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ORIGINAL PAPER/*PRACA ORYGINALNA*

Human papillomavirus (HPV) – assessing the level of knowledge, sexual behaviours, awareness, attitude, and vaccination status among dentistry students

Wirus brodawczaka ludzkiego (HPV) – ocena poziomu wiedzy, zachowań seksualnych, świadomości, postawy i statusu szczepień wśród studentów stomatologii

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ABSTRACT

Introduction: Persistent infection with oncogenic types of human papillomavirus (HPV) can cause cervical cancer in women, penile cancer in men, as well as anogenital and oropharyngeal cancers in both genders. It has been proven that the HPV vaccination, preferably before initiation of sexual life, is highly effective in preventing these cancers.

Aim: The study aims to assess the level of knowledge, awareness and attitudes of dentistry students at Poznan University of Medical Science about HPV infection and HPV vaccinations.

Material and methods: The self-designed survey contained 32 questions regarding basic demographic data, sexual behaviour data, attitude to vaccines, and knowledge about HPV infection and HPV vaccinations. The analysed group consisted of 270 students (213 females and 57 males).

Results: Among the respondents, 166 (61.48%) were younger dentistry students (1–3 years of study) and 104 (38.52%) were older dentistry students (4–5 years of study). Older students had a significantly higher level of knowledge than younger students ($p < 0.0001$). Students after sexual intercourse had a significantly higher level of knowledge compared with students before first sexual intercourse ($p < 0.0001$). Students with a constant sexual partner (64.07%) had a significantly higher level of knowledge compared with students without a constant sexual partner ($p < 0.0001$). Only 30% ($n = 81$) of students had been vaccinated against HPV (35.21% of females and 10.53% of males; $p < 0.0001$).

Conclusions: The results demonstrate that awareness and knowledge about HPV, HPV vaccines, and cancers associated with HPV depends, among other things, on the year of study and sexual activity. It is essential to increase the knowledge and awareness of health risks regarding HPV infection from the beginning of studies because dentistry students and dentists should better educate the population about the risks associated with HPV infection.

KEY WORDS

human papillomavirus (HPV), knowledge, dentistry, vaccination.

STRESZCZENIE

Wprowadzenie: Zakażenie onkogennymi typami wirusa brodawczaka ludzkiego (HPV) może być przyczyną rozwoju wielu nowotworów, między innymi raka szyjki macicy u kobiet, raka prącia u mężczyzn, jak również nowotworów odbytu oraz jamy ustnej, gardła i krtani u obu płci. Udowodniono, że szczepienie przeciwko HPV, najlepiej przed rozpoczęciem współżycia seksualnego, jest wysoce skuteczne w zapobieganiu powyższym nowotworom.

Cel pracy: Przeprowadzone badanie ma na celu ocenę poziomu wiedzy, świadomości i postaw studentów stomatologii Uniwersytetu Medycznego w Poznaniu na temat zakażenia HPV i szczepień przeciwko HPV.

Materiały i metody: Ankieta zaprojektowana przez autorów badania zawierała 32 pytania dotyczące podstawowych danych demograficznych, zachowań seksualnych, stosunku do szczepień oraz wiedzy na temat HPV i szczepień przeciwko HPV. W badaniu wzięło udział 270 studentów stomatologii Uniwersytetu Medycznego im. Karola Marcinkowskiego w Poznaniu (213 kobiet i 57 mężczyzn).

Wyniki: Wśród respondentów 166 (61,48%) stanowią studenci niższych lat studiów (1.–3. rok) oraz 104 (38,52%) – studenci wyższych lat studiów (4.–5. rok). Studenci wyższych lat studiów mają statystycznie wyższy poziom wiedzy na temat HPV oraz szczepień przeciwko HPV niż studenci niższych lat studiów ($p < 0{,}0001$). Studenci, którzy mają za sobą pierwsze współżycie seksualne, posiadają statystycznie wyższy poziom wiedzy na temat HPV i szczepień przeciwko HPV w porównaniu ze studentami przed pierwszym stosunkiem seksualnym ($p < 0{,}0001$). Studenci, którzy posiadają stałego partnera seksualnego (64,07%), mają statystycznie wyższy poziom wiedzy na temat HPV i szczepień przeciwko HPV w porównaniu ze studentami bez stałego partnera seksualnego ($p < 0{,}0001$). Tylko 30% ($n = 81$) studentów jest zaszczepionych przeciwko HPV (35,21% kobiet i 10,53% mężczyzn; $p < 0{,}0001$).

Wnioski: Wyniki przeprowadzonego badania pokazują, że świadomość i wiedza na temat HPV, szczepień przeciwko HPV i nowotworów związanych z HPV zależy m.in. od roku studiów i aktywności seksualnej ankietowanych studentów stomatologii. Istotne jest systematyczne zwiększenie poziomu wiedzy i świadomości zagrożeń zdrowotnych związanych z zakażeniem HPV, jak również propagowanie szczepień przeciwko HPV wśród studentów stomatologii.

SŁOWA KLUCZOWE

wirus brodawczaka ludzkiego (HPV), wiedza, stomatologia, szczepienia.

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INTRODUCTION

Human papillomavirus (HPV) is built of double-stranded DNA that has the ability to enter the body through epithelial cells. Infection occurs, among others, through sexual contact with an HPV carrier and by vertical mother-to-child transmission during vaginal delivery [1]. So far, over 200 types of HPV have been identified, which have been divided into 2 types according to their oncogenic potential: low-risk HPVs (LR-HPVs), which include the types of HPV responsible, among others, for skin lesions on internal and external male and female genitalia, such as genital warts, and high-risk, oncogenic HPVs (HR-HPVs), which include viruses that can induce uncontrolled cell division leading to the development of tumours, such as cancer of the cervix, vulva, penis, vagina, mouth, oropharynx, larynx, or anus [2]. It is assumed that every sexually active woman and man will be infected with HPV at least once in their life, making HPV the most common sexually transmitted virus in the world [3].

Research on the involvement of HPV in oncogenesis has been ongoing since around 1980 [4]. Human papillomavirus is estimated to be the cause of more than 99% of the nearly 600,000 cervical cancer cases reported annually. Every year more than 300,000 women die from cervical cancer, making it the fourth most lethal cancer among women in the world [4, 5]. Gynaecology and obstetrics associations recommend that healthy women aged

21 to 29 with no worrying symptoms undergo screening examinations every 3 years (Pap smear), while women aged 30 to 65 should undergo screening with the use of Pap smears and HPV tests every 5 years, or every 3 years if only a Pap smear is performed [6]. According to WHO recommendations, cervical cancer prevention with HPV vaccines should begin in girls aged 9–14 years, prior to first sexual intercourse [7].

HPV infection also affects men and causes the development of approx. 90% of rectal cancer cases and approx. 50% of penile cancer cases [8]. Due to the prevalence of the virus in the global population and the potentially oncogenic nature of the infection, finding methods to prevent entry into the body as well as the spread of HPV is a global goal of modern science.

Currently, there are 3 types of vaccines developed and commercially available, covering different types of HPV [9]. The initially established vaccination programs were aimed at the female population only, but due to the results of meta-analyses showing a high frequency of infections in both women and men and the demonstrated relationship between HPV and male-specific malignancies, it became justified to extend the preventive programs to cover both genders [10]. Research conducted in Australia showed that the introduction of the National Health Vaccination Program against HPV in 2007 led to a decline in the incidence of the 4 most common HR-HPV (6,11,16,18) in vaccinated women aged 18–24 years; in 2013 it was also made available to men up to 25 years of age. Moreover, based on the results of 7 global HPV prevalence studies, a 68% decrease in the number of HPV infections (types 16 and 18) was found in countries with vaccination coverage of at least 50% [11]. These results confirm the effectiveness of activities aimed at increasing the availability and awareness of the public in the field of HPV infection prevention.

Poland, as one of the few European Union countries, despite the alarming statistics on the incidence of HPV-related cancers in Poland, has not yet introduced a universal HPV vaccination program [12]. Vaccines are available only through local programs and patients' own resources. The lack of national programs, economic exclusion, and ideological influences lead to low awareness among Poles regarding the importance of HPV vaccination, which emphasizes the need to increase educational activities in this area.

AIM

The aim of the study is to assess the level of knowledge, awareness, and attitudes towards HPV and HPV vaccinations among students of dentistry at the Karol Marcinkowski University of Medical Sciences in Poznan. Because of the small number of scientific reports on this subject in Polish and global literature, determining the level of knowledge on HPV and HPV vaccination may support the creation and evaluation of academic training programs for students of medical faculties, such as dentistry.

MATERIAL AND METHODS

MATERIAL

The study was conducted among 270 students (213 women and 57 men) of dentistry at the Karol Marcinkowski University of Medical Sciences in Poznan between November and December 2020 (Table 1). The students were divided into 2 groups: younger students (1–3 years of study) – 166 respondents in total; and older students (4–5 years of study) – 104 respondents in total. The study originally included 307 dentistry students, but all questionnaires that were completed incorrectly or contained incomplete data were eliminated from the study and were not included in statistical analysis.

All respondents gave their informed consent to participate in the study. The study was conducted in accordance with the Declaration of Helsinki and its subsequent amendments, and prior to its commencement approval was obtained from the Bioethics Committee of the Karol Marcinkowski University of Medical Sciences in Poznan.

QUESTIONNAIRE

The surveyed students received a questionnaire designed by the research team, consisting of 32 closed, single-choice questions. The first part of the questionnaire included questions about age, gender, sexual orientation, and past sexual experiences. The second part of the questionnaire included 15 questions concerning knowledge about HPV and HPV vaccination. The third part of the questionnaire included questions about the attitude and views on HPV vaccination and the vaccination status of the respondents.

Before starting the study, a pilot was carried out among students of dentistry at the University of Medical Sciences in Poznan to test and evaluate the questionnaire in terms of clarity and consistency of the questions asked. After taking into account the suggestions of students and introducing all appropriate changes, the study began. Each participant of the study was informed about its purpose as well as the confidentiality and anonymity of the answers provided. The time to complete the survey was unlimited. After completing the survey, the students had the opportunity to present questions about HPV and HPV vaccination to the researchers conducting the study.

TABLE 1. Characteristics and personal sexual history of study participants and their association with HPV knowledge

Variable	Knowledge of HPV					
	Number (% of all)	Median score	Mean score	% of correct answers	SD	*P*-value
Year of study:						
1–3	166 (61.48)	10	9.55	64	2.51	< 0.001
4–5	104 (38.52)	12	12.09	81	1.60	
Sex:						
Female	213 (78.89)	11	10.45	70	2.47	0.242
Male	57 (21.11)	11	10.81	72	2.73	
Sexual intercourse in the past:						
Yes	222 (82.22)	11	10.82	72	2.40	< 0.001
No	48 (17.78)	9	9.15	61	2.63	
Sexual orientation:						
Heterosexual	257 (95.19)	11	10.52	70	2.55	0.806
Other than heterosexual	13 (4.81)	11	10.62	71	2.02	
Permanent sexual partner:						
Yes	173 (64.07)	11	11.05	74	2.17	< 0.001
No	97 (35.93)	10	9.59	64	2.82	
Number of sexual partners in the past:						
0–2	218 (80.74)	11	10.37	69	2.56	0.043
3+	52 (19.26)	11	11.17	74	2.28	
HPV vaccination:						
Yes	81 (30)	10	9.73	65	2.63	< 0.001
No	189 (70)	11	10.87	72	2.41	

STATISTICAL ANALYSIS

In the HPV and HPV vaccination knowledge assessment section, each participant received one point for every correct answer. No points were deducted for incorrect answers or selecting the answer "I don't know". The minimum number of points to be obtained was 0, while the maximum was 15.

The level of knowledge of the dentistry students was compared in terms of their year of study, gender, sexual orientation, vaccination status, and history of sexual intercourse. The following comparative parameters were used: percentage of correct answers, median, mean, and standard deviation.

The attitudes of the students towards vaccination were also analysed, comparing attitudes towards HPV vaccination by year of study, gender, sexual orientation, vaccination status, and sexual intercourse history using statistical analysis.

Statistical analysis was performed using Statistica software (version 13.0). Student's *t*-test was used to compare the individual groups. The comparison of answer percentages between the analysed groups was made using proportion testing. All tests were analysed at a significance level of $p = 0.05$.

RESULTS

KNOWLEDGE ON HPV AND HPV VACCINATION

The average score determining the overall level of knowledge about HPV and vaccinations against HPV among the surveyed students of dentistry at the Medical University of Karol Marcinkowski in Poznan was 10.53 ±2.52 points, with the maximum score of 15 points and the minimum of 0 points.

Among the respondents, 166 (61.48%) were younger students of dentistry (1–3 years of study) and 104 (38.52%) were older students of dentistry (4–5 years of study). The majority of the respondents (82.22%) had experienced sexual initiation. Students after sexual initiation had significantly higher levels of knowledge com-

pared to students before their first sexual intercourse ($p < 0.001$). There was no influence of sexual orientation on the level of knowledge about HPV and HPV vaccinations among students of dentistry. Students with a permanent sexual partner (64.07%) had a significantly higher level of knowledge compared to students who did not have a permanent sexual partner ($p < 0.001$). Knowledge concerning HPV and HPV vaccination was shown to be influenced by the number of previous sexual partners – students who had had 3 or more sexual partners in the past had a higher level of knowledge regarding HPV and HPV vaccination compared to students who had had fewer than 3 sexual partners ($p = 0.043$).

Only 30% ($n = 81$) of students were vaccinated against HPV; statistically, women were vaccinated more often (35.21% of women and 10.53% of men, $p < 0.0001$). The students who were not vaccinated against HPV had a significantly higher level of knowledge compared to those vaccinated against HPV ($p < 0.001$).

There was a general improvement in knowledge of HPV and HPV vaccination with subsequent years of study. Older students (4–5 years of study) had a statistically higher level of knowledge than students of years 1–3 ($p < 0.001$). These differences were reflected in individual questions of the questionnaire (Table 2). First of all, there was an improvement in the students' awareness of the relationship between HPV and the development of cancer of the cervix, penis, vulva, oropharynx, oral cavity, and larynx, as well as anal cancer (questions 1–4, Table 2). Unfortunately, despite the general improvement in knowledge, the level of awareness, in particular the relationship between HPV and cancer of the penis, vulva, or anus, is still low among university students – only about 60% of respondents from this group knew about the relationship between HPV and cancer of the penis, vulva, or anus (Questions 2 and 4, Table 2). Older students were more aware of the relationship between anogenital warts and HPV (Question 5, Table 2) and were able to better differentiate HPV from herpes simplex virus (HSV) (Question 6, Table 2). Higher-year students were also more aware of the risk of HPV infection increasing with the number of sexual partners (Question 7, Table 2) and the potential routes of HPV transmission through anal and oral sexual contact (Questions 12 and 13, Table 2). Unfortunately, there was a noticeably low level of knowledge about vertical HPV transmission (Question 14, Table 2) among both younger (1–3 years of study) and older (4–5 years of study) students of dentistry – only slightly more than half of the surveyed students were aware of this route of HPV infection. Moreover, a relatively low percentage of students knew the recommended HPV vaccination age:

TABLE 2. Comparison of percentages of correct responses to questions provided by students in early years of education (1–3) and late years of education (4–5)

No.	Question	1–3 (166 students)	4–5 (104 students)	*P*-value
1.	Does HPV infection increase the risk of developing cervical cancer?	153 (92%)	104 (100%)	0.008
2.	Does HPV infection increase the risk of developing penile and vulvar cancer?	64 (39%)	63 (61%)	< 0.001
3.	Does HPV infection increase the risk of developing oropharyngeal cancer, oral cancer, and laryngeal cancer?	92 (55%)	102 (98%)	< 0.001
4.	Does HPV infection increase the risk of developing anal cancer?	44 (27%)	65 (63%)	< 0.001
5.	Does HPV infection increase the risk of genital warts?	71 (43%)	96 (92%)	< 0.001
6.	Can HPV infection cause genital herpes?	30 (18%)	31 (30%)	0.022
7.	Does the number of sexual partners affect the risk of HPV infection?	157 (95%)	104 (100%)	0.040
8.	Do condoms reduce the risk of HPV infection?	150 (90%)	99 (95%)	0.131
9.	Is it possible to cure HPV?	73 (44%)	55 (53%)	0.133
10.	Can you be HPV-positive and have no symptoms?	148 (89%)	94 (90%)	0.576
11.	Can you contract HPV through sexual intercourse?	165 (99%)	103 (99%)	0.732
12.	Can you contract HPV through anal sex?	111 (67%)	93 (89%)	< 0.001
13.	Can you contract HPV through oral sex?	114 (69%)	101 (97%)	< 0.001
14.	Is vertical transmission of HPV possible?	95 (57%)	55 (53%)	0.539
15.	What is the recommended age for HPV vaccination?	118 (71%)	82 (79%)	0.120

71% among younger students and 79% among older students of dentistry (Question 15, Table 2).

ATTITUDE TOWARDS HPV VACCINATION

Another aspect assessed in the study, apart from knowledge about HPV and HPV vaccination, was the attitude of the surveyed dentistry students to HPV vaccinations (Table 3). A question was asked to assess attitudes toward making HPV vaccination mandatory and placing HPV vaccination on the mandatory vaccination schedule (Question 1, Table 3). Most of the students believed that HPV vaccination should be made mandatory and included in the current vaccination schedule (n = 217, 80.37%). It transpires that students after their first sexual intercourse were statistically more likely to believe that vaccination against HPV should be included in the mandatory vaccination schedule (p = 0.002). Moreover, when it came to the approach to mandatory HPV vaccination, the number of previous sexual partners was also important – students who had had 3 or more sexual partners statistically more often believed that vaccination against HPV should be mandatory (p = 0.029). Moreover, HPV vaccinated students were more likely to believe that HPV vaccination should be mandatory than unvaccinated students (p = 0.029).

The willingness to recommend HPV vaccination to individual genders – women and men – was also assessed (Questions 2 and 3, Table 3). It was shown that older students of dentistry (years 4–5) more often recommend HPV vaccination to women than students of years 1–3 (p = 0.001). In addition, men were statistically more likely than women to recommend HPV vaccination to women (p = 0.001). The sexual activity status of respondents was also important in this regard – students after sexual initiation and students with a permanent sexual partner were more likely to recommend HPV vaccination to women (p = 0.001). In addition, students who had had 3 or more sexual partners were more likely to recommend HPV vaccination to women than students with less sexual experience (p = 0.029). Importantly, students vaccinated against HPV more often recommended HPV vaccination to women than students not vaccinated against HPV (p = 0.004). There was no impact of sexual orientation on recommending HPV vaccination to women (p = 0.189).

The next question assessed the willingness to recommend HPV vaccination to men among students of dentistry (Question 3, Table 3). Similarly to the question on recommending HPV vaccination to women (Question 2, Table 3), higher-year students (4–5) statistically more often recommend HPV vaccination to men than younger students (p = 0.003). In addition, students who had 3 or more sexual partners were statistically more likely to recommend vaccination to men than students with less sexual experience (p = 0.001). It transpires that the surveyed students whose orientation was other than heterosexual (e.g. homosexual or bisexual) more often recommend HPV vaccination to men (p = 0.005). There was no evidence of any effect of gender, previous sexual initiation, or having a permanent sexual partner on HPV vaccination recommendations given to men. Interestingly, there was also no evidence of any impact of past HPV vaccination on recommending HPV vaccination to men (p = 0.285).

DISCUSSION

The conducted study assesses the level of knowledge and awareness as well as the attitude towards HPV vaccinations among students of dentistry at the Karol Marcinkowski University of Medical Sciences in Poznan. The number of scientific reports on this subject in relation to the Polish education and health care system is small, so a decision was made to perform an up-to-date assessment of the knowledge about HPV and preferences regarding HPV vaccination among students of dentistry. Significant differences were found in the level of knowledge and attitudes toward vaccination in relation to years of study, gender, sexual history, and HPV vaccination status. It transpires that the level of knowledge increases significantly with subsequent years of study, but there are aspects in which its level is still unsatisfactory.

It should be noted that among students of dentistry there is a very high awareness of the link between HPV and the development of cervical cancer. This fact is undoubtedly influenced by popular social and media campaigns informing about the risk of developing cervical cancer in patients infected with HPV. Unfortunately, information campaigns focusing on cervical cancer often fail to inform about other cancers whose development is closely correlated with HPV, such as cancers of the larynx, oropharynx, penis, vulva, or anus. The above is also reflected in the research conducted. Only a small percentage of dentistry students associate HPV with cancer of the penis, vulva, or anus, a trend that was also seen among students of higher years [4, 5]. Although a significant increase in the level of knowledge on this issue was demonstrated, only about 60% of final-year students were aware of these correlations. Awareness of the relationship between HPV and otorhinolaryngological tumours (oropharynx, mouth, and larynx) was slightly better. Almost all final-year students were aware of the relationship between HPV and the development of these cancers.

Another important aspect found in the conducted study is the relationship between sexual activity and in-

TABLE 3. Factors influencing medical students' opinions about HPV vaccination

Variable	Year of study			Sex			Sexual intercourse in the past			Sexual orientation			Permanent sexual partner			Number of sexual partners in the past			Vaccinated against HPV		
	1–3 ($n = 166$)	4–5 ($n = 104$)	*P*-value	Female ($n = 213$)	Male ($n = 57$)	*P*-value	Yes ($n = 222$)	No ($n = 48$)	*P*-value	Hetero-sexual ($n = 257$)	Other ($n = 13$)	*P*-value	Yes ($n = 173$)	No ($n = 97$)	*P*-value	0–2 ($n = 218$)	3+ ($n = 52$)	*P*-value	Yes ($n = 81$)	No ($n = 189$)	*P*-value
Should HPV vaccination be mandatory? Answer – Yes	134 (80.72%)	83 (79.81%)	0.103	175 (82.16%)	42 (73.68%)	0.655	183 (82.43%)	34 (70.83%)	0.002	206 (80.16%)	11 (84.62%)	0.189	145 (83.82%)	72 (74.23%)	0.114	170 (77.98%)	47 (90.38%)	0.029	72 (88.89%)	145 (76.72%)	0.029
would you recommend HPV vaccination to a woman? Answer – Yes	131 (78.92%)	87 (83.65%)	0.001	170 (79.81%)	48 (84.21%)	0.001	187 (84.23%)	31 (64.58%)	0.001	207 (80.54%)	11 (84.62%)	0.057	148 (85.55%)	70 (72.16%)	0.001	169 (77.52%)	49 (94.23%)	0.029	74 (91.36%)	144 (76.19%)	0.004
would you recommend HPV vaccination to a man? Answer –Yes	92 (55.42%)	59 (56.73%)	0.003	121 (56.81%)	30 (52.63%)	1.000	133 (59.91%)	18 (37.50%)	0.202	143 (55.64%)	8 (61.54%)	0.005	104 (60.12%)	47 (48.45%)	0.251	119 (54.59%)	32 (61.54%)	0.001	50 (61.73%)	101 (53.44%)	0.285

creased level of knowledge about HPV. Students who had had their first sexual intercourse, had a permanent sexual partner, or had had 3 or more sexual partners in the past had a statistically higher level of knowledge about HPV and HPV vaccination. This indicates that students who have a sex life are also more aware of the dangers of HPV infection. At the same time, with every subsequent year of study, the students' awareness of the risk of HPV infection through anal or oral sex increases. Importantly, the vast majority of the students were aware that condom use is an important predictor against HPV infection, and that the greater the number of sexual partners, the higher the risk of HPV infection.

The low percentage of HPV-vaccinated students of dentistry (only 30% of respondents, $n = 81$) should also be emphasized. Poland is one of the few European Union countries that has not yet introduced HPV vaccination into the mandatory vaccination schedule. Among other reasons, due to the lack of a universal HPV vaccination program in our country, the percentage of vaccinated people in the population is estimated at only about 7.5–10% [13]. Against this background, the 30% rate of vaccinated dentistry students participating in the study turns out to be a very good result. Importantly, this result is the same as in other studies, in which the percentage of students of medical faculties vaccinated against HPV was about 35% [14].

The vast majority of students vaccinated against HPV were women. This is in line with the global trend, which clearly shows a higher HPV vaccination rate among female patients. Interestingly, even in countries where vaccination programs have been introduced for both genders, women still far outnumber men among the vaccinated [15]. Undoubtedly, the cancer that is most often identified with HPV is cervical cancer, which is why there is a misconception in society that HPV vaccines are intended only for women. This leads to the erroneous conclusion that only women benefit from HPV vaccination, which means that the percentage of young boys vaccinated against HPV is very low worldwide [16]. The results of the study show that students are more likely to recommend HPV vaccination to women than to men. This is significantly associated with the lack of adequate awareness of HPV-related cancers that affect not only women but also men.

The vast majority of the surveyed students believed that HPV vaccination should be considered mandatory and included in the mandatory vaccination schedule ($n = 217$, 80.37%). This result is higher than in the results of other studies on this subject, which showed that 27% to 63.5% of people believed that vaccination against HPV should be mandatory [14, 17, 18].

Research has shown that the main factor influencing the decision to get vaccinated against HPV is the recommendation of a healthcare professional [19–21]. Therefore, it is extremely important to properly educate students of medical faculties, such as dentistry, about HPV and the related risks, as well as the positive effects of vaccination against HPV. In addition, it seems necessary to introduce changes to medical school curricula to address the issue of appropriate patient education in the field of HPV and the associated risks.

Summarizing the overall results regarding HPV vaccination, there is a noticeable positive attitude towards HPV vaccination, which increases with subsequent years of study.

CONCLUSIONS

The knowledge of medical students about HPV and HPV vaccination is extremely important in building public awareness of the issue of HPV and HPV-related cancers. A low level of knowledge among dentistry students may have a negative impact on the level of knowledge in the society due to the lack of proper education of patients about the risks associated with HPV. Educational programs and appropriate training systems for medical students are critical to increasing public awareness of HPV and HPV vaccination.

There are significant gaps in many aspects of HPV-related knowledge among medical students. It is crucial to raise public awareness of the dangers of HPV and the benefits of increasing the rates of HPV vaccination. Improving awareness and knowledge of HPV and the cancers it causes requires multidirectional measures, mainly campaigns and educational programs for the public. It is necessary to introduce appropriate programs to further educate students of medical faculties, including dentistry, in the field of HPV and HPV vaccinations. In addition, it is necessary to periodically assess the state of knowledge about HPV and HPV vaccinations, as well as awareness and individual preferences among health care professionals and students of medical schools. This information can then be used to correct possible irregularities and develop curricula for medical faculties, such as dentistry.

The main limitation of the study was that it was conducted only in one region of Poland, and the students attended one medical university. Moreover, the questionnaire designed by the authors contained few questions about HPV vaccination and was not validated by public health professionals.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Freitas AC, Mariz FC, Silva MA, Jesus AL. Human papillomavirus vertical transmission: review of current data. Clin Infect Dis 2013; 56: 1451-6.
2. Butterfield R, Dhanani S. The development of human papillomavirus (HPV) vaccines and current barriers to implementation. Immunol Invest 2021; 50: 821-32.
3. Kombe Kombe AJ, Li B, Zahid A, et al. Epidemiology and burden of human papillomavirus and related diseases, molecular pathogenesis, and vaccine evaluation. Front Public Health 2021; 8: 552028.
4. Brianti P, De Flammineis E, Mercuri SR. Review of HPV-related diseases and cancers. New Microbiol 2017; 40: 80-5.
5. Rerucha CM, Caro RJ, Wheeler VL. Cervical cancer screening. Am Fam Physician 2018; 97: 441-8.
6. Kreimer AR, Pierce Campbell CM, Lin HY, et al. Incidence and clearance of oral human papillomavirus infection in men: the HIM cohort study. Lancet 2013; 382: 877-87.
7. World Health Organization. Electronic address: sageexecsec@who.int. Human papillomavirus vaccines: WHO position paper, May 2017-Recommendations. Vaccine 2017; 35: 5753-5.
8. de Oliveira CM, Fregnani JHTG, Villa LL. HPV vaccine: updates and highlights. Acta Cytol 2019; 63: 159-68.
9. Harper DM, DeMars LR. HPV vaccines – a review of the first decade. Gynecol Oncol 2017; 146: 196-204.
10. Dunne EF, Nielson CM, Stone KM, et al. Prevalence of HPV infection among men: a systematic review of the literature. J Infect Dis 2006; 194: 1044-57.
11. Patel C, Brotherton JM, Pillsbury A, et al. The impact of 10 years of human papillomavirus (HPV) vaccination in Australia: what additional disease burden will a nonavalent vaccine prevent? Euro Surveill 2018; 23: 1700737.
12. Bruni L, Albero G, Serrano B, et al. ICO/IARC Information Centre on HPV and Cancer (HPV Information Centre). Human Papillomavirus and Related Diseases in the World. Summary Report 22 October 2021.
13. Owsianka B, Gańczak M. Evaluation of human papilloma virus (HPV) vaccination strategies and vaccination coverage in adolescent girls worldwide. Przegl Epidemiol 2015; 69: 53-8, 151-5.
14. Afonso NM, Kavanagh MJ, Swanberg SM, et al. Will they lead by example? Assessment of vaccination rates and attitudes to human papilloma virus in millennial medical students. BMC Public Health 2017; 17: 35.
15. Liddon N, Hood J, Wynn BA, Markowitz LE. Acceptability of human papillomavirus vaccine for males: a review of the literature. J Adolesc Health 2010; 46: 113-23.
16. Newman PA, Logie CH, Doukas N, Asakura K. HPV vaccine acceptability among men: a systematic review and meta-analysis. Sex Transm Infect 2013; 89: 568-74.
17. Gualano MR, Olivero E, Voglino G, et al. Knowledge, attitudes and beliefs towards compulsory vaccination: a systematic review. Hum Vaccin Immunother 2019; 15: 918-31.
18. Perkins RB, Pierre-Joseph N, Marquez C, Iloka S, Clark JA. Parents' opinions of mandatory human papillomavirus vaccination: does ethnicity matter? Womens Health Issues. 2010 Nov-Dec;20(6):420-6. doi: 10.1016/j.whi.2010.07.001. PMID: 21051001; PMCID: PMC3032271.
19. Gilkey MB, McRee AL. Provider communication about HPV vaccination: a systematic review. Hum Vaccin Immunother 2016; 12: 1454-68.
20. Gerend MA, Shepherd MA, Lustria ML, Shepherd JE. Predictors of provider recommendation for HPV vaccine among young adult men and women: findings from a cross-sectional survey. Sex Transm Infect 2016; 92: 104-7.
21. Smith PJ, Stokley S, Bednarczyk RA, et al. HPV vaccination coverage of teen girls: the influence of health care providers. Vaccine 2016; 34: 1604-10.