

## KNOWLEDGE OF NURSING STUDENTS ABOUT THE TRANSMISSION AND PREVENTION OF INFECTIONS CAUSED BY *TOXOPLASMA GONDII*, *RUBELLA VIRUS*, *CYTOMEGALOVIRUS* IN WOMEN DURING PREGNANCY

### WIEDZA STUDENTÓW PIELĘGNIARSTWA W ZAKRESIE DRÓG TRANSMISJI I PROFILAKTYKI ZAKAŻEŃ *TOXOPLASMA GONDII*, *RUBELLA VIRUS*, *CYTOMEGALOVIRUS* U KOBIET W OKRESIE CIĄŻY

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- A. Study design/planning  
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- B. Data collection/entry  
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- C. Data analysis/statistics  
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#### Summary

**Background.** The knowledge about the prevention of infections with TORCH pathogens, including *Toxoplasma gondii*, *Rubella virus* and *Cytomegalovirus*, combined with the proper involvement in health educator's work may affect the creation of the correct attitudes and health promoting habits.

**Study objective -** the evaluation of knowledge of nursing students of the State School of Higher Education in Biała Podlaska (Poland) and the University of Prešov (Slovakia) about the transmission routes and prevention of infections caused by *T. gondii*, *Rubella virus* and CMV in women during pregnancy.

**Material and methods.** The study group included 158 nursing students from the State School of Higher Education in Biała Podlaska, and 240 students from the University of Prešov. An original questionnaire was used; it contained closed questions regarding the specific TORCH pathogens.

**Results.** Correct answers to the question regarding the route of infection with *T. gondii* were provided by 43.5% of respondents from both universities; 42.5% knew the route of foetal infection with *T. gondii*, whereas 79.9% knew the methods to diagnose toxoplasmosis. Respondents knew consequences of infections caused by *Rubella virus* to the foetus (79.4%). Students of the State School of Higher Education (90.5%) and students of the University of Prešov (44.6%) were aware of the importance of rubella vaccination as a method of prevention of infection with *Rubella virus*.

**Conclusions.** Nursing students are familiar with the methods used in the diagnostics of toxoplasmosis and the consequences for the foetus resulting from infections with *Rubella virus*. However, the awareness regarding the transmission routes of *T. gondii* and prevention of infections caused by *Rubella virus* and CMV was insufficient.

**Keywords:** knowledge of nursing students, *Toxoplasma gondii*, *Rubella virus*, *Cytomegalovirus*

#### Streszczenie

**Wprowadzenie.** Wiedza w zakresie profilaktyki zakażeń patogenami grupy TORCH, w tym *Toxoplasma gondii*, *Rubella virus*, *Cytomegalovirus*, połączona z właściwym zaangażowaniem w pracę edukatora zdrowia może wpłynąć na kreowanie prawidłowych postaw i nawyków zdrowotnych.

**Cel badań –** ocena wiedzy studentów kierunku pielęgniarstwo kształcących się w Państwowej Szkole Wyższej w Białej Podlaskiej (Polska) oraz Uniwersytecie Preszowskim (Słowacja) na temat dróg transmisji i profilaktyki zakażeń powodowanych przez *T. gondii*, *Rubella virus*, CMV u kobiet w okresie ciąży.

**Materiał i metody.** Grupa badawcza obejmowała studentów pielęgniarstwa: 158 osób z PSW w Białej Podlaskiej i 240 studentów z Uniwersytetu Preszowskiego. Wykorzystano autorski kwestionariusz ankiety zawierający pytania zamknięte dotyczące wybranych patogenów grupy TORCH.

**Wyniki.** Poprawnie na pytanie o drogi zakażenia *T. gondii* odpowiedziało 43.5% badanych studentów obu uczelni, 42.5% zna drogę, na której dochodzi do zakażenia płodu *T. gondii*, a 79.9% zna metody diagnostyki toksoplazmozy. Ankietowani znają konsekwencje zakażeń *Rubella virus* dla płodu (79.4%). Znaczenie szczepienia przeciwko różyczce jako metody profilaktyki zakażeń *Rubella virus* świadomi są studenci z PSW (90.5%) i Uniwersytetu Preszowskiego (44.6%).

**Wnioski.** Studenci pielęgniarstwa znają metody stosowane w diagnostyce toksoplazmozy oraz konsekwencje dla płodu wynikające z zakażenia *Rubella virus*, jednak świadomość dotycząca dróg transmisji *T. gondii*, profilaktyki zakażeń *Rubella virus* i CMV jest niewystarczająca.

**Słowa kluczowe:** wiedza studentów pielęgniarstwa, *Toxoplasma gondii*, *Rubella virus*, *Cytomegalovirus*

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## Introduction

The right preparation for pregnancy is an important issue for mothers-to-be; the educational role in this respect lies, among others, with the obstetric and nursing staff [1]. Important issues related to the period of pregnancy and the time preceding this period include the risks for the mother and the foetus resulting from infections with TORCH pathogens, which include *Toxoplasma gondii*, *Rubella virus*, *Cytomegalovirus* (CMV) and other pathogens associated with the generation of congenital birth defects [2,3,4,5]. If a pregnant woman becomes ill with rubella, this may lead to the intrauterine foetal infection with *Rubella virus* and the occurrence of the congenital rubella syndrome, which involves a range of serious birth defects. Despite the mandatory vaccination programme, 5-10% of young women are not immune to *Rubella virus* for various reasons, including the absence of vaccination [6]. Women aged 20 to 44 (623 persons) not vaccinated against rubella became ill in Poland in 2013. Women vaccinated (104 persons) with one dose of the vaccine and only 1 vaccinated with two doses [7] fell ill in the same age group. Given the fact that the percentage of the vaccinated women is below 100%, and that almost 50% comprise subclinical infections with *Rubella virus*, there is still a risk of rubella in women of childbearing age [8]. The presence of over a dozen percent of women susceptible to *Rubella virus* in the population of women of childbearing age creates a risk of congenital rubella syndrome cases [9].

The proper hygienic behaviour of women during the pregnancy period reduces the risk of infections caused by *Toxoplasma gondii*, which may result in the occurrence of congenital toxoplasmosis in infants, involving the central nervous system, the organ of sight and delayed psychomotor development [10]. According to the National Institute of Hygiene (PZH), there were 10 and 18 cases, respectively, of confirmed congenital toxoplasmosis in Poland in 2012 and 2013 (incidence per 100 thousand people: 2.50 and 4.87, respectively) [11].

A Cytomegalovirus infection is dangerous for the developing foetus; therefore, women planning pregnancy need to be educated in this respect [12]. Due to the fact that the CMV virus is one of the major causes of hearing loss, deafness and mental retardation in children, the important role in case of pregnant women is played by the knowledge of their CMV serologic status and rules of CMV prevention [13]. A significant role in educating mothers-to-be in respect of TORCH pathogen infection is played by the appropriate involvement of medical personnel, including the nursing staff [13,14].

## Material and methods

The study objective was to evaluate the knowledge of nursing students at the State School of Higher Education in Biała Podlaska (Poland) and the University of Prešov in Prešov (Slovakia) about the transmission routes and prevention of infections caused by *Toxoplasma gondii*, *Rubella virus* and *Cytomegalovirus* in women during pregnancy.

The selection of respondents was purposeful. The study group were undergraduate nursing students in the academic year 2014/2015 at the two selected universities: the State School of Higher Education in Biała Podlaska (Poland) and the University of Prešov in Prešov (Slovakia).

The group of students at the State School of Higher Education in Biała Podlaska comprised of 158 people (average age: 23; SD 4.4). First-year students accounted for 31.6% (50 people), second-year students – 34.2% (54 people), whereas third-year students – 34.2% (54 people).

The group of students at the University of Prešov comprised of 240 people (average age: 22; SD 2.1). First-year students accounted for 35.4% (85 people), second-year students – 32.5% (78 people), whereas third-year students – 32.1% (77 people).

In order to achieve the assumed study objective, an original questionnaire was used; it contained six closed questions regarding specific TORCH pathogens. One correct out of four suggested answers was to be selected in each question. The questions concerned the transmission routes of *Toxoplasma gondii* to the mother and the foetus, the type of tests that confirm the infection with *T. gondii*, foetal infection with *Rubella virus* and prevention methods, and the incidence of CMV infections in the population and the associated risks of infections to the foetus. The questionnaire included demographic-based questions.

The statistical analysis was carried out using the software: STATISTICA 10. Because the lack of normal distributions of the analysed variables was determined (the Shapiro-Wilk test), non-parametric tests were used. In case of more than two predictors (year of study), the Kruskal-Wallis test was used. For qualitative variables, Chi-square independence tests were performed. In all analysed cases, the level of significance  $p=0.05$  was accepted.

## Results

The percentage of correct answers to questions regarding specific TORCH pathogens provided by the total of nursing students participating in the study was 59%. Questions were correctly answered by 48.6% of respondents from the University of Prešov and 74.7% of respondents from the State School of Higher Education in Biała Podlaska ( $p<0.000001$ ).

It was discovered that the percentage of correct answers given by nursing students from the State School of Higher Education in Biała Podlaska decreased during subsequent years of study. Correct responses in respect of the transmission routes and prevention of infections caused by *T. gondii*, *Rubella virus* and *CMV* during the pregnancy period were given mostly by students after the first year of nursing studies (82.7%); after the second year of study, correct answers were given by a significantly fewer number of students (72.5%,  $p < 0.003$ ); whereas after the third year – 69.4%, which was significantly lower compared with first-year students ( $p < 0.0006$ ).

In case of nursing students from the University of Prešov, there was an increase in the percentage of respondents providing correct answers during subsequent years of study: 46.9% after the first year, 48.7% after the second year and 50.4% after the third year; however, the differences were not statistically significant.

Correct answers regarding routes of infections with *T. gondii* were given by a total of 43.5% of nursing students from both universities. Students from the State School of Higher Education in Biała Podlaska (64.6%) and students from the University of Prešov (29.6%) indicated the oral route (consumption of raw vegetables and fruit contaminated with oocysts, or raw or undercooked meat) or contact with cat faeces as important in infections with *T. gondii*. Students from the Polish school (33.5%) and 40% of students from the Slovak university indicated only the contact with cat faeces or soil contaminated with the protozoan as significant in infection with *T. gondii*.

Almost half of all nursing students from both universities involved in the study (42.5%) knew the route of infection with *T. gondii* in the foetus. The respondents from the Polish university (52.5%) and 35.9% students from the Slovak school demonstrated that the transmission of the protozoan may occur through the placenta during pregnancy if a primary infection with *T. gondii* occurs in the mother-to-be during pregnancy.

The vast majority of respondents, i.e. 79.9% of all the students (87.3% of students from the State School of Higher Education and 75% of students from the University of Prešov), were aware that serological tests and determination of *T. gondii* IgM and IgG antibodies were the basis for the toxoplasmosis diagnostics. This knowledge was demonstrated by a similar percentage of students from the Polish and Slovak universities, regardless of the year of study (Tab. I).

The vast majority of the total number of students participating in the study (79.4%) was aware that *Rubella virus* infections in pregnant women were particularly dangerous during the first trimester because it could lead to death of the foetus or severe congenital disorders. The correct answer was indicated by 90.5% of students from the State School of Higher Education in Biała Podlaska and 72.1% of students from the University of Prešov. Only 3.3% of all students at both universities said that the infection with *Rubella virus* to the mother-to-be carried a small risk to the foetus.

More than 62% of all surveyed nursing students from both universities were aware that rubella vaccinations of children and young women before pregnancy were the primary methods affecting the radical reduction of foetal infection with *Rubella virus*. However, there was a difference in the percentage of students from the State School of Higher Education in Biała Podlaska (90.5%) and from the University of Prešov (44.6%) who determined the importance of this type of prevention.

More than 34% of nursing students from the Slovak university and 62.7% of students from the Polish school were aware that Cytomegalovirus (CMV) infections were common, mostly asymptomatic and dangerous to the foetus if mother's primary infection occurred during pregnancy. A significant percentage of all students (11.8%) mistakenly believed that there was a vaccine used to prevent CMV infections (14.2% from Slovakia, 8.23% from Poland).

**Table 1.** The percentage of correct answers given by the students taking into account year of study

University	State School of Higher Education in Biała Podlaska (Poland)			University of Prešov (Slovakia)		
	N=158			N=240		
Number of nursing students						
Year of study	I	II	III	I	II	III
	%	%	%	%	%	%
<i>T. gondii</i> infection may occur by eating raw meat of an infected animal or by contact with cat faeces	90	68.5	37	34.1	24.4	29.9
Foetal infection with <i>T. gondii</i> may occur through the placenta during pregnancy if the mother is infected with the protozoan during pregnancy	64	37	57.4	38.8	26.9	41.6
Serological tests confirming toxoplasmosis – the level of anti- <i>T. gondii</i> IgM and IgG antibodies	84	97	87	68.2	85.9	71.4

A <i>Rubella virus</i> infection in pregnant women is particularly dangerous during the first trimester, may lead to foetal death or severe congenital disorders	98	88.9	85.2	74.1	71.8	70.1
Prevention of foetal infections with the <i>Rubella virus</i> involves the vaccination against rubella of children and young women before pregnancy	82	98.1	90.7	40	46.1	48
CMV infections are common, most of them are asymptomatic; they are dangerous to the foetus if the mother's primary infection occurred during pregnancy	78	51.8	59.1	25.9	37.2	41.6

## Discussion

The knowledge of routes of infections with *T. gondii*, CMV or *Rubella virus*, and their consequences for the foetus, and healthy eating and hygiene habits demonstrated by medical staff to women planning pregnancy may significantly contribute to the creation of conscious health-promoting attitudes. Studies carried out by Wrońska among urban agglomeration women in respect of the conscious preparation for motherhood and the proper control of pregnancy showed different levels of knowledge in this area and identified a continuing need for education of women [4]. Van Damme-Ostapowicz indicates that both working nurses and nursing students are aware that they have a duty to act as health educators. According to 53% of them, patient education regarding infectious and parasitic diseases should be handled by an epidemiological nurse, according to 43% – by every nurse, and 22% – by a doctor [1]. Wrona-Wolny also emphasises the role of students in the fields of promoting healthy and active lifestyle as future health educators [15]. To make educators' activities fruitful, they have to be based on solid knowledge in the field of health. Available literature does not contain data concerning the evaluation of the level of knowledge among nursing students in terms of TORCH pathogens, including *Toxoplasma gondii*, *Rubella virus* and *Cytomegalovirus*. Study papers mainly address the importance of knowledge of students of different fields in terms of infectious diseases that affect the health of women during pregnancy and its consequences for the foetus [15,16]. The analysis of results of studies conducted among nursing students from the two universities indicated that 75% of the nursing students at in the State School of Higher Education in Białą Podlaska (Poland) and 49% at the University of Prešov (Slovakia) were aware of the existing risks for the mother and the foetus in case of infections with *T. gondii*, *Rubella virus* and *Cytomegalovirus*. However, it is worrying that along with the duration of studies, the percentage of students of the Polish university who provide the correct answers to the questions drops: from 82.7% after the first year of study to 69.4% after the third year of study. Another trend is observed in the group of Slovak students participating in the study. An increase of the percentage of respondents providing correct answers was noticed: from 46.9% after the first year to 50.4% after the third year.

According to studies carried out by Wrona-Wolny among physical education students, 96.4% of respondents believe that a woman who wants to give birth to a healthy infant should start taking care of her health before pregnancy begins [15]. Wrońska indicates the importance of the awareness of mothers-to-be in respect of vaccinations against rubella or prevention of the toxoplasmosis incidence in the overall prevention of birth defects in children. In this respect, the level of knowledge among women varies depending on the age and education. The highest awareness as to the significance of vaccinations against rubella is shown by female pupils and female students (70%), female teachers (70%), whereas women who work as clerks and blue-collar workers have a lower level of knowledge (58% and 55%, respectively) [4]. Our study showed that 62.8% of young people who studied nursing at the two universities covered by the study were aware of principles of correct prevention of infections with *Rubella virus* in foetus, based on vaccinations against rubella of children and young women before pregnancy. Many of them (48% of nursing graduates from the University of Prešov and 90.7% from the State School of Higher Education in Białą Podlaska) are therefore ready to carry out educational activities in this field.

*Toxoplasma gondii* infections in early pregnancy may lead to the generation of congenital birth defects. Therefore, it is essential to carry out screening tests for the presence of anti-*T. gondii* antibodies in the periconceptual period, which may lead to a considerable minimisation of the risk of birth defects [17]. In Wrońska's studies, female pupils (51%) and female teachers (56%) showed that they were aware of the need to check the level of toxoplasmosis antibodies; however, the highest awareness in this respect was demonstrated by female clerks (61%) [4]. It is alarming that more than half of all nursing students participating in the study were not aware of the routes of *T. gondii* infections in people (56.5%) and did not know the routes of infection in the foetus with this protozoan (57.5%). This knowledge among students from the Polish university was high (90%) after the first year of study, but dropped after the last (third) year of undergraduate studies. Only 37% of people from the Polish group graduating in nursing remembered the routes of human infection with *T. gondii*, whereas in case of students from the

Slovak university, the figure was 29.9%. Just over half of the nursing graduates from the State School of Higher Education in Białá Podlaska (57.4%) and less than half (41.6%) from the University of Prešov knew the routes of infections with *T. gondii* in the foetus. The vast majority (79.9%) of young nursing students were aware of the methods used in the diagnostics of toxoplasmosis. This knowledge may contribute to the development of responsible attitudes among women planning pregnancy. Many nursing students have no awareness of the significance of CMV infection prevention: almost 12% mistakenly believe that there is a vaccine to prevent CMV infections. Less than half of respondents (45.7%) is aware of the common occurrence of Cytomegalovirus infections in the population, that the majority of them being asymptomatic, and that they are dangerous to the foetus if mother's primary infection occurred during pregnancy.

## Conclusions

Nursing students are familiar with the methods used in the diagnostics of toxoplasmosis and the consequences for the foetus resulting from infections with *Rubella virus*. However, the awareness regarding the transmission routes of *T. gondii* and prevention of infections caused by *Rubella virus* and CMV was insufficient. It is necessary to put more emphasis in the process of educating future nursing staff on the stabilisation of knowledge regarding the routes of transmission and prevention of infections caused by TORCH pathogens.

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