



CONQUERING CANCER: MISSION POSSIBLE

Independent
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Report



Research and
Innovation

Conquering cancer: mission possible

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CONQUERING CANCER: MISSION POSSIBLE

This document is an intermediate report of the Mission Board's progress towards the definition of a Mission in the area of cancer. This Draft Mission outline will be the basis for further discussion and consultation, including with European citizens. Those processes will help with adjusting and fine-tuning the Mission Board's final advice.

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CONQUERING CANCER: MISSION POSSIBLE

As an integral part of the Horizon Europe Framework Programme for Research and Innovation (2021-2027), a set of European Research and Innovation Missions aim to deliver solutions to some of the greatest challenges facing Europe. Cancer is one of these challenges. This Draft Mission outline explains how a mission-driven approach can save and improve the lives of millions of European citizens exposed to cancer and its risk factors. It sets out the goal of the Mission on Cancer and makes recommendations on how to achieve this goal.

In designing the Mission on Cancer, the European Commission invited a Board of European experts – covering cancer research, innovation, policy, healthcare provision and practice – (hereafter Mission Board) to define an ambitious and measurable goal with a substantial impact on and relevance for society and citizens of Europe. The Commission also asked the Board to propose a coherent set of actions to achieve this goal in a set timeframe. These actions will be implemented through Horizon Europe and other instruments of the European Union (EU) and its Member States, and aligned with other initiatives at EU and Member State level.

In preparing this Draft Mission outline, the Board was assisted by the Cancer Mission Assembly, a wider network of experts, and informed by Foresight (see Annex III). In addition, the Board received input from various other sources on several occasions, including the 27 Member States, two pilots of engagement sessions with EU citizens, cancer patients and survivors (see Annex IV), members of the European Parliament and several Directorates-General of the European Commission.

This Draft Mission outline will be used as a basis for further stakeholder and citizen engagement activities in the second half of 2020, and define a broad strategy for the first four years of the Horizon Europe Programme. Synergies will be developed with national cancer plans and other actions of Member States, with the actions of other Horizon Europe Missions and research and investment programmes, as well as with other EU policies and actions, in particular the Europe's Beating Cancer Plan. The final Mission outline, due in December 2020, will be comprehensive and feed the biannual work programmes of Horizon Europe.

1 Cancer: a growing challenge for Europe

Cancer is an umbrella term for more than 200 diseases. These have in common the uncontrolled growth and spread of abnormal body cells, affecting tissues and organs. Considering that Europe has a quarter of all cancer cases and less than 10 % of the world's population¹, it is evident that cancer is a huge threat for Europe's citizens and health systems. Each year, 2.6 million people in the EU-27 are diagnosed with cancer². This number is expected to increase rapidly because of ageing populations, unhealthy lifestyles and unfavourable environmental conditions. Almost three quarters of all cancers in the EU occur in people aged 60 or above.³ Without strong action, the number of cancer cases in Europe will increase by 25 % by 2035.¹ Although survival rates of several cancer types have improved over the last decades, cancer still kills 1.2 million people in the EU-27 each year.⁴ The probability of receiving a timely diagnosis of cancer and of surviving the disease differs substantially across Europe because of major inequities in access to cancer knowledge, prevention, diagnostics, treatments and care. The chances of surviving cancer also depend highly on the type of cancer, as some cancers are still not well understood, including several childhood cancers.

The current COVID-19 pandemic puts high pressure on health systems' capacities and resources. This is a severe threat to cancer prevention, detection and treatment. It may also impact funding for cancer research, innovation and care, as countries may reset their priorities and reallocate resources. However, the Mission on Cancer has lost none of its urgency, considering that the challenges of cancer have increased due to the COVID-19 crisis. At the same time, the COVID-19 pandemic has also shown health systems' and society's resilience and potential to adapt rapidly to changing circumstances, as it has accelerated the development and acceptance of new technologies as well as built strong collaborations across sectors and borders. The lessons learnt from the COVID-19 crisis will be applied in the Mission to develop genuine solutions to the challenges arising from cancer and beyond (see Annex V).

Increasing survival proportions result in more Europeans living with and after cancer. There are more than 12 million cancer survivors⁵ in Europe.⁶ Being

¹ Bray F, Ferlay J, Soerjomataram I, et al. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians* 2018; 68: 394-424.

² ECIS (European Cancer Information System): Estimates of cancer incidence and mortality in 2018, for all cancer sites

³ <https://www.iarc.fr/>

⁴ Eurostat: Causes of death - deaths by country of residence and occurrence (last update 30-04-2020)

⁵ Living within 5 years of a diagnosis; the term "survivor" throughout this Draft Mission outline refers to survivors as well as people living with cancer

⁶ Global Cancer Observatory (<https://gco.iarc.fr/>)

cancer-free does not however mean being free of the cancer experience.⁷ Many survivors experience side-effects from treatment, which may only become apparent years after completing treatment and may intertwine with other comorbidities as survivors get older. Physical and mental health problems significantly impact their quality of life, affecting the ability to play a full role in society and the workforce. In addition, many survivors experience stigmatisation. This is reflected in difficulties in getting a job or having a career, and in obtaining health insurance or other financial products (e.g. life insurance for a mortgage). This all generates a substantial burden for cancer survivors and their families, but also for countries' health systems and society in general.

2 Conquering cancer calls for an EU-wide mission

Given that the challenges that arise from cancer for European citizens and countries are vast, conquering cancer in Europe calls for multiple actions by many stakeholders, both at the national level and EU level. At EU level, citizens, cancer patients, survivors and their family members and carers may benefit from bundling of cancer knowledge, sharing of expertise and exchange of data. The EU could offer large scale for research on less prevalent cancers by providing a platform for sharing knowledge and data, for exchanging experience from best practices and innovations in countries. Previous EU Research and Innovation Programmes and other actions have addressed various challenges in cancer research, prevention and care. However, the increasing burden of cancer in Europe, and the rapidly increasing costs of cancer for health systems and society require collaboration on an ambitious European scale, innovating and integrating fundamental, translational, clinical and interventional research, underpinned by supportive policy and legislation, as well as a strong commitment from Member States to break barriers across Europe.

The Mission on Cancer will address the whole cancer control continuum, i.e. from prevention of risk factors to survivorship support and end-of-life care, for all ages and cancers, including rare and poorly understood cancers⁸, cancers in children, adolescents/young adults and the elderly, cancers in socially or economically vulnerable families and among people living in remote areas, across all Member States. While the Mission provides directions and objectives for research and innovation, it will also generate evidence on factors that limit effective policy and support actions to conquer cancer. In this regard, the Mission's actions will be able to make an important contribution to the Europe's Beating Cancer Plan⁹. Vice-versa, the Cancer Plan will provide opportunities to complement the Mission on Cancer.

⁷ Rowland JH. Cancer survivorship: a new challenge in cancer medicine (pp. 909-916). In: Bast Jr RC, Croce CM, Hait WN et al. (Eds) Holland-Frei Cancer Medicine. 9th Edition. Hoboken, NJ: Wiley, 2017.

⁸ Cancers for which knowledge on their molecular characteristics is lacking. (this outline)

⁹ <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12154-Europe-s-Beating-Cancer-Plan>

3 The goal of the Mission on Cancer

The overall goal of the Mission on Cancer has been formulated as: “By 2030, more than 3 million lives saved¹⁰, living longer and better”. This is consistent with UN Sustainable Development Goal (SDG) 3: Ensure healthy lives and promote well-being for all at all ages. The target of this SDG for non-communicable diseases¹¹ for 2030 is “to reduce by one third premature mortality through prevention and treatment and promote mental health and well-being.”¹²

4 Achieving the goal: areas for action

Given the high level of ambition, a comprehensive plan of bold actions supported by all Member States and stakeholders is required to achieve the Mission’s goal. Figure 1 illustrates that effective interventions are needed to improve 1. prevention, 2. diagnostics and treatment of cancer, and 3. the quality of life of cancer patients, survivors, and their families and carers. As such, these areas are considered the pillars of the Mission. Effective interventions in these areas all require a thorough understanding of cancers, causal factors and mechanisms, and their impact; therefore, understanding is considered the basis for actions. Furthermore, effective policy measures are needed and resources should be allocated to ensure that citizens and other stakeholders in all Member States have equitable access to high-quality prevention, diagnostics and treatment, care and support, including access to research funding and knowledge.

¹⁰ The Mission on Cancer aims to avert more than 3 million additional premature deaths over the period 2021 – 2030, by accelerating progress of cancer prevention and control programmes and creating more equitable access to these programmes. This goal was set based on an analysis of avoidable deaths by the International Agency for Research on Cancer (IARC).

¹¹ www.who.int

¹² <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

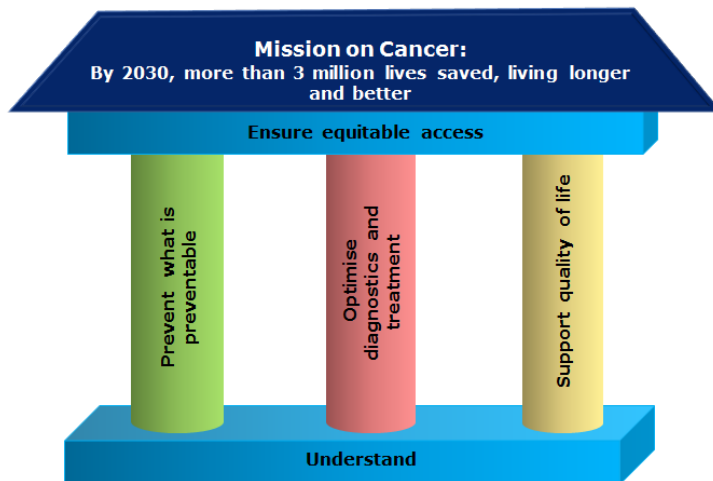


Figure 1. Intervention areas for action

Understand cancer, its risk factors and impact

Understanding is a key starting point for effective actions to save lives and improve the quality of life of persons with and after cancer, their families and carers. What we do not understand, we cannot address effectively.

Understanding the biological processes in the human cell is crucial for diagnosing cancer and developing effective treatment. Despite developments in cancer treatment, some cancers are still resistant to all available therapies, and some well-known targets are still untreatable with current drugs. A special focus is deemed necessary on anti-cancer medication innovation for childhood cancers, cancers in adolescents and young adults, and cancers in the elderly, as these populations have distinct age-related biological and clinical characteristics.

Understanding the complexity of cancer and the role of factors and determinants (e.g. lifestyle, environment, workplace exposure, but also sex/ gender and age) is important for developing effective preventive measures. Some factors are known to play a role in the development of cancers but their precise impact is not clear, whereas other causal factors remain to be discovered. Moreover, changing human behaviour has proven to be a challenge. Therefore, more understanding is needed of how people perceive health threats and cancer risks, how they behave accordingly and how unhealthy behaviours can be sustainably changed.

Furthermore, there is an urgent need to obtain a better understanding of the impact of cancer treatment on patients, both to optimise treatment and improve quality of life. Many people experience physical and mental health problems even years after their cancer diagnosis and initial treatment. Understanding how each individual reacts to treatment and how treatment

affects mental health is crucial for developing more effective care and support for patients and their carers.

🔗 Recommendation 1: Launch UNCAN.eu – a European Initiative to Understand Cancer

Despite tremendous progress in deciphering the genetic and biological basis of cancer, our understanding of the molecular processes at the cancer cell level and the interactions of the tumour and its host is still very limited. This holds in particular for cancers for which understanding is lacking and rare cancers. The potential for increasing our understanding in this area is demonstrated by the significant benefit obtained through targeted therapies and host immune activation against some tumours. Recent technological developments and European collaborations provide an excellent opportunity for realising this potential through obtaining a comprehensive and dynamic view of how certain cancers initiate, develop and spread in the context of the host.

This requires a new level of investment in innovative research, including high-potential/high-risk projects. Therefore, the Mission Board proposes a Europe-wide platform, UNCAN.eu, utilising relevant research infrastructure and investing in the development of new models and technologies interrogating the interactions of cancers and their host. UNCAN.eu would encompass relevant stakeholders and enable integration of innovative models and technologies with longitudinal patient data, samples and biomarkers for identification and translation to patients. UNCAN.eu would provide breakthroughs in understanding how cancers initiate, develop and spread in the context of the host and thereby provide a basis for saving millions of European citizens' lives in synergy with actions related to recommendations 2-6 and 11-12 of this Draft Mission outline as well as actions related to the Europe's Beating Cancer Plan and other EU Research and Innovation Missions (see Annex I).

🔗 Recommendation 2: Develop an EU-wide research programme to identify (poly-)genetic risk scores

This action aims to assess the individual cancer risk with refined algorithms based on newly identified polygenic risk scores (PRS). Based on an increased understanding of individual cancer risks, education activities and counselling could be improved.

Sampling and data collection would be harmonised to enable sharing on an existing European Research Infrastructure¹³ (e.g. BBMRI-ERIC¹⁴, EATRIS-

¹³ A facility that provides resources and services for a research community to conduct research and foster innovation. A Research Infrastructure can be used beyond research, e.g. for education or public services. It may be single-sited, distributed, or virtual. A Research Infrastructure may include: scientific equipment or sets of instruments; collections,

ERIC¹⁵, ELIXIR¹⁶). The proposed research programme¹⁷ would foster the implementation of genomic and informatics infrastructures for (GDPR¹⁸-compliant) data collection and dissemination, taking advantage of Digital Health Europe¹⁹ and the initiative of the EU Member States “towards access to at least 1 million sequenced genomes in the EU by 2022”²⁰. The Mission on Cancer could also contribute to achieving the objectives of this initiative. In addition, the research programme would promote clinical validation of the PRS, educational activities on the clinical relevance of polygenic risk scores and solicit public debate on their usage and control.

The proposed research programme would be carried out in all Member States to overcome existing inequity in access to cancer research and knowledge. In addition, the research programme would be extended to other disease areas, and as such contribute to increased understanding of other life-threatening or disabling non-communicable diseases.

Prevent what is preventable

Despite improvements in cancer detection and treatment, there is a need for cancer prevention and health promotion to remain a very high priority. Lifestyle is a risk factor for many cancers and, although persistent, a modifiable factor. Around one third of deaths from cancer are due to the five leading behavioural and dietary risks: tobacco use, alcohol use, high body mass index, low fruit and vegetable intake, and lack of physical activity, as described in the European Code against Cancer.²¹⁻²² Furthermore, cancer is the leading cause of work-related deaths. The International Labour Organization estimated that over

archives or scientific data; computing systems and communication networks; any other research and innovation infrastructure of a unique nature which is open to external users. (https://ec.europa.eu/info/research-and-innovation/strategy/european-research-infrastructures_en).

¹⁴ A European Research Infrastructure for biobanking. BBMRI-ERIC brings together researchers, biobankers, industry and patients to boost biomedical research. It offers quality management services, support with ethical, legal and societal issues, and a number of online tools and software solutions. (<https://www.bbmri-eric.eu/>)

¹⁵ <https://eatris.eu/>

¹⁶ <https://elixir-europe.org/>

¹⁷ A coherent set of research and innovation actions undertaken by a community of researchers in co-creation with stakeholders, based on common definitions, assumptions, methods and goals. (this Draft Mission outline)

¹⁸ General Data Protection Regulation (<https://gdpr-info.eu/>)

¹⁹ <https://digitalhealthurope.eu/>

²⁰ <https://ec.europa.eu/digital-single-market/en/news/towards-access-least-1-million-genomes-eu-2022-1-year>

²¹ WHO (2018, November 12). Cancer. Retrieved May 19, 2020, from <https://www.who.int/news-room/fact-sheets/detail/cancer>

²² Schütz J, Espina C, Villain P, et al. European Code against Cancer 4th edition: 12 ways to reduce your cancer risk. *Cancer Epidemiol* 2015; 39 Suppl 1: S1-S10. (<https://cancer-code-europe.iarc.fr/index.php/en/>)

106,000 cancer deaths in Europe in 2017 were attributable to occupational causes.²³

Early detection of cancer can improve cancer treatment outcomes and prevent or reduce deterioration of health and wellbeing. Early detection can be achieved by screening and creating awareness of suspicious signals among the population. Despite the Council Recommendation on cancer screening²⁴ adopted unanimously by the Health Ministers of the EU in 2003, in most Member States cancer screening is still not fulfilling the criteria set for population-based, organised programmes.

The area of prevention is particularly suited for creating synergies with other EU Research and Innovation Missions (see Annex I), as well as with the European Green Deal²⁵, the Farm to Fork Strategy²⁶, the European Health Data Space²⁷ and the Europe's Beating Cancer Plan.

👉 Recommendation 3: Support the development and implementation of effective cancer prevention strategies and policies within Member States and the EU

Preventing cancers calls for effective policy underpinned by excellent research. The Mission Board proposes to establish a research programme to identify effective cancer prevention strategies and methods to provide up-to-date knowledge to EU institutions and countries for designing and implementing effective cancer prevention measures at EU- and national level, tailored to local needs and conditions. Initial areas of research would focus on alcohol, food and sugar sweetened beverages and tobacco consumption, as well as commercial determinants²⁸ of health. These would be supplemented with research on exposures to workplace carcinogens, including emerging causes of cancer, air pollution, interactions of behavioural risk factors and comorbidities, as well as prevention strategies along the entire cancer continuum.

The research programme would also provide multi-disciplinary support for the prevention of other non-communicable diseases, and build research capacity and train young researchers across the EU in prevention and implementation research. The added value of an EU-wide approach also lies in its potential to create a large evidence base, including evidence from health economic evaluations of preventive interventions and measures.

²³ <https://www.wsh-institute.sg/-/media/wshi/past-publications/2017/global-estimate-of-occupational-injuries-and-workrelated-illnesses-2017.pdf>

²⁴ <http://data.europa.eu/eli/reco/2003/878/oj>

²⁵ https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

²⁶ https://ec.europa.eu/food/farm2fork_en

²⁷ <https://www.efpia.eu/news-events/the-efpia-view/blog-articles/a-european-health-data-space-a-small-step-or-a-giant-leap/>

²⁸ factors that influence health which stem from the profit motive. (see <https://www.who.int/bulletin/volumes/97/4/18-220087/en>)

To support the implementation of effective prevention strategies within Member States, the Board also recommends the creation of a Policy Support Facility²⁹. This would be aligned with the proposed research programme and research initiated by other EU Research and Innovation Missions (Annex I), as well as flagship EU policy initiatives, such as the Europe's Beating Cancer Plan, the European Green Deal and the Farm to Fork Strategy.

This recommendation will also address an important cross-cutting theme, i.e. the reduction of inequity in knowledge and access to effective cancer prevention and implementation research and programmes between and within Member States. It will also promote a whole-of-government approach to achieving a major breakthrough in cancer prevention.

🔗 Recommendation 4: Optimise existing screening programmes and develop novel approaches for screening and early detection

To improve cancer screening in all Member States, the Mission Board proposes establishment of an EU-wide research programme to identify obstacles, optimise existing screening programmes and develop new approaches for screening and early detection of cancers. Studies will be designed together with citizens and other stakeholders, and support the development and implementation of innovative screening methods for cancers for which a reliable screening tool is lacking or for which current screening methods are suboptimal (as recommended by the Joint Action CanCon³⁰); this also includes individualised approaches to screening. To optimise screening impact, effective communication strategies should be developed to enhance citizens' understanding of cancer risks and screening.

Advances in new low-cost, non- or minimally invasive tests as well as new diagnostic technologies (e.g. liquid biopsies, volatolome testing, imaging biomarkers including radiomics, genetic risk scores, fluid markers, etc.) should be taken into account. Big-data analysis and machine learning methods could be integrated in screening and early detection programmes to generate new insights into risks and risk factors. Decision-making on screening and early detection strategies and programmes in all Member States should include cost-effectiveness modelling.

²⁹ A service offering practical support to EU Member States and countries associated to the Horizon Europe Programme to design, implement and evaluate reforms that enhance the quality of their research and innovation investments, policies and systems. The Policy Support Facility provides best practice, independent high-level expertise and guidance at the request of Member States and Associated Countries through a number of services: peer reviews, mutual learning exercises and specific support to countries. The Policy Support Facility responds to the strong need to offer more customer-oriented services to support evidence-based policy making. (adapted from: <https://rio.jrc.ec.europa.eu/policy-support-facility>)

³⁰ <https://cancercontrol.eu/archived/>

For continuous monitoring of screening quality, the Mission Board proposes development of a quality assessment tool, which could be implemented in all Member States. Exchange of good practices and twinning of high- and low-performing countries to reduce inequity in access to high-quality screening should also be supported.

Optimise diagnostics and treatment

Many lives have been saved and the quality of life of patients and survivors has improved because of early diagnosis and better treatments. However, many cancers are still diagnosed at an advanced stage, are very aggressive and/or resistant to all therapies currently available.

An improved understanding of the aetiology, development and spread of poorly understood cancers could provide new biomarkers for diagnostics and new targets for therapies for all cancers. This would include highly lethal and rare cancers as well as cancers occurring in children, adolescents/young adults and the elderly with distinct age-related biological and clinical characteristics for which currently no effective treatment is available.

The translation from the development of breakthrough diagnostic technologies and from the identification of new targets for treatment into clinical trials is still too long. This requires further development of improved methodological validations and rapid implementation in cancer care.

A mission-driven approach aims to translate research breakthroughs into improved diagnostics and effective treatments, and to support equitable, timely access to optimal cancer diagnosis and treatment for each patient in all Member States.

Recommendation 5: Advance and implement personalised medicine approaches for all cancer patients in Europe

Personalised medicine offers the promise of maximally effective therapies with minimal harm, both for patients and society. While considerable efforts are being made (e.g. ERA PerMed³¹, ICPeMed³²), many cancer patients still do not benefit from personalised medicine approaches. This recommendation aims to advance, scale, implement and optimise current personalised medicine approaches for cancer, deepening our understanding of cancer complexity, i.e. the role of the host, the impact of the outer environment on cancer initiation, and the evolution of cancer over time, to increase the number of patients for whom effective personalised approaches can be found.

As increased precision in cancer management will rely on large datasets for

³¹ ERA-Net (European Research Area Network) on personalised medicine (www.erapermed.eu)

³² International Consortium for Personalised Medicine (<https://www.icpermed.eu/>)

learning as well as advanced methods and standards, this recommendation encourages large-scale collaboration and advanced data analyses in personalised medicine.

The uptake of personalised medicine is currently hampered by uncertainty about its outcomes and, in consequence, access to personalised therapies remains limited. This recommendation therefore aims to advance the methodology into outcome-based personalised medicine programmes, building on – but surpassing – initiatives such as PERMIT³³, in close collaboration with clinical and HTA³⁴ decision-makers. At the same time, personalised medicine for cancer should expand in scope to achieve optimal and person-centred care, i.e. including additional tools for personalisation, such as imaging, but also patient preferences and individual risk/benefit trade-off.

☞ Recommendation 6: Develop an EU-wide research programme on early diagnostic and minimally invasive treatment technologies

With increased and more effective screening, it is expected that many cancers will be detected at an earlier, less advanced stage. At the same time the increasing implementation of effective targeted treatment has shown phenomenal and sometimes even complete responses to preoperative treatment. This raises the question of whether, in very good responders, mutilating resection surgery is still justified. Minimally invasive technologies, such as image-guided surgery, endoscopic management, radiotherapy and interventional radiology, are advancing rapidly, yet research is still highly needed. These treatments use imaging to efficiently target the tumour and spare normal tissue. Hence, minimally invasive treatment has the potential to cure while providing the patient with a better quality of life. With the launch of effective minimally invasive therapies the role of new diagnostic tools and Artificial Intelligence (AI) is becoming increasingly important to guide treatment procedures and monitor treatment response. Research into modern imaging technology is crucial to speed up the implementation of minimally invasive therapies in clinical practice.

Integration of all diagnostic markers, i.e. combining imaging, tissue, genetic, fluid and clinical markers ('integrated diagnostics'), has the potential to increase the accuracy of prediction models of outcome and reduce the use of inefficient diagnostic tools, hereby enhancing personalised medicine. Hence successful research into and implementation in clinical practice of effective early diagnostic tools, integrated diagnostics and minimally invasive treatments may lead to more cures and a better quality of life for patients with less advanced (stage I-III) cancers.

³³ PERsonalised MedicIne Trials (PERMIT) project (<https://www.ecrin.org/activities/permit-project>)

³⁴ Health Technology Assessment

Support quality of life

Increasing incidence and survival rates will result in many more EU citizens in the near future who will need to find a way to live a good life with or after cancer. Therefore, an important part of the Mission's goal is to achieve the best possible quality of life for everyone in the EU who is exposed to cancer in some way and in some phase of their lives.

Supporting the quality of life of people exposed to cancer requires a thorough understanding of their cancer-related problems. For patients and survivors these may be (late) side-effects of cancer treatment, symptoms, comorbidities and functional disability (which will increase with age), mental health and reproductive health problems. Many cancer survivors experience difficulties in returning to work because of persistent side-effects but also due to ignorance, stigma and hesitation on the part of employers. Obtaining health insurance or other financial products may also be difficult or expensive. This may also hold for individuals with a known family history of certain (hereditary) cancers or polygenic risks. Special attention should be paid to survivors of childhood cancer, as they are particularly vulnerable due to early life disruption. Two thirds of childhood cancer survivors experience adverse effects in adulthood.³⁵ This negatively impacts career opportunities, income, social relationships and starting a family.

The Mission on Cancer aims to contribute to a better understanding of (late) treatment side-effects, symptoms, comorbidities, functional disability and psychosocial needs, to relieve symptoms, improve palliative care and survivorship support. The Mission also aims to improve access to quality of life and survivorship support in all Member States. Besides research and innovation, this calls for policy and support actions, adjustment of legal frameworks and close collaboration with EU citizens, cancer patients and survivors. Fundamental for all actions is that they be co-designed, -implemented and -evaluated with those for whom they are of concern.

³⁵ Haupt R, Essiaf S, Dellacasa C, Ronckers CM, Caruso S, Sugden E, Zdravec Zaletel L, Muraca M, Morsellino V, Kienesberger A, Blondeel A, Saraceno D, Ortali M, Kremer LCM, Skinner R, Roganovic J, Bagnasco F, Levitt GA, De Rosa M, Schrappe M, Hjorth L, Ladenstein R; PanCareSurFup, ENCCA Working Group; ExPo-r-Net Working Group. The 'Survivorship Passport' for childhood cancer survivors. *Eur J Cancer*. 2018 Oct;102:69-81. doi: 10.1016/j.ejca.2018.07.006

☞ Recommendation 7: Develop an EU-wide research programme and policy support to improve the quality of life of cancer patients and survivors, family members and carers, and all persons with an increased risk of cancer

The Mission Board recommends developing an EU-wide research programme to improve the quality of life of all cancer patients, survivors and their carers, and all citizens with an increased risk of cancer. This research programme should start by gaining a comprehensive understanding of the holistic needs of all (subgroups) exposed to cancer. Together with this, appropriate methods and metrics should be developed to capture key elements of quality of life from the perspective of those affected by cancer, based on their personal life goals and values. Based on the results of these first actions, research should be conducted to develop innovative effective interventions. This includes high-quality research to limit the (late) side-effects of cancer treatments, to relieve pain and improve palliative care. It may well also include interventions in other sectors, such as regulatory and social interventions.

Apart from research and innovation, there is a need for supportive policies to identify and monitor physical and mental health problems among patients and survivors life-long by implementing a health passport for people living with and after cancer, and to help survivors achieve their personal life goals (e.g. related to work, family life). It is therefore recommended that countries be supported to develop and implement policies and strategies to help cancer survivors assert the 'right to be forgotten', counteract discrimination and strengthen the legal position of individuals with a family history of cancer, cancer patients, survivors and carers. Support should also be offered to improve access to health promotion, mental health and social care for cancer patients and survivors in all Member States.

The research programme and policy support will both link to actions resulting from recommendations 5, 6, 9 and 13, while also feeding the proposed European Cancer Patient Virtual Centre (recommendation 8) and providing evidence and support to the Europe's Beating Cancer Plan.

☞ Recommendation 8: Create a European Cancer Patient Digital Centre where cancer patients and survivors can deposit and share their data for personalised care

This recommendation involves the creation of a European Cancer Patient Digital Centre (ECPDC), i.e. a virtual network of patient-controlled (national) health data infrastructures, in which cancer patients and survivors can deposit their health data provided by their medical care providers (e.g. imaging, genetics, blood markers, clinical and lifestyle data) in a standardised and interoperable manner. The repository would include a summary of treatments and integrate patient-reported outcomes and everyday life data provided by patients and survivors themselves.

The creation of the ECPDC would rely on a patient-driven roadmap and

governance document, drawing on existing expertise at the EU and national level and on EU- and Member State-tailored data-sharing procedures. The ECPDC (with due regard for the GDPR) will provide people living with and after cancer with a health passport, including information on treatments and follow-up recommendations, and foster a (long-term) personalised care plan. For patients and carers, the ECPDC will be a global centre of knowledge on cancer, cancer prevention and health promotion, diagnostics, treatment and supportive care. For survivors and their families, the ECPDC will also be a global point of contact, offering guidance and support on returning to work, addressing financial issues and asserting survivors' rights.

Data within the ECPDC will serve as a valuable resource for research to improve understanding of cancer and its impact on patients' and survivors' lives, thus contributing to the development of improved diagnostics, treatment, care and quality of life support (recommendations 1 and 2, 4 to 7, 9, 13). In line with the European data strategy put forward by the European Commission³⁶, the ECPDC will give a voice to patients and survivors, enable them to enforce their rights, and increase their confidence in sharing their data for cancer research, innovation and policy development.

Ensure equitable access

One of the core values across the European Union is the shared commitment to universal access to high-quality care financed on the basis of equity and solidarity. Unhindered access to prevention and care is often under pressure within health systems broadly, and in the field of cancer in particular, due amongst others to widely shared pressures on limited resources. This impacts all areas of the Mission, making it a cross-cutting challenge that should be addressed in order to reach the Mission's goal.

According to recent European Commission reports³⁷, Europe is characterised by inequitable access to cancer prevention and timely, high-quality diagnostics and treatment. These are the result of geography and socio-economic disparities between and within countries, which have a profound impact on cancer incidence and survival. With no assurance of equitable access to preventive measures, new diagnostics and treatments, achievements in the field of cancer research and innovation will not be distributed evenly within Europe and among its most vulnerable populations. Equitable access implies access to education, amongst others, to improve citizens' (digital) health literacy, to expertise (e.g. training for care professionals) and to research and innovation resources.

Improving access within Member States requires a better understanding of why some policy tools have not been implemented effectively and what could be

³⁶ https://ec.europa.eu/info/sites/info/files/communication-european-strategy-data-19feb2020_en.pdf

³⁷ State of Health in the EU Companion Report 2019. Publications Office of the European Union, 2019, State of Health in the EU Companion Report 2019: ec.europa.eu/health/sites/health/files/state/docs/2019_companion_en.pdf

done to address inequity in access to prevention, diagnostics, treatment and quality of life support for anyone exposed to cancer. In addition, empowering patients should make it possible for them to gain more control over their care and life, and to act on issues of high value to them personally.

Hence, achieving equitable access calls for 1. a strong commitment from Member States, 2. availability and optimal use of research and clinical data (see recommendations 1-8), 3. strong promotion of research and innovation, supported by the establishment of at least one Comprehensive Cancer Infrastructure (CCI) in each Member State (see recommendation 10), and 4. EU-wide acknowledgment of the urgent need to transform the culture around cancer (see recommendation 13).

☞ Recommendation 9: Achieve Cancer Health Equity in the EU across the continuum of the disease

Significant inequities exist in access to and quality of cancer prevention, screening, early detection, treatment, care and survivorship support between Member States and among different social groups and demographic groups (age, gender) within Member States.

The causes of these inequities should be analysed and strategies should be developed to overcome them. This requires an in-depth understanding of their underlying factors at all levels of the health system. In addition, more knowledge is needed to better understand interactions between (multiple) behavioural and environmental risk factors and the impact on successful prevention initiatives of socio-economic and health inequities.

Apart from research, policy support and interventions are needed to overcome existing inequities across and within Member States. These might include, amongst others, an annual public health promotion and cancer education programme to raise awareness and increase cancer knowledge by distributing messages through different channels with a particular focus on disadvantaged groups; policy support to countries to agree on a minimum set of high-quality screening programmes; policy support and facilitation of collaboration to accelerate and monitor access to new diagnostics, treatments and drugs; policy support to improve access to health promotion, effective return-to-work policies, mental health and social care for patients, survivors and their families, asserting the 'right to be forgotten' (in line with recommendations 7 and 8).

☞ Recommendation 10: Set up a network of Comprehensive Cancer Infrastructures within and across all EU Member States to increase quality of research and care

The current situation in the EU is characterised by substantial differences in the standards of care, research and education between Member States, and even within a country: patients receiving care from hospitals in more remote

areas often do not have access to treatment regimens that are offered only in the context of clinical studies. Uniform quality criteria set by accreditation standards are expected to decrease current inequity.

To ensure that each EU citizen or cancer patient has access to and could benefit from high-quality cancer research and care, it is proposed to support establishing a strong network of Comprehensive Cancer Infrastructures³⁸ (CCIs) within and across EU Member States. EU citizens or cancer patients should have access to an accredited CCI in their own country (at least one CCI in each MS), albeit through a national access point to an accredited CCI in another country, if relevant. The network will contribute to sharing experiences and harmonising standards of care and research implementation. Each CCI should take into account the structure, governance, and geographical context – drawing, when possible, on EU-accredited care, teaching and research standards; liaise with the (EU-wide, national or regional) cancer and screening registries and with the European Reference Networks dealing with cancer (EURACAN³⁹, EuroBloodNet⁴⁰, Genturis⁴¹ and PaedCan⁴²); and integrate data collection to allow quality assurance and data consolidation. CCIs are expected to liaise also with biobanking facilities, and to build strong partnerships with research institutes and universities, as well as with an extensive international network. Newly established infrastructures should preferably align with existing initiatives within countries to ensure sustainability. Twinning arrangements could provide benefits for the performance of both newly established and existing CCIs.

Cross-cutting recommendations

The Mission Board proposes several (other) cross-cutting actions below to maximise the impact of the Mission on Cancer.

☞ Recommendation 11: Childhood cancers and cancers in adolescents and young adults: cure more and cure better

Cancer is the leading cause of death in Europe in children above one year of age. This cancer patient population is characterised by multiple types of rare cancers, unique to this population with specific epidemiological, biological and

³⁸ National or regional infrastructures that provide resources and services to support, improve and integrate cancer care, research, training of care professionals and education for cancer patients, survivors and families/carers. Different formats of Comprehensive Cancer Infrastructures are possible, including existing Comprehensive Cancer Centres or Care Networks. (this outline)

³⁹ European Reference Network Rare Adult Solid Cancers (<https://euracan.ern-net.eu/nl/start/>)

⁴⁰ European Reference Network Hematological Diseases (<https://www.eurobloodnet.eu/>)

⁴¹ European Reference Network on Genetic Tumour Risk Syndromes (<https://genturis.eu/l=eng/Home.html>)

⁴² European Reference Network for Paediatric Oncology (<https://paedcan.ern-net.eu/>)

clinical features. Whereas cancers in adults typically result from long-term processes, paediatric cancers develop early in life and over a much shorter period, suggesting that fewer but stronger events play a causal role. In addition to cancers that develop in early childhood, cancers in adolescents and young adults also require special attention, as their biological characteristics are distinct from (early) childhood cancers (and from cancers developing later in life). Given that incidence rates have been increasing continuously over the last decades, it is obvious that we need to increase our understanding of how cancers in children and adolescents/young adults initiate and develop.

Current survival rates come at a high price with a late effect burden from treatment of up to 60 %, which is related to old off-patent, off-label drug supply⁴³. Of all cancer medicines developed in the last decade (>150), only 6 % (9) were approved for children. Improving survival requires well-tested novel anti-cancer drugs tailored to specific tumour entities and age groups. A synergistic mission drawing on existing ambitious EU networks and aligned with the Europe's Beating Cancer Plan, focusing on the complex needs of paediatric cancer patients, survivors and their families could boost the transformation of paediatric cancer care and generate the evidence needed to advance diagnostic, treatment and survivorship support.

Recommendation 12: Accelerate innovation and implementation of new technologies and create Oncology-focused Living Labs to conquer cancer

This recommendation aims to provide new ways for traditional and non-traditional innovators to contribute to cancer understanding, prevention, diagnostics and treatment, and quality of life support. For this purpose, it is proposed to create Oncology-focused Living Labs⁴⁴ to conquer cancer in its broadest sense. These will collate best practices of multi-stakeholder collaborations, distilling principles for successful joint working. It will position the EU as the home of collaboration and research to tackle cancer in order to attract stakeholders across different sectors and disciplines to work on cancer challenges within the EU. Activities will entail horizon-scanning and trend

⁴³ Haupt R, Essiaf S, Dellacasa C, Ronckers CM, Caruso S, Sugden E, Zdravec Zaletel L, Muraca M, Morsellino V, Kienesberger A, Blondeel A, Saraceno D, Ortali M, Kremer LCM, Skinner R, Roganovic J, Bagnasco F, Levitt GA, De Rosa M, Schrappe M, Hjorth L, Ladenstein R; PanCareSurFup, ENCCA Working Group; ExPo-r-Net Working Group. The 'Survivorship Passport' for childhood cancer survivors. *Eur J Cancer* 2018;102: 69-81. doi: 10.1016/j.ejca.2018.07.006.

⁴⁴ User-centred, open innovation ecosystems based on a systematic user co-creation approach integrating research and innovation processes in real-life communities and settings. In practice, Living Labs place the citizen at the centre of innovation, and have thus shown the ability to better mould the opportunities offered by new ICT concepts and solutions to the specific needs and aspirations of local contexts, cultures, and creativity potentials. (JRC: <https://s3platform.jrc.ec.europa.eu/living-labs>)

forecasting across all relevant technologies to inform a holistic cross-sector approach to conquering cancer.

The Oncology-focused Living Labs will enhance cross-sector research, knowledge-sharing and implementation of new technologies. Through increasing mutual understanding, and creating efficient and effective collaborative approaches to driving innovation, job creation and industrial competitiveness in healthcare and health-related industries, innovation will be steered (e.g. facilitated, protected and rewarded) in the direction of solving the societal challenge of the cancer burden, as well as generating economic growth, wellbeing and technological spill-overs.

☞ Recommendation 13: Transform cancer culture, communication and capacity building

It is proposed to develop a coherent set of cross-cutting, cross-sector actions to enable citizens, clinical practitioners (including nurses, primary care physicians), researchers, other stakeholders (e.g. policy-makers, health insurers, employers and trade unions) and communities within all Member States to rethink cancer and challenge cancer culture in all its dimensions. Increased understanding of cancer has substantially improved cancer prevention and treatment over the last decades, with many more people living with and after cancer who are willing and able to live a meaningful life and participate in society as much as possible. However, thinking and communicating about cancer in research, healthcare and society has not substantially changed in the same way. In cancer research and innovation, co-design and co-creation with patients and survivors are still limited, but should become common practice. In cancer care, as in healthcare in general, a paradigm shift is needed towards person-centred, rather than disease-centred, care. This calls for individualisation and co-creating health and wellbeing with patients and their carers. European citizens and societies still hold on to traditional views on cancer, reflected in stigmatisation and discrimination of patients and survivors, and resulting in substantial preventable disease burden.

To support the uptake of accurate and up-to-date knowledge about cancer (joining ongoing efforts, such as for example JRC's Cancer Knowledge Centre), and stimulate communication and understanding on current scientific insights, it is proposed to develop and exploit an EU-wide Cancer R&I Dissemination and Communication Facility⁴⁵ using accessible language and citizen-/stakeholder- adapted communication tools.

Furthermore, it is recommended that national and EU-wide capacity building be developed and supported in order to adapt the skills and competences of all stakeholders in the changing field of cancer. This includes training all

⁴⁵ A service offering practical support to EU Member States and countries associated to the Horizon Europe Programme to disseminate accurate and up-to-date knowledge about cancer in lay language and to stimulate communication in line with current scientific knowledge about cancer. (this outline)

stakeholders and education programmes/campaigns to raise awareness among the general public in line with up-to-date scientific knowledge on cancers, their symptoms, risk factors, preventability, treatment options and impact on patients, survivors, their families and carers, and citizens with an increased risk of cancer.

ANNEX I: OVERVIEW OF RECOMMENDATIONS

Recommendation	Potential synergy with other EU Research and Innovation Missions
<p>1 Launch UNCAN.eu – a European Initiative to Understand Cancer</p>	<p>Missions on Soil health and food; Climate-neutral and smart cities; Adaptation to climate change including societal transformation</p>
<p>2 Develop an EU-wide research programme to identify (poly-) genic risk scores</p>	<p>Missions on Soil health and food; Climate-neutral and smart cities; Adaptation to climate change including societal transformation</p>
<p>3 Support the development and implementation of effective cancer prevention strategies and policies within Member States and the EU</p>	<p>Missions on Soil health and food; Climate-neutral and smart cities; Adaptation to climate change including societal transformation</p>
<p>4 Optimise existing screening programmes and develop novel approaches for screening and early detection</p>	
<p>5 Advance and implement personalised medicine approaches for all cancer patients in Europe</p>	
<p>6 Develop an EU-wide research programme on early diagnostic and minimally invasive treatment technologies</p>	
<p>7 Develop an EU-wide research programme and policy support to improve the quality of life of cancer patients and survivors, family members and carers, and all persons with an increased risk of cancer</p>	<p>Communication to citizens together with other Missions</p>
<p>8 Create a European Cancer Patient Digital Centre where cancer patients and survivors</p>	

	can deposit and share their data for personalised care	
9	Achieve Cancer Health Equity in the EU across the continuum of the disease	
10	Set up a network of Comprehensive Cancer Infrastructures within and across all EU Member States to increase quality of research and care	
11	Childhood cancers and cancers in adolescents and young adults: cure more and cure better	
12	Accelerate innovation and implementation of new technologies and create Oncology-focused Living Labs to conquer cancer	
13	Transform cancer culture, communication and capacity building	Communication to citizens together with other Missions

ANNEX II: FROM RECOMMENDATIONS TO SPECIFIC ACTIONS

This Draft Mission outline describes the overall goal of the Mission on Cancer as identified by the Board based on the expertise of the Board members and valuable inputs from the members of the Cancer Mission Assembly, Member States, other experts, representatives of citizens and patients and from Foresight workshops. To achieve this goal, the Board has made a number of recommendations for actions.

Each of these recommendations has been briefly described in this Draft Mission outline, separately from one another for the purpose of clarity and simplicity. But it should be noted that these recommendations form a coherent framework of proposed actions, as visualised in Figure 2.

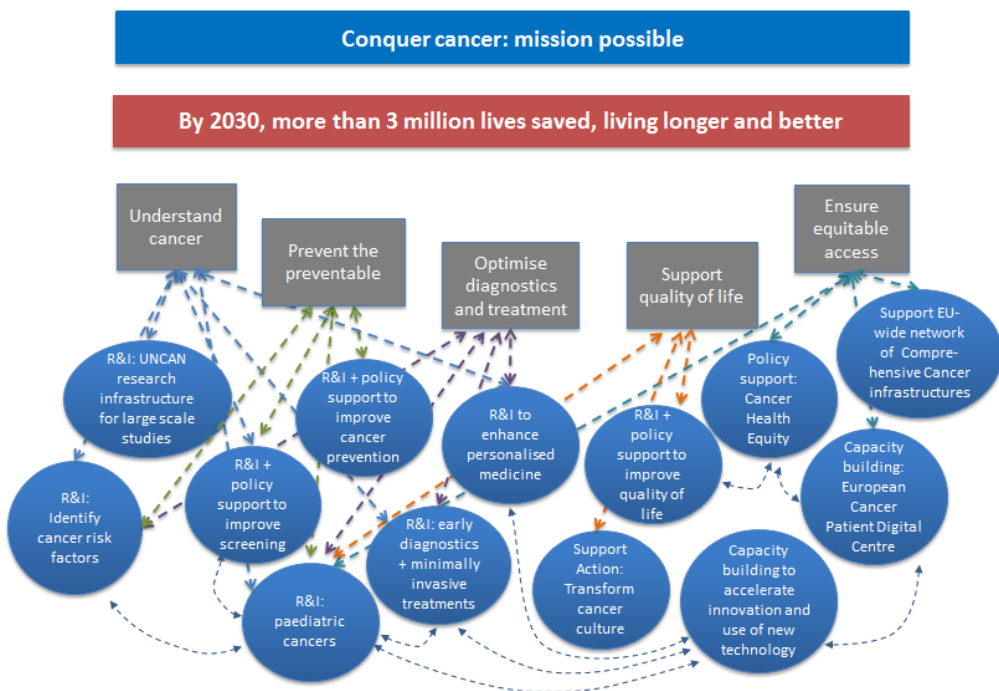


Figure 2. Relationships between Mission’s goal, areas of action and recommended actions

The recommendations described in this Draft Mission outline will be further developed in the second half of 2020. They will be combined and specified in a proposal for specific actions, each with an ambitious and measurable objective, a tight but realistic timeframe, identified key performance indicators to measure progress towards its objective and identified actors. This will be done together with the members of the Cancer Mission Assembly and all stakeholders, for whom several stakeholder engagement activities are being planned for autumn 2020. To strengthen the impact of the Mission, synergies will be created as

much as possible with national cancer plans and other actions of Member States as well as of other Horizon Europe Missions, research and investment programmes and other EU policies and actions, in particular the Europe's Beating Cancer Plan.

To prepare this next step, the Board has started to draft a number of specific actions based on its recommendations, which will be discussed with all stakeholders in Member States and at EU level, to ensure maximal impact of the Mission with optimal use of available resources.

Figures 3 and 4 highlight some examples of how the Board's recommendations could be further developed in specific actions with measurable objectives, identified actors and synergies with related initiatives.

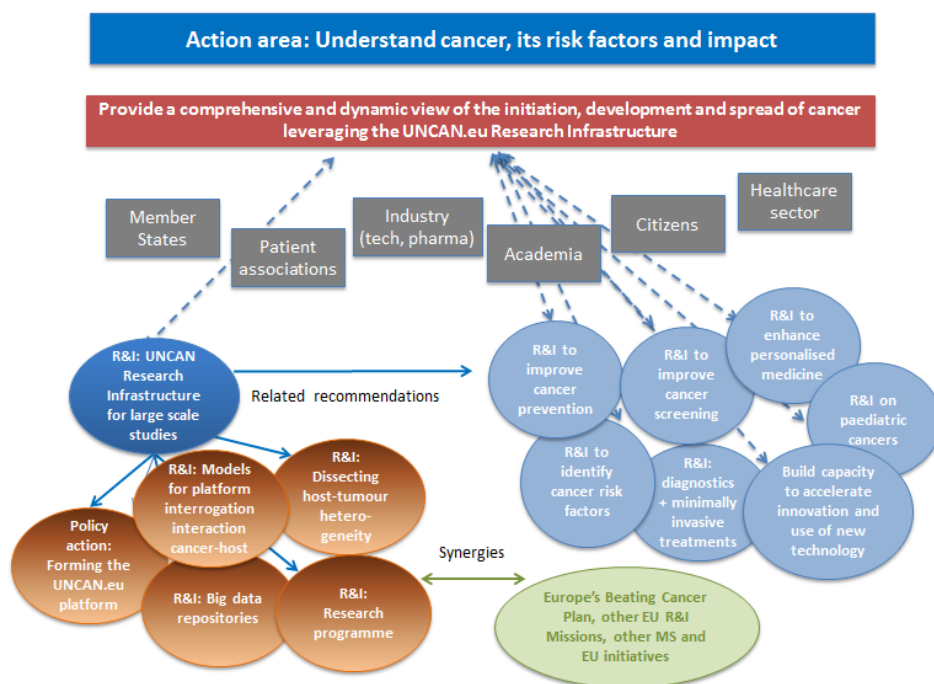


Figure 3. Example of action area 'Understand cancer, its risk factors and impact'

Action area: Prevent what is preventable

By 2030, all EU Member States will have implemented comprehensive cancer prevention strategies, resulting in a reduction of preventable cancer cases of at least 25 %

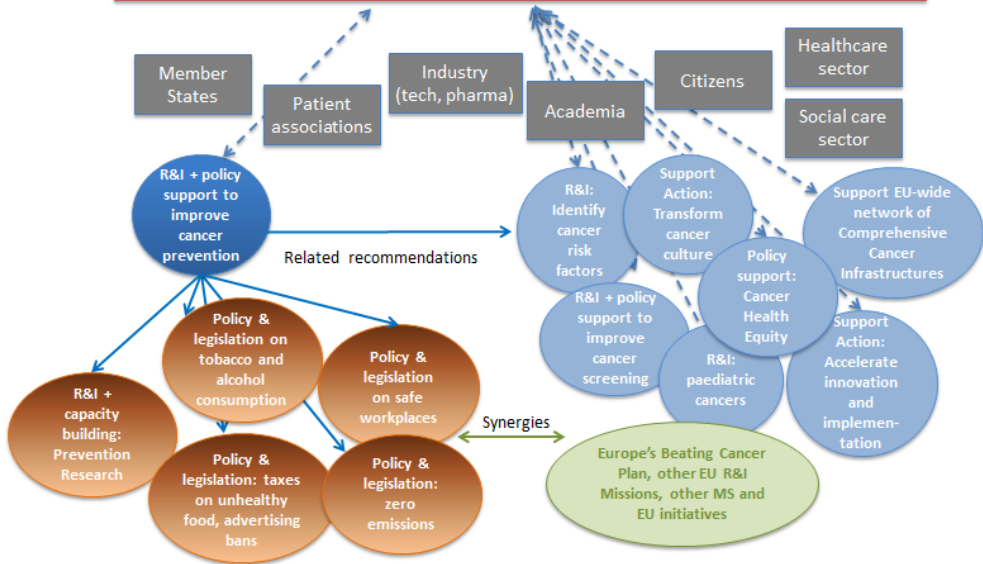


Figure 4: Example of action area 'Prevent what is preventable'

ANNEX III: CITIZEN ENGAGEMENT ACTIVITIES

As explained in this Draft Mission outline, the Mission on Cancer aims to generate a substantial impact on the lives of all European citizens exposed to cancer. Therefore, it is of utmost importance that the Mission is being developed together with citizens and cancer patients, survivors and their families or carers (hereafter, citizens and patients), and that it reflects the voice of these people.

To ensure that the voice of citizens and patients is heard in all phases of Mission development and implementation, several patient representatives are members of the Mission Board and the Mission Assembly. Moreover, members of the Board are taking the role of ambassadors to engage citizens and patients in their home countries in the developmental process. A number of citizen engagement activities has already been organised in Member States and this will be extended in the second half of 2020. Very recently, the European Commission organised a public consultation on the Europe's Beating Cancer Plan. In addition, a first focus group about the Mission on Cancer was organised with the European Youth Forum. A second focus group with the Youth Forum will be scheduled for the second phase of the Mission development. Results of these citizen engagement activities will be integrated in the final Mission outline, which will be published at the end of this year. This final outline will then also include the results of six (online) focus groups with citizens and patients, which will be organised by EUHealthSupport to support the Mission Board in specifying its proposed actions. Below we provide a summary of the preliminary results of the first of these six focus groups. In addition, a summary is provided of the first focus group with the European Youth Forum.

Focus group with (representatives of) EU citizens

Over the period 8-22 May 2020, an online asynchronous focus group took place with 12 (representatives of) EU citizens. Participants were living in Austria, Belgium, Bulgaria, Cyprus, Czechia, Finland, Greece, Ireland, the Netherlands, Slovenia, Spain and Sweden. All were adults, and indicated that they had either had personal experience with cancer (as a patient, survivor, or through family, friends or colleagues) or professional experience. The majority worked in (cancer) patient advocacy; others worked as journalists or as volunteers (in sectors other than health). Questions were posted on a secure IT platform and referred to the proposed Mission's goal, areas for action and recommendations for cancer prevention and screening, treatment and care, and quality of life and survivorship support.

Participants expressed strong support for the goal identified for the Mission. There was appreciation for the fact that the goal did not focus only on saving lives, but also on improving the lives of those exposed to cancer. Regarding the identified areas for action, participants emphasised the importance of cancer prevention, as they felt that actions in this area would have the potential to save and improve many lives while also being relatively inexpensive (compared

to cancer treatments). The area of cancer treatment was also strongly supported, as participants felt that many cancer patients had their hopes pinned on new drugs and therapies. Participants emphasised the importance of raising awareness and educating citizens and society based on up-to-date accurate scientific knowledge about cancer.

Cancer prevention was considered a shared responsibility of citizens and (national) governments. Participants pointed to people's own responsibility for healthy living, but also indicated that national or EU-wide policies were important to support this, for example by enabling access to affordable healthy food, increasing knowledge and raising awareness (e.g. public campaigns, health education at schools) about cancer and risk factors, and by enabling cancer screening and strengthening health literacy. Taxes and bans to reduce smoking, overweight and alcohol consumption were considered a way to go, but not by all participants. As an alternative, some participants suggested putting more effort into health promotion and education (starting at early age, using digital communication channels), research into personalised advice and taking account of personal characteristics and circumstances in developing tailored lifestyle interventions. Cancer screening was felt to be highly important; participants favoured (more) EU policy in this area, while also pointing to the responsibility of countries for offering high-quality cancer screening.

Most participants evaluated the **quality of available cancer treatment and care** in their country as good, although differences were observed in the level of person-centredness of cancer care. Some participants mentioned that cancer care in their country focused exclusively on the medical treatment, providing little opportunity for obtaining mental healthcare, quality of life and survivorship support. Several participants emphasised the importance of patient involvement in designing and evaluating cancer treatments and cancer care in general. Most had a positive attitude on personalised medicine for cancer, but emphasised that careful and accurate communication about this topic is needed to better explain to citizens and patients what it is, including its pros and cons.

In the action area of **quality of life and survivorship support** participants suggested a number of specific actions they felt to be important, such as peer-to-peer support, support from patient-experts, psychosocial support for family members (including support for siblings of children with cancer), return-to-work support, and research to reduce and better manage (late) side-effects of cancer treatment. Some also mentioned that person-centredness of cancer care needed attention and that patients should be considered as partners in care. Participants also emphasised the need to put effort into educating the social environment and society in general on cancer survivors' physical and mental health issues, and related challenges for personal and social life.

In many of their responses, participants mentioned the importance of equity. For example, they pointed to standardisation of cancer care across and within countries, and equitable access to cancer drugs and knowledge.

Focus group with European Youth Forum

On May 14 2020, a group of young citizens met online with members of the Cancer team to exchange ideas on the Mission on Cancer. The meeting brought together four women and three men, aged 18-31 years, from six countries (Lithuania, Poland, Romania, Slovenia, Spain, and Turkey). The group consisted of researchers in oncology, medical students, NGO volunteers, and a patient cancer advocate. The participants shared a common interest in the Mission on Cancer and giving their views about what is important, missing and necessary to tackle cancer. The discussion followed the Cancer Mission outline proposed by the Mission Board, based on open questions addressing each mission intervention area. Following the same rationale, the summary below captures the essential aspects raised in the discussion.

The majority of participants believed that beating cancer requires a **comprehensive approach**, including societal and environmental aspects, and moving beyond genetics and traditional research. Adopting a wide approach also means "making cancer a societal problem". People's awareness about health and cancer stigma are still prevalent in our societies. Hence, the more the public knows about cancer, the easier it is for patients to go through treatment and recovery.

Two additional key issues raised concerned **resource optimisation** and **accessibility**. This is not always a matter of lack of resources, but lack of implementation and optimisation of what exists. Lack of or delayed access to clinical trials demonstrate both inadequate use of resources and inequitable access to treatments and innovative therapies. Furthermore, the patient is left alone in the search for information and alternative therapies, which are hard to access due to a lack of financial programmes and support. In this regard, improvements could mean support for patients' mobility (e.g. financial support to access care across the EU), and making knowledge easily available to both patients and medical staff (e.g. making knowledge on medicines easily available in the EU). Also solutions such as mobile screening are proposed to overcome access barriers to screening systems in rural areas.

Support for **quality of life** addressed concrete aspects of patients' and survivors' daily life. Aspects important to improving everyday life are frequently unseen, such as fertility/cryopreservation and reconstruction surgeries not supported by health systems. The need for and inadequacy of current practices in paediatric cancer were raised, including children and young patients sometimes sharing the same care units with adult patients, the need to ensure paediatric patients' access to education while in treatment and the need to tailor the treatment and care to patients' needs.

To **continue and expand the involvement of (young) citizens**, the group also made concrete suggestions, including via European programmes as Erasmus+ and EU Youth weeks (with specific actions dedicated to cancer), thus also making the Mission widely visible and raising its importance to the public.

ANNEX IV: INSIGHTS FROM FORESIGHT

In order to support the Board in the development and refinement of its Mission a Foresight study was conducted by the Foresight on Demand consortium, led by the Austrian Institute of Technology. It consisted of three components summarised in this Annex.

Scoping of Trends & Drivers for Cancer

As a starting point, a scoping study was conducted in order to provide an overview of relevant trends, drivers, developments and challenges influencing (1) our understanding of cancer, future approaches to (2) prevent, (3) diagnose, and treat cancer, and finally (4) provide support for the survivors. The study pointed to a number of pressing issues and trends. For example, in terms of medical innovation, both technological and social advances are able to point to more and more carcinogenic substances and behaviours, and at the same time are enabling great progress in understanding the causes of cancer. This also includes cancer-inducing factors outside the health sector, such as agriculture, nutrition, the environment and urban developments. It also requires addressing the (economic) burden for cancer on our health systems and the difficulties of national programmes to cope with this. Finally, as cancer is a societal as well as a personal issue, coping strategies are very much dependent on the socio-economic context. This means that across the EU there are fundamental differences within and between countries, among others in terms of the quality of their health systems and the accessibility for patients of proper prevention, diagnosis and treatment, as well as care for survivors.

Scenarios on the future of cancer prevention, diagnostics and treatment, and survivorship

In an earlier EU-funded project entitled FRESHER - FoResight and Modelling for European HHealth Policy and Regulation - a number of scenarios were developed in order to address effectively the burden of non-communicable diseases up to 2050. As part of the current study, two of these scenarios were adapted, with the aim of tailoring them specifically to possible futures in the fight against cancer. The two future health scenarios were discussed in a dedicated workshop with members of the Mission Board.

- Scenario 1, titled "*We will health you*", presents a society in which the main priority is to guarantee access to adequate healthcare for all European citizens in a timely manner in a growth-oriented society. For this purpose governments and the private sector collaborate closely to maintain a healthy workforce and to keep non-communicable diseases under control, with the aim of ensuring the continuation of economic productivity as well as the sustainability of the healthcare systems, among others also making use of big data and public and private investments to influence citizens' behaviour

towards healthy lifestyles effectively. In this scenario, promising medical innovations, such as breakthroughs in personalised prevention and treatment, are all widely accessible and affordable. This is largely due to a strong governmental top-down policy, including on big data and on drug pricing, having affected the fight against cancer dramatically. Hence, in this scenario the rich are not necessarily better off. At the same time this progress leads to acceptance of paternalistic measures and additional surveillance (mutually and by the state). In this scenario there is a strong concentration of people in cities, which are the engines of ongoing growth and a good environment for providing technical as well as social innovations in order to nudge people to a healthier lifestyle. Yet, this emphasis on living in cities also has downsides, such as the huge pressures this imposes on ecosystems, among others in terms of air, soil or other pollution, thus also showing the potential synergies between the Mission on Cancer and the Mission on Climate-neutral and smart cities.

- In the second scenario, "*The rich get healthier*" a picture of a European future is presented that is far more fragmented, with very uneven distributions of wealth and health across and within European countries. In this same scenario, the EU consists of a smaller set of (16) core Member States that have considerable wealth and claim to share the same values, i.e. green growth, technological progress, rollback of the state and the democratic principle of separation of powers. Overall health provision has improved, among others because public hospitals and GPs have become part of much tighter and more efficient network governance by state health authorities, and also with better provision for diagnostic and screening facilities. However, this is generally not affordable for the poorer part of society because of the high burden for them of out-of-pocket payments. Hence, only patients with private insurance benefit from the progress, so that there is more cancer screening among the better-off and access to the newest and most expensive medicines is limited to those in employment or who have an additional health plan or special insurance. EU-wide campaigning to halt carcinogenic emissions has improved the general health of the population and reduced the rate of cancer incidence among younger people. There are fewer dangerous emissions from traffic, heating, industry and agriculture. This has also relieved some of the stress from the bigger EU cities and promoted the attractiveness of small cities and the rural area. Most importantly, healthy lifestyles are fashionable. Wealthy people take part in sport, do not smoke or use alcohol, while unhealthy lifestyles are concentrated in the poorest section of population, also giving rise to by co-morbidities from lifestyle diseases such as diabetes. At the same time, in conjunction with the ageing population, there is still an increase in the total number of cancer patients. As the average age of citizens keeps on rising, one in three persons will be diagnosed with cancer over the course of their life. As certain expensive new medicines can only prolong life to a limited extent, while not necessarily improving the quality of life, this has also ignited a public debate over the value of life prolongation and health investments.

Roadmap of key events and milestones

As a last activity, Board members participated in a set of online sessions in which they were asked to assume the role of certain stakeholders, such as cancer survivors, a patient organisation, Members of the European Parliament group against cancer, a large pharmaceutical company, and general practitioners. From these perspectives, the participants formulated crucial events and milestones to take place in the future on the path to fight cancer in the European Union. These are clustered into three separate roadmaps:

- Roadmap 1 summarises a number of actions as part of a successful pathway in terms of prevention, among others including the development of personalised risk assessment tools, contributing to personalised risk assessments for all cancers, to awareness campaigns on healthy lifestyles and to banning or else increasing taxes on unhealthy products.
- Roadmap 2 addresses diagnostics and treatments. Actions among others include new technologies for early detection and new care models, including more cancer treatments at home, and the creation of Comprehensive Cancer Infrastructures as well as patient care pathways, with the involvement of general practitioners as 'transmural' healthcare professionals.
- Roadmap 3 goes into the steps towards strengthening survivorship, among others by monitoring the quality of life of cancer survivors, including using non-invasive forms of data collection, the co-creation of cancer passports for all citizens and setting up educational programmes.

As foresight modelling is very complex, the wrap-up above is mostly intended to point out a few flashpoints in terms of some pressing issues and trends that might arise, making use as well of a creative and interactive role play exercise as part of a broader foresight approach. It also means the outcomes described are not set in stone, but are mostly intended to support further refinement of the Mission outline.

This summary was drafted from the following Foresight reports:

Giesecke S, S Lipponen, A Nooijen, K Cuhls, M Hutka, T de Jongh, D Wasserbacher, L Petrosova (2020). Scoping paper on Trends & Drivers for Cancer - for the Mission Board on Cancer. Foresight on Demand Policy Brief. Foresight on Demand consortium.

Giesecke S, S Lipponen, T de Jongh, K Cuhls, D Wasserbacher (2020). Two scenarios with focus on the future of fighting cancer with regard to prevention, diagnostics and treatment, and survivorship. Scenario Report. Foresight on Demand consortium.

Giesecke S, S Lipponen, T de Jongh, K Cuhls, D Wasserbacher (2020). Roadmap of events and milestones in the future of fighting cancer from different stakeholder perspectives. Foresight on Demand consortium.

ANNEX V: COVID-19 AND CANCER

COVID-19 may – in a foreseeable future – possibly be prevented by vaccines or effectively treated, while cancer will not.

The COVID-19 crisis has negatively affected cancer care at an unprecedented speed. Its aftermath poses significant threats to prevention and treatment, as well as to research and innovation critical for improvements. In this exceptional situation, the Mission on Cancer – in alignment with other European efforts – offers an excellent opportunity to address these threats, as detailed in this Annex and in the main text of this Mission outline. The ambitious Mission on Cancer aims to improve cancer prevention, diagnostics, treatment and quality of life of people exposed to cancer through a new level of research and innovation. The investment will also provide an important stimulus to European healthcare and its economy, and thereby contribute to societal recovery from the COVID-19 crisis. The Mission on Cancer is an essential and fundamental element in providing a coherent vision and detailed instruments for action to achieve the ambitious goals of the Europe’s Beating Cancer Plan.

Implications for the delivery of the Mission on Cancer

- The goals of the Mission on Cancer are more relevant than before the COVID-19 crisis.

The COVID-19 (SARS-COV-2) disease and the ongoing response by European health systems captured the immediate attention of citizens, healthcare professionals and political decision-makers. The speed of the spread of SARS-COV-2, and the current absence of effective vaccines or treatment created unprecedented uncertainties. This does not, in any way, decrease the burden of other diseases⁴⁶, nor change the historical trend of cancer becoming the first cause of mortality in every European country unless effective cancer control measures are found and implemented in the near future. Thus, the Mission on Cancer’s long-term objectives, as conceptualised before the COVID-19 pandemic, remain largely unchanged but need to be re-weighted in light of the current situation. It is fundamental that cancer patients continue to receive the treatment and care that they need in the aftermath of the most acute phase of the COVID-19 epidemic in Europe. The Mission provides an overarching framework to provide solutions and achieve the goals of the Europe’s Beating Cancer Plan.

- Availability of public and private funding

The crisis caused by the COVID-19 pandemic stressed all sectors of the global economy, including healthcare and research. There is the risk that public funding for research from Member States as well as private investment will

⁴⁶ [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(20\)31067-9/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)31067-9/fulltext)

decrease in the near future. The decisions by the European Commission to put a special effort into improving cancer prevention and care through the Mission on Cancer and the Europe's Beating Cancer Plan – and the recently expressed commitment of Commissioner Kyriakides (27 May 2020 webinar) that cancer remains a priority – provide a unique opportunity in this regard. The risk of the increased attention – and budget investment on issues related to COVID-19 is alleviated by e.g. the expected new EU4Health programme of EUR 9.4 billion: this responds to COVID-19 and provides support for addressing long-term health challenges, including cancer. To reach the ambitious but tangible goals of the Mission on Cancer, it is essential that the required funding be made available as was planned before the COVID-19 pandemic.

- Engaging citizens

The prominent role of prevention and early detection that is critical in reducing the cancer burden requires an active role of citizens. COVID-19 has brought the importance of health to the forefront of citizens' minds and should be used: a shift to health and personal care seems to be taking on momentum.

- Accelerated acceptance of new technologies

The COVID-19 crisis has rapidly led to a willingness to embrace new technologies and approaches by both governments and citizens, an opportunity which it is important to leverage. On the care providers' side, the more intense use of telemedicine, reorganisation of teamwork and task shifts, and new and extended roles of health professions, offer experiences and possibilities that can be of use in cancer care. The Mission on Cancer aims to initiate implementation of its work at the beginning of 2021 with several actions to develop new technologies providing a niche in Europe for adopting new technologies in cancer prevention, early detection, personalised medicine and minimally invasive technologies. The Mission on Cancer proposal is also suited to taking advantage of the rapid development of telemedicine and remote interactions, where earlier resistance from several sources (patients, healthcare professionals, and payers) has been overcome.

- Need for communication

The dominance of COVID-19 in the media requires special attention for the Mission on Cancer. It highlighted once more how much citizens rely on the media and social networks for information, the importance of evidence-based decision-making and clear lay communication of research results, methodologies and uncertainties. The crisis has also compromised the mission's outreach programme as citizens' focus shifted from cancer to COVID-19.

Implications for the relevance of the Mission on Cancer

The relevance of the Mission on Cancer is emphasised by the impact of COVID-19. The impact of the COVID-19 crisis has been immediate and dramatic, illustrated by a 25 % drop in cancer diagnoses in the Netherlands⁴⁷, and a 50 % delay in treatments in the UK⁴⁸, suspended prevention and early detection programmes and halted research activity. Thus, the COVID-19 pandemic is significantly aggravating the cancer crisis in Europe and amplifying the current shortcomings of health systems. A heavy toll in terms of cancers is expected due the need to redirect precious healthcare resources to tackle the COVID-19 crisis. After the immediate shock wave dissipates, three broad challenges to health systems will be added: first, to overcome citizens' and patients' uncertainty regarding the safety of accessing healthcare facilities; second, to learn and apply lessons learned from this period to induce permanent changes in healthcare delivery, while thirdly dealing with increasing resource constraints.

The Mission on Cancer will induce innovations in several areas, as mentioned in the recommendations. The strong emphasis on principles of data collection, data sharing and data use by citizens will require innovative solutions in IT tools that can be used elsewhere in the economy. The COVID-19 pandemic generated a massive movement towards use of remote work. Privacy and security of data was already a concern in healthcare, and innovations in this area can benefit many other fields of economic activity. The development of the required IT tools will also create a demand for specialised work, creating jobs and companies that may extend their reach beyond cancer. The development of new technologies for testing will contribute further to the creation of high-skilled job opportunities in Europe. One of the economic lessons from the COVID-19 pandemic was the need for European supply lines. This will also be true for medical equipment (of all sorts), meaning that products used in cancer prevention, treatment and post-treatment will hopefully be produced within the European Union.

A major threat to the relevance of the Mission on Cancer would be an imbalanced response from the European Commission to the COVID-19 crisis with resources redirected to this single epidemic, leading to an unprecedented health crisis due to other big killers¹, including cancer.

Ways in which the Mission on Cancer supports European economic and societal recovery

COVID-19 has demonstrated, beyond doubt, the critical importance of health for any society. While usually only accounted for on the cost side, the recent pandemic clearly shows that the absence of health leads to severe economic,

⁴⁷ <https://www.thelancet.com/action/showPdf?pii=S1470-2045%2820%2930265-5>

⁴⁸ <https://www.nature.com/articles/s41591-020-0874-8>

political and societal consequences for Europe. COVID-19 has also laid bare critical insufficiencies in healthcare system preparedness, adaptability and resilience.

While the COVID-19 pandemic is unprecedented in terms of incidence and mortality, it is foreseeable that – with determination, political will, and based on rapid scientific and technological advances – both vaccines and effective treatments will be found. Unfortunately, this will not be the case with cancer, which will remain one of the major killers in Europe.

The Mission on Cancer will be a major driving force to apply the lessons from the current COVID-19 crisis to find solutions to the cancer challenge and beyond. We have seen an unprecedented willingness in technology adaptation, collaboration across sectors and borders, including extensive data sharing, genuine communication and alignment between healthcare and research, remarkably shortening the implementation of research findings and the ability to mobilise and allocate considerable funding resources at short notice.

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Under the Horizon Europe Framework Programme for Research and Innovation (2021-2027) five *Missions* aim to deliver solutions to major challenges for Europe. They include a Mission on Cancer. Many more people in Europe are living with cancer as the result of an ageing population, unhealthy lifestyles, and unfavourable social, environmental and working conditions. This is generating a huge burden for citizens, cancer patients, survivors and their families, and for health systems and society at large. To deliver concrete solutions, the Board for the Mission on Cancer is proposing an ambitious goal: "By 2030, more than 3 million lives saved, living longer and better". The Board's Draft Mission outline presents 13 recommendations for bold actions to understand cancer, its risk factors and impact; to prevent what is preventable; to optimise diagnostics and treatment; and to support the quality of life of people living with and after cancer, while ensuring equitable access for all. The Board will use its Draft Mission outline as the basis for a number of stakeholder and citizen engagement activities across Europe to define the actions and strategies required to achieve this goal.

Studies and reports

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