

PREREQUISITES FOR THE DEVELOPMENT OF PREVENTIVE MEASURES AGAINST OFFICE SYNDROME AMONG WOMEN OF WORKING AGE

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Abstract

The purpose of the article is to study prerequisites for the development of preventive measures against office syndrome among women of working age.

Material and methods. The research involved 52 female office employees 21 to 57 years old.

Results. The extended clustering of the original data using EM method with the performance of V-fold crosschecking has shown that female office employees are clearly divided into two clusters depending on the manifestation of office syndrome. Despite our assumptions, their division does not depend on age or length of service in the office, but on the manifestation of office syndrome and behavioral characteristics in the work process. Women assigned to different clusters are characterized by statistically significant ($p < 0.05$) differences between the level of pain in the joints and spine. The research has found that among female office employees with increased musculoskeletal pain, there are statistically significantly ($p < 0.05$) more women with significant overweight and spinal diseases. They are less likely to take active breaks when working at a computer and a larger percentage of them use information technology for entertainment purposes outside the office for 3-4 hours a day. However, a smaller percentage of them work with a PC for more than 7 hours a day. Women with predominant musculoskeletal pain differ in their lifestyle and point to fundamentally different reasons that stop them from taking measures to prevent the risk of occupational diseases. In particular, among female office employees with no office syndrome, a statistically significant ($p < 0.05$) larger share does not need to expand knowledge about the organization of health care in the office and among them the share of those who lead a passive lifestyle predominates.

Conclusions. Thus, these women are potentially at risk of developing office syndrome and, with the absence of preventive measures, are expected to move to the cluster of women with signs of office syndrome. The results of the research indicate the need for different approaches to planning health measures in the work environment, depending on the presence of office syndrome and the level of their responsible attitude to health in the work process.

Keywords: musculoskeletal pain, syndrome, posture, spine, prevention.

Introduction

The development of science, improvement of medical services and the emergence of new reproductive technologies have contributed to the spread among Ukrainian women of the European demographic trend of increasing birth age, including the first birth (Aksonova, 2019). Thus, according

to the State Statistics Service of Ukraine, the average age of a mother at the birth of the first child was 25.9 years old (from 23.4 in Zakarpatska region to 29.2 in Kyiv). The desire to achieve career success, to succeed as a person, the lack of a flexible work schedule along with the reduction in the number of public institutions for children, as well as the social insecurity of young families are the reasons that often force women to delay childbearing to 30-35 years old or more. In turn, it creates a problem of ensuring the uncomplicated

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course of pregnancy after 35 years (Zhabchenko et al., 2019). Therefore, in order to bear, give birth and then raise a healthy child, a woman must maintain her own health and take care of herself.

On the other hand, Ukraine is carrying out a pension reform, one of the steps of which is the rise of the retirement age, including for women (Haiduk, 2018). Increasing competition in the labor market, labor intensity and the need for continuous professional development require significant energy, physical, emotional, intellectual costs, and, consequently, good health.

It is well-known fact that the disease is easier to prevent than to cure. Therefore, experts have intensified their search for the most effective forms of supporting the health of women of working age (Kashuba et al., 2019, 2020). However, only a high level of self-determination of women in health care, i.e. a responsible attitude to maintaining their health, may allow realizing their work and personal potential and may guarantee a job in the labor market until retirement age.

In the information age, the share of people involved in mental work is growing steadily. Currently, many women work in the office. Until recently, office work was considered the most acceptable for women and did not involve any health risks. However, it is now confirmed that office workers, under the influence of adverse factors of the working environment, are prone to office syndrome, which experts understand as a number of disorders, including posture disorders, musculoskeletal pain, carpal tunnel syndrome, headaches, obesity, etc. (Savytska, 2020).

Taking into account the exceptional importance of health as a vital resource, in our opinion, the issues of maintaining the health of female office employees and formation of self-determining behavior in health have become unprecedentedly urgent and need to be addressed immediately.

The purpose of the research is to study prerequisites for the development of preventive measures against office syndrome among women of working age.

Material and methods

Study Participants

The research involved 52 female office employees 21 to 57 years old.

Study Organization

The study involved theoretical research methods, online surveys, assessment of the level of musculoskeletal pain using a visual-analog scale (VAS technique) (Tomilina, Byshevets, 2018; Kashuba, Stepanenko et al., 2020), statistical analysis using cluster (Britvikhin et al., 1994), frequency and comparative evaluation.

The survey, developed using Google Forms, was distributed via social networks and using the most popular messengers Viber and Telegram. It should be noted that the use of Google Forms made it possible to distribute the survey via social networks and messengers, to get the results of the survey in MS Excel spreadsheet and view statistical data analysis online, which greatly simplified the survey procedure and allowed to involve a wider range of people.

Statistical Analysis

The STATISTICA software package developed by StatSoft to perform statistical analysis was used for data processing.

The division of female office employees into subgroups was carried out using the module "Generalized EM and k-means cluster analysis", available in the module of cluster analysis of the software package STATISTICA. The research also used extended EM clustering (probability-based clustering). This allowed dividing the set of obtained data, which were both continuous and categorical variables, into clusters. The best solution to the task of clustering was provided by performing a V-fold crosscheck, which allowed automating the process of selecting the optimal number of clusters according to the observed data. In addition, the application of this module allowed determining the presence of statistically significant differences at a given level of significance between all indicators of female office employees assigned to different clusters.

The hypothesis H0 about the conformity of data to the normal distribution law was checked using the Shapiro-Wilk consistency criterion W (Kashuba, Tomilina et al., 2020). Since the statistical processing revealed that the samples formed from the studied indicators did not correspond to the normal distribution law, the average indicators of work experience, age and intensity of musculoskeletal pain are presented in the form of median and interquartile range Me (25; 75).

The comparative analysis between the level of pain in the spine and joints was performed using non-parametric Mann-Whitney test (Byshevets et al., 2019), and the comparative analysis between categorical variables – using the Pearson correlation coefficient and Fisher's angular criterion ϕ (Byshevets, Denysova et al., 2019a; Byshevets, Shynkaruk et al., 2019b).

The level of statistical significance was taken as $\alpha=0.05$ ($p<0.05$).

The value of p was rounded to the thousandth, and in the case when the value of p-level was less than 0.001, the value of p is given in the standard form.

Results

During the development of preventive measures against the risk of office syndrome among women of working age and the formation of a responsible attitude to health when working at a computer, the results of the survey of female office employees were subject to clustering. The preliminary analysis revealed female office employees are clearly divided into two clusters. Figure 1 shows the first cluster is formed by slightly older female office employees with less experience of a PC user, who have pain in the joints and spine, and the second – by younger women who have a bigger work experience, but are characterized by less pronounced musculoskeletal pain (Fig. 1).

The first cluster included 13 women with an average age of 46.5 (40.0; 49.5) and experience of a PC user 13.0 (7.5; 20.0) years. The second, more numerous cluster, consisted of 39 women with an average age of 40.0 (38.0; 42.0) and experience of a PC user 17.0 (14.0; 20.0) years. The statistical processing of the research results has shown that women

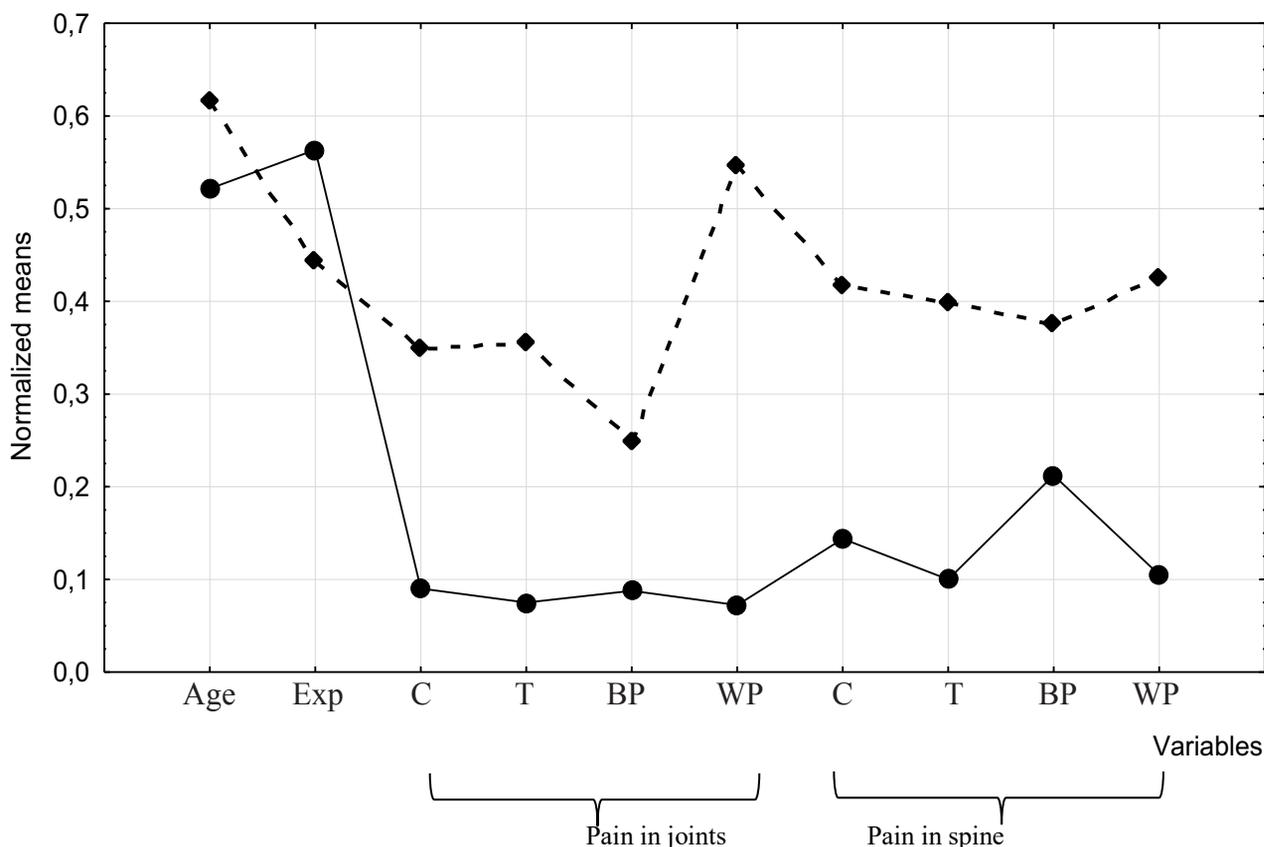


Fig. 1. Graph of means for continuous variables: ◆ Cluster 1; ● Cluster 2; where C – current pain level; T – typical level; BP – pain level in the best period; WP – pain level in the worst period

Table 1. Comparative analysis

N	Indicators	Average values						ANOVA for continuous variables						
		Cluster 1, n=13			Cluster 2, n=39			Between SS	df	Within SS	df	F	p value	
		Me	25%	75%	Me	25%	75%							
1	Age, years	46.5	40.0	49.5	40.0	38.0	42.0	106.19	1	2214.64	50	2.40	0.127	
2	Work experience, years	13.0	7.5	20.0	17.0	14.0	20.0	75.42	1	1540.64	50	2.45	0.124	
3	Pain in joints, score	Current	1.5	1.0	2.0	0.0	0.0	1.0	15.60	1	28.15	50	27.71	3·10 ⁻⁶
		Typical	2.0	1.5	3.5	1.0	0.0	1.0	46.04	1	59.27	50	38.84	<0.05
		Best period	1.0	0.0	1.0	0.0	0.0	1.0	3.90	1	23.10	50	8.44	0.006
		Worst period	4.0	2.5	8.0	1.0	0.0	1.0	168.04	1	112.02	50	75.01	<0.05
4	Pain in spine, score	Current	1.0	0.5	3.0	1.0	0.0	1.0	11.00	1	36.44	50	15.09	3.0·10 ⁻⁴
		Typical	3.0	1.0	5.5	1.0	0.0	1.0	66.46	1	120.52	50	27.58	3.11·10 ⁻⁶
		Best period	1.0	0.0	1.0	0.0	0.0	1.0	0.98	1	16.03	50	3.04	0.087
		Worst period	3.0	2.0	7.5	1.0	0.0	1.0	94.52	1	184.15	50	25.67	5.92·10 ⁻⁶

assigned to different clusters are characterized by statistically significant ($p < 0.05$) differences between the level of pain in the joints and the level of pain in the spine except for the best period indicator (Table 1).

It should be stressed that, in contrast to the level of musculoskeletal pain, no statistically significant differences were found between the age and work experience of female office employees in different clusters ($p > 0.05$).

The research has found that in addition to increased musculoskeletal pain, women belonging to cluster 1 have

other statistically significant ($p < 0.05$) manifestations of office syndrome, namely overweight, musculoskeletal system disorders. The share of women with spinal diseases is also bigger.

In addition, the research has established the presence of statistically significant ($p < 0.05$) differences between the level of responsible attitude to the preservation of own health depending on the cluster. The study has revealed that female office employees differ in the following types of self-determination: control of the working posture of a PC user,

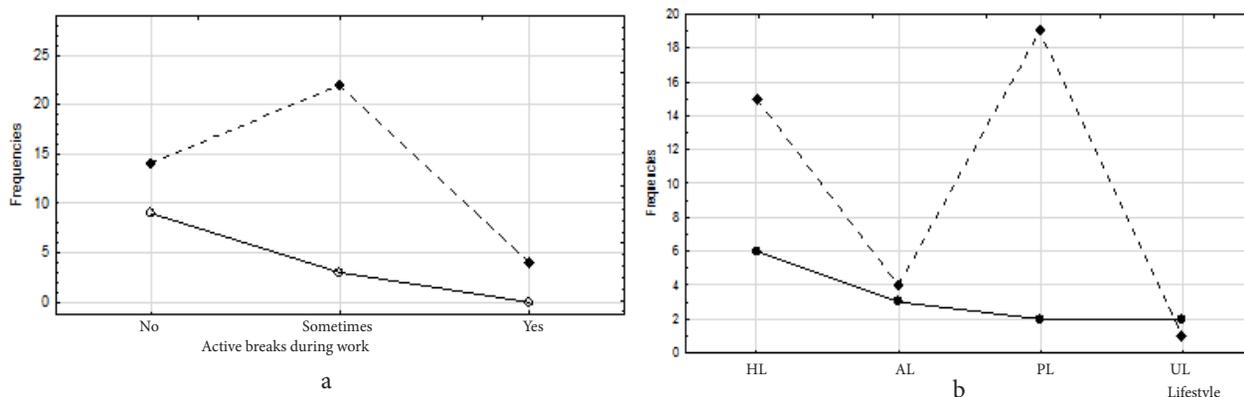


Fig. 2. Graphic analysis of women’s answers to individual questions depending on the cluster, n=52: ◆ Cluster 1; ● Cluster 2; where HL – healthy lifestyle; AL – active lifestyle; PL – passive lifestyle; UL – unhealthy lifestyle

Table 2. Comparative analysis of the results of the survey of female office employees, n=52

N	Survey questions / Questions answered in the affirmative	Independence test for categorical variables					Cluster				p; df=1
		df	Chi-square	p value	G-square	p value	Cluster 1, n=13		Cluster 2, n=39		
							n	%	n	%	
1	Body weight / Presence of significant excess body weight	3	9.29	0.021	12.21	6.7·10 ⁻³	4	30.7	3	7.7	0.042
2	Duration of work with a PC / duration for more than 7 hours a day	4	14.56	0.005	16.66	0.002	3	23.1	28	71.8	0.003
3	Duration of use of IT for entertainment purposes / duration for 3-4 hours a day	3	6.41	0.093	5.53	0.137	4	30.8	2	5.1	0.021
4	Knowledge of ergonomically optimal posture	2	2.28	0.320	2.32	0.314	2	15.4	7	17.9	0.601
5	Posture care	2	2.86	0.239	3.14	0.208	4	30.8	9	23.1	0.415
6	Control of a working pose of a PC user	2	6.95	0.031	6.87	0.032	1	7.7	8	20.5	0.275
7	Systematic classes of health-improving motor activity / Systematic classes	2	4.85	0.089	4.68	0.096	3	23.1	8	20.5	0.562
8	Performing active breaks while working with a PC	2	4.86	0.088	5.71	0.058	4	30.8	25	64.1	0.038
9	Self-massage	2	1.37	0.504	1.44	0.488	2	15.4	5	12.8	0.568
10	Condition of the spine / No spine diseases	2	20.44	0.000	19.39	0.000	6	53.8	39	100	2.9·10 ⁻⁵
11	No joint pain	7	10.40	0.167	10.80	0.148	2	15.4	18	46.2	0.046
12	No pain in the spine	6	16.37	0.012	16.21	0.013	1	7.7	15	38.5	0.035
13	Used measures / Availability of the workplace taking into account ergonomic requirements	16	22.67	0.123	26.27	0.050	0	0	5	12.8	0.222
14	Level of the musculoskeletal system / High and good condition of the musculoskeletal system	3	3.82	0.281	3.65	0.302	3	23.1	16	41.0	0.205
15	Obstructive factors / Lack of knowledge and skills as interfering factors	11	22.45	0.021	24.34	0.011	1	7.7	14	35.9	0.049
16	Lifestyle / Dominating passive lifestyle	3	6.79	0.079	6.77	0.080	2	15.4	19	48.7	0.033
17	Need for knowledge regarding the organization of health care measures in the office / No need for knowledge or doubts about its need	3	4.25	0.235	6.62	0.085	0	0	10	25.64	0.040

Note: p – Fisher’s exact criterion; p <0.05 – proved statistically significant differences between the shares of female office employees assigned to different clusters, which gave an affirmative answer

health-supporting physical activity, and performance of active breaks during the working day.

It should be noted that after assessing the differences between the distributions of female office employees assigned

to different clusters according to the survey answers, the research focused on the study of those questions in which the distributions differed statistically significantly. In such cases, we performed a graphical analysis and assessed

the differences, after which we decided on combining the individual gradations of responses and reducing their number to two possible. For example, Figure 2a shows that among the female office employees included in cluster 2, there are significantly more those who always or from time to time take active breaks during the performance of professional duties compared to women who make up cluster 1. Therefore, by reducing the number of gradations, we combined the number of women who take or sometimes take breaks to perform mini-sets of exercises during the working day in the office. Similarly, a visual analysis of Figure 2b shows that the maximum differences between women depending on the cluster in answering the question "What lifestyle is typical for you" are observed in the answer "I lead a passive lifestyle". Thus, when reducing the number of gradations, we took into account the number of women who chose this answer.

Due to the similar considerations, further analysis of the answers of female office employees to the survey was performed. The results of statistical analysis are presented in the table (Table 2).

The research has found that a smaller percentage of female office employees in cluster 1 work with a PC for more than 7 hours a day. At the same time, in contrast to women in cluster 2, among respondents with increased musculoskeletal pain in the joints and spine, a higher percentage use IT for entertainment at least for 3-4 hours a day.

However, it should be noted that the proportion of female office employees who do not have reasons that prevent them from taking care of their health in the office, does not differ statistically significantly ($p=0.568$). Women without office syndrome are statistically significantly ($p=0.049$) dominated by those who do not have the knowledge and skills to organize activities to maintain health while working at a computer. At the same time, among them there is a significantly higher share of those who do not have the opportunity to systematically engage in health-improving motor activity (20.5% vs. 7.7%). Although no statistically significant ($p=0.275$) differences were found, it is possible to trace the tendency to increase the share of women (among employees without office syndrome) who believe that they do not have the opportunity to systematically engage in health-improving physical activity. It is obvious that in the current situation, there is a need to widely inform female office employees about the causes of office syndrome and the positive impact of a responsible attitude to own health both in the office and outside it.

Discussion

The modern type of employment is considered to be innovative, meaning the ability of employees to perform their duties in the conditions of constant introduction of technological innovations into the production process (Levchuk, 2017).

According to the State Labor Office, more than 50% of working population are office employees; most of them are women.

Despite the existing views, the work of female office employees is characterized by high intensity. Their health is affected by harmful factors, including the sedentary nature of work and the need to stay in the working position of a

PC user for a long time, which lead to the development of office syndrome – a number of health disorders, such as musculoskeletal pain in the spine and joints, posture disorders, spinal diseases, obesity, headache (Savytska, 2020).

The transition to the information age was accompanied by the massive spread of computer technology among the population and a significant increase in sedentary motor activity in the structure of daily physical activity of various groups. It was caused by increased length of time spent in the working position of a PC user. As a result, the problem of increasing the level of responsible attitude to health when working with a computer continues to worsen. Scientists model the rational posture of a PC user in the "Human-Computer" system (Kashuba et al., 2007), study the dynamics of changes in muscle tone that are involved in maintaining working postures at work (Kashuba et al., 2008), assess the state of the bio-geometric profile of posture and working posture of a PC user (Byshevets, 2017; Byshevets et al., 2018; Hakman et al., 2020), develop technologies aimed at neutralizing the negative effects of work with a computer (Kashuba, Byshevets et al., 2019). However, most research in this area concerns the contingent of student youth (Kashuba, Andreieva et al., 2021) and does not take into account the peculiarities of their behavior when working with a computer.

It should be noted that based on the research (Fomin & Fedorova, 1999), the self-determining behavior of female office employees in the field of health is considered to be behavior aimed at maintaining the potential of health in general and in the labor process in particular., Scientists consider diet, exercise, care for the regime, sleep and rest, and abandonment of bad habits (Fomin & Fedorova, 1999) to be indicators of self-determining human behavior in connection to health. In relation to female office employees, we considered the following forms of self-determination: active lifestyle, regular physical activity and control of a working posture. They all require adequate health measures. However, their effectiveness is directly proportional to the motivation of the contingent, the level of responsible attitude of female office employees to their own health, the reasons that prevent them from taking health measures while working at the computer, the level of awareness and so on. Health measures should include maintaining a correct working posture of a PC user, taking active breaks and self-massage in the work process, refusal of overtime work, minimizing the duration of the use of IT for entertainment purposes.

Within the prevention of the risks of occupational diseases of office workers, the issue of differentiation of female office employees into subgroups is now particularly relevant.

Analyzing the works related to the development of treatment or prevention measures, we noticed that scientists divide office employees by age, gender and length of working week. Thus, Savytska (2020), studying the clinical and neurological features of the manifestations of office syndrome among Ukrainian office employees, divided the study participants according to working conditions as follows: workers with working day up to 8 hours, with 8-hour working day and with irregular working hours. On the other hand, the author divided office employees by gender and

into the following age groups: 20-30, 31-40, 41-50 and 51-60 years old.

Taking into account the generally accepted age division of women and the experience of scientists in the comprehensive assessment of pathologies in the health of office workers, we suggested that the manifestations of office syndrome increase with age and/or with increasing length of work experience. However, the use of a modern method of EM clustering, which automates the process of selecting the optimal number of clusters according to the observed data, allowed determining that female office employees are divided into two clusters according to office syndrome manifestations and by self-determining health behaviors when working at a computer.

The first cluster consists of women with pronounced musculoskeletal pain in the spine and joints, diseases of the spine, a tendency to obesity. They are characterized by a reduced level of determinant behavior concerning health when working with a computer. At the same time, the tendency of women without office syndrome to work overtime against the background of reduced need to expand knowledge about the organization of health measures in the workplace creates a risk of developing office syndrome in the future.

Conclusions

In modern world, the problem of maintaining the health of women of working age is urgent because of the increase in the average age of motherhood on the one hand, and the consequences of pension reform on the other. Health is the most important resource in the working life of a person, and only the self-determining behavior of women concerning health care may allow them to remain competitive in the labor market until retirement age.

Under the influence of negative factors of the working environment, the risk of office syndrome among female office employees increases. Some manifestations of office syndrome are posture disorders, spinal diseases, musculoskeletal pain in the spine and joints. They are caused by static loads on the spine of employees during prolonged stay in the same position of a PC user, as well as by the dynamic loads occurring during repeated actions while working with the keyboard and computer mouse. In addition, obesity and cardiovascular disease caused by sedentary work are common among female office employees.

The research has found that female office employees are divided into groups regardless of age and work experience with a PC. This division is based on the manifestations of the office syndrome and their behavior at work; these factors determine their health. According to the obtained data, women in cluster 1, compared with other female office workers, have increased manifestations of office syndrome: they have pain localized in the joints and spine, musculoskeletal system disorders, overweight. At the same time, statistically significant ($p < 0.05$) differences between the following types of self-determination have been revealed: overtime work, control of the working posture of a PC user and factors limiting the implementation of health measures in the labor process.

In addition, the research has shown that among women with manifestations of office syndrome, a statistically

significant ($p = 0.021$) proportion uses IT for entertainment purposes for 3-4 hours a day and a smaller proportion takes active breaks while working with a PC ($p = 0.038$). However, among women without manifestations of office syndrome, a statistically significant ($p = 0.040$) smaller share is aware of the need for knowledge on the organization of measures aimed at maintaining health in the work process.

It is obvious that both overweight and musculoskeletal pain cause a decrease in physical performance of female office employees. These negative factors make it impossible to work overtime and may have a restrictive effect on women's performance of professional duties. On the other hand, women without office syndrome are more prone to passive lifestyles and do not realize the importance of knowledge about the organization of health measures in the office.

When developing preventive measures against the risk of office syndrome among women of working age, it should be taken into account that among women without office syndrome, a statistically significant ($p = 0.049$) share does not have the knowledge and skills to organize measures to maintain health while working with a computer. This share is also characterized by a reduced need to expand this knowledge.

Further research is planned to develop measures aimed at forming a responsible attitude of female office workers to their health when working with a computer.

Conflict of interest

The authors declare that there is no conflict of interest that could be perceived as interfering with publication of the article.

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Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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ПЕРЕДУМОВИ РОЗРОБКИ ПРОФІЛАКТИЧНИХ ЗАХОДІВ, СПРЯМОВАНИХ НА ПОПЕРЕДЖЕННЯ РИЗИКУ РОЗВИТКУ ОФІСНОГО СИНДРОМУ В ПОПУЛЯЦІЇ ЖІНОК ПРАЦЕЗДАТНОГО ВІКУ

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів

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Мета дослідження – дослідити передумови розробки профілактичних заходів, спрямованих на попередження ризику виникнення проявів офісного синдрому в популяції жінок працездатного віку.

Матеріали і методи. У дослідженні прийняло участь 52 офісних працівниці віком від 21 до 57 років.

Результат. Розширена кластеризація вихідних даних методом EM з виконанням V-кратної крос-перевірки показала, що популяція офісних працівниць чітко розподіляється на два кластери залежно від прояву офісного синдрому. Попри наші припущення, їхній розподіл відбувається не за віком або стажем роботи в офісі, а за проявом офісного синдрому й особливостями поведінки в трудовому процесі. Жінки, віднесені до різних кластерів, характеризуються статистично значущими ($p < 0,05$) відмінностями між рівнем больових відчуттів у суглобах та відділах хребта. Установлено, що серед офісних працівниць із посиленими м'язово-скелетними болями, статистично значуще ($p < 0,05$) більше жінок із суттєвою надлишковою масою тіла, захворюваннями хребта, вони рідше виконують активні перерви при роботі за комп'ютером, більший відсоток з них поза офісом 3-4 години на добу використовують інформаційні

технології з розважальними цілями, однак менший їх відсоток працює за ПК понад 7 годин на добу. Жінки з переважними м'язово-скелетними болями відрізняються за способом життя й вказують на принципово інші причини, що заважають їм здійснювати профілактичні заходи, спрямовані на попередження ризику виникнення професійних захворювань. Зокрема серед офісних працівниць з відсутністю офісного синдрому статистично значуща ($p < 0,05$) більша частка не має потреби в розширенні знань щодо організації заходів здоров'язбереження в офісі й серед них переважає частка таких, що ведуть пасивний спосіб життя. Отже, ці жінки потенційно знаходяться в групі ризику розвитку офісного синдрому й за умови відсутності профілактичних заходів очікувано перейдуть до кластеру жінок, що мають ознаки офісного синдрому.

Висновки. Отримані результати свідчать про необхідність різних підходів для планування здоров'язбережувальних заходів у трудовому середовищі залежно від наявності в працівниць офісного синдрому та рівня їх відповідального ставлення до здоров'я в трудовому процесі.

Ключові слова: скелетно-м'язовий біль, синдром, постава, хребет, профілактика.

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