Abstract

BACKGROUND: Healthcare is a sector with a high risk of musculoskeletal disorders. The work of nurses in a hospital is associated with stress, prolonged work, uncomfortable working postures, bending and twisting of the body, etc. There is a high risk of occurrence of musculoskeletal disorders in nurses, with data varying widely [4], [5]. More than half of the absences due to ill health are related to musculoskeletal disorders [1]. The incidence of the musculoskeletal disorders is affected by factors such as individual characteristics of the worker, environmental, and workplace factors (working postures and movements, etc.), work organization, psychosocial factors, and stress [5], [6], [7]. In nurses, the incidence of the musculoskeletal disorders increases with age and the increase in body mass index (BMI), where there are work-related factors (prolonged work in a standing position, awkward working postures and movements, etc.) [8], [9]. The increasing average age of the working nurses is also associated with an increase in the incidence of the musculoskeletal disorders [10], [11]. High workload and working postures involving bending, stretching, and twisting of the body increase the frequency of the musculoskeletal complaints. This relationship is also observed in younger nurses [11], [12].

Aim

The aim of this study was to identify the risk factors for the frequency and localization of musculoskeletal complaints and diagnosed diseases of the musculoskeletal system in nurses in hospitals.

METHODS: The study is cross-sectional and comprised 1,412 female nurses from 19 hospitals in Sofia having an average age of 50.3 ± 9.9 years. An ergonomic analysis of workplaces in hospitals was made. A survey was conducted in relation to the workplace, the workload, the working posture, and movements; Standardized Nordic questionnaires for the analysis of musculoskeletal symptoms were used, body mass index (BMI). Information on musculoskeletal diseases diagnosed by a doctor was collected with work ability index. The statistical analyses were made using SPSS.

RESULTS: The frequency of musculoskeletal complaints is high, complaints in the lower back being in the lead with 74.2%, followed by the back, neck, and shoulders. A musculoskeletal disorder, diagnosed by a doctor, occurs in 35.6% of the individuals. Widespread is the prolonged work in a standing position, awkward working postures, bending, twisting, and stretching. The data from the regression analysis show that the work with bending, twisting, and stretching, prolonged work in a standing position and BMI is predictors of musculoskeletal complaints.

CONCLUSION: The results indicate lack of good workplace organization and equipment. The activity involves prolonged work in a standing position, awkward working postures, and work with bending and twisting of the body. High is the incidence of musculoskeletal disorders and the undergone treatment related to them.

Introduction

The work of nurses in a hospital is associated with short deadlines for tasks, stress and anxiety, work in shifts, prolonged work, uncomfortable working postures, bending and twisting of the body, etc. [1], [2], [3]. There is a high risk of occurrence of musculoskeletal disorders in nurses, with data varying widely [4], [5].
through the graphic map of the human body enclosed to the questionnaire. The questionnaires cover the musculoskeletal complaints over a long period of time (the past 1 year). The data on the musculoskeletal disorders diagnosed by a doctor were collected using an adapted questionnaire for assessment of the work ability index, developed by the Finnish Institute of Occupational Health [15], translated, and adapted in Bulgaria [16]. Collected data were about the BMI [17]. Age aspects of the prevalence and localization of musculoskeletal disorders were studied, and the nurses covered were divided into two groups: <45 years of age and ≥45 years of age (Figure 1). The following statistical tests were used for the data analysis: Chi-square test, Student’s t-test, ANOVA and Stepwise regression analysis. The data were entered and processed using the statistical package SPSS.

Results

Musculoskeletal complaints occur in 97.5% of the nurses. Complaint related to only one area of the body occurs in 8.3%, 2–3 complaints – in 29.2%, and 3 or more complaints occur in 60% of the individuals.

The total number of musculoskeletal complaints is higher in the elderly (<44 years of age 4.19 ± 2.21; ≥45 years of age 4.39 ± 2.36), with no significant difference. There is a significant difference between the two age groups as regards the complaints in the neck area, higher in persons <44 years of age ($\chi^2 = 13.747$ p = 0.000). In persons ≥45 years of age, a higher frequency of complaints was registered in the area of the limbs, hands ($\chi^2 = 10.588$ p = 0.001), elbows ($\chi^2 = 3.957$ p = 0.049), wrist/fingers ($\chi^2 = 5.303$ p = 0.024), and knees ($\chi^2 = 20.450$ p = 0.000) (Figure 2).

Musculoskeletal complaints make difficult the daily activities of 49.4% of the nurses. A visit to a doctor during the last year happened to 46.8% of them. Treatment related to musculoskeletal complaints were applied to 62.6%, with 21.5% being hospitalized and the rest undergoing treatment on an outpatient basis.

A sick leave of up to 10 days was taken by 17.5% of the nurses and 5.1% used sick leave for a longer period.

A musculoskeletal disorder, diagnosed by a doctor, occurred in 35.6% of nurses. The most common are musculoskeletal disorders in the lower back and lumbar area, followed by those in the neck and the upper back (Table 1).

Table 1: Diagnosed by a doctor musculoskeletal disorders in nurses working in hospitals (n; %)

| Neck and upper back areas | Lower back and lumbar area | Pain when moving from back to leg | Limbs (arms and legs) | Rheumatoid arthritis | Other musculoskeletal disorders |
|---------------------------|-----------------------------|----------------------------------|-----------------------|----------------------|-------------------------------|
| 259 (18%)                 | 292 (21.3%)                 | 137 (10%)                        | 167 (12.2%)          | 38 (2.8%)            | 75 (5.5%)                     |

In persons over 45 years of age, the incidence of diagnoses made by a doctor for the neck and the upper back is higher (20.2% compared to 13.7% in younger nurses; $\chi^2 = 7.193$ p = 0.007). The elderly have a higher incidence of diagnoses made for lower back and lumbar pain (25.0% vs. 12.0% in younger nurses; $\chi^2 = 26.010$ p = 0.000), pain shifting from the back to the leg (11.5% vs. 6.2% in younger nurses; $\chi^2 = 8.155$ p = 0.004), and the limbs (14% vs. 7.6% in younger nurses; $\chi^2 = 9.938$ p = 0.001). BMI significantly affects the frequency of musculoskeletal complaints (F = 8.777 p = 0.000), include in the lumbar area (F = 4.130 p = 0.006) and knees (F = 9.881 p = 0.000) (Table 2).

Table 2: Relationship between BMI and musculoskeletal complaints in nurses in hospitals

| BMI (n; %) | Musculoskeletal complaints (n ≥ 50) | F | p |
|-----------|-----------------------------------|---|---|
| < 18.5    | 43 (3.7)                          | 3.88 ± 2.29 | 8.777 | 0.000 |
| 18.5 ≤ BMI< 24.9 | 553 (47.2) | 4.11 ± 2.22 | 0.000 |
| ≥ 25 BMI< 30 | 381 (32.5) | 4.51 ± 2.32 | 0.000 |
| ≥ 30 BMI   | 194 (16.6)                          | 5.03 ± 2.49 | 0.000 |

Nurses in hospitals often work under time pressure and uneven distribution of the workload, which is accompanied by a higher frequency of musculoskeletal complaints (Table 3).

The work of the nurses is dynamic, as the main working posture is standing upright for
56.5% of the individuals. In 26.5%, standing work covers part of the working time and is performed intermittently, with a change in the working posture. Working under good and very good working conditions is reported by 55.8% of the respondents.

Table 4: Impact of the working conditions on the frequency of performing a task in an awkward working posture, in nurses in hospitals

| Working postures | Frequency of performance | Poor and satisfactory working conditions (n, %) | Good and very good working conditions (n, %) | F  | p  |
|------------------|--------------------------|----------------------------------------------|---------------------------------------------|----|----|
| Work in          | No                       | 76 (12.5)                                    | 199 (28.5)                                  | 40.715 | 0.000 |
| An awkward       | Sometimes                | 215 (35.2)                                   | 306 (47.1)                                  |     |    |
| Working          | Often                    | 192 (31.5)                                   | 150 (19.5)                                  |     |    |
| Posture          | Always                   | 127 (22.6)                                   | 54 (7)                                      |     |    |

Table 5: Impact of the working conditions on the frequency of performing a task in an awkward working posture, with bending, twisting, and stretching, in nurses in hospitals

| Working movements | Frequency of performance | Poor and satisfactory working conditions (n, %) | Good and very good working conditions (n, %) | F  | p  |
|-------------------|--------------------------|----------------------------------------------|---------------------------------------------|----|----|
| Work with         | No                       | 31 (5.1)                                     | 85 (11)                                     | 25.226 | 0.000 |
| Bending           | Sometimes                | 157 (25.8)                                   | 280 (36.2)                                  |     |    |
| Twisting and      | Often                    | 212 (34.9)                                   | 283 (36.6)                                  |     |    |
| Stretching        | Always                   | 208 (34.2)                                   | 125 (16.2)                                  |     |    |

Discussion

Our data are in agreement with the studies of other authors who establish a high frequency of musculoskeletal complaints in nurses in hospitals [4], [5]. The frequency of complaints in the lower back, back, and neck is high [1], [3]. Studies have found variation in the frequency of musculoskeletal complaints by country, with differences in the applied methods and the evaluation criteria. [4], [5]. Data about the work, the workplace, and the equipment are scarce, making it difficult to compare results.

The frequency of musculoskeletal complaints is affected by the age of the workers, being higher in the elderly [6], [7]. Our data show difference between two age groups, but for number of all complaints and in the lumbar area did not reach statistical significance. The frequency of complaints in the limbs is higher, with a significant difference. In younger people, the frequency of complaints in the neck, shoulders, and back is higher and the difference is significant for the neck area. The results are in agreement with the studies of other authors, discussing the impact of psychosocial factors, stress and skills gaps in younger people, and lack of professional experience [18], [19].

In our study, almost half of the nurses covered by the survey have difficulty with the everyday activities due to musculoskeletal complaints. The proportion of the older nurses, diagnosed by a doctor as regards disorders in the neck and the upper back, the lower back and the waist, as well as pain moving from the back to the legs and the limbs, is higher, with significant difference. The data are in agreement with the studies of other authors [8]. The musculoskeletal complaints in nurses are affected by work organization (weekly working hours, daily working hours, and overtime work), time pressure, uneven distribution of the workload, etc. [22], [23]. A lot of nurses work often or always under the time pressure and uneven distribution of the workload, which is accompanied by a higher frequency of musculoskeletal complaints. Under these conditions, it is difficult to take short breaks and pauses, the options for a change in the working posture are diminished [13]. The working postures and movements are discussed as the most common risk factors for musculoskeletal disorders in nurses [3], [5], [24]. Our data related to nurses in emergency and intensive care units show a high frequency of performing work with bending, twisting, and stretching [25]. In our study, prolonged work in a standing position is to be encountered in the majority of individuals (56.5%), which is in agreement with other authors [3]. Good working conditions diminish the frequency and affect the frequency of musculoskeletal complaints, the difference for the lower
back being significant. A decrease is also observed in the performance of high-risk work movements (work with bending, twisting, and stretching). One possible reason is the improved ergonomic characteristics of the workplace (size of furniture and equipment, workplace organization) [24]. The data from the regression analysis show that work with bending, twisting, and stretching, work in a standing position and BMI is predictors of the musculoskeletal complaints, which is in agreement with the other authors [3], [6], [7].

Conclusion

A high frequency of musculoskeletal complaints has been established in nurses working in hospitals. The most common complaints concern the lower back, the back, and the neck. The disorders of the musculoskeletal system diagnosed by a doctor are in accordance with the complaints. The working postures and movements, as well as the characteristics of the work, affect the frequency of musculoskeletal complaints in nurses. The results suggest a further study of the ergonomic characteristics of the workplaces, related to improvement of the working conditions. Reducing the incidence of working postures and movements, creating a risk for the musculoskeletal system, should be one of the objectives when taking measures to protect workers’ health. Better organization and optimization of the activities will also contribute to the process of creating and maintaining occupational health and safety.

References

1. Ellapen TJ, Narsigan S. Work related musculoskeletal disorders among nurses: Systematic review. J Ergon. 2014;54:3. https://doi.org/10.4172/2165-7556.54-003
2. Hafner ND, Milek DM, Fikfak MD. Hospital staff’s risk of developing musculoskeletal disorders, especially low back pain. Zdr Varst. 2018;57(3):133-9. https://doi.org/10.2478/szhj-2018-0017
3. Abedini R, Choobineh AR, Hasanzadeh J. Patient manual handling risk assessment among hospital nurses. Work. 2015;50:669-75. https://doi.org/10.3233/WOR-141826
4. Soylar P, Ozer A. Evaluation of the prevalence of musculoskeletal disorders in nurses: A systematic review. MedScience 2018;7(3):479-85.
5. Azma BA, Rusli BN, Oxley J, Quek K. Work related musculoskeletal disorders in female nursing personnel: Prevalence and impact. Int J Collaborat Res Intern Med Public Health. 2016;8(3):294-8.
6. Bernal D, Campos-Serna J, Tobias A, Vargas-Prada S, Benavides FG, Serra C. Work-related psychosocial risk factors and musculoskeletal disorders in hospital nurses and nursing aides: A systematic review and meta-analysis. Int J Nurs Stud. 2015;52(2):693-48. https://doi.org/10.1016/j.ijnurstu.2014.11.003
7. Stanton N, Hedge A, Brookhuis K, Salas E, Hendrick H. Handbook of Human Factors and Ergonomics Methods. Boca Raton: CRC Press; 2005. p. 1-4.
8. Heiden B, Weigl M, Angerer P, Müller A. Association of age and physical job demands with musculoskeletal disorders in nurses. Appl Ergon. 2013;44(4):652-8. https://doi.org/10.1016/j.apergo.2013.01.001
9. Vester L, Verhagen E, Hengel K, Koppe L, van der Beek AJ, Bongers PM. The relation between body mass index and musculoskeletal symptoms in the working population. BMC Musculoskelet Disord. 2013;14:238. https://doi.org/10.1186/1471-2474-14-238
10. Ovcharov VL. Age-related changes in skeletal muscle. Soc Med. 2018;3:4:21-3.
11. Dong H, Zhang Q, Liu G. Prevalence and associated factors of musculoskeletal disorders among Chinese healthcare professionals working in tertiary hospitals: A cross-sectional study. BMC Musculoskelet Disord. 2019;20(1):175. https://doi.org/10.1186/s12891-019-2557-5
12. Sezgin D, Esin M. Predisposing factors for musculoskeletal symptoms in intensive care unit nurses. Int Nurs Rev. 2015;62(1):92-101. https://doi.org/10.1111/inr.12157
13. Oakman J, Neupane S, Nygård CH. Does age matter in predicting musculoskeletal disorder risk? An analysis of workplace predictors over 4 years. Int Arch Occup Environ Health. 2016;89(7):1127-36. https://doi.org/10.1007/s00420-016-1149-z
14. Kuorinka I, Jonsson B, Kilbom A, Biering-Sorensen F, Andersson G, et al. Standardized Nordic Questionnaires for the analysis of musculoskeletal symptoms. Appl Ergon. 1987;18(3):233-7. https://doi.org/10.1016/0003-6870(87)90010-x
15. Tuomi K, Ilmarinen J, Jahkola A, Katajarinne L, Tulkki A. Work Ability Index. Finland: Finnish Institute of Occupational Health Publication Office, Helsinki; 1998.
16. Mincheva L, Vangelova K. Working Capacity: Evaluation by Determining the Index of Working Capacity. Translation and Adaptation. Ruse: Danube Press; 2008.
17. WHO. Body Mass Index. Available from: https://www.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi [Last accessed on 2021 Jul 21].
18. Smedley J, Inskip H, Trevyelen F, Buckle P, Cooper C, Coggon D. Risk factors for incident neck and shoulder pain in hospital nurses. Occup Environ Med.2003;60:864-9.
19. Kalkim A, Midilli JS, Dogru S. Musculoskeletal disorder symptoms in nurses and etiological factors: A cross-sectional research. Ann Med Res. 2019;26(3):374-81.
20. June KJ, Cho SH. Low back pain and work-related factors among nurses in intensive care units. J Clin Nurs. 2011;20(3-4):479-87. https://doi.org/10.1111/j.1365-2702.2010.03210.x
21. Bozic A, Mikov I, Gajdobranski D, Brestovacki B, Ćitric Z. Influence of personal characteristics on the occurrence of lumbar pain in nurses. Med Pregl. 2018;71(1):65-9.

22. Trinkoff A, Le R, Geiger-Brown J, Lipscomb J, Lang G. Longitudinal relationship of work hours, mandatory overtime, and on-call to musculoskeletal problems in nurses. Am J Indus Med. 2006;49(11):964-71. https://doi.org/10.1002/ajim.20330
PMid:16691609

23. Vangelova K, Dimitrova I, Cekova I, Stoyanova R. Shift work and occupational stress in hospital nurses in Sofia. Acta Med Bulgarica. 2021;48(1):81-7.

24. Vinstrup J, Jakobsen M, Madeleine P, Andersen L. Physical exposure during patient transfer and risk of back injury and low-back pain: Prospective cohort study. BMC Musculoskeletal Disord. 2020;21(1):715.

25. Stanchev V, Vangelova K. Musculoskeletal injuries in nurses in emergency and intensive care units in hospitals. Bulgarian J Public Health. 2020;12(4):52-61.