A Model Based Ergonomic Risk Management Program to Reduce the Musculoskeletal Symptoms of ICU Nurses

Duygu Sezgin, PhD
M. Nihal Esin, PhD
Disclosure

- **Duygu Sezgin** PhD Postdoctoral Researcher, University of Limerick, Education & Health Sciences Faculty, Nursing & Midwifery Department, Limerick, Ireland. [dusezgin@gmail.com](mailto:dusezgin@gmail.com)

- **M. Nihal Esin** PhD Professor, Istanbul University, Faculty of Nursing, Public Health Nursing Department, Istanbul, Turkey. [mnesin@istanbul.edu.tr](mailto:mnesin@istanbul.edu.tr)

- No conflict of interest to declare.

- The present work was supported by the Research Fund of Istanbul University. Project No. 55021
Learner objectives

- The learner will be able to explain that how the PRECEDE–PROCEED Model can be used to develop an Ergonomic Risk Management Program to reduce the musculoskeletal problems in the ICU nurses.

- The learner will be able to conclude the effectiveness of the nurse delivered ergonomic interventions to reduce the musculoskeletal problems in the ICU nurses.
Introduction

- Nursing profession is identified as having the highest risk in terms of ergonomic risk.

(Rasmussen et al. 2013, Sezgin and Esin 2015)
The prevalence of the musculoskeletal symptoms (MSS) of nurses working in the clinical settings is found to be between 69.55–88.2% in the literature.

(Samaei et al. 2015, Barkhordari et al. 2015, Ganiyu et al 2015)
Having Musculoskeletal System Symptoms (MSS)

- Decreases work performance, and
- Increases work absenteeism,

This affects patient care negatively and increases the illness costs.

Musculoskeletal disorders may be prevented by effective ergonomic risk management programs

(Lee et al. 2013, Lu et al. 2012, Khamisa et al. 2013)
These programs include:

- Body mechanics training
- Exercise education
- Educational materials

They do not require nurses to leave their daily work.

(Lim et al. 2011, Black et al. 2011, Odeen et al. 2013, Côté et al. 2013, Stigmar et al. 2013)
The aim of this study is to evaluate the effects of ergonomic risk management program with a view to reduce MSS of the ICU nurses.
Hypotheses

Nurses who participated in ERMP will have:

- Decreased perceived pain scores (at least 1 point)

*During patient positioning and bending down movements, on the first and third months following the intervention:*

- Decreased RULA arm, hand, wrist scores (score A) (at least 1 point)
- Decreased RULA trunk, leg, feet scores (score B) (at least 1 point)
- Decreased RULA total scores (at least 1 point)

- Increased exercise frequency
- Decreased medication use due to suffering from MSS
- Decreased sick leave days, compared to nurses in the control group.
Methods

- “Pre-test post-test design for non-equivalent control groups”
- Comprised in Istanbul, Turkey.
- Study population consisted of two hospitals that are connected to Ministry of Health and have adult intensive care units.
- Data was collected from 8 ICUs including general, emergency, reanimation, coronary and neurology.

The ICUs were evaluated and compared by their physical and ergonomic environmental characteristics.
The study sample

- 116 nurses with high ergonomic risk
  (Hospital A: 57, Hospital B: 59)
  - have been working in intensive care unit more than 6 months,
  - accepted to participate the study

The sample size was calculated by power analysis as 72 ICU nurses (36 in intervention group, 36 in control group).

35 nurses were selected for the intervention group and 37 nurses were selected for the control group by systematic sampling.
Ethics

- Bezmialem Vakif University Clinic Research Ethics Committee approval,
- Istanbul Beyoglu Public Hospitals Association’s approval to collect data.
- Informed consent before recruitment and at the first page of data collection tools.
In the pre-test section of the study,

- “Descriptives of Nurses and Ergonomic Risk Reporting Form” (for demographics, working conditions and MSS)
- “Workplace observation form” (to compare ICUs)
- “Rapid–Upper Limb Assessment (RULA)” (for nurses’ level of ergonomic risks)
“Descriptives of Nurses and Ergonomic Risk Reporting Form”

- Demographics
- Working conditions
- MSS (body parts)
- Exercise frequency
- Pain intensity
- Medication use due to MSS
- Sick leave days
Bed spaces, characteristics of transfer equipment, conditioning, lighting were compared and ICUs had similar physical and environmental characteristics.
Rapid Upper Limb Assessment (RULA) is an ergonomic risk assessment tool which is developed by McAttamney and Corlett in 1992.

It enables its users to make a quick risk assessment by observation.
RULA doesn’t provide the user to diagnose a MSD; however it allows the users to determine risks in an early stage.

RULA consists of three main sections ensuring a whole body assessment in terms of ergonomic risks.
RULA

For example; a–Arm&Wrist Score
**“Rapid–Upper Limb Assessment (RULA)”**

- Level of MSD risk can be calculated at the end of the observation by final scores.

<table>
<thead>
<tr>
<th>Score</th>
<th>Level of MSD Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>negligible risk, no action required</td>
</tr>
<tr>
<td>3-4</td>
<td>low risk, change may be needed</td>
</tr>
<tr>
<td>5-6</td>
<td>medium risk, further investigation, change soon</td>
</tr>
<tr>
<td>6+</td>
<td>very high risk, implement change now</td>
</tr>
</tbody>
</table>
“Ergonomic Risk Management Program (ERMP)”

- The ERMP was applied to the nurses in the intervention group.

- The ERMP is a health promotion program developed by using PRECEDE–PROCEED Model.
The interventions were in consistency with the stages of the Model:

(1) Predisposing factors:
A–video training for two weeks which is related to the musculoskeletal risks and exercises to prevent them in the ICU settings (without disrupting the works processes of the nurses)
B–giving educational materials such as booklets

(2) Reinforcing factors:
personal interviews about discussing the predisposing, reinforcing and enabling factors of behaviour change

(3) Enabling factors:
A–giving CDs including the training program to help he nurses to remember the training content
B–providing exercise mats for the nurses to be able to do the exercises shown during the video training.
Data analysis

- The Statistical Package for Social Sciences 16.0 software was used in statistical analysis.
- The sociodemographic, ergonomic and working conditions of the nurses were displayed as number, percentage and mean.
- The paired samples t-test, Q-square test, the analysis of variance in repeated measures, and Cochran’s Q test were applied to evaluate and compare the association between the variables considering the homogeneity and the type.
- The findings were evaluated in between the 95% confidence interval.
Results

- The mean age was $27.71 \pm 5.21$
- 73.6% were female
- Mean Body Mass Index (BMI) was $22.6 \pm 3.1$
- 62.5% of the nurses were not doing regular exercise.

It is found that there was no difference between the intervention and control group for sociodemographic characteristics, general health and work conditions, MSS, level of pain and ergonomic risk scores ($p > 0.05$).
### Table 1. Comparison of demographics (intervention and control groups)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Intervention (n=35) (Mean±SD)</th>
<th>Control (n=37) (Mean±SD)</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>28,57±3,71</td>
<td>26,68±4,44</td>
<td>t= 1,960*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>p= 0,058</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>24 (68,6)</td>
<td>29 (78,4)</td>
<td>(\chi^2 = 0,891)**</td>
</tr>
<tr>
<td>Male</td>
<td>11 (31,4)</td>
<td>8 (21,6)</td>
<td></td>
</tr>
<tr>
<td>Frequency of exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>6 (17,1)</td>
<td>2 (5,4)</td>
<td>(\chi^2 = 7,273)**</td>
</tr>
<tr>
<td>Once a month</td>
<td>13 (37,2)</td>
<td>24 (64,9)</td>
<td></td>
</tr>
<tr>
<td>1-2 times/week</td>
<td>10 (28,6)</td>
<td>9 (24,3)</td>
<td></td>
</tr>
<tr>
<td>3 times or more/week</td>
<td>6 (17,1)</td>
<td>2 (5,4)</td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>23,03±3,31</td>
<td>22,28±2,82</td>
<td>t= 1,017*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>p= 0,316</td>
</tr>
</tbody>
</table>

* Independent groups t test  
** Chi-square test

Following this information, these two groups were identified as having similar characteristics before the ERMP intervention.
MSS symptoms

- Legs and lower back were the body parts that MSS are mostly seen in both groups before the ERMP intervention.
Hypothesis: Nurses who participated in ERMP will have decreased RULA scores (at least 1 point)

<table>
<thead>
<tr>
<th>Score Category</th>
<th>First month follow up score change</th>
<th>Sixth month follow up score change</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm–Hand–Wrist Score</td>
<td>p&lt;0.05 0.79 points</td>
<td>3.75±1.64</td>
<td>“further ergonomic analysis and modifications recommended”</td>
</tr>
<tr>
<td>Neck Trunk Leg Score</td>
<td>p&lt;0.05 0.96 points</td>
<td>3.96±1.34</td>
<td>“further ergonomic analysis and modifications recommended”</td>
</tr>
<tr>
<td>Total Score</td>
<td>p&lt;0.05 0.71 points</td>
<td>4.39±1.49</td>
<td>“not only further ergonomic analysis and modifications but also preventive interventions for working conditions are recommended”</td>
</tr>
<tr>
<td>Score</td>
<td>First month follow up score change</td>
<td>Sixth month follow up score change</td>
<td>Meaning</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------</td>
<td>-----------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Arm–Hand–Wrist Score</td>
<td>↓0.82 points</td>
<td>2.32±0.47</td>
<td>“acceptable”</td>
</tr>
<tr>
<td>Neck Trunk Leg Score</td>
<td>↓1.85 points</td>
<td>3.61±1.61</td>
<td>“further ergonomic analysis and modifications recommended”</td>
</tr>
<tr>
<td>Total Score</td>
<td>↓1.40 points</td>
<td>3.75±1.64</td>
<td>“further ergonomic analysis and modifications recommended”</td>
</tr>
</tbody>
</table>

**Hypothesis:** Nurses who participated in ERMP will have decreased RULA scores (at least 1 point)
At the end of the ERMP follow-up (by the sixth month)

**Frequency of exercise**
The nurses in the intervention group were found to have a significant increase on the frequency of exercise ($p<0.05$).

**Perceived pain intensity scores**
There was a significant decrease on the perceived MSS related pain intensity scores as 0.77 points ($p<0.05$).

**Hypotheses:** Nurses who participated in ERMP will have increased frequency of exercise and decreased perceived pain intensity scores (at least 1 point)
There was a significant decrease on the medication use due to MSS (p<0.05).

There was no significant change in the sick leave days in the intervention group before and after the ERMP (p>0.05).

**Hypotheses:** Nurses who participated in ERMP will have decreased use of medications and decreased sick leave days due to MSS
Conclusion

- This study revealed that ERMP was effective not only to reduce the ergonomic risks and MSS related pain level but also to increase the exercise frequency of the ICU nurses.

- The ergonomic risk management interventions intended at reducing the musculoskeletal symptoms will improve the quality of life of the nurses and their work performance in the long term.
The programs focused on workplace risk management and continuous risk assessment could be recommended for future studies.

Study designs in relation to ergonomic risk prevention should be developed in a model based framework and also include visual technologies such as video films and valid measurement risk assessment tools in order to reduce MSS of the ICU nurses.
References:


Thank you

Questions?