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Impact of two ergonomics training on prevalence of upper and lower extremity complaints among nurses

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Abstract:

BACKGROUND: Musculoskeletal disorders (MSDs) were known as one of the main occupational problems among health-care workers. However, we had some limitations and difficulties for transferring ergonomic concepts to the health-care workers, especially nurses due to heavy work task and insufficient time for that. This study compares the impacts of two ergonomic training methods (lecture and pamphlet) in nurses of an Iranian tertiary hospital on prevalence of their upper and lower extremity complaints.

MATERIALS AND METHODS: In the present randomized clinical trial with parallel groups, 1140 nurses were randomly selected and allocated to the control and two interventional groups. In the interventional groups, nurses revived a training program and pamphlet as ergonomic training methods about work-related MSDs and related ergonomic concept to MSDs prevention and nurses in the control group, did not receive any ergonomic training methods. Upper and lower extremity complaints measure among study nurses with Nordic MSDs before 6 months and 1 year after trial intervention. Statistical analysis including the Kolmogorov–Smirnov goodness-of-fit, Chi-square test, and independent sample *t*-test was performed using SPSS version 22. A two-tailed $P \leq 0.05$ was considered statistically significant.

RESULTS: At the first and second parts of the study follow-up, the prevalence of upper and lower extremities significantly improved in the interventional groups in comparison with the control group. Moreover, between the two trial groups, the frequency of MSDs in upper and lower extremities significantly improved among nurses of the pamphlet group in comparison with the lecture group.

CONCLUSION: Findings of the study showed that we can use pamphlet as a suitable tool for describing ergonomic concepts in comparison with lecture among nurses.

Keywords:

Ergonomics, lecture, lower extremity, pamphlet, upper extremities

Introduction

Musculoskeletal disorders (MSD) were known as the main health problems and might lead to permanent disability. Investigators in previous studies in this field reported that some factors such as ergonomic, individual, and social factors had a basic role in MSD development among the general population.[1] Moreover, health-care workers and specially nurses are one of the high-risk populations for MSD complaints due to their physically demanding jobs.[2] One-year MSD prevalence among nurses varies widely from 34% to 88%.[3,4] As an instance, MSD complaints were reported as the main cause of sickness absence in Greek and Dutch nurses.[5] MSD prevalence among the Asian population was reported between 41% and 92%.[6]

Although there were high MSD prevalence reports among nurses in several studies, MSD management among working

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Table 1: Musculoskeletal disorder complaints at recent week and year in our participants before and 6 months after intervention

Body region	Frequency (%)		*P**
	Before intervention	After intervention	
Lecture group			
Upper limbs	87 (30.53)	82 (28.77)	0.06
Lower limbs	73 (25.61)	69 (24.21)	0.13
Pamphlet group			
Upper limbs	86 (30.17)	76 (26.67)	0.002
Lower limbs	77 (27.02)	64 (22.46)	0.004
Control group			
Upper limbs	172 (30.18)	168 (29.47)	0.13
Lower limbs	165 (28.95)	162 (28.42)	0.12

**P* calculated with McNemar statistical test

Table 2: Musculoskeletal disorder prevalence at recent year in our participants before and 1 year after intervention among the study groups

Body region	Frequency (%)		*P**
	Before intervention	After intervention	
Lecture group			
Upper limbs	87 (30.53)	81 (28.42)	0.06
Lower limbs	73 (25.61)	68 (23.86)	0.06
Pamphlet group			
Upper limbs	86 (30.18)	64 (22.46)	<0.001
Lower limbs	77 (27.02)	54 (18.95)	<0.001
Control group			
Upper limbs	172 (30.18)	171 (30.01)	0.49
Lower limbs	165 (28.95)	167 (29.29)	0.06

**P* calculated with McNemar statistical test

populations is not hopeful and prevention and preventive modalities had been presented as the best modality for avoiding MSD disadvantages.[7,8] According to searching on the literature for consideration of possible MSD prevention modalities, we found three studies which evaluated training interventions alone,[9] one study which evaluated a combination of training and equipment interventions,[10,11] four studies which evaluated equipment interventions alone,[12] and four studies which evaluated supplementary breaks or reduced work hours.[13] Unfortunately, findings of noted clinical trials were mixed[14,15] and their effectiveness has not been consistent and some factors such as type of work, difference in educational programs, and methodological factors were reported as a cause of noted differences.[16] The present study was performed for evaluation of the impact of two ergonomic training modalities for MSD prevention among nurses in one of the Iranian tertiary hospitals.

Materials and Methods

Study design and setting

The present randomized trial was performed on nurses in one of the Iranian tertiary hospitals in Tehran, Iran. We compare in this trial impact of two training modalities including lecture and pamphlet for transferring ergonomic training topics on prevalence of MSDs. The study hospital is one of the superspecial Iranian referral hospitals, in which most of the patients were referred from all of the Iranian cities to receive superficial health-care services.

Study participants and sampling

All of the nurses of the study hospital with more than 1-year work experience were eligible for participating in our trial, and among them, those who had an extra job within their free time with history and available medical documents of fracture or major trauma, degenerative disk diseases, spondylosis, spinal stenosis, neurological deficit, systemic illness, or in vacation were excluded.

At the beginning of the study, 1387 nurses were eligible for randomization and 1203 (response rate: 86.73%) were agreed to participate in the study. The nurses were randomly selected from the list of their names. Eligible participants after written informed consents were included in randomization process with number situational list for randomization. Eligible nurses were randomly allocated into the following two interventional and one control groups. After accepting the study by participants, they signed a written informed consent before randomization. The study protocol was approved by the Research Ethics Committee of the Iran University of Medical Sciences (IUMS).

Study intervention

We performed a pilot study before study intervention and assessed their ergonomic status and related topics to determination of main ergonomic defects. According to findings of a pilot study, more than 40% of nurses espoused high ergonomic risk factors. We extracted main risk factors and designed ergonomic trainings modalities in lecture or pamphlet pattern.

According to the noted assessment study, nurses received one of these ergonomic trainings: (1) one educational lecture about work-related MSD and related ergonomic concept to MSD prevention ($n = 285$). First, in this lecture, after definition and reporting some statistics from national or international MSD reports, we tried to say about proper position and other activities for covering possible ergonomic risks and preventing from next MSD in the study participants.[2] We prepared one educational pamphlet for participants. In the study pamphlet, after MSD definition and its prevalence in national and international reports, proper activities for covering ergonomic risk factors were schematically presented ($n = 285$). We had one control group ($n = 570$) which had not revived any of the study interventions and continued to working with regular work tasks.

Data collection and techniques

Demographic and work-related data for all nurses were gathered at the time of study beginning. The prevalence of MSD was recorded among participants with Nordic Musculoskeletal Questionnaire (NMQ). NMQ was developed from a project funded by the Nordic Council of Ministers and included questions such as age, job duration, weight of loads, daily working hours, and MSDs in each of the following body regions: neck, shoulder, elbow, wrist/hand, upper back, lumbar, one or both hips/thighs, one or both knees, and one or both ankle/feet. Data on daily working hours were obtained by the time spent in the workplace.[17] The validity and reliability of the questionnaire were approved in different studies and several languages including the Persian language.[18] The aim was to develop and test a standardized questionnaire methodology allowing comparison of low back, neck, shoulder, and general complaints for use in epidemiological studies.[19] The NMQ has been used in several studies for evaluating MSDs, including computer and call center workers.[20] Previous studies reported that the NMQ is repeatable, sensitive, and useful as a screening and surveillance tool. However, medical examination is essential to establish a clinical diagnosis. In this study, we only worked on some parts of NMQ data related to upper and lower extremities. We follow workers 1 year, and NMQ was completed for them at 6 months and 1 year after study beginning.

Study outcomes

The study outcome in the present study was prevalence of MSDs in upper and lower extremities of study nurses, which was defined as an experience of pain or discomfort in the soft tissue of the upper and lower extremities, which had occurred at least 2–3 workdays during the past week or 12 months. Noted pain has improved on the weekends, vacations, and holidays.

Study follow-up

In the previous studies, we had different follow-up times for ergonomic training studies. Five studies had a short follow-up period of between 3 and 8 weeks.[21-23] One study had an intermediate-term follow-up period of 16 weeks,[10] and seven studies had a long-term follow-up period of between 6 and 12 months [Tables 1 and 2].[24-26] For better and accurate results, we prefer that to select a 1-year follow-up period (with one visit in middle time).

Statistical analysis

Study data were analyzed with SPSS for Windows, version 22.0 (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp). We presented quantitative and qualitative variables with mean/standard deviation and frequency/percentage, respectively. The normality of data was assessed with the Kolmogorov–Smirnov goodness-of-fit test. We analyzed qualitative variables with Chi-square test and independent-sample *t*-test used for comparing quantitative variables between the trial groups. A two-tailed $P \leq 0.05$ was considered statistically significant.

Ethical consideration

The study was approved by the Research Ethics Board at the IUMS (90-01-127-13328). Approval was also obtained from the IUMS Research Ethics Committee at each participating site. Research Ethics Board approvals were kept current for the duration of the study. The trial was registered at the Iranian Registry of Clinical Trials and Current Controlled Trials IRCT2015092624199N1. Furthermore, this study was conducted according to the Declaration of Helsinki, the Australian NHMRC National Statement on Ethical Conduct in Human Research 2007,[27] the Notes for Guidance on Good Clinical Practice as adopted by the Australian Therapeutic Goods Administration 2000 CPMP/ICH/135/95,[28] and the ICH GCP Guidelines.

Results

Finally, from 1387 invited nurses, 1203 nurses were included in the study (response rate: 86.73%). The mean of age and work history among study participants was 31.45 ± 5.22 and 6.32 ± 3.29 years, respectively. The mean of age in the lecture (31.30 ± 5.99), pamphlet (30.86 ± 3.02), and control groups (33.52 ± 4.51) had no significant differences ($P = 0.15$). The mean of work experience in the lecture (6.41 ± 3.48), pamphlet (5.89 ± 2.86), and control groups (6.53 ± 3.94) had no significant differences ($P = 0.44$). The mean of body mass index (BMI) in the lecture (25.09 ± 3.38), pamphlet (24.14 ± 2.73), and control groups (25.36 ± 1.78) had no significant differences ($P = 0.06$). The frequency of upper extremities discomforts at recent week and year was 164 (14.36%) and 345 (30.26%), respectively. In our study, the frequency of lower extremity discomforts at recent week and year was 135 (11.76%) and 315 (27.56%), respectively.

At the first part of the study follow-up, the prevalence of upper and lower extremities significantly improved in the interventional groups in comparison with the control group. Moreover, between the two trial groups, the frequency of MSDs in upper ($P = 0.002$) and lower ($P = 0.004$) extremities significantly improved among nurses of the pamphlet group in comparison with the lecture group.

At the second part of the study follow-up, the prevalence of upper and lower extremities significantly improved in the interventional groups in comparison with the control group. Moreover, between the two trial

groups, the frequency of MSDs in upper ($P < 0.001$) and lower ($P < 0.001$) extremities significantly improved among nurses of the pamphlet group in comparison with the lecture group.

Discussion

Findings of the study showed that, although MSD prevalence decreased in all of the intervention groups, nursing in the pamphlet group received more impact than the other groups. We found that different similar studies assess the role of ergonomic training on MSD prevalence in different working populations. As an instance, Brisson *et al*. in their study found that MSD prevalence in the upper extremity region decreased from 19% to 3% among workers in video display units after training.[21] In the other study, Bohr reported that the prevalence of MSD among trained workers was lower than other workers.[24] Although several ergonomic training studies were performed for MSD prevention, their findings were inconsistent with previous studies. Johnson reported that there were no significant declines seen in work-related MSD among study workers.[29] In our study, pamphlet can significantly improve ergonomic concepts of study nurses and lead to lower upper and lower estimates complaints. We think that using pamphlet for intervention of ergonomic training allows nurses to read more and they are easier to train. Failure of lecture as an ergonomic intervention in the present study might be due to inadequate sample size and methodological differences. One of the possible causes for failure in detecting effectiveness for interventional programs in noted studies might be due to difficulty in changing the worker's behaviors and some effective training for ergonomic needs to noted change for effectiveness. It seems that 1-year follow-up may none enough long for severe change or difference in MSD of some body parts.[30,31]

In the present study, we tried to randomly select our participants among nurses of an Iranian tertiary hospital with regular and same work tasks. The mean of age, work history, and BMI as three main confoundings had nonsignificant differences between the control and interventional groups. One of the strengths of the present study was that during 1-year follow-up time between interventions and measuring secondary outcome, all of the nurses participated in the final assessment, and we had not any miss follow-up. One of the possible biases in the present study might be related to information bias due to self-reporting nature of MSD assessment tools. There were generally believes that workers trend to over-report MSDs.[19] In this study, upper and lower extremity complaints were assessed according to self-reporting Nordic questionnaire and might lead to underestimation of their prevalence among nurses. We think that our study is one of the few studies which compare two tools for describing ergonomic concepts to study participants and compare them with control. Due to randomly allocation of employees, underestimation of symptoms was the same among the study groups.

Limitation and suggestion

Our study had some limitations; first, we selected study populations from one hospital. It is better that the study population was selected from different health-care centers with different workloads and tasks. Second, MSDs were multifactorial and some other and even nonwork-related factors such psychological and social issues might be responsible for upper and lower extremity complaint development. Findings of the study showed that pamphlet method for ergonomic training had a significantly higher impact on prevalence of upper and lower extremity complaints among nurses than other lectures as other ergonomically training methods.

Conclusion

Findings of the study showed that transferring ergonomic concepts through pamphlet had a significantly higher impact on prevalence of upper and lower extremity complaints among nurses.

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Conflicts of interest

There are no conflicts of interest.

References

1. Kaila-Kangas L, Haukka E, Miranda H, Kivekäs T, Ahola K, Luukkonen R, *et al*. Common mental and musculoskeletal disorders as predictors of disability retirement among Finns. J Affect Disord 2014;165:38-44.
2. Ribeiro T, Serranheira F, Loureiro H. Work related musculoskeletal disorders in primary health care nurses. Appl Nurs Res 2017;33:72-7.
3. Khammar A, Poursadeghiyan M, Marioryad H, Nabi Amjad R, Alimohammadi M, Khandan M. Patient safety climate and its affecting factors among rehabilitation health care staff of hospitals and rehabilitation centers in Iran-Tehran. Iran. Rehabil. J. 2019;17:39-48.
4. Dehghan N, Aghilinejad M, Nassiri-Kashani MH, Amiri Z, Talebi A. The effect of a multifaceted ergonomic intervention program on reducing musculoskeletal disorders in dentists. Med J Islam Repub Iran 2016;30:472.

5. Passali C, Maniopoulou D, Apostolakis I, Varlamis I. Work-related musculoskeletal disorders among Greek hospital nursing professionals: A cross-sectional observational study. Work 2018;61:489-98.
6. Nützi M, Koch P, Baur H, Elfering A. Work-family conflict, task interruptions, and influence at work predict musculoskeletal pain in operating room nurses. Saf Health Work 2015;6:329-37.
7. Duhig S, Shield AJ, Opar D, Gabbett TJ, Ferguson C, Williams M. Effect of high-speed running on hamstring strain injury risk. Br J Sports Med 2016;50:1536-40.
8. Suarez R, Agbonifo N, Hittle B, Davis K, Freeman A. Frequency and risk of occupational health and safety hazards for home healthcare workers. Home Health Care Manag Pract 2017;29:207-15.
9. Nastasia I, Coutu MF, Tcaciuc R. Topics and trends in research on non-clinical interventions aimed at preventing prolonged work disability in workers compensated for work-related musculoskeletal disorders (WRMSDs): A systematic, comprehensive literature review. Disabil Rehabil 2014;36:1841-56.
10. Mouatt B, Kamper SJ. Common challenges in managing neck and upper limb pain in office workers. Aust J Gen Pract 2019;48:746-50.
11. Aghilinejad M, Kabir-Mokamelkhah E, Talebi A, Soleimani R, Dehghan N. The effect of magnification lenses on reducing musculoskeletal discomfort among dentists. Med J Islam Repub Iran 2016;30:473.
12. Gilliaux M, Renders A, Dispa D, Holvoet D, Sapin J, Dehez B, *et al*. Upper limb robot-assisted therapy in cerebral palsy: A single-blind randomized controlled trial. Neurorehabil Neural Repair 2015;29:183-92.
13. Lassen AD, Fagt S, Lennernäs M, Nyberg M, Haapalar I, Thorsen AV, *et al*. The impact of worksite interventions promoting healthier food and/or physical activity habits among employees working 'around the clock' hours: A systematic review. Food Nutr Res 2018; 62:1-13.
14. Straube S, Harden M, Schröder H, Arendacka B, Fan X, Moore RA, *et al*. Back schools for the treatment of chronic low back pain: Possibility of benefit but no convincing evidence after 47 years of research-systematic review and meta-analysis. Pain 2016;157:2160-72.
15. Pillastrini P, Mugnai R, Farneti C, Bertozzi L, Bonfiglioli R, Curti S, *et al*. Evaluation of two preventive interventions for reducing musculoskeletal complaints in operators of video display terminals. Phys Ther 2007;87:536-44.
16. Santos AC, Bredemeier M, Rosa KF, Amantéa VA, Xavier RM. Impact on the quality of life of an educational program for the prevention of work-related musculoskeletal disorders: A randomized controlled trial. BMC Public Health 2011;11:60.
17. Aghilinejad M, Choobineh AR, Sadeghi Z, Nouri MK, Bahrami Ahmadi A. Prevalence of musculoskeletal disorders among Iranian steel workers. Iran Red Crescent Med J 2012;14:198-203.
18. Daneshmandi H, Kee D, Kamalinia M, Oliaei M, Mohammadi H. An ergonomic intervention to relieve musculoskeletal symptoms of assembly line workers at an electronic parts manufacturer in Iran. Work 2018;61:515-21.
19. Andersson K, Karlehagen S, Jonsson B. The importance of variations in questionnaire administration. Appl Ergon 1987;18:229-32.
20. Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G, *et al*. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Appl Ergon 1987;18:233-7.
21. Brisson C, Montreuil S, Punnett L. Effects of an ergonomic training program on workers with video display units. Scand J Work Environ Health 1999;25(3):255–63.
22. Mahmud N, Kenny DT, Zein RM, Hassan SN. Ergonomic training reduces musculoskeletal disorders among office workers: Results from the 6-month follow-up. Malays J Med Sci 2011;18:16.
23. Franasiak J, Ko EM, Kidd J, Secord AA, Bell M, Boggess JF, *et al*. Physical strain and urgent need for ergonomic training among gynecologic oncologists who perform minimally invasive surgery. Gynecol Oncol 2012;126:437-42.
24. Mani K, Provident I, Eckel E. Evidence-based ergonomics education: Promoting risk factor awareness among office computer workers. Work 2016;55:913-22.
25. Robertson MM, Ciriello VM, Garabet AM. Office ergonomics training and a sit-stand workstation: Effects on musculoskeletal and visual symptoms and performance of office workers. Appl Ergon 2013;44:73-85.
26. Aghilinejad M, Ehsani AA, Talebi A, Koohpayehzadeh J, Dehghan N. Ergonomic risk factors and musculoskeletal symptoms in surgeons with three types of surgery: Open, laparoscopic, and microsurgery. Med J Islam Repub Iran 2016;30:467.
27. Nhamrc NH, Council AR, Australia U. National Statement on Ethical Conduct in Human Research 2007 (Updated 2018). Canberra: National Health and Medical Research Council; 2018.
28. Khin NA, Francis G, Mulinde J, Grandinetti C, Skeete R, Yu B, *et al*. Data integrity in global clinical trials: Discussions from joint US food and drug administration and UK medicines and healthcare products regulatory agency good clinical practice workshop. Clin Pharmacol Ther 2020;108:949-63.
29. Johnsson C, Carlsson R, Lagerström M. Evaluation of training in patient handling and moving skills among hospital and home care personnel. Ergonomics 2002;45:850-65.
30. Poursadeqiyan M, Arefi MF, Khaleghi S, Moghaddam AS, Mazloumi E, Raei M, *et al*. Investigation of the relationship between the safety climate and occupational fatigue among the nurses of educational hospitals in Zabol. J Educ Health Promot 2020;9:238.
31. Karimpour Vazifehkhorani A, Karimzadeh M, Poursadeghiyan M, Rahmati-Najarkolaei F. Psychoeducation on improving mental health literacy and adjustment to illness in patients with type 2 diabetes: An experimental stud. Iran. Rehabil. J. 2018;16:395-404.