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Level of nurses' knowledge concerning prevention of hospital-acquired infections in surgical wards

Lidia Elżbieta Sierpińska¹, Sebastian Jaworski²

¹ Military Clinical Hospital No. 1 with Polyclinic, Independent Public Health Unit, Lublin, Poland
Department name and organizational unit: Command

² Students' Scientific Circle, University of Economics and Innovation, Lublin, Poland
Address for correspondence: Lidia Sierpińska, 1 Military Clinical Hospital with Polyclinic, Independent Public Health Care Unit, Al. Raławickie 23, 20-049 Lublin, Poland (e-mail: sierpinska1@wp.pl; 507-810-339)

Abstract

Introduction. Prevention of hospital-acquired infections in surgical wards is associated with a high level of nurses' knowledge and skills in the area of the observance of procedures, standards of prevention of infections, use of personal protection means, and isolation of patients infected with the alert pathogen.

Objective. The aim of the study was recognition of the level of knowledge concerning prevention of hospital-acquired infections among nursing staff in surgical wards.

Materials and Method. The study was conducted in 2021, and included 115 nurses employed in hospital wards in two hospitals. The research method was a diagnostic survey, the technique – a questionnaire, and the research tool – an author-constructed questionnaire.

Results. The majority of the examined nurses (68.0%) presented a 'mediocre' level of knowledge concerning hospital-acquired infections, while 38.9% - a 'low' level. More than a half of the respondents (60.0%) knew the purpose for hygienic handwashing. Approximately $\frac{3}{4}$ of respondents knew that there is no necessity for using sterile gloves during procedures related with the risk of contact with blood or body fluids. The majority of nurses in the study (62.5%) had a deficit of knowledge about transient flora inhabiting the skin, and $\frac{1}{3}$ of respondents had no established principles of observance of personal protection means. More than a half of nurses (65.2%) did not know the objective of isolation of patients infected with an alert pathogen. Nearly a half of respondents (47.8%) knew that standard isolation is applied in each patient, irrespective of the previous medical history taking. Almost $\frac{2}{3}$ of respondents (64.3%) knew that isolations applied in infections transmitted through contact, by airborne-droplet and airborne-dust routes are the types of above-standard isolation.

Conclusions. The results of the study confirm the need for expanding the scope of knowledge about prevention of hospital-acquired infections, the time of hygienic and surgical handwashing, as well as the principles of using personal protection means. The nurses presented a deficit of knowledge concerning transient flora of pathogenic microorganisms inhabiting the surface of the hands, and the principles of using personal protection means. Nurses require the expansion of the scope of knowledge about the goal and principles of standard and above-standard isolation of patients infected with alert pathogen.

Key words: prevention of infections, personal protection means, isolation of patients

INTRODUCTION

Hospital-acquired infection is an important problem in the improvement of medical services in medical facilities. Despite the use of many methods of prevention of hospital-acquired infections, cases of infection are constantly identified among hospitalized patients [1, 2]. Microorganisms in the hospital environment create the risk of infection also for the hospital staff [3, 4]. The occurrence of various forms of infection in medical facilities is associated with the implementation of modern medical technologies, inappropriate application of antibiotic therapy, and the inappropriate technique of washing and disinfecting hands. Stahmeyer et al. emphasized that pathogenic microorganisms are most often transmitted on the hands of hospital staff, and constitute 20% - 40% of all hospital-acquired infections [5].

Studies conducted by researchers indicated that the precondition of preventing hospital-acquired infections is carrying out a reliable assessment of the epidemiological situation in a specified group of patients [6]. Epidemiological surveillance over infections should be a constant and systematic process of the collection of data concerning the occurrence of infectious diseases in the analyzed group of hospitalized patients. Appropriately conducted surveillance is possible due to the knowledge of pathogenic microorganisms currently residing in a hospital environment [7]. According to the statistical data, in health care units in developed countries at least one type of infection is diagnosed daily in about 7% of patients [8]. In turn, in medical facilities in developing countries various types of infections are diagnosed every day in approximately 10% of patients [3, 9].

According to Polish researchers complying with the guidelines by the World Health Organisation (WHO) and the Centers for Disease Control and Prevention (CDC) by the medical staff confirms that the proper hand hygiene is considered to-date to be the most effective and, at the same time, the simplest method of prevention of hospital-acquired infections [10]. Based on the literature, hand hygiene is a basic procedure in the programmes of prevention and control of hospital-acquired infections, in which various methods and means are used which limit the transmission of pathogenic microorganisms belonging to the transient flora and, to a certain extent, to the permanent flora of the skin of the hands [11, 12, 13, 14].

In order to protect hospital staff against infection with microorganisms coming from a patient or hospital environment it is necessary to apply personal protection means in accordance with the principles [15]. The physical barrier preventing the spread of pathogenic microbes in a hospital ward is the use of protective isolation [16, 17]. The goal of isolation is interruption of the routes of infection with alert microorganisms, characterized by a high degree of virulence or contagiousness [15].

Therefore, it was considered important to recognize the level of knowledge concerning prevention of hospital-acquired infections among nurses employed in surgical wards.

OBJECTIVE

The aim of the study was recognition of the level of knowledge concerning prevention of hospital-acquired infections among nursing staff in surgical wards.

MATERIALS and METHOD

Population and study design

The study was conducted within the Students' Scientific Circle, University of Economics and Innovation (WSEI) in Lublin, Poland, during the period from 21 September – 6 October 2021. The project of the study was submitted to the Dean's Office at the University of Economics and Innovation by the co-author of research – member of the Students' Scientific Circle (WSEI) in Lublin (Cat. No. 38 207/2020), and consent for the study was obtained from the Dean of the WSEI in Lublin. The study was carried out among nurses employed in surgical wards in two hospitals: the County Hospital in Koźienice and the District Hospital in Pionki. A total number of 115 nurses participated in the study, the number of females was considerably higher than that of males – 98.3% and 1.7%, respectively. The largest number of respondents were aged 50 - 59 (42.6%). More than a half of respondents were urban inhabitants (55.7%), while 44.3% lived in rural areas. The majority of nurses in the study had secondary medical school education (32.2%). The largest number of respondents had work experience longer than 31 years (44.3%).

Method and research tool

The research method was a diagnostic survey, the technique – a questionnaire, and the research tool – an author-constructed questionnaire specially designed for the purpose of the study. The questionnaire consisted of closed questions arranged in the following 5 domains: I – Level of knowledge concerning hospital-acquired infections; II – Level of knowledge concerning principles of handwashing; III – Level of knowledge concerning transient flora inhabiting the surface of the skin; IV Level of knowledge concerning the use of personal protection means; V – Demographic and social data. The research process was preceded by a pilot study, which enabled the verification of the author-constructed questionnaire. The questions were understandable for the examined nurses.

Statistical analysis

The results of analysis of qualitative data were presented in the form of numbers and percentages, whereas quantitative data – by mean value, standard deviation, median, and minimum and maximum values. In order to investigate statistically significant differences an analysis was performed by means of the Pearson's Chi-square test for qualitative data. The distribution of quantitative data was examined using the Shapiro-Wilk test. After investigation of the distribution (non-compliant with normal) the Mann Whitney U test (MWU, Z) was used for comparing two groups, and Kruskal-Wallis test (KW, H) to compare three or more groups. Spearman's rank correlation (R) was applied. The p values $p < 0.05$ were considered statistically significant. The analysis was performed using the software package StatSoft Statistica 13.1 PL, and the Microsoft Office suite.

RESULTS

Characteristics of the examined group

The study included 115 nurses employed in surgical wards in two hospitals. Table 1 demonstrates the respondents' basic socio-demographic characteristics (independent variables).

Table 1. Structure of the examined nurses according to gender, age, education, place of residence, and length of work experience.

| TYPE OF VARIABLE INDEPENDENT VARIABLE | | | |
|---------------------------------------|--|-----|------|
| Variable | Category | N | % |
| Gender | females | 113 | 98.3 |
| | males | 2 | 1.7 |
| Age | 20–29 | 8 | 7.0 |
| | 30–39 | 15 | 13.0 |
| | 40–49 | 28 | 24.3 |
| | 50–59 | 49 | 42.6 |
| | > 60 | 15 | 13.0 |
| Education | secondary medical school | 37 | 32.2 |
| | first-degree nursing study | 30 | 26.1 |
| | first-degree nursing study with specialization in a particular speciality of nursing | 13 | 11.3 |
| | Master’s degree in nursing | 21 | 18.3 |
| | Master’s degree in nursing with specialization in a particular speciality of nursing | 14 | 12.2 |
| Place of residence | rural | 51 | 44.3 |
| | urban | 64 | 55.7 |
| Length of work experience | < 5 years | 12 | 10.4 |
| | 5–10 years | 8 | 7.0 |
| | 11–20 years | 14 | 12.2 |
| | 21–30 years | 30 | 26.1 |
| | > 31 years | 51 | 44.3 |

The number of females participating in the study was considerably higher than that of males - 98.3% and 1.7%, respectively. The largest number of respondents were aged 50-59 (42.6%), while the smallest, in the youngest group, 20-29 (7.0%). The largest number of the examined nurses has secondary medical school education (32.2%), followed by those with Master’s degree in nursing (18.3%), and the smallest group were respondents who completed first-degree nursing study with specialization in a particular speciality of nursing (11.3%). The majority of respondents were urban inhabitants (55.7%), compared to rural inhabitants (44.3%). Analysis of data concerning the length of work experience of nurses showed that the largest number of them had duration of employment of more than 31 years (44.3%), whereas the smallest group had work experience from 5-10 years – 7.0%.

Level of knowledge concerning hospital-acquired infections

The level of respondents’ knowledge was evaluated using 27 items in the author-constructed questionnaire concerning: definition of a hospital-acquired infection, factors predisposing to the occurrence of hospital-acquired infection in a patient, type of most commonly occurring hospital-acquired infection, risk of occurrence of deep infections causes of endogenous infections, observance of the principles of handwashing, transient bacterial flora inhabiting the skin, principles of using personal protection means, principles of isolation of patients – Tab. 2, Fig. 1.

Table 2. Level of respondents' knowledge concerning prevention of hospital-acquires infections in surgical wards according to respondents' gender, age, place of residence, education, and length of work experience.

| | | M | SD | Me | Min | Max | Statistic | |
|---------------------------|--|-------------|------|------|------|-------|-----------------|--------------|
| Total | | 680 | 121 | 657 | 389 | 1000 | Test/value | p |
| Gender | females | 677 | 118 | 657 | 389 | 963 | - | |
| | males | 824 | 249 | 824 | 648 | 1000 | | |
| Age | 20–29 | 833 | 164 | 898 | 574 | 1000 | R= -0.19 | 0.038 |
| | 30–39 | 747 | 138 | 741 | 537 | 954 | | |
| | 40–49 | 65.6 | 11.5 | 63.9 | 38.9 | 92.6 | | |
| | 50–59 | 64.7 | 9.7 | 63.0 | 44.4 | 92.6 | | |
| | > 60 | 68.0 | 7.7 | 65.7 | 55.6 | 80.6 | | |
| Place of residence | urban | 67.1 | 10.3 | 65.7 | 38.9 | 96.3 | Z= -0.06 | 0.953 |
| | rural | 69.0 | 14.1 | 65.7 | 44.4 | 100.0 | | |
| Education | secondary medical school | 64.3 | 8.4 | 63.0 | 48.1 | 88.9 | H=7.14 | 0.129 |
| | first-degree nursing study | 68.3 | 15.9 | 64.4 | 38.9 | 100.0 | | |
| | first-degree nursing study with specialization in a particular speciality of nursing | 71.2 | 13.1 | 64.8 | 60.2 | 95.4 | | |
| | Master's degree in nursing | 71.9 | 10.7 | 72.2 | 53.7 | 92.6 | | |
| | Master's degree in nursing with specialization in a particular speciality of nursing | 68.1 | 11.0 | 66.2 | 48.1 | 92.6 | | |
| Length of work experience | < 5 | 78.3 | 16.4 | 78.2 | 53.7 | 100.0 | R= -0.26 | 0.004 |
| | 5–10 | 73.5 | 14.1 | 72.2 | 57.4 | 95.4 | | |
| | 11–20 | 69.8 | 14.6 | 65.7 | 48.1 | 92.6 | | |
| | 21–30 | 67.3 | 11.5 | 64.8 | 38.9 | 92.6 | | |
| | > 31 | 64.5 | 8.5 | 63.9 | 44.4 | 80.6 | | |

* M-mean value, SD-standard deviation, Me-median, Min-Max - minimum-maximum

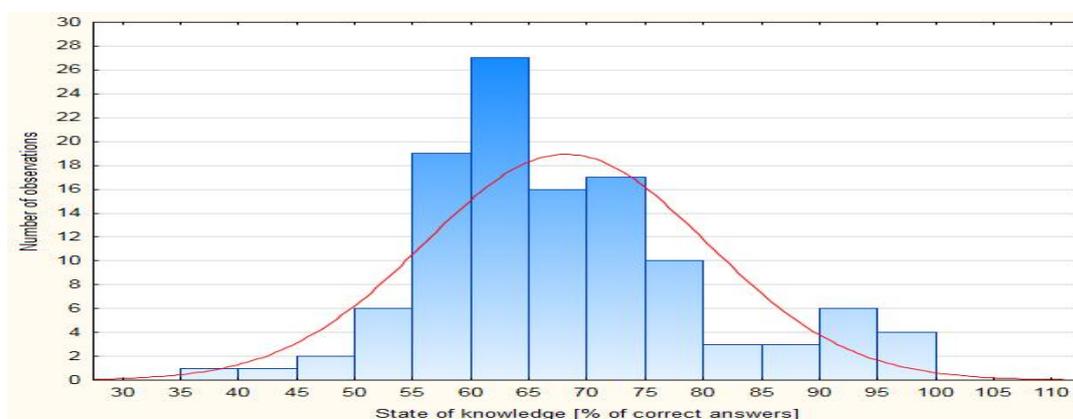


Figure 1. Level of respondents' knowledge concerning prevention of hospital-acquires infections in surgical wards according to respondents' gender, age, place of residence, education, and length of work experience.

Questions concerning subjective assessment of the level of knowledge were not considered in the evaluation of nurses' knowledge. It was found that 68.0% of respondents had a 'mediocre' level of knowledge about prevention of hospital-acquired infections, followed by a 'low' level of knowledge – 38.9%, whereas only one respondent presented a 'high' level. The younger the respondents, the significantly higher their level of knowledge concerning prevention of hospital-acquired infections in surgical wards (negative correlation coefficient; $R=-0,19$, $p=0.038$). It was also observed that the longer work experience in the nursing profession, the significantly lower the level of knowledge about prevention of hospital-acquired infections in surgical wards ($R=-0.26$; $p=0.004$). No statistically significant relationship was noted between the respondents' place of residence and education, and their level of knowledge concerning prevention of hospital-acquired infections in hospital surgical wards, $p>0.05$. Respondents who completed first-degree nursing study with specialization, and those with Master's degree in nursing without specialization represented a higher level of knowledge (71.2% and 71.9% of correct answers, respectively), whereas respondents with secondary medical school education had the lowest level of knowledge (64.3%). Due to insufficient number of male nurses the relationship according to gender was not statistically analyzed; however, it was observed that males participating in the study had a higher level of knowledge, compared to females (82.4% and 67.7% of correct answers, respectively).

The respondents were requested to self-assess their level of knowledge concerning hospital-acquires infections – Fig. 2.

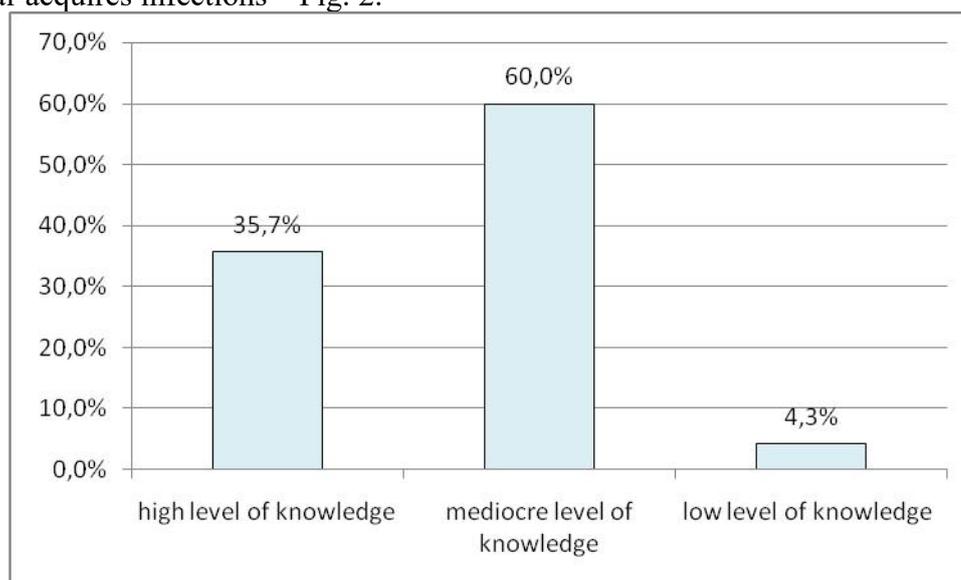


Figure 2. Self-assessment of respondents' level of knowledge concerning hospital-acquires infections (%).

The respondents most frequently evaluated their level of knowledge concerning hospital-acquired infection as 'mediocre' (60%), followed by a 'high' level (35,7%), and a 'low' level (4.3%), while no respondents mentioned the 'lack of knowledge'.

Level of knowledge concerning principles of handwashing

As many as 100.0% of the examined nurses reported that they had general knowledge concerning the principles of particular types of handwashing. Simultaneously, when asked about the purpose for hygienic handwashing 15.7% of respondents indicated the correct answer – Tab. 3, Fig. 3.

Table 3. Respondents' knowledge concerning the purpose for hygienic handwashing according to gender, age, and place of residence, education, and length of work experience.

| Knowledge of the purpose for hygienic handwashing | | correct answer | | partially correct answer | | incorrect answer | | lack of answer | | Total | Statistic |
|---|--|----------------|-------|--------------------------|-------|------------------|-------|----------------|------|-------|-----------------------------------|
| Total | | 18 | 15.7% | 69 | 60.0% | 25 | 21.7% | 3 | 2.6% | 115 | - |
| Gender | female | 17 | 15.0% | 68 | 60.2% | 25 | 22.1% | 3 | 2.7% | 113 | - |
| | male | 1 | 50.0% | 1 | 50.0% | 0 | 0.0% | 0 | 0.0% | 2 | |
| Age | 20–29 | 4 | 50.0% | 3 | 37.5% | 1 | 12.5% | 0 | 0.0% | 8 | Chi ² =17.1; p=.143 |
| | 30–39 | 4 | 26.7% | 10 | 66.7% | 1 | 6.7% | 0 | 0.0% | 15 | |
| | 40–49 | 5 | 17.9% | 16 | 57.1% | 7 | 25.0% | 0 | 0.0% | 28 | |
| | 50–59 | 4 | 8.2% | 30 | 61.2% | 12 | 24.5% | 3 | 6.1% | 49 | |
| | > 60 | 1 | 6.7% | 10 | 66.7% | 4 | 26.7% | 0 | 0.0% | 15 | |
| Place of residence | urban | 8 | 12.5% | 41 | 64.1% | 14 | 21.9% | 1 | 1.6% | 64 | Chi ² =1.91; p=.589 |
| | rural | 10 | 19.6% | 28 | 54.9% | 11 | 21.6% | 2 | 3.9% | 51 | |
| Education | secondary medical school | 2 | 5.4% | 23 | 62.2% | 9 | 24.3% | 3 | 8.1% | 37 | Chi ² =24.3; p=.018 |
| | first-degree nursing study | 5 | 16.7% | 17 | 56.7% | 8 | 26.7% | 0 | 0.0% | 30 | |
| | first-degree nursing study with specialization | 3 | 23.1% | 6 | 46.2% | 4 | 30.8% | 0 | 0.0% | 13 | |
| | Master's degree in nursing | 2 | 9.5% | 18 | 85.7% | 1 | 4.8% | 0 | 0.0% | 21 | |
| | Master's degree in nursing with specialization | 6 | 42.9% | 5 | 35.7% | 3 | 21.4% | 0 | 0.0% | 14 | |
| Length of work experience | < 5 years | 4 | 33.3% | 6 | 50.0% | 2 | 16.7% | 0 | 0.0% | 12 | Chi ² =19.4; p=.078 |
| | 5–10 years | 1 | 12.5% | 7 | 87.5% | 0 | 0.0% | 0 | 0.0% | 8 | |
| | 11–20 years | 5 | 35.7% | 6 | 42.9% | 3 | 21.4% | 0 | 0.0% | 14 | |
| | 21–30 years | 6 | 20.0% | 16 | 53.3% | 8 | 26.7% | 0 | 0.0% | 30 | |
| | > 31 years | 2 | 3.9% | 34 | 66.7% | 12 | 23.5% | 3 | 5.9% | 51 | |

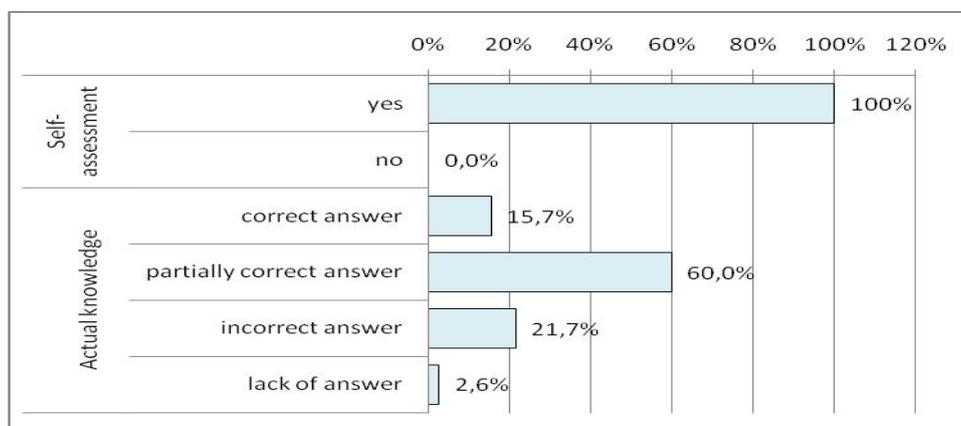


Figure 3. Self-assessment of knowledge concerning the principles of handwashing, and evaluation of the purpose for hygienic handwashing (%).

The examined nurses most frequently provided partially correct answer concerning the aim of of hygienic handwashing – 60.0% of the total number of respondents (the correct answer was ‘elimination of microbes’), followed by incorrect answer – 21.7%. A small group of respondents indicated the correct answer – 15.7%; i.e. they considered ‘elimination of transient flora and partial reduction of the resident permanent flora. Few persons did not provide an answer – 2.6%. Respondents who had Master’ degree in nursing and completed specialization courses in a particular speciality of nursing significantly more often had knowledge about the aim of of hygienic handwashing, compared to the remaining groups of respondents (Master’s degree with specialization: 42.9% of correct answers; secondary medical school: 5.4%, the reminder: from 9.5% - 23.1%), $p=0.018$. The remaining relationships analyzed were statistically insignificant; $p>0.05$.

Level of knowledge concerning transient flora of pathogenic microorganisms inhabiting the surface of skin of the hands

More than a half of respondents (62,5%) provided an incorrect answer that microorganisms of transient flora inhabit and proliferate on the skin. Approximately $\frac{1}{3}$ of respondents (37.4%) correctly replied that microorganisms of transient flora do not inhabit the skin, and do not proliferate on the skin – Tab. 4, Fig. 4.

Table 4. Respondents’ knowledge concerning the risk caused by transient flora microorganisms inhabiting and proliferating on the skin, according to gender, age, place of residence, education, and length of work experience.

| Knowledge of the risk caused by transient flora microorganisms inhabiting and proliferating on the skin | | Yes | | No | | Total | Statistic |
|---|--|-----|-------|----|-------|-------|---------------------------------|
| Total | | 72 | 62.6% | 43 | 37.4% | 115 | - |
| Gender | female | 71 | 62.8% | 42 | 37.2% | 113 | - |
| | male | 1 | 50.0% | 1 | 50.0% | 2 | |
| Age | 20–29 | 2 | 25.0% | 6 | 75.0% | 8 | Chi ² =21.9; p=.0001 |
| | 30–39 | 3 | 20.0% | 12 | 80.0% | 15 | |
| | 40–49 | 18 | 64.3% | 10 | 35.7% | 28 | |
| | 50–59 | 38 | 77.6% | 11 | 22.5% | 49 | |
| | > 60 | 11 | 73.3% | 4 | 26.7% | 15 | |
| Place of residence | urban | 45 | 70.3% | 19 | 29.7% | 64 | Chi ² =3.65; p=.0550 |
| | rural | 27 | 52.9% | 24 | 47.1% | 51 | |
| Education | secondary medical school | 27 | 73.0% | 10 | 27.0% | 37 | Chi ² =7.80; p=.0980 |
| | first-degree nursing study | 17 | 56.7% | 13 | 43.3% | 30 | |
| | first-degree nursing study with specialization | 11 | 84.6% | 2 | 15.4% | 13 | |
| | Master’s degree in nursing | 10 | 47.6% | 11 | 52.4% | 21 | |
| | Master’s degree in nursing with specialization | 7 | 50.0% | 7 | 50.0% | 14 | |
| Length of work experience | < 5 years | 3 | 25.0% | 9 | 75.0% | 12 | Chi ² =20.5; p=.0001 |
| | 5–10 years | 2 | 25.0% | 6 | 75.0% | 8 | |
| | 11–20 years | 6 | 42.9% | 8 | 57.1% | 14 | |
| | 21–30 years | 21 | 70.0% | 9 | 30.0% | 30 | |
| | > 31 years | 40 | 78.4% | 11 | 21.6% | 51 | |

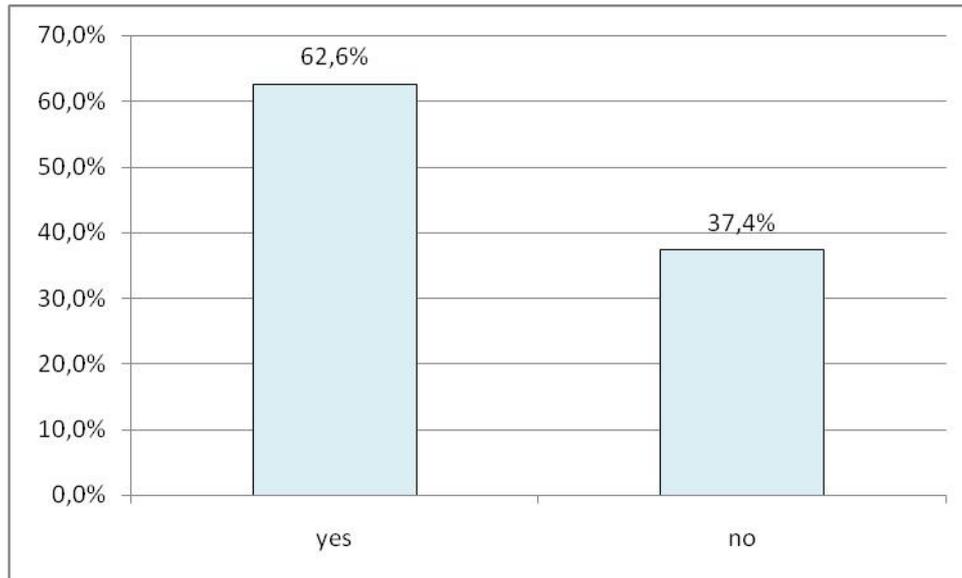


Figure 4. Respondents' knowledge concerning the possibility of transient flora microorganisms inhabiting and proliferating on the skin (%).

Younger respondents significantly more often knew the correct answer that transient flora microorganisms do not inhabit and proliferate on the skin (20-29: 75.0%, 30-39: 80.0%, the remaining older respondents: from 35.7% - 22.5%, $p < 0.0001$), as well as those with less work experience (< 5 years: 75.0%, 5-10 years: 75.0%, 11-20 years: 57.1%, 21-30 years: 30.0%, > 30 years: 21.6%; $p < 0.0001$). No significant differences were observed according to the remaining variables analyzed; $p > 0.05$.

In addition, it was found that the majority of nurses employed in surgical wards (85.2%) knew that transient flora microbes are not difficult to eliminate during washing and disinfection of the hands. The remaining respondents (14.8%) had no knowledge in this area. Statistical analysis showed that urban inhabitants significantly more frequently than rural inhabitants knew that transient flora microorganisms are not difficult to eliminate during washing and disinfection of the hands (92.2% vs. 76.5%); $p = 0.018$. No significant differences were observed according to the remaining variables analyzed; $p > 0.05$.

Level of knowledge concerning the use of personal protection means

All respondents (100.0%) reported knowledge concerning the principles of using particular personal protection means. The respondents' answers were also analyzed from the aspect of knowledge about the justification for using sterile gloves in procedures, during which there occurs the risk of contact with patient's blood and/or body fluids – Tab. 5., Fig. 5

Table 5. Respondents' knowledge concerning the justification for using sterile gloves in procedures, during which there occurs the risk of contact with patient's blood and/or body fluids, according to gender, age, place of residence, education, and length of work experience.

| Justification for using sterile gloves during procedures, during which there occurs the risk of contact with patient's blood and/or body fluids | | Yes | | No | | Total | Statistic |
|---|--|-----|-------|----|-------|-------|--------------------------------|
| Total | | 31 | 27.0% | 84 | 73.0% | 115 | - |
| Gender | female | 30 | 26.6% | 83 | 73.5% | 113 | - |
| | male | 1 | 50.0% | 1 | 50.0% | 2 | |
| Age | 20–29 | 2 | 25.0% | 6 | 75.0% | 8 | Chi ² =4.40; p=.353 |
| | 30–39 | 2 | 13.3% | 13 | 86.7% | 15 | |
| | 40–49 | 11 | 39.3% | 17 | 60.7% | 28 | |
| | 50–59 | 11 | 22.5% | 38 | 77.6% | 49 | |
| | > 60 | 5 | 33.3% | 10 | 66.7% | 15 | |
| Place of residence | urban | 14 | 21.9% | 50 | 78.1% | 64 | Chi ² =1.89; p=.168 |
| | rural | 17 | 33.3% | 34 | 66.7% | 51 | |
| Education | secondary medical school | 14 | 37.8% | 23 | 62.2% | 37 | Chi ² =3.40; p=.491 |
| | first-degree nursing study | 7 | 23.3% | 23 | 76.7% | 30 | |
| | first-degree nursing study with specialization | 3 | 23.1% | 10 | 76.9% | 13 | |
| | Master's degree in nursing | 4 | 19.1% | 17 | 81.0% | 21 | |
| | Master's degree in nursing with specialization | 3 | 21.4% | 11 | 78.6% | 14 | |
| Length of work experience | < 5 years | 3 | 25.0% | 9 | 75.0% | 12 | Chi ² =2.66; p=.616 |
| | 5–10 years | 1 | 12.5% | 7 | 87.5% | 8 | |
| | 11–20 years | 5 | 35.7% | 9 | 64.3% | 14 | |
| | 21–30 years | 6 | 20.0% | 24 | 80.0% | 30 | |
| | > 31 years | 16 | 31.4% | 35 | 68.6% | 51 | |

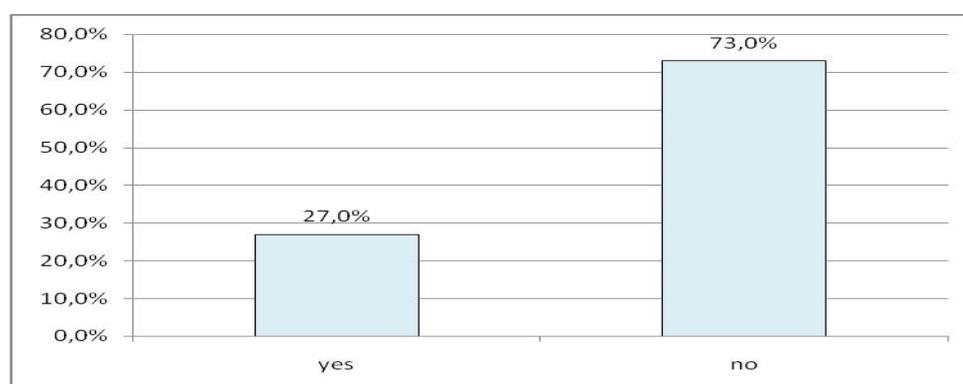


Figure 5. Respondents' knowledge concerning the justification for using sterile gloves in procedures, during which there occurs the risk of contact with patient's blood and/or body fluids (%).

Approximately $\frac{3}{4}$ of respondents (73.0%) knew that while performing procedures during which there occurs the risk of contact with patient's blood and/or body fluids it is not necessary to use sterile gloves. The remaining respondents (27.0%) provided an incorrect answer. No significant relationships were observed according to the analyzed independent variables (age, place of residence, education, and length of work experience as a nurse); $p>0.05$.

More than a half of nurses (60.0%) knew that it is necessary to change protective gloves for each medical procedure performed in the same patient. As many as 40.0% of respondents expressed an incorrect opinion. It was found that nurses living in rural areas significantly more often than urban inhabitants knew that it is necessary to change protective gloves for each medical procedure performed in the same patient (76.5% vs. 46.9%); $p=0.001$. No significant relationships were noted according to the remaining independent variables analyzed (age, education, and length of work experience as a nurse); $p>0.05$.

The majority of nurses in the study (89.6%) knew the necessity for washing and disinfecting the hands after taking off used and before putting on new safety gloves – 10.4% of respondents provided an incorrect answer. No significant relationships were observed according to the analyzed independent variables (age, place of residence, education, and length of work experience as a nurse); $p>0.05$.

Nearly all respondents (99.1%) knew that using a mask with safety glasses reduces the risk of infection of the mucous membranes of the eyes, nasal cavity, and oral cavity. Approximately $\frac{1}{4}$ of the examined nurses (27.0%) knew that surgical masks do not constitute a barrier against pathogenic microorganisms – 73.0% of respondents provided an incorrect answer. Respondents aged 20-29 (50%) and over 60 (53.3%) more frequently provided the correct answer, compared to the remainder aged 30-59: (from 13.3% - 22.5%) – the results were statistically significant; $p=0.043$. No significant differences in knowledge of the above-mentioned problem were observed according to the remaining variables analyzed (place of residence, education, and length of work experience as a nurse); $p>0.05$. No significant relationships were observed according to the analyzed independent variables (age, place of residence, education, and length of work experience as a nurse); $p>0.05$.

Level of respondents' knowledge concerning isolation of patients for epidemiological reasons

A vast majority of respondents (98.3%) declared knowledge of using particular types of isolation – results of self-assessment.

Less than a half of respondents (47.8%) knew that standard isolation is applied with respect to each patient, irrespective of previously taken medical history.

The analyzed variables (age, place of residence, education, and length of work experience as a nurse) were not significantly related with knowledge in the above-mentioned area; $p>0.05$.

More than a half of respondents (65,2%) did not know the purpose for using isolation of patients infected with an alert pathogen – Fig. 6.

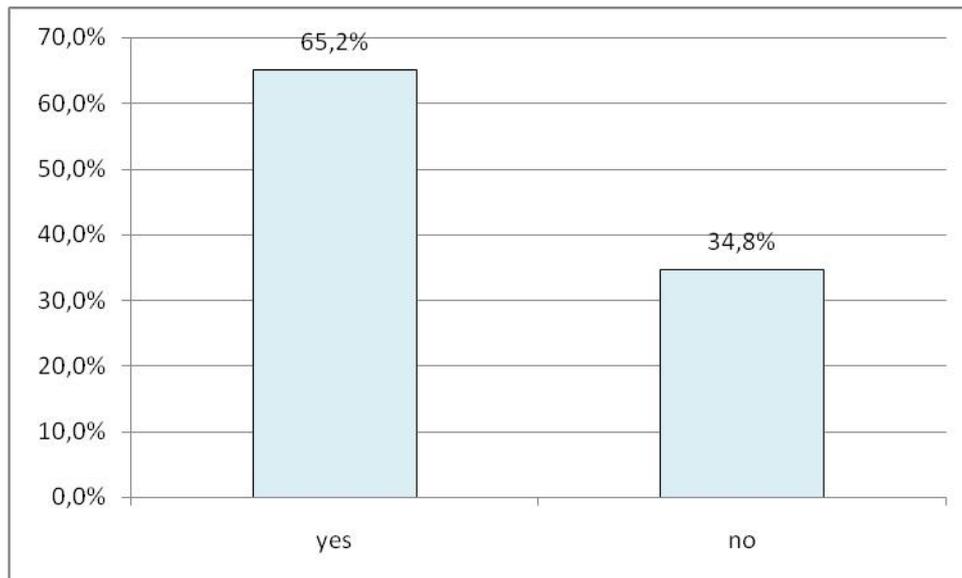


Figure 6. Respondents' knowledge in the area of knowing purpose for using isolation of patients infected with an alert pathogen (%).

The analyzed variables (age, place of residence, education, and length of work experience as a nurse) were not significantly related with knowledge in the assessed area; $p > 0.05$.

Within the concept of the study it was also recognized whether the nurses had knowledge concerning the use above-standard isolation. Nearly $\frac{2}{3}$ of respondents (64.3%) knew that isolations applied in infections transmitted through contact, by airborne-droplet and airborne-dust routes are types of above-standard isolation – Tab. 6, Fig. 6.

Table 6. Respondents' knowledge concerning the use above-standard isolation in the case of infections transmitted through contact, by airborne-droplet and airborne-dust routes, according to gender, age, place of residence, and work experience.

| Knowledge concerning the use above standard isolation in the case of infections transmitted through contact, by airborne-droplet and airborne-dust routes | | Yes | | No | | Total | Statistic |
|---|---------------------------------|-----|-------|----|-------|-------|-------------------|
| Total | | 74 | 64.3% | 41 | 35.7% | 115 | - |
| Gender | females | 72 | 63.7% | 41 | 36.3% | 113 | - |
| | males | 2 | 100% | 0 | 0.0% | 2 | |
| Age | 20–29 | 7 | 87.5% | 1 | 12.5% | 8 | Chi2=9.10; p=.058 |
| | 30–39 | 13 | 86.7% | 2 | 13.3% | 15 | |
| | 40–49 | 13 | 46.4% | 15 | 53.6% | 28 | |
| | 50–59 | 31 | 63.3% | 18 | 36.7% | 49 | |
| | > 60 | 10 | 66.7% | 5 | 33.3% | 15 | |
| Place of residence | urban | 39 | 60.9% | 25 | 39.1% | 64 | Chi2=0.73; p=.392 |
| | rural | 35 | 68.6% | 16 | 31.4% | 51 | |
| Education | secondary medical school | 21 | 56.8% | 16 | 43.2% | 37 | Chi2=10.3; p=.035 |
| | first-degree nursing study | 15 | 50.0% | 15 | 50.0% | 30 | |
| | first-degree nursing study with | 9 | 69.2% | 4 | 30.8% | 13 | |

| | | | | | | | |
|---------------------------|--|----|-------|----|-------|----|-------------------|
| | specialization | | | | | | |
| | Master's degree in nursing | 19 | 90.5% | 2 | 9.5% | 21 | |
| | Master's degree in nursing with specialization | 10 | 71.4% | 4 | 28.6% | 14 | |
| Length of work experience | < 5 years | 11 | 91.7% | 1 | 8.3% | 12 | Chi2=7.35; p=.118 |
| | 5–10 years | 6 | 75.0% | 2 | 25.0% | 8 | |
| | 11–20 years | 10 | 71.4% | 4 | 28.6% | 14 | |
| | 21–30 years | 15 | 50.0% | 15 | 50.0% | 30 | |
| | > 31 years | 32 | 62.8% | 19 | 37.3% | 51 | |

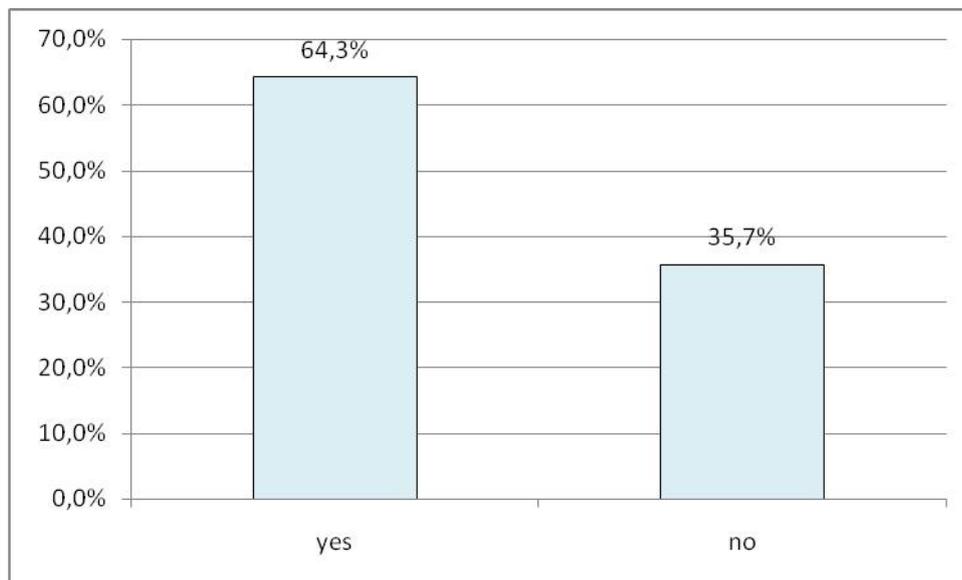


Figure 6. Respondents' knowledge concerning the use of above-standard isolation in the case of infections transmitted through contact, by airborne-droplet and airborne-dust routes (%).

It was found that respondents with Master's degree in nursing without specialization significantly more often than the remainder possessed knowledge in the assessed area (Master's degree: 90.5%, Master's degree with specialization: 71.4%, remainder: from 20% - 69.2%), $p=0.035$. The remaining variables analyzed (age, place of residence, education, and length of work experience as a nurse) were not statistically significantly related with respondents' knowledge in the analyzed area; $p>0.05$.

Discussion

In the presented study the level of knowledge was assessed concerning prevention of hospital-acquired infections among nurses employed in surgical wards. According to the researchers the group at risk of developing infection includes patients with immunodeficiency due to a concomitant chronic disease, patients using long-term antibiotic therapy or immunosuppression, as well as patients receiving specified diagnostic, treatment, and nursing procedures. Apart from this, an important factor predisposing to the occurrence of infection is non-compliance of the nursing staff to the procedures in effect, and epidemiological standards in the hospital environment [18, 19].

A study conducted among nurses by Laskowska et al. concerning self-assessment of their knowledge of the problem of hospital-acquired infections showed that more than a half of respondents (67.0%) evaluated their level of knowledge as good, and the vast majority of nurses (92.0%) provided the correct definition of hospital-acquired infection, irrespective of the ward profile [20]. In turn, Garus-Pakowska and Szatko in 2009 obtained varied results of the study, which depended on the profile of the ward and length of work experience as a nurse [21]. Own study showed that more than a half of respondents (68.0%) evaluated their level of knowledge concerning hospital-acquired infections to be on a mediocre level. Own study demonstrated that the respondents provided the correct answer to 60-65% of the analyzed problems, which confirmed self-assessment of knowledge in this area among nursing staff.

A team of Polish researchers under the direction of Miętkiewicz confirmed that the correct hand hygiene is considered as the most effective method of prevention of hospital-acquired infections [22]. In literature a report was found by a Hungarian researcher Semmelweis, who showed the relationship between the occurrence of hospital-acquired infections and hand hygiene. Simultaneously, he confirmed that pathogenic microorganisms belonging to transient flora are the cause of about 20-40% of the total number of occurring hospital-acquired infections [15]. Own study demonstrated that more than a half of nurses (62.5%) provided an incorrect answer that microorganism of the transient flora inhabit and proliferate on the skin. Apart from this, the majority of the examined nurses (85.2%), employed in surgical wards knew that microorganisms of the transient flora may be effectively eliminated by washing and disinfection of the hands. In addition, it was confirmed that urban inhabitants significantly more frequently than rural inhabitants knew that microorganisms of the transient flora are not difficult to eliminate by washing and disinfection of the hands (92.2% vs. 76.5%); $p=0.018$. Analysis of the collected material showed that all respondents (100.0%) declared knowledge of the principles of using particular personal protection means. Analysis of the material pertaining to the use of personal protection means confirmed that the majority of the examined nurses (89.6%) had knowledge that it is necessary to wash and disinfect hands after taking off the used gloves and before putting on new safety gloves. More than a half of nurses in the study (60.0%) knew that it is necessary to change safety gloves for each medical procedure performed in the same patient. The vast majority of respondents (98,3%) mentioned that they had knowledge concerning isolation of patients for epidemiological reasons. Less than a half of respondents (47.8%) knew that standard isolation is applied with respect to each patient, irrespective of previously taken medical history, while 64.3% of respondents knew the types of above-standard isolation.

Conclusions

1. The results of the study confirmed the need for expanding the scope of nurses' knowledge concerning the problem of prevention of hospital-acquired infections, because the majority of respondents (68.0%) presented a 'mediocre' level of knowledge, and 38.9% - a 'low' level.
2. Nursing staff requires the expansion of knowledge concerning the principles of handwashing, especially the duration of hygienic and surgical handwashing, because a half of respondents had a deficit of knowledge of this problem.
3. During post-diploma improvement courses for nurses the problem of transient flora of pathogenic microorganisms inhabiting the surface of the skin of the hands should be considered, as well as observance of the principles of using personal protection means, regarding the deficits recognized in this area.
4. It is necessary to intensify the training of nurses employed in surgical wards concerning the purpose and principles of standard and above-standard isolation applied with respect to patients infected with an alert pathogen.

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