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Research Report

Anticipatory Science Diplomacy as a Framework for Addressing Inequities in Cancer Research and Care: Insights from Geneva

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Abstract

Cancer is among the leading causes of mortality worldwide, with more than 35 million new cases projected annually by 2050 and the steepest proportional increases expected in low- and middle-income countries (WHO, 2025; IARC, 2024). Despite this foreseeable trajectory, global cancer governance remains predominantly reactive, with limited mechanisms for foresight or equity-oriented planning (Aggarwal, Ginsburg, & Fojo, 2014; WHO, 2020). This study examines how anticipatory science diplomacy (the integration of futures thinking into science–policy interactions) can help bridge systemic gaps in cancer prevention and care (Gluckman, Turekian, Grimes, & Kishi, 2017; GESDA, 2025).

Introduction

Cancer poses a formidable global health challenge, with nearly 10 million deaths in 2020, which is approximately one in six deaths globally (WHO, 2025). Incidence and mortality are rising, with low- and middle-income countries (LMICs) bearing a disproportionate burden of late diagnoses and limited access to care. For example, access to comprehensive cancer treatment is available in over 90% of high-income countries but in less than 15% of low-income countries (WHO, 2020). Such inequities persist despite global calls to action. The World Health Assembly's 2017 cancer resolution urged accelerated efforts in prevention and early detection, and initiatives like WHO's Global Breast Cancer Initiative set ambitious targets, including a 2.5% annual mortality reduction over 20 years, potentially saving 2.5 million lives (WHO, 2023). Yet translating these targets into reality has proven difficult. Traditional public health approaches often remain reactive, mobilizing resources only once a crisis (or epidemic of late-stage disease) emerges. The COVID-19 pandemic and other health emergencies have underscored the costs of this reactive view. Similarly, in the area of cancer control, a similar pattern risks "too little, too late". By the time policymaking catches up with emerging scientific advances or shifting disease trends, opportunities for prevention may be lost.

Science diplomacy has been defined as "the use of scientific collaborations among nations to address the common problems facing 21st-century humanity and to build constructive international partnerships" (Fedoroff, 2009). Classic examples include joint research programs that eased Cold War tensions and scientific input shaping treaties on climate change and infectious diseases (GESDA, 2025). In the 21st century, however, the landscape has evolved:

scientific and technological breakthroughs are emerging at an unprecedented pace, including gene editing and AI-driven diagnostics to personalized immunotherapies. This rapid progress can create "governance gaps," i.e., situations where scientific capabilities outstrip the ethical, legal, and policy frameworks needed to manage them.

This research explores incorporating anticipatory thinking into science diplomacy to proactively address gaps in cancer prevention and care. Geneva, Switzerland, serves as a global hub for diplomacy, ideal for a project exploring anticipatory science diplomacy in order to help global health policies move from reactive to future-informed strategies. The goal is to investigate current practices at the science-diplomacy interface in Geneva, identifying barriers and enablers to anticipatory approaches, and deriving lessons for global health governance. Key questions include: (1) How can anticipatory thinking improve global cancer care and prevention strategies? (2) How can science diplomacy ensure equitable access to health policy and access? (3) What strategies or frameworks could effectively integrate anticipatory thinking into global cancer initiatives to ensure equitable outcomes?

Background

Defining Science Diplomacy

Science diplomacy, as a field, has evolved over the past decade in response to a changing global landscape. In 2010, the Royal Society (UK) and AAAS (US) released a landmark report, New Frontiers in Science Diplomacy, that formalized a simple framework of three dimensions: "science in diplomacy," "diplomacy for science," and "science for diplomacy." This tripartite definition, science advising in foreign policy, international scientific collaborations, and science cooperation improving international relations, became widely cited in academic and policy circles (The Royal Society, 2025). However, the world now presents new complexities and disruptions that have challenged the traditional science diplomacy paradigm. A 2025 follow-up report by the Royal Society and AAAS, Science Diplomacy in an Era of Disruption, observes that geopolitical relations have grown more adversarial and fragmented, while science and technology have become even more central to national interests and economic competition (The Royal Society, 2025). In this environment, science diplomacy is not automatically globally minded, but it can be wielded to advance national or bloc agendas, and non-state actors (like multinational tech companies) are increasingly influential players in the science diplomacy area.

The report proposes a revised framework, simplifying the concept to two overarching dimensions: "science impacting diplomacy" and "diplomacy impacting science." This flexible schema is meant to capture the bidirectional interactions between the domains. In practice, science diplomacy is employed to achieve the objectives of whoever is using it (state or non-state), which may be viewed as positive or negative depending on perspective.

Parallel conversations have been happening in other fora. The European Union, for instance, has invested in conceptualizing and strengthening science diplomacy as part of its foreign policy and research strategy. The EU's Horizon 2020-funded project S4D4C (Using Science for/in Diplomacy for Addressing Global Challenges) convened scholars and practitioners across Europe. In 2019, S4D4C facilitated the drafting of the Madrid Declaration on Science Diplomacy, a global statement endorsed by experts worldwide. Notably, the Madrid Declaration deliberately did not pin science diplomacy down to a strict definition; instead, it described it as "a series of practices at the intersection of science, technology and foreign policy" applied in various ways to tackle cross-border issues (S4D4C, 2021). The declaration calls for a renewed science diplomacy that is more inclusive, globally engaged, and cognizant of power imbalances, moving beyond the initial three-part formula. It's important to acknowledge that LMICs must be partners in setting the agenda, not just recipients of scientific collaboration. Following the Madrid Declaration, the S4D4C project and sister initiatives (such as the InsSciDE program and the EU Science Diplomacy Cluster) have advanced frameworks that distinguish between different purposes of science diplomacy (e.g., solving global challenges vs. competitive advantage) and analyzed "stopping" and "driving" factors that affect science diplomacy in practice. These efforts have added clarity, helping practitioners understand the conditions under which science diplomacy succeeds or fails in addressing issues.

Rights-Based Perspectives on Anticipatory Science Diplomacy

While institutional actors such as the AAAS and Royal Society have moved to reframe science diplomacy as the dual interplay of "science impacting diplomacy" and "diplomacy impacting science" (Royal Society & AAAS, 2025), complementary scholarly interventions have pushed the boundaries further. Porsdam and Porsdam Mann (2024) propose a "fourth pillar" of science diplomacy, which they describe as "diplomacy within science." In contrast to traditional

formulations that see science as an instrument to advance national interests or to support foreign policy agendas, this approach emphasizes science itself as a diplomatic domain.

The distinctive contribution of this framework lies in its explicit linkage to the human right to science, as noted in Article 27 of the Universal Declaration of Human Rights and Article 15 of the International Covenant on Economic, Social, and Cultural Rights. These provisions affirm that everyone has the right "to share in scientific advancement and its benefits." Porsdam and Porsdam Mann (2024) argue that anticipation is not just a tool for better policymaking but an obligation flowing from this right. If states are bound to make scientific progress accessible, then foresight, inclusive governance, and proactive diplomacy are necessary mechanisms to ensure that future benefits are equitably shared.

Anticipatory Thinking and Science Diplomacy

Anticipatory thinking is a forward-looking capacity that enables stakeholders to envision and prepare for multiple possible futures rather than simply projecting past trends. It is rooted in futures literacy, described by UNESCO as 'the skill that allows people to better understand the role of the future in what they see and do' (UNESCO, n.d.). Building on Bishop and Hines' (2013) framework foresight approach, anticipatory thinking has evolved into a systematic practice that combines horizon scanning, scenario planning, and futures literacy to enable organizations to make sense of uncertainty and prepare for multiple possible futures. In contrast to forecasting (which often extrapolates existing data) or prediction, anticipatory thinking emphasizes sense-making under uncertainty by identifying weak signals, exploring scenarios, and considering the implications of emerging trends before they fully materialize. In global health, this could mean, for instance, recognizing nascent patterns in risk factors or technology (e.g., the rise of tele-oncology or AI triage tools) and proactively devising strategies around them. Anticipatory governance has been applied in fields like climate change and disaster risk reduction, where "horizon scanning" and scenario planning help governments prepare for future risks. However, in global health policy, such approaches remain in early stages of adoption. The delay between new scientific evidence and its uptake in practice, often measured in years or sometimes decades, points to the absence of systematic foresight mechanisms in health governance. Bridging this gap is crucial to ensure that advances in science equitably benefit all populations and do not inadvertently widen disparities.

A key theme emerging from recent work is the need to incorporate strategic foresight into science diplomacy. A high-level EU Science Diplomacy Working Group (2023–24) recommended developing a European framework for science diplomacy that explicitly builds capacity for anticipation. In its 2025 final report (published by the European Commission), the working group notes that to deal with complex future challenges, "it is necessary to not only anticipate geopolitical developments and scientific-technological developments, but to assess their combined impact" and embed that analysis into diplomatic strategy (European Commission, 2024). The report calls for better use of foresight in science diplomacy to "anticipate future challenges, opportunities, and strategic directions" so that the EU can proactively shape multilateral agendas. In practical terms, this suggests the creation of consultative platforms of experts (including scientists, diplomats, and even scientific diasporas) to continuously monitor emerging science and geopolitical trends and inject this foresight into policy planning. A similar foresight turn can be observed in the United Nations system: for example, the UN Secretary-General's 2021 Our Common Agenda proposed regular Global Futures reports, and UNESCO has promoted "futures literacy" as a critical skill for policymakers. The International Science Council (ISC), representing the scientific community at the UN, has likewise stressed foresight. In a 2025 position paper to the UN High-Level Political Forum, the ISC warns that global scientific collaboration itself is at risk in an era of geopolitical tension, with science increasingly securitized and international research ties fraying, and urges efforts to rebuild trust, strengthen cooperation, and embed evidence-based foresight into decision-making for the SDGs (International Science Council, 2025). The message is that science diplomacy must become more forward-looking and resilient to fulfill its promise of advancing global public goods under uncertain conditions.

Geneva Science and Diplomacy Anticipator (GESDA)

Nowhere have these trends converged more visibly than in Geneva with the creation of the GESDA. GESDA was established in 2019 by the Swiss Federal Government, the Republic and Canton of Geneva, and the City of Geneva with the mission to anticipate emerging scientific breakthroughs on a 5-, 10-, and 25-year horizon and translate that foresight into tools for multilateral cooperation (GESDA, 2025). In other words, GESDA's core mandate is anticipatory

science diplomacy. Geneva serves as home to the WHO, World Trade Organization, and many UN agencies, providing an ideal hub for this experiment, given its concentration of diplomacy and global health institutions (GESDA, 2025). GESDA operates by scouting advances across fields like quantum computing, artificial intelligence, robotics, human augmentation, climate engineering, and biotech. Their flagship initiative, the Science Breakthrough Radar, published yearly surveys around 40 domains of science and technology where breakthroughs are expected and assesses their potential impact on society and global governance. GESDA then convenes diplomats, scientists, industry, and civil society to discuss how to leverage or govern these advances for the global good. As Enrico Letta (GESDA board member and former Italian PM) wrote in the foreword to GESDA's 2025 report, our world is increasingly defined by the intersection of two accelerating forces: (1) scientific and technological progress racing ahead, often outpacing our capacity to understand or govern its implications, and (2) a fragmented geopolitical and social landscape. This dual acceleration threatens to "leave both global cooperation and scientific opportunity behind" if unaddressed (GESDA, 2025). GESDA frames its mission as responding to that threat by actively building a "freedom of knowledge" across borders.

Materials and Methods

This study employed a qualitative, exploratory case-study design, focusing on Geneva's science and diplomacy ecosystem as a site of emerging anticipatory science diplomacy. A mixed-methods approach was used, combining: (a) document analysis of policy papers, strategy documents, and foresight publications from key institutions (GESDA, WHO, IARC, UN agencies, among others); and (b) semi-structured interviews with stakeholders engaged in science diplomacy, strategic foresight, and global health policy. This design enabled triangulation of data, comparing institutional strategies with on-the-ground perspectives, to build a contextual understanding of how anticipatory thinking is (or is not) operationalized in global health governance.

Fieldwork was conducted in Geneva, Switzerland, over six weeks. Three institutional contexts were prioritized: GESDA pioneering anticipatory science diplomacy; the World Health Organization (WHO) leading UN agency shaping health policy; and the International Agency for Research on Cancer (IARC), WHO's specialized cancer research arm. These were selected for

their complementary roles: GESDA provides foresight and convening functions; WHO, a normative and policy function; and IARC, a scientific and evidence-generation function. Additional perspectives were included from CERN (given its longstanding role in science diplomacy and collaboration with GESDA's quantum initiative) and the private sector (via a pharmaceutical R&D expert) to capture industry perspectives on innovation and policy.

Targeted documents were reviewed to map existing frameworks and identify references to foresight in cancer and health diplomacy. Key texts include but not limited to the *2020 WHO Report on Cancer*; relevant WHO strategies (e.g., WHA70.12 cancer resolution, Global Action Plan for NCDs, Global Breast Cancer Initiative); GESDA's *Science Breakthrough Radar* reports and the 2025 framework *Anticipatory Science Diplomacy: A Global Framework for Action*; outputs from GESDA's Science Diplomacy Week and Summit; and academic literature on science diplomacy (e.g., Royal Society/AAAS).

Five in-depth interviews were conducted with stakeholders representing diverse perspectives:

- GESDA: a Science Breakthrough Radar program manager
- UN: Journalist also serving as GESDA's communications consultant
- WHO: a strategic operations officer
- CERN: a science educator
- Pharmaceutical sector: R&D scientist (Roche)

Interviews were conducted with questions from a semi-structured guide covering integration of science into policy, anticipatory planning practices, successes and failures in preparing for emerging issues, alignment challenges between scientists and policymakers, and strategies for strengthening long-term thinking in global cancer prevention. Interview transcripts underwent inductive thematic analysis. Initial readings highlighted recurring concepts. These were refined into thematic codes (e.g., "short- vs long-term focus," "foresight tools"), then applied systematically across transcripts. Supplementing the interviews with document analysis strengthened validity. For example, when interviewees noted weak long-term investment, documents were checked for funding references or discontinuities. This iterative process enabled the synthesis of findings into a narrative directly linked to research questions.

Ethical approval was obtained through the University of Toronto's Research Ethics Board; all participants provided informed consent. As a qualitative study with five interviews, the findings are exploratory rather than generalizable. Many insights reflect institutional

experimentation in Geneva due to the rather recent adoption of "science diplomacy" and "anticipatory science diplomacy," despite the former being practiced for years. These limitations were mitigated by triangulating multiple sources and purposive sampling across sectors. The methodology offers a contextual account of anticipatory science diplomacy in practice and serves as a foundation for the conceptual framework presented in the discussion section.

Findings

Global Cancer Landscape & Inequities

The IARC World Cancer Report 2020 highlights two of the most notable global successes over the past decade, being the implementation of tobacco control measures and vaccination programs, particularly the HPV vaccine for cervical cancer prevention. These interventions demonstrate that prevention works: tobacco use reduction has averted millions of deaths, while HPV vaccination is already reducing rates of infection and precancerous lesions in high-coverage settings. Yet, the report stresses that adoption remains uneven. In many LMICs implementation of evidence-based prevention policies is hindered by weak health systems, resource constraints, and socio-cultural barriers. The effectiveness of prevention, the report argues, depends not only on scientific efficacy but on contextualized, sustainable, and equitable implementation across diverse populations (IARC, 2020).

Projections from the IARC's Cancer Tomorrow database illustrate divergent trends when cancer incidence and mortality are examined in absolute versus relative terms. In absolute numbers, high-income countries will continue to experience the largest burden, with cancer deaths among men rising from approximately 1.6 million in 2022 to 2.4 million by 2050 (+50%) and among women from 1.3 million to 2.0 million (+54%) (Fig. A1). However, relative growth is much steeper in low-income settings: male cancer deaths are projected to increase by 167% and female deaths by 150% over the same period. A similar pattern is evident for incidence, with high-income populations expected to see a 44–48% rise in new cases, compared to increases of 107% for low-income women and 160% for low-income men (Fig A2). These findings highlight a dual challenge: while high-income countries will continue to manage the largest absolute numbers of cases and deaths, the fastest proportional increases will occur in low-income regions with fragile health systems.

Inequities in cancer burden run along a number of axes. Globally, rates of incidence for most cancers remain highest in high-income countries, a function of higher life expectancy, better programs of surveillance, and behavioral correlates related to higher incomes. But death rates paint a different picture: poorer populations, both within LMICs and better-off countries, experience higher mortality and poor survival due to later diagnosis and lack of access to early therapy. On the one hand, absolute numbers show the bulk of cases arising in high-income regions; on the other, relative increases in incidence and mortality are projected to be steepest in low-income countries and act to widen inequities already entrenched within failing infrastructures of healthcare.

At the same time, scientific advances are reshaping what is possible in prevention and early detection. The World Cancer Report highlights molecular pathology, -omics research, metabolomics, microbiome science, chemoprevention, and novel vaccines (e.g., for H. pylori) as promising frontiers. These emerging fields open pathways for more personalized and effective prevention strategies. For example, microbiome research may identify modifiable risk factors in diet and environment; metabolomics could enable earlier biomarker detection; and vaccines against cancer-causing infections could avert millions of cases. However, the report warns that these innovations risk widening the equity gap if access remains limited to high-income settings.

WHO and Global Health Foresight

Within WHO, traditionally a normative and reactive body, explicit anticipatory mechanisms were found to be nascent but emerging. The WHO interviewee (a Strategic Operations Officer with experience in emergency response) acknowledged that WHO's day-to-day focus is often on addressing current health crises or meeting near-term targets (e.g. the 2030 Sustainable Development Goals). "Long-term strategic foresight hasn't been deeply embedded," he noted, "because the political and funding cycles push toward immediate results".

Epidemic and pandemic intelligence

In the wake of Ebola and COVID-19, WHO launched initiatives for predictive analytics in disease outbreaks (e.g. the WHO Hub for Pandemic and Epidemic Intelligence). These efforts, while not cancer-focused, instill a culture of using data to foresee health threats. The interviewee drew parallels to cancer, suggesting that a "Global Cancer Intelligence" system could aggregate

real-time data on risk factor trends, screening uptake, and emerging research, to flag where future cancer burdens might spike, analogous to how pandemic models project infection curves.

World Health Assembly resolutions

Policy frameworks have begun to respond to these challenges. In 2017, the World Health Assembly adopted a landmark resolution on cancer prevention and control, urging countries to integrate comprehensive strategies into national health plans. Building on this, WHO launched the Global Strategy to Eliminate Cervical Cancer, which sets ambitious "90-70-90" targets for HPV vaccination, screening, and treatment by 2030.

The WHO official referenced the 2020 World Health Assembly resolution on "Strengthening preparedness for health emergencies", noting that it calls for scenario exercises and simulations as standard practice. Applying a similar mandate in NCDs (non-communicable diseases) could mean regularly convening multi-sector stakeholders to simulate future cancer control scenarios (for example, an exercise envisioning the global cancer burden in 2040 under various technology uptake assumptions).

This perspective raises the question of whether the WHO's institutional structure inherently limits long-range planning, or whether anticipatory science diplomacy could be incorporated without undermining the WHO's urgent response role.

AI for Good Summit 2025, Geneva

The WHO–ITU–WIPO session titled "Enabling AI for Health Innovation and Access" showed how anticipatory governance is beginning to take shape around health AI. A key example was AI-driven cervical cancer screening, which demonstrates the potential of emerging technologies to transform early detection (WHO, 2025). Yet panelists warned that without advance coordination on regulation, validation, and access, such tools could reinforce global inequities. This mirrors the central challenge of today's health governance: breakthroughs often arrive faster than policy frameworks.

Foresight Infrastructures

Beyond WHO, Geneva hosts other organizations of interest including GESDA and CERN.

GESDA's Science Breakthrough Radar

The GESDA Science Breakthrough Radar emerged as a flagship example of systematically identifying and integrating future scientific developments into global dialogue. According to the GESDA Radar Program Manager, the Radar is produced through a "series of committees" covering ~30 topics across frontier science and technology, each chaired by leading academics and drawing experts worldwide. These committees forecast where their field is heading in ~5, 10, and 25 years, effectively mapping multiple time horizons of expected breakthroughs. Examples of topics span from Advanced AI and Quantum Computing to Human Applications of Genetic Engineering, Healthspan Extension, Future Therapeutics, and even emerging global issues like Future Food Systems and Infectious Diseases. (GESDA, 2024) By 2024, the Radar's fourth edition engaged over 2,100 scientists from 87 countries, collectively showcasing 40 scientific topics and their anticipated trajectories.

Crucially, the Radar is not just a technical report; it is designed as a diplomacy tool. As the program manager described, GESDA's philosophy is not to "predict the future" but to "anticipate possibilities" and prompt early conversations about their implications. The Radar information is made open-access (both in print and online) to democratize foresight. This transparency helps bridge a common gap where cutting-edge knowledge is siloed among specialists. Instead, GESDA seeks to "make its insights understood beyond the core group of narrow specialists." By doing so, it provides a common reference point for diplomats, policymakers, and the public to discuss emerging science on equal footing. The GESDA Communications Consultant emphasized that anticipation is now framed by GESDA as a new "operating system" for science diplomacy, shifting diplomats' mindset from reacting to proactively shaping the future. He noted that GESDA's mission "to anticipate tomorrow's science and technology for the benefit of all" must resonate clearly with global leaders, hence the effort to translate complex trends into accessible insights.

The process behind the Radar further illustrates anticipatory practices: GESDA convenes its scientific advisory groups annually to update their outlook based on the latest laboratory developments and emerging discoveries. For instance, one committee might discuss the plausible timeline for synthetic biology tools to significantly extend human healthspan or cure certain cancers. The Radar Manager noted that looking 25 years ahead forces experts to "release current

constraints" and imagine big-picture shifts. Meanwhile, the 5-year outlook captures nearer-term innovations already in the pipeline (e.g. next-generation gene therapies). By capturing these different horizons, the Radar can alert policymakers to both imminent developments (where governance may soon be needed) and long-range "what if" scenarios (where there is time to prepare societal responses). Notably, the radar is careful to stress it is not making deterministic predictions; rather, it presents multiple possibilities and leaves judgment of desirability to society. "We're not saying this will happen, we're saying we can anticipate these things and start conversations now," explained the Radar lead. This approach aligns with the concept of honest brokering, whereby knowledge brokers present options without advocacy, enabling informed discussion among stakeholders.

However, one might ask whether this framing reflects GESDA's institutional interest in promoting its own model. While the open-access nature of the Radar suggests genuine commitment to democratizing foresight, the question of whose priorities guide its selection of topics remains important.

Radar Applications to Global Health

The Science Breakthrough Radar presents many global health trends, "Human Applications of Genetic Engineering" (which would include CRISPR-based therapies), "Future Therapeutics" (novel treatment modalities), "Healthspan Extension" (technologies to prolong healthy life), and "Infectious Diseases" (which overlaps with cancer in areas like infection-related cancers and vaccines) (GESDA, 2024). However, an insight from the GESDA team was that the Radar organizes foresight by scientific domains rather than by societal challenges. "We don't start from challenges like cancer; we start from science fields," noted the Radar manager, clarifying that while cancer is a huge global challenge, GESDA's approach was to first map advances in underlying sciences (e.g. biotechnology, AI, genetic engineering) that could impact multiple challenges. In practice, this means that foresight relevant to cancer is woven throughout different Radar topics. For instance, synthetic biology advances (one expert's "favorite topic" for its potential to be as transformative as AI) could lead to engineered viruses that selectively kill tumor cells or biosensors for early cancer detection. Likewise, progress in quantum computing might revolutionize drug discovery or genomic analysis for cancer, and collective intelligence/crowdsourcing platforms might accelerate global research collaboration in oncology.

By highlighting these upstream developments, the Radar indirectly signals to policymakers what breakthroughs could be coming.

One concrete example identified in literature and interviews was mRNA vaccine technology. While widely known due to COVID-19, its application to cancer (e.g. personalized cancer vaccines) is an area on the horizon. If the Radar had existed a decade earlier for health, one interviewee mused, it might have flagged the emerging science of mRNA and its broad potential, possibly accelerating its acceptance or guiding regulatory readiness. In the interview with the Roche R&D Scientist, he pointed out how the rapid deployment of COVID mRNA vaccines "felt extraordinarily fast" to the public and policymakers yet rested on "several decades of R&D" behind the scenes. He stressed that policymakers often lack literacy in the R&D pipeline, they see a breakthrough when it's announced, not the 10–20 years of work preceding it. However, a critical question is whether emphasizing these timelines risks overlooking nearer-term opportunities for prevention or innovation.

GESDA's anticipatory approach could bridge this gap by educating decision-makers early about such pipelines. In fact, GESDA's new Anticipatory Science Diplomacy report explicitly calls for "considering and addressing [scientific advances'] consequences before these become foreseeable".

Anticipatory Science Diplomacy in Action

Incubated by GESDA and launched in partnership with CERN, the UN's ITU, and other international entities, the Open Quantum Institute (OQI) is the world's first platform to apply quantum science to global problems as a diplomacy tool (GESDA, 2025). It represents "anticipatory science diplomacy in action", aiming to harness a technology (quantum computing) before it's widespread, to benefit society. In 2025, OQI announced a collaboration focusing on women's health: using quantum computing to accelerate drug discovery for endometriosis, a disease affecting 10% of women worldwide and long under-prioritized. By leveraging quantum simulations to identify novel non-hormonal therapies, this project seeks to deliver breakthroughs for an underserved health need (Swayne, 2025). Importantly, it's framed as a global public-good effort, with involvement of scientists, clinicians, and diplomats to ensure the outcomes (new drug candidates) are shared and accessible, especially in low-resource settings. The OQI example shows how anticipatory science diplomacy can embed futuristic science into current global

health agendas by uniting quantum technologists and health experts to tackle an intractable condition. It also underscores Geneva's "lessons": the city's international institutions (like CERN and WHO) and neutral diplomatic culture make it an ideal sandbox for such multi-stakeholder initiatives.

Tackling Complexities: Enablers & Barriers to Science Diplomacy

Multi-Stakeholder Partnerships at the Core

Ruffini (2016) highlights that traditional bilateral or state-centered diplomacy cannot by itself address complex transnational challenges. Instead, effective science diplomacy requires platforms that convene actors from government, international organizations, academia, industry, and civil society in sustained collaboration. These partnerships not only broaden the knowledge base but also build legitimacy and resilience into governance processes. This perspective directly aligns with practices observed in Geneva. Interviewees emphasized that trusted conveners are needed to bridge silos between scientists, policymakers, and the public, and that anticipation cannot occur in isolation. For cancer governance, a multi-stakeholder lens underscores the importance of including industry R&D voices (for timelines of therapeutic innovation), WHO and IARC expertise (for epidemiological foresight), and civil society and patient advocates (for equity and ethics) in anticipatory dialogues. Without such inclusion, anticipatory science diplomacy risks becoming technocratic or exclusionary. Yet, convening diverse stakeholders does not guarantee equitable outcomes; power imbalances between industry, governments, and civil society remain a challenge. The question becomes not only who is at the table, but whose voices carry weight in shaping anticipatory agendas.

Short-termism in policy and funding cycles

Every expert noted a mismatch between the timelines of scientific progress and those of political decision-making. The Roche R&D Scientist put it a: "Almost all the big problems we're trying to address require multi-decade investments… but attention and funding come in 2–3 year waves." In cancer research, bringing a new intervention from concept to widespread impact can take 10–20 years, yet governments and donors often allocate resources on annual budgets or 5-year plans. The result is a start-stop dynamic, e.g. a burst of funding for cancer control when a

high-level meeting or “cancer moonshot” initiative occurs, followed by waning interest when political leadership changes or other issues dominate the agenda. The WHO officer concurred, observing that politicians naturally focus on visible wins within their term, whereas prevention benefits might manifest long after they leave office. This political economy makes it challenging to sustain programs like tobacco control or vaccination at the level needed for future payoff. Interviewees suggested solutions like longer-term grant mechanisms, ring-fenced funds for future health threats, or multi-stakeholder coalitions that persist beyond election cycles. The Roche scientist emphasized education of policymakers as critical: “It’s about communicating the real timelines of innovation clearly, so they understand that what we invest in now, we reap much later, but we must stay the course.” He gave the example of HIV/AIDS: initial research in the 1980s led to effective triple therapy by 1996, a 15-year arc. If funding had been pulled in the early 1990s due to a lack of quick wins, that breakthrough could have been delayed indefinitely.

Preparing for the Future

A recurring theme across interviews and documents was the importance of building futures literacy through education and training. *"The biggest example is always imagine there's another Madame Curie or another Einstein sitting in a country and they just happen to have no proper education system where we will not get their best ideas”* – CERN Educator

As Bishop (2013) emphasized in his call for foresight education, futures literacy is not just a technical skill but a mindset that should be cultivated across disciplines. Embedding such foresight training within health governance would extend this vision to the domain of global cancer care (Bishop et al., 2020).

Beyond early education, formal leadership training is also emerging as a vehicle for embedding anticipation into institutions. GESDA’s Global Curriculum for Anticipatory Leadership (launched in 2023) offers structured training for mid-career professionals in navigating future scenarios. The goal is to produce diplomats, policymakers, and scientists who are skilled in interdisciplinary thinking and managing uncertainty. Training programs could address gaps in knowledge, ensuring key institutions have personnel proficient in futures methods like horizon scanning, scenario planning, and foresight facilitation.

Discussion

Policy analysis and the interviews conducted in Geneva reveal both the promise and the tensions inherent in anticipatory science diplomacy. While each stakeholder emphasized the importance of forward-looking approaches, their perspectives also underscored institutional blind spots: the GESDA program manager framed anticipation as a tool for influence, the journalist as a new "operating system," the WHO officer as a matter of mismatched timelines, the CERN educator as a question of literacy, and the Roche scientist as the long road of research and development. Taken together, these highlight a shared recognition that the current system is not fully prepared for the pace and complexity of future health challenges. At the same time, they also raise deeper questions about who defines anticipation, whose priorities it serves, and how these frameworks can be operationalized across very different institutional contexts.

Proposed Science Diplomacy Framework

Drawing on GESDA's model and expert insights, I propose a four-pronged framework, inspired by the four core principles articulated by GESDA. The pillars of this framework are: (1) Science Anticipation, (2) Early Multistakeholder Engagement (Honest Brokering), (3) Pilot Projects & Iterative Policymaking (Adaptive Global Action), and (4) Capacity Building for Futures Literacy

Science Anticipation (Horizon Scanning and Trend Mapping)

The first pillar involves establishing continuous processes to scan the horizon for emerging science and technology relevant to cancer. This goes beyond periodic five-year reviews; it requires real-time monitoring and periodic synthesis. I recommend creating an international Foresight Panel on Cancer and Health Futures under the joint auspices of WHO, IARC, and partner institutions like GESDA. This panel would function similarly to GESDA's Radar committees, enlisting global experts to identify breakthroughs in fields such as genomics, artificial intelligence, biotechnology, nanomedicine, preventive vaccines, and even social sciences (e.g. behavioral economics for prevention) that could impact cancer prevention and care in the next 5, 10, 25 years. The output could be an annual "Global Cancer Foresight Report" highlighting these developments and their plausibility. Each item would be coupled with analysis of its readiness level, uncertainties, and potential health impact. Importantly, this

process should integrate weak-signal data from diverse sources: research publications, patent filings, clinical trial registries, environmental and societal trends (e.g. aging populations, urbanization, climate change impacts on cancer). GESDA's radar already catalogs many such signals; linking it with WHO's data streams (cancer registry trends, risk factor surveys) would enrich the anticipation (GESDA, 2024). The goal is to create a global public good of foresight information that countries and organizations can draw upon.

Early Multi-stakeholder Engagement (Honest Brokering)

The second pillar emphasizes convening the right players at the right time. As the findings show, having scientists and policymakers in the same room well before a decision is urgent leads to better outcomes and trust. Globally, an annual roundtable under the UN or World Economic Forum could coincide with major gatherings (e.g. the World Health Assembly or GESDA Summit) to ensure high-level attention. It would invite researchers (those leading the science in Pillar 1), health ministers and diplomats from various countries, industry leaders (pharma, tech), ethicists, and civil society (patient groups, NGOs, youth representatives). The agenda: discuss the foresight report's findings (from Pillar 1) and explore collectively "What should we do now to prepare?" This setting must be an honest broker space, facilitated by a neutral entity (GESDA or a UN Futures envoy) to understand perspectives and implications. For example, if the foresight panel suggests that an AI diagnostic for cervical cancer will be viable in 5 years, the roundtable can identify regulatory, training, and ethical considerations to address in advance. By engaging, say, an African Union health representative, one can ensure LMIC needs (like affordability, infrastructure) are raised early, rather than after a technology is rolled out elsewhere. This diverse early engagement also helps surface ethical issues In 2018, when the birth of the first gene-edited babies was announced, the CRISPR-Cas9 experiment focused on altering human embryos in ways inheritable by future generations, sparking global controversy. There was no international agreement or advance diplomatic dialogue that had prepared the world for this moment; as a result, responses were ad hoc and mostly after-the-fact, scrambling to address ethical and safety concerns. If a roundtable in 2015 had scientists and ethicists discussing germline editing, perhaps guidelines or moratoria could have been more proactively in place. These roundtables should ideally produce non-binding recommendation briefs that can feed into formal policy venues. For instance, a brief from an anticipatory roundtable on "AI in

Cancer Screening" could be submitted to WHO's Executive Board or IARC Governing Council, ensuring the informal dialogue informs formal proceedings in order to support inclusive processes as a way to balance national interests and common goals (Turekian et al., 2015).

Pilot Projects and Adaptive Global Action

The third pillar addresses moving from talk to action, but in a cautious, trial-and-error fashion suited to uncertain futures. Traditional global health governance often waits for consensus before acting (which can be slow) or implements one-size policies that may fail. An anticipatory approach calls for experimentation and learning, which GESDA describes as "regulatory sandboxes" and pilot initiatives. In practice, this means when a promising technology or policy idea is identified, a coalition of willing countries and organizations should start small-scale trials to test it out. For example, consider a new saliva-based genetic test that can predict cancer risk 20 years in advance. Rather than the WHO immediately trying for a global recommendation (which could be controversial and premature), a few countries with different profiles (say, Japan, Kenya, Brazil) could partner in a pilot program to evaluate the test's performance, acceptability, and ethical implications among their populations. Through this, they would gather evidence on how to integrate it with counseling and safeguards. The results could then guide global norms, either by scaling up if beneficial or abandoning/tweaking if not. This adaptive, experimentalist governance is increasingly recommended in the face of rapid tech change (Victor et al., 2021, in context of climate engineering, for example). GESDA's OQI is a prime illustration: it pilots quantum applications for SDGs on a voluntary basis, creating blueprints that later inform UN debates. For cancer, one could envision an "Open Cancer Tech Initiative" analogous to OQI, where cutting-edge tools (AI, genomics, telemedicine) are implemented in real-world settings via partnerships between UN agencies, companies, and local health systems. This also ties to financing innovation: global health donors (e.g. the Gates Foundation, Gavi, CEPI) could allocate funds specifically for future-focused pilot projects. Not only does this pillar accelerate learning, it also builds the case (or warns) for policy. When governments see successful pilot outcomes, they become more likely to agree on international frameworks.

Capacity Building and Inclusivity

The final pillar underpins the others by investing in people and institutions. As the results showed, a major barrier to anticipation is simply lack of familiarity or skills among policymakers and even scientists in thinking long-term and across disciplines. Strategic foresight has already demonstrated value when applied to oncology. Bishop and colleagues (2020) conducted one of the first foresight exercises in cancer research, using the *Framework Foresight* method to generate scenarios for the Ontario Institute for Cancer Research. Their work highlighted critical strategic issues, from data dilemmas and funding fragility to the growing influence of empowered patients. Incorporating such foresight practices into cancer policy can help institutions anticipate disruptions, identify opportunities for early detection and prevention, and strengthen trust with patients and communities. Dr. Peter Bishop's futures literacy methodology, first taught at the University at Houston and now being offered through his nonprofit, Teach the Future serves as an example of foresight education investment.

Furthermore, training programs like GESDA's Global Curriculum for Anticipatory Leadership need to be expanded and replicated. WHO and academic institutions could develop curricula on "Health Futures and Diplomacy" for public health professionals and diplomats. This could be integrated into existing courses (e.g. adding a foresight module in MPH and international relations programs) or as stand-alone workshops. Embedding futurists or foresight specialists within key organizations can make anticipation routine. A recommendation is for WHO to establish an "Office of Foresight and Futures" (as some governments have, e.g. Singapore's Centre for Strategic Futures) that works horizontally with all disease programs. This office could coordinate the foresight panel (Pillar 1) and ensure outputs reach the relevant units. Similarly, each major health agency or large research funder could designate a "Futures Fellow" role. On the diplomatic side, foreign ministries might include a science and technology foresight attaché in missions to Geneva and New York, bridging discussions between scientific forecasts and diplomatic negotiations.

Conclusion

Anticipatory science diplomacy offers a viable framework for global cancer governance. It enables institutions to align science and policy across multiple time horizons, ensures that equity is embedded early, and fosters trust through inclusive partnerships. By convening diverse stakeholders ahead of foreseeable challenges, aligning on emerging evidence, and coordinating

early interventions, anticipatory diplomacy could mitigate the "lag" between innovation and impact. The challenge now lies in moving from promising models in Geneva to globally coordinated frameworks that can avert inequities and transform cancer prevention for the decades ahead. One might ask whether Geneva's unique density of institutions makes this model replicable elsewhere. Could similar anticipatory initiatives thrive in regions without such diplomatic infrastructure?

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Appendix

Figure 1. IARC's projected global cancer mortality from 2022 to 2050 by income group and sex (all cancers combined).

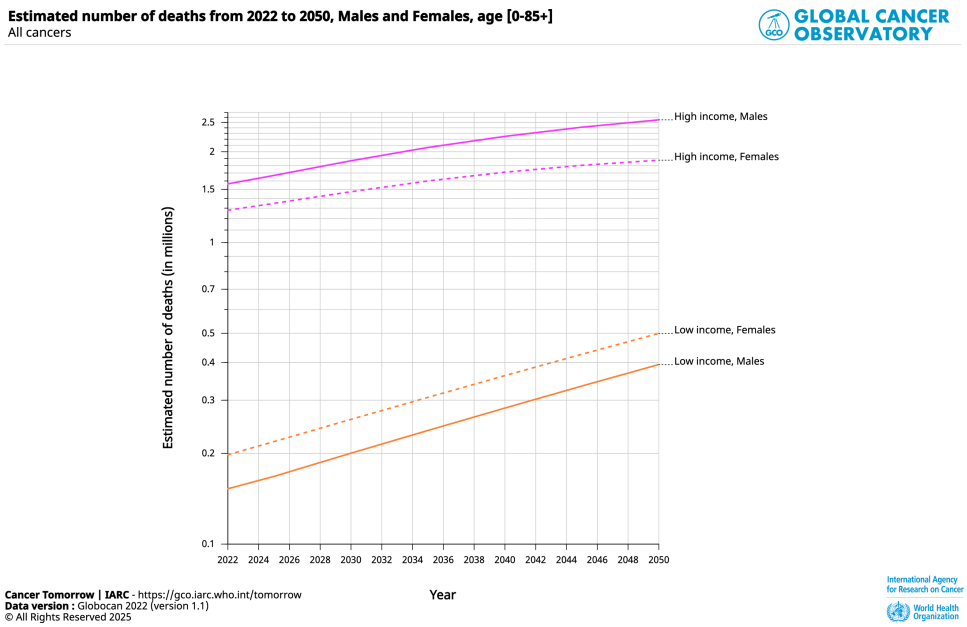
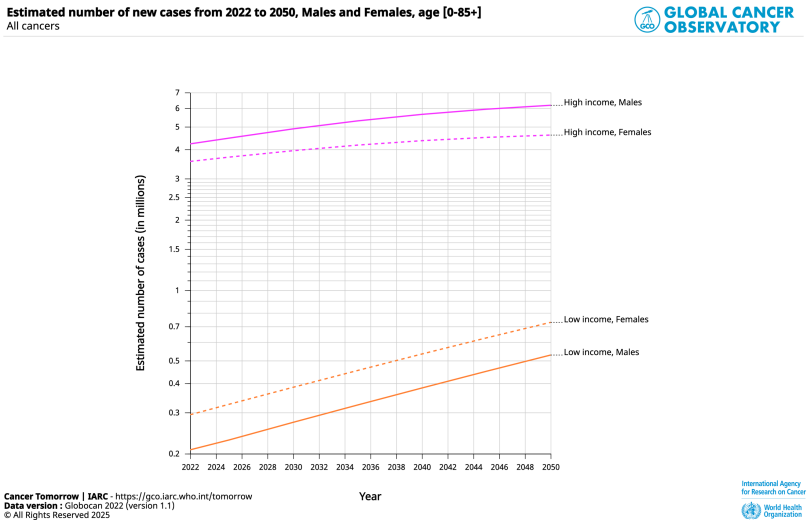


Figure 2. IARC's projected global cancer incidence from 2022 to 2050 by income group and sex (all cancers combined).



Interview Guide

Project Title: Incorporating Anticipatory Thinking within Science Diplomacy to Bridge Gaps in Cancer Research and Care: Lessons from Geneva

Student Investigator: Amna Habiba

Supervisor: Professor Guy Allen, University of Toronto

Interview Type: Semi-Structured, In-Person

Estimated Duration: 30–45 minutes

Location: Geneva, Switzerland (GESDA, WHO)

Interview Purpose

The purpose of this interview is to explore how international institutions (GESDA & WHO) engage with anticipatory thinking and science diplomacy to address long-term challenges in global cancer prevention and equity. The data will contribute to a case study and framework published on the Laidlaw Network.

Project Abstract

Confronting the global cancer burden requires more than scientific progress, it requires international foresight, equity-driven policymaking, and cross-disciplinary collaborations among scientists, policy makers, and the public. This research project explores how anticipatory thinking, a concept grounded in futures literacy, can be integrated into science diplomacy to address systematic inequities in cancer prevention and care. By looking beyond reactive policy cycles, the aim of my research is to uncover how future-oriented approaches can help governments and organizations to prepare for emerging health challenges before they escalate.

Research Questions:

- How can anticipatory thinking improve science for diplomacy?
- How can science diplomacy ensure equitable access to cancer prevention & detection?
- What strategies can international organizations implement to integrate science diplomacy and anticipatory thinking for equitable cancer prevention?

Consent

Thank you for taking the time to speak with me today. I'm conducting this interview as part of my independent research for the Laidlaw Scholars Programme at the University of Toronto. My research focuses on how anticipatory thinking can be integrated into science diplomacy to better prepare for and address global disparities in cancer prevention.

This interview will be recorded for transcription purposes with your permission. Your responses may be included in the final report published on the Laidlaw Scholars Network as part of the Laidlaw Leadership & Research Programme. You are welcome to skip any question or stop the interview at any point.

Proposed Interview Questions

- Could you describe your current role and the main focus of your work?
- How can institutions move from reactive to anticipatory modes of governance, and what tools or frameworks best support this shift?
- In what ways can anticipatory science diplomacy ensure that emerging technologies for cancer prevention and care are accessible and affordable across diverse global contexts?
- How do organizations, such as international agencies, research institutions, or industry, translate foresight into policy and practice, and what barriers limit this process?
- What forms of training or leadership development are needed to cultivate futures literacy among scientists, policymakers, and the public?
- How can multi-stakeholder partnerships and convening platforms build the trust and collaboration necessary for anticipatory diplomacy to succeed?
- Looking ahead, what major blind spots or under-anticipated risks in global health and cancer governance require urgent attention?