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NIGHT WORK AND HEALTH STATUS OF NURSES AND MIDWIVES. CROSS-SECTIONAL STUDY

PRACA W NOCY A STAN ZDROWIA PIELĘGNIAREK I POŁOŻNYCH. BADANIE PRZEKROJOWE

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ABSTRACT

Background: The aim of this study was to assess the association between night shift work and the prevalence of diseases and conditions among nurses and midwives. **Material and Methods:** The study included 725 subjects (354 working on night shifts and 371 working only during the day). The data were collected via an interview based on the “Standard Shiftwork Index”. We analyzed the frequency of diseases and conditions and the relative risk expressed as the odds ratio (adjusted for important confounding factors). **Results:** The most common diseases in the study population were chronic back pain (47.2%), hypertension (24.5%) and thyroid diseases (21.2%). We found no statistically significant increased relative risk of any diseases and conditions among the night shift nurses, compared to the day shift ones. The duration of the work performed on night shifts was significantly associated with the relative risk of thyroid diseases – increased almost two times in the women working for 15 or more years in such system (p for trend: 0.031). The analysis showed the significantly increased (more than eight times higher) relative risk of feet swelling in the women with 8 or more night duties per month, compared to the women having fewer night shifts. **Conclusions:** We did not observe a higher frequency of diseases in the night shift nurses, compared to the day shift nurses. These results may be related to the so-called “Healthy Worker Effect”. There is a need for further long-term observational studies in the populations of nurses. Med Pr 2012;63(5):517–529

Key words: health, night shift work, nurses, midwives, diseases, conditions

STRESZCZENIE

Wstęp: Celem badania była ocena zależności między pracą na zmiany nocne a występowaniem chorób i dolegliwości u pielęgniarek i położnych. **Materiały i metody:** Badaniem objęto 725 pielęgniarek i położnych (354 kobiety pracujące w systemie zmianowym nocnym i 371 wyłącznie w ciągu dnia). Dane zebrane zostały drogą wywiadu kwestionariuszowego, utworzonego w oparciu o „Standard Shiftwork Index”. Przeanalizowaliśmy częstość chorób i dolegliwości, a także ryzyko względne, wyrażone ilorazami szans (po uwzględnieniu istotnych czynników zakłócających). **Wyniki:** Najczęściej zgłaszanymi chorobami w całej badanej populacji były przewlekłe bóle kręgosłupa (47,2%), nadciśnienie tętnicze (24,5%) i choroby tarczycy (21,2%). Nie stwierdziliśmy istotnie statystycznie zwiększonego ryzyka względnego którejkolwiek z badanych chorób i dolegliwości u pielęgniarek nocnych w porównaniu z pracującymi w dzień. Długość stażu pracy na zmiany nocne była istotnie związana z ryzykiem względnym wystąpienia chorób tarczycy, zwiększonym prawie 2-krotnie u kobiet pracujących 15 i więcej lat w tym systemie (p dla trendu: 0,031). Analiza wykazała istotnie statystycznie ponad 8-krotnie wyższe ryzyko względne obrzęków stóp u kobiet mających 8 i więcej dyżurów nocnych w miesiącu w porównaniu z kobietami mającymi mniej zmian nocnych. **Wnioski:** Nie zaobserwowaliśmy częstszego występowania chorób u pielęgniarek pracujących na zmiany nocne w porównaniu z kobietami pracującymi tylko w ciągu dnia. Taki wynik może mieć związek z selekcją do pracy w nocy opartą na stanie zdrowia (tzw. efekt zdrowego pracownika). Niezbędne są więc dalsze długofalowe badania obserwacyjne w populacji pielęgniarek. Med. Pr. 2012;63(5):517–529

Słowa kluczowe: zdrowie, praca nocna, pielęgniarki, położne, choroby, dolegliwości

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INTRODUCTION

Working as a nurse or midwife may be associated with exposure to several harmful agents found in the work environment, including X-ray and UV radiation, aesthetic gases, disinfectants or sterilizing agents. An additional burden is the need to work on rotational shifts, also at night (1,2). The results of some epidemiological studies show that among the workers employed on night shifts, the frequency of certain diseases or disorders may be higher than that in the people working only during the day. An increased frequency of gastric ulcers and duodenal ulcers, coronary heart disease, diabetes, various types of cancer, impaired concentration and attention, sleep disorders, chronic fatigue status and gastrointestinal dysfunction was observed (3–8).

According to the register of occupational diseases in Poland for the years 1997–2008, the occupational diseases most frequently observed among nurses and midwives included: infectious and parasitic diseases (79.9%), skin diseases (12.4%) and diseases of the peripheral nervous system (0.6% of all cases of occupational diseases in this occupational group) (9). The data from the register of occupational diseases are of limited value for assessing the health status of a particular population, as the register includes only the cases of diseases that are formally recognized as occupational diseases. So far, in Poland, the health status of nurses has not been studied against the system within which they work, with the exception of one study which examined the prevalence of gastrointestinal pathology (10).

The data we collected in the cross-sectional study of nurses and midwives conducted at the Nofer Institute of Occupational Medicine in Łódź in the years 2008–2011 were used to evaluate the frequency of diseases and conditions in this occupational group of women. The main purpose of our study was to assess the prevalence of various diseases and conditions, depending on the employment system.

MATERIAL I METHODS

For this cross-sectional study, the subjects were selected from the Local Registry of the Chamber of Nurses and Midwives in Łódź. Nurses or midwives, aged 40–60, currently working, were eligible for the study. In total, 1117 nurses and midwives were randomly selected for the study, based on the registry database (i.e. ~30% of the registered women at this age), out of whom 924 (83%) were contacted. The inclusion criteria were confirmed

for 866 women, and 725 women (84% of the eligible group) agreed to participate in the study. The data on their occupational history and potential confounders were collected through an interview. The list of diseases and conditions contained in the survey was based on the “Standard Shiftwork Index” developed by the Shiftwork Research Team, MRC/ESRC Social and Applied Psychology Unit, University of Sheffield (11). This list, in addition to the diseases contained in the International Statistical Classification of Diseases and Related Health Problems ICD-10, also includes conditions such as chronic back pain or high blood cholesterol levels. The studied women were asked whether they had been diagnosed with any of the listed diseases and about the year of the diagnosis. The respondents described the frequency of the selected conditions by marking one of four possible answers: “almost never”, “rarely”, “fairly often” or “almost always”. None of the women chose the “almost always” answer in relation to any of the conditions contained in the questionnaire, and during the subsequent analysis of the responses, the answers “almost never” and “very rarely” were combined. The information on physical activity was collected using the International Physical Activity Questionnaire (IPAQ) (12). The sum of energy expenditure per week, originating from the work-related and non-work-related activity (MET¹) was calculated. Based on the measurements of the height and body weight, Body Mass Index (kg/m²) was calculated.

Based on the data on occupational history, the work performed on night shifts was characterized with the following variables:

- a) current employment within a shift work system involving night shifts (categorical variable, No/Yes),
- b) average number of night shifts per month (continuous variable, the number of shifts),
- c) duration of night shift work (continuous variable, the number of years) analyzed in the categories of < 15, ≥ 15 years, up to the date of the survey, and
- d) duration of the work on night shifts, counted from the beginning of the employment to the date of having the disease diagnosed (continuous variable, the number of years) analyzed in the categories of < 15, ≥ 15 years.

The prevalence of the diseases and conditions in the groups according to the analyzed variables was com-

¹ MET – metabolic equivalent is a physiological measure expressing the energy expenditure of physical activities. 1 MET is defined as the ratio of the metabolic rate (and therefore the rate of the energy consumption) during a specific physical activity to the reference metabolic rate, set by convention as 3.5 ml O₂/kg body mass or equivalently: 1 kcal/kg·h or 4.184 kJ/kg·h.

pared with a χ^2 test. The differences were considered as statistically significant at the significance level $p < 0.05$.

The logistic regression was used to calculate the odds ratio (OR) to examine a potential link between night shift work and the occurrence of diseases and conditions. The list of potential confounders was created based on a literature review on the analyzed diseases. The analyzes included: age, obesity (Body Mass Index – BMI ≥ 30), number of pregnancies, smoking, alcohol consumption, physical activity, taking oestrogen, use of oral contraceptives, education, marital status, diabetes, hypertension, high level of cholesterol, allergies and depression. In the final logistic regression models, we included those factors that had a statistically significant impact on the analysed associations (assuming the level of $p \leq 0.15$). The models referring to the experienced problems took account of the age of the respondents.

In the analysis of the association between the duration of employment on night shifts and the occurrence of diseases, we used the conditional logistic regression model, in which every woman diagnosed with a disease (case) was matched with the control subjects (healthy people according to the criterion of age, usually in a ratio of 1:3 – for one case three controls, depending on the number of cases). Statistical analysis was carried out in STATA ver. 9.

RESULTS

Characteristics of the study population

The cross-sectional study population consisted of 725 women, including 354 nurses and midwives currently working on rotating night shifts and 371 employees working only during the day. The average age in the group of persons working at night was by almost 2 years lower than

Table 1. Characteristics of the study group divided into night and day work system
Tabela 1. Charakterystyka grupy badanej z podziałem na nocny i dzienny system pracy

| Characteristics Charakterystyka | System of work of nurses System pracy pielęgniarek | | P |
|---|---|-----------------------------|---------|
| | rotating nights nocny (N = 354) | day dzienny (N = 371) | |
| | arithmetic average / średnia arytmetyczna | | |
| Age / Wiek | 48 | 50 | < 0.001 |
| Physical activity [MET*h/week] / Aktywność fizyczna [MET*godz./tydz.] | 242 | 203 | < 0.001 |
| | % | | |
| Tobacco smoking / Palenie tytoniu | | | 0.022 |
| current / obecnie | 35 | 26 | |
| past / w przeszłości | 23 | 31 | |
| never / nigdy | 42 | 43 | |
| Pregnancies / Cięża [n] | | | 0.152 |
| 0 | 5 | 6 | |
| 1 | 22 | 26 | |
| 2 | 39 | 42 | |
| 3 | 23 | 19 | |
| ≥ 4 | 11 | 7 | |
| Use of oral contraceptives / Stosowanie doustnych środków antykoncepcyjnych | | | 0.301 |
| ever / kiedykolwiek | 32 | 36 | |
| never / nigdy | 68 | 64 | |
| Use of oestrogen / Przyjmowanie estrogenów | | | < 0.001 |
| ever / kiedykolwiek | 19 | 30 | |
| never / nigdy | 81 | 70 | |
| Education / Wykształcenie | | | < 0.001 |
| secondary school / średnie | 84 | 71 | |
| university / wyższe | 16 | 29 | |
| Body Mass Index / Współczynnik masy ciała | | | 0.539 |
| < 25 | 35 | 38 | |
| 25–30 | 40 | 40 | |
| > 30 | 25 | 22 | |

in those subjects that worked only during the day (48 yrs vs. 50 yrs, $p < 0.001$). The nurses currently working on night shifts smoked cigarettes statistically more often (35% vs. 26%, $p = 0.022$). The average physical activity levels were higher in women who were working on night shifts (242 vs. 203 MET*h/week, $p < 0.001$) (Table 1).

Almost all nurses included in the study population (except for 10 women), worked on night shifts at some point in their career. The women working currently on the rotating night shifts had been working at night for an average of 25.4 years. The women who, at the time

of the study, were currently working days only, but who had had a history of night shift work, had, on average, worked for 12 years on night shifts. Out of these women, the majority (83%) had changed to day work more than 5 years before their recruitment into the study. Eleven women (3%) had resigned from night shift work during the preceding year. Most women working currently on night shifts had had many years of experience of working within such a system – 15 years and more (93.5%), and among the „day-only” nurses, 35.6% of women had had 15 years of experience working on night shifts.

Table 2. The disease in the study population according to the current system of their work
Tabela 2. Choroby występujące wśród pielęgniarek i położnych według aktualnego systemu pracy

| Disease Choroba | System of work of nurses System pracy pielęgniarek [%] | | | P |
|---|--|---------------------------------------|-----------------------------|-------|
| | total ogółem (N = 725) | rotating nights nocny (N = 354) | day dzienny (N = 371) | |
| Chronic back pain / Przewlekłe bóle kręgosłupa | 47.2 | 46.1 | 48.3 | 0.553 |
| Insomnia / Bezsenność | 16.4 | 15.5 | 17.3 | 0.533 |
| Migraine / Migrena | 12.3 | 9.9 | 14.6 | 0.056 |
| Hypertension / Nadciśnienie tętnicze | 24.5 | 22.3 | 26.7 | 0.172 |
| High cholesterol / Wysoki poziom cholesterolu | 18.2 | 15.0 | 21.4 | 0.027 |
| Ischemic heart disease / Choroba niedokrwienna serca | 2.9 | 2.0 | 3.8 | 0.149 |
| Mitral insufficiency, angina pectoris / Niedomykalność mitralna, dusznica bolesna | 4.7 | 5.1 | 4.3 | 0.623 |
| Cardiac arrhythmias / Zaburzenia rytmu serca | 9.2 | 7.6 | 10.8 | 0.143 |
| Diabetes / Cukrzyca | 2.3 | 2.0 | 2.7 | 0.523 |
| Cholelithiasis / Kamica żółciowa | 12.7 | 11.0 | 14.3 | 0.186 |
| Hepatitis / Wirusowe zapalenie wątroby | 13.1 | 12.4 | 13.8 | 0.599 |
| Gastritis or duodenitis / Zapalenie żołądka lub dwunastnicy | 8.7 | 5.9 | 11.3 | 0.010 |
| Stomach or duodenum ulcer / Wrzód żołądka lub dwunastnicy | 7.4 | 6.5 | 8.4 | 0.341 |
| Irritable bowel syndrome / Zespół nadwrażliwości jelita grubego | 3.3 | 2.0 | 4.6 | 0.050 |
| Bronchial asthma / Astma oskrzelowa | 4.8 | 3.7 | 5.9 | 0.156 |
| Nephrolithiasis / Kamica nerek | 10.2 | 9.6 | 10.8 | 0.601 |
| Varicose veins on lower legs / Żyłki podudzi | 19.0 | 20.9 | 17.3 | 0.210 |
| Premenstrual syndrome* / Zespół napięcia przedmiesiączkowego* | 9.5 | 8.7 | 10.4 | 0.548 |
| Polycystic ovarian disease / Torbielowatość jajników | 9.4 | 10.5 | 8.4 | 0.333 |
| Thyroid diseases / Choroby tarczycy | 21.2 | 22.6 | 20.0 | 0.383 |
| Depression / Depresja | 4.7 | 4.0 | 5.4 | 0.361 |
| Allergic dermatitis / Choroby alergiczne skóry | 8.5 | 8.2 | 8.9 | 0.735 |
| Cancers / Nowotwory | 4.4 | 3.4 | 5.4 | 0.190 |
| Whichever disease / Jakakolwiek choroba | 47.2 | 46.1 | 48.3 | 0.553 |

* Frequency in the group of nurses and midwives who are currently menstruating / Częstość u pielęgniarek i położnych, które aktualnie miesiączkują.
p – value / graniczny poziom istotności.

The prevalence of the reported diseases and conditions

The prevalence of diseases in this population of women is shown in Table 2. The most commonly reported conditions in the total study population were chronic back pain (47.2%) – both in the group of the nurses currently working on rotating night shifts (46.1%) and among those working only during the day (48.3%). Significantly less frequent in the group of “night” nurses were such conditions as: high cholesterol, gastritis or duodenditis and the irritable bowel syndrome. Only in the case of three pathologies: varicose veins on the lower leg, polycystic ovaries and thyroid diseases, the prevalence was slightly higher among the nurses working on night shifts, but the differences were not statistically significant. The nurses working within the night shift work system reported the occurrence of any of the diseases and conditions slightly less often, compared to the nurses who worked only during the day (46.1% vs. 48.3%).

By analyzing the occurrence of diseases according to the number of night shifts per month in the group of the current “night” nurses, we obtained statistically

significant differences in the prevalence only in the case of high cholesterol levels (the highest frequency of this condition occurred in the group of women working on 2–4 night shifts per month – 40.0% vs. 13.4% among the women working on 5–7 night shifts per month vs. 14.3% for the women working on 8 or more night shifts per month, $p = 0.005$) and the irritable bowel syndrome (which also occurred most frequently in the group working the least often on night shifts per month – 10.0% vs. 1.4% vs. 2.4%, $p = 0.027$).

The prevalence of the symptoms reported by the interviewed women is included in Table 3. The women who worked only during the day reported more often the symptoms related to each of the categories, with the exception of feet swelling reported more frequently by women working on night shifts. Constipation and diarrhoea occurred significantly more often in the women working exclusively on day shifts (16.3% in the “night” nurses vs. 23.1% in the “day” ones). The same was observed for a feeling of irregular heart beat (4.2% of women working at night vs. 8.7% current “day” workers).

Table 3. The symptoms reported by nurses and midwives according to the current work system

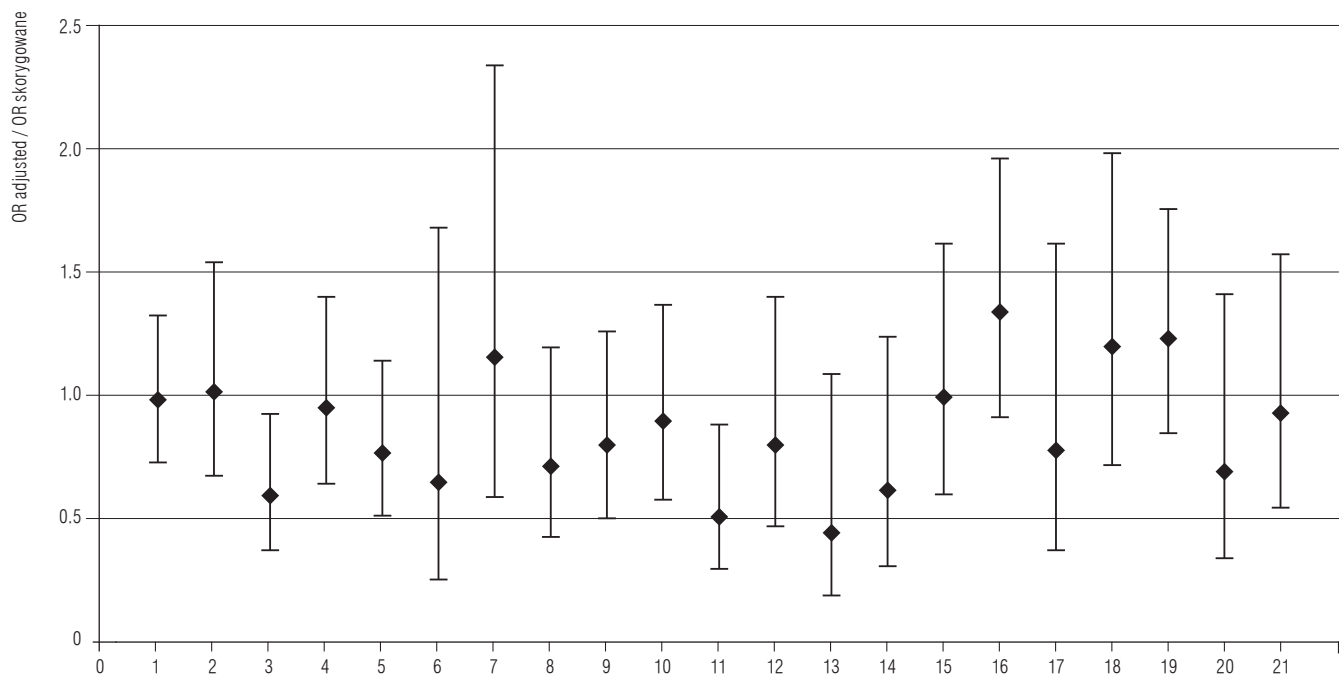
Tabela 3. Dolegliwości zgłaszane przez pielęgniarki i położne według systemu pracy, w jakim aktualnie pracują

| Symptom Dolegliwość | System of work of nurses System pracy pielęgniarek [%] | | | p |
|--|--|---------------------------------------|-----------------------------|-------|
| | total ogółem (N = 725) | rotating nights nocny (N = 354) | day dzienny (N = 371) | |
| Appetite disorders / Zaburzenia apetytu | 2.1 | 1.2 | 2.9 | 0.123 |
| Nausea / Nudności | 2.5 | 1.5 | 3.5 | 0.102 |
| Heartburn and stomach pains / Zgagi i bóle żołądka | 11.8 | 10.5 | 13.0 | 0.320 |
| Digestion disorders / Zaburzenia trawienia | 3.2 | 2.1 | 4.3 | 0.102 |
| Flatulence / Wzdęcia brzucha | 17.4 | 16.6 | 18.2 | 0.573 |
| Abdominal pains / Bóle brzucha | 5.2 | 4.8 | 5.5 | 0.693 |
| Constipation or diarrhoeas / Zaparcia i biegunki | 19.8 | 16.3 | 23.1 | 0.025 |
| Palpitation / Palpacje serca | 4.7 | 3.6 | 5.8 | 0.184 |
| Thorax ache / Bóle w klatce piersiowej | 2.2 | 1.5 | 2.9 | 0.221 |
| Dizziness / Zawroty głowy | 4.4 | 3.6 | 5.2 | 0.315 |
| Flushes / Uderzenia gorąca na twarz | 16.7 | 13.9 | 19.4 | 0.054 |
| Breathlessness when climbing stairs / Utraty tchu podczas wchodzenia po schodach | 8.0 | 6.6 | 9.3 | 0.207 |
| Irregular heart-beat feeling / Uczucie nierównego bicia serca | 6.5 | 4.2 | 8.7 | 0.019 |
| Swelling of the feet / Obrzęki stóp | 12.1 | 13.5 | 10.7 | 0.253 |
| Tightness in the chest / Uczucie ucisku w klatce piersiowej | 2.7 | 1.5 | 3.8 | 0.068 |

p – value / graniczny poziom istotności.

The results of the analysis of the association between working on night shifts and the frequency of diseases and conditions, taking into account significant confounding factors, are shown graphically in Figures 1 and 2. In the case of many medical conditions, the calculated relative risk was lower among those working on night shifts, compared to the women currently working only during the day. Among the subjects working on

night shifts, we recorded a significantly lower relative risk of migraine (adjusted OR = 0.59; 95% CI: 0.37–0.93), gastritis or duodenditis (adjusted OR = 0.51; 95% CI: 0.29–0.88), the conditions such as constipation and diarrhoea (adjusted OR = 0.63; 95% CI: 0.43–0.93), and the feeling of irregular heart beat (adjusted OR = 0.44; 95% CI: 0.23–0.85).



OR – odds ratio / iloraz szans.

Diseases / Choroby

Diseases / Choroby:

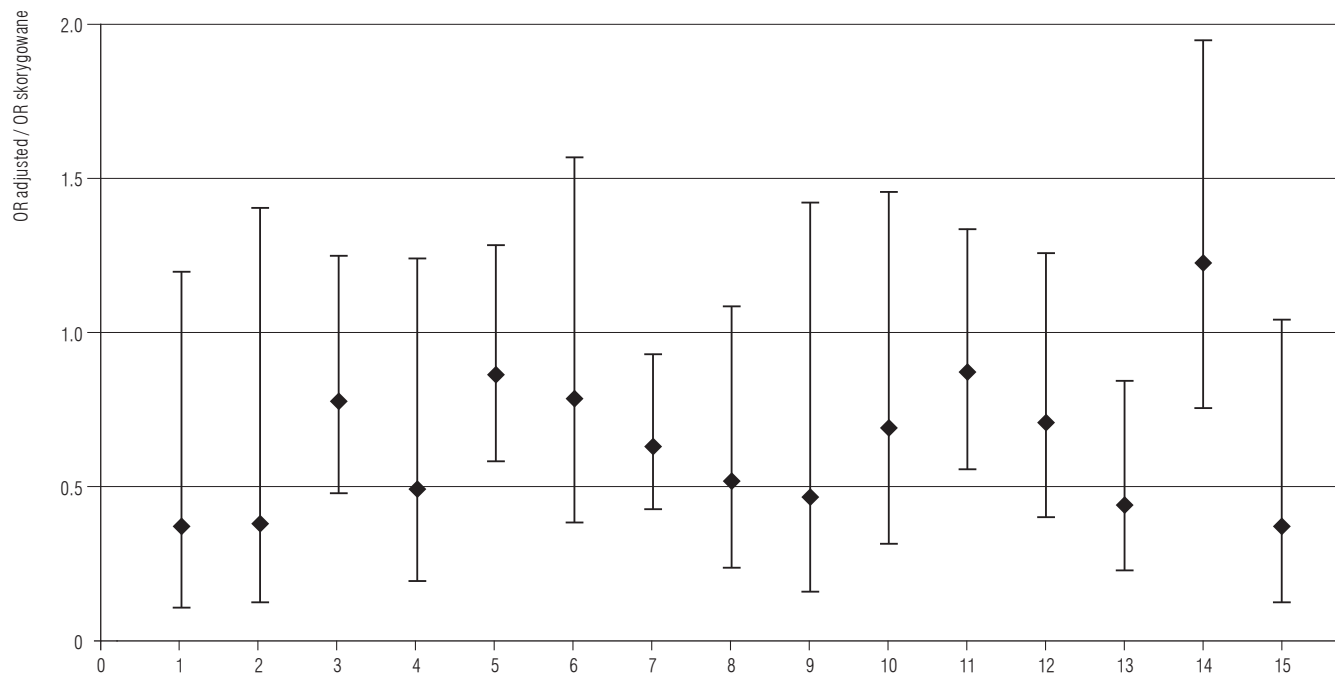
- | | |
|--|---|
| 1 – chronic back pain / przewlekłe bóle kręgosłupa ^a | 12 – stomach or duodenum ulcer / wrzód żołądka lub dwunastnicy ^a |
| 2 – insomnia / bezsenność ^{a,b} | 13 – irritable bowel syndrome / zespół nadwrażliwości jelita grubego ^a |
| 3 – migraine / migrena ^a | 14 – bronchial asthma / astma oskrzelowa ^k |
| 4 – hypertension / nadciśnienie tętnicze ^{a,c,d,e,f} | 15 – nephrolithiasis / kamica nerek ^a |
| 5 – high cholesterol / wysoki poziom cholesterolu ^{a,c,e} | 16 – varicose veins on lower legs / żylaki podudzi ^{a,l} |
| 6 – ischemic heart disease / choroba niedokrwienności serca ^{a,g,h} | 17 – premenstrual syndrome / zespół napięcia przedmiesiączkowego ^a |
| 7 – mitral insufficiency, angina pectoris / niedomykalność mitralna, dusznica bolesna ^{a,g} | 18 – polycystic ovarian disease / torbielowatość jajników ^a |
| 8 – cardiac arrhythmias / zaburzenia rytmu serca ^g | 19 – thyroid diseases / choroby tarczycy ^a |
| 9 – cholelithiasis / kamica żółciowa ^{a,e,i,j} | 20 – depression / depresja ^a |
| 10 – hepatitis / wirusowe zapalenie wątroby ^a | 21 – allergic dermatitis / choroby alergiczne skóry ^a |
| 11 – gastritis or duodenitis / zapalenie żołądka lub dwunastnicy ^d | |

* OR calculated for the group of women currently menstruating / Iloraz szans liczony dla grupy kobiet aktualnie miesiączkujących.

Confounding factors / Czynniki zakłócające: a – age / wiek, b – depression / depresja, c – smoking / palenie tytoniu, d – alcohol consumption / spożycie alkoholu, e – obesity / otyłość (BMI ≥ 30), f – physical activity / poziom aktywności fizycznej, g – high cholesterol / wysoki poziom cholesterolu, h – hypertension / nadciśnienie tętnicze, i – use of estrogen / przyjmowanie estrogenów, j – use of oral contraceptives / stosowanie doustnej antykoncepcji, k – allergic dermatitis / choroby alergiczne, l – number of pregnancies / liczba ciąż.

Fig. 1. The relative risk of particular diseases in the nurses and midwives currently working on night shifts (OR adjusted for important confounding factors)

Ryc. 1. Rzyzko względne wystąpienia chorób u pielęgniarek i położnych pracujących aktualnie na zmianach nocnych (iloraz szans skorygowany o istotne czynniki zakłócające)



OR – odds ratio / iloraz szans.

Symptoms / Dolegliwości:

- 1 – appetite disorders / zaburzenia apetytu
- 2 – nausea / nudności
- 3 – heartburn and stomach pains / zgagi i bóle żołądka
- 4 – digestion disorders / zaburzenia trawienia
- 5 – flatulence / wzdęcia
- 6 – abdominal pain / bóle brzucha

- 7 – constipation or diarrhoeas / zaparcia i biegunki
- 8 – palpitation / palpitacje serca
- 9 – thorax ache / bóle w klatce piersiowej
- 10 – dizziness / zawroty głowy
- 11 – flushes / uderzenia gorąca na twarz
- 12 – breathlessness when climbing stairs / utrata tchu podczas wchodzenia po schodach
- 13 – irregular heart-beat feeling / uczucie nierównego bicia serca
- 14 – swelling of the feet / obrzęki stóp
- 15 – tightness in the chest / uczucie ucisku w klatce piersiowej

Symptoms / Dolegliwości

Fig. 2. The risk of particular symptoms for the group of nurses and midwives currently working on night shifts (OR adjusted for age)
Ryc. 2. Ryzyko wystąpienia poszczególnych dolegliwości w grupie pielęgniarek i położnych aktualnie pracujących na zmianach nocnych (iloraz szans skorygowany o wiek)

The occurrence of diseases or conditions according to the duration of night shift work

The results of the analyses devoted to the association between the duration of night shift work and the occurrence of diseases are included in Table 4. For the majority of the analyzed diseases, we did not observe a significant association with the duration of night shift work, with the exception of thyroid diseases reported significantly more often in the women with over 15 years of night work experience, and gastritis or duodenditis observed significantly less frequently in this group. The frequency of varicose veins on the lower leg was increased by nearly 50% in the women with over 15 years of experience of working on night shifts (statistically insignificant) with a borderline statistically significant trend (p = 0.051) for the relative risk with an increas-

ing number of years worked on night shifts. None of the examined conditions showed a statistically significant association with the duration of working on night shifts.

The occurrence of diseases or conditions among the nurses and midwives working on night shifts depending on the frequency of night duties

In the analysis of the relative risk of occurrence of diseases and conditions depending on the frequency of night duties performed per month, the reference group were nurses and midwives with an average of 2 to 4 night shifts per month (Table 5). We found no increased (statistically significant) relative risk of any of the studied diseases in the women with an average of more than four night shifts per month. In the case of several diseases: hypertension, hepatitis, gastritis/duodenditis,

nephrolithiasis, varicose veins on the lower legs and allergic dermatitis, we observed an increasing relative risk of the occurrence of these diseases with the increasing frequency of night shifts per month, but these differences were not statistically significant. In the case of hypercholesterolemia, the relative risk was significantly lower in the women working on more than four night shifts per month (adjusted OR = 0.25; 95% CI: 0.09–0.71

for the group of women working on 5–7 night shifts/month and adjusted OR = 0.21; 95% CI: 0.06–0.78 for the subjects working on more than 8 night shifts/month). Also, the analysis of the irritable bowel syndrome showed a lower odds ratio among the nurses working on average on 5 to 7 night shifts/month (OR = 0.13; 95% CI: 0.02–0.80), compared to the subjects working less often than four night shifts per month.

Table 4. The relative risk of particular diseases and pathological conditions for the nurses and midwives by the duration of the work performed on night shifts

Tabela 4. Ryzyko względne wystąpienia wybranych chorób u pielęgniarek i położnych w odniesieniu do długości stażu pracy na zmianach nocnych

| Disease Choroba | Relative risk according to the night shift work duration* | | p for trend** p dla trendu** |
|---|---|------------------|---------------------------------------|
| | Ryzyko względne w zależności od stażu pracy nocnej (OR; 95% CI) | | |
| | < 15 years / lat | ≥ 15 years / lat | |
| Chronic back pain / Przewlekłe bóle kręgosłupa | 1.00 | 1.10 (0.75–1.60) | 0.650 |
| Insomnia / Bezsenność | 1.00 | 0.94 (0.61–1.47) | 0.630 |
| Migraine / Migrena | 1.00 | 0.62 (0.25–1.53) | 0.291 |
| Hypertension / Nadciśnienie tętnicze | 1.00 | 0.98 (0.69–1.44) | 0.917 |
| High cholesterol / Wysoki poziom cholesterolu | 1.00 | 0.80 (0.54–1.18) | 0.734 |
| Mitral insufficiency, angina pectoris / Niedomykalność mitralna, dusznica bolesna | 1.00 | 1.64 (0.52–5.21) | 0.193 |
| Cardiac arrhythmias / Zaburzenia rytmu serca | 1.00 | 0.68 (0.36–1.31) | 0.552 |
| Cholelithiasis / Kamica żółciowa | 1.00 | 1.03 (0.56–1.93) | 0.898 |
| Hepatitis / WZW | 1.00 | 0.77 (0.18–3.26) | 0.985 |
| Gastritis or duodenitis / Zapalenie żołądka lub dwunastnicy | 1.00 | 0.43 (0.23–0.80) | 0.052 |
| Stomach or duodenum ulcer / Wrzód żołądka lub dwunastnicy | 1.00 | 0.73 (0.28–1.91) | 0.405 |
| Bronchial asthma / Astma oskrzelowa | 1.00 | 0.52 (0.17–1.62) | 0.172 |
| Nephrolithiasis / Kamica nerek | 1.00 | 1.77 (0.83–3.74) | 0.234 |
| Varicose veins on lower legs / Żyłaki podudzi | 1.00 | 1.49 (0.87–2.54) | 0.051 |
| Premenstrual syndrome / Zespół napięcia przedmiesiączkowego*** | 1.00 | 1.10 (0.25–4.74) | 0.912 |
| Polycystic ovarian disease / Torbielowatość jajników | 1.00 | 1.46 (0.69–3.06) | 0.188 |
| Thyroid diseases / Choroby tarczycy | 1.00 | 1.97 (1.21–3.20) | 0.031 |
| Depression / Depresja | 1.00 | 0.83 (0.36–1.93) | 0.933 |

OR – odds ratio / iloraz szans, 95% CI – confidence interval / przedział ufności.

* The duration of the work on nights shifts until the diagnosis of the disease / Staż pracy na zmianach nocnych liczony do momentu wystąpienia choroby.

** In the calculation of the significance of the trend, the duration of the work was treated as a continuous variable / W obliczeniach istotności trendu staż pracy został potraktowany jako zmienna ciągła.

*** Analysis for the group of currently menstruating women / Analiza wyłącznie w grupie kobiet aktualnie miesiączkujących.

Table 5. The relative risk of selected diseases among the current night shift nurses according to the frequency of rotating night shifts per month (OR adjusted for important confounding factors)**Tabela 5.** Ryzyko względne wystąpienia wybranych chorób u pielęgniarek aktualnie pracujących na zmianach nocnych w zależności od liczby zmian w miesiącu (iloraz szans skorygowany o istotne czynniki zakłócające)

| Disease (confounding factors) Choroba (czynniki zakłócające) | Relative risk Ryzyko względne OR (95% CI) | | | P for trend* P dla trendu* |
|--|--|--|--|-------------------------------------|
| | 2–4 rotating nights shifts per month zmiany nocne w miesiącu | 5–7 rotating nights shifts per month zmiany nocne w miesiącu | ≥ 8 rotating nights shifts per month zmiany nocne w miesiącu | |
| Chronic back pain / Przewlekłe bóle kręgosłupa ^a | 1.00 | 0.94 (0.37–2.34) | 0.94 (0.32–2.76) | 0.509 |
| Insomnia / Bezsenność ^{a,b} | 1.00 | 0.57 (0.20–1.72) | 0.83 (0.23–3.03) | 0.213 |
| Migraine / Migrena ^a | 1.00 | 0.82 (0.18–3.79) | 0.88 (0.15–5.34) | 0.246 |
| Hypertension / Nadciśnienie tętnicze ^{a,c,d,e,f} | 1.00 | 1.19 (0.33–4.28) | 2.12 (0.51–8.81) | 0.729 |
| High cholesterol / Wysoki poziom cholesterolu ^{a,c,e} | 1.00 | 0.25 (0.09–0.71) | 0.21 (0.06–0.78) | 0.071 |
| Ischemic heart disease / Choroba niedokrwienna serca ^{a,g,h} | 1.00 | 0.87 (0.08–9.26) | – | 0.036 |
| Mitral insufficiency, angina pectoris / Niedomykalność mitralna, dusznica bolesna ^{a,g} | 1.00 | 1.51 (0.18–12.93) | 1.41 (0.11–17.64) | 0.655 |
| Cardiac arrhythmias / Zaburzenia rytmu serca ^g | 1.00 | 0.87 (0.18–4.17) | 1.18 (0.19–7.28) | 0.906 |
| Cholelithiasis / Kamica żółciowa ^{a,e,i,j} | 1.00 | 3.71 (0.46–29.83) | 2.92 (0.31–27.64) | 0.578 |
| Hepatitis / WZW ^a | 1.00 | 2.90 (0.37–22.50) | 3.22 (0.36–28.81) | 0.599 |
| Gastritis or duodenitis / Zapalenie żołądka lub dwunastnicy ^d | 1.00 | 1.15 (0.14–9.09) | 1.41 (0.14–14.50) | 0.919 |
| Stomach or duodenum ulcer / Wrzód żołądka lub dwunastnicy ^a | 1.00 | 1.62 (0.20–12.84) | 0.48 (0.28–8.06) | 0.518 |
| Irritable bowel syndrome / Zespół nadwrażliwości jelita grubego ^a | 1.00 | 0.13 (0.02–0.80) | 0.22 (0.02–2.64) | 0.575 |
| Bronchial asthma / Astma oskrzelowa ^k | 1.00 | 0.57 (0.07–4.77) | 1.28 (0.12–13.50) | 0.829 |
| Nephrolithiasis / Kamica nerek ^k | 1.00 | 1.05 (0.22–4.85) | 1.27 (0.22–7.25) | 0.927 |
| Varicose veins on lower legs / Żyłaki podudzia ^l | 1.00 | 1.22 (0.38–3.91) | 1.62 (0.43–6.10) | 0.810 |
| Premenstrual syndrome / Zespół napięcia przedmiesiączkowego ^{**} , ^a | 1.00 | –*** | –*** | 0.546 |
| Polycystic ovarian disease / Torbielowatość jajników ^a | 1.00 | 0.33 (0.10–1.10) | 0.91 (0.24–3.48) | 0.702 |
| Thyroid diseases / Choroby tarczycy ^a | 1.00 | 0.51 (0.19–1.34) | 0.75 (0.24–2.35) | 0.196 |
| Depression / Depresja ^a | 1.00 | 0.89 (0.11–7.13) | – | 0.250 |
| Allergic dermatitis / Choroby alergiczne skóry ^a | 1.00 | 1.57 (0.20–12.34) | 2.54 (0.28–23.31) | 0.408 |

OR – odds ratio / iloraz szans, 95% CI – confidence interval / przedział ufności.

a–l – abbreviations as in Figure 1 / objaśnienia jak w rycinie 1.

* In the calculation of the significance of the trend, the variable was treated as a continuous variable / W obliczeniach istotności trendu zmienna została potraktowana jako zmienna ciągła.

** Analysis for the group of currently menstruating women / Analiza wykonana w grupie kobiet aktualnie miesiączkujących.

*** No cases in the reference group / Brak przypadków w grupie referencyjnej.

Among the studied conditions, in the group of women having 8 or more night duties per month, we observed a statistically significant increase in the relative risk of the swelling of the feet, compared to the women

working less often than five night duties per month (adjusted OR = 8.55; 95% CI: 1.02–71.80) with a statistically significant trend (p = 0.006) (Table 6).

Table 6. The relative risk of selected symptoms in nurses working currently on night shifts according to the number of rotating night shifts per month (OR adjusted for age)

Tabela 6. Ryzyko względne wystąpienia wybranych dolegliwości u pielęgniarek pracujących aktualnie na zmianach nocnych według liczby zmian w miesiącu (iloraz szans skorygowany o wiek)

| Symptom Dolegliwość | Relative risk Ryzyko względne OR (95% CI) | | | p for trend* P dla trendu* |
|--|--|--|--|-------------------------------------|
| | 2–4 rotating nights shifts per month zmiany nocne w miesiącu | 5–7 rotating nights shifts per month zmiany nocne w miesiącu | ≥ 8 rotating nights shifts per month zmiany nocne w miesiącu | |
| Appetite disorders / Zaburzenia apetytu | 1.00 | 0.19 (0.02–2.04) | – | 0.071 |
| Heartburn and stomach pains / Zgagi i bóle żołądka | 1.00 | 0.80 (0.17–3.71) | 1.77 (0.33–9.56) | 0.576 |
| Flatulence / Wzdęcia brzucha | 1.00 | 1.41 (0.31–6.42) | 2.40 (0.46–12.54) | 0.034 |
| Constipation or diarrhoeas / Zaparcia i biegunki | 1.00 | 1.60 (0.35–7.13) | 1.19 (0.21–6.81) | 0.517 |
| Palpitation / Palpitacje serca | 1.00 | 0.22 (0.04–1.15) | – | 0.055 |
| Chest pains / Bóle w klatce piersiowej | 1.00 | 0.15 (0.01–1.63) | 0.41 (0.02–7.12) | 0.242 |
| Flushes / Uderzenia gorąca na twarz | 1.00 | 0.95 (0.27–3.33) | 0.78 (0.17–3.55) | 0.916 |
| Breathlessness when climbing stairs / Utraty tchu podczas wchodzenia po schodach | 1.00 | 0.56 (0.11–2.69) | 0.70 (0.11–4.66) | 0.437 |
| Swelling of the feet / Obrzęki stóp | 1.00 | 1.98 (0.25–15.59) | 8.55 (1.02–71.80) | 0.006 |
| Tightness in the chest / Uczucie ucisku w klatce piersiowej | 1.00 | 0.11 (0.01–1.30) | 0.35 (0.02–6.30) | 0.689 |

OR – odds ratio / iloraz szans, 95% CI – confidence interval / przedział ufności.

* In the calculation of the significance of the trend, the variable was treated as a continuous variable / W obliczeniach istotności trendu zmienna została potraktowana jako zmienna ciągła.

DISCUSSION

In this paper, we presented the results of the cross-sectional study conducted in a population of 725 nurses and midwives aged 40–60 years currently working in the health care units in the city of Łódź and the surrounding area. We analyzed the prevalence of diseases and conditions in this occupational group, established on the basis of the conducted interviews. While preparing the list of diseases and conditions, we used a part of the questionnaire “Standard Shiftwork Index”, which had been developed for research on the determinants of work and health of shift workers. This questionnaire is a tool of proven validity and has been used in other epidemiological studies of health professionals (13).

In our study population, the most commonly reported diseases were chronic back pain (47.2%), hypertension (diagnosed in 24.5% of the respondents) and thyroid diseases (21.2%). The observed prevalence of high blood pressure and chronic back pain is comparable to

the rates recorded in the general population of women in Poland. In 2009, hypertension was diagnosed in 24% of adult Polish females, and back pain affects around 48% of Polish women aged 40–59 years (13). Only in the case of thyroid diseases, the frequency observed in our study population was two times higher than the frequency in the general population of Polish women (10%) (13). We also observed the increased relative risk of thyroid diseases in the women working for 15 years and more on night shifts (almost 2-fold higher relative risk compared to the females working on night shifts for a shorter period of time than 15 years). So far, there are no reports in the literature on an increase in the risk of thyroid abnormalities among nurses. Based on our study, we cannot identify the factors that could explain the increase observed in the frequency of these pathologies in our study population. However, the factors reported to be involved in the aetiology of autoimmune thyroiditis include ionizing radiation and bacterial or viral infections (14). Potentially, these factors may affect

women working as nurses in their work environment. The higher frequency of thyroid diseases noted in our study than that recorded in the general population may also be related to the presumably better access that the women from this professional group have to diagnostic tests and, thus, to an increase in the diagnosed cases of these pathologies. In a large health study of nurses in Canada (almost 19 thousand professional nurses), the frequency of thyroid diseases in this occupational group was slightly higher than in the general population of women (10.1% vs. 8.7%) (15). In the study of 225 nurses in Turkey, the frequency of reported thyroid disorders was similar to our observations and equalled 18.5% (16).

In the study population of nurses and midwives examined by us, the women working within the night shift work system reported the occurrence of diseases or conditions slightly less often, compared with those nurses who worked only during the day (46.2% vs. 48.1%). Also, in the analyses taking into account the confounding factors, the relative prevalence risk of most of the diseases was slightly lower among the women working on night shifts, compared to those working only during the day. The probable explanation for this observation is the so-called "Healthy Worker Effect". It is possible that women with a generally better state of health adapt to night shift work more easily, and may work longer in such a system. There was observed a deterioration of tolerance of night shifts work with age (17), which may lead to a situation when older women change jobs to those done on day shifts only. At the same time, with age, there increases the risk of many diseases (e.g. cardiovascular diseases: hypertension, coronary heart disease, atherosclerosis, cardiac arrhythmias). The relative risk of the frequency of these diseases (adjusted for age) was lower in the group of nurses and midwives working at night in relation to those working during the day (but the differences were not statistically significant). The cross-sectional nature of our study did not allow for the total control of the "Healthy Worker Effect". In this study, we also did not have a reference group of women who had never worked on night shifts. Being aware of this limitation, in the analysis of the relative risk of the frequency of the diseases according to the duration of working on night shifts, we only took into account the duration of work based on the night shift work system to the date of the diagnosis of each of the evaluated conditions. The analyses according to the number of shifts per month were limited only to the women working on night shifts at the time of be-

ing enrolled into our research. The application of this method allowed us to somewhat reduce the impact of selection on the obtained results, which is inevitable in cross-sectional studies.

It is believed that working at night promotes abnormal eating habits and that eating which does not follow the circadian rhythm can lead to disorders and ailments of the digestive system (5–7,18,19). Some epidemiologic studies on night shift workers observed an increased frequency or the risk of gastric ulcers (20,21). There are also occasional reports of increased frequency of gastrointestinal diseases or ailments of the system among nurses. The study of Nojkov et al. on the nurses working on night shifts on a rotating basis in the United States noted a higher frequency of the irritable bowel syndrome in relation to the nurses working only during the day (6). Also, in the study on the functional disorders of the colon in nurses, a higher frequency of this disorder was shown among the nurses working on a rotating basis, compared to the women working during the day (7). A study conducted in Iran revealed a statistically significantly higher frequency of abdominal bloating among the nurses working on shifts, compared to the women working only during the day (18). In a survey conducted among the total of 241 nurses in Poland (mean age: 34.1 years), among the analyzed range of ailments of the gastrointestinal tract, there was observed a statistically significantly increased frequency of irregular bowel movements, and an increase, albeit statistically insignificant, in the frequency of the irritable bowel syndrome and constipation in the women working on night shifts (10). In the studied group of women, we did not identify any increased frequency of any diagnosed diseases of the digestive system among the workers employed on a rotating basis, compared to the women who worked during the day, and the calculated relative risk of these diseases was not dependent on the duration of working on night shifts. It should be emphasized that despite the lack of statistical significance of the obtained results, the prevalence of the symptoms such as heartburn, stomach pain, bloating as well as constipation and diarrhoea was higher in the women with a greater number of night shifts per month (8 or more), compared to those working less than 5 night shifts per month, with a statistically significant trend ($p = 0.034$) for abdominal bloating.

One of the few pathologies observed more frequently (but statistically insignificantly) in the examined population of nurses working on night shifts, compared to those working only during the day, was the

occurrence of varicose veins on the lower leg (20.9% vs. 17.3%). To compare, in the general population of Polish women, varicose veins on the lower leg occur with a frequency of circa 35% (22). The relative risk of this condition among nurses working on night shifts for more than 15 years was slightly increased (OR = 1.49; 95% CI: 0.87–2.54) (p for trend by the number of years of working on night shifts – 0.051). Furthermore, the risk increased with the number of night shifts per month (OR = 1.62; 95% CI: 0.43–6.10) in the women working on 8 night shifts or more per month. The higher frequency of varicose veins on the lower leg observed in our study in the group of nurses and midwives currently working also at night confirms the results obtained by Bonet-Perqueras et al. who reported the higher frequency of this condition in the group of nurses working at night (23). The symptoms often accompanying varicose veins on the lower legs include swelling of the feet. In our study, we observed the significantly increased relative risk of feet swelling in the women working on 8 or more night duties per month, in whom the relative risk calculated against the risk affecting the employees working on 2–4 night shifts per month was over eight times higher. Our results suggest that night shift work may be one of the risk factors for varicose veins on the lower leg. Nevertheless, this pathology occurs with high frequency in the general population and many factors may contribute to its etiology. Among the risk factors for varicose veins on the lower leg age, sedentary lifestyle, multiple pregnancies, obesity, use of hormonal contraceptives and hereditary factors have been established (22,24). The analyzes conducted by us took into account most of these factors, except for the hereditary ones, which is a certain limitation for drawing definitive conclusions about the association between working on night shifts and the risk for varicose veins on the lower leg. To confirm the existence of a cause-and-effect association, further observational studies are necessary that will ensure the verification of the diagnosis on the basis of a medical examination with the possibility to control all the potential risk factors as regards this pathology.

In some studies, a relationship was found between night shift work and an increase in the risk of myocardial infarction (23), type II diabetes (25) and coronary heart disease (3) or malignant tumours including breast cancer (26–29). A small number of cases of these diseases in our study group of women did not allow us to make detailed analyzes of these pathologies.

In conclusion, the cross-sectional study that we conducted among the nurses and midwives in Łódź did not show a statistically significantly increased frequency of any of the studied diseases among the women working based on the system of rotating night shifts, compared to the women working only during the day. The observed lower frequency of diseases and conditions for the women working on night shifts, suggests that there is a selection of employees meant to work at night – the “Healthy Worker Effect”. The observed increased relative risk of thyroid diseases requires confirmation in further epidemiological studies.

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