

HOSPITAL STAFF'S RISK OF DEVELOPING MUSCULOSKELETAL DISORDERS, ESPECIALLY LOW BACK PAIN

TVEGANJE DELAVCEV, ZAPOSLENIH V BOLNIŠNICI, ZA NASTANEK BOLEZNI KOSTNO-MIŠIČNEGA SISTEMA IN VEZIVNEGA TKIVA, ZLASTI ZA NASTANEK BOLEČINE V KRIŽU

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Received: Jan 12, 2018

Accepted: May 7, 2018

Original scientific article

ABSTRACT

Keywords:

health-related absenteeism, musculoskeletal disorders, low back pain, healthcare employees, workplace health promotion

Introduction: Health-related absenteeism impacts individuals, companies, and society. Its consequences are reflected in the cost of benefits, substitutes, and reduced productivity. Research shows that musculoskeletal disorders (MSDs) are the most common work-related health problem reported by hospital staff. This study determines the groups at the Ljubljana University Medical Centre that are most susceptible to MSDs, especially low back pain.

Methods: Using data from the Health Data Centre of the Slovenian National Public Health Institute and the medical centre, this cross-sectional study analysed absenteeism among medical centre employees. The correlation between MSD / low-back pain risk factors and incidence was determined using logistic regression. An odds ratio was calculated to determine the probability of MSDs, most especially low back pain via sex, age, occupation, and education.

Results: Sick leave at the medical centre is higher than 5%, exceeding the Slovenian healthcare sector average. MSDs, as the main reason for absence, is significantly more frequent in women, non-medical staff, and employees with a maximum secondary school education. Among the MSDs, low back pain predominates as a reason for absence and is most frequent among nurses, midwives, and employees of 20 to 44.9 years old.

Conclusion: This study offers insight into the health status of medical centre employees. The high percentage of sick leave is mainly due to musculoskeletal disorders, including low back pain. This is an important basis for further monitoring and analysis of sick leave indicators and for planning systematic and continuous workplace health-promoting measures to manage ergonomic risk factors and reduce health-related absenteeism.

IZVLEČEK

Ključne besede:

zdravstveni absentizem, boleznimi mišično-kostnega sistema in vezivnega tkiva, bolečina v križu, zdravstveni delavci, promocija zdravja pri delu

Uvod: Zdravstveni absentizem ima pomemben vpliv na posameznika, podjetje in družbo. Posledice tega se lahko na ravni podjetja kažejo predvsem v stroških nadomestil zdravljenja, nadomeščanja kadrov in v zmanjšani produktivnosti. Najvišji delež zdravstvenega absentizma je posledica bolezni mišično-kostnega sistema in vezivnega tkiva (KMB). Te bolezni so najpogostejše pri zdravstvenih delavcih. V dosedanjih raziskavah še posebej izstopa bolečina v križu pri delavcih v zdravstveni in babiški negi, medtem ko je tveganje za nastanek bolečine v križu glede na starost delavca nekonsistentno. Cilj študije je bil na podlagi podatkov bolniškega staleža narediti poglobljeno analizo zdravstvenega stanja delavcev v zdravstveni ustanovi, na podlagi katere bi lahko oblikovali, izvedli in spremljali rezultate programov promocije zdravja na delovnem mestu. Želeli smo tudi ugotoviti, katere poklicne skupine v zdravstvenem zavodu so najbolj ogrožene zaradi KMB, posebej zaradi bolečine v križu, katere starostna skupina zdravstvenih delavcev je najbolj ogrožena ter kako na bolečino v križu vpliva socialni status.

Metode: V presečni študiji smo analizirali bolniško odsotnost delavcev UKC Ljubljana. Razlike v pogostosti pojavnosti KMB, posebej bolečine v križu kot najpogostejše diagnoze, med različnimi skupinami zaposlenih smo ugotavljali s testom hi-kvadrat. Povezanost med dejavniki tveganja in pojavnostjo KMB/bolečine v križu smo ugotavljali z logistično regresijo. Verjetnost za pojavnost KMB in bolečine v križu pri delavcih glede na spol, starost, poklicno skupino in doseženo izobrazbo smo ugotavljali z razmerjem obetov (RO).

Rezultati: Analiza bolniške odsotnosti kaže, da je odstotek bolniške odsotnosti v organizaciji večji od 5. Glavni vzrok zadržanosti z dela so KMB, ki se značilneje pogosteje pojavljajo pri ženskah, v poklicni skupini nezdravstvenih delavcev ter pri delavcih z doseženo največ V. stopnjo izobrazbe. Med KMB kot vzrok za bolniško odsotnost prevladujejo bolečine v križu. Te se značilneje pogosteje pojavljajo v poklicni skupini zdravstvene in babiške nege ter pri delavcih v starostni skupini od 20 do 44,9 leta.

Zaključek: Glavni vzrok zadržanosti od dela v UKC Ljubljana so KMB, ki se najpogosteje pojavljajo pri nezdravstvenih delavcih, medtem ko je bolečina v križu najpogostejši vzrok za bolniško odsotnost delavcev v zdravstveni in babiški negi. Posebej je zaradi bolečine v križu ogrožena skupina mlajših delavcev. Ugotovitve raziskave so pomembno izhodišče za načrtovanje ukrepov promocije zdravja pri delu za obvladovanje ergonomskih dejavnikov tveganja s ciljem zmanjšanja zdravstvenega absentizma in boljšega počutja delavcev.

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1 INTRODUCTION

Health-related absenteeism is a socioeconomic phenomenon that has an important effect on individuals, companies, and society in general. Factors influencing health-related absenteeism are diverse and are not linked exclusively to employee health status; they can be economic, psychological, social, and cultural (1, 2). At the individual level, the following negative effects of absence due to illness are mentioned most frequently: low personal income, limited opportunities for promotion and career development, and limited opportunities for changing jobs; in addition, absence due to illness significantly reduces work motivation and indirectly increases the chances of becoming unemployed (2-4). At the company level, the consequences of health-related absenteeism primarily show in the costs of treatment benefits and staff substitution, and in reduced productivity, which in turn can have a negative impact on the economy in general (2).

Work-related diseases are reported by 40 to 60% of the working-age population in the majority of EU countries (5). As a rule, absence due to illness is more frequent and longer among women, older employees, those exposed to more strenuous physical work, and those with low socioeconomic status (5, 6). According to an Irish study, the causes of long-term absence primarily include injuries, poor mental health, and back pain (7). In EU countries, musculoskeletal diseases (MSDs) have the highest prevalence among work-related diseases (8). A diagnosed MSD often leads to early retirement and is the prevailing risk factor for occupational disability, especially among women (9).

MSDs are also the main reason for health-related absenteeism among Slovenian employees (2, 10). In 2015, absence among the employees due to MSDs in Slovenia accounted for 2,320,498 calendar days lost. A single absence due to MSDs lasted 29 days on average and 2.82 calendar days were lost per employee due to this disease group (10).

The majority of studies exploring health-related absenteeism among health professionals focus on nurses, who usually represent the largest group of employees (11-14). Research findings also show that MSDs are the most frequent work-related health problem among hospital staff, especially nurses (11-14). In addition, MSDs and especially low back pain result in substantial financial costs, in which half of the costs related to absence from work and disability due to MSD can be ascribed to low back pain (13, 16, 17).

Based on the currently available literature, studies of MSDs and especially low back pain in healthcare occupational groups other than nurses and midwives are extremely rare (18-20). Moreover, data on the risk of low back pain by age group are not consistent (13, 17).

The aim of this study is to analyse in detail the health status of staff at the healthcare institute observed using sick-leave data in order to provide a basis for developing and implementing workplace health-promotion programs and monitoring their results. This study also examines the occupational groups at the healthcare institute observed that are most susceptible to MSDs and especially low back pain, and the age group that is at the greatest risk in this regard.

2 METHODS

This cross-sectional study analysed health-related absenteeism among Ljubljana University Medical Centre employees from January 1st to December 31st, 2014 and from January 1st to December 31st, 2015.

Anonymised and aggregated data on employee numbers and structure (sex, age, education, and occupation) were obtained from the Ljubljana University Medical Centre personnel records. Data for analysing health-related absenteeism for both years were obtained from the Health Data Portal of the Slovenian National Public Health Institute (hereinafter: the NPHI). The data on absenteeism were processed and presented using a social-medical method, which typically uses calendar days and closed cases per diagnosis during a period observed in order to calculate and present sick leave indices, such as the percentage of sick leave (% SL), the frequency index (FI), and severity (S).¹ Differences in the frequency of MSDs, especially low back pain, as the most frequent diagnosis, between various employee groups, were established using a chi-squared test. The correlation between MSD / low-back pain risk factors and incidence was determined using logistic regression. An odds ratio (OR) was calculated to determine the probability of MSD and low back pain occurrence in employees by sex, age, occupation, and education. A statistically significant difference was defined at $p < 0.05$. IBM SPSS Statistics 20.0.0 software was used for data processing.

¹The percentage of sick leave (% SL) refers to the percentage of calendar days lost per employee in 1 year. The frequency index (FI) refers to the number of sick leave cases per 100 employees, irrespective of the duration of individual sick leave. Severity (S) refers to the average number of calendar days lost per sick leave and reveals the average duration of a sick leave expressed in days.

3 RESULTS

3.1 Analysis of Employee Health at the Ljubljana University Medical Centre

On December 31st, 2014 and December 31st, 2015, the Ljubljana University Medical Centre had 7,778 and 7,884 employees respectively, or 6,168 (79.3%) / 6,246 (79.2%) women and 1,610 (20.7%) / 1,638 (20.8%) men (21, 22; Table 1).

Table 1. Occupational, age, and educational structure of Ljubljana University Medical Centre employees in 2014 and 2015.

	n (%)	
	2014	2015
Occupational structure		
Physicians and dentists	1,177 (15%)	1,212 (15%)
Nurses and midwives	3,791 (49%)	3,857 (49%)
Other health professionals	883 (11%)	884 (11%)
Non-health professionals	1,901 (24%)	1,910 (24%)
Other employees from other pay grades	26 (< 1%)	21 (< 1%)
Age structure		
<44.9 years	4,866 (63%)	4,896 (62%)
>45 years	2,912 (37%)	2,988 (38%)
Educational structure		
Up to and including secondary school degree	4,040 (52%)	3,974 (50%)
College or university degree	2,905 (37%)	3,055 (39%)
Specialisation, master's degree, PhD	833 (11%)	855 (11%)

The analysis of sick-leave indices at the Ljubljana University Medical Centre shows that in both 2014 and 2015, the percentage of sick leave was higher than 5 (2014: 5.52%; 2015: 6.10%) and exceeded that of the Slovenian healthcare sector in general (2014: 5.30%; 2015: 5.77%). The frequency index shows that every employee out of 100 was absent due to illness 1.4 times in 2014 and 1.8 times in 2015. The severity index, which shows the average duration of sick leave, was 1.6 days less compared to 2014 (Table 2).

Table 2. Comparison of sick-leave indices (% SL, FI, and S) at the Ljubljana University Medical Centre for 2014 and 2015.

	% SL	FI	S
2014	5.52	146.70	13.70
2015	6.10	184.43	12.07

% SL=percentage of sick leave, FI=frequency index, S=severity of disease in days

MSDs (%SL₂₀₁₄=1.01%; %SL₂₀₁₅=1.04%) are the main reason for the higher percentage of sick leave. Taking care of a family member is the most frequent reason for taking sick leave (FI₂₀₁₄=42.00; FI₂₀₁₅=52.49), and injuries and poisoning at work are the main reasons for the longest absence from work (S₂₀₁₄=65.47, S₂₀₁₅=68.57).

The percentage of sick leave differs by sex. MSDs account for the highest percentage of sick leave in women, whereas in men, the main reasons are non-work-related injuries and poisoning (Table 3).

Table 3. Percentage of sick leave (%SL) at the Ljubljana University Medical Centre by first five diagnoses in 2014 and 2015.

Condition	% SL			
	Women		Men	
	2014	2015	2014	2015
MSDs	1.15	1.18	0.35	0.43
Pregnancy, birth, and postnatal period	0.67	0.75	-	-
Taking care of a family member	0.67	0.72	-	-
Respiratory diseases	0.57	0.72	0.37	0.45
Non-work-related injuries and poisoning	-	-	0.48	0.43

% SL= percentage of sick leave

There were significant differences in the frequency of MSD incidence between men and women in 2014 ($\chi^2=40.55$, $p<0.0001$) and 2015 ($\chi^2=49.81$, $p<0.0001$). MSDs occurred more frequently in women than in men in both 2014 (OR=1.93; 95% CI=1.57-2.37, $p<0.0001$) and 2015 (OR=1.98; 95% CI=1.63-2.40, $p<0.0001$).

MSDs occurred more frequently in employees above 45 years of age. A comparison of the frequency of occurrence of various MSD diagnoses at the Ljubljana University Medical Centre shows that, compared to other diagnoses, low back pain (dorsalgia, diagnosis code M54) was the most common and occurred in half of all cases reported (51% in 2014 and 55% in 2015). The odds of developing low back pain among employees ranging between 20 to 44.9 years old were twice as high among employees ranging from 45 to 65 years old (Table 4).

Table 4. Odds ratio for MSDs and low back pain by age group at the Ljubljana Medical Centre, 2014-2015.

Age group	Period	OR	(95% CI)	χ^2	<i>p</i>
MSD					
45-65 years vs.	2014	2.46	2.13-2.83	163.21	<0.0001
20-44.9 years	2015	2.66	2.32-3.01	216.83	<0.0001
Low back pain					
20-44.9 years vs.	2014	1.83	1.40-2.39	19.77	<0.0001
45-65 years	2015	2.05	1.52-2.65	30.68	<0.0001

A comparison by an occupational group shows that non-health professionals² had higher odds of developing MSDs in 2014 (OR=1.89; 95% CI=1.63-2.20, $p<0.0001$) and 2015 (OR=2.28; 95% CI=1.99-2.62, $p<0.0001$) than health professionals. However, the results show that health professionals had higher odds of developing low back pain than non-health professionals in 2015 (OR=1.35; 95% CI=1.05-1.73, $p=0.02$; Table 5).

Another interesting finding is that, compared to all other occupational groups, nurses and midwives did not show a higher risk of developing MSDs in 2014 (OR=1.06; 95% CI=0.92-1.22, $p=0.38$). The same was also true in 2015 (OR=0.97; 95% CI=0.85-1.11, $p=0.66$), which cannot be said for low back pain: in 2015, the odds of nurses and midwives developing low back pain were nearly 1.5 times higher than that of other occupational groups (OR=1.41; 95% CI=1.10-1.80, $p<0.006$).

² Non-health professionals (mostly in public employee pay grade J) account for 25% of all employees at this healthcare institution and consist of various occupations: cooks, cleaning and maintenance staff, janitors, heating plant workers, electricians, plumbers, laundry staff, (administrative) secretaries, bookkeepers, accountants, IT specialists, materials managers, warehouse staff, and so on.

Table 5. Odds ratio for the occurrence of MSDs and especially low back pain in various occupational groups at the Ljubljana Medical Centre, 2014-2015.

	Period	OR	(95% CI)	χ^2	P
MSD occurrence					
Non-health professionals vs. health professionals	2014	1.89	1.63-2.20	72.26	<0.0001
	2015	2.28	1.99-2.62	174.71	<0.0001
Nurses and midwives vs. other employees	2014	1.06	0.92-1.22	0.76	0.38
	2015	0.97	0.85-1.11	0.19	0.66
Low back pain occurrence					
Health professionals vs. non-health professionals	2014	1.01	0.77-1.32	0.01	0.92
	2015	1.35	1.05-1.73	5.34	0.02
Nurses and midwives vs. other employees	2014	0.97	0.75-1.26	0.04	0.84
	2015	1.41	1.10-1.80	7.44	0.006

Social status certainly also affects the development of MSDs. Social status established based on educational level shows that in 2014, employees with a maximum secondary-school education had 2.4 times higher odds of developing MSDs compared to higher-educated employees (OR=2.41; 95% CI=2.07-2.80, $p<0.0001$). The same results were also obtained in 2015 (OR=2.49; 95% CI=2.16-2.86, $p<0.0001$).

Compared to higher-educated employees, those with a maximum secondary-school education were not at greater risk of developing low back pain.

4 DISCUSSION

The predominant diagnoses causing absence from work among employees at the Ljubljana University Medical Centre primarily include MSDs, which are also the main reason for health-related absenteeism among all employees in Slovenia (2, 10), in Europe (8, 16, 23), and globally (24).

Among MSDs, low back pain is the most frequent (13, 16, 17, 25-27). The occurrence of MSDs and especially low back pain has been well researched for health professionals, especially nurses (13, 17, 23, 28). Based on the available literature, exceptionally little research has been done on MSDs and especially low back pain among other health professions (18, 19, 20). Some older studies conducted at hospitals reported a high prevalence of MSDs and especially low back pain among non-health professionals, especially administrative and technical staff, who ascribed it to largely sedentary work and lifting or carrying heavy items (18, 19, 20).

Similar findings were also established in this study: the highest odds of developing MSDs were estimated for non-health professionals, who make up a very heterogeneous group at the medical centre. Their work is mostly associated with risk factors for developing MSDs, such as poor ergonomic posture, lifting, pushing, or carrying

heavy items, repeated movement, and static muscular activity (6, 23).

The findings of this study show that, compared to higher-educated employees, those with a maximum secondary-school education, who presumably have a low socioeconomic status, have higher odds of developing MSDs. Similar findings have also been established by other studies (5, 6). Namely, socioeconomic status (SES) has long been considered an exacerbating risk factor for developing MSDs that should not be ignored. In addition, SES also influences employees' capacity to deal with their health problems; employees with a lower level of education show a lower capacity in this regard (27).

This study also shows that health professionals and especially nurses and midwives have the highest odds of developing low back pain. The majority ascribe this to physical strain at work, such as providing care to moving and transporting patients, and lifting heavy loads (13, 15, 23). A Slovenian survey on health-related absenteeism also established that female health and social care employees are the most susceptible to low back pain (27).

In contrast to a 2016 survey conducted at Slovenian hospitals, which showed that it is primarily elderly employees that suffer from low back pain (17), this study reveals a higher risk of developing low back pain among younger employees: the odds of developing low back pain were twice as high among employees of 20 to 44.9 years old than among those of 45 to 64.9 years old. Similar findings were also obtained by Demšar et al. (13). Studies conducted on the general population also report the highest incidence of low back pain in the third decade of life (29). These results can at least be partly ascribed to the healthy worker effect (HWE) - a phenomenon in which employees experiencing low back pain already change jobs or retire as disabled when they are young, and so less absenteeism of this type may be observed at an older stage in life.

One of the weaknesses of this study may be the fact that it was carried out on the health staff of only one healthcare institution in Slovenia. However, it should be noted that this is an extremely large organisation with nearly 8,000 employees and therefore, it is highly likely that the findings obtained can be generalised to all health professionals employed at Slovenian hospitals. In addition, the impersonal approach, whereby the estimates were made based on anonymised and aggregated data, did not allow more complex analyses and additional inquiries about the possible causes of MSDs and especially low back pain.

A clear advantage of this study is that it includes non-health professionals employed at a hospital, who are clearly at risk in this regard. Namely, the majority of published research on MSDs in hospital staff largely describes health professionals, whereas non-health professionals have remained overlooked.

Therefore, in the future, it would make sense not only to monitor sick leave indices for all employees at the healthcare institution but also to conduct an analytical study that would also reveal as many important risk factors as possible for developing MSDs and especially low back pain among non-health professionals.

5 CONCLUSION

MSDs are the main reason for the high percentage of sick leave among Ljubljana University Medical Centre employees. They pose the greatest risk for non-health professionals, who make up an extremely heterogeneous and often overlooked group. The highest odds of developing low back pain were established for health professionals, especially nurses and midwives. The introduction of ergonomic measures in the workplace can prevent or alleviate many of these diseases. The authors of this study expect their findings to help health organisations plan systematic and ongoing workplace health promotion measures to manage the ergonomic risk factors. These measures should include setting up an ergonomic work environment (checking whether the workplace has ergonomic furniture, replacing non-ergonomic furniture with ergonomic furniture, and offering guided active breaks) and providing employee training, especially to vulnerable groups with a lower education level and a low SES, in order to reduce health-related absenteeism and improve employee wellbeing.

CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist.

FUNDING

The development-research tertiary project "Analiza morbiditete in invalidiziranja zaposlenih v UKC Ljubljana" (Analysis of Employee Morbidity and Disability Trends at the Ljubljana University Medical Centre) no. 2015-0014 received funding for the 2015-2017 period.

ETHICS COMMITTEE APPROVAL

The data analysed in this study were obtained from the national database maintained by the National Institute of Public Health and the database maintained by the Ljubljana University Medical Centre. The data were analysed without information about the identity of individuals. The study was conducted in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki). All of the analyses were performed on aggregated data and did not include personal information.

REFERENCES

1. Kocakulah MC, Galligan Kelley A, Mitchell KM, Ruggieri MP. Absenteeism problems and costs: causes, effects and cures. *Int Bus Econ Res J.* 2009;8(5):81-8.
2. Vučković R. Obvladovanje zdravstvenega absenzizma - izziv za družbo. In: Kos D, editor. *Zdravstveni absenzizem v Sloveniji: zbornik prispevkov iz prakse 14 podjetij.* Ljubljana: Zavoda za zdravstveno zavarovanje Slovenije, 2010:10-20.
3. Vingård E, Alexanderson K, Norlund A. Chapter 9. Consequences of being on sick leave. *Scand J Public Health Suppl.* 2004;32(Suppl 63):207-15. doi: 10.1080/14034950410021899.
4. Sieurin L, Josephson M, Vingård E. Positive and negative consequences of sick leave for the individual, with special focus on part-time sick leave. *Scand J Public Health.* 2009;37(1):50-6. doi: 10.1177/1403494808097171.
5. Spasova S, Bouget D, Vanhercke B. Sickpay and sickness benefit schemes in the European Union: background report for the social protection committee's in-depth review on sickness benefits. Brussels: European Commission, 2016.
6. Thorsen SV, Friberg C, Lundstrøm B, Ørnelius K, Sundell T, et al. Sickness absence in the Nordic countries. *Nordic Social Statistic Committee* 2015; 59. Accessed February 28th, 2017 at: <http://norden.diva-portal.org/smash/get/diva2:811504/FULLTEXT06.pdf>.
7. Employee absenteeism: a guide to managing absence. Dublin: Ibec International Research Unit, 2011. Accessed October 27th, 2016 at: [http://www.ibec.ie/IBEC/DFB.nsf/vPages/Research_and_surveys-Employer_issues-ibec-guide-to-managing-absence-16-05-2013/\\$file/Employee%20Absenteeism%20-%20A%20Guide%20to%20Managing%20Absence.pdf](http://www.ibec.ie/IBEC/DFB.nsf/vPages/Research_and_surveys-Employer_issues-ibec-guide-to-managing-absence-16-05-2013/$file/Employee%20Absenteeism%20-%20A%20Guide%20to%20Managing%20Absence.pdf).
8. Schneider E, Irastorza X. OSH in figures: work-related musculoskeletal diseases in the EU - facts and figures. Luxembourg: European Agency for Health and Safety Work (OSHA), 2010. Accessed February 28th, 2017 at: <https://osha.europa.eu/en/tools-and-publications/publications/reports/TERO09009ENC>.
9. Karlsson NE, Carstensen JM, Gjesadl S, Alexanderson KAE. Risk factors for disability pension in a population-based cohort of men and women on long-term sick leave in Sweden. *Eur J Public Health.* 2008;18(3):224-31. doi: 10.1093/eurpub/ckm128.

10. Nacionalni inštitut za javno zdravje. Kazalniki bolniškega staleža po spolu in skupinah bolezni. Accessed July 19th, 2016 at: https://podatki.nijz.si/pxweb/sl/NIJZ%20podatkovni%20portal/NIJZ%20podatkovni%20portal__3%20Zdravstveno%20stanje%20prebivalstva__3f%20Bolni%20a1ki%20stale%20c5%be/BS_TB1.px/table/tableViewLayout2/?rxid=7809fbbe-0840-43f5-955f- ea2101aabfdd.
11. Onishi T, Kurimoto S, Suzuki M, Imaeda T, Hirata H. Work-related musculoskeletal disorders in the upper extremity among the staff of a Japanese university hospital. *Int Arch Occup Environ Health.* 2014;87(5):547-55. doi: 10.1007/s00420-013-0898-1.
12. Yassi A, Lockhart K. Work-relatedness of low back pain in nursing personnel: a systematic review. *Int J Occup Environ Health.* 2013;19(3):233-44. doi: 10.1179/2049396713Y.0000000027.
13. Demšar A, Zorc J, Skela-Savič B. Povezave med izbranimi dejavniki tveganja in pojavnostjo bolečine v križu pri zdravstvenem osebju. *Obz Zdrav Nege.* 2016;50(1):57-64.
14. Fronteira I, Ferrinho P. Do nurses have a different physical health profile? A systematic review of experimental and observational studies on nurses' physical health. *J Clin Nurs.* 2011;20(17-18):2404-24. doi: 10.1111/j.1365-2702.2011.03721.x.
15. Zinzen E. Epidemiology: musculoskeletal problems in Belgian nurses. In: Reilly T, editor. *Musculoskeletal disorders in health-related occupations.* 49. Amsterdam: IOS Press, 2002:41-61.
16. Van Tulder M, Koes BW, Bouter LM. A cost-illness study of back pain in the Netherlands. *Pain.* 1995;62:233-40.
17. Skela Savič B, Pesjak K, Hvalič Touzery S. Pojavnost bolečine v križu med medicinskimi sestrami v slovenskih bolnišnicah in njene posledice. In: 9. Mednarodna znanstvena konferenca. Jesenice: Fakulteta za zdravstvo, 2016:58-69.
18. Troussier B, Lamalle Y, Charruel C, Rchiadi Y, Jiguet M, Vidal F, et al. Incidences socio-économiques et facteurs pronostiques des lombalgies par accidents de travail chez le personnel hospitalier du CHU de Grenoble. *Rev Rhum (Ed Fr).* 1993;60:144-51.
19. Massioroni F, Mian P, Olivato D, Bacis M. Exposure to the risk of the manual lifting of patients and the results of clinical study in 4 hospital establishments of northern Italy. *Med Lav.* 1999;90(2):330-41.
20. Bordes G, Oliva M, Fortin P. Le mal au dos: enquête sur les douleurs du dos et le travail assis. *Arch Mal Prof.* 1999;90:330-41.
21. Univerzitetni klinični center Ljubljana. Letno poročilo 2014. Ljubljana: Univerzitetni klinični center, 2015.
22. Univerzitetni klinični center Ljubljana. Letno poročilo 2015. Ljubljana: Univerzitetni klinični center, 2016.
23. Karahan A, Kavs S, Abbasoglu A, Aognan N. Low back pain: prevalence and associated risks factors among hospital staff. *J Adv Nurs.* 2009;65(3):516-24. doi: 10.1111/j.1365-2648.2008.04905.x.
24. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute of Occupational Safety and Health. *Musculoskeletal disorders and workplace factors: a critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back.* DHHS (NIOSH) Publication. 1997; (Supp 97-141).
25. Dos Reis RJ, La Rocca P de F, Silveira AM, Lopez Bonilla IM, Navarro I Gine A, Martin M. Factors related to sickness absenteeism among nursing personnel. *Rev Saúde Publica.* 2003;37(5):616-23.
26. Softič N, Smogavec M, Klemenc Ketiš Z, Kersnik J. Ocena pogostosti kroničnih bolezni med polnoletnimi prebivalci Slovenije. *Zdr Varst.* 2011;50(3):185-90. doi: 10.2478/v10152-010-0043-4.
27. Bilban M, Djomba JK. Zdravstveni absentizem in boleznj gibal. *Delo Var.* 2007;52(5):10-9.
28. Zorc J. Povezave med gibalno aktivnostjo in pojavnostjo bolečine v križu pri zdravstvenem osebju. *Zdr Varst.* 2012;51(3):207-22. doi: 10.2478/v10152-012-0024-x.
29. Duthey B. Priority medicines for Europe and the world: a public health approach to innovation: background paper 6.24: low back pain. Accessed November 13th, 2017 at: http://www.who.int/medicines/areas/priority_medicines/BP6_24LBP.pdf.