

REVIEW

Should men be exempted from vaccination against human papillomavirus? Health disparities regarding HPV: the example of sexual minorities in Poland

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Keywords

HPV • LGBTQ+ • Health disparities • HPV vaccines • Underserved populations

Summary

Introduction. Social campaigns concerning vaccinations against human papillomavirus (HPV) in Poland are mainly addressed to women. In addition to cervical cancer, anal, penile, and oropharyngeal cancers can be caused by the virus, which clearly affects men as well. HPV vaccinations are voluntary and mostly not refunded in Poland.

Methods. A survey was published on social media's group gathering males and contained questions concerning epidemiological data, knowledge about HPV, and opinions of HPV vaccination. A questionnaire was enriched with educational note regarding HPV-dependent cancers and available vaccines against HPV in Poland.

Results. Because of age limitations, 169 males (115 heterosexuals, 48 homosexuals) aged 14-39 were chosen for the study. Sev-

entyfive percent of straight and 88% of gay men were aware of HPV, but less than 4 and 17% (respectively) were vaccinated against the virus. Main sources of knowledge about HPV were the Internet (61%), media (28%) and relatives (27%). HPV infection was linked with the development of anal and oropharyngeal cancers by 28, and 37% of heterosexual males, compared with 56.3 and 43.8% of homosexual males. The majority of respondents (88%) indicated that all genders should be vaccinated, although only 57% were aware of HPV vaccination availability in Poland.

Conclusions. The men are at risk of HPV-related cancers and the danger is poorly understood amongst Polish men. Despite awareness of HPV vaccines, the vaccination rate is low. Consequently, there is a serious need to broaden educational campaigns with a special attention to LGBTQ+ communities.

Introduction

The incidence of sexually transmitted infections (STIs) in Poland is increasing, with human papillomavirus (HPV) the most common cause [1, 2]. HPV is a dsDNA virus, comprising more than 170 distinguishable types [3]. Almost every sexually active person is exposed to HPV during their lifetime and both women and men are at risk of infection. Approximately 90% of HPV infections are asymptomatic and resolve spontaneously [4]. However, in some cases infection results in palmar/plantar warts, laryngeal papillomatosis, precancerous lesions, and increased risk of developing cancer [2]. More than 99% of cervical cancer is associated with HPV infection (70% caused by HPV 16 and 18), constituting the sixth most common malignant neoplasm of reproductive organs among women and the seventh highest cause of cancer related death in Poland [3, 5]. Moreover, 70% of oropharyngeal, 63% of penile, and 91% of anal cancers are associated with HPV infection [5-7]. In some minority groups, such as gay men, the risk of HPV-dependent cancers is higher [8].

HPV can be transmitted through sexual intercourse, direct skin-to-skin contact, via contaminated surfaces, as well as during labour and the perinatal period (vertically) [2, 9].

The role of blood transfusions in the process of transmission remains uncertain [10]. Early sexual activity, multiple sexual partners or impaired immune function (e.g. immunosuppression) are the leading risk factors for HPV infection [4]. The Centres for Disease Control and Prevention (CDC) recommends mutually monogamous sexual relationships, barrier contraceptives, and vaccines as preventive measures [4, 11, 12]. The World Health Organization (WHO) states that vaccination against HPV is most effective prior to the onset of sexual activity [13]. In Poland HPV vaccinations are targeted at children aged 11-12, are voluntary and mostly not refunded [14]. Whilst the risk of developing HPV-dependant cancer applies to both men and women, social campaigns regarding vaccination against papillomavirus in Poland are aimed mainly at women.

Due to a lack of sexual education in Polish schools, knowledge about STIs is usually obtained from the Internet, media, and social campaigns [15]. An absence of educational programs considering the health needs of LGBTQ+ communities in medical school curricula affects sexual minorities and results in health disparities [16, 17]. Studies regarding knowledge about HPV and vaccination rate among males in Poland are limited and to the best of our knowledge, there are no studies referring to sexual minorities in Poland.

Therefore, we set out to explore the knowledge of Polish men about HPV infection and HPV-related cancers, and to identify any inequalities between heterosexual and homosexual men.

Methods

Institutional Review Board (IRB) approval was obtained from the Wrocław Medical University. A survey comprising open-ended, close-ended, and nominal, multiple-choice questions with predefined answers was prepared in Google™ Form. For nominal questions an additional, optional space was provided for respondents to implement answers not included by authors. A non-probabilistic method of self-selection sampling was used for this study. Participation invitations were posted at selected groups on social media platforms such as Facebook™, Reddit™, and Wykop™.

Target groups were found with the combinations of search terms: 'men', 'boy', 'lad', 'Poland', 'polish', 'lgbt', 'lgbtqia', and 'lgbt+'. The inclusion criteria for group consisted of polish language, number of group's male members above 25, number of posts above 20 while exclusion criteria included presence of homophobic content or hate speech and last post older than 2 weeks. Finally, survey was published on 32 groups.

The questionnaire consisted of 20 questions divided into three parts. The first one concerned epidemiological profile of respondents: age, place of residence (metropolitan, non-metropolitan, rural), educational status (primary, secondary, professional, higher), medical education (medical/non-medical), and sexual orientation (straight, gay, other or I prefer not to say). The second part tested their knowledge about human papillomavirus, HPV-related diseases with distant implications of infection, possible routes of transmission, and prevention methods. The last part referred to vaccines as a protective tool against infection and opinions about HPV vaccines in Poland. Respondents were also asked to declare their vaccination status. At the end of the survey, the information note was projected on respondent's screen with basic information about HPV related cancers and available vaccines in Poland. Moreover, a link to the educational page of the National Institute of Public Health concerning vaccinations against HPV was provided.

Chi-square (χ^2) independence test with Yates correction when necessary and Fisher exact test were used to assess the relationship between the studied variables in the nominal and ordinal scales. Shapiro-Wilk test was used to assess the normality of variable distribution. Mann-Whitney test was used to assess differences between heterosexual and homosexual males. Statistical analysis was performed using Statistica™ v.13.5 (StatSoft™).

Results

Six hundred seventy-one men were asked to participate in the study, 247 responded. Fifty-three participants

were excluded due to incorrectly completed survey. In order to keep age distribution normal, age limit was established and outliers (25 respondents) were removed. Finally, 169 males (aged 14-39) were chosen for the study. The mean age of respondents is 22.7 (+/- 5 years). Most respondents were straight (68.05%), lived in large cities (35.50%), were educated to a secondary school level (53.85), were not medically trained (74.65%), and were not vaccinated against HPV (92.09%) (Tab. I).

The majority (78.7%) of participants were aware (e.g. had heard of the virus) of HPV. Sexually active males were more aware than those who were not sexually active (75.18 vs 24.82%, $p < 0.05$). Unsurprisingly, all participants with a medical education were aware of HPV. Participants living in cities with more than 100,000 habitants were more aware of HPV than those living in areas with less than 100,000 habitants (85.7 vs 69%, $p < 0.05$). However, population density is not correlated with greater general knowledge about the virus ($p > 0.05$).

Whereas, place of residence influences on whether the concept of the virus is known, the percent of correct answers does not vary significantly between respondents from cities above 100,000 habitants and respondents from towns with less than 100,000 habitants and villages. The mean result in the first group is 61.6% of correct answers and 56.2% in second group ($p > 0.05$). The educational level is not associated with better outcomes either. The mean result of men with higher education level constitutes 61.7% of correct answers in comparison with men without higher education whose mean result is 58% ($p > 0.05$).

Respondents reported that information about HPV was obtained most often from the Internet (60.94%), broadcast media (28.4%), and literature [newspapers, magazines, popular science books, and school manuals (24.26%)]. Other sources of knowledge included family/friends (23.67%), social campaigns (22.49%), physicians (21.89%), universities (8.18%), and schools (5.33%). Statistically better results (defined as more than 50% of correct answers) was observed in respondents whose reported the Internet, media, family/friends, physicians, literature, and universities as their sources of information about HPV ($p < 0.05$).

Two-thirds of participants (62.72%) identified HPV infection as being associated with cervical cancer and 36.69% associated HPV with anal cancer. Vaginal and vulvar cancers were also considered a HPV-related diseases by 49.7% of participants, as was oropharyngeal cancer (38.46%), and plantar, and genital warts (43.2%). Most participants (81.07%) identified both sex intercourse, 42.6% identified labour and the perinatal period, 31.36% indicated skin-to-skin contacts, and 26.63% indicated contaminated surfaces. Two-thirds (62.13%) pointed out infected human blood and 14.79% considered droplets as a route of transmission. A small proportion thought that HPV can spread through contaminated food (9.74%) and insect bites (8.28%).

Participants considered vaccination (81.66%), avoidance of sexual encounters (65.09%), and use of condoms (62.72%)

Tab. I. Characteristic of the study group.

Variable		Heterosexual males	Homosexual males	Total
Median age- yr.		22.5	23.1	22.7
Place of living – no. of citizens (%)	City > 500.000	39 (33.91%)	19 (39.58%)	60 (35.50%)
	City < 500.000	25 (21.74%)	11 (22.92%)	38 (22.49%)
	City < 100.000	20 (17.39%)	10 (20.83%)	32 (18.93%)
	City < 10.000	4 (3.48%)	4 (8.33%)	8 (4.73%)
	Village	27 (23.48%)	4 (8.33%)	31 (18.34%)
Education level - no. (%)	Primary	9 (7.83)	8 (16.67%)	19 (11.24%)
	Secondary	68 (59.13%)	21 (43.75%)	91 (53.85%)
	Higher	35 (30.43%)	16 (33.33%)	53 (31.36%)
	Professional	3 (2.61%)	3 (6.25%)	6 (3.55%)
Medical education – no. (%)		33(28.70%)	9 (18.75%)	43 (25.44%)
Vaccinated individual against HPV – no. (%)		4 (3.48%)	8 (16.67%)	12 (7.10%)

Tab. II. HPV-related diseases in opinion of respondents.

Variable		Heterosexual males	Homosexual males	P-value
Diseases - no. of respondents (%)	Cervical cancer	70 (60.87%)	32 (66.67%)	0.49
	Anal cancer	32 (27.83%)	27 (56.25%)	< 0.001
	Testicular cancer	28 (24.35%)	16 (33.33%)	0.93
	Vaginal and vulvar cancers	55 (47.83%)	26 (54.17%)	0.46
	Breast cancer	8 (6.96%)	5 (10.42%)	0.37
	Colon cancer	12 (10.43%)	10 (20.83%)	0.77
	Oropharyngeal cancer	42 (36.52%)	21 (43.75%)	0.39
	Pancreatic cancer	5 (4.35%)	4 (8.33%)	0.45
	Lung cancer	4 (3.48%)	2 (4.17%)	0.97
	Plantar and palmar warts	50 (43.48%)	22 (45.83%)	0.78

as protective measure against HPV infection. Almost half (46.75%) indicated risk of HPV infection can be minimized by mutually monogamous relationships, while 44.37% indicated sexual abstinence. A healthy lifestyle (17.75%), the use of lubricant, and spermicides (42.6%), avoidance of crowded places (11.83%), prophylactic use of antibiotics/antiretroviral therapy (6.51%), elimination of contaminated food/water (5.36%), and use of repellents/insecticides (3.55%) were all proposed as means through which risk of HPV infection could be minimised.

The vast majority of respondents (88.17%) know that both sexes should be vaccinated and 84.02% believe that vaccination should be compulsory in Poland. Conversely, 5.33% opposed mandatory immunization. More than half were aware of vaccine availability in Poland (56.80%), although 67.46% do not know whether vaccination is refunded. Most participants (73.37%) correctly identified that vaccination should occur before the commencement of sexual activity. Less than one-in-ten (7.1%) of participants were vaccinated against HPV. There are no statistically significant differences in vaccination rate between groups declaring medical education and non-medical education (9.30% versus 6.35%). Similarly, no links were demonstrated between residence and education level and uptake of vaccination among participants.

No significant difference existed with regards to awareness of HPV between straight and gay participants (75.65 vs 87.5%). Homosexual participants indicated

HPV infections increased the risk of anal cancer more frequently than heterosexual participants (43.75 vs 27.83%, $p < 0.05$). (Tab. II). Gay people were more frequently vaccinated against HPV than straight ones (16.67 vs 3.48%, $p < 0.05$).

Discussion

There are currently three vaccines available against HPV – bivalent, quadrivalent and nonavalent. Countries with national programs of vaccination (at least 10 years long) have noted a 90% reduction in HPV 6, 11, 16, 18 infections, 90% depletion in genital warts and 85% decrease in high grade squamous intraepithelial lesion (HSIL) of the uterine cervix [18]. A combined analysis of vaccination with bivalent vaccine unveiled that the vaccine was effective at preventing oral, anal, and cervical infections in the cohort of HPV naive women in 83.5% [19]. Data of vaccination effectiveness in occurrence of anal, penile, and oropharyngeal cancers is limited due to their low prevalence [20]. However, evidence is emerging that vaccination for males is warranted. In a study evaluating efficiency of quadrivalent HPV vaccine in men and boys, there was an overall 85.6% reduction in persistent infection of HPV 6, 11, 16, and 18, constituting preventive measure against anogenital cancer, intraepithelial neoplasia, recurrent respiratory papillomatosis and cancer of oropharynx [21].

Most programs target girls exclusively, with only a handful of countries (e.g. Australia, Austria, Canada) vaccinating both sexes [22]. A systematic review and meta-analysis of predictions from transmission-dynamic models funded by Canadian Institutes of Health Research suggest that elimination of HPV 6, 11, 16, and 18 is possible when 80% coverage in girls and boys is reached and a high vaccine efficacy is maintained over time [22]. In 2007, Australia introduced a national HPV vaccination program, which was broadened in 2013 by vaccination of both sexes. In 2017 Australia achieved vaccination levels of 80.2% in girls and 75.9% in boys at the age of 15. It is estimated that the age-standardised annual incidence of cervical cancer will decrease to less than 4 new cases per 100,000 women by 2028 [23]. There are no specific analyses concerning the coverage vaccination level against HPV in Poland. According to estimates of Major Statistical Department, the vaccination level in Poland fluctuates around 7.5-10% [24]. However, it is estimated that vaccination for boys is much lower. In Poland, the vaccine is not mandatory, but recommended by the Ministry of Health [14]. The total cost of vaccination (regardless of type) for one child in Poland is 246 USD [25]. In 2018 the average expenditure per capita in Polish household was 286,65 USD [26]. Consequently, the cost of vaccination in Poland for one person is almost the equivalent of one month's maintenance. Currently in Poland, numerous reimbursement programs for vaccination are being implemented by local governments and are located in the southern/western parts of the country. Only 12 municipalities organize vaccinations for girls and boys [27]. This situation varies from year to year, depending on how the funds are allocated. This is likely to account for the variability in responses in regarding vaccinations reimbursement among the participants. Current WHO recommendations target primary HPV vaccination to the population of girls aged 9-14, prior to becoming sexually active, with at least 2-dose schedule. WHO suggests that achieving >80% vaccination coverage in girls also reduces the risk of HPV infection for boys due to herd protection. Vaccination regardless of gender and age should be considered with other elements, such as competing health priorities, disease burden, programmatic implications, cost-effectiveness, and affordability [28]. The Advisory Committee on Immunization Practices (ACIP) endorses vaccination of all boys and girls under age of 11 or 12 [12]. Catch-up vaccines are recommended for males through age 21 and 26 for females. Furthermore, the CDC advocates vaccination for homosexual men and for both men and women with compromised immune systems, by the age of 26 if they were not fully vaccinated previously [12]. Thus, the need for vaccination among boys and adult men, especially those from higher risk groups cannot be omitted [29].

LIMITATIONS

As the self-selection sampling option was chosen for, there is no random sample. Consequently, the study group may not be representative of the entire

population. Taking under consideration the low number of participants (169 males), the study group should be extended in further research. Any identification verification tool was used in the study, thus one person can submit multiple responses. What is more, the fact that gay men could identify themselves as straight in the survey cannot be forgotten.

Conclusions

The men are at risk of HPV-related cancers and the danger is poorly understood amongst Polish men. Whilst the WHO suggests that vaccination rates of 80% of girls will protect men through herd immunity, gay men remain at risk. As such, HPV vaccination programs need to be extended to include boys and made more affordable to increase uptake for both sexes.

Our study has demonstrated that knowledge about HPV is no correlated with place of residence and level of education. Educational campaigns have demonstrated minimal effectiveness, suggesting that funds should be transferred to improving their influence or expanding training programs within schools and universities. Further, surcharging of HPV vaccines should be introduced. The introduction of compulsory, refunded vaccines is likely the most effective means through which to increase the percentage of vaccinated people, thus decreasing the number of HPV-related cancers in Poland.

Few respondents indicated doctors as a potential source of information about HPV. This situation requires greater engagement of physicians in programs referring to education and prophylaxis. We urge medical schools to broaden the knowledge of Polish medical students and healthcare professionals about health needs of LGBTQ+ communities, preventing from health disparities in the future.

Availability of data and material

The data reported in this manuscript have not been previously published and/or were not collected as part of a larger data collection (at one or more points in time). Findings from the data collection have not been reported in separate manuscripts. All data and materials support published claims and comply with field standards.

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Conflict of interest statement

The authors declare no conflict of interest.

Authors' contributions

All authors contributed to the study conception and design. All authors read and approved the final manuscript. Sentence should be ended with one dot. Material preparation was performed by Konrad Reszka, data collection and analysis were performed by Agata Remiorz, Agata Walas, Łukasz Moskal and Konrad Reszka. The first draft of the manuscript was written by Konrad Reszka, Łukasz Moskal, Agata Remiorz and Agata Walas and all authors commented on previous versions of the manuscript. Drs Urszula Staszek-Szewczyk and Krzysztof Szewczyk critically revised the manuscript and supervised writing process.

References

- [1] Teter Z, Majkut G, Wierzbica W, Śliwczynski A, Brzozowska M, Jacyna A, Marczak M, Myśliwiec M. Syphilis in Poland is on the rise and underreported. *Postepy Dermatol Alergol* 2019;36:192-5. <https://doi.org/10.5114/ada.2019.84595>
- [2] Millner DA. Diagnostic pathology: infectious diseases. *Viral infections*, 40. Philadelphia: Elsevier 2015.
- [3] Alexander KA, Giuliano AR. HPV-beyond cervical cancer (online resource center). *Am J Med* 2012;125:S1. <https://doi.org/10.1016/j.amjmed.2012.03.005>
- [4] Wang CJ, Palefsky JM. Human Papillomavirus (HPV) infections and the importance of HPV vaccination. *Curr Epidemiol Rep* 2015;2:101-9. <https://doi.org/10.1007/s40471-015-0039-3>
- [5] Didkowska J, Wojciechowska U. Zachorowania i zgony na nowotwory złośliwe w Polsce. Krajowy Rejestr Nowotworów, Narodowy Instytut Onkologii im. Marii Skłodowskiej-Curie – Państwowy Instytut Badawczy. Available at: <http://onkologia.org.pl/k/epidemiologia> (accessed on 06/06/2020).
- [6] International Agency for Research on Cancer. Human papillomaviruses. In: IARC monographs on the evaluation of carcinogenic risks to humans, volume 90. Lyon, France: IARC 2007.
- [7] Saraiya M, Unger ER, Thompson TD, Lynch CF, Hernandez BY, Lyu CW, Steinau M, Watson M, Wilkinson EJ, Hopenhayn C, Copeland G, Cozen W, Peters ES, Huang Y, Saber MS, Altekruse S, Goodman MT; HPV Typing of Cancers Workgroup. US assessment of HPV types in cancers: implications for current and 9-valent HPV vaccines. *J Natl Cancer Inst* 2015;107:djv086. <https://doi.org/10.1093/jnci/djv086>
- [8] Glick SN, Feng Q, Popov V, Koutsky LA, Golden MR. High rates of incident and prevalent anal human papillomavirus infection among young men who have sex with men. *J Infect Dis* 2014;209:369-76. <https://doi.org/10.1093/infdis/jit441>
- [9] Lee SM, Park JS, Norwitz ER, Koo JN, Oh IH, Park JW, Kim SM, Kim YH, Park CW, Song YS. Risk of vertical transmission of human papillomavirus throughout pregnancy: a prospective study. *PLoS One* 2013;8:e66368. <https://doi.org/10.1371/journal.pone.0066368>
- [10] Bodaghi S, Wood LV, Roby G, Ryder C, Steinberg SM, Zheng ZM. Could human papillomaviruses be spread through blood? *J Clin Microbiol* 2005;43:5428-34. <https://doi.org/10.1128/JCM.43.11.5428-5434.2005>
- [11] Centers for Disease Control and Prevention. 2017. Genital HPV Infection - Fact Sheet. Available at: <https://www.cdc.gov/std/hpv/HPV-FS-print.pdf> (accessed on 06/06/2020).
- [12] Meites E, Szilagyi PG, Chesson HW, Unger ER, Romero JR, Markowitz LE. Human Papillomavirus vaccination for adults: updated recommendations of the Advisory Committee on Immunization Practices. *MMWR Morb Mortal Wkly Rep* 2019;68:698-702. <https://doi.org/10.15585/mmwr.mm6832a3>
- [13] World Health Organization. Electronic address: sageexecsec@who.int. Human papillomavirus vaccines: WHO position paper, May 2017-Recommendations. *Vaccine* 2017;35:5753-5. <https://doi.org/10.1016/j.vaccine.2017.05.069>
- [14] Dziennik Urzędowy Ministra Zdrowia. Poz. 104. Komunikat Głównego Inspektora Sanitarnego w sprawie Programu Szczepień ochronnych na rok 2019. Warszawa dnia 25 października 2018. Available at: <https://gis.gov.pl/wp-content/uploads/2018/01/akt.pdf> (accessed on 07/06/2020).
- [15] Olejniczak D, Wodzyńska K, Religioni U. The high school graduates knowledge of sexually transmitted diseases. *Nursing Problems / Problemy Pielęgniarstwa* 2012;20:317-26.
- [16] Ministerstwo Edukacji Narodowej. Podstawa programowa kształcenia ogólnego z komentarzem. Szkoła podstawowa. Wychowanie do życia w rodzinie. Available at: <https://www.ore.edu.pl/wp-content/uploads/2017/05/wychowanie-do-zycia-w-rodzinie.-pp-z-komentarzem.-szkola-podstawowa-1.pdf> (accessed on 07/06/2020).
- [17] Ministerstwo Edukacji Narodowej. Podstawa programowa kształcenia ogólnego z komentarzem Szkoła ponadpodstawowa: liceum ogólnokształcące, technikum oraz branżowa szkoła I stopnia. Available at: <https://www.ore.edu.pl/wp-content/plugins/download-attachments/includes/download.php?id=23142> (accessed on 07/06/2020).
- [18] Palmer T, Wallace L, Pollock KG, Cuschieri K, Robertson C, Kavanagh K, Cruickshank M. Prevalence of cervical disease at age 20 after immunisation with bivalent HPV vaccine at age 12-13 in Scotland: retrospective population study. *BMJ* 2019;365:l1161. <https://doi.org/10.1136/bmj.l1161>
- [19] Beachler DC, Kreimer AR, Schiffman M, Herrero R, Wacholder S, Rodriguez AC, Lowy DR, Porras C, Schiller JT, Quint W, Jimenez S, Safaeian M, Struijk L, Schussler J, Hildesheim A, Gonzalez P; Costa Rica HPV Vaccine Trial (CVT) Group. Multisite HPV16/18 Vaccine Efficacy Against Cervical, Anal, and Oral HPV Infection. *J Natl Cancer Inst* 2015;108:djv302. <https://doi.org/10.1093/jnci/djv302>
- [20] St Laurent J, Luckett R, Feldman S. HPV vaccination and the effects on rates of HPV-related cancers. *Curr Probl Cancer* 2018;42:493-506. <https://doi.org/10.1016/j.currprobcancer.2018.06.004>
- [21] Giuliano AR, Palefsky JM, Goldstone S, Moreira ED Jr, Penny ME, Aranda C, Vardas E, Moi H, Jessen H, Hillman R, Chang YH, Ferris D, Rouleau D, Bryan J, Marshall JB, Vuocolo S, Barr E, Radley D, Haupt RM, Guris D. Efficacy of quadrivalent HPV vaccine against HPV infection and disease in males. *N Engl J Med* 2011;364:401-11. <https://doi.org/10.1056/NEJMoa0909537>. Erratum in: *N Engl J Med* 2011;364:1481.
- [22] Drolet M, Bénard É, Boily MC, Ali H, Baandrup L, Bauer H, Beddows S, Brisson J, Brotherton JM, Cummings T, Donovan B, Fairley CK, Flagg EW, Johnson AM, Kahn JA, Kavanagh K, Kjaer SK, Kliewer EV, Lemieux-Mellouki P, Markowitz L, Mboup A, Mesher D, Niccolai L, Oliphant J, Pollock KG, Soldan K, Sonnenberg P, Tabrizi SN, Tanton C, Brisson M. Population-level impact and herd effects following human papillomavirus vaccination programmes: a systematic review and meta-analysis. *Lancet Infect Dis* 2015;15:565-80. [https://doi.org/10.1016/S1473-3099\(14\)71073-4](https://doi.org/10.1016/S1473-3099(14)71073-4)
- [23] Hall MT, Simms KT, Lew JB, Smith MA, Brotherton JM, Saville M, Frazer IH, Canfell K. The projected timeframe until cervical cancer elimination in Australia: a modelling study. *Lancet Public Health* 2019;4:e19-e27. [https://doi.org/10.1016/S2468-2667\(18\)30183-X](https://doi.org/10.1016/S2468-2667(18)30183-X)
- [24] Agency for Health Technology Assessment and Tariff System. 2019. Profilaktyka zakażeń wirusem brodawczaka ludzkiego (HPV) w ramach programów polityki zdrowotnej. Available at: https://bipold.aotm.gov.pl/assets/files/ppz/2019/RPT/19.10.29_raport_zalec_tech_n_art_48aa_profilaktyka_hpv.pdf (accessed on 19/05/2020).

- [25] Grupa Luxmed. Vaccination Programmes. Vaccinations against HPV. About the program. Available at: <https://www.luxmed.pl/en/for-patients/of/vaccines/vaccinations-against-hpv.html> (accessed in 20/05/2020).
- [26] Statistics Poland. 2019. Pracujący i wynagrodzenia w gospodarce narodowej w 2018 r. – dane wstępne. Available at: https://stat.gov.pl/download/gfx/portalinformacyjny/pl/default-aktualnosci/5474/18/1/1/pracujacy_i_wynagrodzenia_w_gospodarce_narodowej_w_2018_r._dane_wstepn....pdf (accessed on 19/05/2020).
- [27] National Institute of Public Health in Poland. 2019. Available at: <https://szczepienia.pzh.gov.pl/faq/gdzie-realizowane-sa-samorzadowe-programy-szczepien-przeciw-hpv> (accessed on 17/05/2020).
- [28] Strategic Advisory Group of Experts on Immunization Working Group on Human Papillomavirus (HPV) immunization, Report to SAGE. 2018. Available at: https://www.who.int/immunization/sage/meetings/2018/october/3_SAGE2018_WG_recommendation_FINAL.pdf?ua=1 (accessed on 19/05/2020).
- [29] Grace D, Gaspar M, Rosenes R, Grewal R, Burchell AN, Grennan T, Salit IE. Economic barriers, evidentiary gaps, and ethical conundrums: a qualitative study of physicians' challenges recommending HPV vaccination to older gay, bisexual, and other men who have sex with men. *Int J Equity Health* 2019;18:159. <https://doi.org/10.1186/s12939-019-1067-2>

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