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ORIGINAL ARTICLE

Pediculosis capitis and scabies in nurses from Eastern Poland – occupational risk and environmental determinants

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Abstract

Introduction and Objective. Nurses are a group of healthcare professionals particularly vulnerable to infestations by *Pediculus humanus capitis* and *Sarcoptes scabiei* var. *hominis* contracted from patients under their medical care.

Materials and method. The cross-sectional study included 322 professionally active nurses within public healthcare units in eastern Poland. The research tool was a questionnaire collecting anonymized data on the occurrence of pediculosis capitis and scabies in nurses, and their patients, concerning the environmental determinants in the period 2001–2013. The study was retrospective and participation of nurses was voluntary.

Results. The obtained results indicated that 24.8% and 9.9% of the 322 respondents were infested by head lice and scabies mites, respectively. During their professional work, most nurses contracted head lice once (76.2%) while others (23.8%) were infested twice or more. The respondents did not declare repeated occupational scabies. The risk of contracting pediculosis capitis and scabies was not related to the length of service, but increased with the rise in the number of patients provided with nursing care. In the head lice-infested patients, the majority were aged 6–10 years (31.3%), while in the case of scabietic patients, children aged 0–5 years prevailed (26.4%).

Conclusions. In medical care facilities, regular hygienic checks of both patients and medical staff, covering the condition of the skin and scalp, should be mandatory. The spread of pediculosis capitis and scabies among nurses can be reduced by the implementation not only of protective procedures mitigating occupational risk, but also the improvement of working conditions in medical facilities.

Key words

occupational hazards, scabies, *Pediculus humanus capitis*, *Sarcoptes scabiei* var. *hominis*, pediculosis capitis, pediatric nursing

INTRODUCTION AND OBJECTIVE

Pediculosis capitis and scabies are among the oldest known and most widespread human parasitic diseases [1, 2] which occur on all continents in countries with varying degrees of economic and cultural development [3–5]. They are a major epidemiological problem in many regions of South America, Africa, and South-East Asia [6–8].

It is estimated that the diseases are diagnosed in approximately one to several percent (pediculosis capitis) [9, 10] and from approximately 1% to over 10% (scabies) [7] of the world population. However, this percentage is much higher in some regions. For example, the prevalence of pediculosis noted in the Middle East is as high as 97.7% [10], and scabies was estimated to affect as much as 87.3% of children in Thai orphanages [11].

The etiological factors of pediculosis capitis and scabies, i.e. *Pediculus humanus capitis* (Insecta: Pediculidae) and *Sarcoptes scabiei* var. *hominis* (Arachnida: Sarcoptidae) (Fig. 1), most often spread through direct physical contact between infested and healthy individuals. However, indirect infestation with lice and scabies, by sharing toiletries, bedding, and clothes with subjects infested by these arthropods, is also possible [12, 13]. As shown by Arlian et al., scabies mites were present in dust samples collected from 44% of homes of

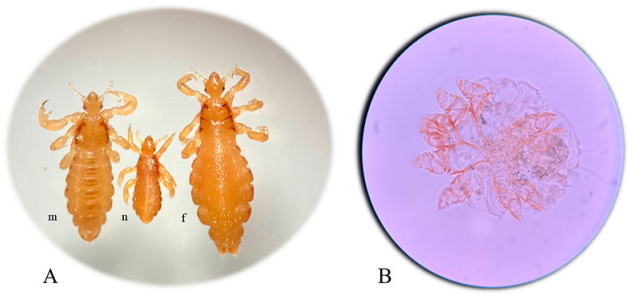

Figure 1. *Pediculus humanus* (A) collected from human scalp: male (m), nymph (n) and female (f), original magnification 10×; *Sarcoptes scabiei* var. *hominis* in human skin scraping (B), original magnification 400×

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scabietic patients. In as many as 64% of the houses, live mites were found on bedroom floors, armchairs, and couches [14].

The rapid spread of pediculosis capitis and scabies is supported by the recently intensified human migrations as well as social and cultural changes offering greater opportunities for human contact. Outbreaks of these contagious diseases are usually associated with population density and poverty [15, 16], poor sanitary and hygienic conditions, and hygiene negligence in some environments [17, 18], and a low level of education in the field of infectious diseases [16, 19].

Many studies conducted so far worldwide have usually focused on the clinical and diagnostic aspects of *P. humanus capitis* and *S. scabiei* var. *hominis* infestations [e.g. 20–22] and the presence of these parasitic arthropods in selected groups of people, e.g. school children [8, 23, 24], adult residents of various regions [17, 25, 26], residents of nursing homes [27–30], and the elderly [31]. In turn, little attention has been paid to the presence of these ectoparasites among medical personnel who may come into occupation-related contact with patients infested by head lice and scabies mite. Only a few studies describe the health hazards posed by scabies infestation to nurses [32–36]. To the best of our knowledge the available literature does not provide information about the prevalence of head lice among healthcare professionals.

To date, no studies have investigated the occupational risk of pediculosis and scabies infestations among medical personnel in the eastern regions of the European Union. Therefore, this study was aimed at identification of the risks posed by *P. humanus capitis* and *S. scabiei* var. *hominis* infestation to nurses' health during their professional activities. The impact of various factors on the spread of these ectoparasites in the nurses' workplace in eastern Poland was also analyzed.

MATERIALS AND METHOD

Participants. The survey was carried out in 2014 in the Lublin Province of eastern Poland (51°15'N), on the eastern border of the European Union with Ukraine and Belarus. The respondents were 322 nurses employed in various medical facilities, educational-care centres, and schools, selected at random. Since the study was retrospective and non-invasive, the diagnostic and treatment process was not interfered with; all collected data were anonymous, and no Ethics Committee approval was required.

Questionnaire. The anonymous questionnaire consisted of 4 groups of 15 single or multiple choice questions. The first group of questions collected information about the place of work, location of the facility, length of service, and the number of patients under the care of the nurses in their workplace.

The second group included questions on pediculosis capitis cases contracted by the nurses during their professional work, the number of head lice infestations, month and year of the infestations, and age of the patient who was the source of the infestation in the workplace.

The third group consisted of questions about cases of scabies infestation among the nurses. The respondents were expected to report their scabies infestations contracted at work, the number of such cases, date of infestation, and the age of the patient who was the source of the infestation.

In the fourth group, there were questions about the circumstances of the patient's infestation by *P. humanus capitis* and/or *Sarcoptes scabiei* var. *hominis* based on epidemiological interviews. These were questions about the gender and age of the patients, year and month of the ectoparasitic infestations, number of pediculosis capitis/scabies cases in the individuals contacted by the nurses during their professional work, and the family history of *Pediculus humanus capitis*/*Sarcoptes scabiei* var. *hominis* infestation with information about their frequency and the person (child or adult) who was the source of the family infestations with these ectoparasites. The epidemiological data collected in the study covered the period 2001–2013.

The Statistical Yearbook of Lubllin Province, from the Statistical Office in Lublin [37], provided information about medical personnel (number of nurses, general practitioners-GPs, dermatologists and paediatricians) employed in healthcare institutions in Lublin Province during the survey. Additionally, data on the number of inhabitants, the unemployment rate (ratio of the number of the unemployed to the number of professionally active people), and the salaries earned by provincial residents receiving medical care from nurses associated with the District Chambers of Nurses and Midwives in Lublin Province. The 2014 Statistical Yearbook of the Republic of Poland was used to collect information on the entire territory of Poland. Reports of the National Institute of Public Health (National Institute of Hygiene, Department of Epidemiology), and Chief Sanitary Inspectorate (Department of Communicable Diseases Control) on the pediculosis and scabies incidence (number of cases per 100 thousand inhabitants) in Lublin Province were analyzed. It should be stated that the data from the above mentioned Registry do not differentiate between infestations by *P. humanus capitis*, *Pediculus humanus corporis* and *Phthirus pubis*. They covered the last 5 year-period (i.e. 2004 – 2008), when recording the incidence of these contagious diseases was compulsory in Poland [38–42].

The above-mentioned data facilitated assessment of the working conditions in nurses' places of work and the level of medical care provided to the inhabitants of Lublin Province. They also helped to trace environmental conditions supporting the spread of pediculosis and scabies among the nurses and their patients.

Statistical analysis. The effect of the analyzed variables on the pediculosis capitis and scabies incidence among the nurses was analyzed using the IBM SPSS Statistics 21 package. Non-parametric analysis of variance with the Kruskal-Wallis test was carried out. The Mann-Whitney U test was used to analyze the differences between the 2 groups, and the chi-square test was used for the analysis of multi-way contingency tables. The presence of correlations between the variables was verified using Spearman's rho coefficient. The values were considered statistically significant at $p<0.05$.

RESULTS

Pevalence of pediculosis capitis and scabies among nurses. All nurses who expressed their willingness to participate in the study were females. As shown by the data collected in the survey, the 322 respondents mostly worked in Lublin,

the provincial capital city (68.6%). A substantially smaller group comprised nurses employed in towns or villages in Lublin Province (Tab. 1).

The majority of nurses were employed in children's hospitals (66.8%) and adult in-patient wards (20.8%). Fewer nurses were employed in non-public health care institutions and other medical facilities, schools, and educational-care centres, where they worked with minors. The largest group comprised respondents with over 15-years of work service (Tab. 1).

Table 1. Characteristics of the studied group taking into account length of service and place of employment (N=322)

Variable	n	%
Length of service		
0–15 years	72	22.4
15–20 years	71	22
20–25 years	100	31.1
more than 25 years	79	24.5
Workplace		
children's hospital	215	66.8
NHCI	23	7.1
primary school	7	2.2
orphanage	4	1.2
care and educational institutions	3	0.9
adult in-patient wards	67	20.8
social welfare home	3	0.9
Location of workplace		
Province capital city (Lublin)	221	68.6
County towns	90	28
Village/country	11	3.4

NHCI- non-public health care institutions; n – number of answers; N- number of nurses in the group studied

Pediculus humanus capitis and *S. scabiei* var. *hominis* infestations contracted during professional activities were reported by 24.8% and 9.9% of nurses employed in various institutions in Lublin Province, respectively. The majority of the infested respondents (76.2%) were affected by pediculosis capitis once, whereas a 4-fold lower number of nurses (17.5%) were infested twice. Only a few respondents reported a greater number of head lice infestations (3–5 times) (Tab. 2). To the best of their knowledge, the nurses most often identified patients aged 6–10 (32.6%), 11–15 (23.3%), and 0–5 (16.3%) as the source of lice infestation in their workplace. All the nurses declared a single scabies infestation during their professional work. The nurses indicated patients aged 6–10 years (24.2%), 11–15 years (18.2%), and 0–5 years (15.2%) to be the most probable source of scabies infestation.

Table 2. Prevalence of pediculosis capitis and number of infestations recorded in one nurse among the surveyed nurses in 2001–2013 (N=322)

Number of infestations	n	%
once	61	18.9
twice	14	4.3
three times	1	0.3
four times	3	0.9
five times	1	0.3
no infestation	242	75.2
Total	**322**	**100**

n – number of infested nurses; N – number of nurses in the studied group

The dynamics of the pediculosis capitis and scabies occurrence varied in different months. The greatest percentage of cases of head louse infestation (52.5%) were recorded between March – June. The highest prevalence of scabies was noted from January – March (43.7%), and from September – October (21.9%) (Fig. 2).

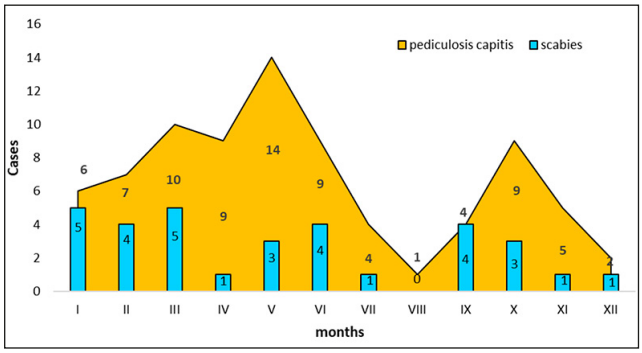

Figure 2. Seasonal occurrence of pediculosis capitis and scabies in nurses participating in the study (2001–2013, N=322)

Environmental determinants of pediculosis capitis and scabies occurrence in nurses. As many as 39.3% of the 163 nurses who reported the number of patients under their medical care in the questionnaire contracted pediculosis capitis in their workplace. Each of these nurses cared for an average of 125.51±404.63 patients in the period covered by the present study. No statistically significant correlation was found between the number of pediculosis capitis cases among the nurses and the number of patients in direct contact with the infested medical staff (Z=1.153, p=0.249). In turn, the statistical test showed a statistically significant relationship (rho=0.342, p<0.0010) between the number of infestations by *P. humanus capitis* among the patients, and the number of patients provided with nursing care (Tab. 3).

Approximately 26.1% from the group of the 163 respondents who declared that they had been infested by *S. scabiei* var. *hominis* provided nursing care for 40.27±82.05 patients. There was no statistically significant correlation between the number of scabies cases among the nurses and the number of their patients. A statistically significant relationship was found between the number of scabies cases in the patients and the total number of patients receiving their nursing care (rho=0.519, p<0.001) (Tab. 3).

A similar frequency of pediculosis capitis cases, ranging from 22.5% – 27.5%, was found in employees with different lengths of service. The statistical test showed a statistically insignificant difference in the infestation incidence in the groups of nurses with different lengths of service (chi^2=2.253, p=0.522). There was no statistically significant correlation between the number of scabies cases contracted by the nurses in their workplace and the length of service (chi^2=3.420; p=0.331) (Tab. 4).

The highest number of pediculosis capitis cases was recorded among nurses employed in the province capital city (68.8% of infested nurses). In contrast, those employed in the smaller towns and villages contracted the parasitosis less often. However, the chi^2 test did not confirm the relationship between the number of pediculosis capitis cases in the nurses

Table 3. Pediculosis capitis and scabies – number of cases among patients of the surveyed nurses in relation to the total number of patients under their care

Variable	Pediculosis capitis			Scabies		
	N	M	SD	N	M	SD
Cases among patients	170	2.8118	4.7205	117	2.9231	4.86393
Number of patients under the care of the surveyed nurses	163*	86.2515	286.8945	111**	37.8108	74.20420
rho=0.342, p<0.001***					rho=0.519; p<0.001***	

N – includes answers of nurses providing information about the number of patients receiving their nursing care in the analyzed period (2001–2013), * number of nurses who simultaneously provided information about the occurrence of pediculosis capitis in their patients and the numer of patients under their care; ** number of nurses who simultaneously provided information about the occurrence of scabies in their patients and number of patients under their care; *** Rho (Spearman's correlation) was used due to the presence of outliers; M – mean; SD – standard deviation

Table 4. Number of pediculosis capitis and scabies cases among nurses (infestation contracted at workplace) taking length of service into account

Length of nurse service (years)	Pediculosis capitis			Scabies		
	Infested	Non-infested	Total	Infested	Non-infested	Total
0–15	18* (22.5%)	54 (22.3%)	72 (22.4%)	10 (31.3%)	62 (21.4%)	72 (22.4%)
15–20	22 (27.5%)	49 (20.2%)	71 (22.0%)	9 (28.1%)	62 (21.4%)	71 (22.0%)
20–25	21 (26.3%)	79 (32.6%)	100 (31.1%)	8 (25.0%)	92 (31.7%)	100 (31.1%)
> 25	19 (23.8%)	60 (24.8%)	79 (24.5%)	5 (15.6%)	74 (25.5%)	79 (24.5%)
Total	80 (100.0%)	242 (100.0%)	322 (100.0%)	32 (100.0%)	290 (100.0%)	322 (100.0%)
	c^2=2.253, p=0.522			c^2=3.420, p=0.331		

* number of cases

and the location of their workplace (chi^2 =0.00; p=1.000) (Tab. 5).

As many as 71.9% of nurses who had contracted scabies were employed in medical facilities located in the province capital. The number of scabies cases among the nurses working in the provincial towns and villages was by a third smaller. The statistical test showed no correlation between the number of scabies cases among nurses and the location of their place of work (chi^2 =0.047; p=0.829) (Tab. 5).

Table 5. Number of pediculosis capitis and scabies cases among nurses (infestation contracted at workplace) taking into account the location of the nurse's workplace

Workplace location	Pediculosis capitis			Scabies		
	Infested	Non-infested	Total	Infested	Non-infested	Total
Province capital city (Lublin)	55* (68.8%)	166 (68.6%)	221 (68.6%)	23 (71.9%)	198 (68.3%)	221 (68.6%)
County towns / villages	25 (31.3%)	76 (31.4%)	101 (31.4%)	9 (28.1%)	92 (31.7%)	101 (31.4%)
Total	80 (100.0%)	242 (100.0%)	322 (100.0%)	32 (100.0%)	290 (100.0%)	322 (100.0%)
	c^2=0.000; p=1.000			c^2=0.047; p=0.829		

* number of cases

Occurrence of pediculosis and scabies among patients in hospitals and other facilities. In 2001–2013, pediculosis capitis was diagnosed in 155 females and 75 males who received care from the respondents. The majority of the 230 people infested by *P. humanus capitis* were children aged 0–15 years. The highest numbers of pediculosis cases (31.3%) were recorded in children aged 6–10 years. Fewer cases were noted in children aged 11–15 years (22.6%) and from 0–5 years (10.8%). Rare infestations by *P. humanus capitis* were observed in other age groups.

In the group of patients aged 6–15 years, pediculosis capitis was more common in girls (27.7% – 34.1%) than in boys (12.0% – 25.3%). In contrast, in the group of patients aged 16–60 years and over, the incidence of pediculosis was usually higher in males (2.6% – 10.6%) (Fig. 3).

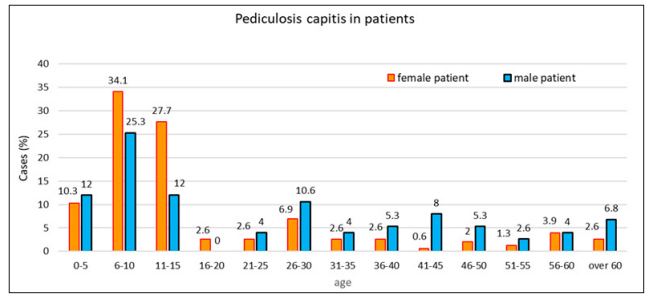

Figure 3. Pediculosis capitis occurrence among patients under the care of the surveyed nurses in 2001–2013, taking into account age and gender (N=230)

The highest number of patients with pediculosis capitis in the respondents' workplace was reported in May, June, and October, i.e. 23.7%, 12.3%, and 10.3%, respectively. In the other months of the year, the percentage of cases of the disease in the patients of the surveyed nurses was lower (3.0% – 9.2%) (Fig. 4).

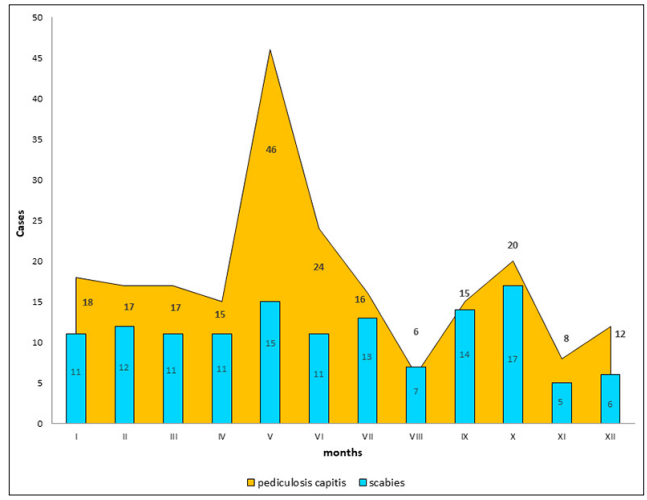

Figure 4. Seasonality of pediculosis capitis and scabies among patients under the care of surveyed nurses in 2001–2013. Pediculosis N=194 (in the case of 36 patients, the month of infestation was not given); Scabies N=133 (in the case of 18 patients, the month of infestation was not given); N – number of cases

Infestations by *Sarcoptes scabiei* var. *hominis* were diagnosed in 151 subjects staying in Lublin Province hospitals and educational-care centres where the respondents were employed. Parasitic mites occurred more frequently in female patients than in males (54.3% vs. 45.7% of the cases noted,

respectively). Most cases of scabies were noted in children aged 0–5 years, 6–10 years, and 11–15 years (26.4%, 20.5%, 11.9% of the cases noted, respectively). The occurrence of scabies among patients under the care of the surveyed nurses, taking into account age and gender, is shown in Figure 5. Scabies cases in the patients were recorded in all months of the year (Fig. 4). It was lower only in August, November, and December (3.7% – 5.2% of the cases noted).

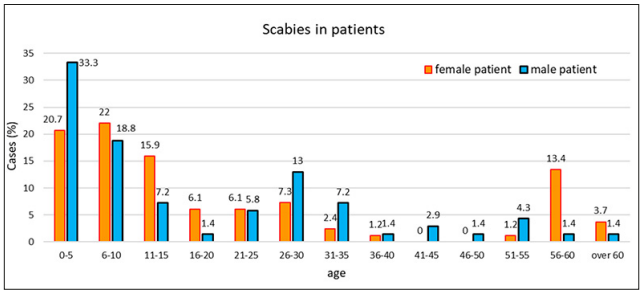

Figure 5. Occurrence of scabies among patients under the care of the surveyed nurses in 2001–2013, taking into account age and gender (N=151)

The epidemiological interviews indicated single or multiple cases of pediculosis capitis in patients' families. Multiple familial infestations were more often reported in patients living in provincial towns and villages than in the large city (5.3% vs. 3.5%); however, statistical analysis did not reveal a relationship between the incidence of familial pediculosis capitis cases in the patients and the nurses' workplace (chi^2=0.000; p=1.000).

No cases of familial scabies infestations among the patients were reported in the epidemiological interview. This may indicate a different source of infestation than their families (e.g. nursery, kindergarten, school, or family member's workplace).

Identification of factors contributing to the spread of pediculosis capitis and scabies in eastern Poland. In 2013 in Lublin Province, which covers an area of 24,859.9 km^2, there were 50 hospitals with only 54.7 beds per 10 thousand inhabitants. The paediatric, infectious disease, and dermatological wards had 546, 307, and 80 beds, respectively. The numbers of medical personnel (nurses and doctors) employed in healthcare institutions were equally low in this region. In 2012–2013, there were only 78 nurses per 10 thousand residents. Similarly, the number of medical specialists in the diagnosis and treatment of mentioned infectious diseases was dramatically low e.g., 4.5 GPs, 0.3 dermatologists, 0.8 paediatricians per 10,000 residents [37].

In 2012–2013, the unemployment rate in Lublin Province ranged from 9.9% – 25.0%, and the average income *per capita* ranged from 710.43 EUR – 731.51 EUR gross (1 PLN = 0.23 EUR) [37]. These data indicate relative poverty among the inhabitants of eastern Poland. For the entire country, the unemployment rate was 13.4% in both years, and the average income *per capita* was 812.00 and 841.66 EUR gross, respectively. The incidence of pediculosis and scabies in Lublin Province in 2004–2008, i.e. in the last years of their obligatory registration, ranged from 0.69–2.73 and from 23.3–28.0, respectively. In the same period, the incidence of these parasitoses across Poland ranged from 1.39–6.96 (pediculosis) and from 29.0–31.7 (scabies) [38–42].

DISCUSSION

Occupational health hazards posed to medical personnel by parasitic arthropods, i.e. head lice and scabies mites, are still underestimated worldwide, which is probably associated with the small number of studies documenting the scale of the problem. The present study confirmed that patients infested by *P. humanus capitis* and *S. scabiei* hospitalized due to non-infectious diseases, as well as residents of educational-care institutions in Lublin Province, may be a source of infestations in nurses and other individuals present in these facilities.

Other authors also highlight the increased exposure of healthcare personnel to infestations with parasitic arthropods [e.g. 33–35]. Among healthcare workers, nurses are the most vulnerable to pediculosis and scabies, as they have the most frequent and close contact with their patients during nursing procedures and other professional activities. For example, at the Johns Hopkins Hospital in Baltimore, Maryland, USA, symptoms of Norwegian (crusted) scabies were reported in 60.8% of nurses/nursing students and 26.0% of physical therapists/technicians who had extensive physical contact with infected patients in the acute-care facility [32]. In a German acute-care hospital, 85% of 13 healthcare workers infected with *S. scabiei* from patients were nurses [35]. In Korea, 72.6% of 2.3% of healthcare workers diagnosed with scabies were nurses [33].

Although head lice and scabies mites are permanent parasites, they are able to survive outside the host for some time. *Pediculus humanus capitis* eggs can survive for 10 days in the external environment at a temperature from 0 °C – 10 °C, and for 7 days in the temperature range of 11–20 °C and 40–80% relative humidity [43]. In the most common indoor conditions, i.e. at a temperature of 21 °C and 40–80% RH, *S. scabiei* var. *hominis* remain capable of infestation for 24–36 hours [44]. Their ability to survive for a certain time in the environment supports their spread among many individuals present in the same rooms in hospitals, outpatient clinics, and educational-care institutions [45, 46].

Due to the high prevalence of pediculosis capitis and scabies in children, nurses working in children's hospitals, children's outpatient clinics, education and care centres, and primary schools are at the highest risk of *P. humanus capitis* and *S. scabiei* var. *hominis* infestations. The closer the contact of nurses with children in the workplace, the greater the risk of contraction of both these contagious diseases. Small children requiring constant help from nurses (e.g. with daily hygiene, getting dressed, making beds, playing) constituted the largest percentage of patients infested by head lice and scabies mites. A high prevalence of scabies was also detected in individuals aged 55–60 years, which may be associated with a low standards of living in this group of inhabitants in eastern Poland.

The absence of correlations between the length of service and the number of nurses infested by head lice and scabies can be explained by the fact that both diseases have been widespread in eastern and central Poland for many years [47, 48]. The persistence of the sources of these diseases in the analyzed area is associated with the poor socio-economic conditions of the inhabitants and neglect of health protection measures. Lublin Province is one of the poorest regions in the European Union with high unemployment rates, low income, and a small number of medical personnel

and medical facilities relative to the number of inhabitants (according to European Commission. Eurostat). According to the reports of the National Institute of Hygiene, the incidence of infectious diseases, especially scabies, in Lublin Province in the period preceding the present study was substantially higher than in other parts of Poland [38–42].

Within 9 years (1996–2000 and 2009–2012), the incidence of pediculosis capitis in children and adolescents in Lublin Province doubled [47, 48]. The increase in the prevalence of infestation by *P. humanus capitis* in children was similar in both rural and urban environments. It is estimated that pediculosis capitis affects 3.52% of rural school-children and 0.98% of students of municipal schools. The greatest number of the cases (8–10%) was observed in schools attended by children from orphanages and single-parent homes [48]. The higher prevalence of pediculosis capitis and scabies in the rural population in eastern [47, 48] and central [49] Poland is associated with worse living conditions and poorer access to healthcare facilities. Similar results were reported in epidemiological studies conducted in other countries [e.g. 15, 50, 51].

The absence of a significant relationship between the number of nurses infested by head lice or scabies mites and the location of their workplace (city, village) in Lublin Province may result from the fact that the patients of the urban medical facilities and educational-care centers were mainly residents of rural areas. The nurses provided medical care to patients who had previously been infested by head lice or scabies mites. Familial pediculosis [48, 52, 53] and scabies [7, 54] are usually diagnosed in the case of subjects living in crowded, unhygienic, and poor economic conditions.

The dynamics of head lice infestations in nurses and their patients in eastern Poland is usually similar to that reported in other regions [9]. Pediculosis capitis outbreaks in children can persist throughout the year only in hot climates [51, 55]. Probably due to the small number of scabies cases, no seasonal rhythm of scabies infestations in nurses and their patients was observed in the present study, unlike in many other epidemiological studies [e.g. 16, 56, 57]. The spread of both these diseases is associated with social behaviour at different times of the year (e.g. close social contacts, longer stay indoors in groups of people in colder months), which facilitates the transmission of these parasites.

The present and other epidemiological studies indicate that pediculosis capitis usually affects children under 15 years of age [9]. Cases of infestations by head lice are reported less frequently in families with a small number of children [23, 58], and in higher-income families where both parents are employed than in single-parent households or families struggling with unemployment [59, 60].

The higher prevalence of pediculosis capitis in girls than in boys staying in hospitals and educational-care centres in the analyzed area is similar to that reported from other parts of the world [9]. This is explained by the fact that girl's long hair offer lice more favourable conditions for development, and the parasites are not readily noticed [60, 61]. The psychological (emotional, aesthetic) differences between girls and boys determining their behaviour are important to a certain extent. Girls show a greater need for closer contacts with their peers and are more concerned about their appearance.

As in the case of pediculosis capitis, the highest prevalence of scabies is observed in paediatric patients [16, 20]. In the group of hospital patients and residents of educational-care institutions in eastern Poland, the boys were more often infested by scabies in the age group 0–5 years, whereas a higher prevalence of this parasitosis in the groups aged 5–10 and 10–15 years was noted in the girls. This is probably associated with differences in the behavioral pattern of girls and boys in these age groups.

To our knowledge, this is the first study to estimate the head lice infestation-related occupational risk in nurses. Every effort has been made to ensure that the study group was as large as possible. However, it was not easy to find nurses who would volunteer their time to reliably collect the necessary data.

As the participants were recruited from the public healthcare system in eastern Poland, the poorest part of the country, there is a possibility that the results obtained are not representative of other parts of the country, or within the private healthcare sector.

When specifying the most probable source of an infestation, the nurses indicated patients after contact with whom symptoms of a given parasitosis developed, taking into account the incubation period. It cannot be ruled out that in some cases an unidentified source of infection may have been encountered by the nurses outside their workplace. Such a possibility exists, although it seems unlikely.

The data were collected in 2014, and they cover the period 2001–2013. Although they are not the most current data, the situation related to the common occurrence of pediculosis capitis and scabies in Poland has not changed considerably over the last 20 years. Infestations still commonly occur and are perceived as an embarrassing topic [18, 24, 62–64], which is highlighted in the public sphere only in the context of advertising products used to treat these parasitoses. The situation was worsened after 2008 by the abolition of the obligation to report the occurrence of head lice and scabies to Sanitary and Epidemiological Stations; therefore, it is not possible to assess the prevalence of those infectious diseases in the Polish population. The lack of data means the lack of arguments to take preventive measures, including educational ones, which are an essential part of actions limiting the occurrence of these ectoparasitoses.

The study has shown that the spread of head lice and scabies in healthcare facilities is promoted by the limited space and close contact between medical personnel, especially nurses and patients. This is particularly evident in the case of pediculosis capitis, which was contracted repeatedly by some of the surveyed nurses. Therefore, the above-mentioned parasitoses should be recognized as occupational diseases of medical personnel and included in the 'List of Infections and Infectious Diseases' annexed to the Act of 5 December 2008 on preventing and combating infections and infectious diseases in humans.

The described group of patients with skin infestations are most often patients of paediatric nurses; therefore, these professionals should be considered particularly vulnerable to occupational infections with *P. humanus capitis* and *S. scabiei* var. *hominis*.

CONCLUSIONS

Pediculus humanus capitis and *Sarcoptes scabiei* var. *hominis* pose a threat to the health of nurses and others staying in hospitals and other healthcare facilities, educational-care centres for children and adolescents, and nursing homes. To limit the spread of pediculosis capitis and scabies in nurses' workplaces, procedures for medical personnel should be developed and implemented in order to reduce the possibility of contracting these ectoparasites from the patient, e.g. regular and mandatory monitoring the hygienic condition of nurses' patients, isolation of infested patients from other individuals present in medical facilities until the infectious agent is eliminated, using gloves and protective clothing when contacting a person infested by lice and scabies. \

Relevant legislation and education of healthcare workers and the public about the epidemiology and prevention of the afore-mentioned ectoparasitoses are essential.

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