

---

## Assessment of Workplace Pathogens by the Nursing Staff: A Research Study

---

Submitted 15/10/23, 1st revision 24/10/23, 2nd revision 19/11/23, accepted 30/11/23

Stanisława Nazaruk<sup>1</sup>, Grzegorz Czapski<sup>2</sup>, Barbara Sokołowska<sup>3</sup>,  
Marzena Chrust<sup>4</sup>

### **Abstract:**

**Purpose:** The paper presents the results of an empirical study showing the current assessment of pathogens by nurses at their workplace. It identifies the problem areas in the professional work of the study group, including exposure to pathogens.

**Design/Methodology/Approach:** The study involved a group of 310 persons: nurses employed in various hospitals and medical institutions. The subjects were aged 23-50 years and above and had work experience ranging from 1 year of service to 35 years and above. The study used a diagnostic survey method based on a survey technique using a proprietary survey questionnaire. The research was administered in an online format in 2023.

**Findings:** There are pathogenic factors at nurses' work including such factors as stress, work overload and biological factors. Regardless of the workplace, the vast majority of nursing staff described their exposure to harmful factors at very high levels. They showed a failure of active involvement and discussion concerning improving working conditions and a lack of conversation about pathogens.

**Practical implications:** The article presents the current knowledge of pathogenic factors in medical facilities and nurses' assessment of these factors. The factors mentioned in the article hinder the professional activity of medical personnel and may lead to the occurrence of diseases. The presented results from our own research may serve some initiative in initiating activity among this professional group, including a dialogue between the medical staff and management in the reduction of the listed factors. Furthermore, it may prompt a discussion on the problems diagnosed in the research. The lack of active involvement of nurses in improving working conditions should change.

**Originality/Value:** The authors present original research that has shown the threat from pathogenic factors in the workplace of medical staff, which significantly hinders professional activity and often causes illnesses and even results in a career change. The presentation of

---

<sup>1</sup>PhD, Department of Pedagogy, Faculty of Social Sciences and Humanities, John Paul II University in Białą Podlaska, Poland, ORCID: 0000-0001-5620-3980, [s.nazaruk@dyd.akademiabialska.pl](mailto:s.nazaruk@dyd.akademiabialska.pl);

<sup>2</sup>MSc, Department of Management, Faculty of Economic Sciences, John Paul II University in Białą Podlaska, Poland, ORCID 0000-0002-1490-7397, [g.czapski@akademiabialska.pl](mailto:g.czapski@akademiabialska.pl);

<sup>3</sup>PhD, Department of Nursing, Faculty of Health Sciences, John Paul II University in Białą Podlaska, Poland, ORCID: 0000-0002-9711-122X, [b.sokolowska@dyd.akademiabialska.pl](mailto:b.sokolowska@dyd.akademiabialska.pl);

<sup>4</sup>MSc, Department of Nursing, University of Humanities and Economics in Łódź, Poland, [marzenachrost80@gmail.com](mailto:marzenachrost80@gmail.com);

*this topic is timely in view of the society expecting high quality medical services. The research conducted provides a basis for outlining new scientific challenges in nursing.*

**Keywords:** Nurse, pathogen, hospital, medical staff, research.

**JEL codes:** I18, J81.

**Paper type:** Research article.

## 1. Introduction

As numerous studies show, the health of working people is directly related to work environment factors and their impact on their bodies. The data collected during a number of inspections carried by the State Labour Inspectorate, as well as the State Sanitary Inspectorate, confirm the possibility of negative disease effects directly related to exposure to harmful factors at work. Reducing the impact of these types of factors on workers is still under-exposed and not popularised enough in the work organisation process (Gniadek and Marcisz, 2014; Chmielewski *et al.*, 2017).

At the turn of the seventeenth and eighteenth centuries, an Italian physician known as the 'father of occupational medicine', Bernardino Ramazzini - noted the health problems associated with the medical profession. In his work *De morbis artificum diatriba*, he listed the medical profession as second only to mining in terms of the level of occupational risks and believed that this occupation was most vulnerable to infectious diseases (Franco, 2001).

It was not possible to reduce infections until more than 150 years later when infection prevention strategies were introduced. As early as the 20th century, subsequent researchers recognised the need to reduce exposure to new harmful agents, which undoubtedly include ionising radiation, electromagnetic fields or allergenic agents (Prażak and Kowalska, 2017).

The current data on working conditions show that it is mainly nurses who are exposed to health problems during their work. This is due, among others, to frequent contact with dangerous and harmful agents, the performer type of duties, as well as the psychosocial load.

According to the current scientific data, the most hazardous agents to health include biological, chemical and physical factors, as well as musculoskeletal overload and stress (Wójcik *et al.*, 2020; Prażak and Kowalska, 2017). It should be mentioned that the employee health problems are not only a cost for the employer, but also for society as a whole (Marcinkiewicz and Tomczak, 2018).

Furthermore, the work-related conditions include not only occupational diseases, but also a group of conditions of a multifactorial origin, where the work environment or

the way it is performed influences their development, course, as well as prognosis (Walusiak *et al.*, 2021).

Although the issue of pathogens in the nurses' work environment has been widely presented in the world literature, there is still a need to undertake research in this area due to its complexity, the changing working conditions and the awareness demonstrated by medical staff. Therefore, this paper presents the results of a nationwide survey conducted in Poland in 2023 among 310 active nurses.

The survey research was carried out using a survey questionnaire. In order to reach the target group of respondents from all over the country, the survey was administered in an online format. The aim of the survey was to find out the nurses' assessment of the prevalence of pathogens in their workplace.

## **2. Pathogens in the Work of the Nursing Staff**

Harmful factors present in the work environment can be defined as the ones whose effects on a worker may lead to or contribute to an occupational disease or other work-related illness (Kujawa and Kaczocka, 2014). It is worth noting that the first linking of workplace factors to disease occurred in ancient Egypt around 2000 BC and concerned silica-containing dust that contributed to respiratory disease.

In turn, Hippocrates, described lead colic in people using lead oxide and lead white in cosmetic dyes, and advised doctors to ask their patients about the type of work the workers performed (Thorwald, 2017).

Nursing is a specialised profession. People in this profession often deal with a wide variety of biological, physical or psychosocial problems. Regardless of where they work, a nurse should be able to perform their duties in safe environment. Nurses are a professional group with an increased risk of exposure to harmful agents.

Performing duties in the field of disease prevention, health promotion, nursing, diagnostic, treatment, rehabilitation and improvement services causes that they are in constant contact with patients and are thus directly exposed to many pathogens (Zhang *et al.*, 2023; Montgomery *et al.*, 2022).

This group of factors also includes others that may directly lead to injury (laceration or puncture) during the performance of professional duties, so they include sharp instruments, e.g., scalpels, needles, venflons, etc., (Pruss-Ustun *et al.*, 2005; Różańska *et al.*, 2014).

The hazards that exist in a nurse's working environment can be divided into:

- hazardous factors - which can lead, for example, to injuries, punctures; these include sharp instruments, venflons, scalpels, needles;

- harmful factors - which include chemical, biological and physical factors;
- psychosocial factors - stress and fatigue, time pressure, high patient responsibility (Al Ma'mari *et al.*, 2020; Prazak and Kowalska, 2017).

## **2.1 Biological Agents**

According to the Directive 90/679/EEC, harmful biological agents in workplace are all micro-organisms - bacteria, fungi and viruses, together with mutants, endoparasites and cell cultures - which may cause allergies, infections or other toxic effects. Currently, according to the epidemiological data, they represent the biggest problem due to the high inter-individual variability both in terms of immunity and the different possibilities of preventive measures (Dz. U. EU L 17.10. 2000).

Because of their large number of duties, nurses are in constant contact with patients during care or procedures and thus with potential biological infectious material (Al Ma'mari *et al.*, 2020). Occupational exposure to a type of biological material can take place through direct contact with the patient (respiratory route - mycobacterium tuberculosis, influenza virus), as well as with infected blood or other body fluids and contaminated equipment or instruments (bloodborne route- HBV, HCV, HIV).

The data from a January 2019 report from the Institute of Occupational Medicine examining the implementation of the Council Directive 2010/32/EU show that approximately 40% of nurses from Polish hospitals did not report an injury or cut.

Failure to report occupational exposures may result in an increased risk of blood-borne infections among healthcare personnel and is not due to ignorance, but often to downplaying the risk or discouragement to report due to the lengthy and complicated procedure and fear of negative consequences from the employer (Rainbow *et al.*, 2020).

## **2.2 Chemical Agents**

The work of a nurse is characterised by an exposure to numerous chemical agents used for pharmacological treatment (cytostatics), sterilisation, anaesthesia, disinfection, or contact with metal instruments made of harmful metal alloys: chromium, nickel or cobalt. Up to 400 of the chemicals causing adverse health effects (irritant, mutagenic, teratogenic or carcinogenic conditions) may be used in medical facilities.

The US National Institute for Occupational Safety and Health (NIOSH), recommends preventing exposure to chemicals including cancer drugs (Pluta *et al.*, 2015). Latex sensitisation affects 6% of medical personnel, while according to the published studies, as many as 2-17% are affected. A very large increase in allergy to this allergen has been noted in Western Europe over the past 20 years (Aksoy *et al.*, 2023; Vandenplas and Raulf, 2017).

### 2.3 Physical Factors

Recent years have seen the arrival of a huge number of electronic and electrical devices that generate electromagnetic fields during operation. Among this type of devices are also medical devices. For this reason, physical factors such as electromagnetic radiation and electromagnetic fields, ionising radiation, laser radiation, or ultrasounds are quite common exposure agents in the nurses' work (Stabin, 2008).

Despite establishing standard limits for the physical agents to which nurses are exposed, measurements are not carried out. Prophylaxis only applies to isotope X-ray, physiotherapy laboratories and mainly concerns the use of individual dosimetry (Stabin, 2008). The basic principles of radiological protection were defined by the International Commission on Radiological Protection in 1990.

The Polish law defines the obligations that the employer has towards an employee exposed to ionising radiation, i.e. to carry out training of employees before allowing them to work, to develop and provide instructions for conduct, to equip employees with appropriate personal protective equipment (Zmyślony *et al.*, 2004).

### 2.4 Physical Workload

Much of the nurses' activity at work involves physical work. This occupational group is most exposed to musculoskeletal overload. Nurses' work requires standing or forced positions, as well as lifting or transporting patients (Pluta *et al.*, 2015). The most physically demanding work is usually performed by nurses working in emergency departments, surgical wards, internal medicine or neurology.

Work overload has a significant impact on back pain syndrome. As studies show, up to 100% of the surveyed nurses complain about back pain, and more than 60% of those surveyed experience pain on a daily basis. The most common pain is in the sacro-lumbar region of the spine, which is indicated by up to 86.2% of the respondents (Wyderka and Niedzielska, 2016).

The nursing profession is still dominated by women and it is they who are responsible, in addition to performing all activities around the patient including transport, nursing, lifting, for the transport of the collected material, distribution of IV fluids, medicines, medical equipment and dressing materials. These activities require wheelchair rides, walking with loads, bending, working in forced positions or walking up stairs (Wyderka and Niedzielska, 2016).

### 2.5 Psychosocial Factors

The nurse's work involves psychological strain, which is often combined with time pressure, high patient responsibility, complexity and variability of tasks to be

performed, as well as conflicts within the team (Debska *et al.*, 2014). The workload varies between wards. The staff working in surgical and intensive care units have the highest workload, while those working in Primary healthcare show the highest level of monotony (Debska *et al.*, 2014).

Working under constant strain is associated with stress; that is, the body's response of physical and mental mobilisation to overcome any obstacles and demands. Currently, the nurses in health care are one of the most stress-prone professional groups (Czarnecka *et al.*, 2014; Chochowska, 2022). Chronic workload leads to professional burnout, which, in the case of a nurse, can manifest itself in lack of interest in the patient, lack of empathy towards the patient and even negligence at work.

### 3. Pathogenic Factors in the Nurses' Workplace

The surveyed occupational group of nurses comprised 310 persons in Poland, in which the vast majority were women 95% with men constituting only 5%. Most of the subjects were aged 41-50 years and over 50 years. In terms of work experience, most respondents indicated between 26-35 years of being in the profession. Most of the respondents work in District Hospitals and, in the second instance, in Research Institutes. A detailed description of the target group is presented in Table 1.

**Table 1.** Characteristics of the target group

Criterium		% participation in the study
Sex	female	<b>95,0</b>
	male	5,0
Age	23-30 years	21,9
	31-40 years	11,4
	41-50 years	<b>35,3</b>
	> 50 years	31,4
Length of the service (work experience)	1-5 years	20,0
	6-15 years	18,1
	16-25 years	13,3
	26-35 years	<b>40,0</b>
	> 35 years	8,6
Workplace	Research Institute	21,0
	District Hospital	<b>23,7</b>
	Specialist Hospital	19,0
	Clinical Hospital	16,0
	Provincial Hospital	12,0
	Public clinic	4,5
	Private clinic	2,3
	Nursing Home	1,0
Others	0,5	

**Source:** Own elaboration.

As the main source of knowledge about pathogens, the respondents indicated studies (61.9%), training sessions organised at the workplace (49.5%), Internet resources (37.1%), specialised literature (36.2%), colleagues (32.4%). The least amount of knowledge is obtained from superiors (15.2%).

Furthermore, nurses rated their knowledge of pathogens on a scale of 1 to 10. The mean score of the whole group was recorded at 6.4. There were, however, individual answers rating knowledge at 1,2,3, i.e. very low. Most nursing staff rated their knowledge at a level of 5 and 8 on a scale of 0-10. The data collected are shown in Table 2.

**Table 2.** Level of the assessed knowledge on pathogens

Level of knowledge Scale of 1 -10	The respondents' self-assessment %
1	1,0
2	2,8
3	4,8
4	6,7
5	21,9
6	13,3
7	15,2
8	21,8
9	7,7
10	4,8

*Source: Own elaboration.*

For the purposes of the research and statistical studies, different jobs in which the surveyed persons work have been assigned to three groups. This division is shown in Table 3.

**Table 3.** Division of the respondents' jobs into three groups

Group name	Workplaces
Highly-specialised Institutions	Research Institutes, Clinical Hospitals
Specialist Hospitals	Specialist hospitals, Private hospitals
Regional Hospitals	District Hospitals, Provincial Hospitals

*Source: Own elaboration.*

Exposure to pathogens of the respondents in their workplace is shown in Table 4.

**Table 4.** Exposure to pathogens

Workplace	Exposure to pathogens %	
	YES	NO
Highly-specialised Institutions	87,2	12,8
Specialised Hospitals	80,0	20,0
Regional Hospitals	72,0	28,0

*Source: Own elaboration.*

The nurses working in Highly-specialized Facilities are the most exposed persons to pathogens in their place of work, as indicated by 87.2% of the respondents who marked 'yes', while the nurses working in Regional Hospitals are the least exposed to pathogens.

A statistical relationship was counted from the data using Pearson's Chi-square test. A correlation was obtained between the respondents' place of work and exposure to pathogens  $p=0.04$ . This correlation is statistically significant.

The respondents subjectively assessed the extent to which they were exposed to harmful factors at their workplace. The overwhelming majority of the respondents (97.1%) thought that they were exposed to a very high degree, which may indicate their awareness of the issue. Only 2.9% of those surveyed were unable to determine the degree of harmful exposure.

As the respondents point out, the exposure to pathogens in medical facilities has not decreased in a significant way over the years, which is confirmed by 53.4 per cent of the answers. 40 per cent of the respondents indicated that it had decreased to a small extent, while 6.6 per cent gave no answer. The largest percentage of the respondents believe that exposure to pathogens has not decreased in a significant way over the years in Regional Hospitals. In the Specialised Hospitals, exposure has decreased slightly.

Table 5 shows a list of the agents to which the respondents are exposed in each workplace. In Highly- specialised Facilities, factors such as viruses, bacteria, musculoskeletal overload and stress were most frequently identified.

In the Specialised Hospitals, the greatest risks are associated with biological agents, musculoskeletal overload, stress, but also disinfectants. Similar responses were obtained in the Regional Hospitals.

**Table 5. List of pathogens**

Pathogenic factors	Highly-specialized Facilities			Regional Hospitals			Specialist Hospitals		
	Yes	No	I don't know	Yes	No	I don't know	Yes	No	I don't know
Bacteria, viruses	100.0%	0.0%	0.0%	96.6%	3.4%	0.0%	100.0%	0.0%	0.0%
Disinfectants	97.2%	2.4%	0.0%	96.5%	3.5%	0.0%	96.9%	0.0%	3.1%
Allergenic agents	90.5%	7.1%	2.4%	93.3%	6.7%	0.0%	93.9%	6.1%	0.0%
Cytostatics	19.0%	76.1%	4.9%	3.3%	93.3%	3.4%	18.1%	72.7%	9.2%
Ionising radiation	47.6%	50.0%	2.4%	23.7%	66.3%	10.0%	33.4%	57.6%	9.0%



Electromagnetic field	40.5%	47.6%	11.9%	36.3%	60.0%	3.7%	57.5%	39.3%	3.2%
Blue radiation	85.7%	14.3%	0.0%	83.3%	16.7%	0.0%	90.9%	6.1%	3.0%
Musculoskeletal overload	100.0%	0.0%	0.0%	96.6%	3.4%	0.0%	100.0%	0.0%	0.0%
Stress	100.0%	0.0%	0.0%	96.7%	3.3%	0.0%	100.0%	0.0%	0.0%
Night-time work	88.1%	11.9%	0.0%	73.3%	26.7%	0.0%	75.7%	21.2%	3.1%
Overwork	97.6%	2.4%	0.0%	90.0%	10.0%	0.0%	96.9%	0.0%	3.1%

*Source: Own elaboration.*

The analysis of the data summarised in the table above indicates that stress, as well as musculoskeletal overload and exhaustion were the most bothersome factors. The factor that was the least burdensome was cytostatics. This type of response could probably be due to the small number of nurses working with such drugs.

A large proportion of the nursing Staff, i.e., 43.8%, negatively assessed the management responsible for protecting employees from the effects of harmful factors. Only 22.9% of the respondents indicated that managers correctly safeguard and protect employees from harmful factors, and 33.3% did not provide an answer.

The survey results showed that 47.6% of the nurses had suffered occupational exposures at work (punctures, injuries, splashes of biological material on the skin or mucous membranes, scratches and bites). Some 19% of the respondents had been exposed to an infectious disease more than once.

There is a statistical relationship between seniority and occurrence of exposure ( $p=0.0046$ ). These data were obtained from Pearson's Chi-square test. The largest number of the respondents, 54.8%, experienced exposure with the length of service of 26-35 years. The least exposed to occupational exposures were young workers with less than five years of work experience.

The data showing reporting of exposure to superiors, which involves taking antiviral medication and being tested according to procedure, is worrying. Such occurrence was reported by only 37.1% of those surveyed. The remaining 62.9% answered that they did not report the case.

#### 4. Discussion

The nursing staff, regardless of their place of work, are exposed to a number of different pathogens, the long-term effects of which on the body can cause various types of discomfort which over time, can develop into illness. Nurses are aware of their exposure to these agents in the workplace and rated their knowledge at an

average of 6.4 (on a scale of 1 to 10). On the same scale, 12.5% of the respondents rated their knowledge at a very high level (9 and 10).

In the available literature, regarding the acquisition of information on pathogens by medical staff different results were noted. According to the study by Garwacka-Czachor *et al.* (2022), as many as 72% of the respondents obtain knowledge about workplace hazards from colleagues and supervisors (Garwacka-Czachor *et al.*, 2020).

Unfortunately, the data obtained in the study are lower, with 32.4 % of the respondents gaining knowledge of such factors from colleagues and 15.2 % - from supervisors. In another study by Lachowicz, up to 89% of the respondents spoke negatively about on-the-job training and lack of conversation with superiors (Lachowicz, 2017).

The results from the study conducted in this area showed that training provided in the workplace is a source of knowledge about pathogens. As many as 49.5% of the respondents chose the option. Another study conducted by Jasiuk and Chochowska and its results pointed to training and the need to update medical knowledge as an important determinants of health safety (Jasiuk and Chochowska, 2023).

The obtained results obtained raise questions about the cause of training not being seen as a source of knowledge about pathogens for nurses. Further, the low percentage of obtaining knowledge from colleagues and an even lower percentage from supervisors is also worrying.

Similar data on biological factors were obtained by Garwacka-Czachor *et al.* where the same answer was indicated by 95% of the respondents. Also, similar data were published in the study by Frąckowiak (2010) and Chochowska (2022).

Disinfectants also pose a serious risk as indicated by the study by Garwacka-Czachor *et al.* (2020) by (99.3%). In the same study, latex was indicated as a pathogen by significantly fewer respondents with a result of 70.6% (Garwacka-Czachor *et al.*, 2020).

In the referenced study, fatigue was not seen so significant an issue as in our own study with the result of 63.2% of the surveyed. A much smaller number of the respondents in the same study identified shift work as a harmful factor with only 39.7% (Garwacka-Czachor *et al.*, 2020).

According to the study conducted by Frąckowiak (2010), Lachowicz (2017), and Czarnecka *et al.* (2014) the vast majority (more than 90%) of the surveyed nursing staff confirmed exposure to stress and fatigue in the workplace. This is similar to the result obtained in our own study. The indicated high percentage does not differ from the previously cited results of our own study.

In turn, the study by Garwacka-Czachor *et al.* (2020) show that the percentage of staff who experienced exposure was even higher, accounting for 64.3% of all the respondents. The same study also indicates a correlation between the length of service and the occurrence of occupational exposure ( $p < 0.05$ ) (Garwacka-Czachor *et al.*, 2020).

The study showed that more than half of the respondents; that is 56.7%, negatively assessed the supervision of their safety at work and, unfortunately, almost half of the respondents, 43.8%, stated that supervisors did not fully exploit the opportunities of protecting staff from pathogens. The data obtained are not optimistic especially in times of pandemics or other unpredictable situations.

## 5. Conclusion

Nurses are the occupational group with the highest exposure to pathogens due to their professional tasks, and therefore there is a need to reduce the impact of such factors in the discussed occupational group of workers. This issue is still not widely exposed in the work organisation process.

The nursing staff rated their knowledge on pathogens at an average level regardless of their place of work, which demonstrates the need to update their knowledge or introduce courses concerning this issue.

Regardless of their place of work, the vast majority of the nursing staff rated their exposure to harmful agents at a very high level. Stress and work overload were considered to be the most onerous at work, followed only by biological factors.

Therefore, in order to protect their co-workers, health care facilities should discuss the right to work under safe and hygienic conditions, the need to reduce work overload and to reduce stress levels. This kind of action needs to be taken in an organised way, both at a basic level, such as a hospital ward, as well as at an organisational level.

Unfortunately, almost half of the surveyed persons had suffered occupational exposures and as many as half of these cases were not reported, which demonstrates a failure on the part of the staff to act in this regard and unwillingness to assert their rights on the part of the nurses.

The study results and the presented conclusions showed that much needs to change in the medical facilities where the nursing staff work even though there are noticeable changes in terms of improving occupational health and safety.

The lack of active involvement of nurses in improving working conditions should change. The analyses presented from the surveys are the basis for outlining new challenges in nursing that the staff have to face.

## References:

- Aksoy, H., Akdeniz, N., Karakurt, F. 2023. Prevalence of Type I Allergy to Latex and Type IV Allergy to Rubber Additives in Turkish Healthcare Workers. *Dermatology Practical & Conceptual*, 13(3), e2023187. doi:10.5826/dpc.1303a187.
- Al Ma'mari, Q., Sharour, L.A., Al Omari, O. 2020. Fatigue, burnout, work environment, workload and perceived patient safety culture among critical care nurses. *British Journal of Nursing*, 29(1), 28-34. doi: 10.12968/bjon.2020.29.1.28.
- Chmielewski, J., Dziechciaż, M., Czarny-Działak, M., Uściński, P., Rutkowski, A., Florek-Łuszczki, M., Żeber-Dzikowska, I. 2017. Środowiskowe zagrożenia zdrowia występujące w procesie pracy. *Medycyna Środowiskowa*, 20(2), 52-61. <https://doi.org/10.19243/2017207>.
- Chochowska, A. 2020. Health safety of Poles based on the applicable legal regulations on preventing and combating infections and infectious diseases using the example of Covid-19 disease. *International Journal of Legal Studies (IJOLS)*, no. 2(12).
- Czarnecka, J., Sienkiewicz, Z., Kobos, E., Wójcik, G., Krupniewicz, A. 2014. Zagrożenia wynikające z pracy pielęgniarek/pielęgniarzy środowiskowych. *Pielęgniarstwo Polskie*, no. 4 (54), pp. 296-301.
- Dębska, G., Pasek, M., Wilczek-Rużyczka, E. 2014. Obciążenia psychiczne i wypalenie zawodowe u pielęgniarek pracujących w różnych specjalizacjach zawodowych. *Hygeia Public Health*, 49(1), 113-119.
- Dyrektywa 2000/54/We Parlamentu Europejskiego I Rady z dnia 18 września 2000 r. w sprawie ochrony pracowników przed ryzykiem związanym z narażeniem na działanie czynników biologicznych w miejscu pracy (siódma dyrektywa szczegółowa w rozumieniu art. 16 ust. 1 dyrektywy 89/391/EWG) (Dz.U.UE L z 17.10. 2000 r.).
- Franco, G. 2001. Bernardino Ramazzini: The Father of Occupational Medicine. *American Journal of Public Health*, 91(9), 1382. doi: 10.2105/AJPH.91.9.1382.
- Frąckowiak, A. 2010. Zagrożenia w pracy pielęgniarki środowiskowej. *Zeszyty Naukowe Wyższej Szkoły Zarządzania Ochroną Pracy W Katowicach*, no. 1(6)/2010, pp. 53-70.
- Garwacka-Czachor, E., Milecka, D., Kędra, E., Gurowiec, P. (red.). 2022. Inwestowanie w pielęgniarstwo i poszanowanie praw pielęgniarek – kontrowersje i wyzwania. Głogów.
- Gniadek, A., Marcisz, E. 2014. Zdrowie środowiskowe w miejscu zamieszkania – czynniki zagrożenia. *Problemy Higieny i Epidemiologii*, 95(3), 526-527. <http://www.phie.pl/phe.php>.
- Jasiuk, E., Chochowska, A. (red.) 2023. Budowanie poczucia bezpieczeństwa w czasach pandemii oraz zagrożenia terroryzmem i wojną, 162-176. Oficyna Wydawnicza Uczelni Łazarskiego, Warszawa.
- Jürgen Thorwald, J. 2017. Dawna medycyna, jej tajemnice i potęga: Egipt, Babilonia, Indie, Chiny, Meksyk, Peru. Wydawnictwo Literackie.
- Lachowicz, K. 2017. Analiza obciążeń organizmu na stanowisku pielęgniarki oddziałowej oraz sposoby ich ograniczenia na przykładzie zakładu opieki zdrowotnej. *Krakowska Akademia, Wydział Zarządzania i Komunikacji Społecznej*. Kraków.
- Marcinkiewicz, A., Tomczak, P. 2018. Choroby niezawodowe związane z pracą - uregulowania prawne, orzecznictwo oraz potencjalne konsekwencje dla pracodawców i pracowników w Polsce. *Medycyna Pracy*, 69(5), 539-546.
- Montgomery, A.P., Patrician, P.A., Azuero, A. 2022. Nurse Burnout Syndrome and Work

- Environment Impact Patient Safety Grade. *Journal of Nursing Care Quality*, 37(1):87-93. doi: 10.1097/NCQ.0000000000000574.
- Pluta, A., Basińska-Drozd, H., Budnik-Szymoniuk, M., Humańska, M., Faleńczyk, K. 2015. Zagrożenia w pracy pielęgniarek rodzinnych. *Problemy Higieny i Epidemiologii*, 96(1), 115-119.
- Prażak, Z., Kowalska, M. 2017. Czynniki biologiczne w środowisku zawodowym pielęgniarek i możliwości zmniejszania narażenia. *Hygeia Public Health*, 52(2), 111-118. <http://www.h-ph.pl/pdf/hyg-2017/hyg-2017-2-111.pdf>.
- Pruss-Ustun, A., Rapiti, E., Hutin, Y. 2005. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *American Journal of Industrial Medicine*, 48, 482-490. <http://dx.doi.org/10.1002/ajim.20230>.
- Rainbow, J.G., Drake, D.A., Steege, L.M. 2020. Nurse Health, Work Environment, Presenteeism and Patient Safety. *Western Journal of Nursing Research*, 42(5), 332-339. doi: 10.1177/0193945919863409.
- Różańska, A., Szczypta, A., Baran, M., Synowiec, E., Bulanda, M., Wałaszek, M. 2014. Healthcare workers' occupational exposure to bloodborne pathogens: A 5-year observation in selected hospitals of the Małopolska province. *International Journal of Occupational Medicine and Environmental Health*, 27(5), 747-756. <https://doi.org/10.2478/s13382-014-0307-3>.
- Stabin, M.G. 2008. *Radiation protection and dosimetry: an introduction to health physics*. Springer, New York.
- Walusiak, J., Dörre-Kolasa, D., Marcinkiewicz, A. 2021. Occupational and work-related diseases in community law and in the legislature of selected EU member states – a comparative perspective. *Medycyna Pracy*, 72(5), 549-560. <https://doi.org/10.13075/mp.5893.0113>.
- Wójcik, A., Jakubowski, K., Bazaliński, D. 2020. Zmęczenie a stres wśród pracowników szpitalnych oddziałów ratunkowych. *Pielęgniarstwo Chirurgiczne i Angiologiczne*, 4, 151-157.
- Wyderka, M.I., Niedzielska, T. 2016. Ergonomia w pracy pielęgniarki. *Pielęgniarstwo Polskie*, 2(60), s.165-169. <http://dx.doi.org/10.20883/pielpol.2016.5>.
- Vandenplas, O., Raulf, M. 2017. Occupational Latex Allergy: the Current State of Affairs. *Current Allergy and Asthma Reports*, 17(3), 14. doi: 10.1007/s11882-017-0682-5.
- Visualization and bibliometric analysis of occupational exposure among nurses in Asia. *Heliyon*, Volume 9, Issue 11, doi.org/10.1016/j.heliyon.2023.e21289.
- Zhang, H., Lin, J., Xie, Y., Song, X., Sun, J., Zhang, B., Qi, Y., Xu, Z., Yang, F. 2023. Structure-guided peptide engineering of a positive allosteric modulator targeting the outer pore of TRPV1 for long-lasting analgesia. *Nature Communications*, 14(1), 4. <https://doi.org/10.1038/s41467-022-34817-1>.
- Zmysłony, M., Mamrot, P., Politański, P. 2004. Ekspozycja pielęgniarek na pole magnetyczne. *Medycyna Pracy*, 55(2), 183 -187.