within both settings.* ***Conclusion:*** *Poor nurses' practices and knowledge about predisposing factors of low back pain, as improper body mechanics and other factors; increased LBP incidence. Multidimensional interventions improved low back pain among nurses.* ***Recommendation:*** *Implementation of programs about nurses back care and fitness training by the hospitals, establishing patient handling policies and establishing.*

Abbreviations. *Back Pain, BP; Low Back Pain, LBP; Body Mass Index, BMI; Intensive Care Units, ICUs*

Keywords: *lower back pain, Nursing, Multifactorial causes, Multidimensional interventions.*

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I. Introduction

Pain is an unpleasant feeling and emotional experience connected with factual or possible tissue impairment, or defined in expressions of such damage and can affect on a being's quality of life and total functioning ***[1].*** Low Back Pain (LBP) means a pain or discomfort in the vertebral area in the middle of the lower costal margins and gluteal folds with or without radiation to the leg under the knee for the minimum single day throughout the previous 12 months ***[2].*** Nursing is a profession high risk for incidence and prevalence of back pain; among others health practitioners within any health institution; back pain considers a public and expensive problem among the nursing profession ***[3].*** The most common anatomical site more exposed to back pain is lower back ***[4].***

Different countries reported LBP prevalence as Egypt it represented 79.3% by El-Najjar, et al (2014) ***[5]***, in Saudi Arabia was 48.4% by Keriri (2013) ***[6]***, in Qatar was 56.5% by Bener (2014)***[4]***, in Nigeria was 70% in Ethiopia was 60% by Sikiru & Shmaila (2009) ***[7&8]***, in Hong Kong was 40.6% by Yip (2001) ***[9]***, in Malaysia was 47.6% by Sopajareeya; et al (2009) ***[10]***, in Taiwan as 48.4% by Lin (2012) ***[11]***, in Tunisia as 50.1% by Ismail Bejia; et al (2005) ***[12]***.

The source of LBP may be from the single of the subsequent structures as bones, intervertebral discs, joints, ligaments, muscles, neural structures and blood vessels. LBP classifies according to its cause into mechanical or musculoskeletal, non- mechanical (chemical) and radiated pain. Another classification of back

pain by intervals of onset is acute pain lasting less than (6 weeks), sub-chronic (6 to 12 weeks), and chronic (more than 12 weeks) ***[13&14]***.

Causes of LBP are a multi-factorial, which contributing to its incidence. These contributing factors may be extrinsic and intrinsic those are related to nursing occupation. Extrinsic factors include environmental and physical factors, wherever intrinsic factors provide for individual and ergonomic risk factors. Other individual factors increase the risk to the incidence of LBP as age, gender, educational level, obesity is a common risk factor for LBP, mainly in cases of morbid obesity where the body mass index (BMI) is 40 and more ***[15;16&17]***.

Mechanical cause is the most reasons of low back pain which include dysfunction of the musculoskeletal and ligamentous structure. It is caused by one of many musculoskeletal problems as acute lumbosacral strain, unsteady lumbo-sacral tendons and weak muscles, or muscle tension occurs when a muscle is overworked. Ligament sprain osteoarthritis of the spine, spinal stenosis, intervertebral disk problems, and unequal leg length. Other causes as overweight, the inappropriate practice of sport which effect on spinal, stress and depression also causes back pain ***[3]***.

Back pain complaints occur after many activities as lifting, bending, waking up in the morning. The patient clarifies the pain as tenderness at a specific point or it can be diffuse to another part of the body. Sometimes pain is radiating to the legs (known as sciatica). Although most people complain of recurrent episodes of pain, but the symptoms usually improve within six weeks ***[15& 16].***

Multidimensional interventions used to reduce the back pain; they were encompassed of application of proper body mechanics which means maintaining good posture during daily nursing practices, as moving, lying in bed, sitting, standing, pulling, pushing and walking. These practices need to frequent flexion and extension of nurse's body joints, so nursing education about proper technique for all these procedures will benefit to maintain bake free from pain and prevent other complication ***[18&19]***. So; it is important for nurses apply correct body mechanic in all nursing activities and in each practice dealing with patients ***[20&21]***. These applications as; avoid shoes heel has more than 4 cm and wearing comfortable low heel ***[22&23]***; maintain good and balanced healthy diet and avoidance of smoking ***[24; 25&26]***, use of medium-firm mattresses promotes good body posture and body weight distribution during sleeping; which maintains natural anatomical shape of the spine and more beneficial for chronic pain than firm mattresses ***[27].*** Encourage use of assistive equipment and ask for help when they need, and increase physical activity for lowering body weight and physical fitness ***[28; 29&30].***

Thoroughgoing scientific knowledge and training of nurses about body mechanics and its correct use in their daily practice, that play a major role in decreasing the occurrence of back pain and muscle injury which cannot deliver the greatest support and strength are forced into exertion, strain, injury, fatigue of the body tissue ***[18&19]***.

1.1 Significance of the study:

World Health Organization, reported that about 800,000 disabilities in the world because of the LBP problem ***[20].*** One-third of those people loss their work because work accidents and occupational because of these disease groups ***[11].*** Furthermore LBP is a public problem; affect more than 90% of the population during their lifetime and around 70% from the all developed countries populations ***[31&32].*** LBP occurred by work-related constructs by37% ***[33&34].*** In Egypt, nurses among other health care providers have been reported that the highest levels of back pain and back work-related injuries ***[35].***

1.2. The aim of the study: to examine the effect of multidimensional interventions on back pain reduction among ICU nurses.

1.3. Hypothesis of the research:

1. There will be no difference between both settings regarding predisposing factors, back pain characteristics and back pain effects.
2. The knowledge score will increase in the post intervention among the study group, so LBP severity will be decreased.
3. The practice score will increase in the post intervention among the study group, so LBP severity will be decreased.
4. There will be presence of a positive correlation between severity of back pain & some of socio-demographic characters among the study sample.
5. There will be presence of a strong positive relationship between predisposing of LBP among nurses and its severity.

1.4 Operational definitions:

Multidimensional interventions applied within the study to reduce LBP among ICU nurses were; application of proper body mechanics during each procedures nurses performed within the unit during their care provided to

patients, instructions about the importance of lowering their body weight (BMI) by performing physical exercises and eating a healthy diet, selection of medium firm mattress to maintain good body posture during their sleeping, finally they should wear a low shoe heel.

II. Method

2.1 Design*:* Quasi experimental design (pretest/post-test for both Egypt and Sudan groups).

2.2 Setting: This study was conducted in intensive care units of two hospitals, Menoufia University Hospital, Egypt and Ibn Sina Specialized Hospital, Khartoum, Sudan.

2.3 Duration of study: Data were collected during the period from the beginning of June 2016 to the middle of the August 2016 (10 weeks).

2.4 Sample: The purposive sampling for this study was used for 120 nurses; 60 nurses from total nurse's number who work in Menoufia University hospital, Egypt and another 60 nurses from Ibn Sina specialized hospital, Khartoum, Sudan at the time of the study.

2.4.1 **Inclusion criteria:** Nurses whom were willing to participate at the time of the study.

a. Age between 20 - 60 years old.
b. Both sexes.

2.4.2 Exclusion criteria*:* Nurses were excluded from the study if they:-

a. Have already attended a formal program about back pain reduction.
b. Were in vacations or sick leave.
c. Had osteoarthritis, discs or a spinal disc herniation, broken vertebra (from osteoporosis) or, an infection or tumor of the spine.
d. Women may have low back pain from medical conditions affecting the female reproductive system, including endometriosis, ovarian cysts, ovarian cancer, or uterine fibroids.
e. Female nurses were excluded from the study if they pregnant.

2.4.3 Sampling Technique*:*

Selection of ICUs were possible, however, as they were in two hospital areas. ICU in Menoufia University hospital, Egypt and the other in Ibn Sina specialized hospital, Khartoum, Sudan, two were similar in resources, and policies. Based on these similarities, these ICUs were selected to be in the beginning of the study.

2.5 Data Collection Instruments:-

All tools except observational checklist and training booklets were developed by the researchers based on the literature and were revised by five specialists.

Data were collected through using the following tools:

2.5.1. The tool I- A structured interviewing questionnaire: It divided into three parts as follows:-

- Part (1): Socio-demographic data of the nurses included age, gender, marital status, number of children, BMI, number of work years, transportation way to work, working status, Degree of satisfaction, Smoking habit, physical exercise, and diet content (calcium, vegetables, vitamins etc.).
- Part (2): Characteristics of back pain, such as history of back pain, a type of back pain, the usual site of back pain, duration of pain, back pain severity, back pain, frequency, causes of back pain, the effect of back pain, average sleeping hours, type of the nursing interventions cause of back pain, type of shoes heel, the type of interventions apply to relive pain, visit the doctor, and treatment prescription.
- Part (3): Nurses' knowledge and practice for proper body mechanics such as, definition of: body mechanics, the center of gravity, the base of support, the body posture, and the body balance, advantage of body mechanic, if using body mechanics during their nursing care, is use of body mechanics important for you, presence of relation between abuse body mechanics and back pain, type of mattress during sleeping, position during sleep, number of used pillow for sleep, using a back support or lumbar support, and use aiding equipment during nursing interventions.

2.5.2. Tool II- it was an Observational Checklist: It developed by Chansirinukor et al, *[36]* and Ozcan ***[37]***; used to assess the nurses application of proper body mechanics by its principles during their caring of patients; which included (practical part) 13 procedures (subdivided into 109 steps).

2.5.3. Tool III: Visual Analogue Pain Scale: used to assess pain severity adopted from ***[38]*.** It numbered from zero to ten (0-10) reference, it classify into four categories, category (1), means no feeling of pain, category (2)

means mild pain sensation, not interfere with daily activities and can cope with it, category (3) means moderate pain sensation, interferes with many activities and needs lifestyle modification to adapt, finally category (4) means severe pain sensation, the person is unable to participate in normal activities or work.

2.5.4. Tool IV: BMI: Measure weight and height and calculate the body mass index (BMI) according to Malcolm Kendrick *(2015) [39]*, it includes six classifications as follows: underweight; BMI is 18.5 and Less than, normal; BMI is 18.5-24.9, pre-obese; BMI is 30-34.9, Obese class I; Obese class II; BMI is 35-39.9, and Obese III; BMI is 40 and more.

2.5.5. Reliability of the tools:

Reliability was applied by the researcher for testing the internal consistency of the tool by administration of the tool in the same subjects before collecting the data to actually assess the clarity and simplicity of the questions.

Reliability was estimated among 12 participants by using a test retest method with two weeks apart between them. Then correlation coefficient was calculated between the two scores. The correlation coefficient was 0.83 which indicates that the questionnaire is reliable to detect the objectives of the study. The correlation coefficient for the VAS is 0.99 by (Hawker, et al; 2011) ***[40].***

2.6. Pilot Study:

A pilot (purposive) study was carried out on 12 nurses (6 nurses from each study area) to assess the clarity, feasibility, applicability of the study tools, and the time needed to fill each tool. The necessary modifications were done as revealed from the pilot study. The sample of the pilot study was excluded from the total sample to assure the stability of the results.

2.7. Validity of the tools:

The tool was tested for its content by a jury of five experts in the field of Medical Surgical Nursing to ascertain relevance and completeness. The validity of the questionnaire was assessed using content validity by an Expert. The relevancy, clarity, fluency, and simplicity of each component in the questionnaire were examined by the expert and they found the questionnaire is useful and helpful.

2.8. Scoring system:

1. Visual Analogue Pain Scale**:** Visual analogue pain scale used to assess pain severity by numeric ***[38],*** numbered from zero to ten (0-10) reference, it classify into four categories, category (1), zero means (no feeling of pain), category (2) 1-3 degree means (mild pain sensation), or feeling of discomforting , but not interfere with daily activities and can cope with it, category (3) 4-6 degree means (moderate pain sensation), the person is distress, this pain interferes with many activities, requires lifestyle modification to adapt, finally category (4) 7-10 degree means (severe pain sensation),the person is very intense or excruciating, the person is unable to participate in normal activities or work.
2. Assessment sheet for measuring weight and height and calculate the body mass index (BMI) according to Malcolm Kendrick, (2015) classification: 18.5 and Less than (Underweight), 18.5-24.9 (Normal), 25-29.9 (Pre-obese), 30-34.9 (Obese class I), 35-39.9 (Obese class II) and 40 and more (Obese III) ***[39]***.
3. Knowledge questionnaire, total score ranged from (1-9) grade. It's defined as follows; from 1-6 grades or below 65% that indicated inadequate knowledge, and from 7-9 grades or above 65% means adequate knowledge.
4. Performance checklist, it included 13 checklists, all checklists had 109 steps, total score ranged from (0-109). The scoring system described as: three levels of practice; the first from 0-8 or below (60%) considered poor body mechanics practice, from 9-10 or (60% to 84%) considered inefficient practice level, and from 11-13 or (85% to 100%) considered efficient practice level.

2.9. Intervention phases.

Pre-intervention phase: -

- An official permission was obtained from both settings directors of the ICUs. Upon receiving the informal approval through formal channel questionnaires was checked for its validity and reliability.
- The consent was obtained from every participant at their work, after explaining the aim of the study and regarding the multidimensional intervention.
- The study participant filled the questionnaire and checklist before intervention (pre-test); then the researchers disturbed a booklet for all studied nurses about back pain (include theoretical and practical part of the study).
- Training Booklet (multidimensional interventions booklet): it divided into two parts: part one; (theoretical part); included aim, objectives & expected outcomes for the intervention, definition of body mechanic, back

structure and component function, causes of back pain and disorder, spine related problem, symptom and diagnosis of back pain, back pain region and classification of back pain, benefit of using body mechanic for nurses, hazard of poor body mechanic, safety principles for body mechanic, methods for maintaining a healthy back and avoid back pain, effect of back pain on nurses, cauda equine syndrome (causes, symptom), management of back pain (goals and methods for treatment), pregnancy and back pain, part two (practical part); included the technique of body mechanics for each procedure; the nurse need to in patient care; and observational checklists for how the nurses apply body mechanics during most of procedures performed within the unit in both settings.

- Arrangements were made to prepare an effective learning environment before the multidimensional intervention began.

Intervention phase: -

- First, classification of nurses into small groups by unit; 10 nurses from each shift. For teaching sessions: short interactive lectures and group discussions supported by audio-visual aids as power point lectures, illustrated pictures and videos; were conducted for each group.
- The theoretical part took 12 sessions (repeated 6 sessions) during the first two weeks from Saturday to Thursday; each session lasted (30) minutes, 6 sessions were covered in the first week and the same sessions repeated in the second week, the same session is presented 3 times a day; first session for the morning group, second session for the afternoon group and the third session for night group.
- Continuous feedback and communication were assured to clear any misunderstanding, and to reinforce learning for these sessions.
- Followed by the practical part was done during the second two weeks (week 4^{th}), which consisted of 12 sessions, each one lasted during (30) minutes and covered around 2 weeks, it's done through demonstration and re-demonstrations utilized on top of using audiovisual aids.

Post –intervention or evaluation phase: -

- Then the first post-test by questionnaire and checklist was done after 3 weeks post intervention (week 7^{th}) and second post-test by questionnaire and checklist was done after 6 weeks post intervention (week 10^{th}).
- The researchers were available for 6 days/week at most hospital care units at the three shifts for 8 hours per shift.

Aim, objectives & expected outcomes for intervention

General aims, reduction of ICU nurses back pain.

Specific objectives; ICU nurses should be able to:

- ❖ Define of body mechanics and other term included in body mechanics.
- ❖ Identify different causes of back pain, symptoms and effects of back pain.
- ❖ Application of good body mechanics in different nursing activities.
- ❖ Discuss different ways used for preventing back pain.

Expected outcomes after intervention

- ❖ Reduction of ICU nurses back pain.
- ❖ Nurses acquire knowledge and practice related back pain.
- ❖ Improve nurses' satisfaction.
- ❖ Decrease number of days off among ICU nurses.

2.10. Ethical Consideration*:*

For ethical reasons, the official permission was taken from the directors of Menoufia University Hospital Shibin Elkom, Egypt and Ibn Sina Specialized Hospital, Khartoum, Sudan. Also, they were assured that the information would remain confidential and used for the research purpose only. Agreement to measures weight and height of the subjects were taken from the nurses.

2.11. Data management:

Data were collected by questionnaire and checklist pre, during, and post intervention for the nurses by a researcher. Knowledge and practice of nurses were calculated. Manual coding was done to check any error in coding. The manual coding and tables were developed before entering the data. Double entry of data by researchers was done to prevent potential data entry error. The data were checked and cleaned by performing preliminary frequency distribution to enhance accuracy and reliability.

2. 12. Statistical analysis:

The data collected were tabulated & analyzed by SPSS (statistical package for the social science software) statistical package version 20 on IBM compatible computer.

Two types of statistics were done:

1) Descriptive statistics: were expressed as mean and standard deviation (X+SD) for quantitative data or number and percentage (No & %) for qualitative data.

2) Analytic statistics: were expressed as Pearson Chi-square test (χ^2) & Fisher`s Exact Test, Student t- test; Mann-Whitney test (non-parametric test); Repeated-Measures ANOVA; ANOVA test; Kruskal-Wallis test (non-parametric test) and Spearman correlation.

P-value of 0.05 was used to determine significance regarding:

- P-value > 0.05 to be statistically insignificant.
- P-value ≤ 0.05 to be statistically significant.
- P-value ≤ 0.001 to be highly statistically significant.

III. Results

Table (1): Distribution of study groups according to their Socio-demographic data:

Socio-demographic characteristics	Studied groups				Test of sig.	P value
	Setting I (Egypt) (N=60)		Setting II (Sudan) (N=60)			
	No.	%	No.	%		
Age (years):						
• Mean± SD	31.95 ± 4.59		32.07 ±6.03		t=0.11	0.90
• Range	25.0 – 44.0		23.0 – 52.0			NS
Age categories:						
• 21-30	20	33.3	26	43.3		
• 31-40	34	56.7	28	46.7	χ^2	0.28
• 41-50	6	10.0	4	6.7	= 3.76	NS
• 51-60	0	0	2	3.3		
Gender:						0.81
• Male	10	16.7	11	18.3	χ^2	NS
• Female	50	83.3	49	81.7	= 0.05	
Marital status:						
• Married	48	80.0	43	71.7	χ^2	0.28
• Not married	12	20.0	17	28.3	= 1.13	NS
Have children						
• Yes	49	81.7	47	78.3	χ^2	0.64
• No	11	18.3	13	21.7	= 0.20	NS
Number of children:						
• 1-3	37	75.5	33	70.2	χ^2	0.76
• 4 or more	12	24.5	14	29.8	= 0.54	NS
Qualification:						
• Diploma	16	26.7	16	26.7	χ^2	0.33
• Bachelor	42	70.0	38	63.3	= 2.20	NS
• Master	2	3.3	6	10.0		
Working status:						
• Head nurse	8	13.3	14	23.3	χ^2	0.15
• Bedside nurse	52	86.7	46	76.7	= 2.0	NS
Experiences (years):						
• Mean± SD	8.02 ± 4.75		8.38 ±5.87		t=0.37	0.70
• Range	2.0 – 21.0		1.0 – 28.0			NS
Experiences years:						
• Less than 5 years	17	28.3	18	30.0	χ^2	0.84
• More than 5 years	43	71.7	42	70.0	= 0.04	NS
Transport way to work:						
• On Foot	12	20.0	9	15.0	χ^2	0.75
• Public transportation	42	70.0	44	73.3	= 0.55	NS
• Private car	6	10.0	7	11.7		
Smoking:						
• Yes	2	3.3	4	6.7	0.70*	0.67
• No	58	96.7	56	93.3		NS

Note: χ^2=Chi-square test, t= student`s test, *=Fisher`s Exact test, NS=not significant
S= significant, HS=highly significant

Table (1): This table showed that more than three quarters from both settings were female nurses, they aged between 31-40 year old, the majority nurses from both settings were married; they had more than 5 years of experience, their professional educational qualification was Bachelor degree in nursing; the main way of transport to their workplace was public way of transport. There was no statistical significant difference between both settings regarding to their socio- demographic characteristics.

Table (2): Distribution of study groups according to predisposing factors of back pain pre & post intervention:

Item	Studied groups				χ^2	P Value
	Setting I (N=60)		Setting II (N=60)			
	NO.	%	NO.	%		
1)Diet rich in calcium & vitamins						
• **Pre-** Yes	16	26.7	15	25.0	0.04	0.83
No	44	73.3	45	75.0		NS
• **Post 1** Yes	34	56.7	31	51.7	0.03	0.58
No	26	43.3	29	48.3		NS
• **Post 2** Yes	57	95.0	56	93.3	0.15*	1.0
No	3	5.0	4	6.7		NS
Test of significance (χ^2)	58.39		57.96			
P value	≤ 0.001	HS	≤ 0.001	HS		
2) Wearing of high heel shoes?						
• **Pre-** Yes	47	78.3	39	65.0	2.62	0.10
No	13	21.7	21	35.0		NS
• **Post 1** Yes	17	28.3	21	35.0	0.61	0.43
No	43	71.7	39	65.0		NS
• **Post 2** Yes	4	6.7	2	3.3	0.70*	0.67
No	56	93.3	58	96.7		NS
Test of significance (χ^2)	68.96		50.53			
P value	≤ 0.001	HS	≤ 0.001	HS		
3) Performing of physical exercise						
• **Pre-** Yes	7	11.7	9	15.0	0.28	0.59
No	53	88.3	51	85.0		NS
• **Post 1** Yes	19	31.7	32	53.3	5.76	0.01
No	41	68.3	28	46.7		S
• **Post 2** Yes	47	78.3	41	68.3	1.53	0.21
No	13	21.7	19	31.7		NS
Test of significance (χ^2)	58.25		36.60			
P value	≤ 0.001	HS	≤ 0.001	HS		
4) Type of sleeping mattress						
• **Pre-** Soft mattress	38	36.3	50	83.3	6.13	0.01
Firm mattress	22	36.7	10	16.7		S
• **Post 1** Soft mattress	17	28.3	19	31.7	0.15	0.69
Firm mattress	43	71.7	41	68.3		NS
• **Post 2** Soft mattress	1	1.7	2	3.3	0.34*	1.0
Firm mattress	59	98.3	58	96.7		NS
Test of significance (χ^2)	53.55		82.66			
P value	≤ 0.001	HS	≤ 0.001	HS		
5)Applying of body mechanics						
• **Pre-** Never	35	58.3	26	43.3	5.11	0.07
Sometimes	23	38.3	26	43.3		NS
Always	2	3.3	8	13.3		
• **Post 1** Never	8	13.3	17	28.3		
Sometimes	42	70.0	25	41.7	9.83	0.007
Always	10	16.7	18	30.0		S
• **Post 2** Never	0	0.0	2	3.3		0.34
Sometimes	16	26.7	17	28.3	2.13	NS
Always	44	73.3	41	68.3		
Test of significance (χ^2)	94.09		47.38			
P value	≤ 0.001	HS	≤ 0.001	HS		

Table (2): This table illustrated that the predisposing factors of LBP were five; four factors presented in this table; they were applying improper body mechanics during caring of patients; wearing high heel during their work, not performing physical activities, and sleeping on a soft mattress. There was no statistical

significant difference between both settings regarding to predisposing factors of back pain pre & post intervention; but the presence of a highly statistically significant difference between pre, post 1 and post 2 within both settings. Hypothesis1was supported by the data.

Table (3): Distribution of study groups according to anthropometric measures pre & post intervention (as predisposing factor of back pain):

Anthropometric measures	Studied groups		Test of significance	P Value
	Setting I (N=60)	Setting II (N=60)		
	Mean± SD	Mean± SD		
1) Height (cm)	166.77 ± 6.16	165.42 ± 4.49	**t**=1.37	0.17 NS
2) Weight (Kg)				
• Pre-	84.15±10.49	76.48±11.62	**t**=3.79	≤0.001 HS
• Post 1	82.42±9.89	74.53±11.76	**t**=3.97	≤0.001 HS
• Post 2	80.68±9.28	74.30±11.58	**t**=3.33	0.001 HS
Test of significance	**F**=97.51	**F**=75.08		
P value	≤0.001 HS P1=≤ 0.001 P2=≤ 0.001 P3= ≤ 0.001	≤0.001 HS P1=≤ 0.001 P2=≤ 0.001 P3=0.19		
3) BMI				
• Pre-	27.48±2.99	26.76±3.97	**t**=1.11	0.26 NS
• Post 1	25.82±2.52	26.08±3.77	**t**=0.45	0.65 NS
• Post 2	24.87±2.50	25.78±3.60	**t**=1.61	0.10 NS
Test of significance	**F**=121.70	**F**=39.02		
P value	≤ 0.001 HS P1=≤ 0.001 P2=≤ 0.001 P3=≤ 0.001	≤ 0.001 HS P1=≤ 0.001 P2=≤ 0.001 P3= 0.003		
	NO. %	NO. %		
3)BMI categories				
• **Pre-**				
Normal	11 18.3	18 30.0	χ^2 = 3.22	0.19 NS
Pre-obese	33 55.0	24 40.0		
Obese	16 26.7	18 30.0		
• **Post 1**				
Normal	27 45.0	21 35.0	χ^2 = 1.96	0.37 NS
Pre-obese	28 46.7	30 50.0		
Obese	5 8.3	9 15.0		
• **Post 2**				
Normal	37 61.7	31 51.7	χ^2 = 2.47	0.29 NS
Pre-obese	19 31.7	20 33.3		
Obese	4 6.7	9 15.0		
Test of significance (χ2)	28.17	10.52		
P value	≤0.001 HS	0.03 S		

Note: F= Repeated measure ANOVA

Table (3): This table represents the fifth predisposing factor of LBP which was increased nurses body weight; it showed that presence of a highly statistically significant difference between both settings regarding to body weight within 3 measures (pre, post 1 & post 2) also among pre, post 1 &post 2. Relation to BMI; most nurses in pre-interventions were pre-obese, but in post 1 & post 2, their BMI, improved into the normal category of BMI; with a highly statistically significant difference between BMI in pre and post two measures.

Table (4): Distribution of study groups according to characteristics of backache pre & post intervention:

Characteristics of backache	Studied groups				χ^2	P Value
	Setting I (N=60)		Setting II (N=60)			
	NO.	%	NO.	%		
1)Presence of back pain						
• **Pre-** Yes	60	100.0	60	100.0	___	___
No	0	0.0	0	0.0		
• **Post 1** Yes	31	51.7	32	53.3	0.03	0.85
No	29	48.3	28	46.7		NS
• **Post 2** Yes	26	43.3	31	51.7	0.83	0.36
No	34	56.7	29	48.3		NS
Test of significance (χ^2)	46.01		38.51			
P value	≤ 0.001	HS	≤ 0.001	HS		
2) Site of back pain						
• **Pre-** **Mid** back	5	8.3	11	18.3	2.59	0.10
Low back	55	91.7	49	81.7		NS
• **Post 1** Mid back	5	8.3	4	18.3		
Low back	26	43.3	28	46.7	0.20	0.90
No pain	29	48.3	28	46.7		NS
• **Post 2** Mid back	3	5.0	4	6.7		
Low back	23	38.3	27	45.0	0.86	0.65
No pain	34	56.7	29	48.3		NS
Test of significance (χ^2)	47.30		39.0			
P value	≤ 0.001	HS	≤ 0.001	HS		
3) Severity of back pain						
• **Pre-** Mild (1-3)	21	35.0	22	36.7	0.67	0.71
Moderate (4-6)	21	35.0	17	28.3		NS
Severe (7-10)	18	30.0	21	35.0		
• **Post 1** Mild (1-3)	23	38.3	22	36.7		
Moderate (4-6)	6	10.0	7	11.7	0.31	0.95
Severe (7-10)	2	3.3	3	5.0		NS
No pain (0)	29	48.3	28	46.7		
• **Post 2** Mild (1-3)	24	40.0	24	40.0		
Moderate (4-6)	1	1.7	5	8.3	3.39	0.33
Severe (7-10)	1	1.7	2	3.3		NS
No pain (0)	34	56.7	29	48.3		
Test of significance (χ^2)	77.17		59.33			
P value	≤ 0.001	HS	≤ 0.001	HS		
4) Frequency of back pain						
• **Pre-** Daily	48	80.0	51	85.0	1.29	0.52
Weekly	11	18.3	9	15.0		NS
Monthly	1	1.7	0	0.0		
• **Post 1** Daily	9	38.3	12	20.0		
Weakly	21	35.0	15	25.0	4.1	0.25
Monthly	1	1.7	5	8.3		NS
No pain	29	48.3	28	46.7		
• **Post 2** Daily	5	8.3	5	8.3		
Weakly	18	30.0	21	35.0	3.39	0.33
Monthly	3	5.0	5	8.3		NS
No pain	34	56.7	29	48.3		
Test of significance (χ^2)	89.82		87.29			
P value	≤ 0.001	HS	≤ 0.001	HS		
Duration of back pain:						
• Acute (6 to 12 weeks)	6	10.0	11	18.3	1.71	0.19
• Chronic (more than 12 weeks)	54	90.0	49	81.7		NS

Table (4): This table exposed that most of nurses within both settings had a history of chronic low back pain; in pre-interventions stage; back pain severity for both settings was moderate degree with daily frequency. There was no statistical significant difference between both settings regarding to characteristics of back pain pre-& post intervention; while all back-pain characters improved in post 1 and post 2 than pre- interventions. With presence of a highly statistically significant difference between pre, post 1 and post 2 within both settings. Hypothesis1was supported by the data.

Table (5): Distribution of study groups according to effect of low back pain of nurses' pre-& post intervention:

Variable	Studied groups				χ^2	P Value
	Setting I (N=60)		Setting II (N=60)			
	NO.	%	NO.	%		
1) State of satisfaction						
• **Pre-** Satisfied	15	25.0	11	18.3	0.78	0.37
Unsatisfied	45	75.0	49	81.7		NS
• **Post 1** Satisfied	38	63.3	46	76.7	2.54	0.11
Unsatisfied	22	36.7	14	23.3		NS
• **Post 2** Satisfied	51	85.0	50	83.3	0.06	0.80
Unsatisfied	9	15.0	10	16.7		NS
Test of significance (χ^2)	45.40		63.64			
P value	≤ 0.001	HS	≤ 0.001	HS		
2)Response to back pain:						
• **Pre-** Restriction of activity	7	11.7	2	3.3	3.23	0.35
Thinking change work unit	16	26.7	20	33.3		NS
Taking days off	35	58.3	36	60.0		
Apply body mechanics	2	3.3	2	3.3		
• **Post 1** Restriction of activity	7	11.7	8	13.3		
Thinking change work unit	7	11.7	12	20.0	2.40	0.49
Taking days off	18	30.0	19	31.7		NS
Apply body mechanics	28	46.7	21	35.0		
• **Post 2** Restriction of activity	8	13.3	10	16.7		
Thinking change work unit	5	8.3	0	0.0	5.48	0.14
Taking days off	12	20.0	11	18.3		NS
Apply body mechanics	35	58.3	39	65.0		
Test of significance (χ^2)	48.49		70.96			
P value	≤ 0.001	HS	≤ 0.001	HS		
3) Average of sleeping hours:						
• **Pre-** Less than 6 hours	48	80.0	41	68.3	2.13	0.14
More than 6 hours	12	20.0	19	31.7		NS
• **Post 1** Less than 6 hours	11	18.3	13	21.7	0.20	0.64
More than 6 hours	49	81.7	47	78.3		NS
• **Post 2** Less than 6 hours	24	40.0	25	41.7	0.03	0.85
More than 6 hours	36	60.0	35	58.3		NS
Test of significance (χ^2)	47.26		26.71			
P value	≤ 0.001	HS	≤ 0.001	HS		

Table (5): This table revealed that in pre-interventions; because of back pain the majority of both settings taken more days off from their work unit, they unsatisfied and slept less than 6 hours per day. There was no statistical significant difference between both settings regarding to back pain effects in pre-& post intervention; but in post 1 and post 2 the improvement occurred for these effects; with a highly statistically significant difference between pre, post 1 and post 2. Hypothesis1was supported by the data.

Table (6): Distribution of study groups according to methods of back pain management pre-& post intervention:

Variable	Studied groups				χ^2	P Value
	Setting I (N=60)		Setting II (N=60)			
	NO.	%	NO.	%		
1)Visiting the doctor						
• **Pre-** Yes	40	66.7	19	31.7	14.70	≤ 0.001
No	20	33.3	41	68.3		HS
• **Post 1** Yes	20	33.3	18	30.0	0.15	0.69
No	40	66.7	42	70.0		NS
• **Post 2** Yes	2	3.3	8	13.3	3.92	0.04
No	58	96.7	52	86.7		S
Test of significance (χ^2)	53.34		6.57			
P value	≤ 0.001	HS	0.03	S		
2)Self-management before doctor visiting:						
• **Pre-** Massage	10	16.7	15	25.0	2.53	0.28
Take pain killer	49	81.7	42	70.0		NS
Apply correct body mechanics	1	1.7	3	5.0		

• **Post 1** Massage	15	25.0	16	26.7		
Take pain killer	19	31.7	20	33.3	0.13	0.93
Apply correct body mechanics	26	43.3	24	40.0		NS
• **Post 2** Massage	23	38.3	14	23.3		
Take pain killer	2	3.3	3	5.0	3.21	0.20
Apply correct body mechanics	35	58.3	43	71.7		NS
Test of significance (χ^2)	83.95		69.73			
P value	≤ 0.001 HS		≤ 0.001 HS			
3)Doctor prescription:						
• **Pre-** Physiotherapy	10	16.7	4	6.7	14.80	0.002
NSAIDs & analgesics	22	36.7	11	18.3		S
Muscle relaxant	8	13.3	4	6.7		
No doctor visit	20	33.3	41	68.3		
• **Post 1** Physiotherapy	8	13.3	3	5.0		
NSAIDs & analgesics	11	18.3	11	18.3	4.12	0.24
Muscle relaxant	1	1.7	4	6.7		NS
No doctor visit	40	66.7	42	70.0		
• **Post 2** Physiotherapy	0	0.0	1	1.7		
NSAIDs & analgesics	1	1.7	4	6.7	4.12	0.24
Surgical treatment	1	1.7	3	5.0		NS
No doctor visit	58	96.7	52	86.7		
Test of significance (χ^2)	61.84		17.16			
P value	≤ 0.001 HS		0.02 S			

Table (6): This table represented that there was a highly statistically significant difference between both setting related to doctor visiting during pre-interventions; two third from setting 1 went to doctor due to back pain; while most of nurses from setting 2 not had doctor visiting; furthermore most of nurses from both settings taken pain killer to manage their pain before doctor visiting; without statistical significant difference between both settings regarding to self management of pain before doctor visiting. While methods back pain management improved in post 1 and post 2 than pre- interventions; with presence of a highly statistical significant difference among pre, post 1 and post 2.

Table (7): Distribution of study groups according to mean knowledge and practice pre-& post intervention:

Variable	**Studied groups**				**Test of significance**	**P Value**
	Setting I (N=60)		**Setting II (N=60)**			
	Mean± SD		**Mean± SD**			
1)Total knowledge						
• Pre-	2.82±1.64		3.07±1.87		**U**=0.64	0.52 NS
• Post 1	5.40±1.72		6.32±1.70		**t**=2.92	0.004 S
• Post 2	8.15±0.73		8.12±0.66		**t**=0.26	0.79 NS
Test of significance	**F**=360.45		**F**=276.23			
P value	≤0.001 HS	P1= ≤ 0.001 P2= ≤ 0.001 P3= ≤ 0.001	≤0.001 HS	P1= ≤ 0.001 P2= ≤ 0.001 P3= ≤ 0.001		
2)Total practice						
• Pre-	1.17±1.53		1.48±1.46		**U**=1.78	0.07 NS
• Post 1	7.82±2.26		9.72±1.76		**t**=5.12	≤ 0.001 HS
• Post 2	11.73±1.27		11.32±1.23		**t**=1.39	0.16 NS
Test of significance	**F**=694.30		**F**=688.01			
P value	≤ 0.001 HS	P1=≤ 0.001 P2=≤ 0.001 P3=≤ 0.001	≤ 0.001 HS	P1=≤ 0.001 P2=≤ 0.001 P3= ≤ 0.001		
	NO.	%	NO.	%		
3)Total practice categories						
• **Pre-**	59	98.3	58	96.7		
Poor	1	1.7	2	3.3	0.34*	1.0 NS
	0	0.0	0	0.0		

Inefficient Efficient						
• **Post 1** Poor Inefficient Efficient	40 11 9	66.7 18.3 15.0	17 20 23	28.3 33.3 38.3	χ^2 = 18.01	≤ 0.001 HS
• **Post 2** Poor Inefficient Efficient	1 6 53	1.7 10.0 88.3	5 8 47	8.3 13.3 78.3	χ^2 = 3.31	0.19 NS
Test of significance (χ^2)	138.63		122.06			
P value	≤0.001 HS		≤ 0.001 HS			
4)Total knowledge categories • **Pre-** Inadequate Adequate	58 2	3.3 96.7	54 6	90.0 10.0	2.14*	0.27 NS
• **Post 1** Inadequate Adequate	46 14	76.7 23.3	29 31	48.3 51.7	10.27	0.001 HS
• **Post 2** Inadequate Adequate	1 59	1.7 98.3	3 57	5.0 95.0	1.03	0.61 NS
Test of significance (χ^2)	123.84		86.88			
P value	≤0.001 HS		≤ 0.001 HS			

Note: U=Mann-Whitney test

Table (7): This table illustrated that improvement in mean knowledge and practice during post 1 and post 2 than pre-of interventions in both settings; with the presence of a highly statistically significant difference between pre, post 1 and post 2. Additionally, presence of statistical significant difference between both settings only in post 1 between two settings. Hypothesis 2 was supported by the data.

Table (8): Relation of back pain (pre-post) and practice (pre-post interventions) among study sample:

Back pain	**Mean practice score (pre-post interventions) among studied groups**		**Test of sig. P value**	**Test of sig. P value**
	Setting I (N=60)	**Setting II (N=60)**	**Setting I**	**Setting II**
	Mean± SD	**Mean± SD**		
1)Presence of back pain				
• **Pre-** Yes No	1.17±1.53 0.0	1.48±1.46 0.0	_____	_____
• **Post 1** Yes No	7.10±1.95 8.59±2.35	8.72±1.61 10.86±1.14	**t**=2.67 0.01 S	**t**=5.97 ≤ 0.001 HS
• **Post 2** Yes No	10.88±1.21 12.58±0.88	9.94±1.75 12.79±0.49	**t**=5.53 ≤ 0.001 HS	**t**=8.73 ≤ 0.001 HS
2) Severity of back pain				
• **Pre-** Mild (1-3) Moderate (4-6) Severe (7-10)	1.10±1.92 1.24±1.26 1.17±1.38	1.64±1.43 1.53±1.94 1.29±1.05	**K**=1.74 0.41 NS	**K**=0.81 0.66 NS
• **Post 1** Mild (1-3) Moderate (4-6) Severe (7-10) No pain (0)	7.96±2.38 6.33±1.96 4.50±0.70 8.24±2.04	9.77±1.90 8.71±1.25 7.67±1.15 10.14±1.62	**F**=2.91 0.04 S	**F**=2.90 0.04 S
• **Post 2** Mild (1-3) Moderate (4-6) Severe (7-10) No pain (0)	11.79±1.14 10.0±0.0 6.0±0.0 11.91±0.93	11.46±1.58 10.60±2.19 7.50±2.12 11.59±1.93	**F**=11.78 ≤ 0.001 HS	**F**=3.42 0.02 S

Note: K=Kruskal Wallis test

Table (8): This table showed that presence of a positive relationship between nursing practices and back pain, for both settings; whenever nurses applied proper body mechanics during patient care and changed their personal behaviors at home, presence of back complains and severity decreased in post 1 and post 2 of the interventions. With statistical significant difference between practice and back in post 1 and post 2 for both studied sample. Hypothesis 3 was supported by the data.

Table (9): Relation of back pain (pre-post) and knowledge (pre-post interventions) among study sample:

Back pain	Mean knowledge score (pre-post interventions) among studied groups		Test of sig. P value	Test of sig. P value
	Setting I (N=60)	Setting II (N=60)	Setting I	Setting II
	Mean± SD	Mean± SD		
1)Presence of back pain				
• **Pre-** Yes	2.82±1.64	3.07±1.87	_____	_____
No	0.0	0.0		
• **Post 1** Yes	4.97±1.44	5.66±1.33	**t**=2.05	**t**=3.50
No	5.86±1.90	7.07±1.78	0.04S	0.001 HS
• **Post 2** Yes	7.88±0.76	7.94±0.68	**t**=2.56	**t**=2.25
No	8.35±0.64	8.31±0.60	0.01 S	0.02 S
2) Severity of back pain			**K**=2.08	**K**=0.11
• **Pre-** Mild (1-3)	3.24±2.09	3.27±2.41		
Moderate (4-6)	2.90±1.54	3.12±1.76	0.35 NS	0.94 NS
Severe (7-10)	2.22±0.87	2.81±1.28		
• **Post 1** Mild (1-3)	5.52±1.41	6.36±1.73	**K**=8.10	**F**=2.84
Moderate (4-6)	4.0±1.67	5.0±1.41		
Severe (7-10)	3.0±1.41	5.0±1.0	0.04 S	0.04 S
No pain (0)	5.76±1.78	6.75±1.62		
• **Post 2** Mild (1-3)	8.13±0.79	8.0±0.72	**F**=4.02	**F**=3.34
Moderate (4-6)	7.0±0.0	8.0±0.70		
Severe (7-10)	6.0±0.0	7.0±0.0	0.01 S	0.02 S
No pain (0)	8.24±0.65	8.31±0.45		

Table (9): This table revealed that presence of a positive relationship between acquiring knowledge after interventions and back pain, for both settings; with a statistical significant difference between acquiring knowledge and back in post 1 and post 2 for both studied samples. Hypothesis 2 was supported by the data.

Table (10): Correlation between Total Score of practice and Total Score of knowledge among the study group:

Variable	Total score of knowledge for setting I		Total score of knowledge for setting II	
	R	P value	r	P value
Total Score of practice	0.50	≤ 0.001 HS	0.51	≤ 0.001 HS

Note: r=Spearman`s coefficient

Table (10): This table exposed that presence of a positive correlation between improvement of total knowledge score and development in total practice score; these knowledge helped nurses to change their practice and application of proper body mechanics.

Table (11): Relation between severity of back pain & socio-demographic characters among study sample:

Socio-demographic characters	Severity of back pain among studied groups											
	Setting I (n=60)						Setting II (n=60)					
	Mild (N=21)		Moderate (N=21)		Severe (N=18)		Mild (N=22)		Moderate (N=17)		Severe (N=21)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Age categories:												
• 21-30	9	42.9	8	38.1	3	16.7	14	63.6	6	35.3	6	28.6
• 31-40	11	52.4	13	61.9	10	55.6	8	36.4	11	64.7	9	42.9
• 41-50	1	4.8	0	0.0	5	27.8	0	0.0	0	0.0	4	19.0
• 51-60	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	9.5
Test of significance (χ^2)	10.75						16.29					
P value	0.02 S						0.01 S					
Gender:												
• Male	4	19.0	4	19.0	2	11.1	7	31.8	2	11.8	2	9.5
• Female	17	81.0	17	81.0	16	88.9	15	68.2	15	88.2	19	90.5

Test of significance (χ^2)	0.57						4.25					
P value	0.75 NS						0.11 NS					
Marital status:												
• Married	13	61.9	19	90.5	16	88.8	11	50.0	14	82.4	18	85.7
• Not married	8	38.1	2	9.5	2	11.2	11	50.0	3	17.6	3	14.3
Test of significance (χ^2)	6.62						8.08					
P value	0.03 S						0.01 S					
Qualification:												
• Diploma	5	23.8	7	33.3	4	22.2	6	27.3	6	35.3	4	19.0
• Bachelor	16	76.2	13	61.9	13	72.2	16	72.7	7	41.2	15	71.4
• Master	0	0	1	4.8	1	5.6	0	0.0	4	23.5	2	9.5
Test of significance (χ^2)	1.96						8.09					
P value	0.74 NS						0.08 NS					
Working status:												
• Head nurse	1	4.8	1	4.8	6	33.3	0	0.0	4	23.5	10	47.6
• Bedside nurse	20	95.2	20	95.2	12	66.7	22	100	13	76.5	11	52.4
Test of significance (χ^2)	8.90						13.62					
P value	0.01 S						0.001 HS					
Transport way to work:												
• On Foot	1	4.8	3	14.3	8	44.4	7	31.8	2	11.8	0	0.0
• Public transportation	16	76.2	16	76.2	10	55.6	14	63.6	14	82.4	16	76.2
• Private car	4	19.0	2	9.5	0	0.0	1	4.5	1	5.9	5	23.8
Test of significance (χ^2)	12.44						12.0					
P value	0.01 S						0.01 S					
Experiences (years): Mean± SD	6.52±3.34		6.71±3.49		11.28±5.90		4.91±2.79		7.59±3.80		12.67±6.99	
Test of sig.(ANOVA)	7.35						13.71					
P value	0.001 HS						≤0.001 HS					

Table (11): This table showed that there was a strong relation between all socio-demographic characters for both settings and back pain severity except gender and qualification. Hypothesis 4 was supported by the data.

Table (12): Relation between severity of back pain & BMI among study sample:

BMI	**Severity of back pain among studied groups**					
	Setting I (n=60)			**Setting II (n=60)**		
	Mild (N=21)	**Moderate (N=21)**	**Severe (N=18)**	**Mild (N=22)**	**Moderate (N=17)**	**Severe (N=21)**
	Mean± SD	**Mean± SD**	**Mean± SD**	**Mean± SD**	**Mean± SD**	**Mean± SD**
Age categories:	26.0±2.16	27.57±3.14	29.08±2.94	24.86±3.34	25.06±4.02	30.12±1.91
ANOVA	6.01			18.37		
P value	0.004 S			≤0.001 HS		

Table (12): illustrated that presence of direct relationship between back pain severity and body mass index as a major predisposing factor of LBP among nurses within both settings.

Table (13): Relation between severity of back pain & some predisposing factors for pain among study sample:

Variable	Severity of back pain among studied groups											
	Setting I (n=60)						Setting II (n=60)					
	Mild (N=21)		Moderate (N=21)		Severe (N=18)		Mild (N=22)		Moderate (N=17)		Severe (N=21)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1)Diet rich in calcium & vitamins:												
• Yes	11	52.4	4	19.0	1	5.6	10	45.5	3	17.6	2	9.5
• No	10	47.6	17	81.0	17	94.4	12	54.5	14	82.4	19	90.5
Test of significance (χ^2)	11.82						8.08					
P value	0.002 S						0.01 S					
2)Do you wear high heel shoes:												
• Yes	12	57.1	18	85.7	17	94.4	7	31.8	13	76.5	19	90.5
• No	9	42.9	3	14.3	1	5.6	15	68.2	4	23.5	2	9.5
Test of significance (χ^2)	8.98						17.62					
P value	0.01 S						≤0.001 HS					
3)Do you perform physical exercise?												
• Yes	5	23.8	1	4.8	1	5.6	7	31.8	1	5.9	1	4.8
• No	16	76.2	20	95.2	17	94.4	15	68.2	16	94.1	20	95.2
Test of significance (χ^2)	4.62						7.71					
P value	0.09 NS						0.02 S					
4) Type of sleeping mattress												
• Soft mattress	8	38.1	16	76.2	14	77.8	15	68.2	15	88.2	20	95.2
• Firm mattress	13	61.9	5	23.8	4	22.2	7	31.8	2	11.8	1	4.8
Test of significance (χ^2)	8.87						6.07					
P value	0.01 S						0.04 S					
Applying body mechanics												
• Never	9	42.9	10	47.6	16	88.9	3	13.6	9	52.9	14	66.7
• Sometimes	11	52.4	10	47.6	2	11.1	14	63.6	6	35.3	6	28.6
• Always	1	4.8	1	4.8	0	0.0	5	22.7	2	11.8	1	4.7
Test of significance (χ^2)	10.04						13.52					
P value	0.04 S						0.008 S					

Table (13): This table represented that presence of a strong relationship between back pain severity and predisposing factors except performing physical exercises in setting 1 in pre-interventions. Hypothesis 5 was supported by the data.

IV. Discussion

LBP is a multi-factorial, which contributing to its incidence; nurses among other health care team had LBP complained**.** These contributing factors may be extrinsic and intrinsic that is related to nursing occupation. Back pain complaints occur after many nursing activities as lifting, bending, waking up in the morning. Multidimensional interventions used to reduce the back pain; they were encompassed of application of proper body mechanics which means maintaining good posture during daily nursing practices, as moving, lying in bed, sitting, standing, pulling, pushing and walking. Avoidance wearing of shoes heel has more than 4 cm and wearing comfortable low heel and maintain good and balanced healthy diet. The current study aimed to examine the effect of multidimensional interventions on back pain reduction among ICU nurses.

Regarding Socio-demographic data and back pain among studies sample.

The current study showed that there was no statistical significant difference between two settings regarding to their Socio- demographic characteristics and presence of statistical significant difference between socio- demographic characteristics and LBP severity; these result was consistent with **''El-Najjar, et al.,** (2014)*[5]*, **Muaadh** & **Higazi (2015)** *[23]*, who reported that low back pain is the most musculoskeletal conditions that include the working people as Egypt and other developed countries especially their job load and being there of risk factors. These results were supported by hypothesis 4.

The present study showed that most of both samples who had a history of back pain were female; this supported with **''Lamina & Hanif (2009) [8],** and **Mulugeta, et al., (2016)'' [17],** they reported that most of the nurses in ICU had lower back pain because of unavailability of male nurses in this working area, which need extra body work and can clarify the greater occurrence of LBP among ICU female nurses. The researcher explained that due to the female's nature was different from males in anatomy, physiology and structure, also because of hormonal effects, reproductive problems, and giving childbirths.

The current study documented that the mean age of both study groups was 31.31+4.9 year old this supported by **Asadi, et al., (2016) [41]**, they reported that most of participant in their study, had a history of low back pain were female, the mean age of them was 32.00 ± 8.24 years. The present study documented that no correlation between back pain and age, this result agreed with **Salah, et al., (2012) [42], & Mulugeta, et al., (2016) [17]**, **they** said that there is no association between age and the incidence of LBP, and older nurses had lower prevalence of LBP than younger nurses, due to older nurses had more administrative duties which not need physical demands during handling and caring patients. The researcher explained that older nurses may be having more knowledge and practice; which protect them from using incorrect body mechanisms during handling and applied daily activities if compared with younger nurses.

The current study confirmed the presence of a positive association between marital status and low back pain, this result in line with **Mulugeta, et al., (2016) [17],** they documented that frequency of LBP among married nurses than unmarried. This result not agreed with **Abou El; et al., (2014) [43]**, they wrote that there was no relationship between nurses back pain and their marital status.

The present study stated that more than two third from both settings, use public transport way to go to their occupation, thus consistent with **Al Dajah, and Al Daghdi (2013) [44]**, they documented that most of the nurses used public way of transport in travelling to their work which indicate bad body mechanics during transport which lead to back pain. The researcher explained that most of the nurses had not muscles, fitness and when nurses use the public way of transport may apply poor posture during sitting or standing that make certain muscles tightening up or shortening while others lengthen and become weak; sometimes nurses may slouch or stoop, so their muscles and ligaments strain to keep the balanced which can lead to low back pain, and other problems.

The present study documented that presence a relationship back pain incidence and experience years; this agreed with **Mulugeta, et al., (2016) [17],** they said that the frequency rate of LBP among nurses with increasing number of experience years. The researcher explained that due to direct patient care activities which involve more of physical demanding activities; which decrease by years.

In relation to predisposing factors of back pain studied sample:

During pre-interventions; the current study documented that; the back-pain complaint among nurses, due to five contributing factors, they were improper body mechanics application **Ibrahim, & Elsaay (*2015)* *[3],*** they said that; many ICU nurses had lower back pain because of applied bad body mechanics; physical inactivity lead to back pain, supported by **Janusz Maciaszek, et al., (2016) [28]** they said that exercise programs very important in the management and prevention of back pain. Wearing high heel shoes during their work, agreed with **ALSerhany & ALAnazi (2015) [23]**, they said that shoes with heel over a 4 cm lead to backache, with prolonged wearing it anatomical degeneration. These results were supported by hypothesis 1.

Eating an unhealthy diet was another predisposing factor, this in line with **National Institutes of Health (2017) [45]**,who stated that eating healthy meal, play an effective role in maintaining a healthy back and may reduce back problems. These results were supported by hypothesis 1.

Finally, factor was obesity, most nurses had increased in their body weight, which make more pressure on spine led to back pain, this result supported by **Hershkovich, et al., (2013) [46], Scott, et al.,(2016) [47]**, they stated that presence of direct relationship between low back pain and obesity (body mass index, >30 kg/m2). Furthermore the present study approved that presence of a strong positive relationship between predisposing of LBP among nurses and LBP severity. These results were supported by hypothesis 5.

According to back pain characteristics among the study sample.

The present study approved that in pre-interventions, there was no differences between both settings regarding backache characters; and the majority of studied sample (ICU nurses) complain of daily chronic low back pain, its severity was a moderate degree of pain (4-6); This result supported with **El-Najjar, et al., (2014)**

[5]; they stated that the prevalence of low back pain complaints was 79.3%. Among Egyptian nurses at all while about 95.0% of all ICU nurses suffered from low back pain; also, **Ibrahim, & Elsaay *(2015)*** [3], who reported that two third of their study participants complaint of low back pain. In post 1 & post 2 of the interventions; development occurred in all characteristics of backache among nurses; with a highly statistically significant difference among poor, post1 & post 2 for both setting and between acquiring knowledge after interventions and back pain severity; agreed with **El-Najjar, et al., (2014)** [5]. These results were supported by hypothesis 1.

In relation to LBP effect among studied sample

The findings of the current study reported that more than half from participants in both setting taken a day off from their work due to low back pain. **This supported by Bin Homaid, et al., (2016)** [48], **and Ibrahim, & Elsaay (*2015)*** [3]**,** they said that the main cause of work day missing among nurses was back pain. After intervention, the nurses' day off decreased within post 1 & post 2 by lowering back pain severity. The researcher explained that backache among nurses develops emotional and physical symptoms led to more days' sick leaves.

The current study represented that most of participants from both settings had a LBP effect on sleeping hours led to less than 6 hours sleeping, this result consistent with **Kelly, et al., (2011)** [49]**,** they found that presence of positive correlation between chronic back pain and sleeping in its number of hours, needed time to fall in deep sleep, disturbance in sleep habits and no feelings with sleep satisfaction. The researcher explained that feeling with low back pain led to incidence of disturbance in sleeping pattern, sleep duration becomes shorter even show symptoms of anxiety. After interventions; more nurses applied correct posture during sleeping and chosen the best type of mattress so decreased in their feeling with low back pain and improvement in number of sleeping hours; this supported by **Kelly, et al.,(2011)** [49]**.**

Nurse satisfaction was an another effect of LBP; the current study revealed that; more than two third from both setting were felt little pleasure and unsatisfied in pre-interventions; but after interventions, enhancement happened by their satisfaction in post 1 and post 2; **this result consistent with Björck**, **et al.,**(2008) [50] & **Mulugeta, et al.,(2016)**[17]**, they explained that** LBP characterized by increased muscle tension and discomfort **lead to** psychosocial conditions; as feeling little pleasure**.** These results were supported by hypothesis 1.

As regards to methods of back pain management.

The current study represented that there was a highly statistical significant difference between both setting related to doctor visiting during pre-interventions; two third from setting 1 went to doctor due to back pain; while most of nurses from setting 2 not had doctor visiting; this result supported by **Katerina & Robin (2016)**[51]**,** they documented that many individual differences as experience, personality, and sociocultural factors interfered with asking medical help. Regarding self management of pain; before doctor visiting; most of nurses from both settings taken pain killer to manage their pain without prescription; this consistent with **National Institute of Drug Abuse (2015)** [52], reported that many people as Americans taken unprescribed medications; also, **SAGE (2017)** [53]**,** documented that nurses have information about analgesics; which enable them to self-management of their pain to go to doctor visits**.** In post 1 and post 2 after nurses visited the doctor for managing their pain; with the presence of a highly statistically significant difference between pre, post 1 and post 2.

Regarding to nurses' knowledge & back pain

The current study approved that around all nurses within both settings had inadequate knowledge in pre-interventions; but after interventions total knowledge score was adequate;. This result agreed with **Anisha, & Sita Devi, (2015)** [54] & **Belay**; **et al.,(2016)** [55]**,** they found presence of important improvement in nurses' knowledge regarding the application of correct body mechanics and preventive methods would be taken to lessen the possibility of LBP. Finally, the researchers' opinion is all nurses in any hospital within every country have the desire for improvement their knowledge, this agreed with **Mohmmed & Ibrahim (2016)** [56] **& El-sol (2017)** [57]. These results were supported by hypothesis 2.

Regarding to nurses' practice & back pain

The current study approved that, nearly all nurses within both settings had poor practice in pre-interventions; but after interventions total practice score was adequate; which reflected by changing in their practices to efficient category of practice in post 1 & post 2. This result agreed with **Anisha; and Sita Devi, (2015)** [54] & **Belay**; **et al (2016)** [55]**;** they found presence of important improvement in nurses' application of correct body mechanics and preventive methods would be taken to lessen the possibility of LBP. Finally, the researchers' opinion is all nurses in any hospital within every country have the desire for changing and improving their practical skills, this agreed with **Mohmmed and Ibrahim (2016)** [56] **& El-sol (2017)** [57]. These results were supported by hypothesis 3.

V. Conclusion

The current study concluded that LBP is a widespread complaint among nurses and the main cause of their absence in the workplace. Poor nurses' practices and knowledge about predisposing factors of LBP, as improper body mechanics which consider the chief factor, the otherwise absence of routine physical exercises, overweight, wearing high heel shoes, sleeping on a soft mattress and unhealthy diets. Multidimensional interventions improved LBP among nurses.

VI. Recommendation

- Establishing protective procedures as decrease nurse workload; ordering correct rest periods, improved schedules and accurate use of body mechanics to diminish the risk of LBP by
- Availability of equipment necessary for lifting patients, implementation of programs about nurses back care and fitness training by the hospitals, establishing patient handling policies and establishing.
- Future research might include; nurses' lifestyle at home and a number of children's together with nurses working in Governmental and Private hospitals and other health sectors for better extra data.
- Hospital administers assign a medical team to evaluate the risk of LBP among their nurses and to design interventions which reduce prevalence of LBP.

References

[1]. International Association for the Study of Pain: Pain Definitions". Retrieved 12 January 2015. Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage Derived from the need of taxonomy. Pain. 1979; 6(3):247–8. Doi: 10.1016/0304-3959(79)90046-0. PMID 460931.

[2]. Amirah F, Low back pain among nurses in orthopedic and intensive care unit at University Kebangsaan Malaysia Medical Centre: the incidence, impacts and level of disability. IIUM, December 2011.Ellapen TJ and Narsigan S. Work Related Musculoskeletal Disorders among Nurses: Systematic Review. J Ergonomics 2014, S4:S4-003.

[3]. Reda Abd Eslam Ibrahim and Om Ebrahiem A. E. Elsaay. The Effect of Body Mechanics Training Program for Intensive Care Nurses in Reducing Low Back Pain. IOSR Journal of Nursing and Health Science (IOSR-JNHS) Volume 4, Issue 5 Ver. IV (Sep. - Oct. 2015), PP 81-96.

[4]. Bener A, Dafeeah EE, Alnaqbi K. Prevalence and correlates of low back pain in primary care: what are the contributing factors in a rapidly developing country? Asian Spine J. 2014, Jun; 8(3):227-36.

[5]. Amany M Abou El-Soud, Amany R El-Najjar, Nada A El-Fattah and Hassan, Prevalence of low back pain in working nurses in Zagazig University Hospitals: an epidemiological study, Egyptian Rheumatology and Rehabilitation, 2014 | Volume : 41 | Issue : 3

[6]. Hasan M. Keriri. Prevalence and risk factors of low back pain among nurses in operating rooms, Taif, Saudi Arabia. American Journal of Research Communication, 2013, 1(11): 45-70 .

[7]. Sikiru L, Shmaila H. Prevalence and risk factors of low back pain among nurses in Africa: Nigerian and Ethiopian specialized hospitals survey study. East Afr J Public Health. 2009; 6(1):22-5.

[8]. Sikiru L, Hanifa S. Prevalence and risk factors of low back pain among nurses in a typical Nigerian hospital. Afr Healt h Sci. 2010; 10(1):26-30 .

[9]. Yip Y. A study of work stress, patient handling activities and the risk of low back pain among nurses in Hong Kong. J Adv Nurs. 2001 Dec; 36(6):794-804 .

[10]. Sopajareeya C, Viwatwongkasem C, Lapvongwatana P, Hong O, Kalampakorn S. Prevalence and risk factors of low back pain among nurses in a Thai public hospital. J Med Assoc Thai. 2009 Dec; 92 Suppl 7: S93-9**.**

[11]. Lin, P. H., Tsai, Y. A., Chen, W. C., & Huang, S. F. (2012). Prevalence, characteristics, and work-related risk factors of low back pain among hospital nurses in Taiwan: A cross-sectional survey. International Journal of Occupational Medicine and Environmental Health, 25(1), 41-50.

[12]. Ismail Bejia. et al. Prevalence and factors associated to low back pain among hospital staff. Joint Bone Spine 72 (2005) 254–259.

[13]. Casazza, BA (15 February 2012). "Diagnosis and treatment of acute low back pain". American family physician. 85 (4): 343–50. PMID 22335313.

[14]. Menezes Costa Lda, C; Maher, CG; Hancock, MJ; McAuley, JH; Herbert, RD; Costa, LO (7 August 2012). "The prognosis of acute and persistent low-back pain: a meta-analysis.". CMAJ: Canadian Medical Association. 184 (11): E613–24. doi:10.1503/cmaj.111271. PMC 3414626Freely accessible. PMID 22586331.

[15]. Stanley C. Ewald, Eric L. Hurwitz and Anupama Kizhakkeveettil. The effect of obesity on treatment outcomes for low back pain. Chiropractic & Manual Therapies (2016) 24:48, DOI 10.1186/s12998-016-0129-4.

[16]. Julie M. Fritz, Shannon N. Clifford. Low Back Pain in Adolescents: A Comparison of Clinical Outcomes in Sports Participants and Nonparticipants. J Athl Train. 2010 Jan- Feb; 45(1): 61–66.

[17]. Mengestie Mulugeta, Amare Worku and Serebe Abay, Epidemiology of Low Back Pain among Nurses Working in Public Hospitals of Addis Ababa, Ethiopia. ISSN 2073-9990 East Cent. Afr. J. surg. 2016. https://www.researchgate.net/publication/305534138.

[18]. McCauley M. The Effect of Body Mechanics Instruction on Work Performance among Young Workers http://ajot.aota.org/ on 03/12/2015.

[19]. Bejia, I., Younes, M., Jamila, H. B., Khalfallah, T., Ben Salem, K., Touzi, M., Akrout, M. & Bergaoui, N (2005). Prevalence and factors associated to low back pain among hospital staff. Joint Bone Spine, 72:254-259.

[20]. Karahan A, Bayraktar N, Effectiveness of an Education Program to Prevent Nurses' Low Back Pain an Interventional Study in Turkey Workplace Health & Safety • VOL. 61, No. 2, 2013

[21]. Jadranka Stricevic, Zvone Balantic, Zmago Turk, Dusan Celan and Majda Pajnkihar (2012). Occupational and Environmental Risk Factors for Development of Low Back Pain in Hospital Nursing Personnel, Low Back Pain, Dr. Ali Asghar Norasteh (Ed.), ISBN: 978-953-51-0599-2, InTech, Available from: http://www.intechopen.com/books/low-back-pain/occupational-and-environmental-risk-factors-fordevelopment- of-low-back-pain-in-hospital-nursing-per.

[22]. Sahar T, Cohen MJ, Uval-Ne'eman V, et al. (April 2009). "Insoles for prevention and treatment of back pain: a systematic review within the framework of the Cochrane Collaboration Back Review Group". *Spine*. 34 (9): 924–33. doi:10.1097/BRS.0b013e31819f29be. PMID 19359999.

[23]. Hadeel ALSerhany & Fahad ALAnazi. Effect of prolonged wearing high heeled shoes on occurrence of low back pain (LBP) and disability among females in ALJouf city. International Journal of Advanced Research (2015), Volume 3, Issue 12, 1715 – 1722. Available at *http://www.journalijar.com*.

[24]. Calcium: What's best for Your Bones and health? T.H. Chan Harvard School of Public Health. http://www.hsph.harvard.edu. Accessed March 1, 2017.

[25]. National Institutes of Health Office of Dietary Supplements web site. https://ods.od.nih.gov/factsheets/Calcium-Consumer/. Updated November 17, 2016. Accessed March 3, 2017.

[26]. Bailey RL, Dodd KW, Goldman JA, et al. Estimation of total usual calcium and vitamin D intakes in the United States. J Nutr. 2010; 140(4):817-22.

[27]. Victor Ancuelle, Rodrigo Zamudio, Andrea Mendiola, Daniel Guillen, Pedro J Ortiz, Tania Tello, and Darwin Vizcarra. Effects of an adapted mattress in musculoskeletal pain and sleep quality in institutionalized elders. Sleep Sci. 2015 Nov; 8(3): 115–120. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4688575**.**

[28]. Janusz Maciaszek, Damian Skrypnik, Marzena Ratajczak, Rafał St emplewski, Wiesław Osiński, Paweł Bogdański, Edyta Mądry, Jarosław Walkowiak and Joanna Karolkiewicz. Two aerobic exercise programs in management of back pain among middle-aged obese women: a randomized controlled study. HUMAN MOVEMENT.2016, vol. 17 (2), 72–79**.**

[29]. Steffens, Daniel; Maher, Chris G.; Pereira, Leani S. M.; Stevens, Matthew L; Oliveira, Vinicius C.; Chapple, Meredith; Teixeira-Salmela, Luci F.; Hancock, Mark J. (11 January 2016). "Prevention of Low Back Pain". *JAMA Internal Medicine*. 176: 199–208. Doi:10.1001/jamainternmed.2015.7431. PMID 26752509.

[30]. Choi BK, Verbeek JH, Tam WW, Jiang JY (2010). Choi, Brian KL, ed. "Exercises for prevention of recurrences of low-back pain". Cochrane Database of Systematic Reviews (1): CD006555. doi:10.1002/14651858.CD006555.pub2. PMID 20091596.

[31]. Manmeet, K., Dhaliwal, Amandeep, Jagmohan and Manjeet. To Compare the Effect of Proprioceptive Neuromuscular Facilitation Program Versus Core Stabilization Exercises for Decreasing Pain and Improving Functions in Patients with Low Back Pain. OSR Journal of Sports and Physical Education (IOSR-JSPE) e-ISSN: 2347-6737, p-ISSN: 2347-6745, Volume 1, Issue 5 (May-Jun. 2014), PP 29-35 www.iosrjournals.org.

[32]. Jitendra Mangwani, Claire Giles, Mark Mullins, Tuncar Salih, and Colin Natali. Obesity and recovery from low back pain: a prospective study to investigate the effect of body mass index on recovery from low back pain. Ann R Coll Surg Engl. 2010 Jan; 92(1): 23–26. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3024611.

[33]. Chiou WK., Wonk MK., Lee YH: Epidemiology of low back pain in Chinese nurses. Int J nurse studies, 2003, 31:361-368.

[34]. Health Canada, Statistics Canada, CIHI. Findings from the2005 National Survey of the Work and Health of Nurses. 2006. Available at http://secure.cihi.ca/cihiweb/products.

[35]. Aqqad, B., Ammoura, S., &Mohamad, A. (2004): Low Back Pain among Royal Jordan Air Force Personnel. Medical Journal of Cairo University, 72 (1): 109-11. European Scientific Journal November 2013 edition vol.9, No.33 ISSN: 1857 – 7881 (Print) e - ISSN 1857- 7431 198.

[36]. Chansirinukor, W., Maher, C., Latimer, J., & Hush, J. (2004): Comparison of the Functional Rating Index and the 18-Item Roland-Morris Disability Questionnaire: Responsive and Reliability. Spine, 30(1): 141-145.

[37]. Ozcan, A. (2006): The Relationship of the Functional Rating Index with Disability, Pain and Quality of Life in Patients with Low Back Pain. Pain, 12 (10): 435-439.

[38]. Bain G., Kuwahata T., Raymod B and Foster R. (2005). Tea Tree hydrogel dressing used in wound care, available at: // www.ridc.gov.aul reports / tt 0105-114.pdf

[39]. Malcolm Kendrick (April 12, 2015). "Why being 'overweight' means you live longer: The way scientists twist the facts". http://www.independent.co.uk. Retrieved 12 April 2015.

[40]. Hawker G., Mian S., Kendzerska T and French M. (2011). Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain). Arthritis Care & Research, Supplement: Special Outcomes; 63(11): 240–252.

[41]. Payman Asadi, Vahid Monsef Kasmaei, Seyyed Mahdi Zia Ziabari, Behzad Zohrevandi, the prevalence of low back pain among nurses working in Poursina hospital in Rasht, Iran, Journal of Emergency Practice and Trauma. Volume 2, Issue 1, 2016, p. 11-15. http://jept.ir; they stated that there was no relation between back pain and married status among nurses.

[42]. Salah; M., Mahdy; N., and Mohamed; L, Effect of educational Program on Performance of Intensive Care Nurses to Decrement the low Back Pain Life Science Journal, 2012;9(4).

[43]. Abou El; et al. Prevalence of low back pain in working nurses in Zagazig University Hospitals: an epidemiological study. Egypt Rheumatol Rehabil 2014; 41:109-15.

[44]. Al Dajah, S., Al Daghdi, A., Prevalence and risk factors of Low Back Pain among Nurses in Sudayr Region. European Scientific Journal November 2013 edition vol.9, No.33.

[45]. National Institutes of Health Office of Dietary Supplements web site. https://ods.od.nih.gov/factsheets/Calcium-Consumer/. Updated November 17, 2016. Accessed March 3, 2017.

[46]. Hershkovich O, Friedlander A, Gordon B, Arzi H, Derazne E, Tzur D, Shamis A, Afek A.Associations of body mass index and body height with low back pain in 829,791 adolescents. Am J Epidemiol. 2013 Aug 15; 178(4):603-9. https://www.ncbi.nlm.nih.gov/pubmed/23690249.

[47]. Scott T. Shemory; Kiel J. Pfefferle, and Ian M. Gradisar, Modifiable Risk Factors in Patients with Low Back Pain, Orthopedics. 2016 - Volume 39 · Issue 3: e413-e416http://www.healio.com/orthopedics/journals/ortho

[48]. Moath Bin Homaid, Doaa Abdelmoety, Waleed Alshareef, Amer Alghamdi, Fareed Alhozali, Naif Alfahmi, Wael Hafiz, Abdulrahman Alzahrani and Soha Elmorsy, Prevalence and risk factors of low back pain among operation room staff at a Tertiary Care Center, Makkah, Saudi Arabia: a cross-sectional study, Bio Med Cent. (2016) 28:1 https://aoemj.biomedcentral.com/articles/10.1186/s40557-016-0089-0.

[49]. Kelly GA, Blake C, Power CK, O'keeffe D, Fullen BM (February 2011). "The association between chronic low back pain and sleep: a systematic review". Clin J Pain. 27 (2): 169–81. doi:10.1097/AJP.0b013e3181f3bdd5. PMID 20842008.

[50]. Björck-van Dijken C, Fjellman-Wiklund A, Hildingsson C. Low back pain, lifestyle factors and physical activity: a population based-study. J Rehabil Med.2008 Nov; 40(10):864-9.

[51]. Katerina V.-A. Johnson & Robin I. M. Dunbar. Pain tolerance predicts human social network size. Scientific Reports 6, Article number: 25267 (2016). Available at: https://www.nature.com/articles/srep25267.

[52]. National Institute on Drug Abuse; National Institutes of Health; U.S. Department of Health and Human Services. Prescription and Over-the-Counter Medications November 2015. www.drugabuse.gov/publications/research-reports/prescription-drugs.

[53]. SAGE. "Nurse-led intervention helps careers' manage medication and cancer pain." Science Daily. Science Daily, 7 July 2017. Available at: www.sciencedaily.com/releases/2017/07/170707095754.htm

[54]. Anisha Kochitty, and Sita Devi, A Study to assess the Effectiveness of a Self-Instructional Module on the Knowledge & Practice regarding Proper Body Mechanics among the Critical Care Nurses in Selected Hospitals of Pune, J AdvSci Res, 2015, 6(4): 13-21, http://www.sciensage.info/jasr.
[55]. M. Belay, A Worku, S A. Gebrie, and B L. Wamisho. Epidemiology of Low Back Pain among Nurses Working in Public Hospitals of Addis Ababa, Ethiopia. COSECSA/ASEA Publication -East & Central African Journal of Surgery. March/April 2016 Volume 21 (1).
[56]. Mohmmed, S. and Ibrahim, K. "Effect of Health Educational Program on Nurses Knowledge and practice Regarding Infection Control in Neonatal Intensive Care Unit at Pediatric Hospitals in Khartoum State, Sudan-2015" Vol 2 (3) pp.20-27 October 2016 Available at: http://www.pyrexjournals.org/pjnm. ISSN: 2985- 878X.
[57]. El-Sol, et al. Effects of Intervention Training Module Regarding Hospital Nurse's Preparedness for Patient's Blood Transfusion. International Journal of Novel Research in Healthcare and Nursing Vol. 4, Issue 1, pp: (102-116), Month: January - April 2017, Available at: www.noveltyjournals.com.

Dr. Ragaa Gasim Ahmed "Effect of Multidimensional Interventions on Back Pain Reduction among Intensive Care Unit Nurses "." IOSR Journal of Nursing and Health Science (IOSR-JNHS) , vol. 7, no.8, 2018, pp. 09-28.