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Cervical cancer in Poland — epidemiology, prevention, and treatment pathways

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ABSTRACT

Introduction. Cervical cancer in Poland has a higher incidence and mortality rates, and lower 5-year survival rates compared to Western Europe. The Polish government has initiated screening and vaccination programs to improve outcomes. This study reviews cervical cancer epidemiology in Poland and assesses adherence to preventative measures. Additionally, we tried to assess the potential for improving the epidemiological situation in the future.

Material and methods. Data were collected from the Polish National Cancer Registry and the National Health Fund. We performed desk research using international databases and peer-reviewed publications to contextualize Poland's situation within Europe.

Results. The incidence rate of cervical cancer in Poland is gradually decreasing, with an annual percent change of -3.3 (95% CI from -5.2 to -1.4; $p < 0.05$). The age-standardized incidence rate of 18.9 ranks Poland 20th of 27 European countries, while the mortality rate of 10.5 is twice as high as the European average. With only 55.1% of diagnosed women surviving 5 years, Poland ranks near the bottom in Europe. Additionally, only 10% of Poles have received anti-HPV immunization, and cytology screening coverage does not exceed 25%.

Conclusions. Cervical cancer outcomes in Poland remain significantly below the European average. There is a pressing need for enhanced preventative measures and education in women's health.

Keywords: cervical cancer, epidemiology, prophylaxis adherence, polish patients, screening programs, vaccination, health outcomes

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Introduction

Cervical cancer (CC) is a significant public health challenge worldwide due to its high incidence and mortality rates. In Europe, approximately 33,000 cases and 15,000 deaths are reported annually, making CC the second leading cause of cancer-related deaths in women after breast cancer. Importantly, there is considerable variation in disease burden across Europe [1], with Eastern European countries, including Poland, experiencing some of the highest rates. Consequently, treatment outcomes in these regions are often less satisfactory compared to Western Europe.

In response to the high incidence and mortality rates of CC, the Polish government implemented the National Program for Combating Neoplastic Diseases (NPCND) in 2006, following European Union (EU) and World Health Organization (WHO) guidelines [2–4]. This program aims to enhance oncological education, prevention, and cancer treatment support [5]. In 2007, the Organized Cervical Cancer Screening Program (OCCSP) was introduced under NPCND, offering free cervical smear tests every three years to insured women aged 25–64. The program also provides access to colposcopy, cervical biopsy, conization, hysterectomy, chemotherapy, and radiotherapy as needed [6].

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Due to the established link between human papillomavirus (HPV) infection and CC, HPV vaccination has been recommended since 2010 as part of the protective vaccination program. In 2019, the Act on the National Cancer Strategy (NCS) 2020–2030 was adopted, further promoting vaccination and other proactive health measures [7, 8]. Since 2016, HPV immunization has been recommended primarily for individuals before sexual initiation. Starting in 2021, the vaccination target group expanded to include individuals aged 9 and older.

The NCS focuses on improving 5-year survival rates and enhancing the quality of life for all patients undergoing oncological treatment [8, 9]. Additional initiatives, such as liquid-based cytology for better detection of cervical abnormalities and the reimbursement of anti-HPV vaccines for girls and boys aged 11–13, are expected to significantly reduce CC rates in Poland [10, 11].

This study aims to review the current epidemiology, adherence to prevention, and treatment pathways of CC in Poland to assess prospects for the population with this neoplasm.

Material and methods

A desk review was conducted to analyze available data on CC epidemiology in Poland. National prevention strategies, policies, and practice guidelines for CC (coded as C53 in ICD-10) were assessed. The most recent incidence rate (IR) and mortality rate (MR) data for Poland were obtained from the Polish National Cancer Registry (PNCR), supplemented by a report from the National Health Fund (NHF) in collaboration with the Maria Skłodowska-Curie National Research Institute of Oncology in Warsaw (NRIO). Additionally, national data were compared with external sources such as the WHO, the European Cancer Information System (ECIS), and peer-reviewed research to provide context on Poland's status relative to the rest of Europe.

Data on patients' treatment paths were obtained from the NHF [12].

A detailed description of the join-point regression analysis was conducted using Joinpoint Regression software, version 4.0.1 (Information Management Services Inc, Rockville, MD, USA) to determine the trend in incidence. The analysis involved logarithmic transformation of the rates and standard errors, with a maximum of five join points and a minimum of four years between two join points. Subsequently, the annual percentage change (APC) was calculated to quantify the trend over a fixed number of years as a geometric weighted average of the trend analysis. All statistical tests were two-sided. The trend data were presented as APC values with 95% confidence intervals.

Results

Epidemiology in Poland

According to data, covering the period from 2013 to 2021, nearly 22.9 thousand cases of CC were documented in Poland. Likewise, during the same period, over 14,000 fatalities were reported. Table 1 provides detailed information on case numbers and crude rates per 100,000 individuals.

More recent data provided by the NHF reveal higher numbers of cases and deaths compared to those reported in PNCR. According to these data, between 2013 and 2022, approximately 32,000 cases of CC were registered in Poland [12]. Reflecting on the past decade, there was a gradual but consistent decline in the incidence rate, with an average APC of -3.3% [95% confidence interval (CI) from -5.2 to -1.4 ; $p < 0.05$]. Notably, a discernible acceleration in the decline was observed following the implementation of the OCCSP (2008–2018), with an APC of 3.97% across all age groups and -6.1% among women aged 25–59 [14–16].

Table 1. Number of cervical cancer (CC) cases and deaths and crude rates in 2013–2021 in Poland [13]

Year	No. of cases	Crude incidence rates	No. of deaths	Crude death rates
2013	2913	14.66	1669	8.4
2014	2860	14.4	1628	8.2
2015	2780	14.01	1585	7.99
2016	2690	13.56	1570	7.92
2017	2561	12.91	1609	8.11
2018	2428	12.25	1593	8.03
2019	2494	12.59	1569	7.92
2020	1985	10.02	1511	7.63
2021	2160	11.01	1361	6.93

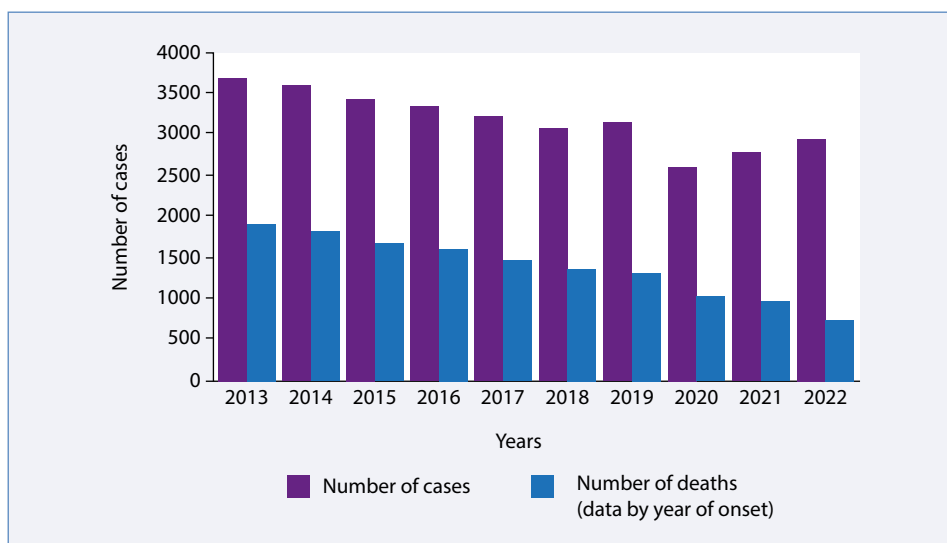


Figure 1. Number of cervical cancer (CC) cases and related deaths in 2013–2022 in Poland [12]

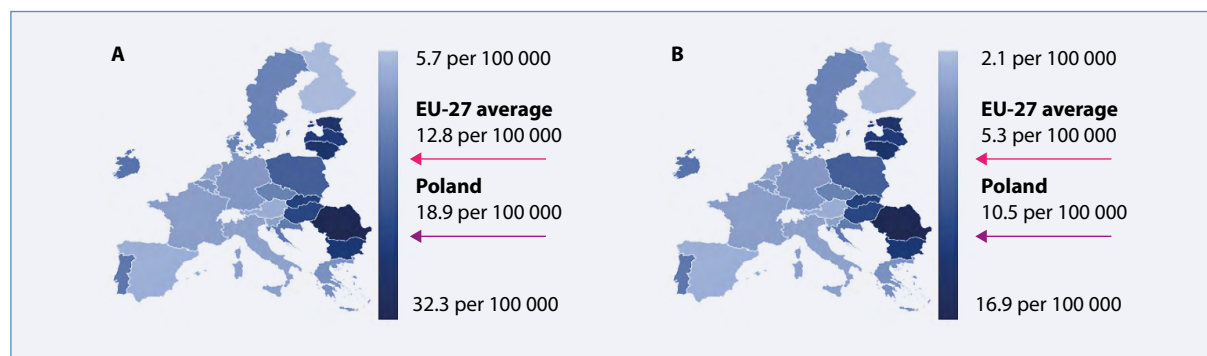


Figure 2. Estimated age-standardized incidence rate (A) and the all-age mortality rate (B) in European Union countries (EU-27) in 2020 [22] (Based on the European Cancer Information System)

The trend in CC IR in Poland is declining, in contrast to some countries in the region such as Latvia, Lithuania, or Bulgaria, which are experiencing alarmingly increasing trends. However, despite this downward trend, Polish results have not reached European average values, and the country still lags significantly behind Western countries regarding CC health outcomes [17].

In 2022, the NHF reported 2,952 new cases of CC (15 cases/100 thousand Polish women) and 698 CC-related deaths [12]. Even though the trend is downward (the current disruption of the general trend is probably a consequence of the COVID-19 pandemic-related backlog in diagnostics) (Fig. 1), still many Poles are not saved from cervical malignancy every year [12]. Cervical cancer ranks high, in eighth place among all cancers, both in terms of incidence and mortality rates in Polish women [18].

Despite the decline in the number of new patients receiving treatment for CC, the overall number of patients

undergoing treatment has increased due to the need for adjuvant treatment, therapeutic support, and palliative care. The rate of treated women per 100,000 rose from 73 in 2005 to 125 in 2014 [19]. This places a significant strain on the already burdened Polish healthcare system. In 2021, the NHF reported that 17,880 patients received treatment, with a total of 95,687 individuals benefiting from any CC-related health services [20]. Additionally, the Polish Society of Gynecologic Oncology projects that by 2030, the number of women in Poland requiring treatment for CC will exceed 40,300 [21].

Poland versus Europe

The morbidity rates in Poland are concerning: as estimated by ECIS, the age-standardized IR of 18.9 places Poland in the 20th position of 27 European countries while the MR of 10.5 is as high as the European Union countries (EU-27) average (Fig. 2 [22]).

The difference in CC burden among Poles and other Western Europeans can be attributed to the timing of national anti-HPV immunization programs across the EU [23–27]. France, Germany, and Spain implemented these programs as early as 2007, while Poland only began its free vaccination program in 2023. Similarly, the delayed implementation of cytology-based screening in Poland, Slovakia, and Latvia contrasts with the sharp declines in incidence and mortality seen in high-income countries after introducing such programs in the 1960s and 1970s [28, 29].

In addition to prevention efforts, significant disparities exist in access to innovative cancer treatments across Europe, with expenses varying fivefold between regions [30]. This disparity is reflected in region-specific mortality rates. CONCORD-3 data show a 3.5% improvement in Polish 5-year survival rates for CC between 2000–2004 and 2010–2014. However, this progress is slower than the EU average and has not closed the gap with other countries [31]. Currently, Poland and Bulgaria rank lowest in Europe, with a 5-year survival rate of 55.1%, compared to over 80% in Iceland and 73% in Norway. Despite the downward trend, Poland's incidence rates still lag behind European averages, resulting in poorer health outcomes for Poles [31]. Despite the downward trend in the incidence rates in Poland, it still falls short of European averages, leaving Poles far behind in relation to outcomes of treatment for CC in Western countries [17].

Prophylaxis adherence

The CC screening program in Poland is fully reimbursed by the NHF for women aged 25–64. Provincial Coordinating Centers were established to support the administration and implementation of the program, including sending personal invitation letters to eligible women. However, despite these efforts, the screening

program in Poland has never reached optimal levels. Participation rates have been unexpectedly low, with an average of only 24.66% of invited individuals participating from 2007 to 2014, and as of May 2023, only 11.31% of the population was screened [32, 33]. This contrasts with Northern European countries where participation rates as high as 80% have been achieved [19].

The relatively low participation in the OCCSP may be partly attributed to the availability of Pap smear tests through Outpatient Specialist Care (OSC) in Poland, which are conducted concurrently with the established program. In recent years, the annual number of medical services for cervical material collection has ranged between 360,000 and 500,000, except for 2020, during the pandemic, when only 280,000 women participated in cervical prophylaxis using this method [34, 35]. Additionally, some Poles seek cervical prophylaxis in the private sector; however, estimating this number is challenging as their results are not recorded in any/public systems [35, 36]. The figures from the NHF and NRIO show the scale of this underestimation [12]. These data indicate a steady annual increase in the percentage of patients who underwent cytology before a CC diagnosis, rising from 22% in 2013 to 40% in 2022 (Tab. 2).

Before June 2023, HPV vaccinations in Poland were recommended but not widely accessible, with public funding limited to programs implemented by certain local governments. As a result, only 10% of Poles have been vaccinated, compared to nearly 90% in Iceland or Great Britain [37, 38].

This sub-optimal vaccination rate has led to a high number of persistent HPV infections in Poland, which, if untreated, increase the incidence of CC [26]. Additionally, insufficient cervical screening coverage and delayed detection of abnormalities contribute to poor health outcomes [39]. Notably, EU member countries that joined in 2004 or later, including Poland, have similar proportions of patients diagnosed at

Table 2. Patients who had cytology performed before the diagnosis of cervical cancer in Poland [12]

Year	Number of cases [no.]	Number of cases per 100 thousand [no.]	Average share [%]
2013	824	4.1	22
2014	894	4.5	25
2015	1028	5	30
2016	1010	5.1	30
2017	959	4.8	30
2018	963	4.9	32
2019	1103	5.6	35
2020	899	4.5	35
2021	1083	5.5	39
2022	1192	6.1	40

Table 3. Treatment path for cervical cancer patients in Poland [12]

Year	No.	First step of treatment				Adjuvant postsurgery treatment				
		Surg.	Rad.	Chem.	Chem. + Rad.	Surg. + Chem.	End	Rad.	Chem.	Chem. + Rad.
		no. (%)	no. (%)	no. (%)	no. (%)	no. (%)	no. (%)	no. (%)	no. (%)	no. (%)
2013	2889	1470 (50.88%)	629 (21.77%)	575 (19.90%)	210 (7.27%)	5 (0.17%)	633 (43.06%)	446 (30.34%)	270 (18.37%)	121 (8.23%)
2014	2789	1405 (50.38%)	557 (19.97%)	608 (21.80%)	216 (7.74%)	3 (0.11%)	612 (43.56%)	386 (27.47%)	323 (22.99%)	84 (5.98%)
2015	2711	1364 (50.31%)	501 (18.48%)	635 (23.42%)	208 (7.67%)	3 (0.11%)	659 (48.31%)	320 (23.46%)	284 (20.82%)	101 (7.40%)
2016	2706	1326 (49.00%)	550 (20.33%)	606 (22.39%)	216 (7.98%)	8 (0.30%)	654 (49.32%)	301 (22.70%)	305 (23.00%)	66 (4.98%)
2017	2581	1273 (49.32%)	532 (20.61%)	584 (22.63%)	189 (7.32%)	3 (0.12%)	604 (47.45%)	319 (25.06%)	263 (20.66%)	87 (6.83%)
2018	2488	1207 (48.51%)	549 (22.07%)	556 (22.35%)	172 (6.91%)	4 (0.16%)	570 (47.22%)	311 (25.77%)	264 (21.87%)	62 (5.14%)
2019	2524	1251 (49.56%)	608 (24.09%)	487 (19.29%)	175 (6.93%)	3 (0.12%)	599 (47.88%)	300 (23.98%)	262 (20.94%)	90 (7.19%)
2020	2108	1044 (49.53%)	479 (22.72%)	401 (19.02%)	181 (8.59%)	3 (0.14%)	506 (48.47%)	241 (23.08%)	219 (20.98%)	78 (7.47%)
2021	2235	1105 (49.44%)	481 (21.52%)	461 (20.63%)	186 (8.32%)	2 (0.09%)	515 (46.61%)	278 (25.16%)	223 (20.18%)	89 (8.05%)
2022	2324	1174 (50.52%)	475 (20.44%)	480 (20.65%)	195 (8.39%)	0 (0.00%)	757 (64.48%)	205 (17.46%)	149 (12.69%)	63 (5.37%)

advanced stages of CC compared to the EU average (with local stage CC diagnosed in every second case and regional stage in every fourth case). However, these countries exhibit significantly worse outcomes in age-standardized, stage-specific 5-year relative survival rates. For instance, the 5-year relative survival rate for local stage CC is 81% across all of Europe but only 75% in newer EU states; for regional stage CC, it is 46% in Europe versus 40% in new EU states; and for metastatic stage CC, it is 16% in Europe compared to just 6% in new EU states [39].

A Polish study conducted three years after the implementation of the OCCSP found that the program improved detection of advanced tumors (from 25.5% to 39.0% of all detected CC cases). Despite the increase in the detection of advanced cases, overall patient survival remained unchanged, likely due to concurrent advances in treatment methods for advanced CC stages [40]. Prospects for improving statistics are promising as student knowledge about CC prevention in Poland increases and public awareness of cervical health issues grows [41]. In 2019, 54% of young Poles (ages 15–29) reported having a cervical smear test in the last three years, surpassing the EU-27 average of 44% [42].

Treatment pathways

Data in Table 3 shows that, on average, 50% of patients undergo surgical treatment as the first step, while the other half receive systemic treatment (radiotherapy or chemotherapy in various combinations). A positive prognostic sign is the noticeable increase in patients completing the therapeutic path after surgical treatment, rising from 43% in 2013 to over 64% in 2022.

Observing data in the coming years will help assess the pace of improvement in the epidemiological and clinical situation of CC patients in Poland.

Discussion

Cervical cancer is among the most burdensome and distressing cancers in Poland and takes a heavy toll on Poles every year. The country has struggled with the heavy burden of the disease for decades. The high incidence and mortality in CC patients are a real strain on the national budget and society.

The high prevalence of CC in Poland can be attributed to a high HPV infection rate, low vaccination rates,

and suboptimal implementation of the screening program. These preventative methods aim to reduce the CC incidence to the levels achieved in Western European countries [43]. Unfortunately, cancer elimination trends in Poland are not accelerating sufficiently, and current prevention efforts fall short of expectations.

One reason may be the limited preventative actions by primary care physicians, whom women visit more frequently than gynecologists. According to the Polish Supreme Audit Office, in 2017, cytology exams were recorded in only 9.4% of patient records. Studies show that preventative actions are crucial, as cancers detected through screening are at a much earlier clinical stage compared to symptomatic cases [19, 44]. Moreover, almost all initial stages of CC can be cured, and treated patients can reach the same mortality rates as the general population [45]. The prevention program must evolve and expand to reach a wider population, both in primary and secondary settings. The introduction of free HPV vaccinations in June 2023 was a crucial step toward reducing CC incidence in Poland and addressing health disparities between Poland and the rest of Europe. Secondary prevention also needs attention. A review of epidemiological studies in Europe shows a strong correlation between low socioeconomic status and certain cancers, including CC, head and neck, lung, and stomach cancers [46]. Coordinating all preventive activities and collecting data on tests performed is essential. Currently, no institution in Poland records the results of cytology tests performed outside the public system. Effective preventive care requires identifying who has been tested and who has not.

Poland is a middle-income country with CC rates much higher than the European average. This exemplifies the financial inequalities between European countries and their impact on health outcomes. In 2022, Poland's GDP per capita was \$17,117, with total health expenditure at 6.5%, compared to the EU's \$34,160 GDP with an average of 10.9% for health expenditure [9, 47]. There is still much to do to reduce that disparity and improve public health practices in Poland.

A limitation of the study is that in Poland, reported IR suffer from under-registration, so the term "incidence" should be understood as "registered incidence" [48]. Additionally, the presented levels of participation in prevention do not give a full picture due to the popularity of Pap smear tests in the private sector, and the lack of data on how many women regularly do these tests.

Conclusions

Poland's health outcomes for CC treatment remain below the European average. Although this situation

started to improve in recent years, there is an urgent need for stepping up actions aimed at strengthening education and prevention (both primary and secondary) by public authorities of all levels and the medical community.

Further analysis of epidemiological data, preventative measures, and patient pathways within the health-care system should be the subject of ongoing research. This research will provide valuable data for improving public health policies related to cervical cancer in Poland.

Article Information and Declarations

Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article.

Ethics statement

Ethical approval is not applicable for this article, because this article does not contain any studies with human or animal subjects

Author contributions

All authors were involved in planning the work. All authors discussed the results and commented on the manuscript.

M.S.: processed the experimental data, performed the analysis, drafted the manuscript, performed the calculations; A.L.: processed the experimental data, performed the analysis, drafted the manuscript, designed the figures; J.J.: supervised the work and made last corrections; T.B.: performed the calculations.

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Conflict of interest

The authors have no conflicts of interest to disclose.

Supplementary material

None.

References

1. European Centre for Disease Prevention and Control. <https://www.ecdc.europa.eu/en/human-papillomavirus/factsheet> (12.06.2023).
2. Nowakowski A, Arbyn M, Turkot MH, et al. A roadmap for a comprehensive control of cervical cancer in Poland: integration of available solutions into current practice in primary and secondary prevention. *Eur J Cancer Prev.* 2020; 29(2): 157–164, doi: 10.1097/CEJ.0000000000000528, indexed in Pubmed: 31517672.
3. Bulmer S, Parker O, Bache I, et al. Council of the European Union. Promoting cancer screening in the EU. Council Recommendation

- of 2 December 2003 on Cancer Screening (2003/878/EC). *Off J Eur Union*. 2003; 878: 34–38.
4. WHO Guidelines Approved by the Guidelines Review Committee. *Comprehensive Cervical Cancer Control: A Guide to Essential Practice*. 2nd edition. Geneva: World Health Organization. 2014, indexed in Pubmed: [25642554](#).
 5. Ministry of Health. Postal Gov.pl. National Program for Combating Cancer (NPZChN) [Narodowy Program Zwalczenia Chorób Nowotworowych (NPZChN) - Ministerstwo Zdrowia]. www.gov.pl (18.04.2024).
 6. Poniewierza P, Śniadecki M, Brzeziński M, et al. Secondary prevention and treatment of cervical cancer - update from Poland. *Nowotwory. Journal of Oncology*. 2022; 72(1): 20–25, doi: [10.5603/njo.2022.0002](#).
 7. Regulation of the Minister of Health of September 16, 2010 on the list of recommended preventive vaccinations and the method of financing and documenting recommended preventive vaccinations required by international health regulations [Rozporządzenie Ministra Zdrowia z dnia 16 września 2010 r. w sprawie wykazu zalecanych szczepień ochronnych oraz sposobu finansowania i dokumentowania zalecanych szczepień ochronnych wymaganych międzynarodowymi przepisami zdrowotnymi]. eli.gov.pl (13.06.2023).
 8. Ministry of Health. National Oncology Strategy [Narodowa Strategia Onkologiczna - Ministerstwo Zdrowia]. www.gov.pl (18.04.2024).
 9. EU Country Cancer Profile: Poland 2023. EU Country Cancer Profiles. 2023, doi: [10.1787/04cfc3ee-en](#).
 10. Ministry of Health. Announcements of the Minister of Health of February 23, 2023 on the list of recommended preventive vaccinations for which the purchase of vaccines is covered by financing. mz.gov.pl (18.04.2024).
 11. Rynek Zdrowia. Reimbursement of liquid cytology in 2023? rynek-zdrowia.pl (31.05.2023).
 12. National Health Fund, E-Health Center, National Oncology Institute. Cervical Cancer. 2023. Data in Polish. <https://app.powerbi.com/view?r=eyJrjoiY2Q4MmW5M2YyZgyZS00YjNiLTgwZGMtYWRjYjZhZml3NGVmlhlcWl6IjJncwYzE2LWmWnZiEiNDI1Mi04MzdlTU0NjWJzTlBmZQwYyIsImMiOj9> (18.04.2024).
 13. Polish National Cancer Registry. <https://onkologia.org.pl/pl/raporty> (06.05.2024).
 14. Piechocki M, Koziołek W, Sroka D, et al. Trends in Incidence and Mortality of Gynecological and Breast Cancers in Poland (1980-2018). *Clin Epidemiol*. 2022; 14: 95–114, doi: [10.2147/CLEPS330081](#), indexed in Pubmed: [35115839](#).
 15. Nowakowski A, Wojciechowska U, Wieszczy P, et al. Trends in cervical cancer incidence and mortality in Poland: is there an impact of the introduction of the organised screening? *Eur J Epidemiol*. 2017; 32(6): 529–532, doi: [10.1007/s10654-017-0291-6](#), indexed in Pubmed: [28780640](#).
 16. Nessler K, Ball F, Chan SK, et al. Barriers and attitudes towards cervical cancer screening in primary healthcare in Poland - doctors' perspective. *BMC Fam Pract*. 2021; 22(1): 260, doi: [10.1186/s12875-021-01612-8](#), indexed in Pubmed: [34969373](#).
 17. Singh D, Vignat J, Lorenzoni V, et al. Global estimates of incidence and mortality of cervical cancer in 2020: a baseline analysis of the WHO Global Cervical Cancer Elimination Initiative. *Lancet Glob Health*. 2023; 11(2): e197–e206, doi: [10.1016/S2214-109X\(22\)00501-0](#), indexed in Pubmed: [36528031](#).
 18. Didkowska J, Wojciechowska U, Barańska K, et al. National Research Institute of Oncology, Polish National Cancer Registry. *Cancer in Poland in 2021*. Ministry of Health 2023.
 19. Supreme Audit Office. Health prevention in the health care system. Department of Health, 2017 KZD.430.007.2016. No. 211/2016/P/16/054/KZD. nik.gov.pl (18.04.2024).
 20. Poland's Data Portal. <https://dane.gov.pl/pl/dataset/2556.liczbapacjentow-z-udzielonym-w-danym-roku-swadczy> (18.05.2023).
 21. Polish Society of Gynecological Oncology. Raporty i analizy. ptgo.pl (26.05.2023).
 22. European Cancer Information System. Cancer burden statistics and trends across Europe. europa.eu (18.05.2023).
 23. Wojtyła C, Ciebiera M, Kowalczyk D, et al. Cervical Cancer Mortality in East-Central European Countries. *Int J Environ Res Public Health*. 2020; 17(13), doi: [10.3390/ijerph17134639](#), indexed in Pubmed: [32605159](#).
 24. Kojalo U, Tisler A, Parna K, et al. An overview of cervical cancer epidemiology and prevention in the Baltic States. *BMC Public Health*. 2023; 23(1): 660, doi: [10.1186/s12889-023-15524-y](#), indexed in Pubmed: [37029357](#).
 25. Chrysostomou AC, Stylianou DC, Constantinidou A, et al. Cervical Cancer Screening Programs in Europe: The Transition Towards HPV Vaccination and Population-Based HPV Testing. *Viruses*. 2018; 10(12), doi: [10.3390/v10120729](#), indexed in Pubmed: [30572620](#).
 26. Nowakowski A, de Souza SC, Jach R, et al. HPV-type distribution and reproducibility of histological diagnosis in cervical neoplasia in Poland. *Pathol Oncol Res*. 2015; 21(3): 703–711, doi: [10.1007/s12253-014-9877-4](#), indexed in Pubmed: [25547828](#).
 27. Tjalma WA, Fiander A, Reich O, et al. HERACLES/SCALE Study Group. Differences in human papillomavirus type distribution in high-grade cervical intraepithelial neoplasia and invasive cervical cancer in Europe. *Int J Cancer*. 2013; 132(4): 854–867, doi: [10.1002/ijc.27713](#), indexed in Pubmed: [22752992](#).
 28. Ponti A, Anttila A, Ronco G, et al. Cancer screening in the European Union (2017). Report on the implementation of the Council Recommendation on cancer screening (second report). europa.eu (18.04.2024).
 29. Canfell K, Kim JJ, Brisson M, et al. Impact of HPV vaccination and cervical screening on cervical cancer elimination: a comparative modelling analysis in 78 low-income and lower-middle-income countries. *Lancet*. 2020; 395(10224): 575–590, doi: [10.1016/S0140-6736\(20\)30068-4](#), indexed in Pubmed: [32007141](#).
 30. Small W, Peltecu G, Puiu A, et al. Cervical cancer in Eastern Europe: review and proceedings from the Cervical Cancer Research Conference. *Int J Gynecol Cancer*. 2021; 31(7): 1061–1067, doi: [10.1136/ijgc-2020-001652](#), indexed in Pubmed: [33122244](#).
 31. Glińiewicz A, Zielińska A, Kwiatkowska K, et al. Survival in women diagnosed with breast and cervical cancer in Poland – compared to European countries, based on CONCORD - 3 Programme. *Przeegl Epidemiol*. 2018; 72(4): 499–508, doi: [10.32394/pe.72.4.25](#), indexed in Pubmed: [30810005](#).
 32. Trzeciak-Bilska K. Effectiveness of the Population Program for Prevention and Early Detection of Cervical Cancer in 2007–2009. *Medical University of Gdańsk* 2017. <https://pbc.gda.pl/Content/71074/doktorat%20TRZECIAK-BILSKA%20Katarzyna.pdf> (25.05.2023).
 33. <https://dane.gov.pl/pl/dataset/2583.dane-z-realizacji-profilaktycznych-programow-zdrow/resource/47682/table> (31.05.2023).
 34. System and Implementation Analysis Database, BASIW. <https://basiw.mz.gov.pl/mapy-informacje/mapa-2022-2026/analizy/ambulatoryjna-opieka-specjalistyczna/> (31.05.2023).
 35. <https://pulsmedycyny.pl/prof-michal-kaminski-w-polsce-jakosc-badan-profilaktycznych-w-onkologii-jest-fatalna-1165131> (31.05.2023).
 36. Maździarz A, Wyględowski J, Osuch B, et al. New directions in cervical cancer prophylaxis worldwide and in Poland - Case study of the Polish rural female population. *Ann Agric Environ Med*. 2017; 24(4): 592–595, doi: [10.5604/12321966.1232093](#), indexed in Pubmed: [29284230](#).
 37. Nowakowski A, Jach R, Szenborn L, et al. Rekomendacje Polskiego Towarzystwa Ginekologów i Położników, Polskiego Towarzystwa Pediatrycznego, Polskiego Towarzystwa Medycyny Rodzinnej, Polskiego Towarzystwa Ginekologii Onkologicznej, Polskiego Towarzystwa Wskrywania i Patofizjologii Szyjki Macicy w zakresie szczepień profilaktycznych przeciwko zakażeniom wirusami brodawczaka ludzkiego w Polsce. *Ginekologia i Perinatologia Praktyczna*. 2022; 7(2): 81–91.
 38. Śniadecki M, Poniewierza P, Jaworek P, et al. Thousands of Women's Lives Depend on the Improvement of Poland's Cervical Cancer Screening and Prevention Education as Well as Better Networking Strategies Amongst Cervical Cancer Facilities. *Diagnostics (Basel)*. 2022; 12(8), doi: [10.3390/diagnostics12081807](#), indexed in Pubmed: [35892517](#).
 39. Bielska-Lasota M, Rossi S, Krzyżak M, et al. EURO CARE-5 Working Group. Reasons for low cervical cancer survival in new accession European Union countries: a EURO CARE-5 study. *Arch Gynecol Obstet*. 2020; 301(2): 591–602, doi: [10.1007/s00404-019-05412-5](#), indexed in Pubmed: [31853712](#).
 40. Nowakowski A, Cybulski M, Buda I, et al. Cervical Cancer Histology, Staging and Survival before and after Implementation of Organised Cervical Screening Programme in Poland. *PLoS One*. 2016; 11(5): e0155849, doi: [10.1371/journal.pone.0155849](#), indexed in Pubmed: [27196050](#).
 41. Osowiecka K, Yahuza S, Szwiec M, et al. Students' Knowledge about Cervical Cancer Prevention in Poland. *Medicina (Kaunas)*. 2021; 57(10), doi: [10.3390/medicina57101045](#), indexed in Pubmed: [34684082](#).
 42. Eurostat. Self-reported last cervical smear test among women by age and income quintile Statistics. europa.eu (18.04.2024).
 43. Ministry of Health. Cervical cancer prevention program (cytology) [Program profilaktyki raka szyjki macicy (cytologia) - Ministerstwo Zdrowia]. www.gov.pl (18.04.2024).
 44. Wang J, Elfström KM, Andrae B, et al. Cervical cancer case-control audit: Results from routine evaluation of a nationwide cervical screening program. *Int J Cancer*. 2020; 146(5): 1230–1240, doi: [10.1002/ijc.32416](#), indexed in Pubmed: [31107987](#).

45. Andrae B, Andersson TML, Lambert PC, et al. Screening and cervical cancer cure: population based cohort study. *BMJ*. 2012; 344: e900, doi: [10.1136/bmj.e900](https://doi.org/10.1136/bmj.e900), indexed in Pubmed: [22381677](https://pubmed.ncbi.nlm.nih.gov/22381677/).
46. Mihor A, Tomsic S, Zagar T, et al. Socioeconomic inequalities in cancer incidence in Europe: a comprehensive review of population-based epidemiological studies. *Radiol Oncol*. 2020; 54(1): 1–13, doi: [10.2478/raon-2020-0008](https://doi.org/10.2478/raon-2020-0008), indexed in Pubmed: [32074075](https://pubmed.ncbi.nlm.nih.gov/32074075/).
47. Trading economics. GDP per capita in Europe. <https://trading-economics.com/country-list/gdp-per-capita?continent=europe> (15.05.2024).
48. Wojciechowska U, Barańska K, Michalek I, et al. National Research Institute of Oncology, Polish National Cancer Registry. Cancer in Poland in 2020. Ministry of Health 2022. onkologia.org.pl (18.04.2024).