From cervical cancer to HPV elimination in Bulgaria: Building robust data systems and infrastructure

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Foreword

Cervical cancer is one of the few cancers that can be effectively prevented and ultimately eliminated; through vaccination, screening, and timely treatment. However, success depends not only on the availability of medical tools, but also on the strength of the systems that deliver them.

Countries that have made the greatest progress in reducing cervical cancer have invested in strong public health infrastructure. Comprehensive registries, integrated data systems, and organized screening programs allow prevention efforts to be monitored, evaluated, and continuously improved. These foundations are essential for ensuring that vaccination and screening programs reach the population effectively and equitably.

Bulgaria has taken important steps in recent years. The introduction of gender-neutral HPV vaccination and the commitment to implement a nationwide cervical cancer screening program represent important milestones. However, challenges remain. Fragmented data systems, limited monitoring mechanisms, disparities in access to services, and low awareness continue to constrain the full impact of prevention efforts.

Strengthening the underlying infrastructure for prevention is therefore a critical priority. While Nordic countries are often seen as leaders in this area, important examples are also emerging within Central and Eastern Europe. Countries such as Slovenia have demonstrated that relatively small health systems can successfully build effective programs.

This white paper aims to support Bulgaria in taking the next steps toward cervical cancer elimination. Developed in consultation with Bulgarian experts, it presents a strategic roadmap that prioritizes the development of robust data systems and infrastructure as the foundation for effective prevention.

With sustained commitment and coordinated action, Bulgaria can strengthen its prevention systems and significantly reduce the burden of all HPV-related cancers in the years ahead.

Lund, March 2026

Peter Lindgren
Managing Director, IHE

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Summary

Despite the existing measures to eliminate cervical cancer, Bulgaria still experiences a high burden. Persistent barriers, including lack of comprehensive data registries, suboptimal monitoring and evaluation mechanisms, disparities in accessing services, and low awareness, have historically hindered progress. However, the country has taken important decision in recent years, by implementing gender-neutral HPV vaccination and committing to a widespread cervical cancer screening program.

This white paper is intended to support Bulgaria in building robust data systems and infrastructure and laying the foundation for cervical cancer and HPV elimination in the country. It outlines a strategic, evidence-based roadmap, co-developed in consultation with Bulgarian experts, and aligned with the objectives of the European Beating Cancer Plan and the WHO 90-70-90 strategy. The roadmap is organized into three sequential phases moving from immediate, high-impact steps to longer-term reforms:

- **Phase 1: Building foundations**
  The first steps toward cervical cancer elimination include building the infrastructure that will constitute the backbone of these efforts. Robust data registries and monitoring systems need to be established to track the country's progress and inform decision-making and resource allocation, through key-performance indicators that are regularly monitored and evaluated. Upgraded electronic reminder and invitation systems, linked with national registries will enable participation in prevention programs. Multiple actors need to be involved in awareness-raising initiatives, including HCP.
- **Phase 2: Integration of the systems and piloting**
  The next step is to move towards integrating the new systems in practice and piloting interventions adapted in the Bulgarian context. Interoperable electronic systems and registries will enable linkages between databases and unhindered flow of information. Pilot programs should gradually move from the regional level to national adaptation. It is crucial that Bulgaria moves to a nationally organized screening program and introduces new methods such as HPV-based primary screening and self-sampling options. To further promote primary and secondary prevention, culturally sensitive materials need to be developed, along with multidisciplinary teams for post-treatment follow-up management.
- **Phase 3: Scalability and sustainability**
  To ensure the larger scale implementation and sustainability of initiatives, inter-ministerial and cross-sectoral collaboration needs to be prioritized, ensuring that HPV and cervical cancer elimination efforts are embedded across the spectrum. Vaccination capacity should be expanded to more sites and specialists, while the transition to opt-out vaccination policies should be assessed. Continuous monitoring should be institutionalized through the National Health Information System, and implementation research adapted to serve local programs.

Achieving cervical cancer elimination requires strong foundations, including predictable funding, robust data, monitoring and evaluation systems, and valuable partnerships that will drive change towards a common national goal. By implementing the actions presented in the roadmap, Bulgaria can turn the tide and greatly reduce the HPV and cervical cancer burden for the generations to come.

Abbreviations

AIS	Adenocarcinoma in situ
ASR	Age-standardized rate
BNCR	Bulgarian National Cancer Registry
CCEI	Cervical Cancer Elimination Initiative
CIN	Cervical Intraepithelial Neoplasia
CT	Computed tomography
DALYs	Disability-Adjusted Life Years
EBCP	Europe's Beating Cancer Plan
ECO	European Cancer Organisation
EFPIA	European Federation of Pharmaceutical Industries and Associations
EHR	Electronic health records
EMA	European Medicines Agency
EML	Essential Medicines List
ESGO	European Society of Gynaecological Oncology
ESMO	European Society for Medical Oncology
ESP	European Society of Pathology
ESTRO	European Society for Radiotherapy and Oncology
EU	European Union
EU-27	EU member states
GNV	Gender-neutral vaccination
GP	General practitioner
HCP	Healthcare professional
HPV	Human papillomavirus
HR-HPV	High-risk human papillomavirus
KPIs	Key performance indicators
LGBTIQ	Lesbian, gay, bisexual, transgender, intersex and queer people
MDT	Multidisciplinary team
MoH	Ministry of Health
MRI	Magnetic resonance imaging
NGO	Non-Governmental Organization
NHIF	National Health Insurance Fund
NHIS	National Health Information System
NHS	England's National Health Service
OECD	Organization for Economic Cooperation and Development
OOP	Out-of-pocket
Pap smear	Papanicolaou smear
Patients W.A.I.T. Indicator	Patients Waiting to Access Innovative Therapies Indicator
PET-CT	Positron emission tomography–computed tomography
PVFLP	Present value of future lost productivity
QALYs	Quality-Adjusted Life Years
RACE framework	Readiness assessment for cervical cancer elimination framework
ROI	Return on investment
VCR	Vaccination coverage rate
WHO	World Health Organization
YLD	Years lived with disability
YLL	Years of life lost

1. Introduction

1.1 Cervical cancer: The most preventable HPV-related cancer

Human papillomavirus (HPV) is one of the most common viral infections worldwide, with more than 200 known genotypes (1). Of these, 14 are considered high-risk (HR-HPV) and can cause multiple cancers. Low-risk HPV types cause genital warts. While cervical cancer contributes to the largest part of HPV-related disease in Romania, the virus also contributes to other cancers and conditions affecting both women and men; HR-HPV types are also causally linked to anal, vulvar, vaginal, penile, and head and neck cancers[1] (2). Low-risk HPV types cause genital warts.

Cervical cancer is a type of cancer that develops in the cervix, in the lower part of the uterus (3). It usually begins with abnormal changes in the cells lining the cervix called "precancerous lesions". Over time, if these changes are not detected and treated, they can develop into a tumor. The main cause of cervical cancer is persistent infection with certain types of HPV, a very common sexually transmitted virus. In early stages, cervical cancer often causes no symptoms. When symptoms do appear, they may include abnormal vaginal bleeding (i.e., bleeding after sex, between menstrual periods or after menopause) (4). Because of its well-understood cause and predictable natural history, cervical cancer serves as the flagship disease in the global fight against HPV.

The good news is that cervical cancer is almost entirely preventable. Vaccines with demonstrably favorable safety profiles protect against the most common high-risk HPV types. When delivered through gender-neutral vaccination programs targeting adolescents, these vaccines can greatly reduce the prevalence of HPV within populations and subsequently the future burden of disease (5).

Although HPV vaccination protects against the most common HR-HPV types, it does not protect against all possible subtypes. Moreover, not everyone has had—or currently has—the opportunity to be vaccinated, therefore, secondary prevention through screening and treatment of precancerous lesions remains essential. High-performance HPV testing, the recommended method of screening by the European Union (EU) guidelines, allows for early detection of pre-cancerous changes before they progress and develop into cancer. When coupled with accessible triage and management, cervical cancer can be prevented or treated in early stages.

Eliminating cervical cancer as a public health problem thus represents a key milestone toward the broader goal of HPV elimination. The same tools that enable cervical cancer prevention, primarily vaccination, also forms the foundation for reducing the incidence of all HPV-related cancers over time.

1.2 Global and European momentum towards elimination

Eliminating cervical cancer requires a coordinated multi-stakeholder and multi-sectoral approach; from public health authorities to civil society. Global momentum is already underway, and in 2020, the World Health Organization (WHO) launched the Cervical Cancer

[1] The link between HPV and these cancers is supported by the epidemiological evidence. Inclusion of this information is not intended to reference vaccine use, indications, or prevention of penile or head and neck cancers.

Elimination Initiative (CCEI) which sets benchmarks across three key pillars — vaccination, screening, and treatment and management. Building on this, Europe's Beating Cancer Plan (EBCP) introduced a year later, in 2021, explicitly commits to eliminating cervical cancer and other HPV-related cancers in Europe, see Figure 1.

Figure 1: Cervical Cancer Elimination Initiative and Europe's Beating Cancer Plan targets for cervical cancer.

1.3 White paper: Objectives and process

The objective of this white paper was to outline and co-design a policy roadmap for cervical cancer elimination in Bulgaria. The process combined collaboration with leading experts and a targeted review of the evidence, as well as validation of evidence and recommendations to ensure scientific and contextual accuracy and feasibility.

The white paper contributes to the Bulgarian elimination effort by outlining a roadmap based on three interdependent pillars: primary prevention through HPV vaccination, secondary prevention through screening, and tertiary prevention through timely treatment and management of precancerous and cancerous lesions, see

Figure 2. While the primary focus of the paper is on cervical cancer elimination, it should be read as the first step towards a broader milestone of HPV-related cancer control.

Moreover, the roadmap emphasizes cross-cutting themes critical to success: robust infrastructure for evaluation and monitoring, including data systems, broad stakeholder participation, and strong policy alignment. Above all recommendations are grounded in equity, ensuring that prevention and care are equally accessible to all segments of the population.

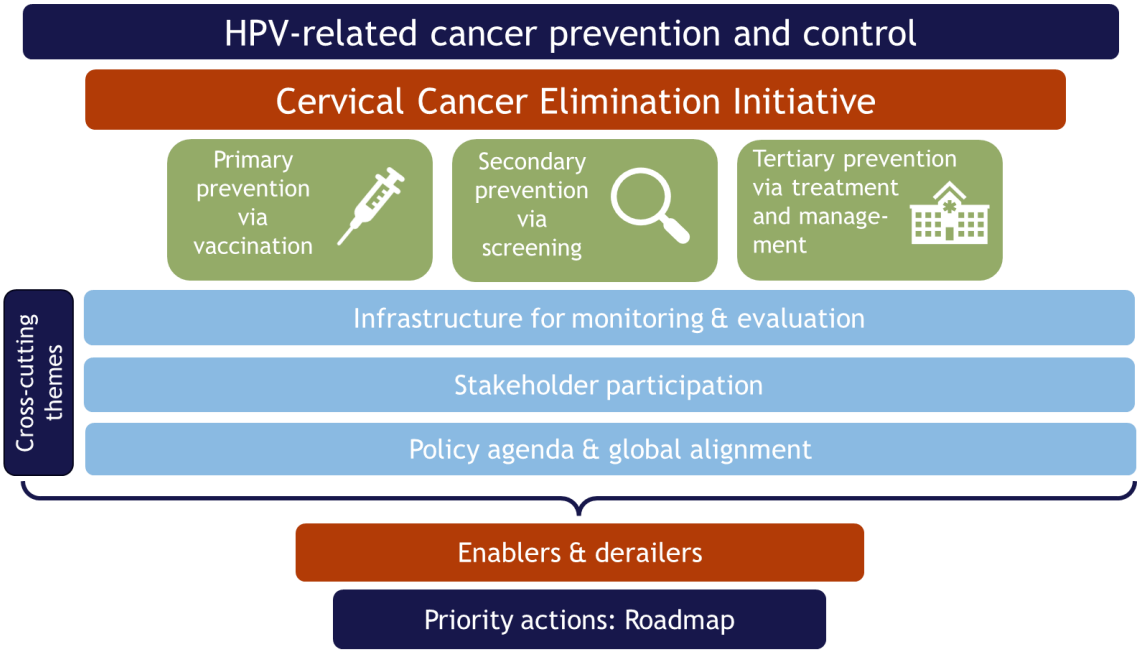


Figure 2: Cervical Cancer Elimination rests on three pillars.

2. Cervical Cancer in Bulgaria

Cervical cancer presents an important public health challenge in Bulgaria. According to 2024 estimates, it was the fifth most common cancer among women, accounting for 6% of all new diagnoses[2] (6). The age-standardized rate (ASR) was 22.6 cases per 100,000 in Bulgaria, almost double than the EU member states (EU-27) average of 11.7 (6), see Figure 3.

Bulgaria's age distribution in the incidence of cervical cancer shows substantial disease burden affecting younger women. Data from the Bulgarian National Cancer Registry (BNCR) indicate that between 2013 and 2020, 7,861 women were diagnosed, of those, only around 26% were 65 years or older at diagnosis (7). In fact, cervical cancer is the second most common cancer among women younger than 45 years (6). Despite higher prevalence, younger women were more often diagnosed at an early stage; 63% of those aged 15-29 years were diagnosed at stage I, compared to only 33% of those over the age of 65 (7). However, the proportion of early-stage diagnoses declined overall, from 48.3% in 2015 to 37.5% in 2020 (7). Local experts further highlighted that new cervical cancer cases are now usually detected in advanced stages and warrant more extensive and costly treatment.

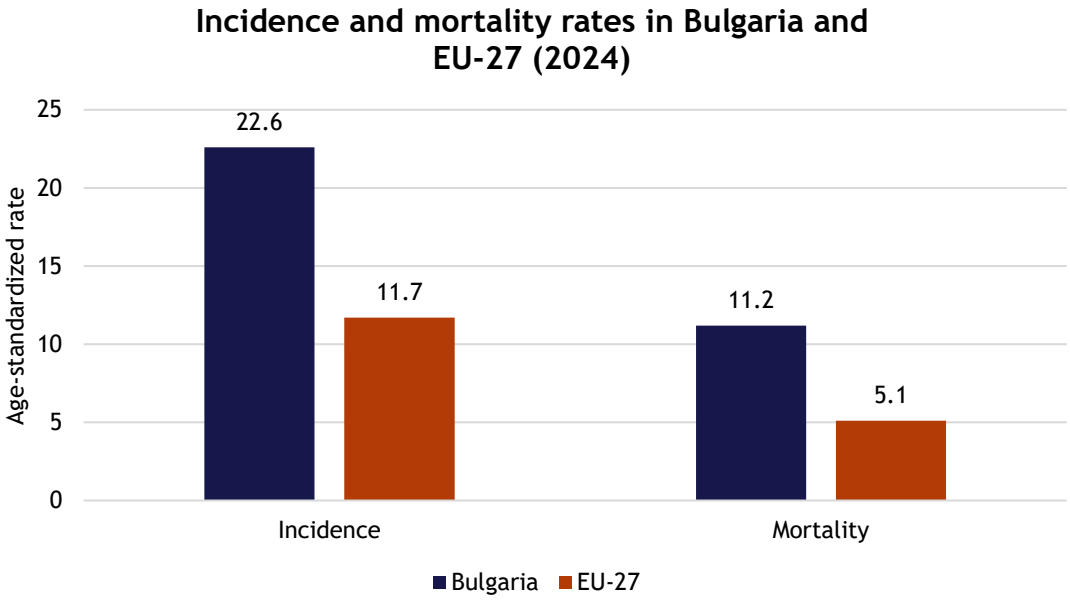


Figure 3: Age-standardized incidence and mortality rate of cervical cancer in Bulgaria and EU-27 in 2024.

Source: (6).

Cervical cancer is also a major cause of premature mortality in Bulgaria. In 2024, it was the sixth leading cause of cancer death among women, with the ASR mortality of 11.2 deaths per 100,000, more than double compared to 5.1 in the EU-27, (6), see Figure 4.

Similarly to the trends in incidence and mortality, survival from cervical cancer in Bulgaria is lower than the EU average. Data show that the five-year net survival rate improved modestly, from 49.2% in 2000-2004 to 54.8% in 2010-2014, yet remained below the EU-27 average of 64% (8), see Figure 4. More recent data is scarce; one study found a median overall survival of 92.5

[2] Refers to all cancer sites but non-melanoma skin cancer.

months, with poorer outcomes for patients with prior cancer diagnoses (7). Due to ongoing organizational and technical reforms of the BNCR in 2023, updated and internationally comparable survival statistics are not yet available (9).

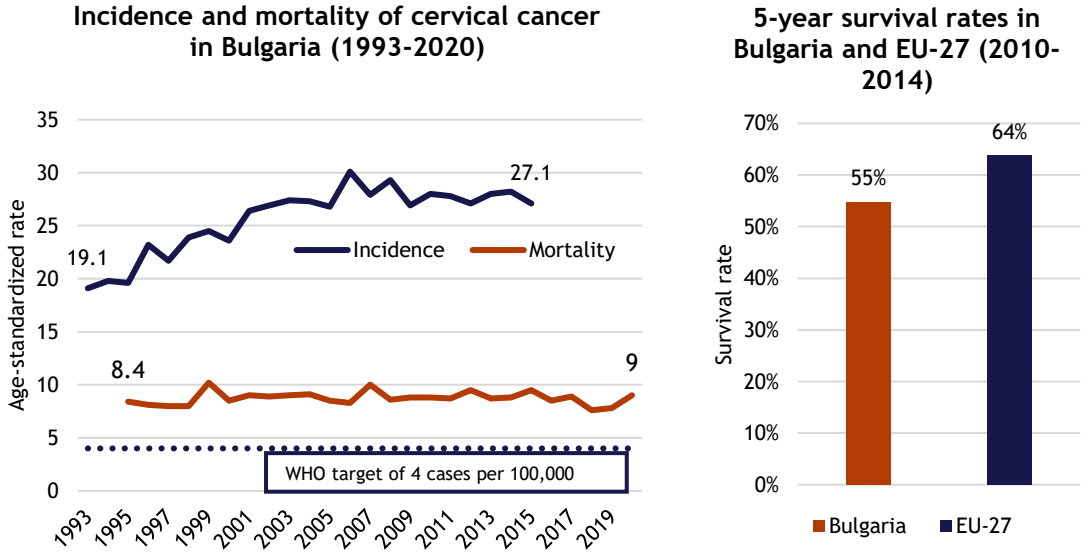


Figure 4: Age-standardized incidence (1993-2015) and mortality (1995-2020) of cervical cancer in Bulgaria & 5-year cervical cancer survival rates in Bulgaria and EU-27 in 2010-2014.

Source: (8, 10).

The epidemiological picture of cervical cancer in Bulgaria demonstrates substantial burden of this disease and poorer prognoses compared to the EU average. The high incidence, concerning trends among young women, and poorer survival outcomes highlight the urgency of strengthening prevention through a more widespread HPV vaccination uptake and early detection via screening of the target populations.

2.1 Societal and economic burden

Cervical cancer carries a significant social and economic burden, but investment in prevention offers one of the highest returns in public health. In the context of fiscal pressures and competing priorities, prevention should be seen as a cost-saving, productivity-enhancing strategy rather than an added expense. Evidence from multiple countries shows that every dollar invested in prevention, early detection, and treatment of cervical cancer yields three to eight times its value in economic benefit (11). According to WHO estimates, each US$1 invested through 2050 can generate an average return of US$3.20, primarily by enabling women to remain healthy, active, and productive in the workforce (12). By strengthening preventive services, Bulgaria can reduce long-term treatment costs, ease pressure on the health system.

Data from Bulgaria suggest that cervical cancer constituted a significant economic burden for the healthcare system, with an annual cost of about €6.8 million in 2020 (13). The largest part of this cost was drug-related, followed by inpatient costs (13).

Info box 1. The value of investing in prevention

Investment in preventive measures is a valuable tool for relieving disease and economic burden from HPV-related cancers. However, investment in immunization is suboptimal in the EU; about three-quarters of the member states spend less than 0.5% of their healthcare expenditure on immunization and only two member states spend more than 1% (14).

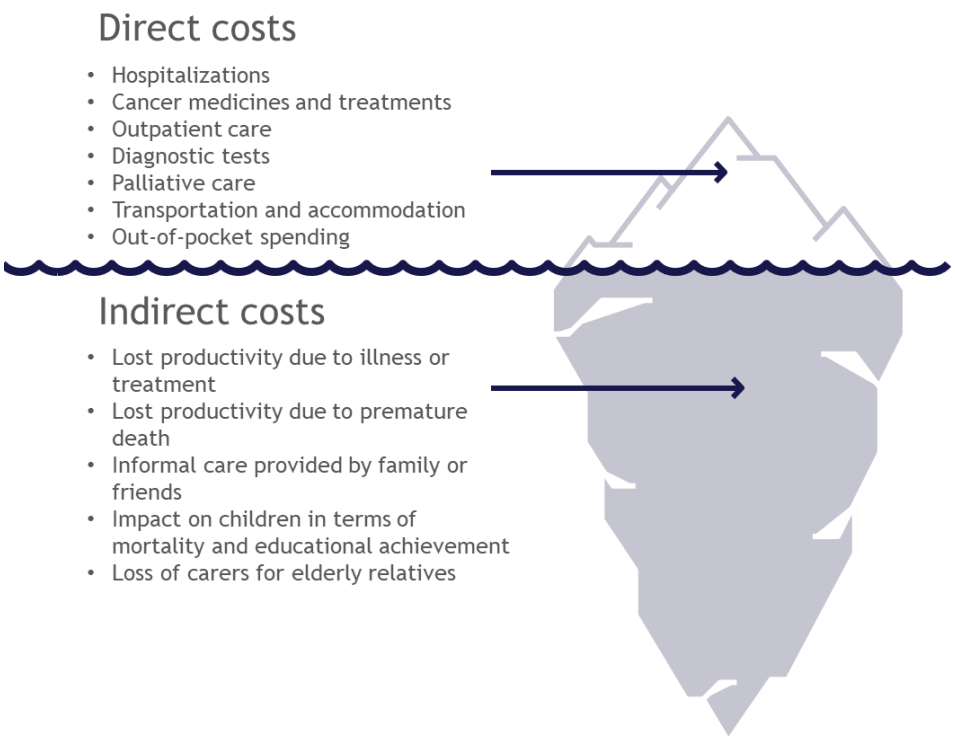
The low share invested is alarming, considering the great benefits and returns on investment (ROI) of prevention:

- Every dollar invested in prevention, early detection, and treatment of cervical cancer yields 3 - 8 times its value in economic benefit (11).
- Childhood immunization can return up to 44 times the cost invested (15).
- The returns of adult immunization programs reach up to 19 times their initial investment, when benefits beyond the healthcare system are taken into account (16).
- Investment in preventive interventions yields a median return of €14 for every €1 invested (17).
- Health protection and legislative interventions, as well as those implemented at national level, such as vaccination, generally yield higher ROI (17).

The evidence showcases the value of investing in prevention to alleviate the economic and societal burden caused by cervical cancer in Bulgaria.

Table 1: Components of the economic burden of cancer.

Direct costs	These are the costs of disease-related resource consumption. They include public and private expenditure for services within the health care system, such as diagnostic procedures, surgeries, radiation therapy, and medicines. Expenditure on social support services outside of the health care system are also direct costs. Expenditure by patients for travelling to receive treatment is also a direct cost.
Indirect costs (productivity losses)	These are the costs of patients' productivity loss arising from the inability to participate in the economy due to the disease. They consist of the temporary or permanent inability to work in the formal labor market (called morbidity) and from premature death (called mortality) of working-age patients.
Informal care costs	These costs represent the value of the time spent by family members and friends providing unpaid care, such as transportation to a health care facility or assistance with household chores.



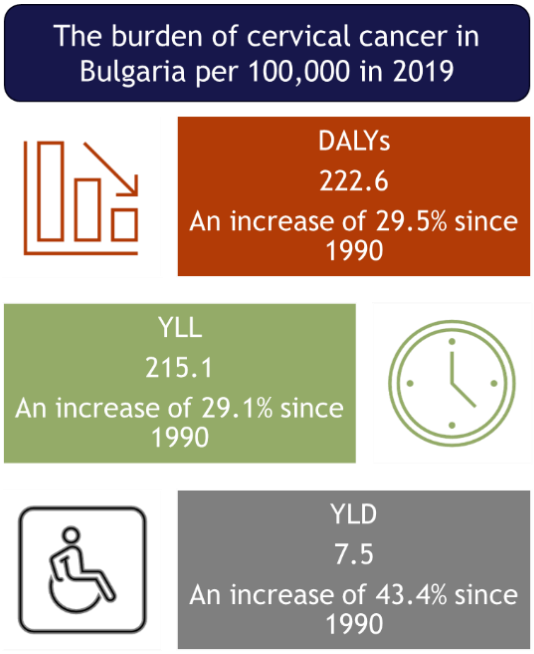


Figure 5: The burden of cervical cancer in Bulgaria in 2019.

Abbreviations: DALYs = Disability-adjusted life years; YLL = Years of life lost; YLD = Years lived with disability. Source: (19).

Info box 2. Cancer stage and treatment costs

The stage of disease when diagnosed often plays an important role in treatment costs. Data from Bulgaria reveal that treatment of early-stage cervical cancer costs €1,862; about 19 times less than treatment of late-stage cervical cancer, i.e. €34,635 (18).

In addition to lower costs, treatment of early disease incurs higher gains in quality-adjusted life years (QALYs); the gains in QALYs for early-stage cervical cancer are about 13, but only around 1.4 for late-stage disease (18).

Taken together, these data show the importance of prevention, early detection and management of cervical cancer, both in alleviating the economic burden and improving patient quality of life.

Cervical cancer also constitutes a high societal burden in terms of productivity losses. A study among 9 Central Eastern European countries, found that in 2019, HPV-related cancers[3] were responsible for €6.9 million in present value of future lost productivity (PVFLP) (20).

2.2 Cervical cancer patient pathway

International standards, guidelines, patient care algorithms for cervical cancer prevention and treatment are well-established. Given that cervical cancer is among the most preventable cancers, effective control begins with HPV vaccination, followed by screening, and timely treatment of precancerous lesions or cancer. Figure 6 below shows the continuum of prevention, control, and treatment, structured around the three key pillars: vaccination, screening and treatment. These pillars align with the WHO's global elimination targets and the EBCP, which aims to significantly reduce the burden of HPV-related cancers. The subsequent chapters of this white paper will examine each pillar in detail, highlighting opportunities to strengthen Bulgaria's response.

[3] For Bulgaria, HPV-related cancers referred to cancers of the cervix, anus, larynx and pharynx; for the rest of the countries 11 HPV-related cancer types were included.

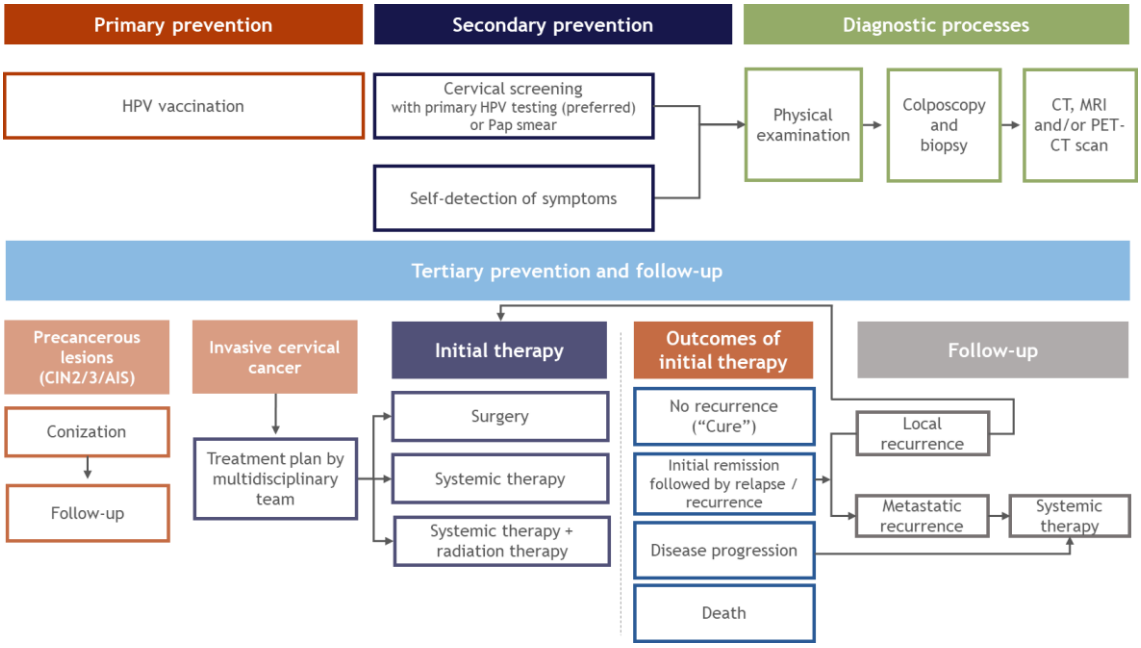


Figure 6: Cervical cancer pathway from prevention to treatment.

Note: based on ESMO and ESGO/ESTRO/ESP guidelines (21, 22). Abbreviations: CIN = Cervical intraepithelial neoplasia; AIS = Adenocarcinoma in situ; HPV = Human papillomavirus; Pap smear = Papanicolaou smear; CT = Computed tomography; MRI = Magnetic resonance imaging; PET-CT = Positron emission tomography-computed tomography.

GLOBAL & EUROPE

1990s

1993
1st European guidelines for quality assurance in cervical cancer screening

2000s

2006
1st HPV vaccine approved, covering 4 strains, among them 2 high-risk (16, 18)

2014
WHO global monitoring framework includes cervical cancer screening coverage as one of the 25 indicators for monitoring non-communicable diseases (NCD) progress

2010s

2016
WHO Strategic Advisory Group of Experts on Immunization (SAGE) recommends HPV immunization for individuals before sexual initiation

2020
WHO publishes the Global Strategy to accelerate the elimination of cervical cancer (90-70-90 targets)

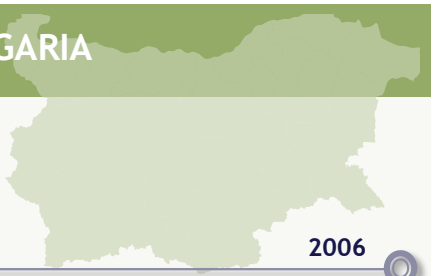
2021
Europe's Beating Cancer Plan: target 90% HPV vaccine coverage among girls and increase coverage in boys by 2030

WHO updated screening guidelines, recommending HPV DNA testing as the primary screening method, replacing visual inspection and cytology (Pap smear)

2020s

2022
Recommendations on the use of HPV vaccines were issued by the WHO Strategic Advisory Group of Experts (SAGE) on Immunization at its meeting in April 2022, and subsequently endorsed by WHO. The simplified schedule presents an opportunity to expand coverage in LMICs and whenever financial or logistical barriers exist. However, evidence on its long-term effectiveness beyond 10 years as well as protection in boys and at non-cervical sites remains limited. In addition, a single dose schedule represents off label use.

BULGARIA



2006
Updating of 2003 introduction of annual preventive health check ups (1st included BE for breast cancer) and in 2006 they added gynecological exams with cytology for women 30-40 every 2 years

2011
The gynecological exams with cytology expanded

2012
First National HPV vaccination program started with free vaccination for voluntary basis for girls aged 12-13

2021
HPV vaccination program includes girls aged 10-13

National program for the Prevention of chronic non-communicable diseases 2021-2025

2023
HPV vaccination program includes 9-valent vaccine in addition to 2 & 4

Bulgaria adopts its first National Cancer Plan 2021-2027 (Bulgarian Parliament), and it aligns with the EBCP, among them is a key action for introducing cervical cancer screening

Bulgaria closes the existing cancer Registry and transfers all data to the National Health Information System without a clear plan

2024
Bulgaria approved the National Health Strategy 2030 which prioritizes targeted action strategies on specific public health issues

2025
Gender neutral HPV vaccination

3. Primary prevention through HPV vaccination

HPV vaccination is the cornerstone of primary prevention of cervical cancer. Despite clear evidence of its effectiveness and longstanding recommendation, vaccination coverage in Bulgaria remains below the European and global targets.

After introduction of the HPV vaccination in Bulgaria, the vaccination coverage rate (VCR) of eligible girls reached 24% in 2013 (9). However, it saw a sharp decline in the years that followed, and in 2023, mere 2% of the eligible cohort of girls aged 10-13 got vaccinated against HPV.

In 2024, the WHO estimated that 9% of eligible girls received the final vaccination dose through the vaccination program below the European and global averages of 38% and 28%, respectively (23). Vaccination coverage by age 15 was estimated at 3% among girls in the same year, compared to the EU-27 average of 59%; see Figure 7. Data for vaccination among boys in Bulgaria are not yet available, as vaccination initiatives have only started targeting boys in the country in mid-2025. These numbers indicate a substantial gap to reach the EBCP and the WHO targets of 90% HPV coverage for girls by 2030 (12, 24).

Evolution of HPV vaccination program in Bulgaria

Bulgaria's HPV vaccination program has undergone several phases of development, reflecting both challenges and progress in public health implementation.

The first HPV vaccination program was initiated in 2012, offering free vaccination to girls aged 12-13 on a voluntary basis. The target groups of the national HPV vaccination program expanded over time, and in 2021 girls 10-13 years old were included.

In 2023, the HPV nonavalent vaccine was included in the Bulgarian vaccination program. During the same year a media campaign was launched to raise awareness of the benefits of HPV vaccination.

An important milestone was reached in 2025, with the introduction of gender-neutral vaccination (GNV) and the expansion of the target group. From 2025 to 2030, the National Program for Primary Prevention of Cancers Caused by Human Papillomavirus (HPV) 2025-2030, gradually includes boys aged 10-13/14 and young women up to 21 years old, and sets specific coverage goals for each group, see Table 2.

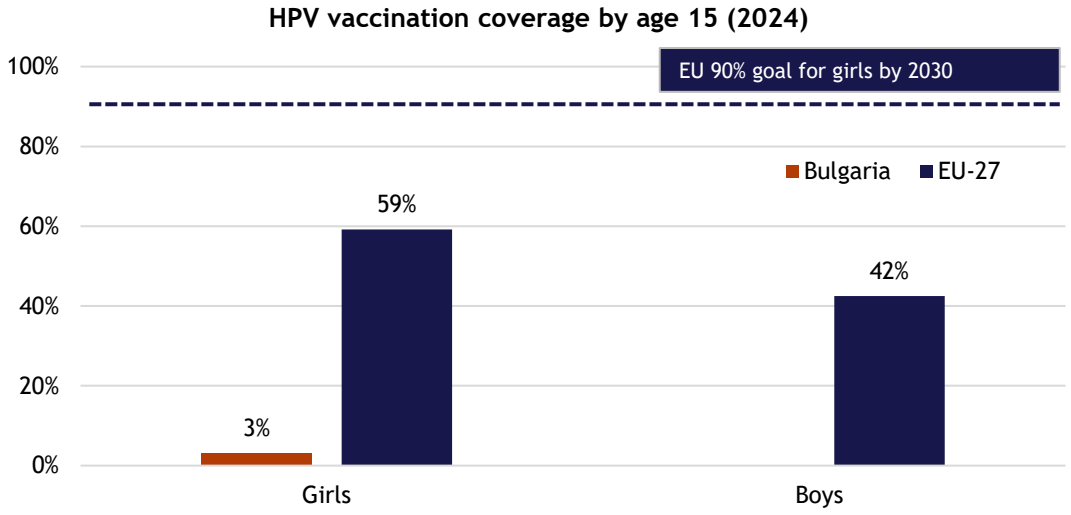


Figure 7: HPV vaccination coverage of girls and boys by age 15 in Bulgaria and EU-27 in 2024.

Note: HPV vaccination coverage rate (VCR) refers to last-dose coverage by age 15 in 2024. A weighted average of EU-27 was estimated. Source: (23).

Info box 3. The case for school-based & school-assisted HPV vaccination[4]

Embedding HPV vaccination within schools enables systematic outreach, minimizes logistical barriers, and supports higher and more equitable vaccination rates compared to primary care or facility-only-based programs (25). To achieve the desired outcome – high VCR, it is important that there is strong collaboration between the Ministry of Health and Ministry of Education, and strong engagement between school staff and healthcare workers. While the school-based vaccination programs take time to establish, a stepped and well-planned approach can begin by improving health education, including on HPV and vaccination, for students and parents.

Best practice examples from abroad can offer valuable insights for Bulgaria:

- **Sweden:** HPV vaccination has been part of the school-based vaccination program for girls since 2012 and extended to boys from 2020 (26). All girls and boys in year 5, a school nurse administers HPV vaccination to all children whose parents have signed the consent. The nurse acts as the primary information source for children and parents. Sweden's HPV vaccination strategy relies on an "organized" and school-based program to achieve high coverage. All schools are automatically enrolled and have an assigned nurse that will cover it for school-health services (27).

- **Poland:** Poland's school-assisted vaccination program is very young and has operated since August 2024. The primary school-assisted vaccination program has already recruited 40% (5,207 schools) of schools in 2024/2025 (28). Though regions show varying uptake, where successful, the program relies on strong public health and school collaboration, and ongoing campaigns that target parents and adolescents.

3.1 Infrastructure for monitoring and evaluation in primary prevention

Publicly available and internationally comparable HPV vaccination data from Bulgaria are limited. The number of HPV immunizations are available on the National Health Information System (NHIS), and are further disaggregated by region on the "Plusmen" platform (29, 30). "Plusmen" is a platform coordinated by the Ministry of Health, that also provides information on the National Program for Primary Prevention of Cancers Caused by HPV 2025-2030, and a list of specialists who perform HPV immunizations. Although these partial data are available, there are no publicly available HPV VCRs for the target populations in the country. In addition, there is not enough evidence on parental and HCPs attitudes regarding HPV vaccination. Taken together, insufficient evidence makes it challenging to make definitive conclusions about the situation of HPV vaccination in the country and benchmark it against international targets.

Progress of healthcare digitalization in Bulgaria

Since 2020, Bulgaria has been using electronic health records (EHRs) for every healthcare user, which are continuously updated (31). The electronic health records gather information in several modules, e.g. examinations, referrals, prescriptions, results, and immunizations, and annual statistical reports with data from 2021 onwards are available through the NHIS. Robust digital data infrastructure underpins effective monitoring and evaluation, prerequisites for successful national cervical cancer elimination strategies.

Since 2022, healthcare users can access their health record through a web platform and a mobile application, "eZdrave" (eHealth) (32). In the following years, further updates and improvements to the digital systems have been conducted. For example, the "eZdrave" application sends notifications when new documents are registered in the record, when referrals and prescriptions are close to expiring, or when preventative examinations are due. In 2023, parents started having access to their children's health records.

The new digital infrastructure signifies important progress in Bulgaria in terms of health data collection, enabling faster and more efficient care provision. In addition, the existing infrastructure offers the potential to summarize

[4] Internationally, the term "school-based vaccination" is widely used to describe programs delivered directly within the school setting. In Poland, HPV vaccination is primarily administered through outpatient clinics, with schools serving as a secondary point of engagement that supports and facilitates the process (information, consent procedures, coordination, and the school also serves as the vaccination venue, with administration performed by a clinic team).

and present more advanced and population-representative statistics, which are valuable in the monitoring and evaluation of health outcomes in the country.

Best practice examples from the Nordics and Slovenia

Transitioning to a mature data infrastructure presents a great opportunity; Bulgaria can move toward next-generation, vendor-neutral data architectures that are designed for interoperability, sustainability, and public value.

Such approaches, based on open standards, separate health data from specific software applications, allowing data to be captured once, remain consistent over time, and be reused securely for multiple purposes, including clinical care, program monitoring, cancer registries, research, and policymaking. Importantly, such architectures support privacy by design, enabling permissioned data sharing while keeping stewardship and control with trusted public institutions.

Transitioning to this model represents a significant paradigm shift, requiring new governance models and skills, however, the long-term benefits are substantial: data infrastructure based on open standards embodies the principles of a patient-centered and value-based health care, where individuals are visible across the continuum of care, data follows the patient rather than the institution, and national programs are equipped with the evidence needed to achieve cervical cancer elimination.

These approaches have a track record in the Nordics, however, even south and eastern Europe is catching up, with Slovenia being the most recent example of passing the law to support this type of digitalization on a national level in 2025 (33, 34).

The National Program for Primary Prevention of Cancers Caused by HPV 2025-2030 sets the goal of creating an information portal for the reporting of HPV vaccination coverage both at regional and national levels, which is necessary to improve data availability and monitoring of the country's progress (35). The development of an HPV Dynamic Dashboard could serve as an important next step. Such a digital tool would enable real-time, geographical-level monitoring of vaccine uptake, facilitating detection of regional disparities, tracking of progress over time, and timely adjustment of policy and implementation strategies. Beyond improving responsiveness resource allocation, a dynamic dashboard would also strengthen coordination between national and local health authorities, support public communication, and enhance policy evaluation.

Info box 4. Best practice examples: HPV dashboard

An HPV Dynamic Dashboard is a valuable tool to support the monitoring and evaluation of HPV vaccination. Some countries already use such tools in their decision-making. Most commonly, national institutes for public health have become the owner of such platforms, thus ensuring reliability, credibility, and sustainability of such important infrastructures.

Bulgaria has a dedicated portal owned by the Ministry of Health, where vaccinations, including HPV are recorded. To date, only absolute numbers are reported, thus overlooking VCR, a key information from such tools (29).

Slovakia and Poland are two countries where the HPV Dashboard is available and regularly updated, providing disaggregated vaccination data. For example, in Slovakia vaccination data are updated twice per year with high granularity; they are disaggregated by sex, year of birth, territory of residence and number of doses. Released data have informed decisions, such as the extension of reimbursement to more age cohorts, the sending of automized vaccination reminders, and the expansion of best practices, such as the mass vaccination campaign in Bratislava, to more municipalities.

To further develop and upgrade the HPV dashboard, the future steps involve understanding the local regulatory context and identifying opportunities as well as relevant stakeholders that can secure the necessary resources for redesign of the dashboard. It is important to define the metrics of success and the key actions to be undertaken. Ensuring sustainability with continuous stakeholder engagement is key to achieving progress and improvement over time.

3.2 Stakeholder participation in primary prevention

Success of HPV and cervical cancer elimination efforts does not only require good governance, but also strong participation of healthcare professionals and citizens. Over the past years, Bulgaria has intensified efforts to raise awareness of the benefits of HPV vaccination and increase its uptake. This has been particularly important due to the decreasing VCR over time,

following damaging media campaigns that placed a spotlight on vaccine side-effects, and caused mistrust among parents, instead of a constructive debate around primary prevention.

In 2023, a media campaign was initiated and several awareness-raising activities took place, organized by stakeholders, such as the Ministry of Health (MoH), professional organizations, and the HPV Coalition (35). These efforts were considered successful as the number of girls that initiated vaccination, doubled in 2024 compared to 2023 (35). Local experts highlighted the need for systematic education on HPV and its prevention, to ensure sustainability. Examples of interventions may include the introduction of age-appropriate health education in school curricula and the increase of courses related to epidemiology, infectious diseases and vaccines, in university curricula for HCPs, such as nurses and pharmacists. Universities are an important setting to utilize in awareness-raising efforts, as shown by recent examples coming from the country.

Info box 5. HPV awareness-raising initiatives in Bulgaria & beyond

- **2023**: The HPV Coalition organized an "Academy" for journalists, social media influencers and parents, and provided participants with a certificate on HPV knowledge. These events increased visibility on both traditional and social media, placing HPV and primary prevention high on the agenda.
- **2025**: At the Faculty of Pharmacy, Medical University Sofia, the students organized workshops and seminars on vaccination, as well as an informational campaign on vaccination and associated risks. For this initiative, students created brochures to share information not only on the campus, but also by talking to people on the street. The topic of HPV vaccination was also included in the course of pharmaceutical care.

Similar locally led initiatives are taking place in neighboring countries as well.

- **Romania:** The ***"HPV Free Cities"*** initiative is designed to increase community engagement and improve HPV vaccination coverage rates (36). It is part of a broader community-driven public health communication initiative, designed to deliver a scalable "plug-and-play" toolkit—including a guide, visual assets, and educational materials—that other counties can begin adopting starting in Q3 2025 and continuing throughout 2026. The first city in the rollout is Cluj, with the Coalition having been launched also in Timișoara. The next city is Bucharest (October 2025), followed by Craiova.

These examples highlight the importance of multisectoral engagement in the effort to improve uptake of HPV preventive measures. Sharing such locally led initiatives is important to mobilize additional stakeholders and groups in the future.

When knowledge about HPV and its potential impact is suboptimal, organized educational efforts play an important role in addressing people's concerns and ambivalence. Over the years, parental attitudes towards HPV vaccination have improved in Bulgaria; willingness to vaccinate one's children increased from 2023 to 2024, whereas the proportion who believes that vaccination is unnecessary decreased from 14% to 1.6% (35). A survey among mothers of girls in showed that they have a relatively good level of HPV awareness and one-third considers vaccination effective, however, they report a need for more information (38). Gynecologists are currently still the primary specialists informing women on HPV vaccination and thus it is important to equip them with adequate resources and tools to strengthen their role as prevention ambassadors. At the same

Info box 6. Best practice example: Walk-in HPV vaccination sessions

In March 2024, the Institute of Public Health of Vojvodina in Serbia launched the "Open door" walk-in vaccination sessions, when the HPV vaccine can be administered without prior appointment (37). "Open door" sessions are implemented three times per year and last for a week. Educational content and information on sessions are shared through media (TV, radio, social media), as well as in collaboration with school principals, with information about the timing and setting of the sessions communicated to parents through SMS or Viber messages. The initiative has been associated with increased HPV vaccination uptake, with vaccination peaks during the weeks of "Open door" implementation.

In addition to the ongoing activities in Bulgaria, such "Open door" initiatives could further complement the efforts of raising awareness and participation in preventative behaviors.

time, more healthcare professionals (HCPs) need to participate in raising awareness and promoting health literacy among broader audiences.

Since 2025, the "eZdrave" app includes a "health library" section that uploads health information verified by authorities. This tool is a great initiative that aims to centralize and harmonize the resources and health-related messaging. Its uptake has been slow, with only ~200,000 registered users as of end of 2025, but in the future, such resources integrated into the EHRs hold promise in dissemination of the latest evidence on HPV prevention and beyond.

Southeast Europe commits to eliminating HPV-related cancers

The work towards cervical cancer elimination should not be conducted in isolation; international collaboration provides the opportunity for countries to exchange experiences and provide support towards a common goal. International commitments to actions can further empower and mobilize individual actors.

In January 2025, European Cancer Organisation (ECO) held the conference "*A Shared Vision for Southeast Europe: Eliminating HPV Cancers Together*" at the Bulgarian Parliament (39). The conference brought together stakeholders from Southeastern Europe, i.e., Albania, Bosnia and Herzegovina, Bulgaria, Croatia, North Macedonia, Romania, Serbia, Slovakia and Turkey, with the goal of enhancing cross-border collaboration in eliminating HPV-related cancers in the region.

The conference resulted in the Joint Declaration "*Message across borders - A Regional Call to Action to Eliminate HPV in Southeast Europe*", through which stakeholders committed to actions that will:

i. strengthen data and monitoring systems,
ii. engage stakeholders for collective action,
iii. expand gender-neutral vaccination coverage,
iv. enhance screening programs, and,
v. address common challenges together.

3.3 Policy agenda and global alignment

It is important to view Bulgaria's performance in light of the global, EU, and national objectives for HPV vaccination. International frameworks, such as the WHO Global Strategy, set ambitious benchmarks aimed at eliminating cervical cancer as a public health problem, while Europe's Beating Cancer Plan outlines concrete timelines and coverage targets. The Bulgarian National Program for Primary Prevention of Cancers Caused by HPV 2025-2030, as well as the National Plan to Fight Cancer in the Republic of Bulgaria 2030, sets specific targets for the immunization of target groups. The comparison in Table 2 highlights the scale of the gap between current vaccination levels and the milestones needed to align with these commitments.

Table 2: Key objectives for primary prevention worldwide, the EU and Bulgaria.

Key objectives	
World 	• 90% coverage of HPV vaccination in girls by 2030 in the Global strategy to accelerate the elimination of cervical cancer as a public health problem (12).
EU 	• Under Europe's Beating Cancer Plan, the EU has set a goal to vaccinate 90% of girls in the target population against HPV and significantly increase the vaccination of boys by 2030 (24). • The Council Recommendation adopted in June 2024 supports Member States by providing a common framework to strengthen HPV vaccination program, improve monitoring and data systems, promote

Key objectives	
	equitable access, and share best practices, with EU-level support through the EU4Health program, Horizon Europe, and ECDC coordination under the European Health Union (40).
Bulgaria 	• The National Program for Primary Prevention of Cancers Caused by HPV 2025-2030, aims to gradually increase vaccination coverage among certain groups, and reach a VCR of: i. 70% among girls aged 10-14 by 2030, ii. 30% of boys aged 10-13 by 2028 and 40% of boys aged 10-14 by 2030, iii. 10% annually among girls aged 15-17 from 2026-2028, iv. 10% annually among women aged 18-21 in 2029-2030 (35). • It additionally aims to increase public awareness of HPV prevention, through several measures, e.g. i) national information campaigns for people in the target groups and their guardians, ii) messages on platforms such as “eZdrave”, to inform people in the target groups about the possibility to get vaccinated, and iii) to enhance collaborative efforts with different sectors, e.g. education, sports, culture, science (35). • Another goal is to involve a wide range of medical specialists in implementing HPV vaccinations, e.g., general practitioners (even for those not registered in their patient lists), pediatricians, obstetricians-gynecologists, and other professionals, and, • facilitate access for those in vulnerable groups, through the introduction of mobile teams and vaccination points to better include the hard-to-reach communities. • The National Plan to Fight Cancer in the Republic of Bulgaria 2030, sets the goal to prevent and reduce cancer risk cause by infections in the period 2025-2030. Relevant measures include achieving and maintaining a >95% HPV VCR (41).

4. Secondary prevention through screening

Early detection through cervical cancer screening remains a critical tool to reduce disease incidence and mortality. Organized screening programs can detect precancerous lesions and early-stage cancers, significantly improving outcomes. At present, Bulgaria screens opportunistically.

Evolution of cervical cancer screening in Bulgaria

In 2003, Bulgaria introduced preventive health checkups on an annual basis, for all citizens above 18 years, covered by the National Health Insurance Fund (NHIF) (9). Starting in 2006, the checkups included cervical cancer screening through cytology. With Regulation No. 8, from November 2016, on preventive examination and dispensary visits, liquid-based cytological cervical cancer screening performed by an obstetrician-gynecologist is reimbursed by the NHIF every two years for women 30-40 years old (9). Formal invitations are not sent, and the individual is responsible for initiating their own visit. GPs are responsible for promoting cancer screening services to the target population and provide orientation, based on the person's sex and age.

A large screening initiative for cervical cancer was conducted through the "Stop and get checked" project, run between May 2009 and October 2014. The program invited eligible individuals to get screened for breast, cervical and colorectal cancer, but did not yield the desired outcomes (42). During that time, almost 1 million eligible people were invited to screen for breast, cervical, and colorectal cancer. However, the program did not reach its target of 400,000 examinations; only around 56,000 screening exams were performed, of which, 33,237 were Pap smears to detect cervical cancer (the rest were screening tests for breast and colorectal cancer). The number of examinations performed indicate a participation rate of 5.5%.

In 2024, the Bulgarian government announced that a widespread cervical cancer screening program, with an initial funding of €4.5 million, will be launched, including women aged 20-49, regardless of their insurance status (43). The utilization of mobile units for hard-to-reach places and an information campaign with an allocation of €1 million, were also announced.

In implementation of the National Plan for Combating Cancer in the Republic of Bulgaria 2027, adopted by Decision No. 3/04.01.2023 of the Council of Ministers, the Cervical Cancer Screening Campaign 2025 - 2030 has been approved.

The campaign provides for conducting medical diagnostic tests to detect DNA of 14 high-risk genotypes of human papillomavirus (HPV) in vaginal samples from women aged 25 to 65, collected with a self-sampling kit. Participants in the screening campaign will be provided with a home sampling package, along with instructions for its use. The person must provide the collector with the sample taken to a clinical laboratory included in the list of clinical laboratories participating in the screening campaign (44). Test kits are to be distributed by GPs and regional health inspectorates.

At present, the Ministry of Health has submitted a request for the supply of medical devices and the campaign is expected to start the first half of 2026.

Cytological (Pap smear) sampling for cervical cancer screening, is performed by a gynecologist as part of annual checkups. A woman may directly visit her gynecologist and request a cervical cancer screening test or visit a GP that will, in turn, refer her to a gynecologist. When a woman is tested for the first time, she is tested for two consecutive years. In case of negative results, a Pap smear is then taken once every three years (41).

Despite the availability of the cervical cancer screening, the rates remain relatively low in Bulgaria. Nonetheless, there has been a positive trend; self-reported data show that compared to the 2008 level of 47%, in 2019, the screening coverage was 57% among women aged 20-69 (9), see Figure 8.

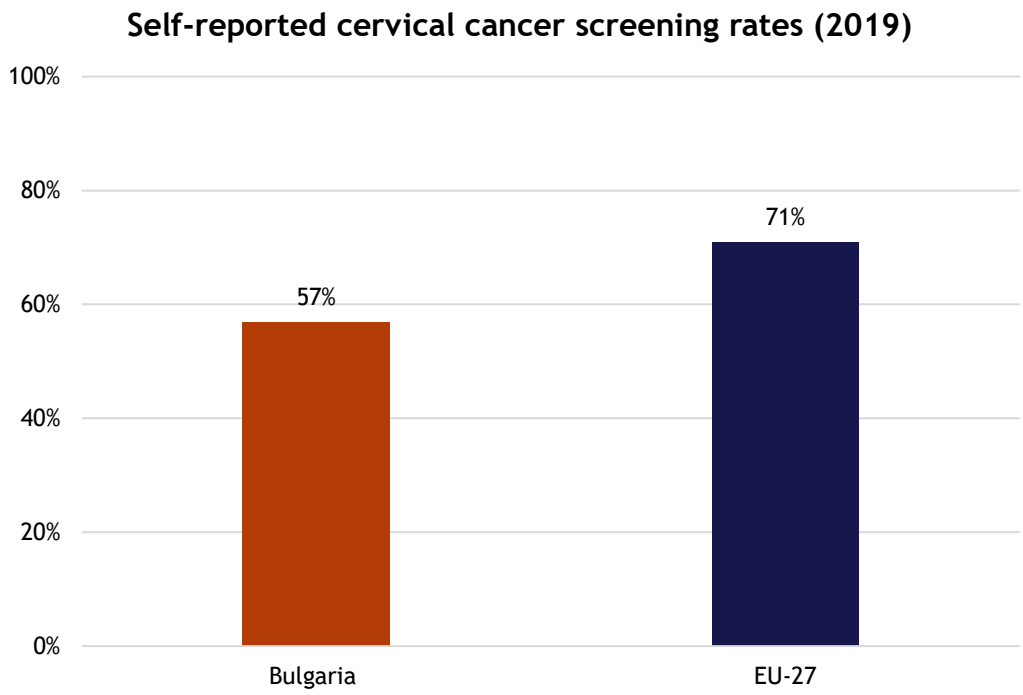


Figure 8: Self-reported cervical cancer screening rates in Bulgaria and EU-27 in 2019.
Note: Screening rates refer to screening within the last three years. Source: (45).

In the past, the suboptimal screening uptake, has been attributed to several factors, such as lack of commitment from the GPs and authorities at the regional/local level, long distance between invitee's residence and the location of medical specialists involved in the program, and the lack of coherence in notifications and invitation. In addition, the general distrust of the population towards the health care system and the lack of a preventive mindset compounded the difficulty.

In response, The National Plan to Fight Cancer in the Republic of Bulgaria 2030, proposed the introduction of cancer screening programs, including for cervical cancer, following European and international standards (41). Population-based screening will become an avenue for better coverage and outcomes but require a comprehensive infrastructure.

4.1 Infrastructure for monitoring and evaluation in secondary prevention

At present, the Bulgarian EHRs gathers information on several modules, such as examinations, referrals and test results (31). All information is entered into the database by medical specialists, regardless of how medical services were funded, including out-of-pocket expenses for privately done procedures. This allows for better and more equitable monitoring of care. Despite the availability of this basic data collection infrastructure, data on the screening coverage of the target population in the country is incomplete and seldom available.

A national screening registry, with nationally representative data for cervical cancer screening, is currently not available in Bulgaria. As part of the 2009-2014 screening program, a National Screening Registry and Notification System were created, but these are no longer utilized. The National Plan to Fight Cancer in the Republic of Bulgaria 2030 aims to develop a national cancer registry, which will, among others, include data on potential patients (from population programs), supporting monitoring of risk groups through screening. The development of the cancer registry is set to take place in the first stage of the National Plan to Fight Cancer (41). However, the strategy does not explicitly mention the development of a cervical cancer screening registry. Without a registry and accurate data, it will be difficult to measure the progress that Bulgaria is making and compare its performance against other countries, and international targets. The EHRs provide a basis that can be further utilized to create a valuable cancer registry with relevant data. As pointed out by local experts, work towards linking the national cancer registry with the NHIS is underway. Cross-sectoral collaboration and continuous political support are key to navigating this process and reaching the targets of the cancer plan in the specified timeframes.

Info box 7. Best practice example: Cervical cancer screening registry and invitation systems

Slovenia. Since 2003, Slovenia's ZORA program has operated as a population-based, centralized screening system with a centralized registry and a set of defined and monitored key-performance indicators (KPIs) (46). Managed by the Institute of Oncology Ljubljana, it invites all women aged 20+ for Pap tests every three years and follows up if no result is recorded within four years. Incidence has nearly halved, with ASR ~7/100,000 and coverage >70%. A single central registry links the ZORA database with the national population registry and updates nightly. This enables automated invitations, active follow-up, and continuous monitoring across both public and private clinics. Additional logistics include standardized triage algorithms, a set of monitored KPIs, professional training, multilingual materials, and a nurse-led helpline.

England. England's National Health Service (NHS) cervical screening program traditionally relied on mailed letters, but in 2024–2025 introduced a "'ping and book'" system sending invitations through the NHS App and SMS, with paper letters as a fallback (47).The system is integrated with NHS health records, enabling personalized app notifications linked directly to booking functions. Layered reminders (app first, followed by SMS and later a letter) ensure outreach covers both digitally connected and less connected groups, while GP practices receive lists of due patients for additional follow-up.

4.2 Stakeholder participation in primary prevention

Women in Bulgaria face several barriers in accessing cervical cancer screening, both at an individual and systemic level. Evidence show that common barriers to screening participation include lack of suggestion by the woman's doctor, the unpleasantness of the exam, and the high cost of the test, see Figure 9 (48). Barriers such as informal payments, shortages of supplies and the discouragement from getting preventive exams, coming from GPs, constitute some of the barriers that women express. Bulgarian women also identify difficulties in obtaining referrals to gynecologists given that GPs are "gatekeepers" in the Bulgarian healthcare system (9, 48). Since an invitation system for cervical cancer screening is not established in Bulgaria, it is important that women receive active reminders to increase screening participation. In turn, systemic barriers are associated with negative attitudes and norms towards screening, further exacerbating non-participation (48).

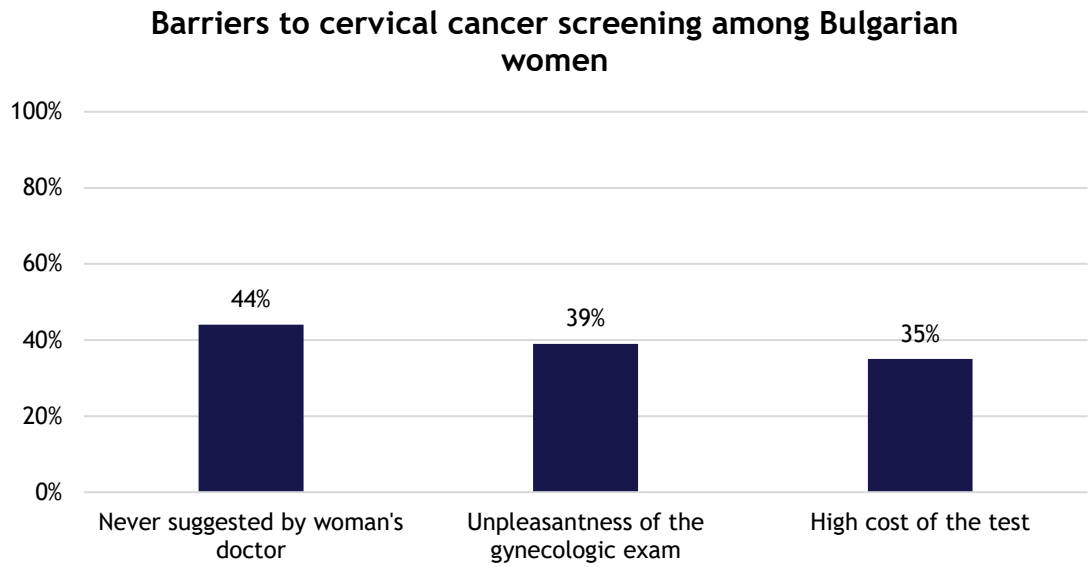


Figure 9: Barriers to cervical cancer screening among Bulgarian women (survey data[5]).
Source: (48).

Bulgaria also faces large socioeconomic disparities in screening participation. About three-quarters of women with higher education (73%) report that they performed a cervical cancer screening test in the last three years, compared to only one-third of women with lower levels of education (29%) (45). Uneven screening coverage is also noted across women with different living environments; 47% of women in rural areas report participation in screening, compared to 63% of women from major cities (52). Individuals from disadvantaged populations, e.g., uninsured people, those of low socio-economic status and people from remote locations, may face additional barriers in accessing cancer screening, heightening health inequities. Although preventive check-ups and screening are covered by the NHIF, individuals without adequate insurance coverage are required to pay for the pap smear. Despite the overall low screening rates in Bulgaria, lesbian, gay, bisexual, transgender, intersex and queer (LGBTIQ) people aged 25-39 report a higher screening rate in the last five years (72%), compared to the EU average (64%), whereas those aged 40-55 report a similar screening rate in Bulgaria (73%) and the EU (74%)(9).

Info box 8. Reducing inequity in access through mobile units

One way to address geographic barriers and disparities is by using mobile units for delivering healthcare services. Countries in Europe already utilize mobile units to increase participation in cancer screening. In France, the "mammobile" is a fully-equipped mobile unit that aims to offer free breast cancer screening to women from underserved communities (50). In Ireland, mobile units for breast cancer screening are also deployed under "BreastCheck", the country's breast screening program (51).

In 2024, when the Bulgarian government announced the launch of a widespread cervical cancer program, the utilization of mobile units for hard-to-reach places was also mentioned (43). Measures such as the utilization of mobile units and the distribution of self-sampling kits (announced in 2025 by the Bulgarian MoH) can enhance equity in accessing screening services and early detection of cervical cancer (44).

The role of GPs is crucial in the screening process to adequately inform and refer women. This is highlighted by women themselves who consider that it is the doctor's responsibility to actively suggest screening (48). Therefore, greater support of GPs through education interven-

[5] Results derive from a secondary analysis of quantitative data first presented by Todorova et al. (49). The time period of data collection is not stated but most likely occurred before 2009.

tions that enhance a preventive mindset could support both primary and secondary prevention uptake.

Cervical cancer screening awareness-raising initiatives must also directly engage women. Evidence from Bulgaria shows that while nearly half of women express an intention to be screened within the next three months, many remain insufficiently informed and feel unable to make a confident decision, often expecting their doctors to initiate the conversation (48). To address the persistent gaps, education and health literacy initiatives should aim to strengthen understanding of cervical cancer and the benefits of early detection, using communication strategies that are culturally sensitive, tailored to local norms, and supportive of informed decision-making.

Info box 9. Anatomy of a successful screening campaign

Looking at examples of successful campaigns can inform the development of new ones.

Between March and June 2024, a nationwide and very successful campaign for colorectal cancer screening took place in Bulgaria (53). More than 93,000 tests were performed, and around 14% were found positive. The campaign was a private initiative of the "Lachezar Tsotsorkov Foundation", with an investment of €731,000.

An important component of this successful screening initiative was its effective communication, later recognized and awarded with the Effie Bulgaria Silver Award. The campaign used multiple channels to raise awareness, such as the internet, TV and radio stations, as well as information materials, both printed and for social media. In addition, adequate funding was available to allow for an organized multi-channel communication campaign with harmonized messaging.

The screening campaign is estimated to potentially contribute over €15.9 million to the GDP, over the lifetime of potentially diagnosed patients, as more than half of the participants were of working age. National implementation among the target population (individuals aged 50-74), can result in savings of over €13.8 million in healthcare costs by 2029 through the prevention of advanced stage disease.

4.3 Policy agenda and global alignment

Secondary prevention through screening is an important component for the elimination of cervical cancer, for which specific targets have been set at both International and EU level. The National Plan to Fight Cancer in the Republic of Bulgaria 2030 sets several objectives that are pertinent, see Table 3.

Table 3: Key objectives for secondary prevention worldwide, EU and Bulgaria.

Key objectives	
World 	• By 2030, 70% of women screened using a high-performance test by the age of 35, and again by the age of 45 (12).
EU 	• Under Europe's Beating Cancer Plan, by 2025, 90% of the target population should be invited for cervical cancer screening (24).
Bulgaria 	• The National Plan to Fight Cancer in the Republic of Bulgaria 2030, sets the overarching goal to introduce modern cancer screening programs, including for cervical cancer, which will cover the largest possible fraction of the target population, involve GPs in the process and follow European and global standards (41). • Specific activities related to cervical cancer screening include an educational and a screening program to be implemented by 2030. The educational program sets out to: i) raise public awareness on the

Key objectives	
	importance of early detection of cancer, ii) train medical professionals on the importance of screening programs and their role in informing eligible populations about them, and iii) build a multi-channel information network. • The screening program activities include, among others, the i) alignment of the program and clinical guidelines with European and international standards, ii) introduction of the HPV DNA test, iii) inclusion of GPs in the process, iv) definition of the target population, v) ensuring equitable access to the program, its sustainability, and proper documentation for monitoring and evaluation.

5. Tertiary prevention through treatment and management

Cervical cancer can either be detected when women notice symptoms or through screening before symptoms appear. Detecting precancerous lesions early and timely management of CIN can interrupt the disease process (54), avoiding the need for more complex and costly treatments. However, when cervical cancer develops, comprehensive treatment strategies become essential to achieve cure or control of the disease.

Cervical cancer diagnosis is confirmed by colposcopy and biopsy (21, 22). MRI, PET, or CT scans may also be used. Management of cervical cancer should be guided by a multidisciplinary team (MDT) (22), including oncologists, surgeons, radiologists, pathologists, and oncology nurses to ensure the most appropriate care for each patient.

The stage at diagnosis determines therapeutic options. Standard treatment typically involves surgical removal of the tumor and often the entire uterus, radiation therapy, and systemic cancer medicines, alone or in combination depending on the stage (22, 55). The updated WHO Essential Medicines List (EML) from September 2025, includes immunotherapy as a first-line monotherapy for metastatic cervical cancer (56).

Bulgaria experiences high burden from cervical cancer due to the limited utilization of prevention and early detection services, and limitations in the provision of cancer care. The situation is exacerbated by systemic gaps, such as the lack of a cancer registry and comprehensive data on treatment, as well as the absence of palliative services. This leaves Bulgaria at a low-moderate readiness level for cervical cancer treatment and management, with one of the lowest scores among neighboring and other Eastern European countries, see Figure 10.

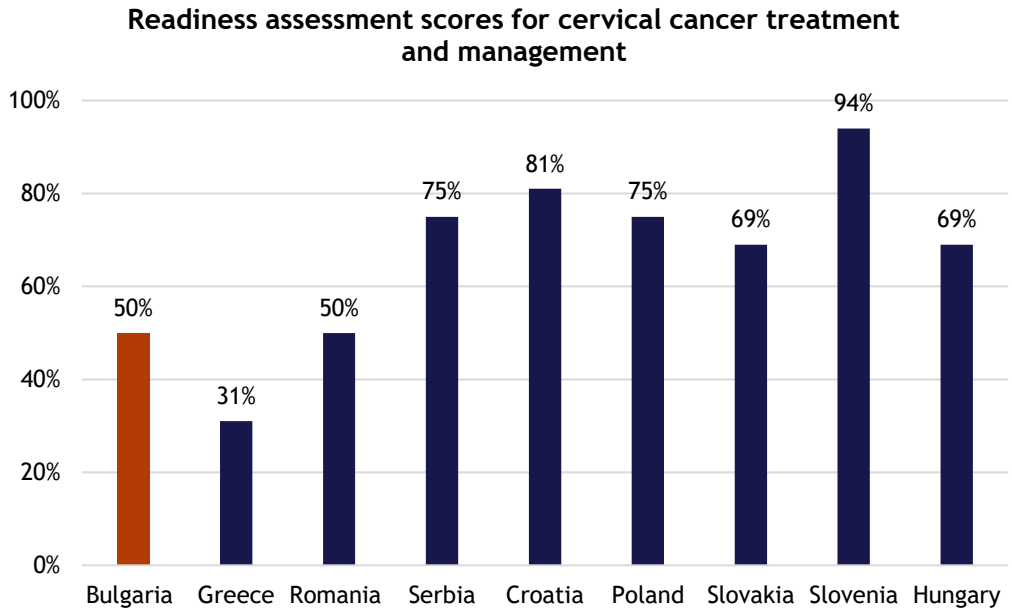


Figure 10: Scores of readiness assessment for cervical cancer treatment and management in Bulgaria and selected countries, according to the RACE framework.

Abbreviations: RACE framework = Readiness assessment for cervical cancer elimination framework. Source: (57).

5.1 Infrastructure, monitoring and evaluation in tertiary prevention

Data availability. Addressing the third pillar of the WHO CCEI and EBCP – 90% of women with precancerous lesions or cancer managed and treated, the ideal source of information for monitoring and evaluation are detailed clinical cancer registries. However, at present Bulgaria lacks the necessary registries and thus, accurate nationally representative data on cervical cancer incidence, mortality, survival and treatment rates, as well as other relevant indicators are not available. Bulgaria had a functioning national cancer registry since 1952; however, local experts highlighted that its coverage was suboptimal as it did not include data from all treatment units in the country. The BNCR ceased to exist in 2023 in order to be reorganized and digitalized (9). At present, the NHIS gathers data reported by medical professionals, and publishes statistical reports in several modules, e.g., examinations, referrals, medications, immunizations and hospitalizations.

A functioning information platform is the cornerstone of monitoring and evaluation of cancer outcomes, and a valuable tool for informing policy decisions and budget allocation. Available and comparable data can also be used to monitor and evaluate the country's performance and progress, as well as to conduct comparisons with other countries, and benchmark against international and European targets. The National Plan to Fight Cancer in the Republic of Bulgaria 2030 acknowledges the significance of data availability and sets the aim to develop an up-to-date cancer registry, as well as an oncology data and information plan, during the first stage of the National Plan's implementation period, i.e., 2022-2025 (41). As local experts highlighted, work to link the cancer registry with the NHIS has already been initiated. In this work, it is important to consider equity perspectives and the collection of data that will allow for monitoring inequities in the country and support the design of targeted interventions.

Challenges in diagnosis and treatment. Availability of diagnostic and therapeutic equipment is a crucial component of cancer care. Bulgaria has seen a large increase in the volume of radiotherapy equipment between 2012 and 2022, when it more than doubled, placing the country among the best-performing EU countries (9). Increases in CT and MRI equipment have also been noted. In 2022, Bulgaria had more than 47 CT scanners per 1 million inhabitants, almost double compared to the EU average, whereas MRI scanners remained lower than the EU. Despite progress in acquisition of new equipment, challenges and inequities in access remain. Equipment and medical centers offering oncology services are also unevenly distributed across the country; 40% of medical institutions providing such services, and half of the country's PET-CT scanners, are located in the capital (9, 58). As a result, university hospitals in other cities are unable to meet their patients' needs.

Info box 10. Best practice example: Equity indicators and treatment KPIs

In 2023, "Ireland's Cervical Cancer Elimination Action Plan 2025-2030" was published, which explicitly aims to make cervical cancer rare in every community and sets 2040 as the target year for elimination (59).

In the Action Plan, cervical cancer-specific treatment key performance indicators (KPIs) have been established (59). A central indicator tracks the proportion of women with invasive cervical cancer treated within one year of diagnosis. Ireland's baseline and national target is 97%, exceeding the WHO target of 90% treatment coverage by 2030. The Action Plan also commits to developing additional KPIs for timely outpatient services and for gynecological cancer pathways.

The overarching priority of the Action Plan is equity, reaching its cervical cancer elimination targets in all population groups by 2030. People from underserved communities were included in the development of the plan through focus group discussions. To achieve its goals, Ireland sets four priority actions which include: i) partnering with priority populations and co-designing solutions, ii) collecting priority data, iii) utilizing said data

to address disparities, and iv) implementing a new cervical cancer registry with enhanced ability to measure equity.

Ireland's Cervical Cancer Elimination Action Plan 2025-2030 places data, monitoring and evaluation at the core of its treatment KPI framework. It prioritizes the development of a suite of KPIs for gynecological cancer services to track treatment timeliness, alongside better integration of healthcare data across the care pathway to enable comprehensive monitoring. Progress toward national targets is published annually through a national cervical cancer elimination dashboard.

The example of Ireland showcases the importance of both data availability, as well as data granularity, in the fight against cervical cancer. This approach can also strengthen Bulgaria's effort in cervical cancer elimination by including the collection of granular data on socioeconomic and other demographic characteristics in the country's upcoming national cancer registry. Considering the equity perspective can support monitoring of inequities and inform decision-making and resource allocation to interventions that target groups with higher unmet needs.

Access to medicines. According to the European Federation of Pharmaceutical Industries and Associations (EFPIA) Patients W.A.I.T. Indicator (Patients Waiting to Access Innovative Therapies Indicator) 2024 Survey, the reimbursement rate for novel cancer medicines approved by the European Medicines Agency (EMA) between 2020 and 2023 was 64% in Bulgaria (as of January 5, 2025), above the EU average of 50% (60), see Figure 11. Overall, the availability rate of cancer medicines has increased since 2020 (W.A.I.T. Indicator 2019 Survey), when it was 49% (61). On the contrary, the average time from EMA approval to local reimbursement in Bulgaria is longer than the EU average. As of January 5, 2025, it takes an average of 25 months for new cancer medicines to be reimbursed, compared to the EU average of 20 months (60), see Figure 11. Over the years, the availability time in Bulgaria has remained fairly stable, from around 24 months in 2020 to 26 months in 2024, but has always been longer than the EU average (61, 62).

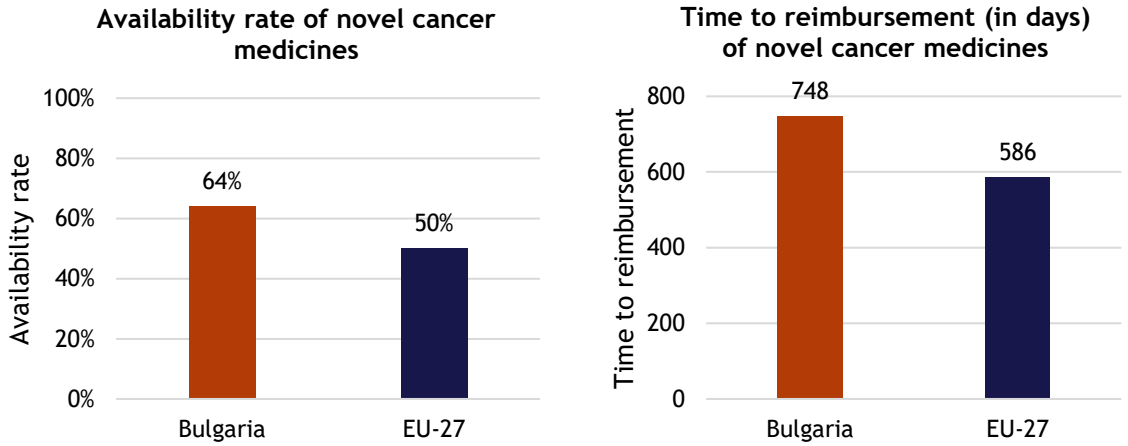


Figure 11: Availability rate and time to reimbursement (in days) of novel cancer medicines approved by the EMA in Bulgaria and EU-27 as of January 5, 2025.

Source: (60).

Although progress has been made in the availability of novel cancer medicines in Bulgaria, it still takes long until their reimbursement by the NHIF. Delays in the reimbursement process can hinder some cancer patients from accessing necessary treatment and increase inequalities. In fact, out-of-pocket (OOP) spending for medicines is the main driver of catastrophic health spending in Bulgaria, while one-fourth of cancer patients report OOPs for medical treatment (9).

5.2 Stakeholder participation in tertiary prevention

Healthcare workforce capacity is an important factor in timely management and treatment of cervical cancer. Bulgaria has a good availability of physicians (967 physicians per 1,000 new cancer cases), which is 42% higher than the EU average, see Figure 12. On the contrary, the country faces shortages in the availability of nurses, 31% below the EU (9). Several important specialties also face shortages, including GPs, where Bulgaria has the fourth lowest number in the EU, medical oncologists radiologists and radiation therapists (9). HCPs are unevenly distributed across the country and mainly concentrated in large cities, resulting in access difficulties for those in small and remote places. Notably, there are no nurses specializing in oncology care outside the capital, Sofia (9). These limitations can compromise access to quality and timely healthcare services, by increasing waiting times and delays across the cervical cancer patient pathway, from referrals and accessing specialists to diagnosis and treatment delays.

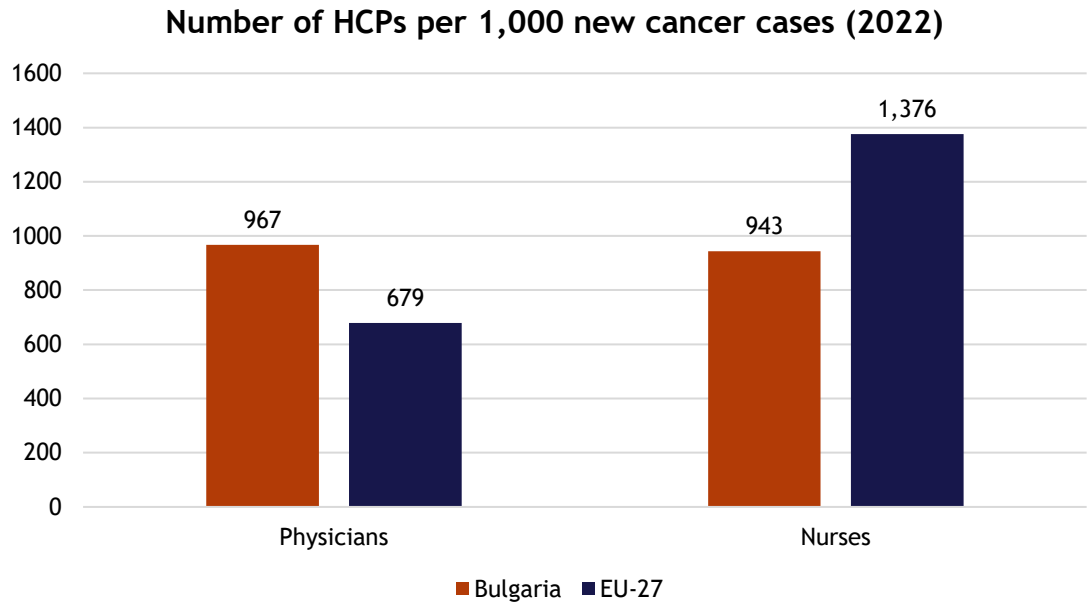


Figure 12: Number of physicians and nurses per 1,000 new cancer cases in Bulgaria and EU-27 in 2022 (or latest available year).
Note: The EU average is unweighted. Source: (9).

Bulgaria has made efforts to attract medical graduates in certain specialties that face shortages, including GPs (63, 64). One of the measures introduced was working and financial arrangements to provide more flexibility when choosing employment after graduation. The aim is a more even distribution of medical graduates across specializations, although monitoring of the initiative and its results is needed. Further amendments were introduced which allow certain professionals, e.g. physicians assistants, nurses, midwives, rehabilitation therapists, to practice certain nursing, preventive and health promotive services, independently or in groups. However, not many practices have been established, and these are mostly found in larger cities.

Further measures to improve access to care in underserved areas have been brought forward (64). In 2022, a new way of addressing workforce shortages in remote areas through financing healthcare establishments was introduced. In 2023, a map of long-term needs was developed, with the objective to inform planning and resource allocation based on population needs and infrastructure. The project “Doctors in Small and Remote Settlements” was also piloted,

including the provision of care to underserved populations by specialists in district hospitals. The aim is for the initiative to be expanded, by establishing outpatient facilities with a physician and a nurse, in small communities.

5.3 Policy agenda and global alignment

The WHO Global Strategy calls for 90% of women identified with cervical disease to receive treatment by 2030—both for precancer and invasive cancer (12). The EU adds specific targets: by 2030, 90% of women with Grade 3 precancerous lesions should be treated within three months, and 90% of invasive cervical cancers should be appropriately managed (24). The National Plan to Fight Cancer in the Republic of Bulgaria 2030 does not set cervical cancer-specific treatment targets but outlines broader objectives with direct relevance to cervical cancer (41); see Table 4.

Table 4: Key objectives for tertiary prevention worldwide, EU and Bulgaria.

Key objectives	
World 	• By 2030, 90% of women identified with cervical disease to receive treatment (90% of women with pre-cancer treated and 90% of women with invasive cancer managed) (12).
EU 	• Under the EBCP, the Commission will, by 2025, establish an EU Network linking recognized National Comprehensive Cancer Centers in every Member State to support quality-assured diagnosis, treatment, training, research and clinical trials. The Cancer Plan aims for 90% of eligible cancer patients to have access to such centers by 2030 (24). • Under the EBCP, one of the 2025 flagships is to develop guidelines and quality assurance schemes for cervical cancer screening, diagnosis, treatment, rehabilitation, follow-up and palliative care (24).
Bulgaria 	• The National Plan to Fight Cancer in the Republic of Bulgaria 2030 aims to modernize diagnostic and treatment services, and ensure equal access to these (41). • Specific measures regarding diagnostics include establishing a “Center of excellence” (by 2030), creating opportunities for telemedicine and artificial intelligence, (by 2030) as well as introducing a standard of care based on European or American guidelines (by 2025). • Specific measures regarding treatment include effectively implementing the multidisciplinary approach (by 2025), ensuring earlier access to treatment through regulatory changes (by 2025), as well as streamlining and enhancing training programs for HCPs.

6. A call to action: Cervical cancer elimination roadmap for Bulgaria

Bulgaria is facing important challenges in cervical cancer prevention and control. Despite recent progress in making HPV vaccination more broadly available, uptake and awareness remain low. Even though screening is offered nationwide, it remains opportunistic, and infrastructure shortages limit timely and equitable access to treatment and management. In addition, limited data and monitoring systems make it difficult to track progress or target interventions effectively.

The following roadmap serves as an advocacy tool to guide policymakers, clinicians, and partners in building the essential foundations for HPV and cervical cancer elimination in Bulgaria. It outlines priority actions to strengthen systems, pilot and scale new approaches, and ensure long-term sustainability—ultimately supporting the development of a comprehensive national elimination plan aligned with WHO's 90-70-90 targets and the latest EU recommendations. The proposed actions are organized into three sequential phases, each reinforcing the previous one, from immediate, high-impact steps to longer-term structural reforms.

6.1 Phase 1: Building foundations

The first step for to ensure robust data systems and infrastructure that will support Bulgaria in cervical cancer and HPV elimination, is building the foundations. This entails establishing the digital and institutional groundwork for data-driven care, policy, and research. To enable that, certain policy actions need to be prioritized; these are outlined below, accompanied with key enablers, relevant stakeholders to be involved, as well as potential challenges in implementation.

Priority action	Key enablers	Key stakeholders	Potential challenges
Develop an HPV Dashboard, an operational cervical screening registry and a comprehensive cancer registry	Political buy-in; Integration with National vaccination data; open data policies and legislation	Ministry of Health (MoH), National Center of Public Health, Non-governmental Organizations (NGOs), GPs, pharmacists, academia, media, NHIS, NIP, EU partners	Data fragmentation and incomplete reporting; interoperability barriers; limited technical capacity
Develop KPIs for monitoring and evaluation of care and train healthcare professionals and policymakers on effective data use	Existing collaborations with EU partners and organizations	Academic partners, health economists, policymakers, NHIS	Resource constraints; resistance to new metrics
Implement reminder and	Use of e-health infrastructure;	MoH, regional health inspectorates,	Low health and digital literacy; low

Priority action	Key enablers	Key stakeholders	Potential challenges
invitation system for HPV vaccination and cervical screening (via SMS, or digital health portals)	piloting in selected municipalities	primary care providers, NHIF	uptake of digital solutions and public trust issues
Develop and implement a national Strategy for Risk Communication and Community Engagement (RCCE) for HPV prevention and vaccination	Communication experts; NGO partnerships; EU funding	NGOs, patient orgs, media, educators, academia, NHIF, professional associations	Public misinformation; competing health priorities, suboptimal support from HCPs

6.2 Phase 2: Integration of the systems and piloting

The second phase towards cervical cancer and HPV elimination builds on having strong foundations in place, and involves the integration of the newly developed systems in practice, ensuring their linking and interoperability. In addition, this phase includes the piloting of interventions in the Bulgarian context, aligned with international guidelines, as well as integrating solutions for potential setbacks. Relevant priority actions, as well as enablers, key stakeholders and possible challenges are presented below.

Priority action	Key enablers	Key stakeholders	Potential challenges
Launch micro-elimination pilot programs and projects	Regional partnerships; EU twinning; local leadership	Regional municipalities, universities, NGOs	Uneven implementation (resources); sustainability post-pilot; quality assurance and monitoring
Link HPV dashboard, cervical screening and cancer data to create a centralized, national data registry	Legal frameworks for data sharing; digital ID systems	MoH, National Health Insurance Fund, National Center for Public Health and Analysis	Privacy regulation compliance; participation of all the necessary partners in reporting of the data; system maintenance costs
Introduce HPV-based primary screening (starting at age 30) and introduce self-	Updated clinical guidelines	MoH, labs, GPs	Cost barriers; supply chain issues; low participation

Priority action	Key enablers	Key stakeholders	Potential challenges
sampling options for non-attenders			
Co-develop culturally sensitive materials for HPV vaccination and cervical screening	Participatory design, funding of NGOs	NGOs, patient orgs, educators, grass-roots organizations that represent minorities	Cultural resistance; ensuring representation
Transition from opportunistic to nationally organized cervical cancer screening with set targets	National screening plan; financing and logistics support	MoH, primary care, gynecologists,	Workforce shortages and uneven participation across regions; public awareness gaps
Establish multidisciplinary teams that will be able to triage and manage patients (including palliative care services and psychosocial support), and establish guidelines for post-treatment follow-up	National and international guidelines; clear clinical pathways and HCP training programs	MoH, National Health Insurance Fund, Professional societies, patient organizations	Limited availability of professionals; lack of reimbursement; fragmentation of care, especially outside of major centers

6.3 Phase 3: Scalability and sustainability

The third and final phase of building robust infrastructure and achieving progress towards cervical cancer elimination includes the expansion of the newly developed capacity, and the sustainability of the systems and progress. In order to achieve that, effective governance and intersectoral collaboration are key. Building on the Organisation for Economic Co-operation and Development (OECD) Policy coherence for sustainable development approach (65), it is important to acknowledge the need for multi-stakeholder collaboration within and beyond governmental bodies, and the inclusion of HPV- and cervical cancer elimination in the work beyond the Ministries of Health and Education.

Priority action	Key enablers	Key stakeholders	Potential challenges
Transition to opt-out vaccination policy, before establishing mandatory HPV vaccination	Legal feasibility assessment; public dialogue	Parliament, MoH, ethics boards, NGOs	Social acceptability and political/legal feasibility

Priority action	Key enablers	Key stakeholders	Potential challenges
Expand vaccination capacity to more sites (e.g. schools) and more specialists (e.g. pharmacists)	National funding; public-private partnerships to ensure adequate reporting and monitoring of data	MoH, NIPH, municipalities, pharmacists	Funding sustainability; rural access
Institutionalize continuous monitoring through National Health Information System	Data systems build on open standards, low code technical solutions for registries, EU and global alignment	MoH, eHealth Agency, Eurostat, WHO	Cost; technical integration and feasibility
Research and evaluation platform beyond the HPV Dashboard (contains patient-reported outcomes measures (PROMs), sociodemographic barriers and impact evaluation)	Academic partnerships; EU research grants	Universities, National Center of Public Health, citizen	Funding and sustainability planning; data harmonization; stakeholder buy-in
Establish inter-ministerial and cross-sectoral collaboration mechanisms (e.g. health, education, labor, IT, social affairs)	Political will; policy coordination body; synergies with other national (and EU) initiatives and projects	Cabinet Office, MoH, Education, Social Affairs	Bureaucratic silos; changing administrations; competing priorities and budget restraints

Conclusion

Bulgaria has made significant strides toward cervical cancer elimination, but achieving national and EU targets requires coordinated, evidence-driven action across multiple fronts. The roadmap presented here identifies priority actions that build on existing initiatives, international best practices, and expert consultations.

Key lessons highlight that: robust data systems allow for progress monitoring and guide targeted interventions; awareness-raising initiatives improve attitudes and acceptance of HPV preventive measures; exploring measures to enhance access in hard-to-reach areas can minimize equity gaps; and multi-stakeholder and cross-sectoral collaboration drives sustainable action towards national goals.

By leveraging these enablers and continuing to advocate for supportive policy changes, stakeholders can ensure that cervical cancer elimination in Bulgaria becomes a sustainable reality and a catalyst for broader HPV-related disease control, while also generating substantial economic returns through reduced healthcare costs, higher productivity, and fewer years of life lost.

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