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# From Evidence to Impact: Multilevel Strategies for Cancer Prevention in Europe

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## ABSTRACT

**Background:** Around one-third to one-half of cancers in Europe are preventable, yet gains remain uneven because behavior change efforts—whether focused on individual choices or shaped by legislative, fiscal, educational, and social environments—are too often decoupled from the structural conditions that influence those choices.

**Objective:** To synthesize evidence on multilevel cancer-prevention strategies in Europe and to propose a practical agenda for oncologists and multidisciplinary teams.

**Methodology:** Narrative review of WHO/IARC/WCRF guidance and high-quality evaluations across six domains where policy and legislation can encourage voluntary behavioral change by facilitating the healthier choice: tobacco, alcohol, nutrition/physical activity, screening, vaccination, and digital environments, integrating illustrative quotations from peer-reviewed publications co-authored by the authors to ground policy advocacy in science.

**Results:** Prevention is maximized when individual support is aligned with structural levers. Effective measures include: for tobacco and alcohol: taxation/

pricing, comprehensive marketing restrictions (including online), smoke-free and availability policies, clear labelling, and routine brief interventions; for diet and physical activity: healthy food environments (front-of-pack labelling, reformulation, fiscal tools, protection of children from marketing of unhealthy products), and active-living infrastructure coupled with clinical counseling; for early detection and infection-related cancers: organized, quality-assured screening (HPV-based cervical, breast, colorectal; targeted lung in high-risk populations) and high-coverage vaccination (HPV, HBV). Cross-cutting enablers are equity-by-design, youth protection, robust information systems, and implementation/quality assurance.

**Conclusion:** Bridging behavioral interventions with structural policies can substantially reduce preventable cancers and narrow inequities in Europe. Oncologists and multidisciplinary teams can accelerate impact by embedding brief prevention in care pathways (smoking cessation, alcohol advice, weight management and physical activity), supporting organized screening and vaccination uptake, partnering with primary care and community actors (especially youth organizations), and advocating evidence-based policy within Europe's Beating Cancer Plan. This pragmatic alignment of clinic, community and policy turns evidence into impact, aligning with the principles of the European Code Against Cancer, including its newly launched 5th Edition, which reinforces the need for multilevel action.

**Keywords:** Cancer prevention; European health policy; behavioural interventions; structural policies; health equity; oncology.

# Introduction

Cancer remains a leading cause of mortality in Europe accounting for 1.1 million fatalities and representing 21.6% of all deaths across the region in 2021 (Eurostat, 2024). An estimated 30–50% of cancers are preventable through primary and secondary prevention that address modifiable risk factors and ensure early detection underscoring the need for more robust public health interventions that prioritize prevention over cure[1,2,3].

The European Code Against Cancer (ECAC) provides evidence-based recommendations for individuals and policy-makers, having the 5th Edition been launched this year[4], building on previous versions by emphasizing equity digital environments, building on previous versions by emphasizing equity digital environments, youth engagement, while reaffirming core lifestyle and screening guidance. These principles align with Europe's Beating Cancer Plan, which mobilizes EU-level investment to reduce the cancer burden across the continent. Prevention is one of its four pillars with ambitious goals, such as, creating a "tobacco-free generation" by 2040[5]. However, implementation remains uneven, with many strategies lacking actionable mechanisms, funding pathways or measurable outcomes[6,7].

Under normal conditions—during peacetime and in a reasonably stable social context—cancer prevention is partly in individuals' hands: their decisions and behaviors can increase or reduce the underlying risk associated with the development of cancer. However, these behaviors are shaped by broader legislative, fiscal, educational, and social environments, which influence how easy—or difficult—it is to adhere to healthier lifestyle patterns. Aligning personal interventions with enabling policies is essential to make healthier choices easier and more sustainable[8].

# Principles: Behavioral and Structural Interventions

Prevention is maximized when individual-level support, such as counseling and education, is aligned with structural levers like taxation/pricing, marketing restrictions, labelling, urban design, and social protection[9]. This dual approach recognizes that behavior change is not solely a matter of personal willpower, but also of opportunity shaped by policy and environment.

One key insight is that changing behaviours requires addressing the "causes of the causes." Spreading information about quitting smoking, eating better, or exercising is relatively easy and inexpensive; the true challenge lies in removing the structural and social hurdles that prevent people from acting on that information. While knowledge is the foundation of any successful public health initiative, it is not enough on its own to change behavior. Learning must lead to empowerment, and empowerment must be paired with opportunity. Telling people what is healthy is ineffective if their environment offers no support to act on that information—a principle already underscored in the Ottawa Charter for Health Promotion back in 1986[10]. For example, if a town has no safe sidewalks or bike lanes, advising residents to be more physically active will have limited effect. If healthier foods cost significantly more than processed, high-sugar products, nutritional education alone will not change diets in low-income families.

Effective cancer prevention, therefore, must involve multiple stakeholders working in concert to build an ecosystem that fosters healthy behaviors. Governments, civil society organizations, schools, employers, urban planners, and healthcare providers all have roles to play in this ecosystem. Practical steps include investing in infrastructure (like parks, sports facilities, and water supply), regulating advertising and availability of tobacco,

alcohol, and junk food, and integrating health promotion into community programs and primary care[11,12,13,14,15].

## Tobacco: Comprehensive Control and Emerging Digital Risks

Tobacco use remains the leading preventable cause of cancer in Europe and globally. Combustible cigarettes are classified as Group 1 carcinogens and drive substantial burdens of lung and multiple other cancers, alongside cardiovascular and respiratory disease[16]. Reducing initiation and accelerating cessation are therefore central pillars of any cancer prevention strategy. Comprehensive tobacco control—taxation, smoke-free laws, plain packaging, point-of-sale restrictions, cessation support—should now be complemented by measures in digital environments where young people are exposed to tobacco and nicotine marketing[17,18].

The World Health Organization's Framework Convention on Tobacco Control (FCTC) has served as a global catalyst for anti-smoking legislation19. The United Kingdom, for example, combined standardized packaging, high excise taxes, and national cessation support to reduce smoking prevalence from 20.2% in 2011 to 12.9% in 2022[20]. Similarly, the Netherlands launched the "Smoke-free Generation" movement, led by civil society organizations, which helped accelerate declines in smoking and demonstrated the power of unified advocacy[21]. Comparable measures in France, including plain packaging and tax increases, have also contributed to declines, primarily among youth[22,23].

As for electronic cigarettes (e-cigarettes) and heated tobacco products (HTPs), these are widely marketed as "reduced-exposure" alternatives to combustible cigarettes and, in some settings, as cessation aids. While exposure to certain toxicants may be lower than in cigarette smoke, neither category is risk-free[24], and their long-term health effects remain under study. Both deliver nicotine and can introduce additional harmful constituents, raising concerns particularly about youth uptake and dual use[25,26,27]. In light of these uncertainties, we advise against their use and urge coordinated policy action to curb marketing and forbid all forms of advertising.

Alcohol: Price, Marketing and Availability
Alcohol is a Group 1 carcinogen[28]. Sustained, population-level reductions in alcohol-attributable harm require a comprehensive policy package combining higher, inflation-indexed excise taxes (and, where appropriate, minimum unit pricing), strict marketing controls across all media, improved labeling, and tighter availability policies (outlet density, trading hours, age-verification, drink-driving enforcement), with the protection of children and adolescents as a first-order priority.

Although some authors have argued that moderate drinking may confer health benefits—claims often influenced by industry interests or outdated beliefs about antioxidant effects such as Resveratrol—current evidence shows there is no safe level of alcohol consumption; the safest option is to avoid alcohol[29,30,31,32].

Labelling should be strengthened as part of (not instead of) this broader strategy. The evidence supports the prompt inclusion on all alcoholic beverages of: (i) a full list of ingredients (including allergens/additives), (ii) clear nutritional information—at minimum energy (kcal)—and (iii) prominent, rotating health warnings modeled on effective tobacco labels (simple, highly visible, and periodically refreshed to avoid wear-out). Standard drink information can help consumers track intake, but is most effective when paired with education and pricing policies. By contrast, defining "moderate intake" on the label is misleading, given varied individual risk profiles, and is better handled in clinical and public-health communication. These positions align with the evidence synthesis on enhanced alcohol labelling and its practical pros and cons, including consumers' right-to-know, the need for warnings tailored to product and audience, and the risks of relying on labels in isolation[33].

However, alcohol consumption is not dictated merely by individual choice, even when individuals are well informed. A clear example of how strict regulation of availability reduces harm can be seen in the Nordic countries. State-run monopolies in Sweden, Norway and Finland are associated with some of the lowest levels of youth alcohol use in Europe[34,35,36]. By contrast, Denmark, which lacks a monopoly, reports the region's highest rates of adolescent intoxication37, showing that reducing availability is necessary to curb consumption.

In short, because alcohol causes cancer and a wide spectrum of other harms, policy should make alcohol less affordable, less ubiquitous, and less glamorized; make products more transparent and warnings more salient; shield children and adolescents from exposure; and integrate labelling with taxation, marketing restrictions, availability controls, and routine brief interventions in healthcare. Done together—and done decisively—these measures offer the clearest, most equitable path to reducing the health and social burden of alcohol[37,38,39].

# Nutrition, Obesity and Physical Activity

Lifestyle factors such as diet, body weight, and physical activity play a pivotal role in primary cancer prevention. An estimated 30–50% of all cancer could be prevented by adopting healthy lifestyles specially avoiding tobacco and maintaining a healthy body weight[40]. Conversely, current trends of rising obesity and declining physical activity risk overtaking smoking as the leading preventable risk factor for cancer worldwide, making tackling these lifestyle risk factors a priority in cancer prevention efforts[40,41].

Obesity, classically defined as a body mass index (BMI) ≥30 is conclusively linked to at least 13 different types of cancer, including cancers of the breast (postmenopausal), colorectal, pancreas, liver, kidney, endometrium, ovary, being responsible for ~200,000 new cancer cases annually in the region and 1.2 million deaths per year when considering all obesity-related diseases[42]. Maintaining a healthy body weight (BMI 18.5–24.9) and avoiding weight gain in adulthood substantially decreases cancer risk[43].

Dietary patterns also strongly influence risk. Plant-rich diets (vegetables, fruits, whole grains, pulses, nuts) are associated with lower risk of developing several cancers, while excess consumption of red and processed meat, sugary drinks, and ultra-processed foods increase the risk[4,44,45]. Processed meat is classified by the International Agency for Research on Cancer (IARC) as carcinogenic (Group 1), and red meat as probably carcinogenic (Group 2A)[40,46]. Guidelines therefore advise limiting red meat consumption to ~350–500g/week and avoiding processed meats altogether. Furthermore, limiting energy-dense "fast-foods" and sugar-sweetened drinks further reduces the excess calorie intake and weight gain[40], and with it, the incidence of cancer[47].

Regular physical activity provides independent protection against several types of cancer, including colon, postmenopausal breast cancer, and endometrial (uterine) cancer, as well as reducing cancer mortality rates[48,49]. Exercise improves insulin sensitivity, reduces inflammation, and modulates hormones – processes that can influence cancer development[50]. Global health guidelines recommend at least 150–300 minutes of moderate-intensity physical activity per week such as brisk walking for ~30 minutes each daily as it is associated with improved cardiometabolic health and can help lower the risk of cancer and overall mortality[51].

The relationship between nutrition and cancer is complex, developing over decades and entangled with genetic, socioeconomic, and environmental factors. Unlike the case of tobacco—where the carcinogenic risk is direct and well-understood—the links between diet and cancer are often indirect and harder to communicate, making it more difficult to rally political will for aggressive policies. Diet-related cancer risks accumulate over long time horizons, making interventions harder to design and evaluate. Nevertheless, some policies have produced partial impact. For example, the introduction of taxation of sugar-sweetened beverages (SSB) has shown a decrease in the sugar content in soft drinks across some of the European countries that have introduced this measure, albeit the effect has been uneven, possibly due to confounding factors harder to account for[52].

Another example would be the Nutri-Score front-of-pack labeling that can steer food purchasing trends toward healthier products, supporting the idea that clear consumer information has the capacity to shift behaviors[53,54,55]. Yet taxation alone has proven insufficient to shift dietary patterns or on obesity outcomes, as shown in Mexico, where declines in sugary drink sales did not translate into meaningful reductions in adolescent overweight and obesity[56]. These experiences illustrate that fiscal and informational tools must be combined with structural supports, such as access to clean drinking water, affordable healthy foods, and environments that encourage physical activity, if obesity prevention policies are to deliver meaningful health outcomes. Still, the persistence of rising obesity rates, particularly among children[57,58,59], shows that this is the area where cancer prevention is failing the most. It is time to go back to the drawing board and design strategies that match the scale of the challenge.

Governments are sometimes reluctant to regulate the food environment out of fear of being accused of "nanny-state" intervention or facing pushback from powerful food and beverage industry interests[60]. Yet the rising rates of obesity and related cancers demand action, particularly to protect vulnerable groups like children and low-income communities who often have the least access to healthy choices[61].

# Screening

Organized screening is one of the most powerful population tools for preventing cancer and down-staging disease. For breast, cervical and colorectal cancers, decades of evaluation by the IARC show that well-designed, quality-assured, population-based screening programs reduce incidence and/or mortality. Moving from opportunistic to organized models—with personal invitations, call–recall systems, clear age ranges and intervals, and rigorous quality assurance—consistently achieves

higher, more equitable coverage and better outcomes. For example, primary HPV testing is now the preferred approach for cervical cancer screening in ages 30–65, with longer intervals and options such as self-sampling to close coverage gaps[62].

In the European Union, the updated Council Recommendation (9 Dec 2022) underpins the EU Cancer Screening Scheme—a flagship of Europe's Beating Cancer Plan—which aims for 90% of eligible people to be offered screening for breast, cervical and colorectal cancer by 2025, while encouraging a stepwise, evidence-based expansion to targeted lung and prostate screening and consideration of gastric cancer strategies in high-incidence settings. Member States are urged to adapt protocols (e.g., HPV-based cervical screening, extended breast age ranges) and to invest in registries, IT infrastructure, and quality standards to ensure equity and continuous improvement[63,64].

Screening programs for cervical, breast, and colorectal cancers have shown demonstrable success in early detection and prevention. Finland's cervical cancer screening program, operational since the 1960s, has significantly reduced mortality, as shown by long-term national data, and achieved near-universal invitational coverage, reaching almost 100% of eligible women through organized outreach efforts[65]. Sweden's long-standing national mammography program, informed by the landmark Swedish Two-County Trial, has achieved population coverage above 80% and contributed to a 20–30% reduction in breast cancer mortality, supported by continuous monitoring through national quality registries[66]. The Netherlands' national colorectal screening program, introduced in 2014 using fecal immunochemical testing (FIT), significantly improved the early detection of colorectal cancer during its phased implementation[67]. Importantly, the Dutch program stands out for its use of active monitoring during the implementation phase, serving as a model of how real-time evaluation enables timely adjustments. This approach helps mitigate unnecessary burdens on the healthcare system, reduce false positives, and enhance the overall cost-effectiveness of the program by continuously optimizing its performance. These national experiences are consistent with international guidance, including the IARC/WHO Handbooks on breast, colorectal, and cervical cancer screening[68,69,70].

For cancers beyond the "big three", evidence now supports targeted lung-cancer screening with low-dose CT in high-risk adults, with clear mortality reductions demonstrated in the NLST and NELSON trials[71,72]. Such programs must ensure smoking-cessation support, dose optimization, nodule management protocols, and equity-minded outreach. The EU Recommendation encourages Member States to assess feasibility and progressively implement high-quality programs for lung (and prostate, with PSA testing plus MRI triage) as capacity and evidence allow[63].

## Vaccination

Vaccination programs have had an undeniable impact on reduction of death due to communicable diseases and this impact also holds true when the outcome of an infection is cancer.

Together with cervical cancer screening, HPV vaccination has had an unprecedented impact in real-world cancer prevention[73]. High-coverage programs have produced steep reductions in high-grade lesions and now invasive cervical cancer—particularly when vaccination occurs before age 15[74,75]. WHO's 2022 position paper supports one- or two-dose schedules for girls and young women[76], a policy that can accelerate scale-up while easing supply and delivery constraints; HPV vaccination remains a pillar of WHO's Cervical Cancer Elimination Strategy[77]. Routine screening must evolve alongside vaccination (e.g., risk-based intervals and vaccination-status-informed protocols).

For liver cancer prevention, universal hepatitis B immunization—including a timely birth dose within 24 hours—prevents chronic HBV infection and reduces hepatocellular carcinoma. Long-term population studies from Taiwan demonstrate marked declines in pediatric and early-adult HCC following universal infant vaccination[78,79], reinforcing HBV vaccination as a core cancer-prevention strategy; global guidance now stresses both high birth-dose coverage and completion of the 3-dose series[80].

## Practical Priorities for Medical Oncologists, Clinicians, and Policymakers

It is clear that Europe as a society has come a long way in establishing evidence-based goals to aim for in the reduction of preventable cancer, however, we still have a long way to go to consolidate wins, reduce inequities, and tackle future challenges. At the intersection where policy meets individual choice, both clinicians and policy makers can take action to achieve these goals. **Table 1** includes some of the recommendations where clinicians and policy makers can converge to make cancer prevention a reality across the continent.

**Table 1: Priorities and actions in cancer prevention strategies**

| Priority Area | Action Steps |
|---|---|
| **Consolidate organized screening** | Achieve and sustain 70–90% coverage (program-specific) with personal invitations, call–recall systems, centralized registries, and continuous quality improvement. Transition to primary HPV testing for cervical screening, and enable self-sampling to reach under-screened groups [70] |
| **Deliver the EU Cancer Screening Scheme** | Resource workforce, infrastructure, and IT to meet the 90% screening-offer target; reduce regional and socioeconomic inequities; and monitor interval cancers and stage shifts [63] |
| **Scale HPV vaccination** | Strive for ≥90% coverage in girls (and consider gender-neutral programs) using one- or two-dose WHO-endorsed schedules and robust school-based delivery, paired with screening reforms [76] |
| **Close HBV gaps** | Guarantee timely birth dose within 24h and completion of the 3-dose series; add catch-up for at-risk adults; integrate testing and perinatal prophylaxis in antenatal care [78,79,80] |
| **Implement targeted lung screening** | Define eligibility using risk criteria, embed smoking-cessation support, and ensure QA for dose, reporting, and downstream work-up; evaluate equity impacts [71,72] |
| **Advocate for healthy life-style habit facilitating policies** | Advocate for effective education on healthy lifestyle habits in all stages of schooling and for policy reforms that support integration of physical activity in daily life. Integrate cancer care with survivorship programs that include a healthy lifestyle development approach together with regular oncologic check-ups. |
| | undefined |

Done together—and done decisively—these measures will prevent thousands of premature deaths in Europe and worldwide, while narrowing the preventable inequities that persist in cancer outcomes. They must be embedded in a broader vision of Health in All Policies[81], where education, transport, agriculture, and urban planning are aligned with health goals. This means building walkable cities with safe green spaces, equitable access to nutritious food, and work–life balance that enables physical activity rather than reliance on fast food or sedentary routines. Critically, prevention must start in schools through environments that support focus and wellbeing (including emerging no-phone policies), by teaching children the WHO "healthy plate" model, and by guaranteeing daily physical activity as part of the school curriculum[82,83].

## Youth Engagement and Health Promotion

Youth participation in public health forums enhances messaging credibility and reach, strengthening tobacco-free and cancer prevention agendas.

Crucially, policy must be accompanied by public engagement. Even the most well-intentioned top-down strategies will fall short if they do not involve and earn the trust of the communities they aim to serve. Cancer prevention policies often require changes in social norms and personal habits, which can be sensitive. Engaging community members in designing and implementing interventions can increase acceptance and effectiveness—

examples include involving local parents in school nutrition reforms or youth in anti-smoking campaigns. Empowering communities also means supporting grassroots initiatives and amplifying their impact through funding and integration into larger programs. The European Union and national governments have a role in not only setting broad cancer control targets, but also in funding and scaling up successful local projects that align with those targets. By investing in "place-based" solutions—programs that meet people where they live, work, and learn—the EU can help bridge the gap between high-level policy and actual behavioral change on the ground[84,85].

# Conclusion

Oncologists and multidisciplinary teams can accelerate prevention by integrating brief interventions into routine care, partnering with patient and youth organizations, supporting evidence-based policy (tobacco, alcohol, healthy environments), and contributing to monitoring of Europe's Beating Cancer Plan. The combined behavioral-structural evidence base supports an ambitious, equity-centered prevention agenda for Europe. The next step is clear: Prevention must be treated with the same urgency and rigor as diagnosis and therapy in oncology.

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