SIERPIŃSKA, Lidia, SKOWRONEK, Katarzyna and JEDYNAK, Anna. Level of knowledge of prevention of blood-borne infectious diseases among Master's degree students of nursing. Journal of Education, Health and Sport. 2024;72:51680. eISSN 2391-8306.
https://dx.doi.org/10.12775/JEHS.2024.72.51680
https://apcz.umk.pl/JEHS/article/view/51680

The journal has had 40 points in Minister of Science and Higher Education of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 05.01.2024 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical culture sciences (Field of medical and health sciences); Health Sciences (Field of medical and health sciences).
Punkty Ministerialne 40 punktów. Załącznik do komunikatu Ministra Nauki i Szkolnictwa Wyższego z dnia 05.01.2024 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).© The Authors 2024;
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The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 15.04.2024. Revised: 10.05.2024. Accepted: 22.05.2024. Published: 29.05.2024.

Level of knowledge of prevention of blood-borne infectious diseases among Master's degree students of nursing

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Abstract

Introduction. Blood-borne infections are a serious problem among medical staff, especially nursing staff, because nurses have the most frequent contact with patients. As future employees of health care, students of nursing are exposed to a number of hazardous factors. Work with patients of unknown serological status (during practical classes and apprenticeships) is associated with the risk of infection with various pathogens.

Objective. The aim of the study was recognition of the level of knowledge concerning prevention of blood-borne infectious diseases among Master's degree students of nursing.

Material and Methods. The study was conducted in the second half of 2022 among 104 Master's degree students of nursing, who were educated at the Radom School in Radom, by the method of a diagnostic survey, using an author-constructed questionnaire.

Results. The majority of the examined students (96.2%) knew what diseases are transmitted through blood. More than a half of respondents (63.5%) evaluated their level of knowledge about blood-borne diseases as mediocre, and 19.2% - as low. A part of respondents (67.3%) had knowledge that trace amounts of blood are enough to cause infection with blood-borne diseases. All students in the study knew the main methods of prevention of infections transmitted via blood, and the deficit of knowledge concerned proper use of personal protection equipment (5.8%) and the observance of the procedure to be followed in the event of occupational exposure (3.8%). A large group of respondents (82.7%-100.0%) knew various risk factors of infection with blood-borne diseases. The majority of respondents (88.5%) knew that there is an effective vaccine against hepatitis B, but 43.3% of the students in the study did not know the main symptoms of infection with HBV. Students most often knew (90.4%) how to diagnose infection with HCV – anti-HCV test for the presence of antibodies against hepatitis C virus in blood; however, 26.9% of respondents were not aware that there is no vaccine against hepatitis C. The majority of the examined students (84.7%) knew early symptoms of infection with HIV, while the remainder had a deficit of knowledge in this area. A large group of respondents (82.0%-94.0%) knew various risk factors of infection with HIV.
Conclusions. Students of nursing should be motivated to expand their knowledge concerning prevention of blood-borne diseases, observance of the principles of personal protection, prevention of occupational exposure, and proper post-exposure prophylaxis.
Key words: **blood-borne infections,** HBV, HCV, HIV, students' knowledge

Introduction

Viruses transmitted through blood lead to serious diseases, and even to death. According to the *Centers for Disease Control and Prevention – CDC,* medical staff worldwide are exposed to infection with blood-borne pathogens, 30% of which concern infections with HBV, 1-3% - with HCV, and 0.3% - with HIV [1, 2, 3, 4].

Blood-borne infections are a serious problem among medical staff also in Poland, especially among nursing staff, because nurses have the most frequent contact with patients. Practical experiences show that students of nursing may become infected with: HIV (*human immunodeficiency virus*), HBV (*hepatitis B virus*), or HCV (*hepatitis C virus*), which are present in blood and other materials potentially infectious after contact with infected blood. Knowledge of proper principles of prevention allows reduction of the risk of infection with these pathogens.

Epidemiological data demonstrate that trace amounts of blood are enough to cause the development of an infectious disease transmitted through blood. To the group at risk belong:

blood recipients, patients with haemophilia, drug addicts who intravenously administer preparations, patients on dialysis, homosexuals, newborns of positive mothers, health care employees after occasional exposure [5, 6, 7, 8, 9].

Transmission of HBV, as well as HCV is most frequently due to direct exposure to blood related with the provision of medical services in health care facilities [10, 11]. The problem of infections with HIV is among public health challenges. The number of detected cases of infection with HIV increases on a global, European, and also Polish scale. Infection with HIV may also take place via blood by instrumental treatments and vertical transmissions may also occur – the mother infected with HIV may infect her baby during pregnancy, labour, or during breastfeeding [12].

In the prevention of exposure to patient's blood it is important to provide personal protection equipment, proper handling of medical waste, implementation of procedures in the event of exposure to infectious material while performing medical activities, and surveillance over observance of these procedures. The above-mentioned procedures/standards should be known to students of nursing to be respected by them during practical classes in hospital wards.

The above-mentioned issues provided an incentive for survey among Master's degree students of nursing who, according to the education programme are obliged to undergo professional internships in various hospital wards, where there is a risk of occupational exposure and exposure to infection with a blood-borne infectious disease.

Objective: The aim of the study was recognition of the level of knowledge concerning prevention of infectious diseases transmitted through blood among Master's degree students of nursing.

Material and Methods

3.1. Population and research project

The study included 104 Master's degree students of nursing who were educated at the Radom Higher School in Radom, Poland, and was carried out during the period from 15 October – 15 December 2022. The research project was submitted to the Dean's Office at the Radom Higher School in Radom (RSW) by the co-author of the research project – member of the Students' Scientific Circle at the RSW in Radom (Catalogue No. 12944/2021), and consent for the study was obtained from the Dean of the RSW in Radom. The nurses in the study were aged 22-60. The study group included a larger number of females (86.5 %), compared to males – 13.5%.

3.2. Selection of the study group

Students for the study were selected at random. The selection criterion was being a student of nursing at second-cycle studies (Master's degree). These were students who had a nursing diploma received during licentiate studies. The criterion for exclusion was being a student at first-cycle studies (licentiate) who has not yet received a nursing diploma and did not work professionally as a nurse.

3.3. Method and research tool

The study was conducted by the method of a diagnostic survey using an author-constructed questionnaire specially designed for the purpose of this project. The questionnaire consisted of closed questions systematized into the following five domains:

Domain I– Level of knowledge concerning blood-borne diseases. The questions were: Do you know what diseases are transmitted through blood? How do you evaluate your level of knowledge about blood-borne diseases? What actions do you know in the prevention of infections transmitted through blood? What risk factors of infection with blood-borne diseases do you know?

Domain II – Level of knowledge concerning prevention of infections with HBV. Content of the questions: Is there an effective vaccine against hepatitis B? Do you know symptoms of infection with hepatitis B? Is it possible to become infected with HBV during a visit at a beautician/hairdresser? Is it possible to become infected with hepatitis B while collecting blood with non-sterile needles/syringes?

Domain III – Level of knowledge concerning prevention of infections with HCV. How infection with hepatitis C may be confirmed? Is there an effective vaccine against hepatitis C? Who is most exposed to infection with HCV? Is it possible to become infected with HCV during unprotected sexual intercourse?

Domain IV – Level of knowledge concerning prevention of infections with HIV. Do early symptoms of infection with HIV resemble flu-like symptoms? Is there an effective vaccine against HIV? Can using condoms during intercourse reduce the risk of infection with HIV? What do you think are the routes of infection with HIV?

Domain V – Demographic and social data. The questions concerned independent variables: gender, age, and place of residence of the examined nurses.

The presented study was preceded by a pilot study in order to test the author-constructed questionnaire. After the verification of the research tool it was evaluated that the items in the questionnaire and instruction for the examined students are understandable, and the tool is correctly constructed.

3.4. Statistical analysis

The results of the study were presented in the form of percentages and numbers. The presence of statistically significant relationships was investigated using Pearson's chi-square test. The ***p*** values $p<0.05$ were considered statistically significant. In this study statistical analysis was performed using statistical calculators available online (https://www.socscistatistics.com/tests/), and using Microsoft Office software.

4. Results

4.1. Characteristics of the study group

The study included 104 Master's degree students of nursing. Table 1 demonstrates the respondents' socio-demographic characteristics.

Table 1. Respondents' structure according to gender, age, and place of residence.

INDEPENDENT VARIABLE	N	%
GENDER		
female	90	86.5
male	14	13.5
AGE		
22-30	26	25.0
31-40	36	34.6
41-50	38	36.6
>51	4	3.8
PLACE OF RESIDENCE		
rural	50	48.1
urban	54	51.9

4.2. Self-assessment of the level of students' knowledge concerning blood-borne diseases.

Table 2 presents the results of analysis of the collected research material concerning self-assessed level of students' knowledge of blood-borne diseases.

Table 2. Self-assessed level of respondents' knowledge concerning blood-borne diseases according to variables.

Do you know what diseases are transmitted through blood?		Yes		No		Total		Statistics
Total		100	96.2%	4	3.8%	104	100.0%	-
Age	22-30	24	92.3%	2	7.7%	26	25.0%	$Chi^2=2.846$ $p=0.416$
	31-40	36	100.0%	0	0.0%	36	34.6%	
	41-50	36	94.7%	2	5.3%	38	36.5%	
	>51	4	100.0%	0	0.0%	4	3.8%	
Place of residence	rural	48	96.0%	2	4.0%	50	48.2%	$Chi^2=0.006$ $p=0.937$
	urban	52	96.3%	2	3.7%	54	51.9%	
Gender	female	88	97.8%	2	2.2%	90	86.5%	$Chi^2=4.768$ $p=0.029$
	male	12	85.7%	2	14.3%	14	13.5%	

It was confirmed that the analyzed variable (gender) was significantly related with the level of respondents' knowledge concerning blood-borne diseases, $p<0.029$ – females presented a higher level of knowledge, compared to males. At the same time, no significant correlation was found between the respondents' age ($p=0.416$) and place of residence ($p=0.937$), and the presented level of knowledge about diseases transmitted through blood.

The respondents were asked to assess their knowledge of blood-borne diseases. (Fig. 1).

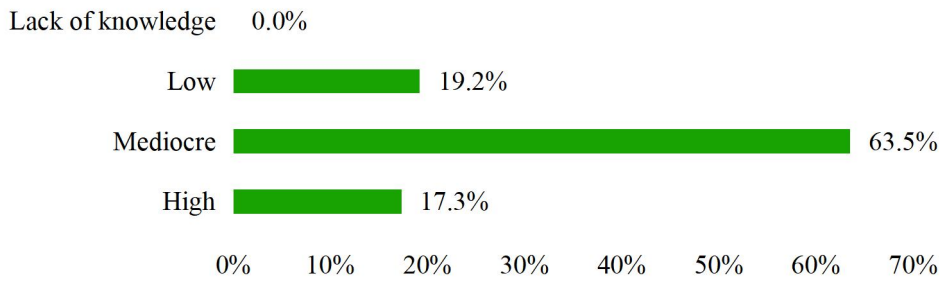

Figure 1. Self-assessed level of respondents' knowledge concerning blood-borne diseases.

More than a half of the examined students (63.5%, n=66) assessed their level of knowledge concerning blood-borne diseases as mediocre, 19.2% of respondents (n=20) assessed their knowledge as low, while 17.3% of students (n=18) - as high.

Analysis of data showed a significant relationship between the level of respondents' knowledge and age ($p=0.039$) – Tab. 3.

Table 3. Self-assessed level of respondents' knowledge concerning blood-borne diseases according to variables.

How do you evaluate your level of knowledge about blood-borne diseases?		Low		Mediocre		High		Total	Statistics
Total		20	19.2%	66	63.5%	18	17.3%	104	-
Age	22-30	2	7.7%	18	69.2%	6	23.1%	26	$Chi^2=13.279$ $p=0.039$
	31-40	4	11.1%	28	77.8%	4	11.1%	36	
	41-50	12	31.6%	18	47.4%	8	21.0%	38	
	>51	2	50.0%	2	50.0%	0	0.0%	4	
Place of residence	rural	10	20.0%	32	64.0%	8	16.0%	50	$Chi^2=0.129$ $p=0.937$
	urban	10	18.5%	34	63.0%	10	18.5%	54	
Gender	female	16	17.8%	56	62.2%	18	20.0%	90	$Chi^2=3.696$ $p=0.158$
	male	4	28.6%	10	71.4%	0	0.0%	14	

Respondents aged 22-30 (69.2%, n=18) and 31-40 (77.8%, n=28) assessed their knowledge as mediocre, while those aged 41-50 (21.0%, n=8) – as high. No relationships were observed

between the respondents' place of residence and gender, and the level of their knowledge ($p>0.05$).

It was found that 67.3% of respondents (n=70) considered that trace amounts of blood are enough to cause infection with blood-borne diseases, whereas 7.7% of the examined students (n=8) considered that this is not enough, and 25.0% (n=26) had no such knowledge. The results of the study were analyzed according to independent variables – Tab. 4.

Table 4. Self-assessed level of respondents' knowledge concerning blood-borne diseases according to variables.

Are trace amounts of blood enough to cause infection with blood-borne diseases?		Yes		No		I do not know		Total	Statistics
Total		70	67.3%	8	7.7%	26	25.0%	104	-
Age	22-30	20	76.9%	2	7.7%	4	15.4%	26	$Chi^2=8.629$ $p=0.071$
	31-40	26	72.2%	4	11.1%	6	16.7%	36	
	41-50	20	52.6%	2	5.3%	16	42.1%	38	
	>51	4	100.0%	0	0.0%	0	0.0%	4	
Place of residence	rural	34	68.0%	4	8.0%	12	24.0%	50	$Chi^2=0.057$ $p=0.972$
	urban	36	66.7%	4	7.4%	14	25.9%	54	
Gender	female	60	66.7%	6	6.6%	24	26.7%	90	$Chi^2=7.239$ $p=0.026$
	male	10	71.4%	2	14.3%	2	14.3%	14	

The study confirmed a significant relationship between the level of respondents' knowledge and gender ($p=0.026$). More than a half of the examined females (66.7%, n=60), as well as males (71.4%, n=10) considered that trace amounts of blood are enough to cause infection with blood-borne diseases, whereas 26.7% of females (n=24) and 14.3% of males (n=2) had no such knowledge, or provided an incorrect answer: males (14.3%, n=2), females (6.6%, n=6).

The students in the study were asked whether they know effective actions for prevention of diseases transmitted through blood – Fig. 2.

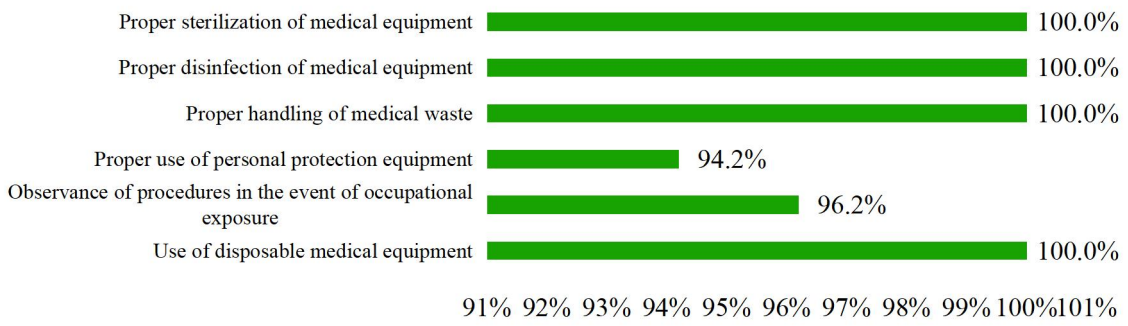

Fig. 2. Known activities in the prevention of infections with blood-borne diseases in the opinion of respondents

Analysis of the collected research material demonstrated that 100.0% of respondents (n=104) considered that proper sterilization, disinfection of medical equipment, proper handling of medical waste, and use of disposable medical equipment are known actions for the prevention of diseases transmitted through blood. A large number of respondents (96.2%, n=100) drew attention to the preventive role of observance of procedures in the event of occupational exposure, and 94.2% of the examined students (n=98) mentioned that the proper use of personal protection equipment is necessary for prevention of infections. The respondents' answers did not show any significant correlations between gender age and place of residence, and the level of knowledge concerning known actions for prevention of blood-borne diseases ($p>0.05$).

Based on the analysis of the collected data the known risk factors of infection with blood-borne diseases according to the respondents' opinions were established – Tab. 4.

Table 4. Known risk factors of infection with blood-borne diseases according to respondents' opinions.

Risk factors of infection	%	n
Surgical procedures	100.0	104
Dental treatments	94.2	98
Occupational exposure	90.4	94
Tattoos	82.7	86
Beauty treatments	84.6	88
Repeated use of disposable equipment	100.0	104

The study showed that 100% of the examined students (n=104) mentioned surgical procedures and repeated use of disposable equipment as known risk factors of infection with blood-borne diseases, followed by dental treatments (94.2%, n=98), and occupational exposure (90.4%, n=94). The lowest percentage of respondents (82.7%, n=86) considered tattoos as a risk factor – the results according to independent variables were insignificant ($p>0.05$).

4.3. Self-assessed level of students' knowledge concerning infection with HBV

The students were asked whether there is an effective vaccine against hepatitis B – Tab. 5.

Table 5. Level of respondents' knowledge concerning the existence of an effective vaccine against hepatitis B according to variables.

Is there an effective vaccine against hepatitis B?		Yes		No		I do not know		Total	Statistics
Total		88	88.5%	8	7.7%	8	7.7%	104	-
Age	22-30	20	76.9%	4	15.4%	2	7.7%	26	Chi^2=19.183 p=0.004
	31-40	32	88.9%	4	11.1%	0	0.0%	36	
	41-50	34	89.5%	0	0.0%	4	10.5%	38	
	>51	2	50.0%	0	0.0%	2	50.0%	4	
Place of residence	rural	44	88.0%	4	8.0%	2	4.0%	50	Chi^2=1.849 p=0.397
	urban	44	81.5%	4	7.4%	6	11.1%	54	
Gender	female	78	86.6%	6	6.7%	6	6.7%	90	Chi^2=2.161 p=0.339
	male	10	71.4%	2	14.3%	2	14.3%	14	

Significant correlations were found between the respondents' age and their level of knowledge concerning the existence of an effective vaccine against hepatitis B ($p<0.05$). Approximately 90% of the examined students aged 31-50 (n=32) considered that there is an effective vaccine, whereas 50.0% of respondents (n=2) aged >51 had no such knowledge. No significant correlations were observed between the respondents' place of residence and gender, and their level of knowledge concerning the existence of an effective vaccine against hepatitis B ($p>0.05$).

It was considered important to recognize whether the respondents knew the symptoms of infection with HBV – Fig. 3.

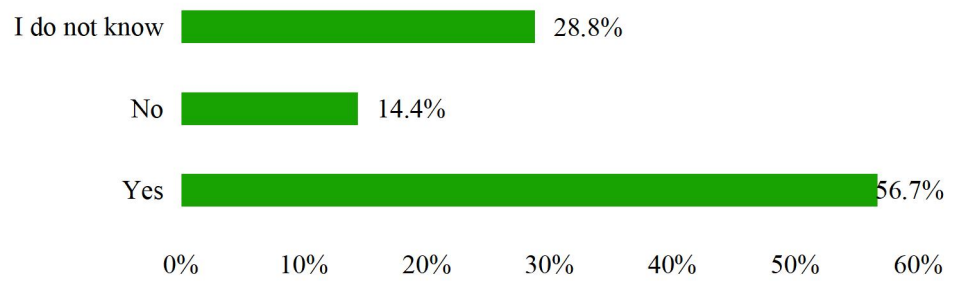

Figure 3. Respondents' knowledge of symptoms of hepatitis B.

It was found that more than a half of respondents – 56.7% (n=59) knew the symptoms of hepatitis B, while 14.4% of them (n=15) did not have such knowledge. Nearly every third respondent (28.8%, n=30) did not know anything about symptoms of hepatitis B.

The respondents' answers were analyzed according to independent variables – Tab. 6.

Table 6. Respondents level of knowledge concerning symptoms of infection with hepatitis B according to variables.

Do you know symptoms of infection with hepatitis B?		Yes		No		I do not know		Total	Statistics
Total		59	56.7%	15	14.4%	30	28.8%	104	-
Age	22-30	18	69.2%	4	15.4%	4	15.4%	26	Chi^2=5.982 p=0.425
	31-40	16	44.4%	6	16.7%	14	38.9%	36	
	41-50	22	57.9%	6	15.9%	10	26.2%	38	
	>51	2	50.0%	0	0.0%	2	50.0%	4	
Place of residence	rural	32	64.0%	6	12.0%	12	24.0%	50	Chi^2=2.671 p=0.263
	urban	26	48.1%	10	18.5%	18	33.4%	54	
Gender	female	52	57.8%	10	11.1%	28	31.1%	90	Chi^2=9.609 p=0.008
	male	6	42.9%	6	42.9%	2	14.2%	14	

Significant correlations were observed between the respondents' gender and their level of knowledge concerning the symptoms of infection with hepatitis B ($p<0.05$). More than 50% of females (n=52) and 40% of males (n=6) knew the symptoms of infection with hepatitis B, whereas 11.1% of females (n=10) and about 43% of males (n=6) did not know typical symptoms. Apart from this, no significant correlations were noted between the respondents' age and place of residence, and their level of knowledge of the symptoms of infection with hepatitis B ($p>0.05$).

The respondents who knew the symptoms of hepatitis B, most often mentioned abdominal pain (67.8%, n=40), yellowing of the skin (57.6%, n=34), vomiting (49.2%, n=29), nausea (42.4%, n=25), fatigue (33.9%, n=20), and yellowing of the whites of the eyes (28.8%, n=17). The symptom most rarely indicated was dark urine (11.9%, n=7) and weakness (8.5%, n=5). The correlations according to the variables: age, place of residence, and gender were insignificant, $p>0.05$.

The examined students were asked whether they had knowledge about the risk of becoming infected with HBV during a visit to a beautician/hairdresser.

A significant correlation was found between the respondents' age and their level of knowledge concerning the risk of infection with HBV during a visit to a beautician/hairdresser. More than a half of respondents (88.9%) aged 31-40, and 84.2% of those aged 41-50 reported that infection during a visit to a beautician/hairdresser is possible. The replies were significant, compared to respondents from the remaining age groups ($p<0.05$). It was found that 16% of rural inhabitants (n=8) and 3.7% of urban inhabitants (n=2) considered that infection with HBV is impossible while using the

services of a beautician/hairdresser. More than 14.3% of males (n=2) and 13% of females (n=12) had no such knowledge – the results were insignificant (p>0.05).

It was considered important to find out whether the examined students had knowledge concerning the risk of becoming infected with HBV while collecting blood using non-sterile needles/syringes – Tab. 7.

Table 7. Level of respondents' knowledge concerning the possibility of infection with HBV while collecting blood using non-sterile needles/syringes, according to variables.

Is it possible to become infected with HBV while collecting blood using non-sterile needles/syringes?		Yes		No		I do not know		Total	Statistics
Total		98	94.2%%	2	1.9%	4	3.9%	104	-
Age	22-30	26	100.0%	0	0.0%	0	0.0%	26	Chi^2=29.351 p=0.0001
	31-40	36	100.0%	0	0.0%	0	0.0%	36	
	41-50	34	89.4%	2	5.3%	2	5.3%	38	
	>51	2	50.0%	0	0.0%	2	50.0%	4	
Place of residence	rural	48	96.0%	0	0.0%	2	4.0%	50	Chi^2=1.889 p=0.388
	urban	50	92.6%	2	3.7%	2	3.7%	54	
Gender	female	86	95.6%	2	2.2%	2	2.2%	90	Chi^2=5.019 p=0.081
	male	12	85.7%	0	0.0%	2	14.3%	14	

A correlation was observed between the respondents' age and their level of knowledge of a given problem (p<0.05). All respondents in the age group 22-30 (n=26) and 31-40 (n=36) expressed an opinion that it is possible to become infected with HBV while collecting blood using non-sterile needles/syringes; 96.0% of rural inhabitants (n=48) and 92.6% of urban inhabitants (n=50) considered that it is possible to become infected with HBV while collecting blood using non-sterile needles/syringes. As many as 95.6% of females and 85.7% of males had knowledge in this area – the results were insignificant (p>0.05).

4.4. The students' self-reported knowledge concerning infection with HCV

The students were asked whether it is possible to confirm an infection with HCV – Tab. 8.

Table 8. The respondents' level of knowledge concerning the possibility of confirming infection with HCV according to variables.

How to confirm an infection with HCV?		Buying a kit at a pharmacy and performing the test at home		Performing blood test for the presence of antibodies against HCV		Vaccination		Total	Statistics
Total		2	1.9%	94	90.4%	8	7.7%	104	-
Age	22-30	0	0.0%	26	100.0%	0	0.0%	26	Chi^2=22.695 p=0.0009
	31-40	0	0.0%	36	100.0%	0	0.0%	36	
	41-50	2	5.3%	30	78.9%	6	15.8%	38	
	>51	0	0.0%	2	50.0%	2	50.0%	4	
Place of residence	rural	2	4.0%	46	92.0%	2	4.0%	50	Chi^2=3.894 p=0.142
	urban	0	0.0%	48	88.9%	6	11.1%	54	
Gender	female	2	2.2%	82	91.1%	6	6.7%	90	Chi^2=1.264 p=0.531
	male	0	0.0%	12	85.7%	2	14.3%	14	

It was found that 100.0% of respondents aged 22-30 (n=26) and 31-40 (n=36) considered that in order to confirm infection with HCV blood test should be performed for the presence of antibodies against HCV. The results were significant ($p<0.05$), compared to respondents from the remaining age groups. It was noted that 92.0% of rural inhabitants (n=46) and 88.9% of respondents living in urban areas (n=48) indicated that a test for antibodies against HCV is the tool to confirm an infection with HCV. Similarly, the majority of females (91.1%) and males (85.7%) mentioned that infection with HCV may be confirmed by test for the presence of antibodies against HCV – the results were insignificant ($p>0.05$).

It was confirmed that 73.1% of the examined students (n=76) considered that there is no effective vaccine against hepatitis C, because it could not be developed due to the high variability of the virus. However; 15.4% of respondents (n=16) reported that the vaccine has been available on the market for several years. A small group of respondents (11.5%, n=12) considered that although there is no vaccine against hepatitis C, and hepatitis A, the vaccine against hepatitis B protects against infection with hepatitis C. Based on the results of the study no significant correlation was observed between the respondents' age, place of residence, and gender, and the level of their knowledge concerning the existence of an effective vaccine against hepatitis C ($p>0.05$).

Based on the analysis of the collected data the respondents' opinions were presented concerning the group of persons exposed to infection with HCV – Fig. 4.

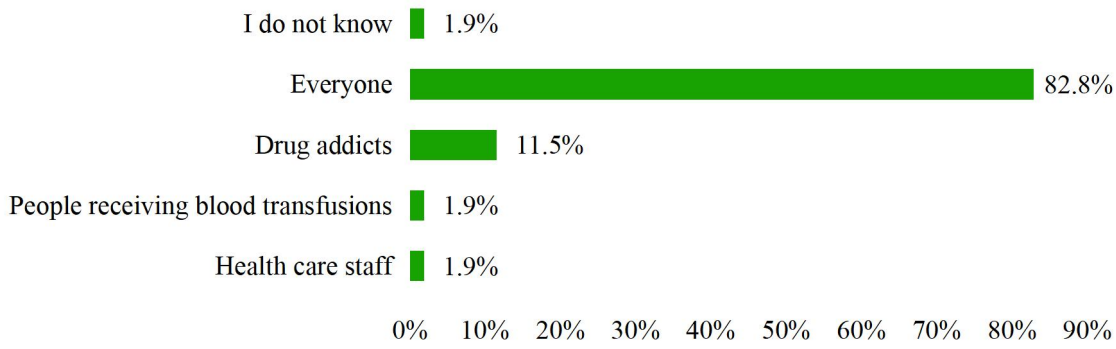

Figure 4. Persons exposed to infection with HCV.

It was found that 82.8% of respondents (n=86) mentioned that everyone is exposed to infection with HCV, followed by those who indicated drug addicts (11.5%, n=12). Few respondents – 1.9% each considered that health care staff and people receiving blood transfusions are exposed to infection. A correlation was observed between the respondents' gender and their level of knowledge concerning the risk of infection with HCV ($p<0.05$). Females (84.5%, n=76) more often than males (71.4%, n=10) reported that everyone is exposed to infection with HCV.

4.3. Self-assessed level of students' knowledge concerning infection with HIV

The examined students were asked whether early symptoms of infection with HIV resemble flu-like symptoms – Tab. 9.

Table 9. Level of respondents' knowledge concerning whether early symptoms of infection with HIV resemble flu-like symptoms according to variables.

Do early symptoms of infection with HIV resemble flu-like symptoms?		Yes		No		I do not know		Total	Statistics
Total		88	84.7%	4	3.8%	12	11.5%	104	-
Age	22-30	22	84.6%	2	7.7%	2	7.7%	26	$Chi^2=11.032$ $p=0.087$
	31-40	34	94.4%	0	0.0%	2	5.6%	36	
	41-50	30	78.9%	2	5.3%	6	15.8%	38	
	> 51	2	50.0%	0	0.0%	2	50.0%	4	
Place of residence	rural	44	88.0%	4	8.0%	2	4.0%	50	$Chi^2=9.193$ $p=0.010$
	urban	44	81.5%	0	0.0%	10	18.5%	54	
Gender	female	78	86.7%	2	2.2%	10	11.1%	90	$Chi^2=5.022$ $p=0.081$
	male	10	71.4%	2	14.3%	2	14.3%	14	

The majority of rural inhabitants (88.0%, n=44), as well as urban inhabitants (81.5%, n=44) considered that early symptoms of infection with HIV resemble flu-like symptoms. A statistically significant correlation was observed between the respondents' place of

residence and the level of their knowledge of the given problem ($p<0.05$). Based on the results of the study no significant correlations were found between the respondents' age and gender, and the level of their knowledge concerning early symptoms of infection with HIV resembling flu-like symptoms ($p>0.05$).

It was noted that 90.4% of the examined students (n=94) considered that there is no effective vaccine against HIV. Few respondents (5.8%, n=6) indicated that the vaccine does exist, while 3.8% of the examined students (n=4) had no knowledge of this problem. In addition, 100.0% of respondents (n=104) reported that using condoms during sexual intercourse may reduce the risk of infection with HIV.

It was considered important to recognize whether the examined Master's degree students of nursing had knowledge concerning the routes of infection with HIV – Fig. 5.

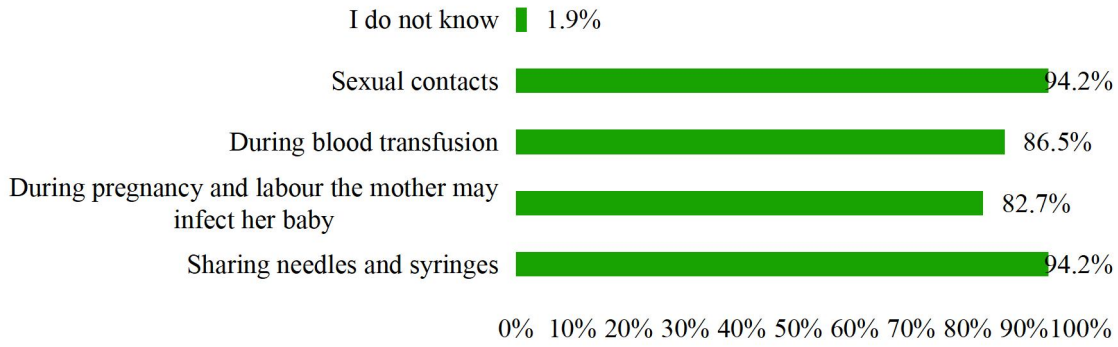

Figure 5. Respondents' state of knowledge concerning routes of infection with HIV.

It was found that 94.2% of respondents (n=98) considered that sharing needles and syringes and sexual contacts are the routes of infection with HIV, followed by those who indicated that infection may take place during blood transfusion (86.5%, n=90). More than 82.7% of the examined students (n=86) mentioned that the mother may infect her baby with HIV during pregnancy and labour.

Discussion

Based on literature concerning the epidemiology of blood-borne diseases the most frequent infections during contact with blood include HIV, HCV, and HBV. These viruses are transmitted to humans through trace amounts of blood in association with disruption of tissue continuity [13]. In the relevant literature a report was encountered that in Poland more than 2,000 cases of infection with HBV are noted annually. The introduction of safe, effective, and cheap vaccines at the end of the 20th century resulted in a considerable decrease in the number of infections with HBV in developed countries. Epidemiological studies carried out in

Poland, mainly among honorary blood donors or patients of inpatient and outpatient health care facilities indicated the presence of antibodies against HCV in 0.6−2.1% of the population [8, 14]. According to the available analyses during 2017-2021, in Poland, the mean incidence of hepatitis C was 6.77 per 100,000 cases. It is estimated that in the whole of Poland more than thirty years after the detection of the first case of infection with HIV there are more than 35,000 infected persons, every second of whom are unaware that they may infect other people [3].

Students of nursing, as future employees of health care, are exposed to many hazardous factors, including those biological. Work with patients creates the risk of infection with various infectious pathogens transmitted through blood. Blood-borne infections are a serious problem among medical staff, especially nursing staff who have the most frequent contacts with patients [15]. Therefore, the primary aim of the presented study was the assessment of the level of knowledge of Master's degree students of nursing concerning the prevention of blood-borne infectious diseases.

The study was conducted among students of the Radom Higher School in Radom, during the period from 15 October 2022 – 12 December 2022, and covered 104 randomly selected respondents aged 22–60. The research tool was an author-constructed questionnaire designed for the purpose of this study.

A study carried out by Michalak et al. among 98 students of nursing showed that more than 37% of respondents had sufficient knowledge concerning the prevention and post-exposure procedures for HBV, HCV, or other potentially infectious material [16]. A study conducted among students of Medical University in Łódź demonstrated that 78% of respondents provided the correct answer that infection with hepatitis C may occur through contact with the blood of an infected person [17]. A study carried out in Macedonia (Medical College of Bitola) confirmed that full-time students of nursing showed a higher awareness of infection with HCV (84%), compared to the students of extramural studies [18]. The presented study showed that a large group of respondents (96.2%) knew what diseases are transmitted through blood, whereas 3.8% of students had no such knowledge. More than a half of respondents (63.5%) assessed their level of knowledge of blood-borne diseases as mediocre, 19.2% of the examined students evaluated the level of their knowledge as low, while 17.3% - as high. A high level of knowledge concerning blood-borne diseases was most frequently declared by respondents aged 22-30 (23.1%) and 41-50 (21.0%). The older the respondents, the lower the level of their knowledge.

According to researchers from Tanzania (Mashoto et al.) the risk of infection with blood-borne infectious diseases in association with occupational exposure is very high [19]. Abere et al. confirmed that in Ethiopia within one year 65.3% of infections were documented among health care staff after contact with blood and body fluids [20]. Considering the above-mentioned goal of prophylaxis of infections with blood-borne diseases knowledge of various preventive actions is very important. According to a study by Michalak et al. carried out among students the majority of them knew personal protection equipment and the principles of post-exposure procedures as part of prevention of infections with blood-borne diseases [16]. The presented study demonstrated that 100% of the examined nursing students considered that proper sterilization and disinfection of medical equipment, and the use of disposable medical equipment is a known procedure for prevention of blood-borne diseases, 96.2% of respondents attracted attention to the prophylactic role of the observance of post-exposure procedures in the event of occupational exposure, and 94.2% of them mentioned that proper use of personal protection equipment is effective in the prevention of infections. Deficit of the respondents' knowledge within the range 4.8%-5.8% evidences the necessity for education in the area of observance of the principles of personal protection and prevention of occupational exposure, as well as proper post-exposure procedures.

A study conducted among students by Czarnecka et al. showed that they knew the routes of the spread of infection with HCV – through contact with the blood of an infected person (77.5%), administration of narcotics (62.5%), sexual contacts (41.5%), and the use of dental (38.5%) and beauty services (57%) [19]. Based on own study it was found that the respondents knew the risk factors of infection with blood-borne diseases - 100% of respondents mentioned surgical procedures and multiple use of disposable equipment as known risk factors. The smallest percentage of respondents (82.7%) considered tattoos as a risk factor. More than 80% of both rural and urban inhabitants indicated beauty treatments as a risk factor. More than 90% of females and 80% of males considered that occupational exposure is a risk factor.

Conclusions

1. In education of Master's degree students of nursing an emphasis should be placed on expanding knowledge in the area of prevention of blood-borne diseases, considering self-assessment of knowledge of this problem on a mediocre level.
2. Master's degree students of nursing presented the highest level of knowledge in the area of prevention of infection with HIV, followed by prevention of infection with HBV.

3. It was found that ¼ of Master's degree students of nursing had a deficit of knowledge of prevention of infection with HCV concerning the lack of vaccine, which should be included in the education programme.
4. Considering the deficit of knowledge of Master's degree students of nursing concerning the principles of personal protection, post-exposure prophylaxis, and proper procedures after exposure, an emphasis should be placed on expanding knowledge in this area.

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Financing:
No external funding has been received

Institutional Review Board Statement:
Does not apply

Statement of informed consent:
Does not apply

Data Availability Statement
Does not apply

Conflict of interests:
The authors report no conflict of interest

References:

1. Gańczak M., Szych Z., Karakiewicz B.: Ocena zawodowego narażenia na zakażenie HBV, HCV i HIV u personelu oddziałów ginekologii i położnictwa. Medycyna Pracy 2012; 63(1): 11-17.
2. Gańczak M., Topczewska K.: Ryzyko ekspozycji zawodowych na patogeny krwiopochodne u ratowników medycznych. Medycyna Pracy 2018; 69(6): 685-694. https://doi.org/10.13075/mp.5893.00741

3. Kudłacik B., Fraś M., Kajor I., Ryś B., Ilczak T., Ćwiertnia M., Białka Sz.: Zakażenia przenoszone drogą krwi - problem współczesnego krwiodawstwa. Problemy Pielęgniarstwa 2014; 22(2): 228-233.
4. Gołofit-Szymczak M., Górny R.L.: Narażenie pracowników opieki zdrowotnej na patogeny krwiopochodne. Bezpieczeństwo Pracy. Nauka i Praktyka 2019; 1: 15-18. https://doi.org/10.5604/01.3001.0012.8509
5. Goździcka-Józefiak A.: Wirusologia. Wydawnictwo Naukowe PWN, Warszawa 2022.
6. Pałucka K., Łepecka-Klusek C., Pilewska-Kozak A.B.: Zakażenia wirusem zapalenia wątroby typu C jako problem w opiece perinatalnej. Problemy Pielęgniarstwa 2015; 23(1): 123-127. https://doi.org/10.5603/PP.2015.0021
7. Sawczuk M., Kapica-Topczewska K., Kochanowicz J., Kułakowska A.: Zaburzenia neurologiczne w przebiegu zakażenia ludzkim wirusem niedoboru odporności. Przegląd Neurologiczny 2019; 15(4): 218-224. https://doi.org/10.5603/PPN.2019.0036
8. Sierpińska L.: Hepatitis C as an epidemiological problem in the Polish population. Medical and Biological Sciences 2015; 29(2): 41-46. https://doi.org/10.12775/MBS.2015.017.
9. Kryczka T., Jedynak A., Olszewski A., Sierpińska L., Kuźniarska P., Sulejczak D.: Military Blood Service in Poland. Journal of Blood Medicine 2023; 14: 309-316. https://doi.org/10.2147/JBM.S390673
10. Parszuto J., Jaremin B., Bardoń A.: Zawodowe zakażenia wirusami HBV i HCV wśród pracowników ochrony zdrowia. Medycyna Pracy 2012; 63(4): 441-452.
11. Torre P., Aglitti A., Masarone M., Persico M.: Viral hepatitis: Milestones, unresolved issues, and future goals. World Journal of Gastroenterology 2021; 27(28): 4603-4638. https://doi.org/10.3748/wjg.v27.i28.4603
12. Haczyński J., Skrzypczak Z.: Sytuacja ekonomiczna w Polsce a epidemiologia zakażeń HIV. Seksuologia Polska 2017; 15(2): 51-56. https://doi.org/10.5603/51-56
13. Goździcka-Józefiak A.: Wirusologia. Wydawnictwo Naukowe PWN, Warszawa 2022.
14. Sierpińska L: Zakażenie wirusem HCV jako współczesne zagrożenie zdrowotne w szpitalu.W: Mróz-Jagieło A., Brzozowski A.: EPIMILITARIS 2017. Mundurowe i cywilne służby medyczne wobec współczesnych zagrożeń. Stowarzyszenie Ruch Wspólnot Obronnych, Warszawa 2017, s. 97-103.
15. Sierpińska L.: Ryzyko zakażenia z wirusem HCV w przypadku ekspozycji zawodowej pracy pielęgniarek i położnych. Aspekty Zdrowia i Choroby 2017; 2(4): 7-17.

16. Michalik A., Krawczyk B., Zalewska-Puchała J., Byrska E.: Ocena wiedzy studentów pielęgniarstwa na temat profilaktyki zakażeń HBV i HCV – doniesienie wstępne. Problemy Pielęgniarstwa 2012; 20(4): 466-472.
17. Burzyńska M, Urbaniak J, Maniecka-Bryła I. Ocena wiedzy studentów na temat wirusowego zapalenia wątroby typu C. Probl Hig Epidemiol. 2015; 96(1): 218-223.
18. Prodanovska-Stojcevska W., Isjanovska R., Popova Ramova E.L.: Knowledge of HCV Infection Among Nursing Students of the Medical College of Bitola. Archives of Industrial Hygiene and Toxicology 2010; 61(2):197-201. https://doi.org/10.2478/10004-1254-61-2010-1990
19. Mashoto K.O., Mubyazi G.M., Mushi A.K.: Knowledge of occupational exposure to HIV: a cross sectional study of healthcare workers in Tumbi and Dodoma hospitals, Tanzania. BMC Health Serv. Res. 2015; 15: 29. https://doi.org/10.1186/s12913-015-0700-z.
20. Abere G., Yenealem D.G., Wami S.D. Occupational exposure to blood and body fluids among health care workers in gondar town, northwest Ethiopia: a result from cross-sectional study. Journal of environmental and public health 2020; 3640247. https://doi.org/10.1155/2020/3640247
21. Czarnecka J., Olszewska E., Kobos E., Sienkiewicz Z., Krupienicz A.: Wiedza studentów na temat wirusowego zapalenia wątroby typu C. Pielęgniarstwo Polskie 2016; 2(60): 201-207. http://dx.doi.org/10.20883/pielpol.2016.11