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Women's Knowledge Regarding the Effects of Cigarette Smoking and Human Papillomavirus (HPV) Infection on the Development of Cervical Cancer in Poland

Barbara Kozakiewicz[1,2*], **Ewa Dmoch-Gajzlerska**[1], **Małgorzata Chądzyńska**[3] **and Małgorzata Stefaniak**[1]

[1]*Maria Skłodowska-Curie Institute of Oncology, Warsaw, Poland*

[2]*Gynecological and Obstetrics Department, Medical University of Warsaw, Poland*

[3]*Institute of Psychiatry and Neurology, Warsaw, Poland*

[*]**Corresponding author:** Barbara Kozakiewicz, MD, Maria Skłodowska-Curie Memorial Cancer Center and Institute of Oncology, Wawelska 15 St, 02-034 Warsaw, Poland, Tel: +48 602290198; E-mail: wum@wp.eu

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Abstract

Introduction: Cervical cancer is one of the major causes of death in women worldwide. Women's knowledge regarding the effects of cigarette smoking and human papillomavirus (HPV) infection on the development of cervical cancer as well as the appropriate preventive measures should play a significant part in health education of women.

Aim: The aim of the study conducted in a sample of women from different socio-economic groups was to assess women's knowledge regarding the effects of cigarette smoking and HPV infection on the development of cervical cancer.

Material and methods: In the years 2010-2012, a questionnaire-based survey was conducted in 870 adult and adolescent females aged 14 to 70 years (mean age 37.1) living in Poland in rural areas and towns of different sizes.

Results: In groups with different demographic characteristics, 8% to 89% (mean: 61%) of the respondents were aware of the role of HPV infection in cervical cancer development.

Significantly fewer of the respondents, i.e. 0 to 73% (mean: 14%) knew about the link between nicotine and cervical cancer development. Cigarette smoking was not perceived as a contributing factor by elderly women and pregnant women living in rural areas.

All respondents, irrespective of their place of residence, age and education had been rarely educated by health care professionals (mean: 32%). The most common source of knowledge was the Internet accessed by 20% to 98% of the respondents (mean: 81%).

Conclusion: Knowledge regarding the effects of cigarette smoking and HPV infection significantly differed and depended on the age, education and residence (rural *vs.* urban areas). The Internet as the source of information was especially important in the youngest age group (schoolgirls) who were the only of the study populations not educated by health care professionals.

Keywords: Women's knowledge; Oncology education; Cervical cancer development; Nicotine and HPV as risk factors; Cigarette smoking

Introduction

There has been increased evidence provided by published studies of significant effects on health of tobacco smoke and its toxic ingredients which actively participate in the development of malignant tumours and other chronic diseases. However, so far evaluation of the effects of nicotine on the human body has been mainly based on the epidemiological data regarding the relationship between smoking and lung cancer [1].

The role of HPV in the etiology of cervical cancer was first demonstrated in 1980. Almost three decades later, in 2008, Professor Harald zur Hausen from Heidelberg (Germany) was awarded the Nobel Prize in Physiology or Medicine for describing the role of papillomavirus in oncogenesis.

In 1995, the World Health Organisation (WHO) identified human papillomavirus (HPV) type 16 and 18 as "at least a necessary factor" in the development of cervical cancer. However, the report also found that HPV infection was diagnosed in only 65% of patients with cervical cancer and therefore other factors, in addition to HPV, also appeared to contribute [2-6].

Since the late 1990s, studies on the molecular basis of carcinogenesis have provided evidence strongly supporting the role of both HPV infection and smoking in the development of cervical cancer.

According to a Swedish study conducted in 2006 at Karolinska Institutet in Stockholm, nonsmokers were six times as likely to develop cancer of the cervix if infected with HPV while in HPV-infected smokers the likelihood of developing cervical cancer was increased more than 16 times [7,8].

Toxic components of tobacco smoke produce changes in the DNA of smokers' cells. These changes are due to the potent effects of benzopyrene and other compounds found in cigarette smoke that are responsible for damage to the p. 53 gene, which appears to be the most important of many identified suppressor genes. Its task is to suppress malignant cellular proliferation and the damage leads to its inactivation [9,10].

Comparison of the p.53 gene mutation profiles in smokers and non-smokers with the same malignancies revealed both quantitative and qualitative differences. In smokers, a higher number of mutations was observed persisting up to 10 years after smoking cessation, which confirms that the process of DNA damage is continued in the non-smoking period [11,12]. The K-ras gene is another gene studied for its significant association with development of nicotine-related malignancies [13].

A fairly recent study from deCODE Genetics in Reykjavik, Iceland, published in 2010 confirms the earlier findings, but also identifies other genes whose mutations may affect smokers' health. Mutated genes on chromosome 13 may predispose to smoking habit-formation, mutations on chromosome 9 are responsible for difficulties in smoking cessation while errors on chromosomes 8 and 9 enhance craving for smoking. According to the deCODE Genetics researchers mutations on chromosome 15 are responsible for strong addiction to cigarettes. Additionally, genes encoding nicotine-metabolizing enzymes (CYP2A6 and CYP2B6) and nicotine acetylcholine receptor subunits (CHRNB3 and CHRNB6) may affect smoking behaviour [8,14,15].

The reports on cigarette smoking and its effects may be described as truly dramatic. According to the 1996 data, in the UK, smoking was annually responsible for 121, 000 premature deaths. That mortality rate was 6 times as high as the total mortality from road traffic accidents (3 647), poisoning and overdosage (1 071) and other causes of accidental death (9 974), murder and manslaughter (448), suicide (4 175), and HIV infection (577). The causes of deaths in smokers included malignancies (38%, with ⅔ due to lung cancer), cardiovascular disease (34%), and respiratory disease (28%). The statistics in Poland are similar. In 2000, there were 69 000 deaths attributable to smoking with the most common causes being cancer (39%, of which lung cancer accounted for 66%), cardiovascular disease (38%) and respiratory disease [16,17].

Material and Methods

The study was based on the results of a questionnaire-based survey conducted by students of the Medical University of Warsaw (MUW) in the years 2010-2012. A total of 870 subjects participated in the survey: 110 students of junior high schools and high schools in Warsaw aged 14 to 17 years, 90 MUW students and 670 vocationally active women aged 25 to 70 years (mean age: 45 years). The survey was carried out in Mazovia (east-central Poland) and included 208 (24%) respondents living in rural areas, 187 (21%) inhabitants of small towns (population ≤ 30 000) and 475 (55%) inhabitants of big cities [18-24]. The study questionnaire was anonymous and comprised of 25 closed questions with a cafeteria-style checklist and 2 multiple-choice questions.

The Pearson's chi-squared test for dependent variables using contingency tables and the Wilcoxon signed-rank test for dependent samples were employed in the statistical analysis.

The demographic characteristics of the study group are presented in Table 1.

Place of residence	**Study group size**	**Respondent's age (years)**	**Education (%)**		
	N	**Range**	**Vocational**	**Secondary**	**Higher**
Students					
Junior high school (Warsaw)	40	14-16			
High school (Warsaw)	70	15-17			
Students (Medical University of Warsaw)	90	21-29			
Results - subdivisions of the study group by place of residence and education					
Rural areas	208	21-59	32	35	33
Small towns	187	18-60	30	39	31
Big cities	475	14-70	28	46	26

Table 1: The demographic characteristics of the study group.

Results

The respondents were asked whether cigarette smoking and HPV infection may contribute to the development of cervical cancer. The percentage of 'yes' answers, confirming the respondents' awareness of the effects of these harmful factors on the development of cervical cancer is presented in Table 2.

	Respondents' age (years)	**N**	**Smoking (%)**	**HPV infection (%)**
1.	14-16	40	15	55
2.	21-20	80	12	50
3.	21-29	328	24	85
4	30-50	265	6	57
5	51-60	61	16	49
6	≥60	96	0	8
	Total	870	14% (N = 122)	61% (N = 530)

Table 2: The percentage of women in particular age groups recognizing cigarette smoking and HPV infection as factors contributing to the development of cervical cancer.

The respondents' knowledge of the link between cigarette smoking and cancer of the cervix was related to their age (Pearson's chi-square=59.383; df=5; pv<0.001). On average, 14% of the respondents linked smoking to the development of cervical cancer. This association was mostly described by women aged 21–29 years (24%), but it should be noted that students of the Medical University of Warsaw accounted for 73% of this age group. The lowest level of knowledge concerning the link between cigarette smoking and cervical cancer was found in elderly women as none of the respondents aged over 60 indicated smoking as a risk factor. Small proportions of women in the other age groups (6% to 16%) recognized smoking as an important contributory factor.

Of all 870 women, the majority (61%) knew that HPV infection may contribute to the development of cervical cancer. The level of knowledge varied depending on the age group (Pearson's chi-square=204.041; df=5; pv<0.001). Most of the women aged 21 – 29 years (85%) knew that HPV infection was a risk factor for cervical cancer while in the other age groups (with exception of the elderly) approximately half of the respondents (range 49%-57%) were aware of the link. Interestingly, only 8% of the elderly women (age ≥ 60) knew about this risk.

A number of special subgroups were distinguished in the study population (students, women who were already pregnant or planning to become pregnant, cancer patients and other vocationally active women presenting for cervical screening tests) to assess their knowledge concerning the risk factors in question. Table 3 shows the percentage of women with knowledge of the risk factors for cervical cancer, depending on the additional circumstances listed above.

	N	Smoking (%)	HPV infection (%)	Wilcoxon signed-rank test*	
Study group				**Z**	**pv**
Students (junior high school)	40	15	55	-4.000	0.,000
Students (high school)	70	16	60	-5.568	0.,000
Students (Medical University of Warsaw)	90	73	89	-3.742	0.000
Pregnant women (rural areas)	127	0	52	-7.810	0.000
Planning to become pregnant	165	4	nda**		
Cancer patients	70	19	86	-6.856	0.000
Other adult women	308	5	47	-10.954	0.000
Total	870	14	61	-15.100	0.000

*Wilcoxon signed-rank test was used to compare the distribution of knowledge concerning the effects of cigarette smoking and HPV infection

**nda - no data available

Table 3: Percentage of women with knowledge of the risk factors for cervical cancer, depending on additional circumstances.

In all subgroups surveyed, knowledge concerning the effect of HPV infection on the development of cervical cancer was more common (the respondents were aware of that more often) than knowledge of the link with cigarette smoking (Table 3).

The respondents' knowledge concerning the effect of cigarette smoking on the development of cervical cancer was related to the additional circumstances listed above (Pearson's chi-square=324.3260; df=6; pv<0.001). It was most common in students at the Medical University of Warsaw (73%) and inadequate in the remaining subgroups. Only 19% of women treated for cancer were aware of the link between cigarette smoking and cervical cancer while pregnant women were totally ignorant of the association.

Also, knowledge concerning the effect of HPV infection on the development of cervical cancer was related to the additional circumstances (Pearson's chi-square=73.907; df=5; pv<0.001). Over 85% of students at the Medical University of Warsaw and cancer patients knew that HPV infection was a risk factor for cervical cancer with fewer (47% to 60%) of other respondents aware of the association.

Table 4 shows the distribution of knowledge concerning the risk factors for cervical cancer, depending on the respondents' level of education.

Education	N	Smoking (%)	HPV infection (%)
Primary and vocational	256	12	32
Secondary	364	14	51
Higher	250	16	79

Table 4: Percentage of women recognizing cigarette smoking and HPV infection as the risk factors for cervical cancer, depending on the respondent's level of education.

Knowledge of the effect of cigarette smoking on the development of cervical cancer was not related to the respondents' level of education (Pearson's chi-square=1.588; df=2 pv<0.452) while knowledge about the effect of HPV infection was (Pearson's chi-square=114.666; df=2; pv<0.001), with higher levels of education being associated with better knowledge about HPV infection as a risk factor for cervical cancer.

This knowledge was also assessed in relation to the place of residence and the results are shown in Table 5.

Place of residence	N	Smoking (%)	HPV infection (%)
Rural areas	208	6	77
Town (≤30,000)	187	11	64
Cities (>55 000)	475	19	52
Total	870	14% (N=122)	61% (N=530)

Table 5: Percentage of women recognizing smoking and HPV infection as the risk factors for cervical cancer, depending on the respondents' place of residence.

Knowledge of the effect of cigarette smoking on the development of cervical cancer was related to the respondents' place of residence (Pearson's chi-square=23.024; df=2 pv<0.001): 19%, 11% and 6% of women living in big cities, small towns and rural areas respectively. Association was also found between the place of residence and knowledge concerning the effect of HPV infection (Pearson's chi-square=36.911; df=2; pv<0.001). Interestingly, however, the tendency was reverse as the best knowledge of the effects of HPV infection was shown by women living in rural areas (77% vs. 64% of women from small towns and 52% of women from big cities).

The survey also found by means of multiple-choice questions the sources of knowledge concerning the causes of cervical cancer and then assessed them by place of residence and education as well as in pregnant women and cancer patients (Table 6).

Study subgroup		Internet	Health-care professionals	Books/ educational leaflets	TV/ radio	Friends/ family
	N	(%)	(%)	(%)	(%)	(%)
Students (junior high school)	40	93	0	2	5	0
Students (high school)	70	98	0	1	1	0
Students (Medical University of Warsaw)	90	20	36	25	0	0
Rural areas	208	50	28	5	73	30
Small towns	187	89	4	12	6	17
Big cities	475	45	30	33	20	19
Pregnant women (rural areas)	117	55	38	5	73	34
Women who are pregnant or planning to become pregnant (small towns and big cities)	165	71	8	43	3	1
Cancer patients	70	22	29	0	30	26

Table 6: Sources of knowledge concerning the effects of cigarette smoking and HPV infection on the development of cervical cancer.

The sources of knowledge for Medical University of Warsaw students included mostly health care professionals (36%), books (25%) and the Internet (20%). Junior high and high school students predominantly relied on the Internet for information on health issues (93-98%) with the other sources used only occasionally, including books, television and radio in single cases. Use of particular sources of information about the risk factors is related to such additional circumstances as pregnancy, actual or planned, or being treated for cancer (Pearson's chi-square=236.206; df=8; pv<0.001). Of all respondents, pregnant women living in rural areas were informed about the causes of cervical cancer mostly by health care professionals (38%). The other common sources of information included radio programmes (73%) and talking to relatives and friends (34%). For town and city-dwellers, pregnant or planning to become pregnant, the Internet and books were the most frequently used sources of information, 71% and 43% respectively.

Cancer patients relied on the Internet, TV/radio, health care professionals and friends family for information in almost equal proportions (22%-29%). The choice of the source depends on the place of residence (Pearson's chi-square=254.786; df=8; pv<0.001). Women in rural areas derived their knowledge from TV/radio (73%) and the Internet (50%), followed by health care professionals (28%) and family members (30%). City dwellers used all sources of information listed above, with the predominance of the Internet (45%) *vs.* 19-33% using the other sources.

The Internet proved to be the most popular source of information on the health issues in question as it was used by 81% of the respondents on average. Surprisingly, health care professionals proved to be fairly infrequently involved in health education as only one woman in three learned from them about the risk factors for cervical cancer.

In the study group of 870 women which differed in place of residence, education and age, 20% only (174) recognized that the two factors, smoking and HPV infection, may contribute to the development of cervical cancer. Both factors were listed by a relatively small proportion of respondents, i.e. 23% of high school students, 46% of medical university students, 20% of cancer patients and 11% of respondents living in big cities.

Discussion

In Poland, cancer of the cervix is the most common gynaecologic cancer and the second most common cancer in women. Awareness of the factors which are known to contribute to its development is very important in its prevention, especially as these two contributory factors, cigarette smoking and HPV infection, may be excluded by preventing HPV infection and refraining from smoking, which may be achieved without additional financial burden to individual women and the national health service. That is why girls and women should be informed about bad health habits especially by health care professionals.

The survey showed that cigarette smoking was not perceived as an important risk factor for the development of cervical cancer as only 14% of the respondents was aware of its role. Not a single pregnant woman living in a rural area realized that there was a potential link between smoking and the development of cervical cancer. Also, elderly women did not have this knowledge. The survey was conducted in both smokers and non-smokers and for this reason low awareness of

the contributory effect of smoking in cervical cancer cannot be attributed to such psychological mechanisms as denial or minimizing losses due to the nicotine addiction [25].

The link between cigarette smoking and the development of cervical cancer has been known to specialists for many years. Cervical Pap tests have identified conditions predisposing to the development of cervical cancer more frequently in smokers [26,27]. Cervical smears from smokers diagnosed severe cervical dysplasia (CIN 3-grade 3 cervical intraepithelial neoplasia]) three times more often than in nonsmokers [7,26]. High levels of cotinine, a metabolite of nicotine, which is a co-factor in human papilloma carcinogenesis, were found in the cervical mucus and the vagina of smokers, including pregnant smokers [28,29].

The studies by Ulman-Wlodarz on the knowledge concerning the prevention of HPV infection among Polish women attending gynaecological clinics demonstrated inadequate knowledge in this area [30,31]. The report from the Polish Centre for Public Opinion Research based on a survey conducted in 2002 yielded similar results. Similarly to our study, carried out eight years later, it demonstrated poor awareness among women of cervical cancer prevention and low activity of health care professionals in this respect [32].

It is important for women to know that passive smoking, i.e. the inhalation of second-hand smoke, is as harmful as active smoking while nicotine is responsible for the development of not only lung cancer, but also other malignancies, including cervical cancer [33,34].

The present study demonstrated that while most of the respondents (61%) knew about the harmful effects of HPV infection, almost 40% remained ignorant of the link between HPV and cervical cancer. The knowledge of HPV infection improves with the level of education and is inversely proportional to age as only 8% of the elderly respondents realized its dangers. Most Medical University students (89%) and cancer patients (86%) knew about the role of HPV infection but only about one in three women (36% and 29% respectively) was educated by health care professionals despite obviously more frequent contacts with physicians and nurses.

The 'booster' effect of smoking on the already present HPV infection contributing to the development of cancer was known to 46% of the students, 20% of cancer patients and 23% of high school students. The impact of smoking on cervical cancer is the subject of a growing number of studies [35,36].

The study showed that women derive their knowledge of factors contributing to cervical cancer development from a variety of sources. Medical health professionals do not adequately inform women about cigarette smoking and HPV infection as two important risk factors as on average only 32% (range 0%-38%) of the respondents got the relevant information from medical health professionals. There are virtually no professional health education efforts aimed at junior high school students who increasingly more often become sexually active at younger age and obviously should be informed about sex-related risks to health. Nowadays, the Internet is a major 'educator' of young people and not only them as it is very frequently accessed for health information by all age groups and populations. In the present study it was an especially important source of knowledge for junior high and high school students and inhabitants of small towns. It must be noted, however, that the reliability of the information varies. Women get information from books and educational leaflets or radio and television as often as from health care professionals while a direct person-to-person communication is known to have a much more powerful effect.

The findings indicate the need for tackling the preventable, i.e. for a much more active involvement of health care professionals such as doctors, nurses and midwives in providing health education, including cancer prevention, especially to young women. When aware of the risk factors, in many cases they may be able to avoid them and thus reduce their chances of developing the disease which requires complex, long and gruelling treatment, and may lead to infertility or even death [37,38].

Conclusions

Both vocationally active women and female students have considerable knowledge concerning the effect of human papillomavirus on the development of cervical cancer.

Cigarette smoking, in the opinion of most of the respondents, has no effect on the development of cervical cancer.

Women's knowledge concerning the risk factors for cervical cancer comes mostly from the Internet, but not from health care professionals.

Women are not aware that HPV-infected smokers are more likely to develop cervical cancer.

Health care professionals should become more actively involved in health education, especially of junior high school students and in providing comprehensive information about the causes of cervical cancer.

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