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# Assessment of workload and pain in hospital workers using the Standardized Nordic Questionnaire -NMQ during the COVID-19 pandemic – a cross-sectional study

## Ocena obciążenia pracą i występowanie bólu u pracowników szpitala badane za pomocą Standaryzowanego Kwestionariusza Nordyckiego -NMQ w czasie pandemii COVID-19 – badanie przekrojowe

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A – Development of the concept and methodology of the study/Opracowanie koncepcji i metodologii badań; B – Query - a review and analysis of the literature/Kwerenda – przegląd i analiza literatury przedmiotu; C – Submission of the application to the appropriate Bioethics Committee/Złożenie wniosku do właściwej Komisji Biotycznej; D – Collection of research material/Gromadzenie materiału badawczego; E – Analysis of the research material/Analiza materiału badawczego; F – Preparation of draft version of manuscript/Przygotowanie roboczej wersji artykułu; G – Critical analysis of manuscript draft version/Analiza krytyczna roboczej wersji artykułu; H – Statistical analysis of the research material/Analiza statystyczna materiału badawczego; I – Interpretation of the performed statistical analysis/Interpretacja dokonanej analizy statystycznej; K – Technical preparation of manuscript in accordance with the journal regulations/Opracowanie techniczne artykułu zgodne z regulaminem czasopisma; L – Supervision of the research and preparation of the manuscript/Nadzór nad przebiegiem badań i przygotowaniem artykułu

**STRESZCZENIE**

**OCENA OBCIĄŻENIA PRACĄ I WYSTĘPOWANIE BÓLU U PRACOWNIKÓW SZPITALA BADANE ZA POMOCĄ STANDARYZOWANEGO KWESTIONARIUSZA NORDYCKIEGO -NMQ W CZASIE PANDEMII COVID-19 – BADANIE PRZEKROJOWE**

**Cel pracy.** Celem pracy było ukazanie stopnia zaawansowania dolegliwości bólowych i problemów społecznych pracowników szpitala.
**Materiał i metody.** Badanie przeprowadzono w jednym ze szpitali w południowej Małopolsce. Badanie przekrojowe przeprowadzono w okresie od 1.11.2021 r. do 31.01.2022 r. Grupę badaną stanowiło 106 osób (93 (87,7%) kobiety i 13 (12,3%) mężczyzn) z oddziałów szpitalnych, pogotowia ratunkowego, pracowników administracyjnych oraz laboratorium analitycznego. Do badania pracowników wykorzystano Standardowy Kwestionariusz Nordycki w wersji polskiej (NMQ). Badanie przeprowadzono w czasie pandemii SARS-CoV-2, a respondenci włączyli się do badania dobrowolnie.
**Wyniki.** Ból w ciągu ostatnich 7 dni potwierdziło 65% ankietowanych, u ponad 65% ankietowanych ból pojawia się w czasie odpoczynku i snu. U 64% badanych ból występował po obu stronach ciała. Najsilniejszy ból odnotowany był najczęściej w odcinku lędźwiowym kręgosłupa, stwierdzono go u 54% ankietowanych. Średni ból wynosił prawie 5,35 w skali wizualno-analogowej (VAS).
**Wnioski.** Pandemia COVID-19 może mieć negatywny wpływ na kondycję fizyczną pracowników medycznych. Zaburzenia układu mięśniowo-szkieletowego związane z pracą (WRMSD) są powszechne i stanowią poważny, stale narastający problem.

**Słowa kluczowe:** pracownicy medyczni, choroby zawodowe, ból mięśniowy, NMQ, COVID-19

**ABSTRACT**

**ASSESSMENT OF WORKLOAD AND PAIN IN HOSPITAL WORKERS USING THE STANDARDIZED NORDIC QUESTIONNAIRE -NMQ DURING THE COVID-19 PANDEMIC – A CROSS-SECTIONAL STUDY**

**Aim.** The aim of the study was to show the degree of advancement of pain and social problems of medical employees.
**Material and methods.** The study was conducted in one of the hospitals in Lesser Poland. A cross-sectional study was conducted from 1.11.2021 to 31.01.2022. The study group consisted of 106 participants (93 (87.7%) women and 13 (12.3%) men) from hospital wards, emergency ambulance stations, administrative employees and an analytical laboratory. The Standardized Nordic Questionnaire in the Polish version – NMQ survey was used to survey employees. The survey was conducted during the SARS-CoV-2 pandemic, and respondents were included in the research voluntarily.

**Results.** Pain in the last 7 days was confirmed by 65% of the respondents, in more than 65% of the respondents the pain occurs during rest and sleep. In 64% of the subjects, pain was present on both sides of the body. The greatest pain was related to the lumbar spine in 54% of the respondents. The average pain is almost 5.35 on the Visual Analog Scale – VAS scale.
**Conclusions.** The COVID-19 pandemic may have had a negative impact on the physical and mental condition of medical workers. Work Related Musculoskeletal Disorders - WRMSD ailments are common and are a serious, constantly growing problem.

**Key words:** medical workers, occupational diseases, WRMSD, NMQ, COVID-19



## INTRODUCTION

The working environment of the hospital is characterized by numerous negative physical and psychological stimuli that have a negative impact on the body. Destructive physical stimuli include: heavy lifting, forced posture and repetitive movements, non-ergonomic work environment and exposure to chemical and visual factors, such as medical screens [1,2]. There are also negative mental stimuli at work, such as: responsibility for performed procedures, work under time pressure, shift work, as well as too much workload [1-3]. The COVID-19 pandemic has only deepened the problem of increased workload in hospitals and medical centers. The negatively increased effects on the psycho-physical burden during the pandemic and immediately after it are most visible in the staff working in emergency stations and intensive care units (ICU), who usually have the first, direct and long-term contact with coronavirus patients [3,4].

The concept that best characterizes work-related dysfunctions is the definition of work-related musculoskeletal disorders (WRMSD), which defines all musculoskeletal disorders and injuries as arising out of work or directly in the course of work. This is the so-called „Umbrella Heading" containing: various types of tendinopathy, bone syndromes, compression syndromes of vessels and nerves, as well as overloading of joint structures (e.g. meniscus) [1,2]. The symptoms are mainly pain in multiple places, with a specific location, lasting for a long period of time [1]. All these factors have a negative impact on the quality of work of medical groups, increasing absenteeism at work and reducing productivity. Employees often suffer from micro-injuries, mainly to the musculoskeletal structures and the nervous system [1]. The dominant and most troublesome ones include: persistent pain and the appearance of inflammation in the joints, muscles and tendons. The most common overloads occur in the area of the upper limbs and the spine [1]. Compression syndromes (e.g. carpal tunnel, brachial plexus compression) and pelvic pain in women are also common [1].

In the literature on the subject, the currently standardized method for assessing the occurrence of WRMSD syndromes is the Standardized Nordic Questionnaire – NMQ. This survey has been used in a number of clinical and cohort studies to assess the occurrence of this syndrome [1]. The NMQ questionnaire was used by Sharan D. et al. [5] when examining pain in 350 physiotherapists. In the study by Almhdawi KA et al. [6] the NMQ scale was used to assess musculoskeletal complaints among nurses during the COVID-19 pandemic in Jordan. The questionnaire is also widely used in research conducted in Poland. Mynarski, W et al. [7] used the NMQ questionnaire to assess pain among 93 nurses, and Zejda JE et al. [8] in a group of 477 office workers.

## AIM

The aim of the research is to present the severity of musculoskeletal ailments and the consequences resulting from them during increased work during the COVID-19 pandemic for hospital employees. The aim of this study is to determine the location and severity of the most common ailments of medical staff, and then to propose preventive measures aimed at these locations. Increasing the amount of work in medical professions may have far-reaching health effects in the later (even several years) time for medical workers who, working under stress, may be more exposed to the negative effects of overloading the body in terms of injuries at work. Research is needed that can effectively show what prophylaxis and prevention of overloading could be used in the event of an increased need for hospital work, as in the case of the SARS-CoV-2 pandemic. Currently, there are publications indicating the advancement of the pain problem, but there are not enough studies that could comprehensively show the consequences of the SARS-CoV-2 pandemic on the psycho-physical situation of medical staff and effective standard prevention programs.

## MATERIALS AND METHODS

The research concerned the impact of psychophysical load on pain, workload outside work and the need for treatment and absence of medical workers. A cross-sectional study was conducted from November 2021 to January 2022. The minimum sample size of 96 people was calculated so that it was possible to detect a medium effect (effect size 0.3 according to Cohen's definition, for Pearson's linear correlation testing) assuming a significance level of 0.05 and a power of 0.85. The study included employees with a permanent employment contract in the hospital. The Standardized Nordic Questionnaire survey was used to survey employees. The questionnaire was obtained from the original version by Kuorinka I. et al. [9], which was made available for research. The survey was translated into Polish based on the recommendation of Beaton D. et al. [10]. The translation from English into Polish was carried out by two independent native translators with academic education. Blind back-translation was then performed by another two translators with academic training. Source and final translations were compared by a multidisciplinary research team. The surveys were made available to 15 health sciences students to verify that the translation was fully comprehensible. The survey used for the research

consisted of two blocks. The first part of the survey contained six questions about personal data such as: gender, age, height, weight, seniority and occupation. The second part consisted of 10 questions with the possibility of single or multiple choice and descriptive answers. The first question concerned the occurrence of pain during the last 12 months. After a positive answer, the respondents were asked to identify the place where the pain occurred and about the single area of greatest pain (cervical spine, thoracic spine, lumbosacral spine, shoulder joints, elbow joints, wrist joints and hands, hip joints, knee joints, feet). Respondents were asked questions about the total duration of pain (every day, 1-7 days, 8-30 days, and more than 30 days but not every day) and whether pain was felt while resting or sleeping. There were also questions whether the pain affect their activity at work and outside of work, the need to change their duties at work and the need for specialist help, or the need to take time off due to pain (yes/no answers). The last question which was the Visual-Analog Scale with the possibility of marking the intensity of pain. The survey was completed by 124 people, however, 18 surveys had errors disqualifying the possibility of using them for analysis. In total 106 questionnaires of people from hospital wards, emergency medical services and administrative staff were used for the analysis. The study group was acquired through a traditional paper questionnaire, which was conducted in one of the district hospitals in Lesser Poland. The survey with participants was conducted with the heads of hospital departments and the research director collecting the questionnaires. The research was carried out during the pandemic, hospital restrictions and mandatory quarantine after detecting infection with the SARS-CoV-2 virus. The study participants were informed and consented to the use of health data for analyzes and scientific publications. Employees marked their own answers without viewing their medical records. The study was approved by the departmental Ethics Committee (approval no. 1072.6120.369.2020 consent dated January 20, 2021) for research involving humans. The characteristics of participants were presented in premade groups of persons with mild (VAS ≤ 4), moderate (VAS > 4 AND VAS ≤ 6), and severe (VAS > 6) pain according to tertile distribution of VAS score. Normality was assessed by the Shapiro-Wilk test. The quantitative variables were depicted as the mean and standard deviation and qualitative variables were depicted by counts and percentages. Significance was verificated by Student T/ANOVA test and Fisher exact test, dependently of type of the analysed feature. We adopted a significance level of 0.05. Additionally, Pearson correlation coefficient was calculated to show the association between VAS score and age of participants. R software (Development Core Team, Vienna, Austria, version 4.0.4) was used for all the statistical analyses.

# RESULTS

## General information about the group

The group of respondents consisted of 93 (87.7%) women and 13 (12.3%) men. The average age in the group was 43 years (21-68 years). Among the group of participants 99 (93.4%) of them declared themselves to be right-handed and 7 (6.6%) people declared their left hand dominant. The subjects' BMI was calculated, which averaged 25.3 kg/m2, the data are shown in Tab. 1.

Tab. 1. Assessment of the BMI of the respondents

| Variable | Average | Min | Max |
|---|---|---|---|
| Height [cm] | 166.5 | 152 | 187 |
| Weight [kg] | 70.2 | 47 | 105 |
| **BMI** | 25.3 | 19.4 | 42.6 |

The respondents were asked about their previous work experience on a 4-point scale, most employees had over 11 years of experience in the profession – 64% of respondents, the second largest group was the group working for 2-5 years in the profession – 18% of respondents, experience between 6-10 years – 12% of the respondents, and annual or less – 6% of the participants. In the group of respondents, the largest group were nurses – 66% of the respondents, followed by paramedics – 12.3% and administrative employees – 11.3%, the least numerous group were medical analysts – 6.6% and physiotherapists – 3.8%.

## Pain complaints in medical workers

In the survey, as many as 102 (96.2%) people indicated the occurrence of pain in the last 12 months. The respondents were asked two questions about the location of pain, one with the possibility of multiple choice and one with the possibility of marking the most painful zone. The areas with the most frequent overloads include the lumbosacral section of the spine, which was indicated by 82 (77.4%) people, and the upper cervical section, which was indicated by 66 (62.3%) people. The occurrence of pain with the possibility of selecting more than one area is presented in Tab. 2.

Tab. 2. Pain complaints of the respondents – quantitative comparison

| The place of pain | Number of respondents (% occurrence) |
|---|---|
| cervical spine | 66 (62.3%) |
| thoracic spine | 22 (20.8%) |
| lumbosacral spine | 82 (77.4%) |
| shoulder joints | 27 (25.5%) |
| elbow joints | 3 (2.8%) |
| wrist joints and hands | 15 (14.2%) |
| hip joints and thighs | 23 (21.7%) |
| knee joints | 20 (18.7%) |
| feet | 10 (9.4%) |

Medical workers were also asked about one area where the greatest pain occurs. Almost 54% of people pointed to the lumbosacral section of the spine, over 22% to the cervical

section of the spine, the fewest respondents indicated pain in the elbow joints – just over 1%, the areas of greatest pain are presented in Fig. 1.

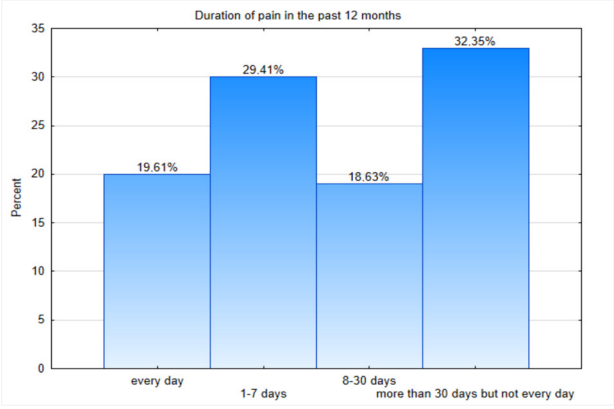


Fig 1. The greatest pain complaints of the respondents – percentage comparison

Pain in the last 7 days was confirmed by as much as 65% of respondents, in 35% this pain did not occur. In 64% of the subjects, pain was present on both sides of the body, 22% of people indicated pain on the right side, and 14% felt pain only on the left side of the body. In the question about pain during rest and sleep, as many as 65% of the respondents complained about pain and nuisance, 35% of people did not confirm pain during rest.

## Social factors and constraints by work

In the next question, the participants were asked to indicate the need to see a specialist. When it comes to 40% of respondents, they indicated the necessity of such a visit, while 60% did not have such a necessity.

According the question about the necessity of absenteeism from work, almost 13% of the respondents reported the need for a leave of 1-7 days, 4% of the respondents for a leave of 8-30 days, and 3% of a leave of over 30 days. For over 30% of the surveyed, ailments negatively affect activity outside work, almost 10% limit activity at work, and almost 20% of people indicate limitations both at work and outside of work. These data are shown in Fig. 2. When asked about the necessity to change their job, almost 11% of the respondents were forced to change their job due to the occurrence of ailment.

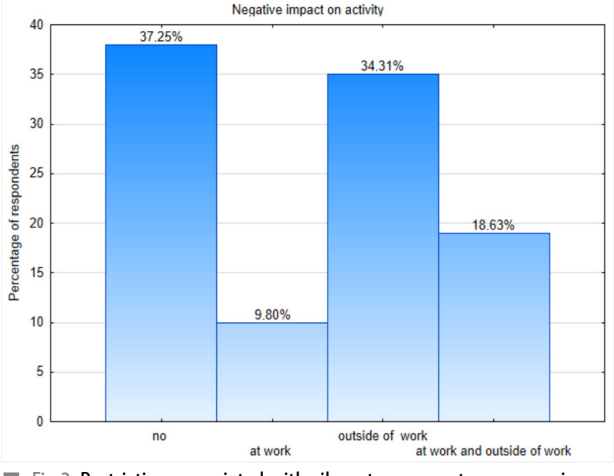


Fig 2. Restrictions associated with ailments – percentage comparison

The average pain intensity was assessed by the respondents at almost 5.35 on the VAS scale [min 2; max 9; SD 1.99]. This result in the Student's t-test for a single sample is statistically significant ($p<0.00$).

The duration of pain determined in the last 12 months in medical workers varied, however, it was large. When it comes to 20% of respondents, they indicated pain that has been present every day for the last year, almost 30% indicated pain lasting from 1-7 days and nearly 20% suffered from pain 8-30 days, and as many as. More than 30% indicated that the pain lasted for more than 30 days, but was not burdensome every day. The data is shown in Fig. 3.

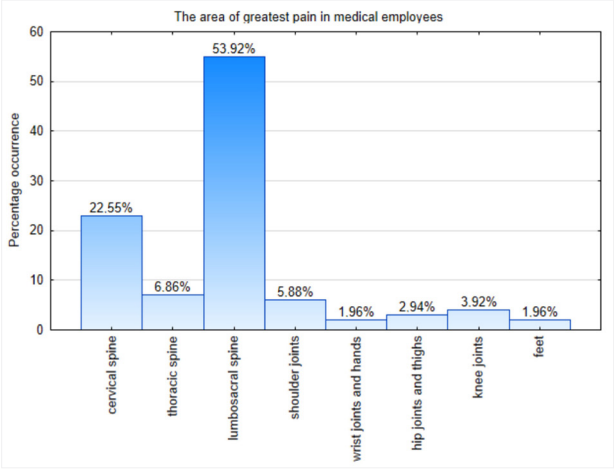


Fig 3. The duration of pain in the respondents - percentage comparison

The intensity of pain was characterized on the VAS scale depending on the occupation performed, no statistically significant relationships were found in the Student's t-test, the data are presented in Tab. 3.

Tab. 3. Correlation between occupation and pain intensity on the VAS scale

| VAS | Mean (SD) | Median [Min, Max] |
|---|---|---|
| Administrative | 5.92 (1.88) | 6.50 [3.00, 9.00] |
| MLT | 4.57 (1.72) | 5.00 [2.00, 7.00] |
| Nurse | 5.30 (2.12) | 6.00 [0.00, 9.00] |
| Paramedic | 5.23 (1.42) | 5.00 [4.00, 8.00] |
| Physiotherapist | 6.25 (2.06) | 6.50 [4.00, 8.00] |
| Overall | 5.35 (1.99) | 5.50 [0.00, 9.00] |
| p# Student T test | 0.571 | |

The relationship between age and pain intensity was also assessed. It was noticed that in higher pain categories, there is a higher average age, which is illustrated in table 4, and that the higher the age, the greater the pain on the VAS scale, which is confirmed by the correlation ($P = 0.380$, $r < 0.0001$ Pearson correlation coefficient), the results are shown in Fig. 4.

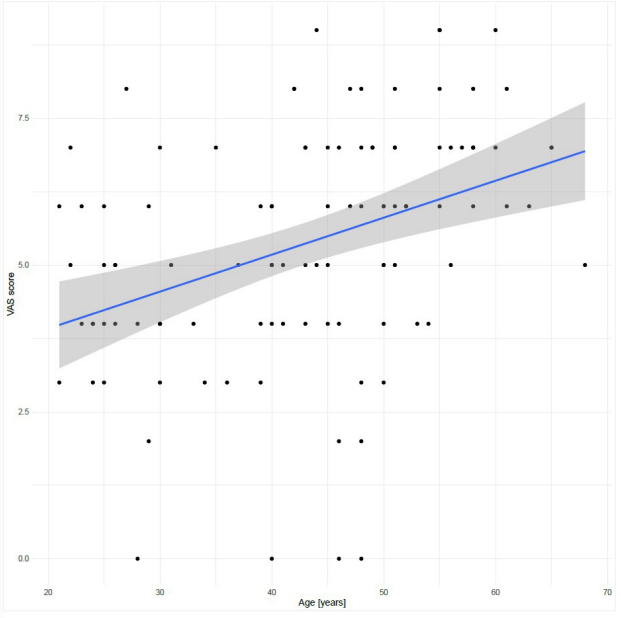


Fig 4. Correlation of participants' age and pain intensity on the VAS scale

## DISCUSSION

Musculoskeletal disorders WRMSD are a serious problem concerning work-related injuries and overloads affecting many medical groups. Overload complaints, particularly related to WRMSD, affect many medical groups, including doctors, nurses, paramedics and physiotherapists [1]. In the study by Sharan D. et al. [5], musculoskeletal pain was reported by 88% of physiotherapists: lower back pain in 62% and upper back pain in 59%. The average age in the group was 28 years old. In own study, lower back pain affected 77.4% and upper back pain – 62.3% – these data are consistent, while the average age in our own group was higher – 43 years. In their own research, physiotherapists rated the pain intensity on the VAS scale at 6.25 (SD: 2.06). In the study by Saleem M. et al. [11], pain symptoms are present in nurses: 58% had an average level of muscle pain, more than 30% experienced severe pain between the ages of 22 and 30 (n=250). A survey by Fátima D. et al. [12] among 254 oral hygienists in Portugal showed pain in the cervical spine and pelvic region in more than 50%. A systematic review by Clari M. et al. [13] analyzing 22 studies involving more than 3,500 nurses combined: reported the greatest pain in the lower back (62%), knee (47%), shoulder (44%), waist (42%), neck (39%), ankles (35%), upper back (34%), hands and wrists (29%) and elbows (18%). Research by Sandos E. et al. [14] using a modified NMQ form with the participation of nurses from orthopedic departments (n=29) showed pain in 96.6% of respondents in at least one of the following places during the 12 months preceding the study: lower spine (79.3%), upper spine (75.9%), neck (65.5%), shoulders (62.1%), feet (55.2%) and hands (51.7%). The average age of the surveyed people was 41.3 years and 86% of the surveyed were women. Own study presents the results most consistent with the above; both studies used the NMQ survey. Our study confirmed the occurrence of pain in the 12 months preceding the study in as many as 96.2% of respondents. The severity of the symptoms is also similar, the average age in our study is only 1.7 years higher. A survey by Krishnan KS. et al. [15] on 300 nurses showed work-related pain in the last 12 months in 97.3%: lower back (86.7%), ankles (86.7%), neck (86%), shoulders (85%) and upper back (84.3%). Research done by Santos RA. [16] shows pain in 71.6% paramedics, 89.5% of nursing technicians, 73.3% of nurses, 55.6% of ambulance drivers and 50% of physicians. The research was conducted on a group of 95 participants assessed using the NMQ questionnaire. The greatest pain was observed in the lumbar spine, knee joints and cervical spine. In a study of the quality of life of nurses during the COVID-19 pandemic by Almhdawi KA. et al [6], the questionnaire was completed by 245 nurses. Using the NMQ questionnaire, they obtained the results: 75.5% of the participants had low back pain, 52.7% of the participants had neck pain, and 49% complained most about knee pain. When it comes to 86.5% of the respondents, they indicated joint pain for at least 7 days, and 62.9% had limited daily activity in the last 12 months. Pain in the VAS was assessed by the respondents as 4.41 on average. The mean age in the group was 35 years, almost 40% of the respondents were men. Similar results were obtained in our own research – as much as 65% respondents indicated pain in the last 7 days. Only nurses in our study rated the pain at 5.30 (SD: 2.12) on the VAS scale. Research in Poland also indicates a high percentage of musculoskeletal ailments. A cross-sectional study by Zejda JA et al. [8] shows the occurrence of pain in the upper back (49.6%), in the lower back (50.1%), in the neck (55.6%), arms (26.9%) and wrists or hands (29.9%), and the least frequently elbows (13.3%) in office workers. Our own research confirms the occurrence of severe pain in administrative workers, assessed on the VAS scale at 5.92 (SD: 1.88). In a study by Mynarski W. et al. [7] concerning 93 nurses with an average age of 41.4 years, pain was reported in 61% of respondents in the lower back, upper back (43%), neck (37%) and arms (32%). Both of the above studies used the NMQ questionnaire. Own research confirms the very frequent occurrence of pain: in the lumbar-sacral spine (77.4%), cervical spine (62.3%), thoracic spine (20.8%). Minor ailments in the joints of the upper limb: shoulder joints (25.5%), elbow joints (2.8%), wrist joints and hands (14.2%), and lower limbs: hip joints and thighs (21.7%), knee joints (18.7%), feet (9.4%). The average age partially coincides with our own research, indicating the direction of the relationship: the greater the age, the greater the intensity of pain, which is consistent with the research of Sandos EC. et al. [14] and Almhdawi KA. et al [6], but differs from the research of Saleem M. et al. [11], where severe pain symptoms are observed in younger age groups. This may be related to the selection of the group and the nature of the work performed. In the research by Sandos EC. et al. [14] 65.5% of respondents state the need for leave due to health conditions, including 42.1% as diseases of the musculoskeletal system. Ailments constitute a serious problem of absenteeism from work. This is also confirmed by own research – almost 20% of respondents took time off work as a result of overload symptoms with varying lengths of leave, while almost 11% changed their job due to the severity of the symptoms.

## Implications for practice

Currently, various prophylactic and preventive programs are being tested (as in the study by Marshall L. et al. [17]), such as the purchase of lifts or kinesiological training, and the impact of recreational physical activity (as in the study by Mynarski, W. et al. [7]) on the severity of symptoms is also assessed. Information and preventive campaigns regarding WRMSD are constantly being conducted, such as Prevention of work-related musculoskeletal disorders (MSDs) planned for 2020-2022 by the Healthy Workplaces Campaign (HWC) [1]. However, further research is needed to assess the severity of workers' overuse complaints and to develop further preventive measures that may improve the quality of life of hospital workers.

## CONCLUSIONS

The Covid-19 pandemic has shown how important work in hospitals is. Medical workers, especially nurses, were burdened with additional work, more hours and more stress. Increasing the number of responsibilities may have had a direct impact on the deterioration of their health. The greatest pain occurs in the lumbar, sacral and cervical spine. One-third of employees reported feeling pain every day over the past year. The presented research and our own research show that during and before the pandemic, medical workers were forced to take sick leave due to deterioration of their health, changing jobs and seeking help from specialists. The current situation indicates a high incidence of pain associated with work in medical professions, which may translate into a deterioration of the health of health care workers in the coming years.

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