

together

WHO REPORT ON CANCER

SETTING PRIORITIES,
INVESTING WISELY
AND PROVIDING
CARE FOR ALL

2020



World Health
Organization

WHO report on cancer: setting priorities, investing wisely and providing care for all

ISBN 978-92-4-000129-9 (electronic version)

ISBN 978-92-4-000130-5 (print version)

© **World Health Organization 2020**

Some rights reserved. This work is available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; <https://creativecommons.org/licenses/by-nc-sa/3.0/igo>).

Under the terms of this licence, you may copy, redistribute and adapt the work for non-commercial purposes, provided the work is appropriately cited, as indicated below. In any use of this work, there should be no suggestion that WHO endorses any specific organization, products or services. The use of the WHO logo is not permitted. If you adapt the work, then you must license your work under the same or equivalent Creative Commons licence. If you create a translation of this work, you should add the following disclaimer along with the suggested citation: "This translation was not created by the World Health Organization (WHO). WHO is not responsible for the content or accuracy of this translation. The original English edition shall be the binding and authentic edition".

Any mediation relating to disputes arising under the licence shall be conducted in accordance with the mediation rules of the World Intellectual Property Organization.

Suggested citation. WHO report on cancer: setting priorities, investing wisely and providing care for all. Geneva: World Health Organization; 2020. Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at <http://apps.who.int/iris>.

Sales, rights and licensing. To purchase WHO publications, see <http://apps.who.int/bookorders>. To submit requests for commercial use and queries on rights and licensing, see <http://www.who.int/about/licensing>.

Third-party materials. If you wish to reuse material from this work that is attributed to a third party, such as tables, figures or images, it is your responsibility to determine whether permission is needed for that reuse and to obtain permission from the copyright holder. The risk of claims resulting from infringement of any third-party-owned component in the work rests solely with the user.

General disclaimers. The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by WHO in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by WHO to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall WHO be liable for damages arising from its use.

Printed in Switzerland

WHO REPORT ON CANCER

SETTING PRIORITIES, INVESTING WISELY
AND PROVIDING CARE FOR ALL

2020

Table of contents

Acronyms and abbreviations	5
Acknowledgements	6
Executive summary	13
Introduction	17
 SECTION I	
Making the Case	22
 Chapter 01.	
Global burden of cancer: current and future	23
1.1 Understanding the global burden of cancer	25
1.2 Social and economic inequalities in cancer	32
 Chapter 02.	
Positioning cancer as a public health priority	37
2.1 Global commitments to cancer control	39
2.2 Meeting global commitments in the national context	41
2.3 Using a legal framework	46
2.4 Why act now? Understanding the business case	48
 SECTION II	
What works in cancer control: Translating evidence into policies and programmes	55
 Chapter 03.	
Primary prevention of cancer	57
3.1 Background	59
3.2 Current landscape of cancer prevention	60
3.3 Effective cancer prevention interventions	62
3.4 Integrated approach to cancer primary prevention	65
3.5 Emerging science and programmes	69
 Chapter 04.	
Early diagnosis and screening for cancer	71
4.1 Background	73
4.2 Current landscape	78
4.3 Effective interventions for early diagnosis	81
4.4 Effective interventions for screening	82
4.5 Effective strategies for access to high-quality pathology and diagnostic imaging	84
4.6 Integrated approach to early diagnosis and screening	84
4.7 Emerging science and programmes	85

Table of contents

Chapter 05.	
Cancer management.	87
5.1 Background	89
5.2 Current landscape of cancer management services	90
5.3 Setting priorities in cancer treatment	91
5.4 Supportive, survivorship and palliative care	94
5.5 Effective interventions for ensuring equitable access to high-quality care	97
5.6 Coordinated cancer management	102
5.7 Emerging science and programmes	102
 SECTION III	
Putting it all together: decision-making and implementation	105
 Chapter 06.	
Planning cancer control programmes	107
6.1 Approach to planning and programmes.	109
6.2 Cancer Intelligence and information systems	110
6.3 Strengthening stewardship and leadership in cancer control	114
6.4 Value and priority-setting.	117
6.5 Stepwise priorities in cancer control.	121
 Chapter 06.	
Financing cancer control: challenges and strategies.	125
7.1 Background of cancer financing.	127
7.2 Financing cancer services within progressive universal health coverage	127
7.3 Current sources of funding for cancer control	128
7.4 Spending on cancer control: effectiveness, cost-effectiveness, affordability and feasibility	130
 Chapter 08.	
Effective implementation: improving capacity and capability	135
8.1 Delivering comprehensive cancer control: background	137
8.2 Preparedness for implementing activities	138
8.3 Scaling-up cancer control	144
8.4 Monitoring and evaluation	145
8.5 Enablers of successful cancer control	146
 Conclusions and recommendations	150
Annex 1. WHO tools and resources	152
Annex 2. Glossary and key terms	154
Annex 3. Country Profiles	158

Acronyms and abbreviations

EDL	Essential Diagnostics List
EML	Essential Medicines List
ENDS	electronic nicotine delivery system
ESMO	European Society for Medical Oncology
GDP	gross domestic product
HDI	human development index
HIC	high-income countries
HPV	human papillomavirus
HTA	health technology assessment
IARC	International Agency for Research on Cancer
imPACT	integrated mission of PACT (Programme of Action for Cancer Therapy)
LIC	low-income countries
LMIC	low- and middle-income countries
NCCP	national cancer control programme
NCD	noncommunicable disease
PAF	population attributable fraction
QA	quality assurance
SDG	Sustainable Development Goals
TRIPS	Trade-related Aspects of Intellectual Property Rights
UHC	universal health coverage
WHO FCTC	WHO Framework Convention on Tobacco Control

Acknowledgements

The report was produced by the Department of Noncommunicable Diseases of the World Health Organization (WHO), Geneva, Switzerland under the leadership of Ren Minghui, Assistant Director-General, Universal Health Coverage/Communicable and Noncommunicable Diseases. Etienne Krug, Director, provided key strategic direction.

Executive WHO editors and writers: André Ilbawi, Cherian Varghese.

Executive WHO team: Melanie Bertram, Elena Fidarova, Ariunzul Ganbaatar and Dario Trapani.

We would like to thank the external Editorial Committee for their vision, commitment and guidance: Samar Alhomoud, Manami Inoue, Sharon Kapambwe, Raul Murillo, Rajeev Sadanandan and Richard Sullivan.

Thanks are due to Josep Maria Borrás Andres for overall technical writing, research support and inputs. We would like to also acknowledge with appreciation Hellen Gellbrand and Cindy Gauvreau, who performed technical review and editing. Primary coordination and project management were performed by Ariunzul Ganbaatar.

WHO Headquarters consultants or volunteers who provided valuable inputs to this Report include: Rei Haruyama, Scott Howard, Catherine Lam and Shilpa Murthy. Statistical analysis and review were provided by Melanie Cowan, Diana Estevez Fernandez and Jessica Ho.

This report benefited from the dedication, support and expertise of a number of WHO staff and external collaborators.

The Headquarters Department of Noncommunicable diseases gratefully acknowledges the contributions from the following individuals at WHO Office:

WHO Regional Offices who provided strategic guidance and direction: Prebo Barango, Marilys Corbex, Gampo Dorji, Warrick Kim, Silvana Luciani, Nasim Pourghazian, Hai-Rim Shin and Slim Slama. WHO Country Offices: Nisreen Abdel Latif, Abdulwahab Al-Nehmi and Elena Vuolo

WHO Headquarters: Shannon Barkley, Douglas Bettcher, Paul Bloem, Allison Colbert, Alison Commar, Gwenaël Dhaene, Hebe Gouda, Ivan Ivanov, Benn McGrady, Maria Perez, Vladimir Poznyak, Vinayak Prasad, Dag Rekve, Kiu Siang Tay, Tami Toroyan, Emilie Van Deventer. Sophie Schmitt, Sheila Nakpil and Joel Tarel provided appreciated administrative support.

We would like to express our special thanks to contributors from the International Agency for Research on Cancer (IARC) and International Atomic Energy Agency (IAEA) who provided expert input, data and support.

From IARC, coordination and support were provided by Nicolas Gaudin and Partha Basu under the leadership of Elisabete Widerpass, Director. Valuable data and statistical analyses were performed by Freddie Bray, Filip Meheus, Isabelle Soerjomataram and Eva Steliarova-Foucher.

Valuable support was provided by the International Atomic Energy Agency (IAEA). We would like to acknowledge appreciated contributions by Kirsten Hopkins, Francesco Giammarile, Diana Paez and Eduardo Zubizarreta under the leadership of May Abdel Wahab, Director, Division of Human Health as well as additional inputs by Lisa Stevens, Director, Division of Programme of Action for Cancer Therapy (PACT) Cooperation. Valuable data on country capacity were kindly shared by the Division of Human Health from the DIRAC and IMAGINE databases (Annex 3).

We would like to sincerely thank the many authors, reviewers and other contributors who made this publication possible. The following individuals provided external authorship to specific chapters:

Executive summary: Hellen Gelbrand

Chapter 1: Freddie Bray, Isabelle Soerjomataram.

Chapter 2: Jonathan Liberman with support from Monika Arora, Fatia Kiyange, Miriam Schneidman, Hans Storm.

Chapter 2 (investment case): Melanie Bertram with support from Filip Meheus and Cindy Gauvreau.

Chapter 3: Carolina Wiesner with support from Raul Murillo

Chapter 4: Rengaswamy Sankaranarayanan with support from Silvina Arrossi, Lynette Denny, Ishu Kataria, Groesbeck Parham,

Mohamed Zaghloul

Chapter 5: Josep Maria Borrás Andres, Bishal Gyawali, Eric Krakauer, Dario Trapani

Chapter 6: Tit Albrecht and Jose Martin Moreno with support from Terry Sullivan

Chapter 7: Filip Meheus, Cindy Gauvreau, Hellen Gelband

Chapter 8: Ben Anderson, Catherine Duggan

Country profiles (available online): Dulguun Tugsbayar with support from Ariunzul Ganbaatar and Shilpa Murthy.


Case studies: Jeff Gershenwald, Christine Giles, Catherine Lam, Carlos Rodriguez-Galindo, Lisa Stevens

WHO wishes to thank the following external contributors and reviewers whose expertise made this report possible: Melissa Adde, Anssi Auenin, Afsan Bhadelia, Gracemarie Bricalli, Fatima Cardoso, Paolo Casali, Ann Chao, Fortunato Ciardiello, Sally Cowal, Piotr Czauderna, Els Dams, Elisabeth de Vries, Maria die Trill, Jean-Yves Douillard, Kalina Duncan, Kenneth Fleming, Lewis Foxhall, Marina Garassino, Jeffrey Gershenwald, Christine Giles, Rosa Giuliani, Bishal Gyawali, Melissa Henry, Cristian Herrera, Ophira Ginsburg, Chris Jackson, Xiaoxiao Jiang, Sonali Johnson, Ravindran Kanesvaran, Emily Kobayashi, Ian Magrath, Tomohiro Matsuda, Keith McGregor, Dan Milner, Tomio Nakayama, Rachel Nugent, Solange Peters, Srinath Reddy, Carlos Rodriguez-Galindo, Felipe Roitberg, Piotr Rutkowski, Suleeporn Sangrajang, Diana Sarfati, Gretchen Stevens, Lisa Stevens, Josep Tabernero, Julie Torode, Guillermo Tortolero-Luna, Ted Trimble, Jane Turner, Vivien Tsu and Malvika Vyas.

Penceo is a Digital Communications Agency offering a 360° approach to marketing, covering Content, Strategy, Design, Social Media, Video and more - www.penceo.com

Design and Layout by Penceo.

This publication was produced with the financial support from the Government of Japan and United States of America (United States National Cancer Institute, grant number 5 U01 AI108543-04)) and from the European Society for Medical Oncology, New Sunshine Charity Foundation and St Jude Children's Research Hospital. These partners are thanked for their valuable contributions.



**The cancer
burden is
significant and
increasing.**

01.

**We must
act now.**

02.





**By investing
wisely and
equitably, cancer
cases and deaths**

**can be
avoided.**

together





03. **UHC and cancer care** **for all**

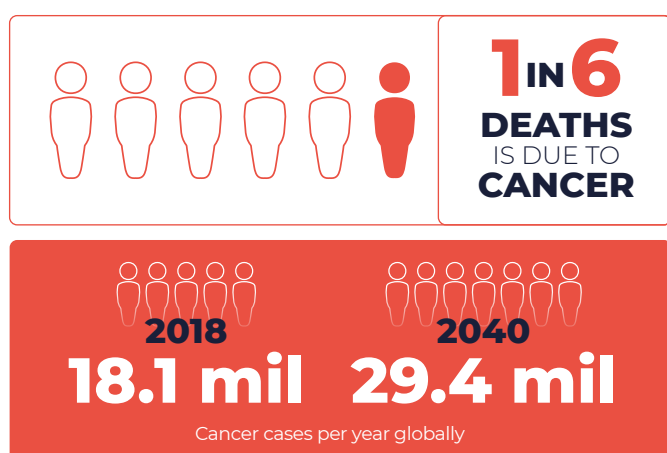
**will require building capacity,
reducing financial risk and
eliminating inequalities.**



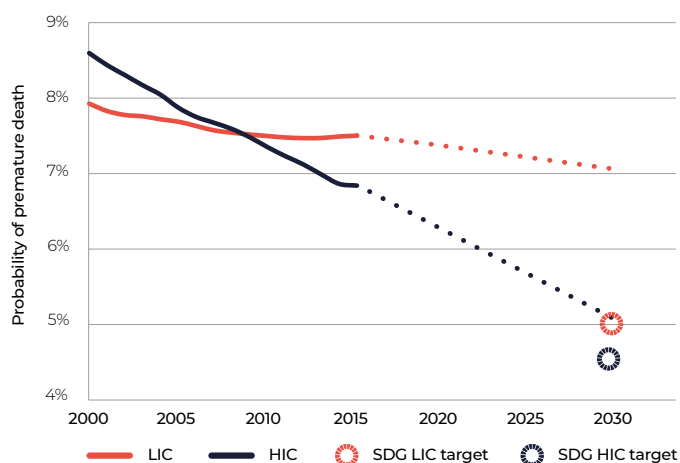
WHO REPORT ON CANCER

SETTING PRIORITIES, INVESTING WISELY & PROVIDING CARE FOR ALL

The global cancer burden is significant and increasing



Probability of premature death (30-69 years old) from cancer



INVEST WISELY TO SAVE LIVES

PER CAPITA EXPENDITURE

By 2030, investments needed are:

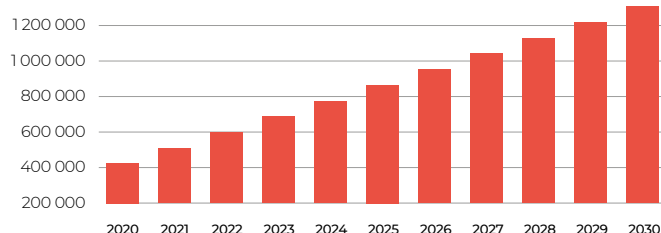
US\$ 2.70
LIC:

US\$ 3.95
LMIC:

US\$ 8.15
UMIC:

7.3
MILLION
LIVES
BY 2030

LIVES SAVED



SET PRIORITIES



Strengthen tobacco control to reduce cancer deaths by 25%



Focus on early diagnosis and treatment for curable cancers. For example, childhood cancer to save 1 million lives by 2030



Vaccinate against HPV and hepatitis B, reaching >90% coverage



Scale-up capacity to manage 200 million cancer cases in next decade



Screen for cervical cancer with >70% participation



Provide palliative care for all

PRIORITIES THAT ARE



FEASIBLE

Are planned interventions operationally and economically feasible given the state of the health system?

For example, treatment interventions require diagnostic capacity, workforce competency and sustainable financing. Screening programmes should only be implemented if treatment is available.



EVIDENCE-BASED

Are planned interventions consistent with the best available evidence to optimize impact?

For example, screening, diagnosis, and treatment guidelines are based on sufficient evidence to improve population health and achieve clinically meaningful benefits for people with cancer.

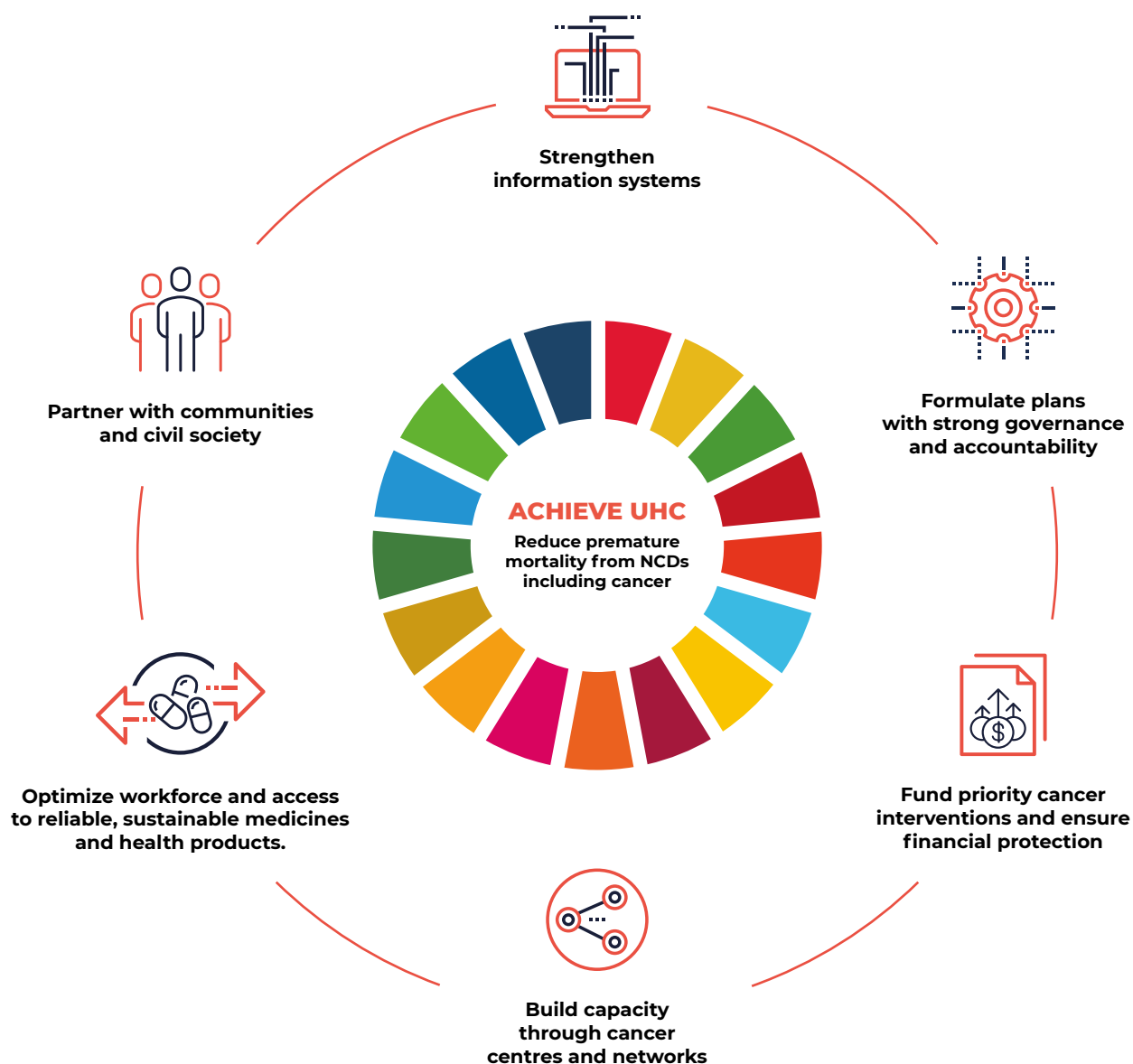


COMPREHENSIVE AND INCLUSIVE

Are planned interventions accessible to disadvantaged or vulnerable populations?

For example, tailored strategies should be developed to ensure equitable access to comprehensive, high-quality services with financial protection for all people.

TOGETHER, PROVIDE CANCER CARE FOR ALL





Tedros Adhanom Ghebreyesus

Director-General
World Health Organization



Foreword

Cancer is a deeply personal disease. It affects all of us – including me. We all have friends and family who have lived and sometimes died with this horrible disease. Cancer exerts a tremendous physical, emotional and financial strain on individuals, families, communities, health systems, and countries.

Nearly every country has seen an increase in cancer cases over the past decade, and over the next 20 years, cancer rates are projected to rise by at least 60%.

Many low- and middle-income countries already have large numbers of cancer patients who do not have access to timely, quality diagnosis and comprehensive treatment. In 2019, more than 90% of high-income countries reported that treatment services for cancer were available in the public health system, compared to less than 15% of low-income countries, where survival is unacceptably low.

Countries passed a resolution at the World Health Assembly in 2017 committing themselves to cancer prevention and control through an integrated approach, and asking WHO to provide guidance. Now is the time to convert political commitments into action. In 2018 WHO launched an initiative to save the lives of millions of children from cancer, and in 2019 we prequalified a biosimilar medicine for the first time, trastuzumab, paving the way for more women to have access to one of the most effective but most expensive breast cancer treatments. In 2020 WHO will present countries with a global strategy towards the elimination of cervical cancer, which kills one woman every two minutes, but is largely preventable.

My hope and expectation is that this report will help countries to set priorities for investing in cancer control and universal health coverage. This report builds on the science and evidence from the International Agency for Research on Cancer's World Cancer Report.

WHO does not work alone. Controlling cancer will require governments to prioritize investments and implement policies to address risk factors; countries to have trained health workers and medicines; civil society to take a lead in mobilizing communities; development partners and donors to make strategic investments; individuals to make healthy choices; and industry to promote access and innovation.

Recent decades have seen rapid innovation in cancer diagnosis and treatment. Yet the distribution and uptake of these services, medicines and technologies have been profoundly inequitable and inefficient. Being diagnosed with cancer shouldn't be a death sentence because you do not have access to health care or the means to pay for it.

If people have access to primary care and referral systems, cancer can be detected early, treated effectively and cured. Careful evidence-based investments in cancer interventions will deliver meaningful social and economic returns, with increased productivity and equity. Together, we can reverse the tide of cancer, avoiding 7 million unnecessary deaths by 2030.

Executive summary

Cancer is a serious health problem in all populations, regardless of wealth or social status. The global response to cancer has been uneven and inequitable. Most low- and middle-income countries (LMIC) started later to address the cancer burden, having made hard choices to concentrate limited resources on an enormous burden of infectious diseases. In 2020, when one in five people globally will face a cancer diagnosis during their lifetime and as gains against infections and other conditions have led to increased life expectancy, it is beyond time to accelerate global cancer control, through prevention, diagnosis, treatment and management, palliative care and surveillance. Every year, effective cancer control is delayed, the response becomes more expensive, the preventable loss of life increases, and economic and human development remain stifled.

Whatever a country's current stage of cancer control, the next steps can be informed by validated analytical tools, guiding

principles, examples and global assistance. This report introduces the principles, tools and current priorities in cancer control. It also presents new evidence of the value of cancer control as an investment, with substantial human and economic returns. The burden of noncommunicable diseases (NCDs) now outweighs the burden of infectious diseases in every country and will continue to grow over the coming decades. The urgency of the NCD problem led to adoption of the Sustainable Development Goals (SDGs) and their target 3.4: "By 2030, reduce by one third premature mortality from NCD through prevention and treatment and promote mental health and well-being." Universal health coverage (UHC) is a related SDG target (3.8). The cancer control interventions described in this report can be melded into UHC benefit packages to drive progress in meeting both targets. Let it be clear, without substantial – perhaps monumental – efforts in cancer control, these targets cannot be met.

Chapter 01. The Growing Burden of Cancer

In 2018, 18.1 million people around the world had cancer, and 9.6 million died from the disease. By 2040, those figures will nearly double, with the greatest increase in LMIC, where more than two thirds of the world's cancers will occur. Cancer is the cause of about 30% of all premature deaths from NCDs among adults aged 30-69.

The most frequently diagnosed cancer is lung cancer (11.6% of all cases), followed by female breast (11.6%) and colorectal cancers (10.2%). Lung cancer is the leading cause of death from cancer (18.4% of all deaths), followed by colorectal (9.2%) and stomach cancers (8.2%). The most common cancer type varies among countries, with certain cancers, such as cervical cancer and

Kaposi sarcoma, much more common in countries at the lower end of the human development index (HDI) than in high-HDI countries. Cancer mortality is a function of incidence and survival. Inequity in access to effective treatment is mirrored in the much higher case fatality rates in lower-HDI countries, a result of diagnosis at later stages and lack of treatment. Progress in reducing the probability of premature deaths from cancer has been much greater in high-income countries (HIC), where there has been a 20% reduction from 2000 to 2015. In low-income countries (LIC), the probability of premature mortality decreased by only 5% in that time period, reflecting increasing global inequality.

Chapter 02. Cancer Control Is Effective

The spectrum of cancer control interventions includes primary prevention, screening and early diagnosis, multimodal treatment and survivorship and palliative care. In each domain, highly effective interventions have reduced the cancer burden in countries where they are widely available and used by the population. In countries with widespread access to the full range of effective measures - mainly higher HDI

countries - cancer mortality rates have fallen and continue to do so. The rate of death from cancer is rising in many countries at the lower end of the spectrum. This can be changed by adoption of affordable, feasible national cancer control plans (NCCPs) for programmes to expand the services offered and financial and geographic access. Cancer control is an integral component of the path towards UHC.

*Key recommendation #1: **Activate political will, strengthen governance and make a cancer control plan founded on UHC.***

By focusing on a set of priority interventions and investing efficiently, more than 7 million lives can be saved by 2030, with major social and economic benefits. The total required investment is US\$ 2.70 per person in LIC, US\$ 3.95 per person in

LMIC and US\$ 8.15 per person in upper-to middle-income countries by 2030. While these investments are ambitious, they are achievable and feasible. The key message is that cancer management is not prohibitively expensive.

*Key recommendation #2: **Identify priorities that are feasible, evidence-based and can be financed.***

Chapter 03. Effective Primary Prevention

Globally, approximately one third to one half of all cancers could be prevented with current knowledge and technology. With WHO “best buys” for NCDs as a guide, tobacco control through taxation and other policies and high coverage with vaccines to prevent infection with human papillomavirus (HPV) and hepatitis

B virus are effective and feasible ways to prevent cancer. Particular consideration should also be given to obesity, alcohol, occupational exposures and air pollution that are persistent or increasing major cancer risk factors.

*Key recommendation #3: **Focus on WHO “best buys” for NCD primary prevention.***

Chapter 04. Early Detection and Screening

Early diagnosis is the best alternative for the many cancers that cannot yet be prevented and those that occur despite prevention. Currently, in most LMIC, cancer is diagnosed at an advanced stage, when treatment is generally less effective, more expensive and more disabling. Two distinct approaches can be used to identify cancer early - early diagnosis for symptomatic disease and screening of asymptomatic individuals in a target population. Early diagnosis programmes are the priority. They consist of raising awareness about cancer symptoms,

ensuring the capacity for rapid clinical and pathological diagnosis and timely referral to a site where effective treatment can be given. The priority in screening should be cervical cancer in all countries and breast and colorectal cancer screening in well-resourced countries. There is significant inequity in the availability of high-quality pathology and diagnostic imaging, which are necessary for making an appropriate treatment plan.

*Key recommendation #4: **Prioritize and invest in early diagnosis.***

Chapter 05. Cancer Management

Cancer management is generally more complex than that for other diseases, even other NCDs. Treatment can involve surgery, systemic therapy (e.g. chemotherapy, immunotherapy, endocrine therapy) and radiotherapy. These diagnostic and therapeutic approaches should be delivered by a multidisciplinary team, which is the cornerstone of integrated, patient-centred care. The past half century has seen tremendous progress in cancer treatment, mainly

through advances in systemic therapy, more recently in immunotherapy, as well as refinements in radiotherapy and surgery. For some common cancers – breast, cervix and colorectal cancers, leukaemias, most childhood cancers and others – curative treatment has existed for several decades and is affordable to countries at all income levels. Decisions on the treatments to be selected will have to be made in NCCPs, according to impact, cost and feasibility. While some recent innovative therapies can

have meaningful survival or quality of life benefits for certain cancer patients, many of the newest treatments have only marginal population benefits over older ones. WHO has defined priority interventions to help guide decisions on the choice of medicines and health products.

*Key recommendation #5: **Implement effective, feasible cancer management interventions, ensuring high-quality value-based care.***

The aim of palliative care is to prevent and relieve suffering during all phases of serious health problems, including pain and suffering as a result of treatment, in both survivors and people who eventually die from cancer. In cancer, the foremost (although not the only) target is pain control,

which in most cases can be relieved by inexpensive oral morphine or other opioids. These are unfortunately largely unavailable in much of the world, particularly in LMIC. Some countries have, however, overcome political and regulatory barriers to provide adequate palliative care, including pain control and other services, demonstrating that it is feasible. The World Health Assembly has called for universal access to palliative care as a necessary step towards UHC. With more than 50 million cancer survivors currently alive, attention must be paid to their long-term health needs and re-integration into society and the workplace.

*Key recommendation #5: **Palliative and survivorship care should be included in all NCCPs.***

Chapter 06. National Cancer Planning

Ideally, a national cancer plan starts with the collection and analysis of data on the disease burden, the prevalence of risk factors and current capacity and system performance. In view of the multisectoral, multimodal nature of cancer control, planning is essential to synchronize the delivery of services and to work towards realistic milestones. Even in the absence of complete data, cancer plans can define the appropriate steps for advancing cancer control. Short- and medium-term capacity development is necessary to extend services and achieve full population coverage for effective interventions. WHO and others can provide guidance to countries in planning and selecting interventions that are effective and cost-effective and information for budgetary analyses.

Cancer planning should be led by a designated responsible government directorate, working with all relevant stakeholders, including knowledgeable members of the public and professionals. Sustainable success will require commitment to regular reviews of progress and revision of the plan, increasing investment in information systems, strengthening governance structures and, because cancer services are currently less well funded than other disease programmes in many LMIC, ensuring a continual, appropriate increase in the share of the health budget.

*Key recommendation #6: **Strengthen information systems to improve planning and accountability.***

Chapter 07. Financing Cancer Control

Funding of cancer control with capital investments and funding of services with the best value for the greatest good ensure equitable financial and geographical access to high-quality cancer services. A WHO and international Agency for Research on Cancer (IARC) tool for setting priorities and costing cancer control plans is available for

costing cancer services, which can be used to model financial projections with both domestic and external funding.

In general, payment for direct patient services under UHC is a government responsibility. Where resources are limited, there has been minimal external aid for NCDs, particularly cancer; however, there

are many private-sector initiatives in some countries for certain types of cancer (e.g. childhood cancer) that provide resources for capacity-building, training and capital investments. In countries in which cancer control has lagged, cancer control planning can include sources of financing for the necessary investments. Financing for both services and population

coverage should be extended in steps, in line with the national cancer plan and with the principle of progressive realization of UHC. Country experience indicates that this is best achieved in a system of pre-paid, centrally disbursed funding.

*Key recommendation #7: **Fund priorities in cancer interventions, and ensure financial protection***

Chapter 08. Cancer Control Implementation, Together

Cancer control is implemented by ensuring that all the necessary facilities, equipment, personnel, information systems and financing are in place to deliver the cancer plan. A radiotherapy unit is of no use without trained professionals in several categories (e.g. medical physicists), specialized maintenance personnel and record-keepers, as well as laboratory and imaging services to evaluate progress. If one link in the chain is missing, the patient suffers, and resources are wasted. Similarly, a screening programme for breast cancer will have no impact unless the technology necessary for diagnostic and treatment is available. Cancer centres are important hubs for increasing capability, strengthening standards and increasing efficiency.

*Key recommendation #8: **Build capacity through cancer centres and networks linked to strong primary care.***

The most pressing needs, particularly in LMIC, are training a cancer workforce and ensuring the basic infrastructure for cancer (only some of which is shared with that for other medical conditions). Global collaboration is a necessity for some countries, including training in other countries and collaborating with national, international and private-sector organizations. Implementation also involves working within the assigned budget for infrastructure and staff and procuring the necessary commodities. One of the greatest global threats to the

solvency of cancer control is the cost of cancer medicines and products. In this area, regional and global cooperation can improve access, as individual countries and particularly small markets have little leverage.

*Key recommendation #9: **Optimize the workforce and access to reliable, sustainable medicines and other products.***

An overriding concern in cancer control is maintaining high quality. Cancer is less forgiving of lapses in quality than many other diseases. Delays in access to diagnosis and treatment, substandard cancer medicines, poor control of radiotherapy can all lead to unnecessary suffering, deaths and wasted resources.

Implementation requires good working relationships among government departments, with the medical and business communities and globally with international and national organizations. Internally, a coalition of stakeholders should be involved in preparing the national cancer plan. Governments are responsible for setting policy and creating an enabling environment through laws and regulation, but they rely on partners with real responsibilities for aspects of implementation. It is only together that we can achieve progress in cancer and provide care for all.

*Key recommendation #10: **Engage communities and civil society to achieve cancer control together.***

Introduction

Purpose and scope

In 2017, by adopting World Health Assembly resolution WHA70.12 on cancer prevention and control, governments committed themselves to accelerating action against cancer. This WHO Report on Cancer, led by WHO and prepared with the IARC, fulfils the mandate given to WHO. Its purpose is to provide guidance for policy-makers in formulating a response to their national cancer burden by showing that cancer can be controlled as a public health priority by making strategic investments. It thus describes priority policies and programmes in cancer control and evidence-based interventions along the cancer continuum. It sets an agenda for accelerated action to achieve political commitments.

The main target audience is government policy-makers, particularly in LMIC. Its messages are, however, relevant to groups in countries at all income levels, including nongovernmental organizations, philanthropic foundations, academic

institutions, the private sector and people living with cancer and their families. Controlling cancer will require the best efforts of: governments to set policies and prioritize investments, communities to mobilize action, individuals to make healthy choices and use health care services, professional societies to strengthen coordination and complement capacity, industry to promote access and innovation and development partners and donors to make strategic investments.

The report seeks to change the dialogue on cancer from one based on fear of death, financial catastrophe, uncertainty and resignation (Box 1) to a positive message that cancer can be controlled through strategic, high-impact investments in programmes, policies and services. Pragmatic decision-making and evidence-based interventions can yield value for money and sustainable development

Structure of the Report

The first section makes the case for accelerating action to control cancer globally. The second describes effective action that can be taken along the continuum of cancer, from prevention through care, and form the basis for policies and programmes. The last section provides guidance on decision-making, financing and implementing cancer control interventions.

The report complements the IARC *World Cancer Report* (2), to be launched concurrently, as well as WHO global reports on tobacco (5) and alcohol (6). The IARC report addresses the impact of cancer on the world, including the burden and trends in cancer, the known causes of certain cancers, the biological processes and research on the prevention of particular tumour types. It provides the

most up-to-date science on cancer. This Report indicates how that science can be translated into policies and programmes for action.

The three key messages for policy-makers are as follows.

1. Globally, the cancer burden will increase by at least 60% over the next two decades, straining health systems and communities.
Cancer is a significant, growing public health concern (chapter 1). It is already responsible for one in six deaths globally, and the burden on individuals, communities, health systems and economies will continue to increase (chapter 2).
2. There have been rapid advances in cancer diagnosis and treatment; however, selection of programmes

and products has been inefficient and uninformed, and access to effective services has been profoundly inequitable.

Cancer control can be a highly beneficial investment (chapter 2). If strategic programmes are prioritized, investments in cancer care can have a positive return, saving lives, reducing suffering and promoting equity, economic growth and increased productivity (chapter 2 and 7).

3. Countries should select and implement a set of prioritized interventions that are feasible for their health systems, adapted to their epidemiological burden and available to people of all ages and to disadvantaged groups. No country can take on the entire cancer agenda; each must set priorities and address them in a phased manner. Many current cancer control strategies do not adhere to global best practices

and are not adapted to the capacity of national health systems (chapters 4 and 5), resulting in inappropriate resource allocation or diversion of resources and potential harm to patients and communities. Evidence-based policies and programmes should be formulated (chapter 6) and monitored to ensure effective, high-quality care (chapter 8). Coordination and collaboration are essential for successful implementation.

Annex 1 lists WHO tools and resources for cancer control, Annex 2 provides a glossary of terms used in this publication, and Annex 3 provides profiles of cancer control in countries and WHO regions. The country profiles are online.

Understanding cancer

A response to the increasing cancer burden requires accurate understanding of the disease and the potential impact of programmes and policies. “Cancer” is a generic term for a large group of diseases that can affect any part of the body. A defining feature is the rapid creation of abnormal cells that grow beyond their usual boundaries and can then spread to other organs and tissues, a process referred to as metastasis. Metastases are a common cause of death from cancer. Abnormal cells generally arise because of alterations in the DNA of cells that result in the growth and spread of related cells. Such changes

are multifactorial in origin, involving environmental agents (carcinogens or infections), alterations in developmental pathways, chance errors in DNA replication, impairments in the immune system and other factors.

The International Classification of Diseases (revision 11) lists more than 600 types of cancer, most of which require unique diagnostic and management approaches.

Box 1. Dispelling myths and misconceptions

“Cancer cannot be prevented.”

- Between one third and one half of cancers can be prevented by eliminating or minimizing exposure to risk factors. The most common cause of cancer is tobacco use, which accounts for 25% of all cancer deaths globally (chapter 3) (1).

“Cancer is a death sentence.”

- One of the most important messages for the public is that cancer can be cured when detected early and treated effectively (chapter 4). It should not be viewed as a death sentence. Similarly, policy-makers should understand that cancer services can be cost-effective, and investing in cancer control will save lives (chapter 2).

“Cancer is contagious.”

- Cancerous cells cannot be transmitted from one person to another. Physical contact with a cancer patient should not be feared or discouraged. Certain infections, such as with human papillomavirus or hepatitis viruses, are known causes of cancer and can be spread from one person to another (chapter 3); highly-effective vaccines can prevent both HPV and hepatitis B.

“Everything causes cancer.”

- There is significant misinformation about what does and does not cause cancer and about individual relative risks. The IARC Monographs series is the definitive reference for evidence-based causes of cancer (chapter 3) (2).

“Over-the-counter remedies can cure cancer.”

- Standard cancer treatments have been rigorously evaluated and should be prescribed and administered only by government-approved health care professionals (chapter 5). Replacing conventional treatment with over-the-counter products has been linked to lower survival (3). Some complementary therapies can be used to support evidence-based, standard care in close consultation with government-approved health care professionals (4).
- Accepted, effective cancer treatment generally requires a combination of surgery, medicines and radiotherapy (chapter 5).

“Children don't develop cancer.”

- Childhood cancers accounts for approximately 2-3% of all cancer cases and require a unique approach to provide optimal care. Most childhood cancers are highly curable, reaching greater than 90% in some HIC, if they are promptly diagnosed and patients are referred and given multidisciplinary care (chapter 5).

“The latest equipment and medicine should be used for cancer treatment.”

- Some recent innovations in cancer treatment have improved outcomes; however, not all new cancer treatments have a high impact, and established standards may be more effective, feasible and appropriate. Policy-makers should refer to health technology agencies, and patients should seek discussions with trained health professionals in making decisions (chapters 5 and 7).

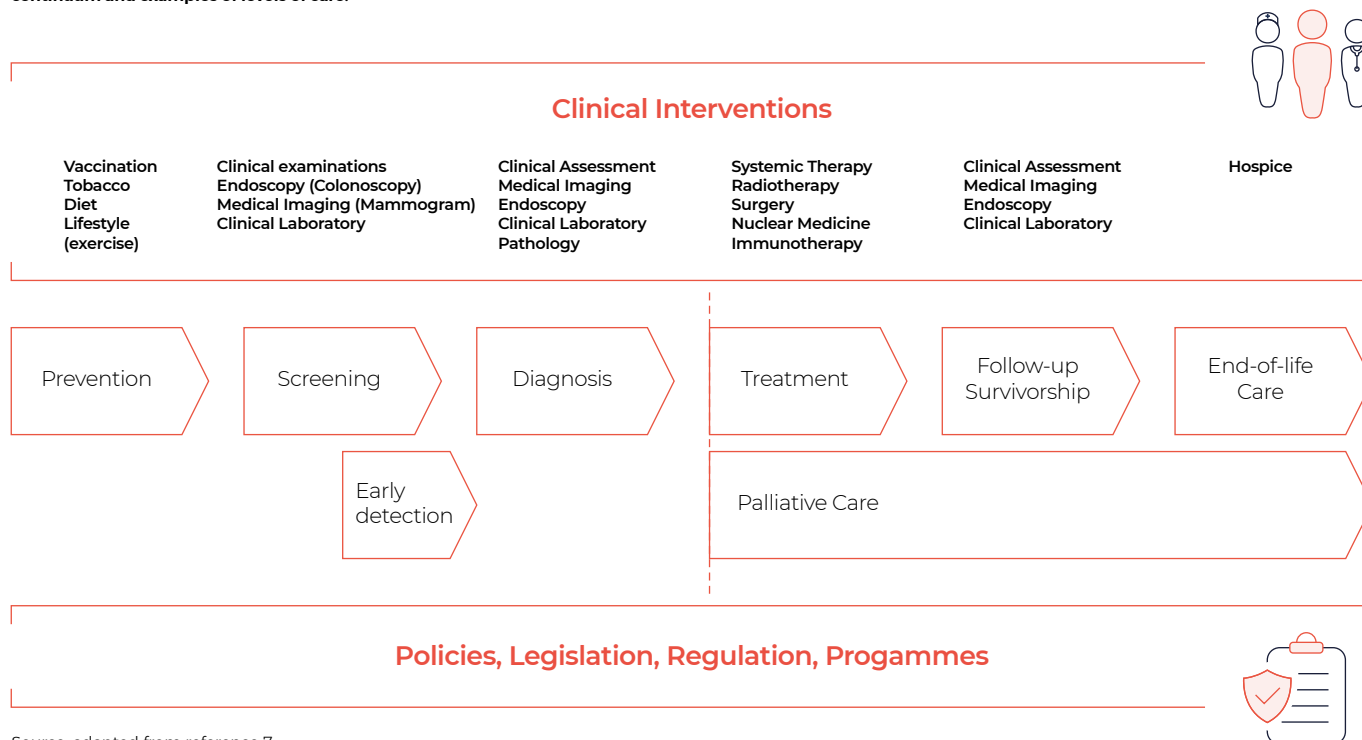


Comprehensive cancer control

Cancer control requires a comprehensive approach. Generally, interventions can be organized thematically along the “cancer continuum”, from prevention

to survivorship or end-of-life care, each of which requires unique activities and supporting policies (Fig. i.1).

Figure i.1. Interventions along the cancer continuum and examples of levels of care.



Source: adapted from reference 7.

Primary prevention of cancer consists of modification of factors that increase the risk of cancer (see chapter 3). The goal of early detection is to identify cancer or precancerous lesions as early as possible by one of two distinct approaches: early diagnosis or screening (see chapter 4). The main diagnostic steps are assessing the anatomical extent of disease and the cancer type and subtype. Common cancer treatments are systemic therapy (e.g. chemo-, endocrine and targeted therapy), surgery, radiotherapy, nuclear medicine, bone-marrow transplantation and cancer cell therapy. Survivorship care is the provision of services after completion of treatment for cancer and includes surveillance to identify recurring cancer and any toxicity of treatment (see chapter 5). Palliative care is an approach to improving the quality of life of patients with life-threatening

diseases and of their families and is part of the management strategy at the time of a cancer diagnosis (8).

Effective planning of cancer control requires contextualization to the country situation, with information from population-based cancer registries and information systems (see chapter 6). Services and interventions must be integrated, multisectoral and inter-disciplinary. An integrated national cancer response must be appropriate for the capacity of the health service and the epidemiological burden.

This report sets forth an agenda for action in comprehensive cancer control for today and the next decade.

Cancer control must be a pillar of any strategy towards achieving UHC, an SDG included in Agenda 2030 (target 3.8), and must be founded on the principles of equitable access to health services, financial protection of the whole population and prioritization of interventions that provide value for money. The impact of the cancer burden on patients, communities and economies summarized in this Report indicate that the public health and policy approach must be based on UHC. The interventions in a country's benefits package should be chosen in accordance with these principles and the resources and capacity available (Box 1) and with services defined

as essential by WHO, such as "best buys" and the Model List of Essential Medicines (EML) and Diagnostics (EDL), and by other normative agencies.

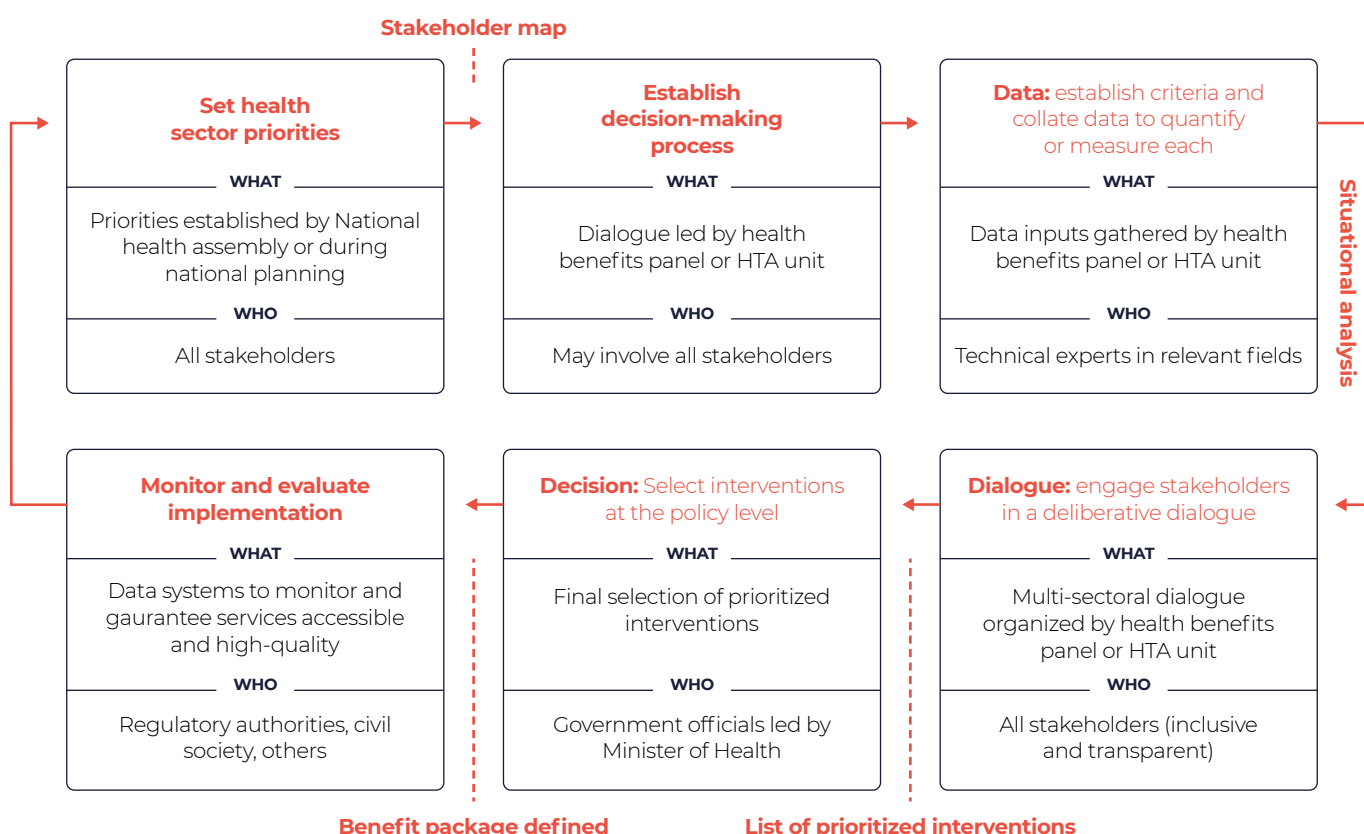
Both population-based (generally for prevention) and clinical (health services) interventions should be selected. Any new intervention against cancer included in a benefits package should be scaled up progressively to reach the entire target population before the introduction of new services, consistent with the principles of progressive realization (Fig. i.2).

The growing challenge posed by cancer to our societies can be addressed only if it is based on the objective of achieving UHC and health for all.



Box 1: Cancer and UHC: Providing care for all

Fig. i.2. Identifying and implementing priority interventions as part of UHC



References

- GBD results tool. Seattle (WA): institute for health Metrics, University of Washington; 2020 (<http://ghdx.healthdata.org/gbd-results-tool>, accessed January 2020).
- Wild CP, Weiderpass E, Stewart BW, editors. World cancer report. Cancer research for cancer prevention. Lyon: International Agency for Research on Cancer; Feb 2020 (<http://publications.iarc.fr/586>, accessed January 2020).
- Johnson SB, Park HS, Gross CP, Yu JB. Use of alternative medicine for cancer and its impact on survival. J Natl Cancer Inst. 2018;110 (1):121–4.
- Calcagni N, Gana K, Quintard B. A systematic review of complementary and alternative medicine in oncology: Psychological and physical effects of manipulative and body-based practices. PLoS One. 2019 Oct 17;14 (10):e0223564. doi: 10.1371/journal.pone.0223564. eCollection 2019. PubMed PMID: 31622362; PubMed Central PMCID: PMC6797104
- WHO report on the global tobacco epidemic, 2019. Offer help to quit tobacco use. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/bitstream/handle/10665/274603/9789241565639-eng.pdf?ua=1>, accessed January 2020).
- Poznyak V, Reke D, editors. Global status report on alcohol and health, 2018. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/bitstream/handle/10665/274603/9789241565639-eng.pdf?ua=1>, accessed January 2020).
- WHO list of priority medical devices for cancer management (WHO Medical device technical series). Geneva: World Health Organization; 2017 (https://www.who.int/medical_devices/publications/priority_med_dev_cancer_management/en/, accessed January 2020).
- WHO definition of palliative care. Geneva: World Health Organization; 2019 (<https://www.who.int/cancer/palliative/definition/en/>, accessed January 2020).

Making the case

Cancer is a major public health challenge. Between 2012 and 2018, the number of cases is estimated to have increased in nearly every country for which population-based registry data are available (1). Since 2011, significant global and national commitments have been made to respond to and address the challenge. To achieve these political commitments, UHC must be the foundation for strengthening cancer prevention and control.

The cost of inaction is too great. Investment in an essential package of cancer services and activities could avoid 7.3 million deaths from cancer between 2020 and 2030 with gains for the broader health system and economic benefits for governments, families and individuals. Action is required now.

1. Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Piñeros M, et al. Global Cancer Observatory: cancer today, Lyon: International Agency for Research on Cancer; 2019.

Chapter 01.

Global burden of cancer: current and future



The background of the slide is a dark blue field filled with numerous handprints of varying sizes and orientations, all in a lighter blue shade. A solid orange horizontal bar is positioned at the top left, and a solid pink horizontal bar is at the bottom right.

Key messages

- 1.** In 2018, there were an estimated 18 million new cases of cancer and 10 million deaths from cancer worldwide. The predicted global burden will double to about 29–37 million new cancer cases by 2040, with the greatest increases in LMIC.
- 2.** Cancer cases and deaths occur inequitably. Countries with lower incomes have significantly worse population outcomes, and, within countries, people at the lowest economic levels have poorer cancer outcomes and are more likely to suffer financial hardship.
- 3.** Of the 15 million deaths between the ages of 30 and 69 (“premature deaths”) in 2018, 4.5 million were due to cancer. In 80% of countries, trends in premature mortality from cancer are inhibiting progress toward achieving SDG target 3.4.
- 4.** Scaling-up cancer control to achieve UHC is essential to improve outcomes and save lives in all countries.

1.1 Understanding the global burden of cancer

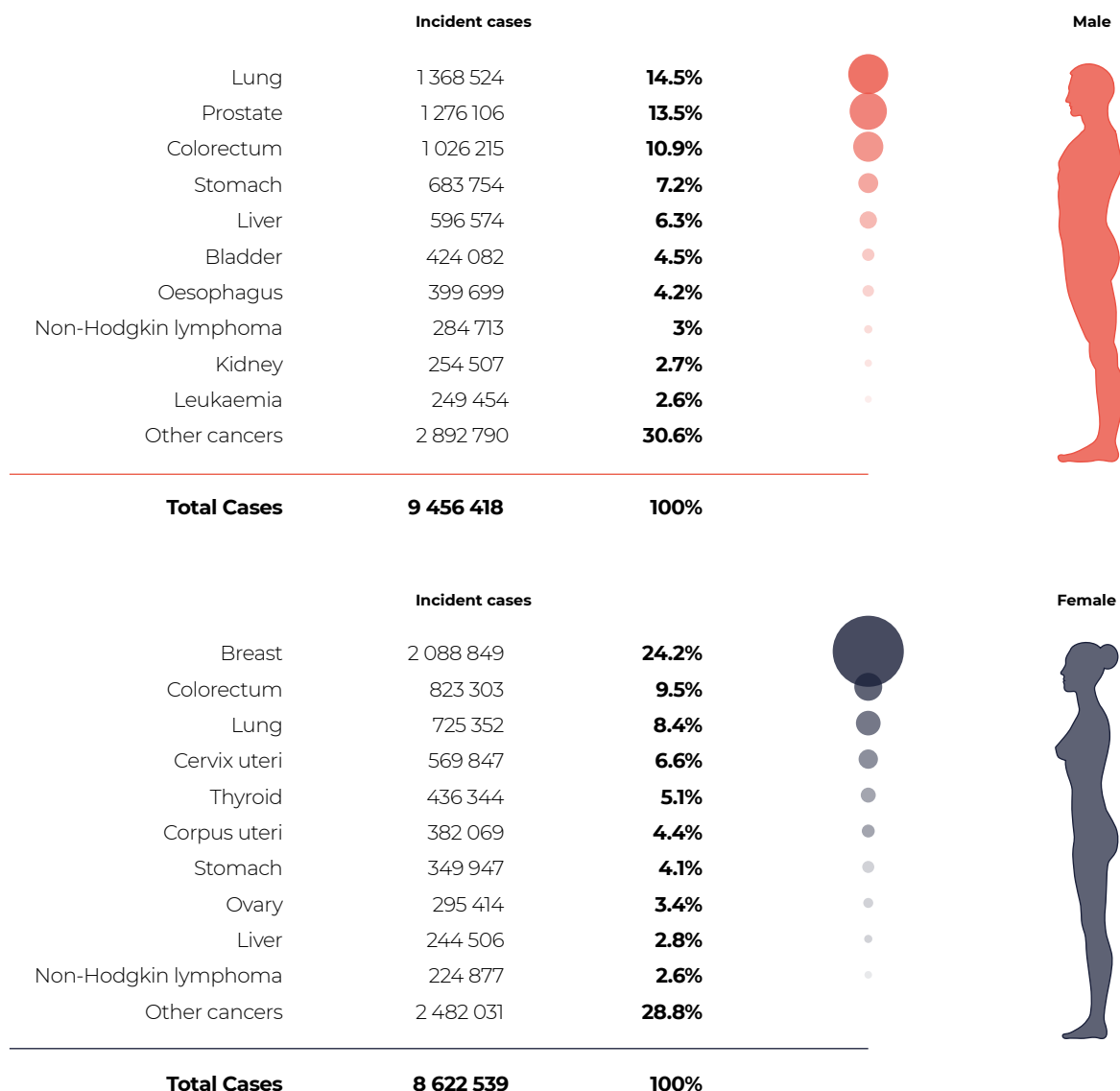
NCDs are by far the leading cause of death globally, responsible for 71% of all deaths in 2016 (1), and, of the 15.2 million premature deaths, 4.5 million (29.7%) were due to cancer. Cancer is the first or second leading cause of premature death in 134 of 183 countries in the world (2).

In 2018, there were an estimated 18.1 million new cases and 9.6 million deaths from cancer (Fig. 1.1).

Cancer is already responsible for one in six deaths globally. The numbers of new cases and deaths continue to rise because of increasing life expectancy and epidemiological and demographic transitions (3). SDG 3.4 calls for a one-third reduction in premature mortality from NCDs by 2030. Unfortunately, progress in cancer has been slower than general progress in NCDs (4).

Cancer will develop in one in five people before they reach the age of 75.

Fig. 1.1. Estimated global burden of cancer in 2018



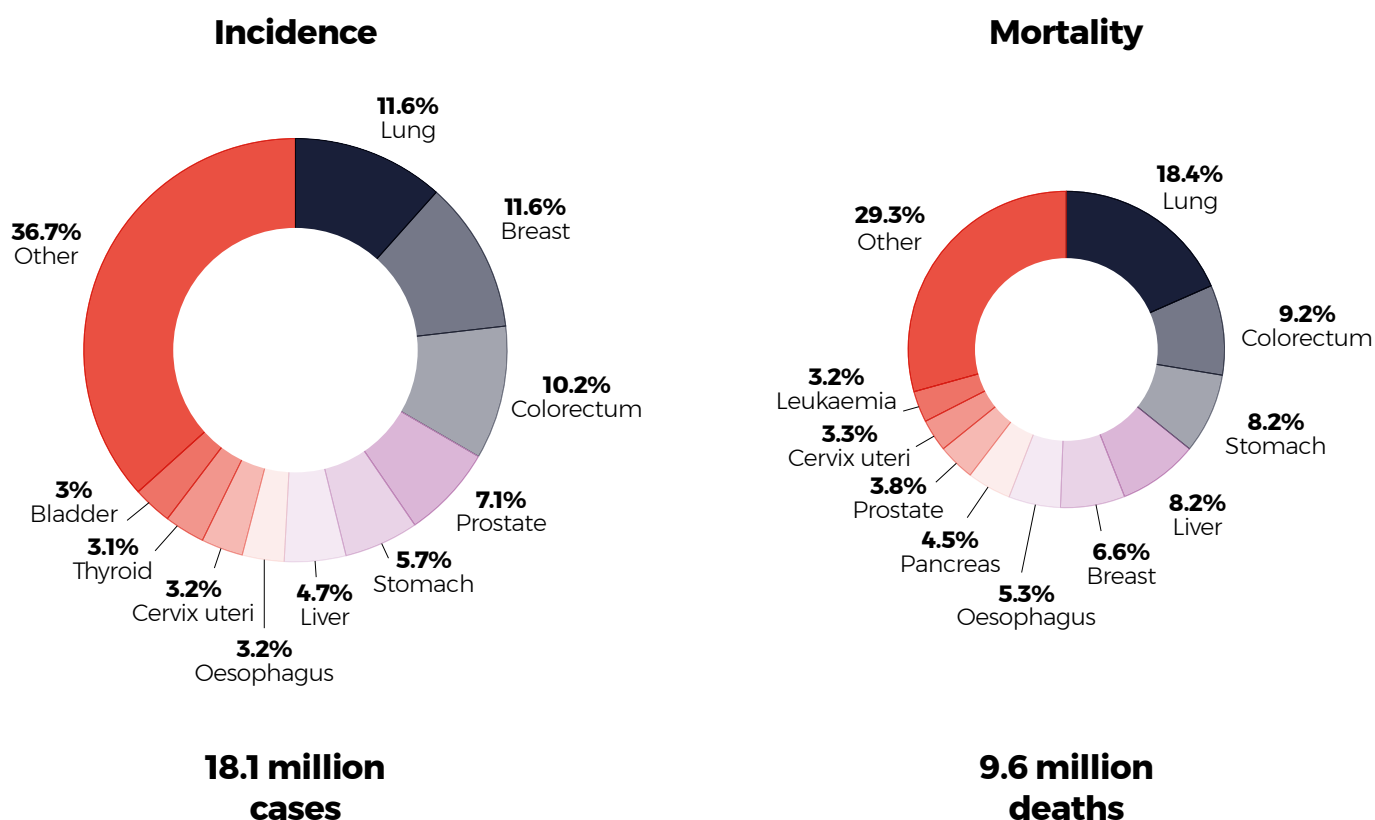
1.1.1

Scale and profile of cancer

In 2018, the most frequently diagnosed cancer was of the lung (11.6% of all cases), followed by female breast (11.6%) and colorectal cancer (10.2%). Lung cancer is also the leading cause of death from cancer

(18.4% of all deaths), followed by colorectal (9.2%) and stomach cancers (8.2%). The 10 most common cancers are responsible for 60-70% of cancer incidence and mortality (Fig. 1.2).

Fig. 1.2. Distribution of cases and deaths by the leading 10 cancer types in 2018 for both sexes.

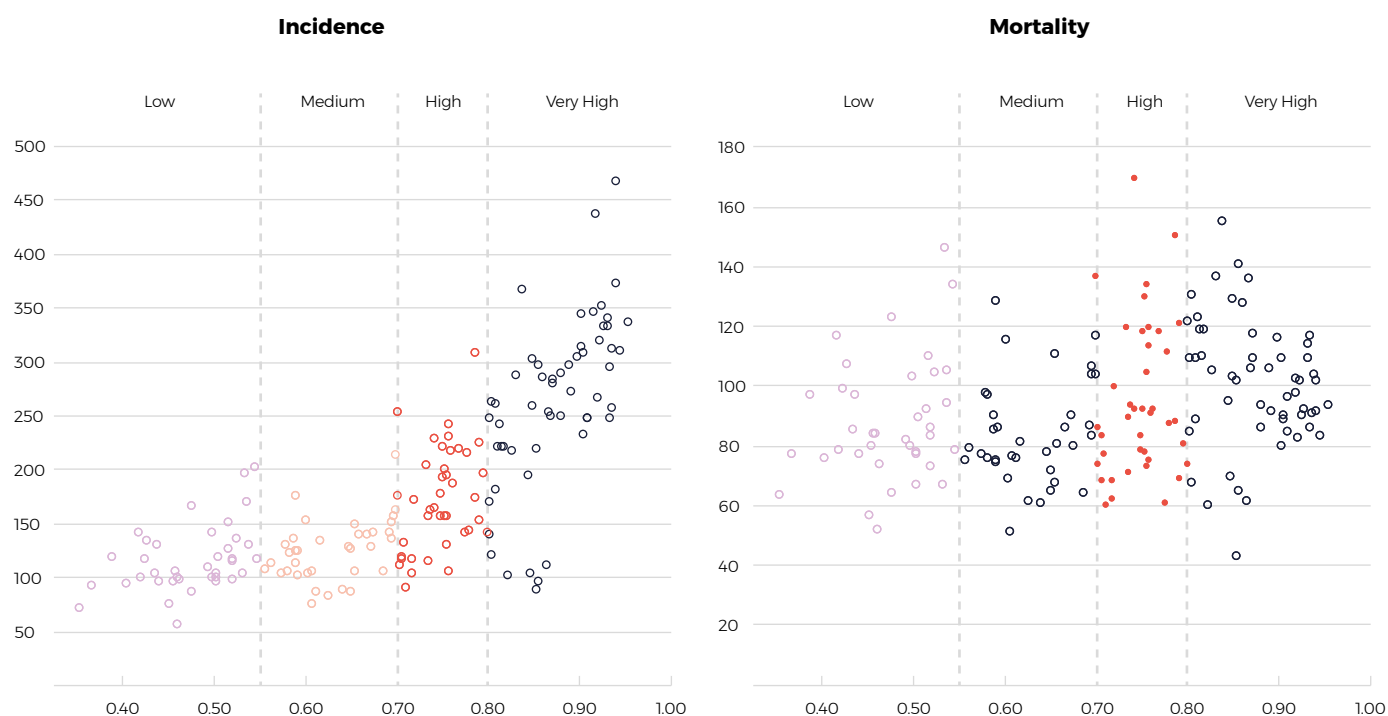


Source: references 1,2

Substantial global heterogeneity in the leading cancer types is due to differences in exposure to risk factors and in life expectancy (Fig. 1.3) (5). The age-standardized rates for the majority of cancer types are higher in countries with a higher HDI (6), although some cancers, such as Kaposi sarcoma, cervical

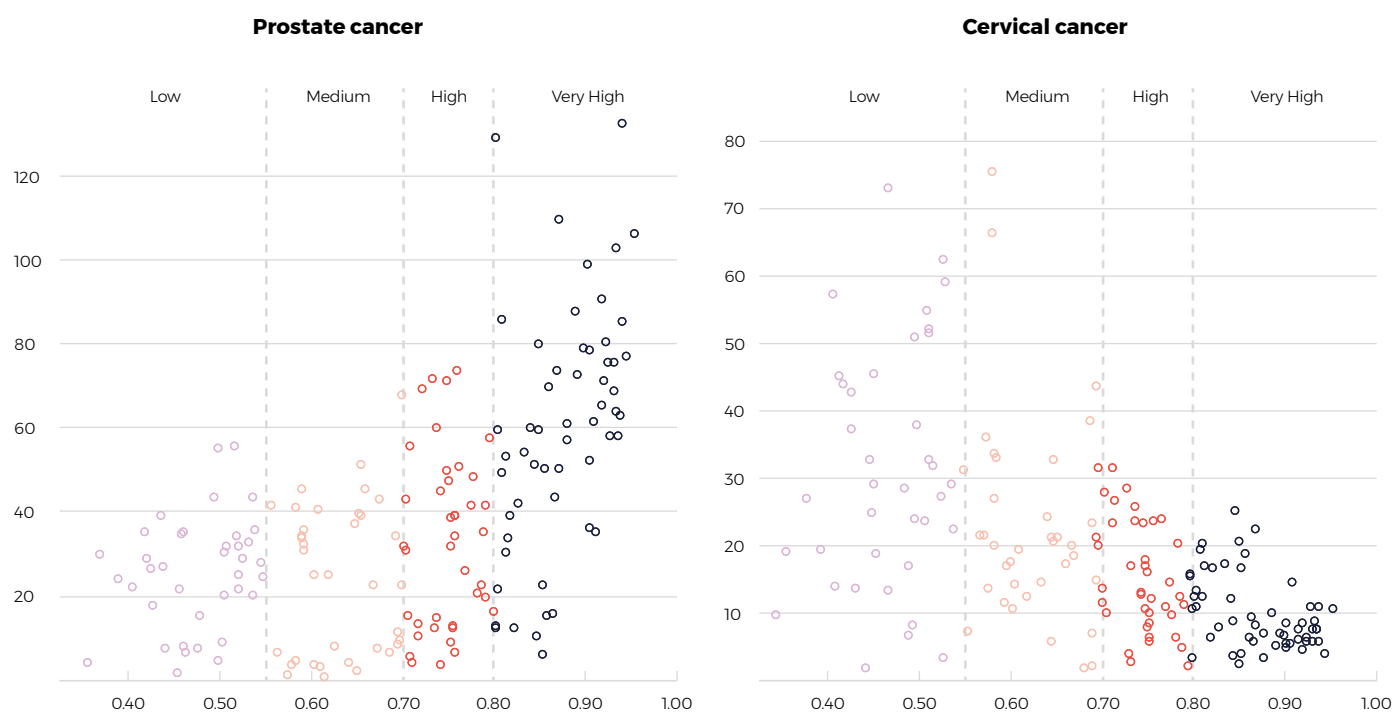
cancer and nasopharyngeal cancer, are more frequent in countries with low HDI (Figs 1.4 and 1.5; Annex 2) (3). Differences among countries in the occurrence of most common cancers indicate that the national response must be contextualized to the epidemiological burden.

Fig. 1.3. Age-standardized rates for cancer incidence and mortality according to human development index in 2018.



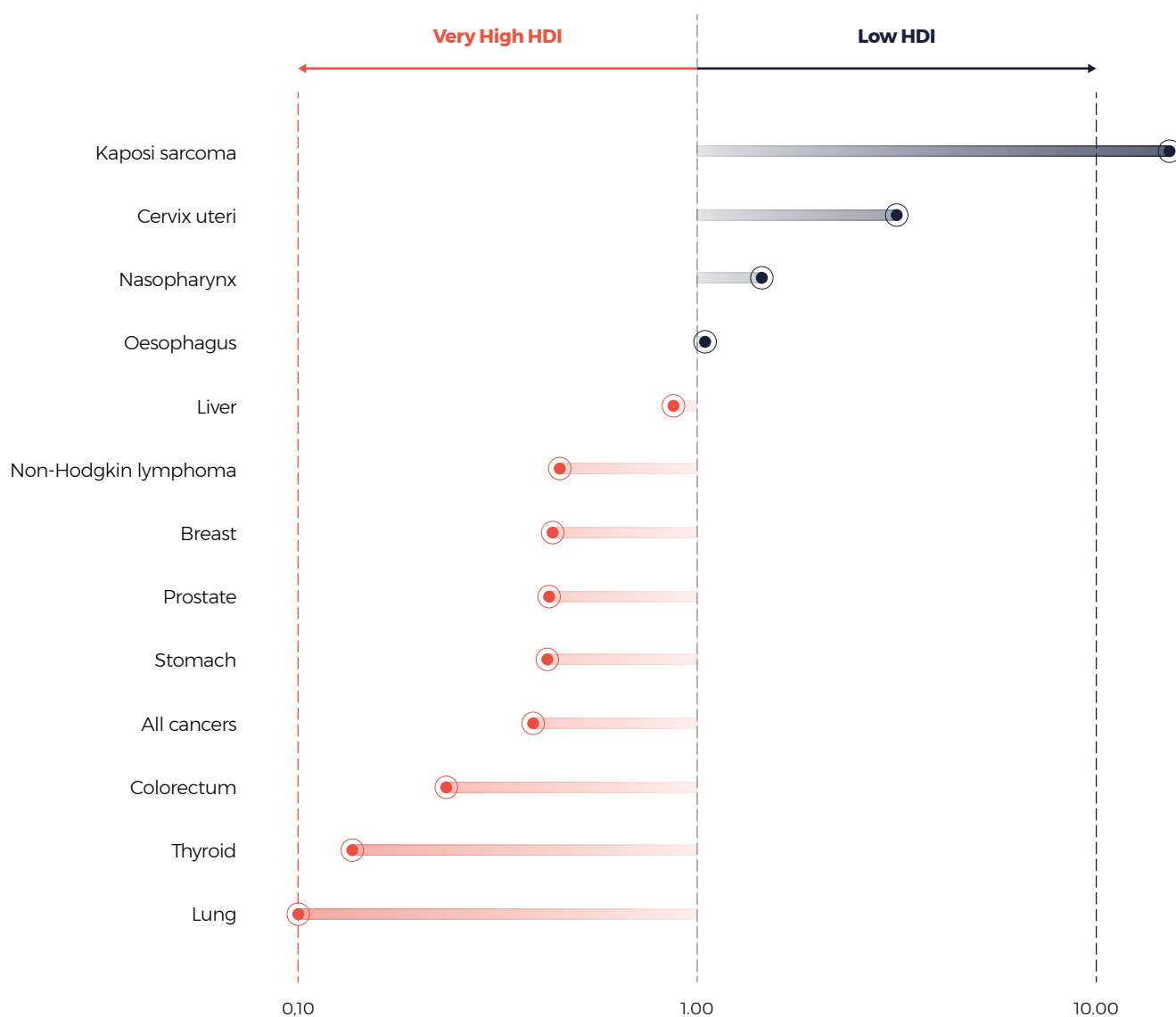
Source: references 3,6.

Fig. 1.4. Age-standardized rates of prostate cancer and of cervical cancer in countries according to human development index in 2018.



Source: references 3,6.

Fig. 1.5. Differences in relative risks of cancers according to human development index.

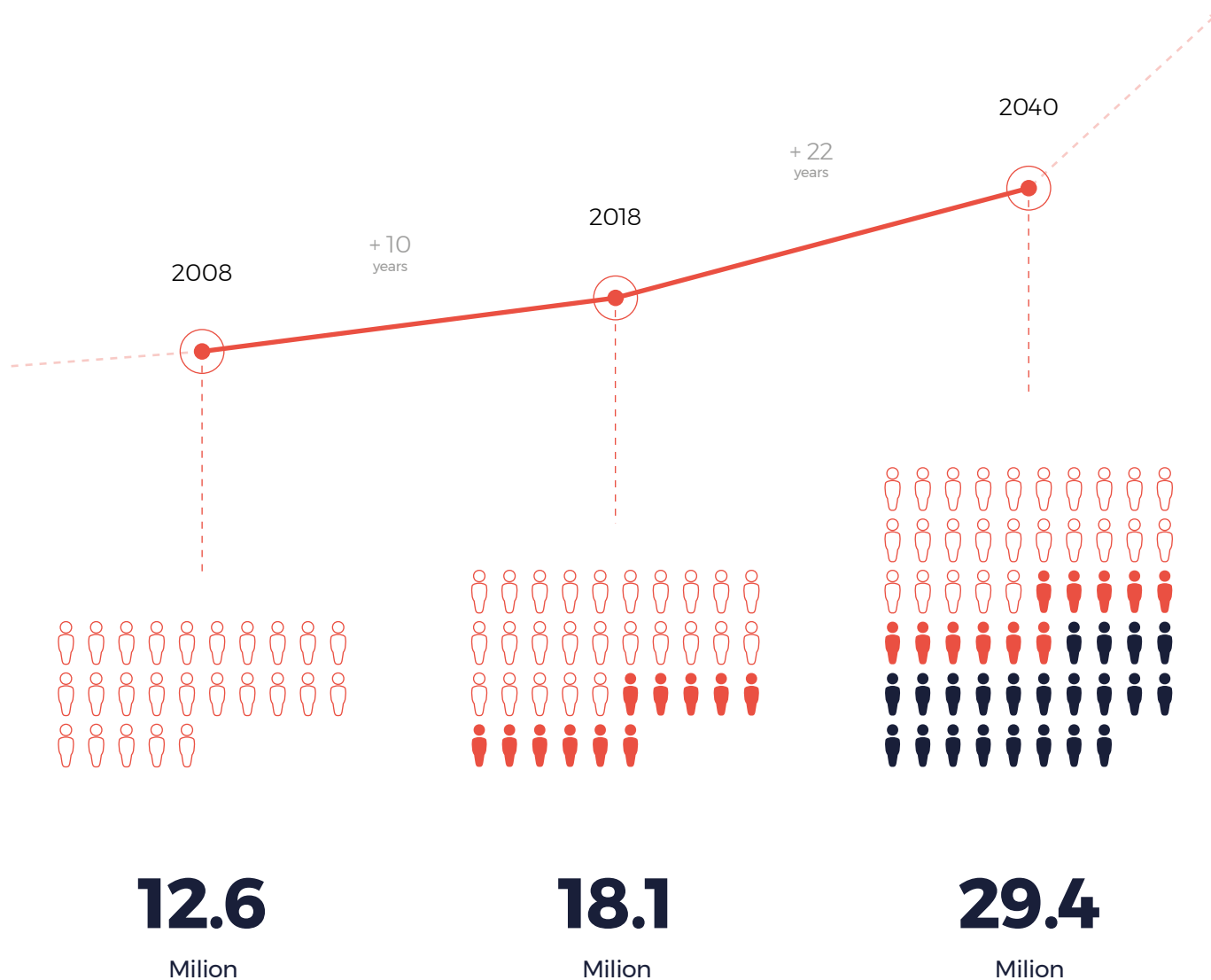


Source: reference 5.

Ideally, long-term predictions also account for recent trends in national cancer- and sex-specific rates based on projections of age, period and birth cohort (7). Yet, for much of the world, there is too little information on cancer incidence and mortality. Exercises in which recent trends in the rates of major cancers in countries by HDI were derived from high-

quality cancer registry data indicated that increased life expectancy and the ageing of the population contribute three fifths and the increased age-standardized rates contribute two fifths of future trends (8). If these assumptions hold, the predicted global incidence will double to about 37 million new cancer cases by 2040 (Fig. 1.6).

Fig. 1.6. Estimated global burden of cancer in 2018 and that in 2040 according to United Nations population projections.

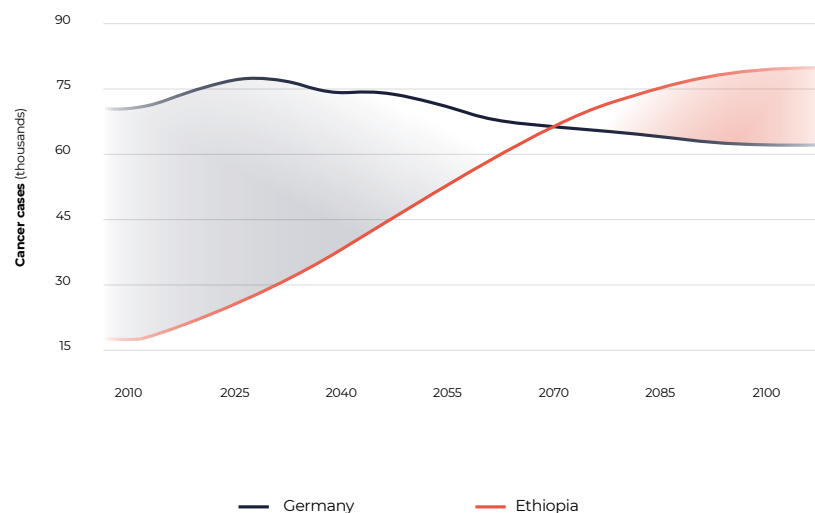


Source: reference 3

In absolute terms, the burden is highest in countries with high and very high HDIs, although, in relative terms, the increases will be proportionally greater in countries with low and medium HDIs (2). The anticipated surge in the annual number

of new cancer patients over the coming decades, particularly in countries with low or medium HDI (see Fig. 1.7), is a clear signal for immediate, sound investment in cancer control.

Fig. 1.7. Trends in annual numbers of breast cancer cases in Ethiopia and Germany, 2010-2110.



Source: reference 1,7

1.1.2 Recent trends and future cancer burden

An epidemiological transition has occurred over the past 60 years, as deaths from infectious disease have decreased and the burden of NCDs, including cancer, has increased. Improvements in sanitation, the discovery of antibiotics and vaccine development have contributed to this epidemiological shift.

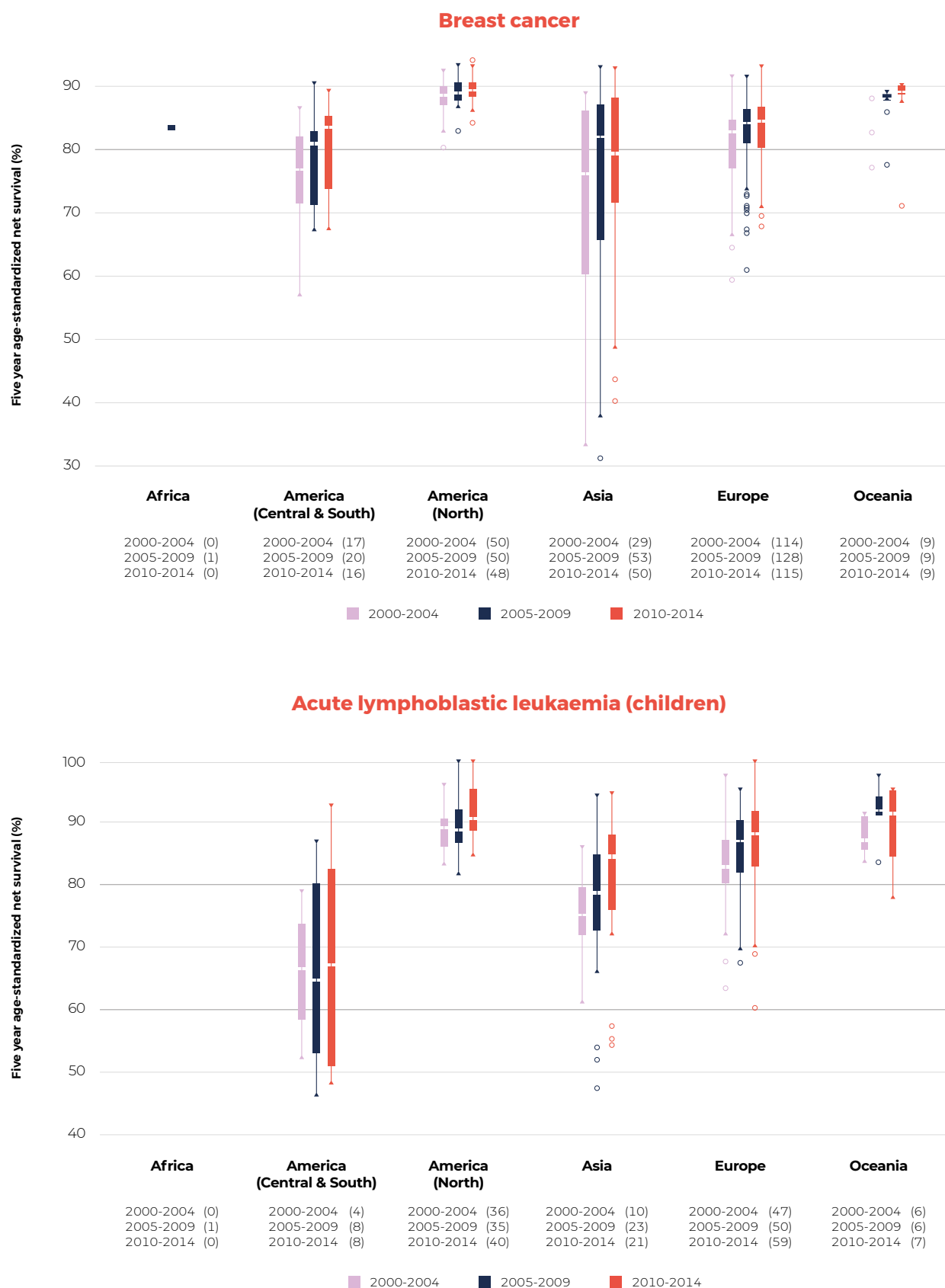
Changes in the prevalence and the distribution of risk factors strongly affect trends in cancer types, with implications for cancer control strategies. For example, the different impact of the smoking epidemic on lung cancer incidence in countries with high and lower HDIs is correlated with the prevalence of tobacco use. Countries with very high HDIs were the first to adopt and subsequently relinquish tobacco habits; thus, a steady rise, peak and decrease in smoking prevalence among men were followed 20-30 years later by a similar pattern in lung cancer rates (71). Similarly, the incidence of infection-related cancers, such as of the cervix, liver and stomach, has decreased significantly over the past three decades in countries with very high

The full cancer burden, including those in children and rare cancers, should be considered. Cancer in children is commonly under-recognized, which has resulted in significant global inequality. Cancer occurs in more than 300 000 children every year worldwide, and the rate is expected to increase with control of competing causes of mortality, such as communicable diseases. Studies of the burden of childhood cancer have shown wide inequality among countries, as children in countries with low and medium HDIs are significantly less likely to access care or receive successful treatment (70).

HDIs, but they remain common in those with low and medium HDIs.

Trends in mortality rates are also a function of changes in incidence and survival, which are related to health system capacity for cancer management, including earlier diagnosis and access to effective treatment. Studies on the probability of surviving cancer have two clear findings: (i) survival can be improved by investing in cancer management, and (ii) trends in survival differ by country and region (Fig. 1.8; 72).

Fig. 1.8. Box plot (minimum, first quartile, median, third quartile, and maximum) for survival from breast and acute lymphoblastic leukaemia (children) by continent



1.2 Social and economic inequalities in cancer

Cancer cases and deaths occur unequally. Social and economic inequalities such as differences in income, education, housing, employment, diet, culture, gender, ethnic group and environment can affect the cancer burden, and socially and economically disadvantaged populations have poorer outcomes, as they are more likely to have preventable cancers that are diagnosed at a later stage, with a poorer prognosis, and they are more likely to have inadequate access to treatment. In order to reduce inequality, cancer control should include targeted activities to decrease the exposure of such populations to avoidable risk factors.

In absolute terms, the burden of cancer is highest in countries with high and very high HDIs, but, in relative terms, the increases will be proportionally greater in countries with low and medium HDIs

By 2040, 67% of annual cancer cases will be in LMIC (3).

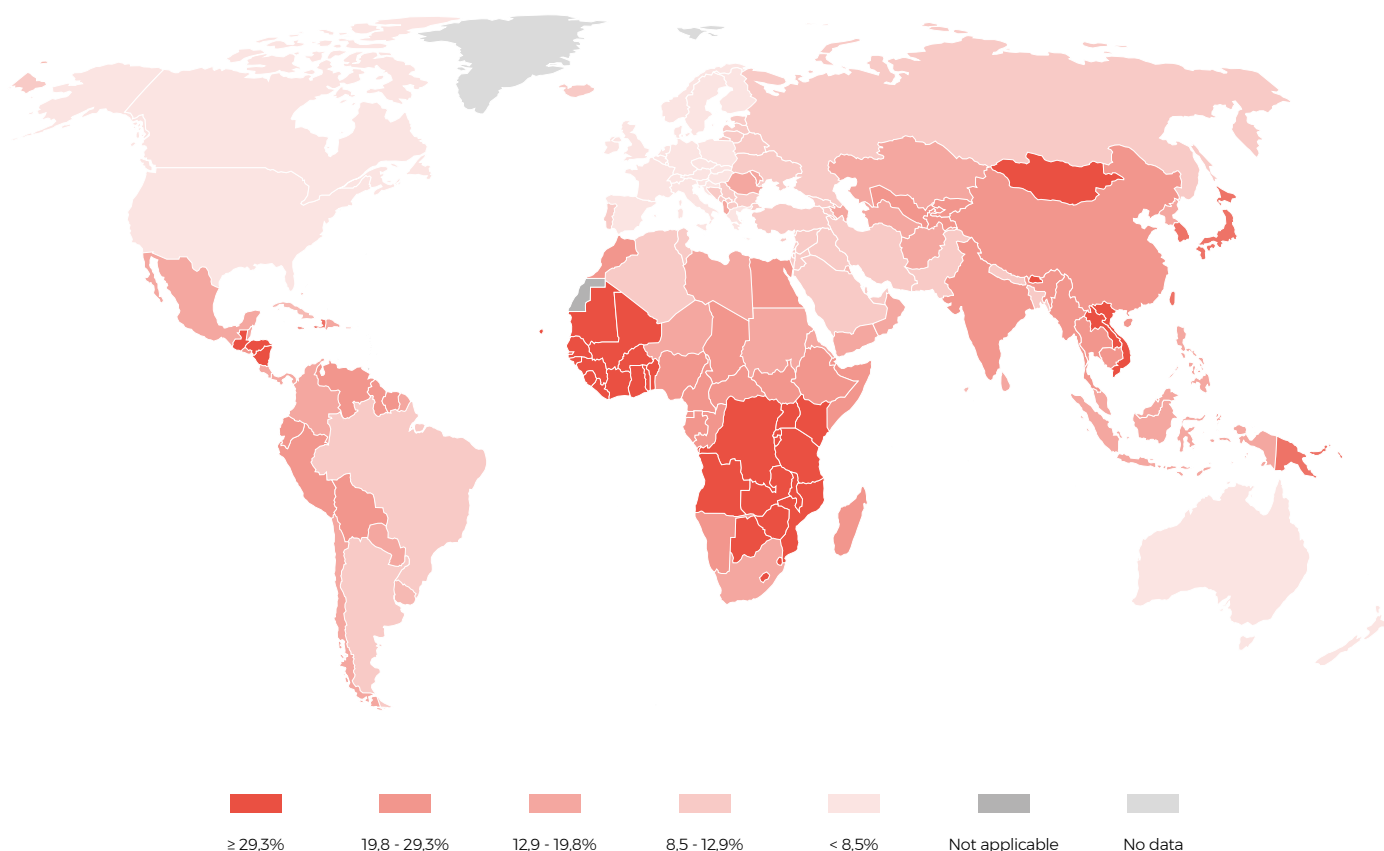
1.2.1 Socioeconomic determinants of cancers

Determinants of health and cancer incidence: Determinants of health, such as biological factors, physical and social environments and economic status, influence cancer incidence and outcomes. Tobacco use, for example, is more prevalent in lower socioeconomic groups in countries with higher HDIs, resulting in 60–90% higher rates of tobacco-related cancers (13). The differential distribution of cancer rates by socioeconomic status is partly explained by differences in tobacco use, alcohol consumption, unhealthy nutrition, obesity and lack of physical activity (14). Environmental factors also contribute to socioeconomic inequality in cancer (Fig. 1.9). The prevalence of a number of common cancers related to infection, including cancers of the stomach (*Helicobacter pylori*), cervix (HPV) and liver (hepatitis B and C viruses), is higher in the most disadvantaged groups (13), both

nationally and sub-nationally, with larger overall proportions of infection-associated cancers in lower-income countries and lower socioeconomic groups (14). Unequal access to policies and programmes for cancer prevention increases inequality over time. For example, in 2014, 34% of young women in HIC and only 3% of those in LMIC received a full course of HPV vaccine (15). There has been recent progress.

While access to HPV vaccine was previously mainly restricted to girls in HIV, by 2020, most HPV vaccine doses are to be given to girls in LMIC.

Fig. 1.9. Proportions of cancer cases attributable to infectious agents, 2018.



Source: reference 14

People living with HIV are also at higher risk of several cancers, particularly those that are AIDS-defining (Kaposi sarcoma, non-Hodgkin lymphomas and invasive cervical cancer) and those associated with infectious agents (anal cancer caused by HPV, Hodgkin lymphoma linked to Epstein-Barr viruses and liver cancer related to hepatitis B and C viruses). Public health interventions for the control of HIV have already mitigated the growing cancer burden (16). With even better treatment and a projected increase in the life expectancy of people living with HIV/AIDS, further investment in clinical trials will be required to identify the most effective cancer prevention and control strategies.

Determinants of health and cancer mortality: Mortality from cancer is strongly correlated to the stage of cancer

at diagnosis and the quality of treatment. Disadvantaged groups often delay presentation, experience geographical and economic barriers to care and participate less in screening programmes, resulting in more late diagnoses and marked differences in outcomes (17–19). Even when cancers are diagnosed at an early stage, disadvantaged groups are generally more likely to receive lower-quality care, fail to complete treatment or, for cancers with a poor prognosis, be transitioned to non-curative care (20–22).

In countries with universal access to education and health care, outcomes may still be unequal (23). Concerted, broad population-based approaches are required, such as increasing education, health literacy and access to clinical services for disadvantaged populations.

1.2.2

Social and economic consequences of cancer

Nearly everyone has been affected by a cancer diagnosis in themselves, their family or their friends.

Cancer thus directly affects not only patients but also their families, friends and communities. People with cancer experience high rates of financial hardship and in many cases, catastrophe, which is increasing over time as cancer care becomes more expensive (24). In South-East Asia, for example, the rate of financial catastrophe is 70% or higher (24–26) (see also section 2.4.1). Severe financial distress after a cancer diagnosis may increase the likelihood of death, even after apparently effective treatment (27).

Psychological and financial distress extend to families and caretakers, particularly when there is limited or no access to care or when it is prohibitively expensive. Family members and caretakers often provide unpaid care that can result in loss of employment, financial hardship and poor physical and mental health (28). The children of a parent with cancer also have worse health outcomes (29).

The burden of cancer affects a country's economy because of absence from work, lost productivity and premature mortality. An assessment of the productivity lost due to premature death from cancer in Brazil, China, India, the Russian Federation and South Africa in 2012 indicated a loss of US\$ 46.3 billion, corresponding to 0.2–0.5% of total gross domestic product (GDP) in those countries (30). In 2009, the total cost of premature mortality related to cancer in Europe was estimated to be €945.7 million (31). Countries with UHC can protect people against such negative economic and social consequences and improve their outcomes (23).

1.2.3

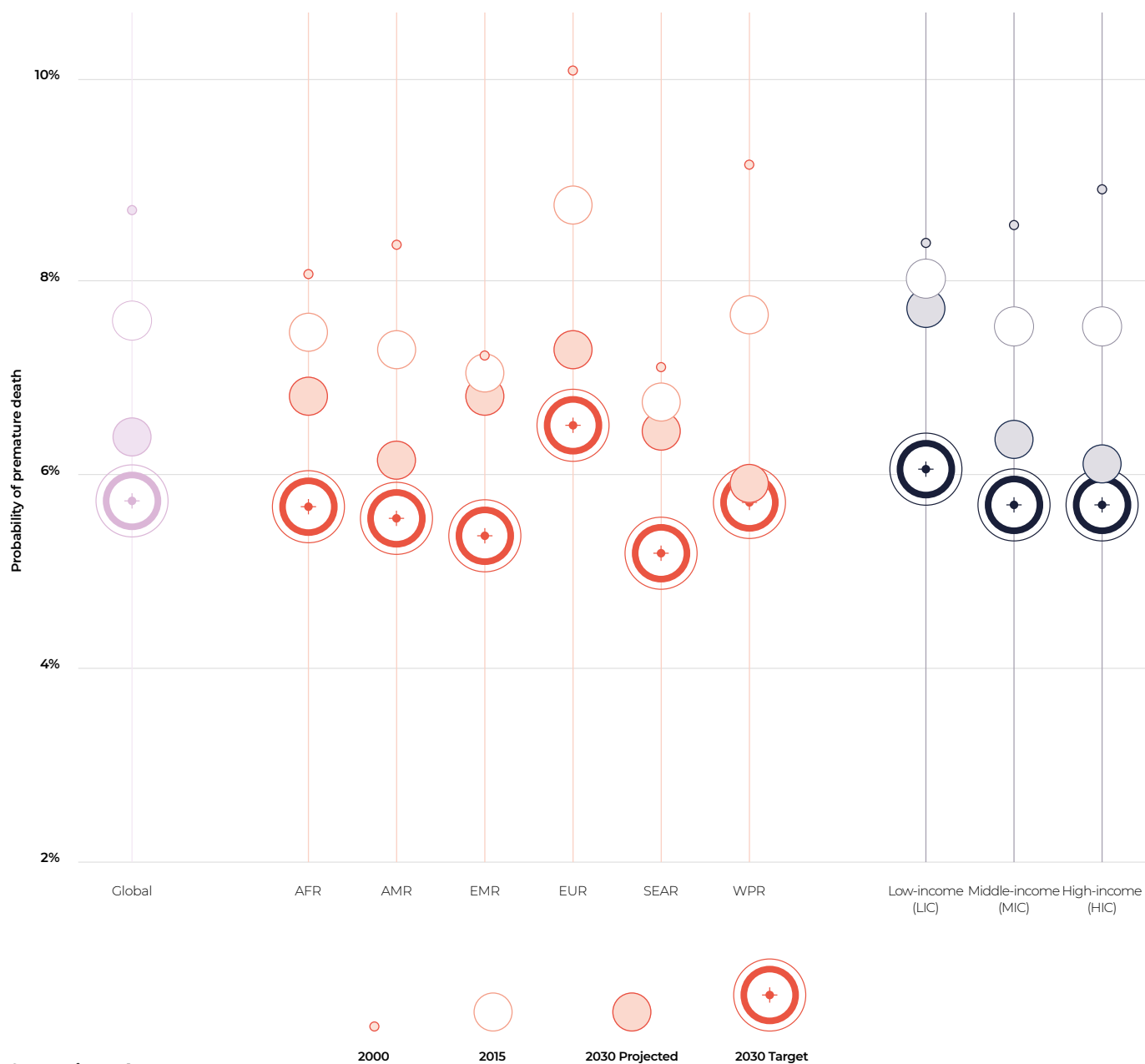
Achieving cancer-related Sustainable Development Goals

Reducing the burden of cancer is a vital component of meeting commitments to reduce premature death and disability from NCDs, particularly SDG target 3.4. In 2015, the probability of premature death from NCDs was 7.5% in LMIC and 6.8% in HIC (7).

Only 12 countries globally are on track to achieve a one-third reduction in premature mortality from cancer by 2030. Reaching SDG target 3.4 will require greater investment in cancer and other NCDs.

While substantial progress has been made in HIC because of favourable trends in cancer incidence and mortality attributed directly to advances in cancer control, progress in LMIC has been slow and insufficient (32, 33) (Fig. 1.10) and must be accelerated.

Fig. 1.10. Progress towards SDG target 3.4. Change between 2000 and 2015 in probability of dying from cancer during ages 30-69 years of age and trend toward 2030, by region and World Bank income level.



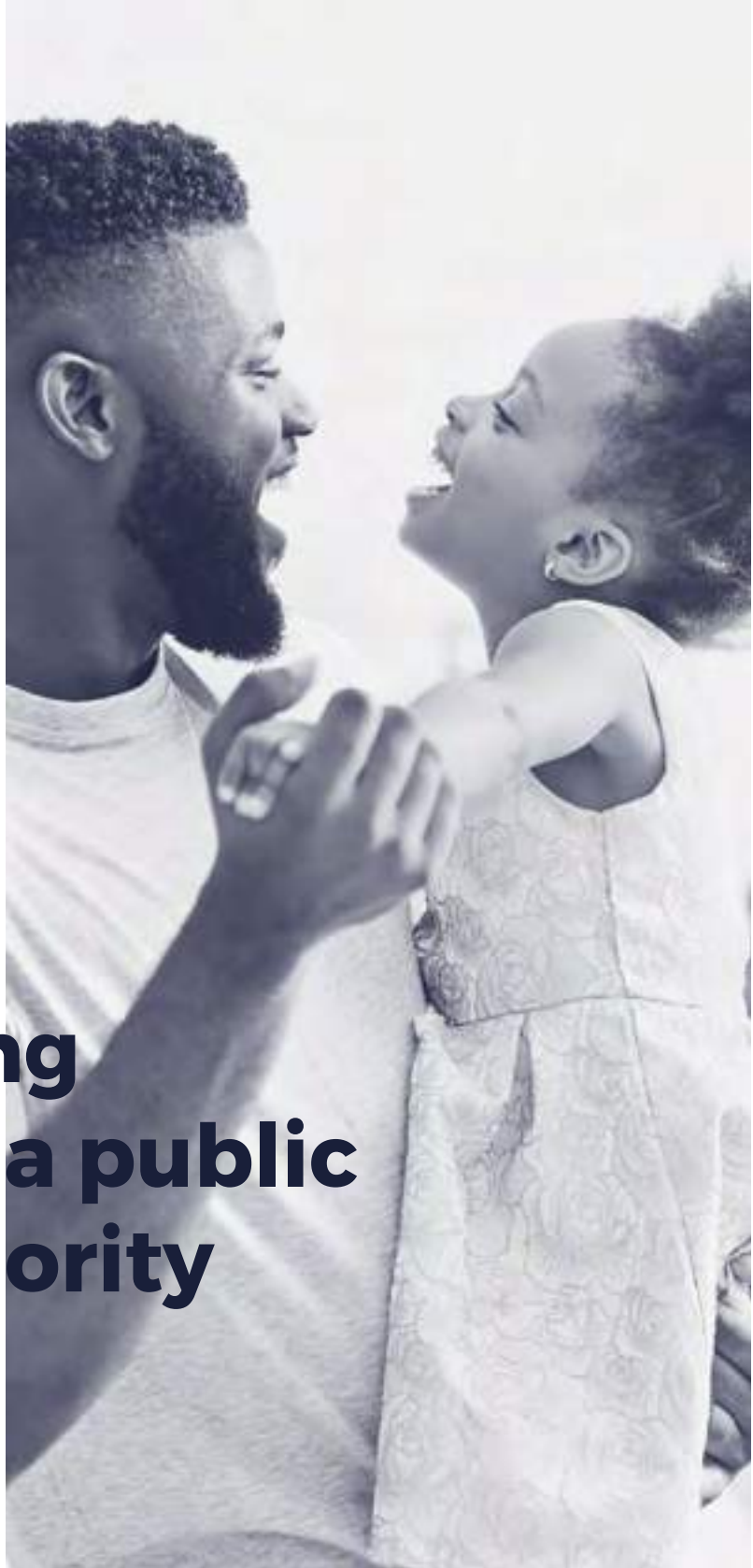
Source: reference 1

References

- Global Health Observatory. Geneva: World Health Organization; 2016 (<http://www.who.int/gho/database/en/> accessed [date]).
- Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Piñeros M, et al. Global Cancer Observatory: cancer today. Lyon: International Agency for Research on Cancer; 2019.
- Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Piñeros M, et al. Global Cancer Observatory: cancer tomorrow. Lyon: International Agency for Research on Cancer; 2019.
- NCD Countdown 2030 collaborators. NCD Countdown 2030: worldwide trends in non-communicable disease mortality and progress towards Sustainable Development Goal target 3.4. *Lancet*. 2018;392(10152):1072–88.
- Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*. 2018;68(6):394–424.
- Human Development Index. New York City (NY): United Nations Development Programme; 2020 (<http://hdr.undp.org/en/content/human-development-index-hdi>, accessed January 2020).
- Bray F, Moller B. Predicting the future burden of cancer. *Nature Rev Cancer*. 2006;6(1):63–74.
- Bray F, Jemal A, Grey N, Ferlay J, Forman D. Global cancer transitions according to the Human Development Index (2008–2030): a population-based study. *Lancet Oncol*. 2012;13(8):790–801.
- World population prospects. New York City (NY): United Nations; 2019 (<https://population.un.org/wpp/>, accessed January 2020).
- Lam CG, Howard SC, Bouffet E, Pritchard-Jones K. Science and health for all children with cancer. *Science*. 2019;363(6432):1182–6.
- CI5plus. Cancer Incidence in Five Continents time trends. Lyon: International Agency for Research on Cancer; 2020 (http://ci5.iarc.fr/CI5plus/Pages/graph1_sel.aspx, accessed January 2020).
- Allemani C, Matsuda T, Di Carlo V, Harewood R, Matz M, Nikšić M, et al. Global surveillance of trends in cancer survival 2000–14 (CONCORD-3): analysis of individual records for 37 513 025 patients diagnosed with one of 18 cancers from 322 population-based registries in 71 countries. *Lancet*. 2018;391(10125):1023–75.
- Bryere J, Dejardin O, Launay L, Colonna M, Grosclaude P, Launoy G, et al. Socioeconomic status and site-specific cancer incidence, a Bayesian approach in a French Cancer Registries Network study. *Eur J Cancer Prev*. 2018;27(4):391–8.
- de Martel C, Georges D, Bray F, Ferlay J, Clifford GM. Global burden of cancer attributable to infections in 2018: a worldwide incidence analysis. *Lancet Glob Health*. 2020;8(2):e180–e190. doi:10.1016/S2214-109X(19)30488-7
- Bruni L, Diaz M, Barrionuevo-Rosas L, Herrero R, Bray F, Bosch FX, et al. Global estimates of human papillomavirus vaccination coverage by region and income level: a pooled analysis. *Lancet Glob Health*. 2016;4(7):e453–63.
- Yarchoan R, Uldrick TS. HIV-associated cancers and related diseases. *N Engl J Med*. 2018;378(11):1029–41.
- Stanbury JF, Baade PD, Yu Y, Yu XQ. Cancer survival in New South Wales, Australia: socioeconomic disparities remain despite overall improvements. *BMC Cancer*. 2016;16:48.
- Aarts MJ, Kamphuis CB, Louwman MJ, Coebergh JW, Mackenbach JP, van Lenthe FJ. Educational inequalities in cancer survival: a role for comorbidities and health behaviours? *J Epidemiol Community Health*. 2013;67(4):365–73.
- Brand NR, Qu LG, Chao A, Ilbawi AM. Delays and barriers to cancer care in low- and middle-income countries: a systematic review. *Oncologist*. 2019;24(12):e1371–80.
- Bakens M, Lemmens V, de Hingh I. Socio-economic status influences the likelihood of undergoing surgical treatment for pancreatic cancer in the Netherlands. *HPB (Oxford)*. 2017;19(5):443–8.
- Foerster M, Anderson BO, McKenzie F, Galukande M, Anele A, Adisa C, et al. Inequities in breast cancer treatment in sub-Saharan Africa: findings from a prospective multi-country observational study. *Breast Cancer Res*. 2019;21(1):93.
- Bergeron-Boucher MP, Oeppen J, Holm NV, Nielsen HM, Lindahl-Jacobsen R, Wensink MJ. Understanding differences in cancer survival between populations: a new approach and application to breast cancer survival differentials between Danish regions. *Int J Environ Res Public Health*. 2019;16(17).
- Maruthappu M, Watkins J, Mohd Noou A, Williams C, Ali R, Sullivan R, et al. Economic downturns, universal health coverage, and cancer mortality in high-income and middle-income countries, 1990–2010: a longitudinal analysis. *Lancet*. 2016;388(10045):684–95.
- Choi JW, Cho KH, Choi Y, Han KT, Kwon JA, Park EC. Changes in economic status of households associated with catastrophic health expenditures for cancer in South Korea. *Asian Pac J Cancer Prev*. 2014;15(6):2713–7.
- Ilbawi A, Meheus F. Universal health coverage. Chapter 40. In: Jemal A, Torre L, Soerjomataram I, Bray F, editors. *The cancer atlas*, 3rd edition. New York City (NY): American Cancer Society; 2019 (<https://canceratlas.cancer.org/taking-action/universal-health-coverage/>, accessed January 2020).
- Leng A, Jing J, Nicholas S, Wang J. Catastrophic health expenditure of cancer patients at the end-of-life: a retrospective observational study in China. *BMC Palliat Care*. 2019;18(1):43.
- Ramsey SD, Bansal A, Fedorenko CR, Blogh DK, Overstreet KA, Shankaran V, et al. Financial insolvency as a risk factor for early mortality among patients with cancer. *J Clin Oncol*. 2016;34(9):980–6.
- Romito F, Goldzweig G, Cormio C, Hagedoorn M, Andersen BL. Informal caregiving for cancer patients. *Cancer*. 2013;119(Suppl 11):2160–9.
- Mailhot Vega RB, Balogun OD, Ishaq OF, Bray F, Ginsburg O, Formenti SC. Estimating child mortality associated with maternal mortality from breast and cervical cancer. *Cancer*. 2019;125(1):109–17.
- Pearce A, Sharp L, Hanly P, Barchuk A, Bray F, de Camargo Cancela M, et al. Productivity losses due to premature mortality from cancer in Brazil, Russia, India, China, and South Africa (BRICS): a population-based comparison. *Cancer Epidemiol*. 2018;53:27–34.
- Hanly PA, Sharp L. The cost of lost productivity due to premature cancer-related mortality: an economic measure of the cancer burden. *BMC Cancer*. 2014;14:224.
- Cao B, Bray F, Ilbawi A, Soerjomataram I. Effect on longevity of one-third reduction in premature mortality from non-communicable diseases by 2030: a global analysis of the Sustainable Development Goal health target. *Lancet Glob Health*. 2018;6(12):e1288–96.
- Cao B, Bray F, Beltran-Sanchez H, Ginsburg O, Soneji S, Soerjomataram I. Benchmarking life expectancy and cancer mortality: global comparison with cardiovascular disease 1981–2010. *BMJ*. 2017;357:j2765.

Chapter 02.

Positioning cancer as a public health priority



The background of the slide is a dark blue field filled with numerous handprints of varying sizes and orientations, all in a lighter blue shade. At the top left, there is a solid orange rectangular bar. At the bottom right, there is a solid light purple rectangular bar.

Key messages

- 1.** Governments have committed themselves to preventing and controlling cancer in several global declarations, including the 2030 United Nations Agenda for Sustainable Development. Progress in meeting their commitments has been slow.
- 2.** WHO “best buys” for the prevention and control of NCDs should be implemented by all governments, with existing legal instruments and frameworks for an integrated response.
- 3.** The SDGs cannot be achieved without accessible cancer management services that provide value for money. Cancer control is an integral component of the path towards UHC and a reduction in premature mortality by 2030.
- 4.** Investment in an essential package of cancer interventions will provide a positive return on investment, with meaningful social and economic returns, including increased productivity and equity.
- 5.** By 2030, more than 7 million cancer deaths in LMIC can be avoided; the investment required will be US\$ 2.70 per person in LIC, US\$ 3.95 per person in lower-middle-income countries and US\$ 8.15 per person in upper-middle-income countries.

2.1 Global commitments to cancer control

Cancer is rising on the global health and development agendas. For many years, cancer was considered a disease of wealthy countries, and the global public health emphasis was on prevention. With recognition of the rapidly increasing global burden and that less than 50% all cancer cases are preventable with current knowledge and interventions, governments have increased the importance of comprehensive cancer control on the development agendas. Cancer and other NCDs constitute one of the major barriers to development in the 21st century, and strong commitments have been made in United Nations and World Health assemblies during the past decade (Fig. 2.1).

The first United Nations high-level meeting on NCDs in 2011 resulted in a political declaration and commitments by Member States (Fig. 2.1). The next year, in 2012, WHO Member States agreed to the Global Action

Plan for the Prevention and Control of NCDs 2013–2020, which includes the goal of a 25% reduction in premature mortality from NCDs by 2025, with targets for reducing risk factors and changing health systems. Public health commitments to a multisectoral response to NCDs are also reflected in the United Nations 2030 Agenda for Sustainable Development, with SDG 3.4 as the banner for cancer control and with recognition of the centrality of UHC, the importance of caring for children and the elderly and the necessity of palliative care.

To track progress in achieving the Global action plan, Member States adopted time-bound commitments to set national targets for NCDs, prepare national plans, reduce the risk factors for NCDs and strengthen health system responses to NCDs. Progress in meeting these commitments has, however, been disappointing (Fig. 2.2).

Fig 2.1. International political commitments relevant to cancer control

* Tentative. To be discussed at the 148th Executive Board meeting (2020)

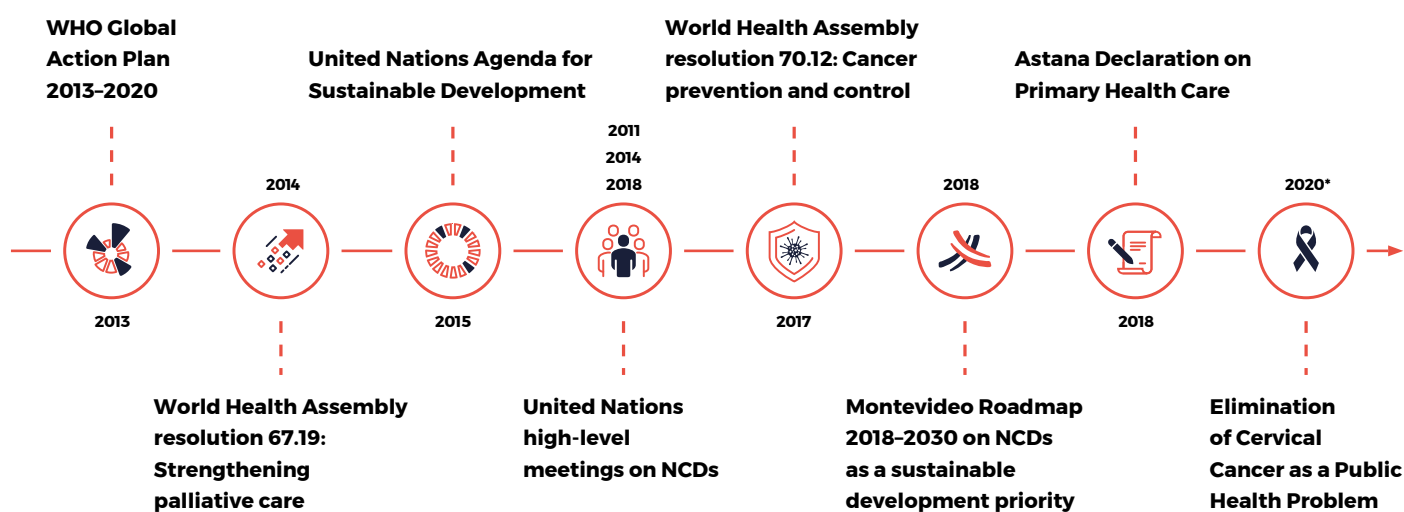








Fig. 2.2. Status of 10 indicators to chart progress in national responses and fulfilment of commitments made since the first United Nations high-level meeting on NCDs in 2011

Only ½ have achieved more than 5 of 19 progress indicators

Areas of achievement

-  setting national targets
-  operational multisectoral national strategy
-  evidence-based national guideline for management of NCDs

Areas for improvement

-  data systems to track NCD risk factors and mortality
-  restrictions on exposure to tobacco and alcohol advertising or promotion
-  provision of drug therapy for NCDs

With a mandate from Member States, WHO has framed the global response to cancer through an integrated approach, built on UHC and strengthening health systems through robust NCCPs (2,3). This is reflected in three interconnected WHO targets: to ensure that one billion more people benefit from UHC, one billion more people enjoy better health and well-being, including protection against cancer risk factors, and one billion more people are better protected from health emergencies (4). WHO regional frameworks

for action have also been adopted (5,6). Global commitments to reducing the cancer burden have been made by many other United Nations agencies, including the UN Interagency Task Force on NCDs (7).

Recognizing that progress in cancer control must be accelerated and to meet its global mandate, WHO has launched two global initiatives to address the cancer burden (Box 2.1).

Box 2.1 WHO global initiatives to reduce the cancer burden



WHO remains committed to supporting governments in formulating comprehensive responses to the growing cancer burden, with other United Nations agencies and global partners.

Elimination of cervical cancer:

The initiative toward the elimination of cervical cancer as a public health problem includes reducing the age-adjusted incidence rate in every country to less than 4 per 100 000 women per year and scaling up capacity to treat and provide palliative care to women with cervical cancer. At present, national age-standardized incidence rates per 100 000 women range from more than 70 in the countries at highest risk to less than 10 in those at lowest risk. Although the incidence cannot be reduced to 0 with current interventions, the elimination threshold is achievable in every country during this century. WHO, its Member States and partners are activating resources to assist policy-makers and other stakeholders to invest and implement policies and programmes to eliminate cervical cancer.

Global Initiative for Childhood Cancer:

The aim of this initiative is to ensure the survival of at least 60% of children with cancer by 2030, thereby saving an additional one million lives and reducing suffering for all. This represents a doubling of the present global cure rate for childhood cancer. The Initiative includes increasing the priority of these cancers by governments and improving the capacity of countries for diagnosing, treating and monitoring the outcomes of these cancers. It involves active global partners and networks. Within a structured "CURE All" plan, six index cancers and focused implementation in countries, the care of every child with cancer will be improved through scientific advances and assurance that children will benefit from them.

2.2 Meeting global commitments in the national context

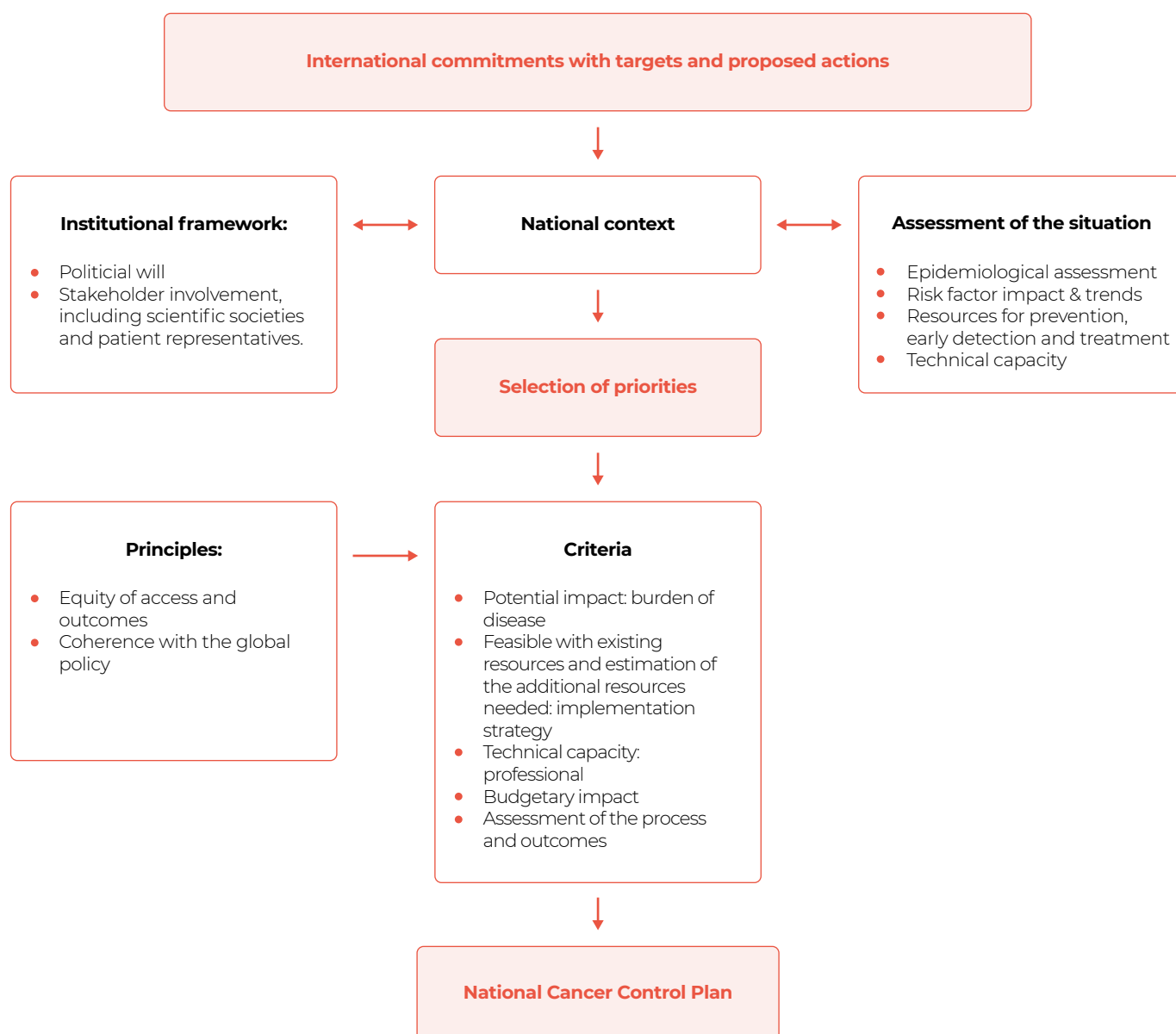
2.2.1 Adapting commitments to regions and countries

Global commitment to international goals and targets must be translated into action nationally and regionally according to their political and legal systems, the epidemiology of cancer, risk factors and their resources and technical expertise. Strategic priorities should be set on the basis of accurate data and feasibility; appropriate stakeholders should be engaged; and a consensus agenda or list

of priorities drawn up for an NCCP (Fig. 2.3; see also chapter 6). The priorities should meet national and global targets.

In 2019, national targets in the NCD plans of approximately 67% of countries were aligned with global targets (1).

Fig. 2.3. Translating global commitments into national and regional plans.



Regional bodies with knowledge of their territories and populations have a central role in determining regional priorities for their member States, including influencing their health policies and formulating regional responses (Box 2.2). For example, the European Union is involved in many areas of health and development that

are directly relevant to cancer. Similarly, the Union of South American Nations established a regional network of national cancer institutes in 2011 to facilitate cooperation in advancing cancer control (8).

Box 2.2. European Union policies for cancer (9)



Prevention and screening

- *Primary prevention: European Code against Cancer (see Box 3.4); regulation of carcinogens in the environment, food, at work, tobacco products*
- *Screening: Council recommendation for population-based cancer screening and support in implementation*

Diagnosis and treatment

- *Regulation of medical technologies*
- *Cross-border services (e.g. tele-radiology, provision of radioisotopes)*
- *Cross-border care (e.g. reference networks for rare diseases)*
- *Cross-border care financing (e.g. European health insurance card)*
- *Regulation of qualification of health care professionals*
- *Orpha.Net (information portal for rare cancers and diseases)*
- *Clinical guidelines (e.g. nutrition for cancer patients)*
- *Anti-discrimination protection for cancer patients and survivors under legislation on disability*

Monitoring and research

- *European cooperation for data on health services and outcomes (e.g. Eurostat) and cancer-specific studies, (e.g. EUROCARE)*
- *European Network of Cancer Registries*
- *Financing of European research on cancer*
- *Regulation on use of personal data*
- *Regulation of clinical trials*

Policy and infrastructure

- *Overall policy statements by the Council of Ministers and European Parliament on cancer*
- *Financing of cooperation between Member States on cancer, including multiple joint actions*
- *European guidance on comprehensive cancer control strategies*
- *Financial support to health infrastructure (e.g. from European Structural and Investment Funds, European Investment Bank)*

2.2.2

Guiding principles of a national response

Cancer cannot be prevented or controlled by the health sector alone.

The prevention and control of cancer require a coordinated, multisectoral, multidisciplinary approach. Multisectoral collaboration and health-in-all policies are necessary for many of the most powerful NCD interventions, such as taxation of tobacco and unhealthy products, mitigation of air pollution and access to expensive medicines and

technologies. Cancer control is thus an excellent example of the whole-of-government, whole-of-society approach, with the leadership and involvement of many sectors, including health, education, energy, justice, agriculture, sports, transport, communication, urban planning, environment, labour, employment, industry, trade, finance and social and economic development (Box 2.3).

Box 2.3. Case study of tobacco control in Brazil

Brazil has a long-standing commitment to tobacco control. It is one of two countries with the highest achievement of all MPOWER policies. Key measures implemented include designating all public and work places as 100% smoke-free, providing tobacco cessation services and strong pictorial health warnings, enforcing a comprehensive ban on tobacco advertising, promotion and sponsorship through Federal law and raising taxes on tobacco to 83% of the retail price. The result is that the prevalence of smoking among adults decreased from 35% in 1989 to 10% in 2017.

Key drivers of change are strong political will, multisectoral action, with the involvement of civil society, investments in research, synthesis of evidence to inform policy, domestic resources and strong technical cooperation with WHO. Brazil has also been involved in sub-regional forums to exchange experience and technical cooperation on tobacco taxation (10).



A coalition of government ministries, public health institutes, insurance companies and health care providers are needed, with continuous support from stakeholders in civil society, voluntary and religious organizations and the private sector, as appropriate

(Fig. 2.4). Collaboration in promoting and supporting the objectives of cancer control should be strengthened (Box 2.4). In this whole-of-society perspective, alliances improve implementation of programmes and policies.

Fig. 2.4. Addressing common cancer risk factors through a whole-of-government, whole-of society approach



Box 2.4. Knowledge transfer between countries in Africa

In a South-South partnership, the Uganda Cancer Society provided technical assistance to stakeholders in Eswatini (previously Swaziland) in setting up and operating a cancer unit in Mbabane Government Hospital. A formal arrangement was established, coordinated by the African Palliative Care Association and supported by the American Cancer Society. The cancer unit

now provides services for patients with breast cancer, with plans to extend services for other cancers. The main interventions were exchange visits of experts, with on-the-job training and mentorship of staff at the Hospital and visits to Uganda for the lead pharmacist and a doctor for both observation and application of knowledge and skills (11).



Towards achievement of UHC: UHC is the defining public health priority on the 2030 Agenda for Sustainable Development. Its components are equitable access to services along the cancer continuum and financial protection for the whole population.

Experience has shown that, when small initial investments in cancer care are oriented towards UHC, they ensure the feasibility and value of cancer services, improve population outcomes and justify the addition of services over time (12) (Box 2.5).

Box 2.5. Case study of cancer in UHC agenda (Kazakhstan)

Kazakhstan has made a strong political commitment to cancer control and UHC founded on strong primary health care. After an imPACT mission in 2016, WHO was requested to review the cancer programme and to identify interventions that would maintain or increase coverage of cancer services, provide value for money and ensure financial protection. WHO and the Ministry of Health reviewed the country's screening programmes and concluded that focusing on three evidence-based programmes would have more impact than six. In reviewing the country's cancer treatment standards, WHO enlisted support from the European Society for Medical Oncology (ESMO), which analysed 20 cancer disease settings (over 300 protocols) using the WHO EML, the

European Medicines Agency's medicine indications, the ESMO Clinical Practice Guidelines (13) the ESMO-Magnitude of Clinical Benefit Scale version 1.1 and expert peer review (14). The assessment supported the Ministry of Health in optimizing its cancer treatment protocols and linking them to the national EML.

Screening coverage increased from 60% to 90% for breast and cervical cancer, and treatment coverage increased from 85% to 89%. By incorporating the recommendations into the Kazakhstan national cancer control plan 2018 -2022, the country maintained its long-standing commitment to offer its citizens evidence-based comprehensive cancer care as part of UHC (15).

The response to the NCD burden should be based on primary health care and UHC and guided by human rights to promote equity, empowerment of peoples and communities, international cooperation and solidarity and multisectoral action in a life-course approach. To succeed, cancer control must be integrated into the broader health system, and the investments made should also strengthen the health system (see also sections 3.4 and 7.2).

As recommended in the World Health Assembly resolution on cancer, an integrated approach should be used in which cancer control programmes are aligned with the broader NCD agenda

through primary prevention, coherence is promoted in national cancer plans within broader health strategies, and horizontal integration ensures that cancer services are delivered as part of a comprehensive package at appropriate levels of care, with a focus on primary care. Scaling up diagnostic imaging, laboratory capacity, infection prevention and control or palliative care can strengthen the whole health system for delivering other disease-specific programmes. Cancer control can be an indicator of a health system's capacity and serve as an entry point for broader investment in the system.

2.3

Using a legal framework

Many legal and regulatory frameworks have been used globally and locally to fulfil political commitments and for implementation, and

national laws and regulations have been enacted to strengthen cancer control (Table 2.1).

Table 2.1. Examples of use of law to advance cancer control

Area of cancer control	Examples
Tobacco use, harmful use of alcohol and unhealthy diet	<ul style="list-style-type: none"> • Ban or restrict advertising, promotion and/or sponsorship of products or companies; • Regulate products, including health warnings and product content • Ban smoking in workplaces and public places; restrict when and where tobacco is sold • Impose excise taxes and enact regulations to increase product price;
Occupational and environmental cancers	<ul style="list-style-type: none"> • Occupational health and safety laws limiting exposure to carcinogens • Environmental laws, including regulation of chemicals
Screening, diagnosis and/or treatment	<ul style="list-style-type: none"> • Regulate the safety, quality and efficacy of cancer services • Regulate, qualify and educate health practitioners including educational curriculum • Protect patient privacy and confidentiality • Regulate health insurance
Life after a cancer diagnosis	<ul style="list-style-type: none"> • Promote well-being and avoid any negative consequences of having had cancer, including protection against discrimination or stigmatization • Protect employment, including access to insurance and other financing mechanisms
Cancer registries and other means of collecting and storing health information	<ul style="list-style-type: none"> • Establish appropriate legal structures for cancer registries and other information systems, including notification of individual cases

Imbalances may occur in attempting to achieve coherence among different aspects of policy and practice. These include:

- liberalization and promotion of international trade and investment and regulation of unhealthy products, such as tobacco, alcohol and foods with excessive saturated fats, trans-fatty acids, salt or sugar;
- intellectual property protection, which can incentivize research and development, and the price of medicines and technologies;
- regulation of the trade and distribution of controlled medicines and the availability of opioids, which is essential for the relief of pain;
- laws designed to protect personal information and population-level cancer research; and

- material obtained for diagnostic purposes that could be used for research and the requirements of informed consent and linkage with clinical databases.

Legal and regulatory actions must be implemented and enforced. For example, legislation to ensure that cancer is a reportable disease will increase the availability of data on incidence; however, resources should also be available for checking data for consistency and quality and for analysing them. Legislative acts can authorize government agencies to formulate and implement programmes, as done in the Republic of Korea (17). While legislation to ensure access to treatment demonstrates government commitment, the capacity to make accurate diagnoses and provide survivorship care must be ensured (Box 2.6).

Box 2.6. Case study: Cancer law in the Philippines

The Philippines has effectively used health legislation to promote UHC. In March 2019, a bill on UHC was signed into law (Republic Act No. 11223), automatically enrolling all Filipinos in the National Health Insurance Program. The bill built on previous legislation for UHC (the National Health Insurance Act of 1995), the Z Benefit Package of 2011 (for health conditions that require prolonged hospitalization and expensive treatment) and the Sin Tax Reform Law in 2012 on tobacco and alcohol. Immediately before passing the UHC bill, the Government passed the National Integrated Cancer Control Act (Republic Act No. 11215) to strengthen cancer control, increase cancer survivorship and reduce physical and financial burdens on cancer patients and families. Elements of the Act include creation of a cancer centre, a cancer assistance fund and a governance structure for multisectoral cancer control planning. The goal of the legislation is attainment of the SDGs (18–20).

International agreements that do not specifically address cancer but have a strong impact include the WHO Framework Convention on Tobacco Control (WHO FCTC) and the World Trade Organization Agreement on Trade-related Aspects of Intellectual Property Rights (TRIPS Agreement).

Under the WHO FCTC, a treaty negotiated under the auspices of WHO, 181 Parties are currently committed under international law to take evidence-based measures for tobacco control and to cooperate to achieve the aims of the convention. Since its entry into force in 2005, the WHO FCTC has supported and empowered implementation of tobacco control measures around the globe. It was followed by the WHO FCTC Protocol to Eliminate Illicit Trade in Tobacco Products, the first protocol to the WHO FCTC, adopted in 2012, that was approved to reduce smuggling and other forms of illicit trade (21). The WHO FCTC is now integrated into the SDG agenda as one of the “means of implementation” to reach the overall health goal (SDG 3) and a target on NCDs.

Domestic implementation of the WHO FCTC has often been challenged in legal disputes, including claims that tobacco control measures violate other international commitments. Prominent examples include legal challenges to tobacco packaging laws in Australia and Uruguay, where it was argued that the proposals violated the TRIPS Agreement. The TRIPS Agreement, concluded in 1994, sets minimum standards for the protection of intellectual property, including patents and trademarks. These requirements can intersect with public health goals, such as when governments restrict use of tobacco trademarks or seek to promote access to patented medicines. In November 2001, the World Trade Organization Ministerial Conference adopted the Doha Declaration on the TRIPS Agreement and Public Health, which states that “the TRIPS Agreement does not and should not prevent members from taking measures to protect public health ... and, in particular, to promote access to medicines for all”. Member states have also agreed to protect intellectual property under various bilateral and multilateral trade and investment agreements.

2.4

Why act now? Understanding the business case

Many countries are in the process of defining guaranteed health benefits packages for UHC, to explicitly define the rights and responsibilities of the population in accessing services. This process often involves the use of economic data to quantify the value for money and budgetary impact of different intervention options, which reflect the necessity of the health sector to justify expenditures, particularly in relation to other sectors. Additionally, investment cases are used to show the economic benefits of investing in particular services, either for specific diseases or for UHC as a whole. Investment cases facilitate discussions between health and finance ministries regarding increasing the health budget for better, more responsible use of government resources.

WHO has drawn up an investment case for NCD prevention and control, *Saving lives, spending less: a strategic response to noncommunicable diseases* (22), which shows that for every US\$ 1 invested in scaling up interventions to address NCDs in LMIC, there will be a return to society of at least US\$ 7 in increased

employment, productivity and longer life. The interventions are now known as “best buys” and endorsed by member states (23). Achievement of the SDG target of UHC would cost an estimated additional US\$ 371 billion per year in LMICs (24), equivalent to an additional investment of US\$ 58 per person per year in all LMICs; however, this estimate included only a limited set of cancer management services. Other groups have defined essential packages of services based on systematic reviews of published studies (25, 26). Interventions such as management of childhood cancer are considered priorities in countries at all income levels.

As LMICs face an increasing need for cancer care services with continuation of the epidemiological transition, comprehensive planning for increased budgetary space for cancer services will become a necessity (see Box 7.1). Thus, a new investment case solely for cancer care, with three progressive tiers of service, has been produced (Box 2.7).

2.4.1

Current investments in cancer

In 2016, the world spent US\$ 7.5 trillion on health, representing almost 10% of global GDP (24). The average per capita expenditure was US\$ 1000, but more than half of all countries spent less than US\$ 350 per person. To date, in many LMIC, domestic and external investments in cancer management have been insufficient, resulting in avoidable deaths (27).

The unmet burden of cancer has both health and economic consequences at global, country, household and individual levels, resulting in hundreds of billions of dollars in economic loss each year (see section 1.2.2). At country level, the lower the coverage of cancer care services, the

greater the potential economic loss. Each individual who is unable to work or who dies prematurely as a result of cancer represents a loss of workforce participation, GDP contribution and human capital.

Box 2.7 Methodology for an investment case for cancer

Understanding the resources required, both financial and physical, to scale up cancer services is essential for negotiations between health and finance ministries on expanding the fiscal space for health, resulting in increasing financing for cancer services. In this model, the additional resources required globally to scale up cancer services were estimated for eight cancers, of the breast, cervix, prostate, colon, rectum, lung, liver and stomach. These cancers correspond to 54% of all cancer cases and 58% of all deaths; the estimate would likely increase with the addition of other cancers. In order to focus on unmet needs, HIC, where cancer services are generally close to comprehensive and accessible, are excluded.

At three tiers of capacity (see section 6.5), resource-stratified packages of care were estimated as a basis for a phased approach for implementing cancer prevention and control plans. Tiers are assigned according to a country's health system. In these calculations we modelled scale-up package 1 for LIC and package 2 for middle-income countries (MIC) to reach 90% of current unmet need by 2030. This ambitious pattern is aligned with the ambitious scenario modelled in the Global cervical cancer elimination initiative investment case (30). In addition, we assumed that the scale up will have the added benefit of shifting the stage distribution at diagnosis, which is included in the health benefits calculation (31). Data on

baseline coverage were taken from the same source as those for cervical cancer elimination (30). For countries for which data were not available, we assumed a current coverage of 20%, which reflects the current average coverage in LMIC.

All costs associated with delivering care are included, regardless of who currently pays for them. Costs are calculated in a bottom-up approach in which all the ingredients required to deliver an intervention are identified, the quantity of each is estimated and the price of each ingredient sought from global databases. For human resource and facility costs, we used the WHO CHOICE global databases, inflated to 2020 (32,33). Medicine prices are taken from the Drug Price Indicator Guide and also inflated to 2020 values (34).

The health impact associated with scaling up the package of interventions is calculated in a multistage life-table model. Epidemiological data for each cancer are taken from the IARC Global Cancer Observatory database (35). Effect sizes associated with the scaling-up of each intervention were derived from systematic literature searches and are described in chapter 6 on the resource-stratified packages.

To calculate the economic return on investment, two parameters aligned with previous investment case analyses are estimated (36,37). First, the productivity gains associated with reductions in mortality due to cancer are estimated. Each person whose life is saved is able to be an active member of

the workforce and contribute to GDP at the average wage rate of the population (38). Secondly, each life saved results in broader societal benefits beyond direct workforce participation. This value is quantified by a metric known as the value of statistical life, which is the amount an individual would be willing to pay to avoid death. For this analysis, we assume that the statistical value of a life is 22 x GDP per capita per life saved (39). While the long-term aim is comprehensive packages of care available for all countries as modelled, this may be unachievable in the short term for some countries. We therefore also provide a less ambitious scenario, in which the same packages of services are modelled to reach 50% of unmet need by 2030, with no improvement in stage distribution from the country baseline. The trade-off is the number of lives saved, which will be only 400 000 per year by 2030 or a total of 2.2 million over 10 years. This increase is unlikely to allow these countries to achieve the SDG of reducing premature mortality due to NCDs by one third.



2.4.2

Additional investment needs for cancer control programmes

The cancer investment case indicates that an ambitious scale up to 90% coverage of cancer services by 2030 would cost US\$ 140 billion between 2020 and 2030. As coverage increases, so does cost, and the additional investment required will be US\$ 2.5 billion in 2021 and up to an additional US\$ 25.3 billion in 2030. This investment corresponds to US\$ 4.05 per person per year by 2030; this includes the US\$1.65 per capita captured in the SDG costing for colorectal, cervical and breast cancers and an additional US\$2.40 for the other four cancers, representing a 4% increase to the previous estimate of US\$ 58 per person required to attain the health-related SDGs (37).

The greatest investment is needed for additional human resources to deliver health services for priority packages in tiers 1 and 2 (Fig. 2.5). Medicines constitute the second greatest share. Package 3, which includes many of the high-cost cancer medications, is not included in the priority packages selected for LMIC. The additional human resources required may represent a hindrance to rapid scaling-up of these interventions, given the long pre-service training necessary for the many highly specialized services.

Fig. 2.5. Percentage contribution of different costs to priority cancer packages in LMIC.

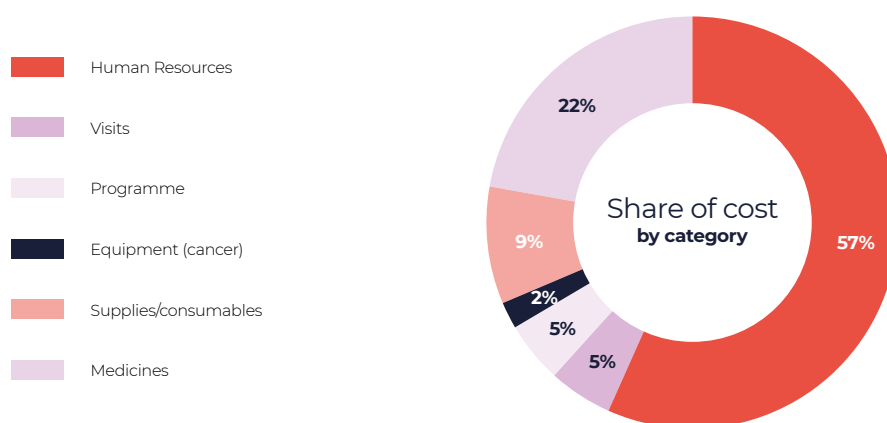


Fig. 2.6. Per capita investments needed for cancer management scale-up by World Bank country income level (expressed in US\$ and based on 2018 population estimates)

The per capita investment required varies by country, partly because of the expensive package modelled for MIC and partly because of the higher costs of non-traded goods in those countries. By 2030,

the investment required will be US\$ 2.70 per person in LIC, US\$ 3.95 per person in lower-middle-income countries and US\$ 8.15 per person in upper-middle-income countries (Fig. 2.6).



2.4.3

Health impacts of investing in cancer control programmes

This ambitious target for rapid scale up would save 1.1 million lives per year in LMIC in 2030 (Fig. 2.7).

Over the course of the 10-year investment, 7.3 million lives can be saved.

The numbers of lives saved depend on the cancer type, the baseline burden of disease

and the effectiveness of interventions. Populations in LMIC will not only live but will also become healthier, with 10 million years of healthy life added to the population between 2020 and 2030 (Fig. 2.8).

Fig. 2.7. Projected numbers of lives saved for each common cancer type over the next 10 years

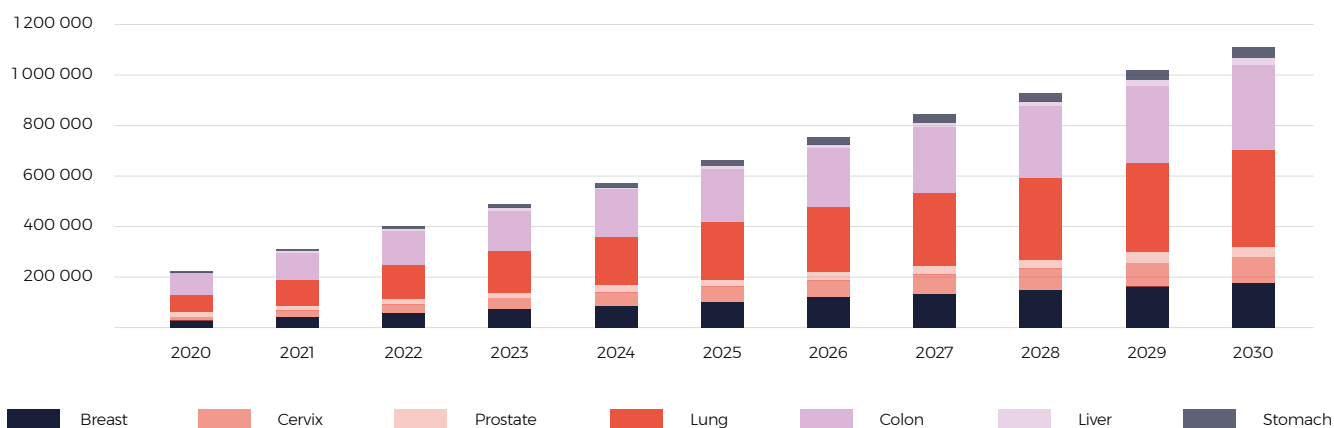
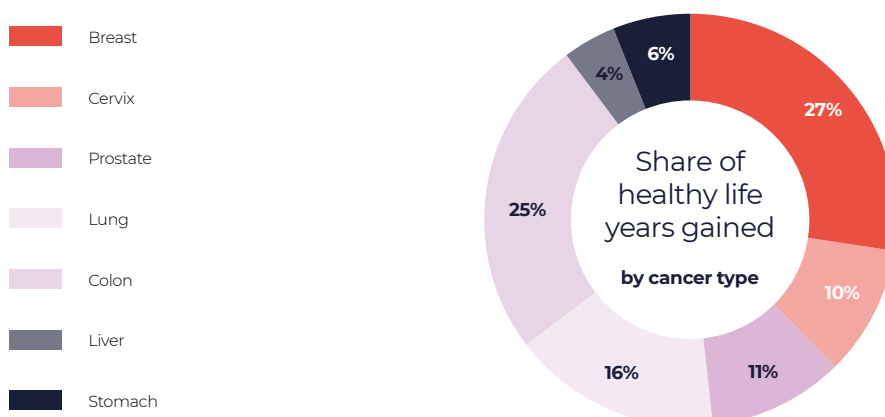


Fig. 2.8. Estimated healthy life years gained in LMIC by cancer type between 2020 and 2030.



2.4.4

How will economies benefit?

While health benefits alone are a convincing basis, economic rationales are increasingly used to strengthen the case for additional investment in health care. Investments will not only keep people alive but will increase both direct workforce participation and a broader societal contribution, adding US\$ 325 billion in direct productivity gains over the next 10 years

and US\$ 990 billion in indirect societal gains, for a full social value of US\$ 1.315 trillion. This is equivalent to a direct productivity return of US\$ 2.30 for each US\$ 1 invested in cancer care and a full social return based on both direct productivity and societal gains of US\$ 9.50 (Fig. 2.9). Box 2.8 illustrates the consequences of investing less.

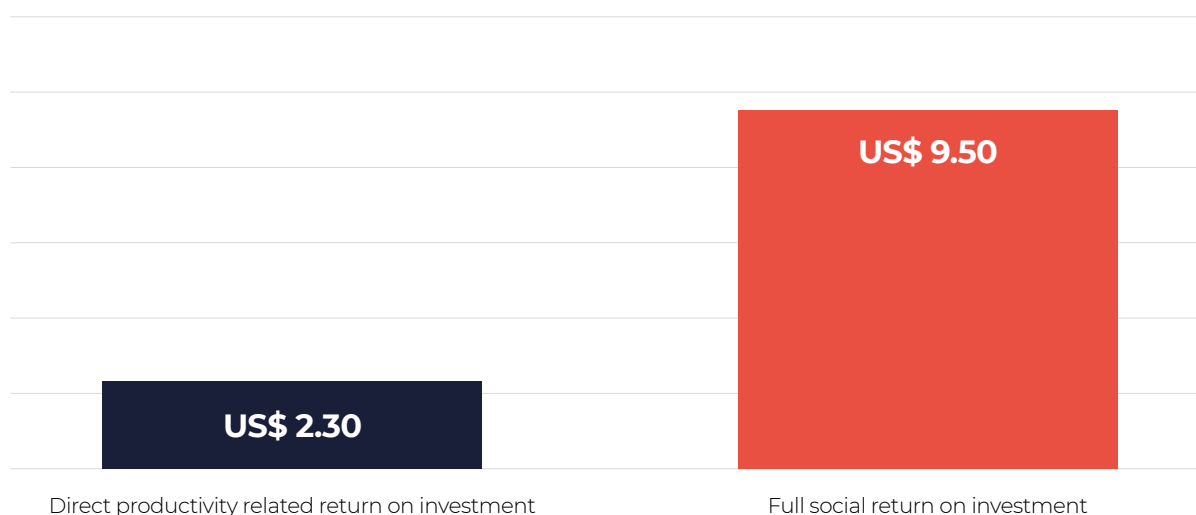
Fig. 2.9. Productivity gain, societal value and costs of investing in cancer management



Investing in cancer control makes sense from both a health and an economic viewpoint. Scaling-up access to health services and ensuring that access is free from financial barriers will improve quality of life and

reduce mortality rates. This will lead to a more productive society, with greater workforce participation and a strengthened social fabric.

Fig 2.8. Return on investment



Box 2.8. What will happen if less is invested?

While the long-term aim is for all countries to have comprehensive packages of care available, some countries may not be able to achieve this in the short term. A less ambitious scenario was therefore prepared, scaling up the same packages of services to reach 50% of unmet need by 2030. In this scenario, the additional investment required is much lower and, in some settings, possibly more affordable, at only US\$ 1.70 per person per year by 2030. The trade-off is the number of lives saved, which will be only 400 000 per year by 2030 or a total of 2.2 million over 10 years. This increase is unlikely to allow these countries to achieve the SDG of reducing premature mortality due to NCDs by one third.

These estimates are intended to highlight the possible health benefits in LMIC resulting from investment in cancer control programmes. The 90% coverage scenario gives countries an ambitious option and the 50% coverage scenario is an alternative, lower investment option. Ultimately, countries should rely on their own data and priorities for deciding where to spend their limited health budgets (see section 7.4.4, Box 7.1).

References

- Noncommunicable diseases progress monitor 2019. Geneva: World Health Organization; 2020 (<https://www.who.int/ncds/surveillance/ncd-capacity/en/>, accessed February 2020).
- National cancer control programmes. Policies and managerial guidelines. Geneva: World Health Organization; 2002 (<https://www.who.int/cancer/publications/nccp2002/en/>, accessed January 2020).
- Cancer control: knowledge into action. WHO guide for effective programmes. Geneva: World Health Organization; 2006 (<https://www.who.int/cancer/modules/en/>, accessed January 2020).
- Thirteenth general programme of work 2019–2023. Geneva: World Health Organization; 2019 (<https://www.who.int/about/what-we-do/thirteenth-general-programme-of-work-2019---2023>, accessed January 2020).
- Regional framework for action on cancer prevention and control (EM/RC64/3). Cairo: WHO Regional Office for the Eastern Mediterranean; 2017 (http://applications.emro.who.int/docs/RC_technical_papers_2017_3_20037_en.pdf, accessed January 2020).
- Strategic framework for the Comprehensive Control of Cancer Cervix in South-East Asia Region. New Delhi: WHO Regional Office for South-East Asia; 2015 (http://apps.searo.who.int/PDS_DOCS/B5155.pdf, accessed January 2020).
- United Nations Inter-Agency Task Force on the Prevention and Control of Non-communicable Diseases Note by the Secretary-General (E/2019/55). New York City (NY): United Nations Economic and Social Council; 2019 (<https://undocs.org/E/2019/55>, accessed January 2020).
- Ministros de Salud se comprometen a reducir 30% los casos y Muertos por cancer cervicouterino en las Américas para 2030 [Health ministers pledge to reduce cervical cancer cases and deaths by 30% in the Americas by 2030]. Santiago: Pan-American health organization; 2018 (https://www.paho.org/chi/index.php?option=com_content&view=article&id=1066:ministros-de-salud-se-comprometen-a-reducir-30-los-casos-y-muertes-por-cancer-cervicouterino-en-las-americas-para-2030&Itemid=1005, accessed January 2020).
- Greer SL, Fahy N, Elliott HA, Wismar M, Jarman H, Palm W, editors. Everything you always wanted to know about European Union health policies but were afraid to ask. 2nd revised edition [Health Policy Series, No. 54]. Copenhagen: European Observatory on Health Systems and Policies; 2019 (<https://www.ncbi.nlm.nih.gov/books/NBK551087/#Ch1-sec2>, accessed January 2020).
- WHO report on the global tobacco epidemic, 2019. Offer help to quit tobacco use. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/bitstream/handle/10665/274603/9789241565639-eng.pdf?ua=1>, accessed January 2020).
- Kiyange F, Walusansa V, Mandosela G, Kambale HN, Luyirika E, Orem J. The role of South-to-South partnerships in developing cancer services in Africa. *J Global Oncol*. 2018;4 (Suppl 2):163s.
- Mao W, Tang S, Zhu Y, Xie Z, Chen W. Financial burden of healthcare for cancer patients with social medical insurance: a multi-centered study in urban China. *Int J Equity Health*. 2017;16(1):180.
- ESMO guidelines. Lugano: European Society for Medical Oncology; 2019 (<https://www.esmo.org/Guidelines>, accessed January 2020).
- ESMO – Magnitude of clinical benefit scale version 1.1. Lugano: European Society for Medical Oncology; 2019 (<https://www.esmo.org/Guidelines/ESMO-MCBS/Articles/ESMO-Magnitude-of-Clinical-Benefit-Scale-version-1.1>, accessed January 2020).
- On approval of the comprehensive plan to combat cancer in the Republic of Kazakhstan for 2018–2022. Decree of the Government of the Republic of Kazakhstan dated June 29, 2018 No. 395. Nur Sultan: Ministry of Justice; 2018 (https://onco.kz/wp-content/uploads/2019/07/Kompleksnyj-plan-2019-2022gg_rus_.docx, accessed January 2020).
- The role of law in reducing global cancer inequalities. Chapter 12. In: Vaccarella S, Lortet-Tieulent J, Saracci R, Conway DI, Straif K, Wild CP, editors. Reducing social inequalities in cancer: evidence and priorities for research [IARC Scientific Publications No. 168]. Lyon: International Agency for Research on Cancer; 2019.
- National R&D program for cancer control. Goyang-si Gyeonggi-do: National Cancer Center; 2019 (https://www.ncc.re.kr/main.ncc?uri=english/sub04_ControlPrograms, accessed January 2020).
- Implementing rules for cancer act signed. Manila: Department of Health; 2019 (<https://www.doh.gov.ph/press-release/implementing-rules-for-cancer-act-signed>, accessed January 2020).
- Case study: Cancer and universal health coverage in the Philippines. Paris: Organization for Economic Co-operation and development; 2019 (<https://www.uicc.org/case-studies/cancer-and-universal-health-coverage-philippines>, accessed January 2020).
- UHC Act in the Philippines: a new dawn for health care. Manila: WHO Representative Office for the Philippines; 2019 (<https://www.who.int/philippines/news/feature-stories/detail/uhc-act-in-the-philippines-a-new-dawn-for-health-care>, accessed January 2020).
- Protocol to eliminate illicit trade in tobacco products. Geneva: World Health Organization; 2013 (https://www.who.int/fctc/protocol/illicit_trade/protocol-publication/en/, accessed January 2020).
- Saving lives, spending less. A strategic response to noncommunicable diseases. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/bitstream/handle/10665/272534/WHO-NMH-NVI-18.8-eng.pdf>, accessed January 2020).
- Preparation for the third High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases, to be held in 2018 Report by the Director-General (A71/14). Geneva: World Health Organization; 2018 (https://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_14-en.pdf, accessed January 2020).
- Stenberg K, Hanssen O, Edejer TT, Bertram M, Brindley C, Meshreky A, et al. Financing transformative health systems towards achievement of the health Sustainable Development Goals: a model for projected resource needs in 67 low-income and middle-income countries. *Lancet Glob Health*. 2017;5(9):e875–87.
- Gelband H, Sankaranarayanan R, Gauvreau CL, Horton S, Anderson BO, Bray F, et al. Costs, affordability, and feasibility of an essential package of cancer control interventions in low-income and middle-income countries: key messages from Disease Control Priorities, 3rd edition. *Lancet*. 2016;387(10033):2133–44.
- Fung A, Horton S, Zabihi V, Denburg A, Gupta S. Cost and cost-effectiveness of childhood cancer treatment in low-income and middle-income countries: a systematic review. *BMJ Glob Health*. 2019;4(5):e001825.
- Xu K, Soucat A, Kutzin J, Brindley C, Van de Maele N, Toure H, et al. Public spending on health: a closer look at global trends. Geneva: World Health Organization; 2018 (https://www.who.int/health_financing/documents/health-expenditure-report-2018/en/, accessed January 2020).
- Gordon LG, Chan RJ. Financial toxicity among patients with cancer – Where to from here. *Cancer Nurs*. 2017;40(4):257–8.
- ASEAN Costs in Oncology ‘Cancer and its economic impact on households in the ASEAN countries’ (ACTION) study. Newtown (NSW): The George Institute; 2020 (<https://www.georgeinstitute.org/projects/asean-costs-in-oncology-cancer-and-its-economic-impact-on-households-in-the-asean>, accessed January 2020).
- Canfell K, Kim JJ, Brissom M, Keane A, Simms KT, Carunaa M, et al. Mortality impact of achieving WHO cervical cancer elimination targets: a comparative modelling analysis in 78 low-income and lower-middle-income countries. *Lancet*. 2020;doi: [https://doi.org/10.1016/S0140-6736\(20\)30157-4](https://doi.org/10.1016/S0140-6736(20)30157-4).
- Sungwalee W, Vatanasapt P, Suwanrungruang K, Promthet S. Comparing survival of oral cancer patients before and after launching of the universal coverage scheme in Thailand. *Asian Pac J Cancer Prev*. 2016;17(7):3541–4.
- Stenberg K, Lauer JA, Gkoutouras G, Fitzpatrick C, Stanciole A. Econometric estimation of WHO-CHOICE country-specific costs for inpatient and outpatient health service delivery. *Cost Eff Resour Alloc*. 2018;16:11.
- Serje J, Bertram MY, Brindley C, Lauer JA. Global health worker salary estimates: an econometric analysis of global earnings data. *Cost Eff Resour Alloc*. 2018;16:10.
- International Medical Products Price Guide. Arlington (VA): Management Sciences for Health; 2016 <http://mshpriceguide.org/en/drug-search-page-2/>.
- Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Piñeros M, et al. Global Cancer Observatory: cancer today. Lyon: International Agency for Research on Cancer; 2019.
- Stenberg K, Axelson H, Sheehan P, Anderson I, Gülmezoglu AM, Temmerman M, et al. Advancing social and economic development by investing in women's and children's health: a new Global Investment Framework. *Lancet*. 2014;383(9925):1333–54.
- Stenberg K, Hanssen O, Edejer TT, et al. Financing transformative health systems towards achievement of the health Sustainable Development Goals: a model for projected resource needs in 67 low-income and middle-income countries. *Lancet Glob Health*. 2017;5(9):e875–e887. doi:10.1016/S2214-109X(17)30263-2
- ILOStat. Geneva: International Labour Office; 2020 (<https://www.ilo.org/ilostat/>, accessed January 2020).
- Robinson LA, Hammit JK, Jamison DT, Walker DG. Conducting benefit–cost analysis in low- and middle-income countries: Introduction to the special issue. *J Benefit Cost Anal*. 2019;10(S1):10–4.

**What works in
cancer control:**

Translating evidence into policies and programmes

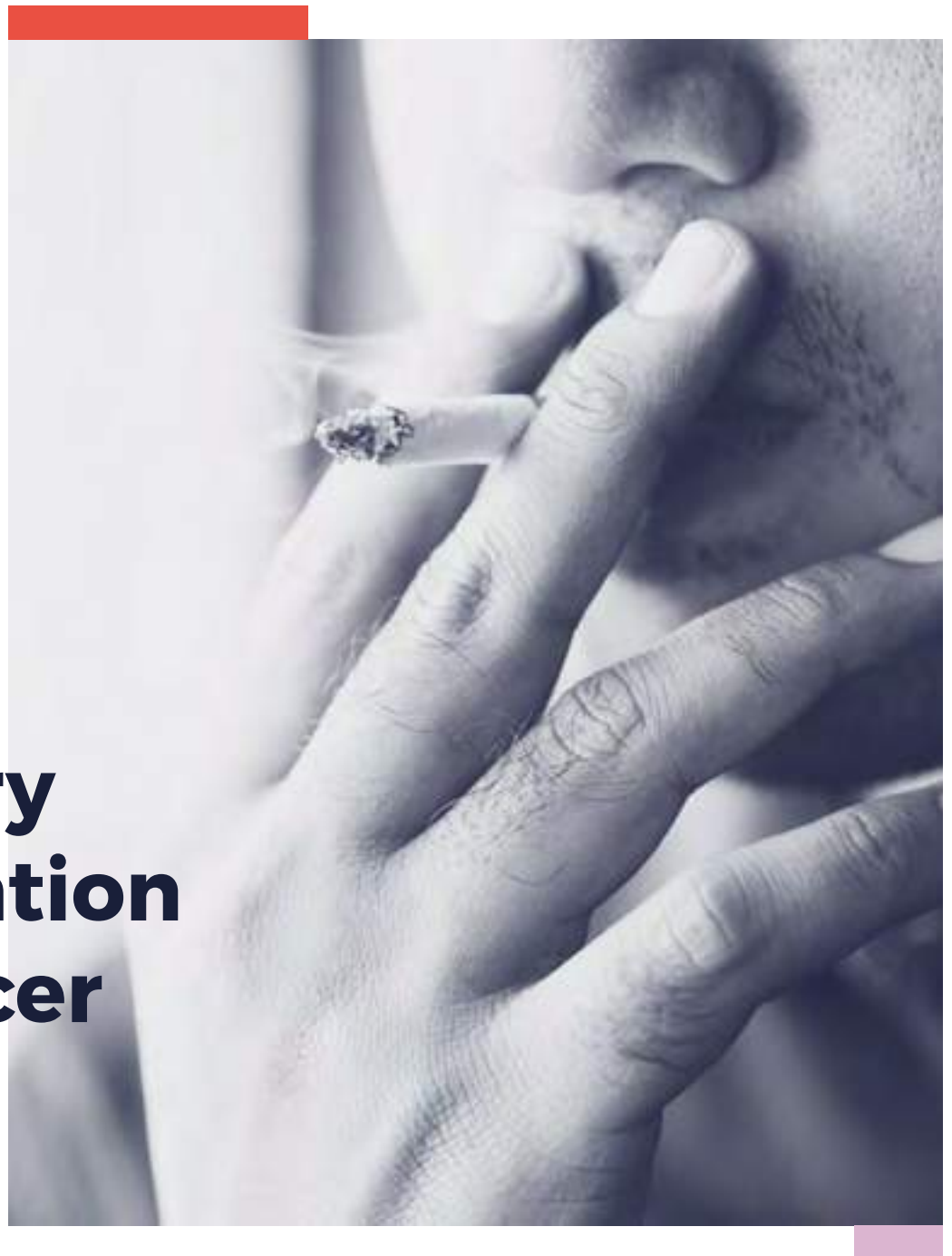
Adherence to evidence-based cancer control programmes and policies is essential to improve cancer outcomes and achieve value for money. Programmes and policies that are inconsistent with evidence or best practice are common and result in ineffective implementation and potentially in harm. Misallocation of resources has been compounded by incorrect perceptions of the benefits of cancer interventions and distortion of the market for cancer products. To translate evidence into policy and programmes, scientific knowledge must be contextualized to the disease burden and health system capacity throughout the cancer control continuum.

The cancer control continuum



Chapter 03.

Primary prevention of cancer



The background of the slide is a dark blue field filled with numerous handprints of varying sizes and orientations, all in a lighter blue shade. A solid orange horizontal bar is positioned at the top left, and a solid pink horizontal bar is at the bottom right.

Key messages

- 1.** One third to one half of cancer cases could be prevented by reducing exposure to known risk factors. Examples of actionable interventions are tobacco control and HPV vaccination.
- 2.** Most countries do not fully implement cancer prevention policies and programmes, resulting in millions of avoidable cancer cases.
- 3.** The most effective approach to primary prevention of cancer involves the whole-of-government, with a combination of legislation, regulation and fiscal policies and activities to change community and individual behaviour. Public health messages and promotion should include evidence for specific risk factors.

3.1 Background

Mutations that lead to cancer may be caused by interaction between an external agent and a person's DNA. Carcinogens may be physical, such as ultraviolet and ionizing radiation; chemical, such as components of tobacco, asbestos and aflatoxins; and infectious, such as certain viruses (e.g. HPV), bacteria and parasites.

About half of all cancers are due to unknown risk factors or carcinogens. Many result from spontaneous mutations during continual cell division, and some are due to yet-to-be-identified causes (1).

3.1.1 Public health approaches to cancer primary prevention

Primary prevention of cancer comprises a broad spectrum of interventions: legislation and policies to minimize or eliminate exposure to carcinogens; promotion of healthy behaviour; health sector programmes such as vaccination and clinical counselling for tobacco cessation. These strategies require a whole-of-government, whole-of-society approach (see section 2.2.2).

Many risk factors for cancer are also risk factors for other NCDs, including tobacco use, harmful use of alcohol, physical inactivity, unhealthy diet and air pollution. Therefore, cancer prevention programmes and policies should be integrated into a broader national or regional NCD strategy for greater efficiency and impact.

Other risk factors might be included in a coherent response for comprehensive cancer prevention. IARC working groups have identified more than 100 carcinogens, many of which can be controlled through regulation or legislation. Infectious agents are responsible for 13% of cancers globally and predominantly affect lower socioeconomic and vulnerable populations (2). Such agents are therefore often amenable to public health responses that promote equity (see section 1.2; 3,4). Programmes for hepatitis B vaccination at birth, particularly in endemic countries like China, have significantly reduced the incidence of primary liver cancer. Progress in reducing the burden of liver disease will be made through the global health sector strategy to eliminate viral hepatitis as a public health threat by 2030, approved by

the World Health Assembly and aligned with SDG target 3.3 (5,6).

All prevention activities should accord with national priorities, the prevalence of risk factors and causes of the main cancers and local social and economic determinants of health. Risk factors differ in their impact on cancer and the extent to which they are avoidable. Therefore, hazard (whether an exposure is carcinogenic) must be distinguished from risk (the extent to which an exposure causes cancer). For example, tobacco and older age of first pregnancy are both cancer hazards. Tobacco smoking is responsible for more than 8 million deaths per year and is a preventable risk factor; on the other hand, older age of first pregnancy has broader potential social value and is responsible for significantly fewer cancer cases, on the order of thousands of cases per year (7). The priority among risk factor reduction strategies should therefore be tobacco control because of the greater associated harm and acceptability.

3.1.2

Guiding principles of cancer prevention

First, prevention interventions must factor in the time lag of their intended impact. Investments today are among the most cost-effective ways of reducing the number of cases and deaths in the next two or three decades and beyond. Secondly, given this horizon and understanding that half or more of cancers cannot be prevented,

prevention strategies cannot be isolated from an overall approach that includes access to timely, accurate diagnosis and high-quality treatment.

3.2

Current landscape of cancer prevention

Adoption of effective cancer prevention policies and programmes has been inadequate, particularly in LMIC. Tobacco control remains the main prevention policy in nearly every country.

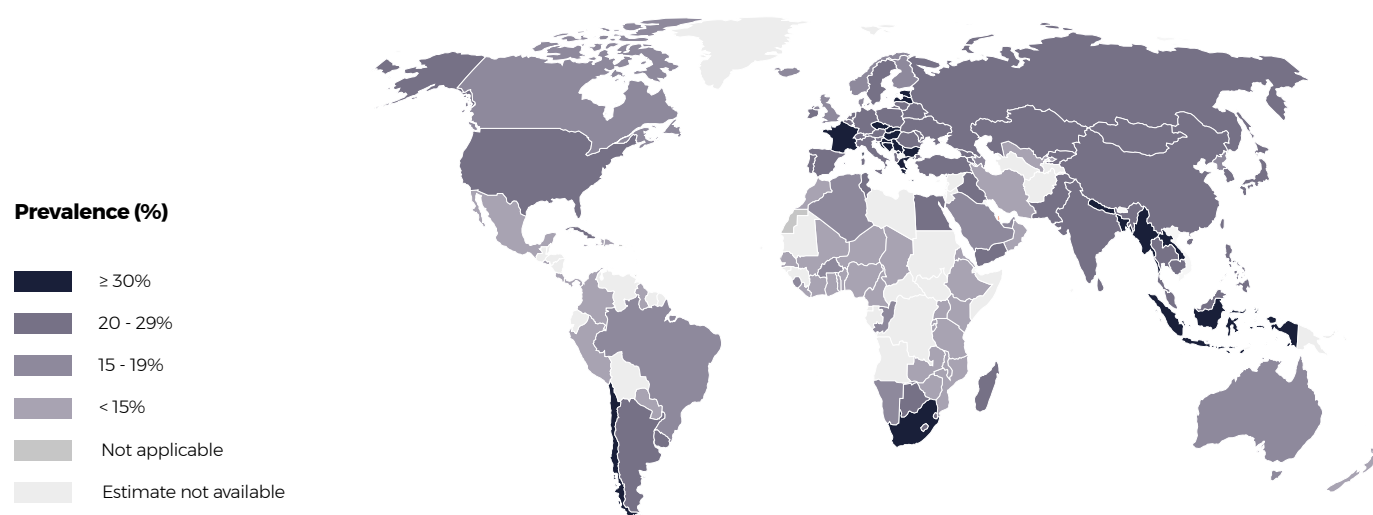
Globally, 2.4 million deaths from cancer due to use of tobacco products occur every year (8).

Tobacco use is a risk factor for at least 20 cancer types and for other medical conditions, such as cerebrovascular disease, heart disease and chronic respiratory disease. About 1.1 billion people in the world use tobacco products (Fig. 3.1), and consumption is often highest among people with the least education and income (7; see also section 1.2). Only two countries, however,

have thus far fully implemented MPOWER measures. “MPOWER” is a set of measures to reduce the demand for tobacco products that is recommended by WHO and in line with the WHO FCTC to reduce the demand for tobacco products, as recommended by WHO and in line with the WHO FCTC (7).

While there has been some progress, without accelerated action, tobacco will be responsible for over one billion deaths this century (9). During the past decade, there has been increasing uptake of electronic nicotine delivery systems (ENDS), including by children and adolescents. The effect on cancer incidence is not yet established, but these systems pose a new and significant public health risk (3).

Fig. 3.1. Prevalence of tobacco smoking among people aged 15 years and older, 2018



Alcohol consumption is another major risk factor for cancer. It is causally associated with 10 cancers and more than 20 other diseases and health outcomes (3,10). In 2016, alcohol was estimated to have contributed to 4–5% of all cancer deaths and 10.3 million cancer-associated life-years lost (11). According to WHO, any alcohol use is associated with some risk, even if the individual risk may be low with low consumption. From a public health perspective, there is no level of consumption at which no risks are involved. Implementation of policies on alcohol has been uneven since endorsement of the WHO Global strategy to reduce the harmful use of alcohol (11). Most HIC (82%) but only 55% of LIC have national policies on alcohol, adding to global health inequity (12).

Over the past decade, obesity rates increased in every country because of physical inactivity and unhealthy diets; there were more than 1.9 billion overweight adults in 2016 (13). Obesity is

already responsible for 6% of cases of breast cancer, 8% of colon cancer and 34% of corpus uteri cancer, and its contribution will increase drastically over the next two decades with increasing obesity rates (14).

An operational plan for unhealthy diet and physical inactivity is available in 80% and 78% of countries, respectively (12).

Countries and societies with low HDIs have higher risks of infection-associated cancers (see section 1.2), in spite of the availability of evidence-based interventions, such as vaccination. Environmental and occupational determinants of cancer, such as radon, food safety, clean water supply, ultraviolet-emitting devices for cosmetic purposes and asbestos, should also be considered in comprehensive cancer prevention policies (Box 3.1) (15,16).

Box 3.1. Case study: tanning salons in Poland and the USA

Box 3.1. Case study: tanning salons in Poland and the USA

There is convincing evidence that exposure to ultraviolet radiation, including overexposure to the sun or any exposure from artificial tanning devices, increases the lifelong risk of melanoma. In the USA, since 2012, 21 states have enacted legislation to prohibit indoor tanning by people under 18 years of age, strengthened by a US Food and Drug Administration mandate for a “black box” warning. Prior to such legislation, 25% of female high-school students reported having used an indoor tanning device in the previous year. In 2016, experts at the University of Texas MD Anderson Cancer Center partnered with stakeholders in Poland, including President Andrzej Duda. A collaborative review of Polish cancer registry data (2005–2015) revealed a near doubling of melanoma

incidence in women under 45. Following dialogue on the adverse effects of indoor tanning, the potential health benefits of restricting access to such devices and US legislative experience, Poland introduced national legislation in 2017 to prohibit indoor tanning by people under 18. The law, enacted in 2018, includes provisions for compliance, enforcement, local business and national education on the harmful effects of indoor tanning and restrictions on advertising. Remarkably, early surveillance demonstrated over 95% compliance. Age restriction laws in the USA have been associated with a reduced prevalence of indoor tanning among female high-school students (8% in 2017), and corresponding registry data show a decrease in the incidence of melanoma in young adults (17,18).

Air pollution is increasingly contributing to the global burden of cancer.

Outdoor air pollution contributes to 29% of deaths and disease from lung cancer (19).

The pace of urbanization means that more and more people live in large cities, with increased exposure to air pollution. Control of air pollution should be a component of any cancer prevention strategy through a whole-of-government approach.



3.3

Effective cancer prevention interventions

3.3.1

“Best buys” in primary prevention of cancer

WHO “best buys” for control of the main risk factors for NCDs (Table 3.1) are highly relevant for primary prevention of cancer and should be used for setting priorities in countries (Box 3.2). Activities should be selected according to the country's cancer burden, contextual cost-effectiveness

and available resources, ensuring equity and acceptability. Population-wide interventions generally have a greater potential impact; individual interventions should be part of a broad integrated national strategy and not be implemented in isolation.

Table 3.1. WHO “best buys” for reducing the prevalence of risk factors for NCDs, including cancers

Action	“Best buy” intervention
Tobacco control	<ul style="list-style-type: none"> • Increase excise taxes and prices on tobacco products • Implement plain/standardized packaging and/or large graphic health warnings on all tobacco packages • Enact and enforce comprehensive bans on tobacco advertising, promotion and sponsorship • Eliminate exposure to second-hand tobacco smoke in all indoor workplaces, public places, public transport • Implement effective mass media campaigns that educate the public about the harms of smoking/tobacco use and second hand smoke
Prevent harmful use of alcohol	<ul style="list-style-type: none"> • Increase excise taxes on alcoholic beverages • Enact and enforce bans or comprehensive restrictions on exposure to alcohol advertising (across multiple types of media) • Enact and enforce restrictions on the physical availability of retailed alcohol (via reduced hours of sale)
Improve and increase physical activity, improve diet quality and reduce overconsumption leading to obesity	<ul style="list-style-type: none"> • Reduce salt intake • Implement community-wide public education and awareness campaign for physical activity which includes a mass media campaign combined with other community-based education, motivational and environmental programmes, aimed at supporting behavioural change of physical activity levels
Cancer prevention	<ul style="list-style-type: none"> • Vaccination against HPV to prevent cervical cancer • Prevention of cervical cancer by screening women aged 30–49 years through: visual inspection with acetic acid; Pap smears with cervical cytology or HPV test linked with timely treatment of pre-cancerous lesions (screening) (see also chapter 4)

**Box 3.2. Case study: implementing WHO “best buys”
in cancer prevention programmes**



Application of “best buys” to reduce tobacco and alcohol use and inadequate physical activity was evaluated in seven countries in Asia (Bhutan, Cambodia, Indonesia, Philippines, Sri Lanka, Thailand and Viet Nam). Progress was observed in regulation and awareness, such as advertising of alcohol, restrictions on sales (except in one country) and mass media campaigns against smoking. Few countries met the WHO FCTC requirement for taxes on tobacco, and only two had activities to increase physical exercise. The poor results were related to inadequate funding, limited institutional capacity, difficulty in implementing multisectoral actions and lack of monitoring systems and also to resistance from the private sector to some policies.

Similar slow, uneven implementation of “best buys” was observed in five African countries (Cameroon, Kenya, Malawi, Nigeria and South Africa). Implementation research should be conducted on effective interventions for “best buys” in LMIC, with greater political support and resources to improve uptake of evidence-based programmes and policies (21–23).

3.3.2 Setting national priorities for primary prevention

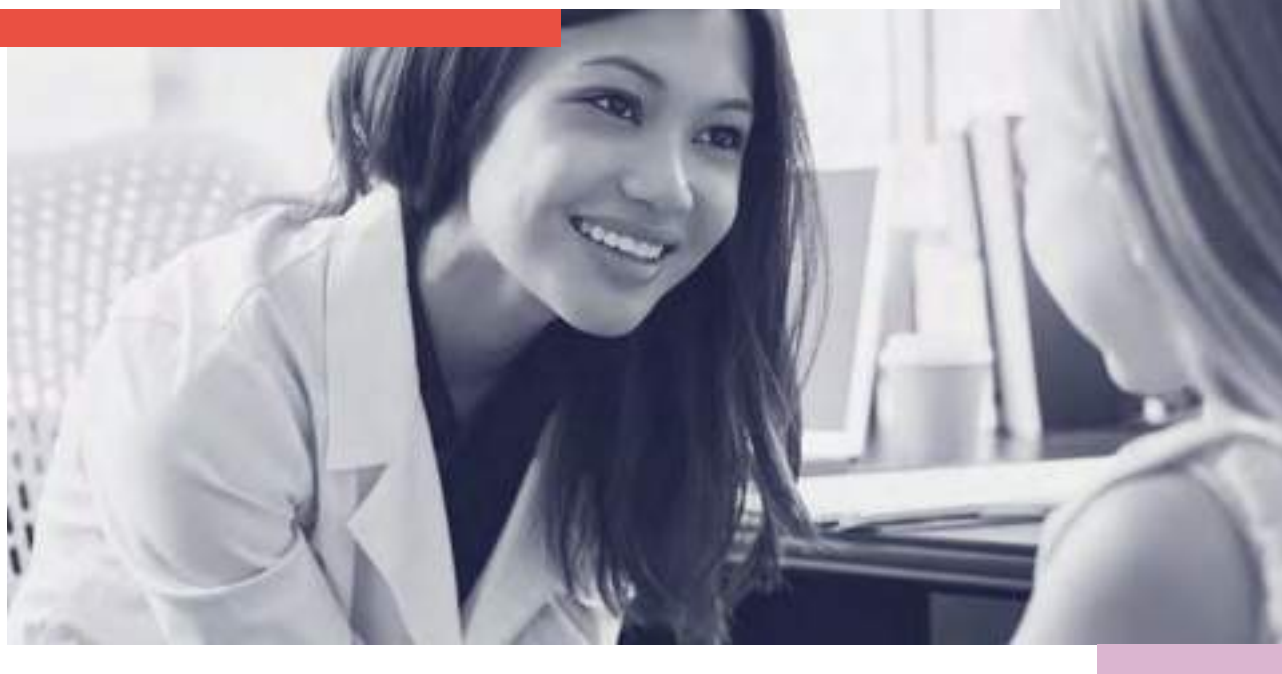
Resistance to cancer prevention policies and programmes is common. It may arise from weak governance, a negative influence of the private sector, resistance to legislation and other restrictions on behaviour and insufficient public health services (24). These threats and challenges are seen in countries at all income levels, although they may be particularly severe in LMIC (25). There has nevertheless been robust political will to promote population

health and well-being and to overcome resistance from the private sector. Strong legal frameworks must be supplemented by effective public health messages to influence perceptions of cancer risk factors and promote behavioural change (Box 3.3; 26).

Box 3.3. Case study: Effective messaging in cancer prevention

There have never been so many means to communicate sound evidence on the prevention of cancer. Social media have extended the ways of reaching target populations and delivering tailored messages to specific groups. Reminders and text messages to people over 55 to increase their physical activity, apps for setting goals, activity tracking and reminders and websites with virtual coaching have been shown to be effective (26). For example, a digital intervention

increased physical activity by 28% more than a non-digital intervention. Social media activities could be combined with more traditional approaches, such as printed leaflets. Use of social media should be optimized to the target population and the characteristics of the message. For instance, in an analysis of Facebook pages related to cancer in Brazil, "testimonies" or "real-life stories" generated high engagement but were posted in only a small percentage of cases.



Decisions on the main targets for primary prevention of cancer should involve all relevant stakeholders, from government to civil society, at all levels of planning, implementation and evaluation of programmes. Priorities for interventions should be set according to the importance of each risk factor in the country, the pattern of incident cancers and the potential success of prevention interventions, in addition to the most efficient use of resources. First, governments could evaluate the risk factors that significantly affect the population, exacerbate inequities and stall economic growth.

One measure of the burden of a risk factor is the "population attributable fraction", which is the estimated proportional reduction in population disease or mortality that would occur if exposure to a risk factor were reduced to an alternative ideal exposure scenario. Preventive interventions could also be evaluated by tumour site or by prevention strategy to facilitate priority-setting (Table 3.2).

Table 3.2. Types of interventions for primary prevention of cancer

Factor	Sample carcinogenic risk factor	PAF	Prevention strategy	Multisectoral partners
Behavioural	Tobacco	25% ^{a,c}	Health promotion Tobacco cessation (MPOWER)	General population Legislative bodies
	Alcohol	4-5% ^{a,d}	Reduced alcohol consumption (SAFER)	Health care workers
	Obesity	3-4% ^{b,e}	Nutrition (ENA) and physical activity interventions (Global action plan on physical activity 2018-2030)	Civil society
Infectious	Total	13% ^{b,f}	Vaccination	Health care workers
	HPV		Early diagnosis and treatment of infections	Pharmaceutical companies
	Hepatitis B and C <i>H. pylori</i>		(e.g. <i>H. pylori</i>)	Legislative bodies Civil society
Environmental	Occupational exposures	3-8% ^{a,g}	Environmental standards and regulations	Legislative bodies
	Air pollution	5% ^{a,h}	Robust energy policies, reduction of household kerosene	Regulatory authorities
	Ultraviolet radiation	1% ^{b,i}	Regulation, justification and optimization of procedures.	Business sector
	Radon and other radiation			Civil society
	Aflatoxins			
Additional factors	Hereditary risk factors	5-10% ^{a,j}	Chemoprevention, surgical procedures (e.g. prophylactic mastectomy)	Health care workers Genetic counsellors Pharmaceutical companies Civil society

Adapted from reference 27. PAF, population attributable fraction; MPOWER, set of six cost-effective and high-impact measures that help countries reduce demand for tobacco; SAFER, set of five high-impact strategies to prevent and reduce alcohol harm and related health, social and economic consequences; ENA, essential nutrition

a Percentage reflects PAF for deaths from relevant cancer types

b Percentage reflects PAF for cases from relevant cancer types

c Global health data exchange. Seattle (WA): Institute for Health Metrics and Evaluation; 2020 (http://ghdx.healthdata.org/ihme_data, accessed January 2020).

d Global status report on alcohol and health 2018. Geneva: World Health Organization; 2018 (https://www.who.int/substance_abuse/publications/global_alcohol_report/en/, accessed January 2020).

e Arnold M, Pandeya N, Byrnes G, Renehan PAG, Stevens GA, Ezzati PM, et al. Global burden of cancer attributable to high body-mass index in 2012: a population-based study. *Lancet Oncol*. 2015;16(1):36-46.

f de Martel C, Georges D, Bray F, Ferlay J, Clifford GM. Global burden of cancer attributable to infections in 2018: a worldwide incidence analysis. *Lancet Glob Health*. 2019. pii: S2214-109X(19)30488-7.

g Preventing disease through a healthier and safer workplace. Geneva: World Health Organization; 2018 (<https://www.who.int/publications-detail/preventing-disease-through-a-healthier-and-safer-workplace>).

h Ambient air pollution: a global assessment of exposure and burden of disease. Geneva: World Health Organization; 2016 (<https://apps.who.int/iris/bitstream/handle/10665/250141/9789241511353-eng.pdf?sequence=1>).

i Cancers attributable to UV radiation (website). Lyon: International Agency for Research on Cancer; 2020 (<http://gco.iarc.fr/causes/uv/home>, accessed January 2020).

j Wild CP, Weiderpass E, Stewart BW, editors. World cancer report. Cancer research for cancer prevention. Lyon: International Agency for Research on Cancer; 2019:section 3.3 (<https://apps.who.int/iris/bitstream/handle/10665/326043/9789241516204-eng.pdf?ua=1>, accessed January 2020).

3.4 Integrated approach to cancer primary prevention

Comprehensive primary prevention should include all measures, from health promotion to clinical interventions, and involve all sectors to maximize its impact.

Prioritizing health promotion: In the Shanghai Declaration (2016), governments made a commitment to increase investment in all pillars of health promotion (good governance, healthy cities and health literacy) to achieve the SDGs (28; see also chapter 2.2). The aim of all such activities should be to deliver knowledge, skills and information to allow healthy choices and behaviour change. Health literacy ensures equitable access to information on cancer prevention and better health outcomes; however, education must be accompanied by an enabling environment and supportive

national policies (29,30). Health messages must be consistent and coordinated to avoid misinterpretation. Both mass media campaigns and programmes in schools have been shown to be effective in optimizing nutrition and physical activity (31). Public health messages about risks of skin cancer from solar radiation for specific populations and residential radon exposure are also effective for specific populations (15, 16).

The approach used in the European Union (with technical support from IARC and the European Code against Cancer) is a simple, clear, comprehensive, evidence-based set of 12 messages for preventing cancer (Box 3.4).

Box 3.4. European Code against Cancer: 12 ways to reduce cancer risk

Source: reference 32

12 WAYS TO REDUCE CANCER RISK



01.

Do not smoke or use any form of tobacco.



02.

Make your home smoke-free, and support smoke-free policies in your workplace.



03.

Maintain a healthy body weight.



04.

Be physically active in everyday life, and limit the time you spend sitting.



05.

Eat a healthy diet.

- Eat a lot of whole grains, pulses, vegetables and fruit.
- Limit consumption of high-calorie foods (high in sugar or fat), and avoid sugary drinks.
- Avoid processed meat, and limit red meat and foods with a high salt content.



06.

Limit your intake of alcohol of any type, or don't drink alcohol.



07.

Avoid too much exposure to the sun, especially children; use sun protection; do not use sunbeds.



08.

In the workplace, protect yourself against cancer-causing substances by following health and safety instructions.



09.

Determine whether you are exposed to radiation from high radon levels in your home; reduce high radon levels.



10.

For women:

- Breastfeed your baby if you can, as breastfeeding reduces your risk for cancer.
- Limit the use of hormone replacement therapy, which increases the risks for certain cancers.



11.

To reduce your child's risk of cancer, ensure that your children are vaccinated against:

- hepatitis B (for newborns) and
- human papillomavirus (HPV).



12.

Take part in organized cancer screening programmes for:

- bowel cancer (men and women),
- breast cancer (women) and
- cervical cancer (women).

Fiscal, legislative and regulatory measures to reduce exposure:

Policies to reduce exposure to cancer risk factors have a demonstrable, well-established impact. Major progress in reducing the prevalence of tobacco use has been achieved through implementation of WHO FCTC measures. Stringent prohibition

and regulation of tobacco consumption reduce exposure, generate further political will and provide long-term health benefits (3,33). Countries with fewer public health warnings and fewer restrictions on the promotion, advertising and sponsorship of tobacco products become targets for tobacco companies, particularly as

smoking becomes less acceptable and less profitable in many HIC as regulation has increased (34). In recent years, the tobacco industry has introduced an array of products that deliver nicotine, including heated tobacco products, ENDS and electronic non-nicotine delivery systems. While the level of risk associated with ENDS is still not conclusively defined, ENDS are undoubtedly harmful, should be strictly regulated and, most importantly, must be kept away from children (35). Betel quid and areca nut are major exposures for oral and other cancers in the South-East Asia and Western Pacific regions and should also be regulated (36).

To reduce harmful use of alcohol, WHO and partners launched the SAFER initiative in 2018, which lists five high-impact strategies to reduce harmful use of alcohol: strengthen restrictions, implement strict drunk-driving counter-measures, facilitate access to screening and treatment, enforce bans or restrictions and raise prices through excise taxes and policies. These are all proven interventions for reducing the harm caused by alcohol (37).

Policies and legislative control measures should also be considered against certain occupational exposures, such as to crystalline silica or benzene, which can cause cancer in exposed workers and, in some cases, their families.

More than 40 agents, mixtures and exposure circumstances in the working environment are carcinogenic to humans, contributing to more than 450 000 cancer-related deaths each year (38).

International standards can also serve as benchmarks for national norms and regulations to reduce public exposure to carcinogens (e.g. international and European radiation basic safety standards (39,40)).

Vaccination programmes for cancers caused by infection:

Vaccination against HPV and hepatitis B virus reduces the incidence of cancers of the cervix and liver, respectively. Both are priority interventions and should be included in primary prevention of cancer. Maximum coverage will ensure effectiveness at population level. Although most data are from HIC, there is evidence that programmes to increase vaccination coverage, such as home visits, reminder and recall systems, reducing out-of-pocket expenditure and school programmes or requiring vaccination are effective (31).

While most HPV-related cancers affect women, some affect both sexes or only men. High HPV vaccination coverage of females also offers strong protection of males, through a “herd effect”. The most cost-effective strategy is therefore to vaccinate females, and WHO’s

current position is that the primary target of HPV vaccination should be girls aged 9–14. The overall cost of HPV vaccination is expected to decrease further as new manufacturers, products and optimized schedules become available. This might improve the cost-effectiveness and prioritization of male vaccination (41).

Ensuring healthy environments: Physical, chemical and biological environments affect health and cancer risks. They include air pollution, exposure to radiation such as radon (a naturally occurring radioactive gas), unhealthy urban and working environments and occupational carcinogens. Ambient (outdoor) and indoor air pollution and, specifically, diesel engine exhaust are known carcinogens and are targeted in the WHO global strategy on health, environment and climate change (42). Radiation and radon at high doses also increase cancer risks.

In 2016, over 58 000 lung cancer deaths were caused by residential exposure to radon (43).

Policies should be developed to support national programmes in setting target concentrations and developing and implementing regulations and protocols to minimize exposure (39,44). Actions to be taken to prevent or reduce exposure to occupational carcinogens include: eliminate carcinogenic substances or replace them with less hazardous alternatives, avoid or reduce exposure (usually by capsulation and closed processes), reduce the amounts of carcinogens to threshold limit values established by a competent national authority, and provide workers with personal protective equipment while restricting the amount and duration of work with exposure to carcinogens (45).

Policies for increasing physical activity include education, redesign of urban landscapes and workplaces to promote walking and cycling, efficient mass public transport and inclusion of physical activity in education (20).

Clinical interventions: Individuals can change their behaviour when they are provided with information and are educated during encounters with the health care system, including clinical support services. The strategies may include strengthening primary health care to increase understanding of risk factors for cancer and other NCDs, cessation programmes, counselling and vaccination programmes (46). Activities in primary care are particularly valuable in promoting equity, as they address the needs of disadvantaged populations. Coordination of prevention activities by the government and by civil society organizations can maximize their effectiveness (Table 3.3; Box 3.5).

Table 3.3. Links between responses to NCDs and priorities in other sectors

Sector	Sample link to policy
Finance and trade	<ul style="list-style-type: none"> • Trade treaties or commerce to discontinue or ban asbestos and other carcinogens • implement tax policies on harmful and unhealthy products according to national health objectives.
Social policy	<ul style="list-style-type: none"> • Policies to protect disadvantaged populations, particularly against infectious causes of cancer, such as safe water standards, and social protection for victims of occupational cancers
Education	<ul style="list-style-type: none"> • Strengthening health promotion in schools and related activities and provide dietary and physical activity guidelines
Agriculture, land and the environment	<ul style="list-style-type: none"> • Ensuring food availability and security as outlined in national food and nutrition security policy • Promoting dietary guidelines, food safety and drinking-water quality and reducing use of carcinogenic pesticides
Civil society and advocacy	<ul style="list-style-type: none"> • Working with civil society, women's groups and workers' organizations to change social norms of behaviour to reduce risks for cancer
Private sector	<ul style="list-style-type: none"> • Creating healthier and safer workplaces, and integrating cancer prevention and control into occupational health measures, workplace health promotion and health insurance for workers and their families
International	<ul style="list-style-type: none"> • Full implementation of the WHO FCTC and its Protocol to Eliminate Illicit Trade in Tobacco Products

3.5

Emerging science and programmes

New avenues for cancer prevention are emerging from research and innovation in several domains, such as tailoring preventive actions to potential exposure to risk factors, evaluation of chemopreventive strategies and development of new vaccines

to prevent cancer (Table 3.4). A detailed summary of current and emerging science of cancer prevention is included in the IARC World Cancer Report.

Table 3.4. Emerging science: selected activities from the IARC World Cancer Report (3)

Type of carcinogen or approach	Risk factor	Type of emerging science	Examples of activities
Diet	Dietary exposures	Understanding linkages	Using tumour molecular pathology and -omics research, including genetics (section 3.2), metabolomics (section 3.7), and microbiome (section 3.10)
Infection-related cancers	HPV	Vaccine	Market shaping for prophylactic or therapeutic vaccine (section 2.2)
	<i>H. pylori</i>	Vaccine <i>H. pylori</i> eradication and screening	Combination of <i>H. pylori</i> eradication and screening for early disease (section 2.2)
Health services	Chemoprevention	Therapeutic medicines	Chemoprevention agents for gastric, breast, prostate and endometrial cancers (sections 5.3, 5.11, 5.13, 6.5)
Urban planning	Air pollution, physical inactivity	Innovative approaches to urban planning	Urban planning, e.g. with proximity to green spaces (section 2.9)
Metabolomics, epigenetics, microbiome	To be studied	Carcinogenesis, epidemiology	Study of molecular phenotypes, epigenetics or gene expression to improve identification of gene-environment interactions (section 3.3) Improved environmental sampling technology, biomarkers, genomics and informatics to measure exposome (section 6.9)
Information systems	All risk factors	Strengthening information systems	High-quality monitoring data on the magnitude and multi-dimensional aspects of social inequalities in cancer (section 4.1) Harmonizing assessment of dietary patterns and exposures (section 2.6)

^a Reference section from IARC WCR in parentheses

References

1. Tomasetti C, Li L, Vogelstein B. Stem cell divisions, somatic mutations, cancer etiology, and cancer prevention. *Science*. 2017;355 (6331):1330–4.
2. de Martel C, Georges D, Bray F, Ferlay J, Clifford GM. Global burden of cancer attributable to infections in 2018: a worldwide incidence analysis. *Lancet Glob Health*. 2019. pii: S2214-109X(19)30488-7.
3. Wild CP, Weiderpass E, Stewart BW, editors. World cancer report. Cancer research for cancer prevention. Lyon: International Agency for Research on Cancer; Feb 2020 (<http://publications.iarc.fr/586>, accessed January 2020).
4. WHO leads the way towards the elimination of cervical cancer as a public health concern. Geneva: World Health Organization; 2018 (<https://www.who.int/reproductivehealth/cervical-cancer-public-health-concern/en/>, accessed January 2020).
5. Qu C, Chen T, Fan C, Zhan Q, Wang Y, Lu J, et al. Efficacy of neonatal HBV vaccination on liver cancer and other liver diseases over 30-year follow-up of the Qidong hepatitis B intervention study: a cluster randomized controlled trial. *PLoS Med*. 2014;11(12):e1001774.
6. Global health sector strategy on viral hepatitis 2016–2021, towards ending viral hepatitis. Geneva: World Health Organization; 2016 (<http://apps.who.int/iris/bitstream/10665/246177/1/WHO-HIV-2016.06-eng.pdf>, accessed January 2020).
7. WHO report on the global tobacco epidemic, 2019. Offer help to quit tobacco use. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/bitstream/handle/10665/274603/9789241565639-eng.pdf?ua=1>, accessed January 2020).
8. CBD results tool. Seattle (WA): Institute for Health Metrics, University of Washington; 2020 (<http://ghdx.healthdata.org/gbd-results-tool>, accessed January 2020).
9. WHO report on the global cancer epidemic, 2008. The MPOWER package fresh and alive. Geneva: World Health Organization; 2008 (https://apps.who.int/iris/bitstream/handle/10665/43818/9789241596282_eng.pdf?sequence=1, accessed January 2020).
10. Bagnardi V, Rota M, Botteri E, Tramacere I, Islami F, Fedirko V, et al. Alcohol consumption and site-specific cancer risk: a comprehensive dose–response meta-analysis. *Br J Cancer*. 2015;112(3):580–93.
11. Poznyak V, Rekke D, editors. Global status report on alcohol and health, 2018. Geneva: World Health Organization; 2019 (<https://apps.who.int/iris/bitstream/handle/10665/274603/9789241565639-eng.pdf?ua=1>, accessed January 2020).
12. Assessing national capacity for the prevention and control of NCDs. Geneva: World Health Organization; 2019 (<https://www.who.int/ncds/surveillance/hcd-capacity/en/>, accessed January 2020).
13. Cancer attributable to obesity. Lyon: International Agency for Research on Cancer; 2020 (<http://gco.iarc.fr/causes/obesity/home>, accessed January 2020).
14. 10 facts on obesity. Geneva: World Health Organization; 2017 (<https://www.who.int/features/factfiles/obesity/en/>, accessed January 2020).
15. Ambient air pollution: health impacts. Geneva: World Health Organization; 2019 (<https://www.who.int/airpollution/ambient/health-impacts/en/>, accessed January 2020).
16. Zeeb H, Shannoun F, editors. WHO handbook on indoor radiation. A public health perspective. Geneva: World Health Organization; 2009 (https://apps.who.int/iris/bitstream/handle/10665/44149/9789241547673_eng.pdf?sequence=1, accessed January 2020).
17. 2019 Skin cancer progress report. U.S. Department of Health and Human Services Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion. (<https://www.cdc.gov/cancer/skin/pdf/SkinCancerPreventionProgressReport-2019-508.pdf>, Accessed January 2020)
18. Legislation against Polish solarium (<http://prawo.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20170002111>, Accessed January 2020)
19. Ambient air pollution: a global assessment of exposure and burden of disease. Geneva: World Health Organization; 2016 (<https://apps.who.int/iris/bitstream/handle/10665/25014/9789241511353-eng.pdf?sequence=1>, accessed January 2020).
20. Tackling NCDs. “Best buys” and other recommended interventions for the prevention and control of noncommunicable diseases. Geneva: World Health Organization; 2017 (<https://www.who.int/ncds/management/best-buys/en/>, accessed January 2020).
21. Tuangatanano T, Wangmo S, Widanapathirana N, Pongutta S, Viriyathorn S, Patcharanarumol W, et al. Implementation of national action plans on communicable diseases: Bhutan, Cambodia, Indonesia, Philippines, Sri Lanka and Viet Nam. *Bull World Health Organ*. 2018;97:129–41.
22. Allen L, Pullar J, Wickramasinghe KK, Williams J, Roberts N, Mikkelsen B, et al. Evaluation of research on interventions aligned to WHO “best buys” for NCDs in low income and lower middle-income countries: a systematic review from 1990 to 2015. *BMJ Glob Health*. 2018;3:e000535.
23. Juma P, Mohamed SF, Mwangomba BLM, Ndinda C, Mapa-Tassou C, Oluwasanu M, et al. Non-communicable disease prevention policy process in five African countries. *BMC Public Health*. 2018;18 (Suppl 1):961.
24. Mackenbach JP, McKee M, editors. Successes and failures of health policy in Europe. Four decades of divergent trends and converging challenges. Copenhagen: World Health Organization Regional Office for Europe; 2013 (http://www.euro.who.int/__data/assets/pdf_file/0007/215989/Successes-and-Failures-of-Health-Policy-in-Europe.pdf, accessed January 2020).
25. Busolo DS, Woodgate RL. Cancer prevention in Africa: a review of the literature. *Glob Health Promot*. 2015;22 (2):31–9.
26. Muellmann S, Forberger S, Mollers T, Bröring E, Zeeb H, Pischke CR, et al. Effectiveness of eHealth interventions for the promotion of physical activity in older adults: a systematic review. *Prev Med*. 2018;108:93–110.
27. Ilbawi AM, Anderson BO. Cancer in global health: How do prevention and early detection strategies relate? *Sci Trans Med*. 2015;7:278.
28. Shanghai Declaration on promoting health in the 2030 Agenda for Sustainable Development. Geneva: World Health Organization; 2017 (<https://www.who.int/healthpromotion/conferences/9gchp/shanghai-declaration.pdf?ua=1>, accessed January 2020).
29. Berkman ND, DeWalt DA, Pignone MP, Sheridan SL, Lohr KN, Lux L, et al. Literacy and health outcomes (Evidence Reports/Technology Assessments, No. 87). Rockville (MD): Agency for Healthcare Research and Quality; 2004 (<http://purl.access.gpo.gov/GPO/LPS47971>, accessed January 2020).
30. Health 2020: Education and health through the life-course: Synergy between sectors. Fostering better education and health outcomes. Copenhagen: World Health Organization Regional Office for Europe; 2015.
31. The community Guide. Atlanta (GA); 2020 (https://www.thecommunityguide.org/publications?field_topic_tid=7607, accessed January 2020).
32. European Code against Cancer. Lyon: International Agency for Research on Cancer; 2016 (<https://cancer-code-europe.iarc.fr/index.php/en/>, accessed January 2020).
33. Jones MR, Barnoya J, Stranges S, Losonczy L, Navas-Acien A. Cardiovascular events following smoke-free legislations: an updated systematic review and meta-analysis. *Curr Environ Health Rep*. 2014;1 (3):239–49.
34. Chaloupka FJ, Hu TW, Warner KE, Jacobs R, Yurekli A. The taxation of tobacco products. In: Jha P, Chaloupka F, editors. Tobacco control in developing countries. Oxford: Oxford University Press; 2000.
35. Chebreyes TA. Progress in beating the tobacco epidemic. *Lancet*. 2019;394 (10198):548–9.
36. Review of areca (betel) nut and tobacco use in the Pacific: a technical report. Manila: WHO Regional Office for the Western Pacific; 2012.
37. WHO launches SAFER, a new alcohol control initiative. Geneva: World Health Organization; 2018 (https://www.who.int/substance_abuse/safer/en/, accessed January 2020).
38. Wolf J, Prüss-Ustün A, Ivanov I, Mudgal S, Corvalán C, Bos R, et al. Preventing disease through a healthier and safer workplace. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/bitstream/handle/10665/272980/9789241513777-eng.pdf?ua=1>, accessed January 2020).
39. Radiation protection and safety of radiation sources. International basic safety standards. General safety requirements (IAEA Safety Standards Series No. GSR Part 3). Vienna: International Atomic Energy Agency; 2014 (<https://www.iaea.org/publications/8930/radiation-protection-and-safety-of-radiation-sources-international-basic-safety-standards>, accessed January 2020).
40. Council Directive 2013/59/EURATOM. Off J Eur Union. 2014;L131 (<https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ.L:2014:013:0001:0073:EN:PDF>, accessed January 2020).
41. Global market study. HPV. Geneva: World Health Organization; 2018 (https://www.who.int/immunization/programmes_systems/procurement/mi4a/platform/module2/WHO_HPV_market_study_public_summary.pdf, accessed January 2020).
42. Health, environment and climate change. Draft plan of action on climate change and health in small island developing States. Report by the Director-General. Geneva: World Health Organization; 2019 (http://apps.who.int/gb/ebwha/pdf_files/WHA72/A72_16-en.pdf?ua=1, accessed January 2020).
43. Healthy environments for healthier populations: Why do they matter and what can we do? Geneva: World Health Organization; 2019 (<https://www.who.int/publications-detail/healthy-environments-for-healthier-populations-why-do-they-matter-and-what-can-we-do>, accessed January 2020).
44. WHO handbook on indoor radon: a public health perspective. Geneva: World Health Organization; 2009 (https://www.who.int/ionizing_radiation/en/9789241547673/en/, accessed January 2020).
45. Cancer control: Prevention. WHO guide to effective programmes. Geneva: World Health Organization; 2007 (https://www.who.int/cancer/publications/cancer_control_prevention/en/, accessed January 2020).
46. Rubin G, Berendsen A, Crawford SM, Dommett R, Earle C, Emery J, et al. The expanding role of primary care in cancer control. *Lancet Oncol*. 2015;16 (12):1231–72.

Chapter 04.

Early diagnosis and screening for cancer



Key messages

1. The two distinct approaches to cancer early detection – *early diagnosis* for symptomatic individuals and *screening* of asymptomatic individuals – have significantly different costs, impact and evidence for implementation. *Early diagnosis* is one of the most effective public health measures in cancer.
2. Late-stage diagnosis is common in LMIC. Effective early diagnosis programmes are a priority for investment and should address all three steps – awareness of symptoms, rapid clinical and pathological diagnosis and referral to an appropriate treating facility.
3. While many LMIC have screening programmes, the vast majority are not effectively planned or implemented, with incorrect target populations, low participation rates and misallocation of resources.
4. The initial priorities for LMIC should be early diagnosis programmes with rapid access to effective treatment as well as cervical cancer screening.
5. Although a number of cancers can be detected by screening, they should not necessarily be screened for in all countries. Priority should be given to cervical cancer in all countries. In well-resourced countries with advanced health systems, additional consideration can be made for breast and colorectal cancer screening.
6. Effective population-based cancer screening programmes should be implemented in a stepwise approach, with assured access to testing and validation of health system capacity. High coverage of target populations, good-quality screening tests and high follow-up rates for positive tests are essential performance indicators. The participation of disadvantaged populations should be ensured.

4.1 Background

The goal of early detection is to identify cancers early, before the cancer has developed, grown or spread. Treatment of cancers found at an early stage is less aggressive, less expensive and more effective, with higher long-term survival rates and better quality of life. Affordable access to prompt, adequate, effective treatment is essential (7).

Stage at diagnosis is one of the most important predictors of cancer outcomes at the population level.

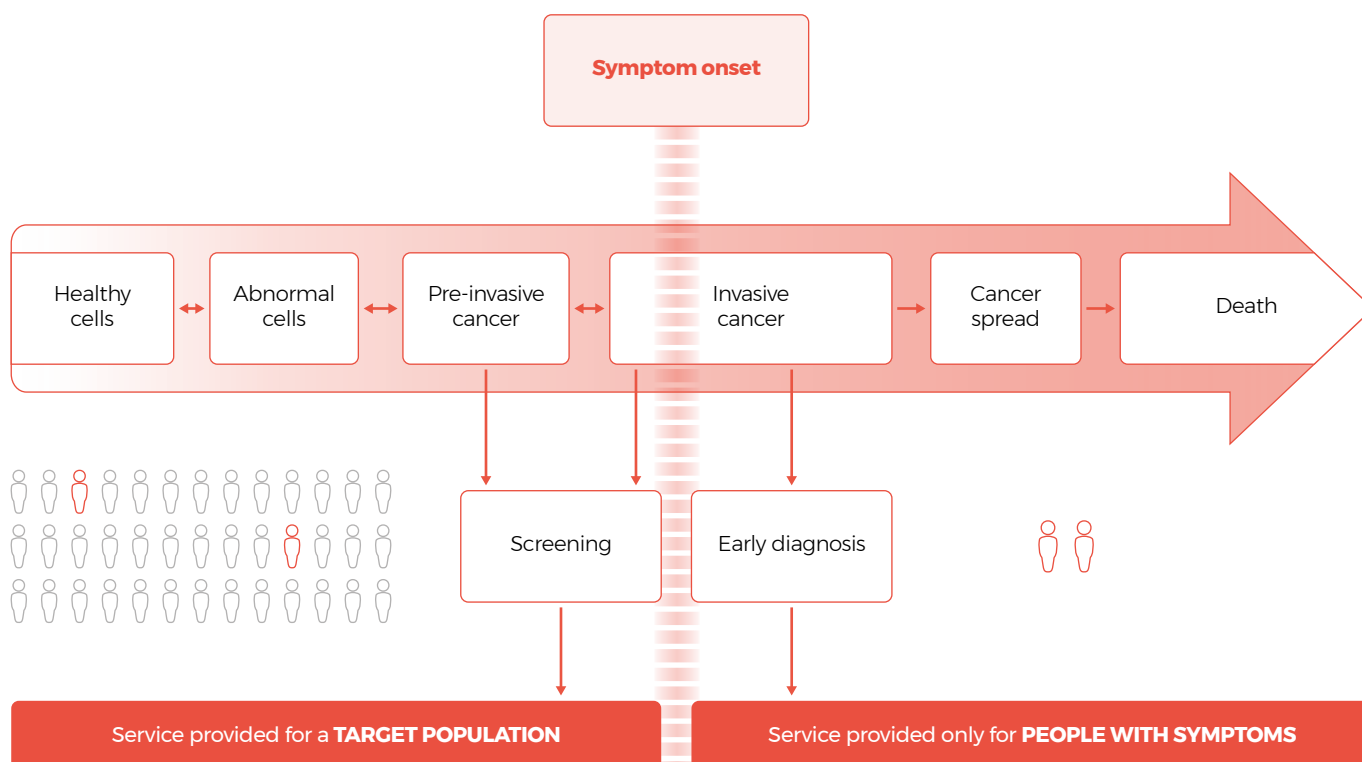
The goal of early detection is to detect cancers in early stages (in the case of solid tumours, when they are very small and localized to the organ of origin) in both asymptomatic and symptomatic people. Incremental investments in public health programmes should be made to meet the demands for early diagnosis, treatment and follow-up care.

Two approaches can be used (Fig. 4.1):

- screening for precancerous lesions or early, preclinical (asymptomatic) cancer among apparently healthy people with no symptoms and
- early diagnosis of invasive cancer in people with symptoms and signs of disease.

Early diagnosis, in particular, can be one of the most efficient investments in cancer control and must be linked to access to prompt, affordable, high-quality treatment.

Fig. 4.1. Distinguishing early diagnosis from screening.



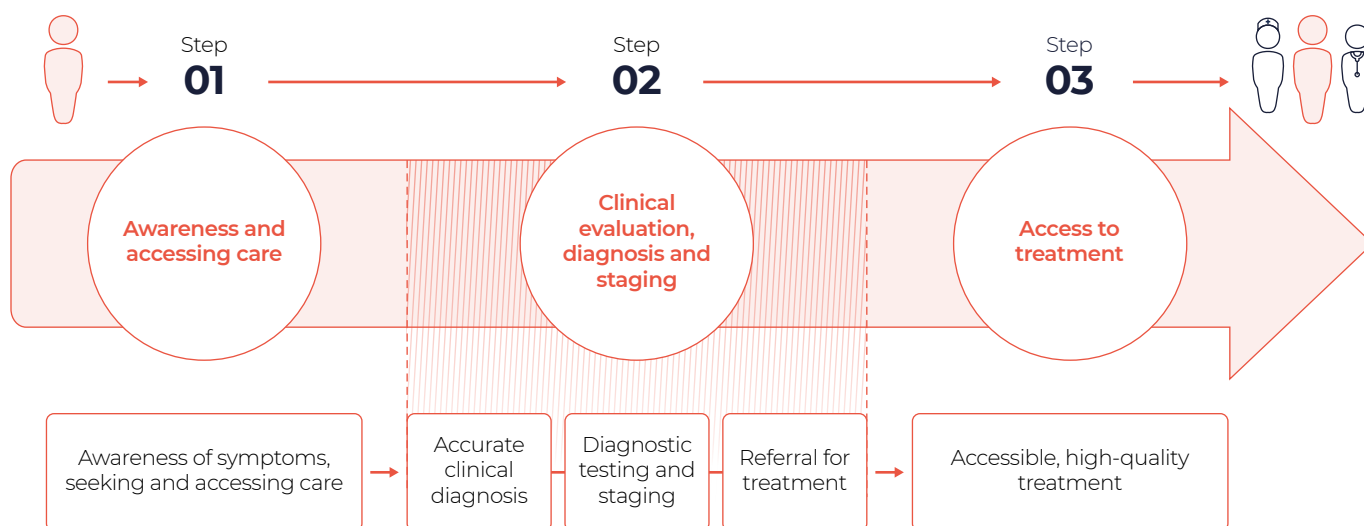
4.1.1 Early diagnosis

Early diagnosis of cancer and the provision of prompt, appropriate treatment are widely applicable priorities in public health. They are particularly relevant to the control of tumours such as of the breast, colon and rectum, cervix, head and neck and other cancers as well as lymphoma and leukaemia.

Effective early diagnosis of cancer involves three steps (Fig. 4.2). The first step, “presentation”, requires awareness and ability of the general public to seek medical attention promptly when symptoms of

suspected cancer arise. In the second step, “diagnosis”, health care providers must be able to recognize early signs and symptoms of cancer with accurate, accessible laboratory services and imaging devices. The final step, “treatment”, requires timely access to high-quality, affordable health services to initiate cancer therapy (1).

Fig. 4.2. Steps in cancer early diagnosis.

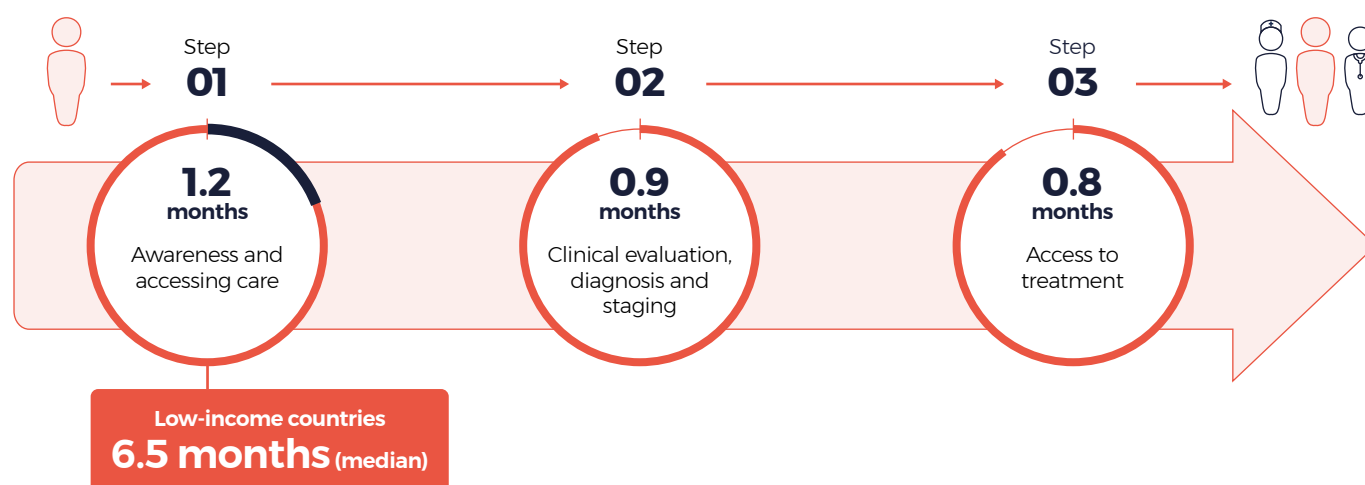


The status of early diagnosis may be measured as intervals for each of the three steps. Delays may occur along the entire pathway and are generally associated with system failures, such as numerous contacts with the health system before proper

referral, long pathology or laboratory turnover time, the cost of diagnostic and/or staging services and geographical proximity to diagnostic and treatment facilities (Fig. 4.3).

Fig. 4.3. Delays in cancer diagnosis by interval in LMIC from systematic review (reference 2)

Source: reference 2



4.1.2 Components of screening

The principles and practice of screening for suitable cancers are well defined (3-5) (Table 4.1). To be effective, screening must

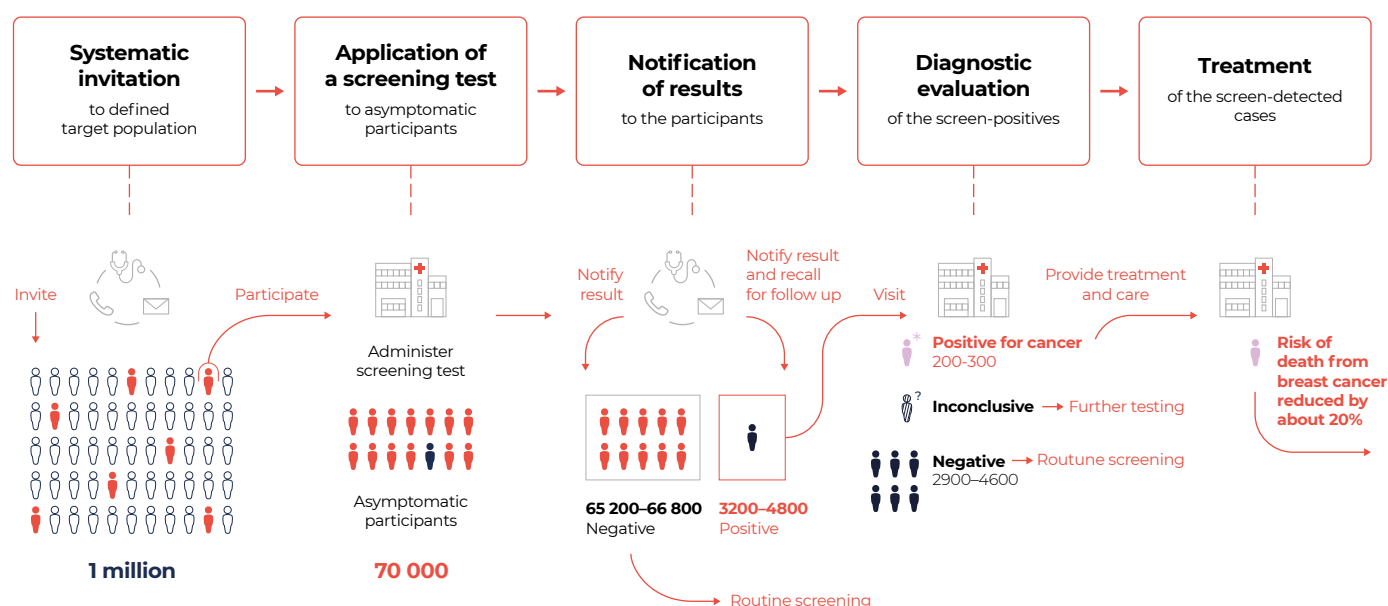
- cover a substantial proportion of the target population;
- be conducted with tests of assured accuracy to maintain discriminatory capacity and guarantee diagnostic verification and
- include timely, effective treatment of detected cases. A rigorous quality assurance (QA) protocol should therefore be used, comprising all three components.

Screening programmes are a major public health activity for managing and evaluating large numbers of people, and substantial investment is required to create awareness, train and re-train providers, ensure the necessary infrastructure for screening, diagnosis and treatment and QA and information systems for monitoring programme inputs and outcomes. The entire pathway, from recruitment to accessible treatment, is essential to realize the full benefits of screening and to reduce inefficiency, costs and harm (Fig. 4.4).

Table 4.1. Sample criteria for suitability for screening and type of screening programme

Element	Requirements
Disease	<ul style="list-style-type: none"> • Major public health problem with well-known, sufficiently long natural history • Preclinical detection phase (before symptom onset) • Affordable, effective and safe treatment for early disease, which reduces deaths when well implemented
Test	<ul style="list-style-type: none"> • Easy-to-administer, safe, affordable, acceptable tests; rapid turn-around of results • Highly accurate (high sensitivity to minimize missing cancers, high specificity to avoid false-positive results) • High positive predictive value, because disease prevalence is sufficiently high • Results reproducible; interpretation of test more objective than subjective
System	<ul style="list-style-type: none"> • Adequate infrastructure and supply of providers for screening, diagnosis, treatment and follow-up of screen-positive individuals • Accessible, including geographically, and affordable • Integrated financing mechanism to minimize out-of-pocket payments • Supported by information system and QA mechanism

Fig. 4.4: Screening pathway



Note: Based on general global estimates and not the exact impact of a breast screening programme. In this scenario, global demographics were used to estimate effects for approximately 147 000 women aged 50–69 who are screened every other year. The screen-positive rate was estimated to be 6–9%, the positive predictive value 6–8%, technique assumed to be digital mammography (single read) and an age-standardized rate of 40 women with breast cancer per 100 000.

Cancer screening programmes may be organized or opportunistic (6). Organized programmes comprise systematic testing with a standardized test, centralized call and recall of a well-defined target population, delivery of test results as well as investigations, treatment and follow-up care if necessary. The criteria for an effective organized screening programme (7) are:

- an explicit policy, with specified age categories, method and interval for screening;
- a defined target population;
- a management team responsible for implementation;
- a health care team for decisions and care;
- a QA structure with links to information systems for monitoring and evaluation; and
- a method for identifying cancer occurrence in the target population

In opportunistic programmes, testing may be provided on request or coincidentally during unrelated health care interactions. Organized and population-based screening programmes have a greater impact and are more equitable and cost-effective than opportunistic programmes (6). It is thus important that screening be organized and population-based.

Differences in screening programmes by cancer type should be considered. Cervical cancer screening is a WHO “best buy” (Table 3.1) and a priority in all countries, while people should be screened for breast and colorectal cancers only in countries with sufficient health system capacity (8) (Table 4.2).

Table 4.2 Current WHO and IARC recommendations for cancer screening programmes

Cancer	Screening test	Target population and frequency	Health system considerations
Cervical^a	HPV test VIA Pap smear	Optimal age: 30–49 years Frequency: every 3–5 years, depending on test used	Recommended for all health systems Where resources permit, HPV test and treatment recommended rather than screening with VIA
Breast^b	Mammography <i>Insufficient data to support CBE^e</i>	Optimal age: 50–69 years Frequency: every 2 years	Well-resourced setting: screening recommended for 50–69 years; ages 40–49 and 70–75 years can be considered (conditional recommendation) Limited-resource settings with strong health systems, screening at ages 50–69 years is a conditional recommendation In weak health systems, screening is not recommended
Colorectal^{c, d}	Stool tests (guaiac, FIT) Endoscopy (sigmoidoscopy, colonoscopy)	Optimal age: generally, 50–70 years Frequency: stool tests, 1–2 years, depending on test; endoscopic techniques at least once in a lifetime	No health system assessment

Sources: **a** reference 8; **b** reference 9; **c** reference 10

VIA, visual inspection with acetic acid; CBE, clinical breast examination; FIT, faecal immunochemical test

d There is inadequate data to support computed tomography colonography as a screening test**e** There is insufficient data to support CBE as a screening test

*WHO or IARC have not conducted systematic analyses regarding the appropriateness of population-based cancer screening programmes of lung, prostate or ovarian cancer

Individual health assessment: Radiation imaging technology, such as whole-body computed tomography, is being increasingly used in asymptomatic individuals for individual health assessment. Such ad hoc tests are often

performed outside screening programmes and without regulatory oversight, defined target population or without sufficient evidence to justify their clinical use (71). Individuals undergoing individual health assessment are subjected to the harm of

imaging, including exposure to radiation, and a risk of overdiagnosis with no or little benefit. Such practices should be monitored and regulated.

4.1.3 Selecting early diagnosis versus screening programmes

In countries of all income levels, early diagnosis is a priority. The human and financial resources and infrastructure required for an early diagnosis programme are considerably less than those for a population-based screening programme, and the time horizon and population impact also differ. The average time lag before benefits from cancer screening are seen may be 10 years, whereas early diagnosis can have an immediate impact (72). Most cancers are detected outside screening programmes. In the United Kingdom, for example, more than 90%

of cancers are detected outside the three national screening programmes (for cervical, breast and bowel cancers), indicating that many cancers are detected in primary care (73).

In LMIC with weaker health systems, early diagnosis is a more feasible than screening (Box 4.2), except for cervical cancer for which both early diagnosis and screening are priorities, as specified in the Global Strategy for the Elimination of Cervical Cancer (74).

Box 4.2. Case study: Zambia – selecting early diagnosis programmes (15)

Zambia carried out an analysis of its major gaps in breast cancer care in 2014 to address late-stage diagnosis, compounded by little use of resources for early detection, concentration of diagnostic and advanced therapy in the capital of the country, without proper integration with the rest of health services, insufficient trained professionals and low breast cancer awareness among women. The report triggered a discussion with relevant stakeholders, with international support,

to discuss priorities. Early diagnosis of breast cancer was selected as the main objective to improve breast cancer control, with better referral to reduce late-stage diagnosis and decrease mortality. This objective was combined with guidelines and training for health professionals, which should allow, in the medium term, decentralization of breast care services to district hospitals, prompt referral from primary care and strengthened pathology and imaging services (15).

4.2 Current landscape

In LMIC, most cancers are diagnosed at a late stage. A recent review of breast cancer in sub-Saharan Africa found that 77% of cases were diagnosed in stage III or IV (16). Early diagnosis depends on the available health services and resources and the interest

of health care practitioners. The three main issues in practice are failure to detect symptoms in primary care (Fig. 4.5), inconsistent application of criteria for early referral and lack of services for pathology and diagnostic imaging (Fig. 4.7).

4.2.1 Current landscape of early diagnosis

Currently, only 29% of countries have referral guidelines for the early diagnosis of colorectal, breast, cervical and childhood cancers (17).

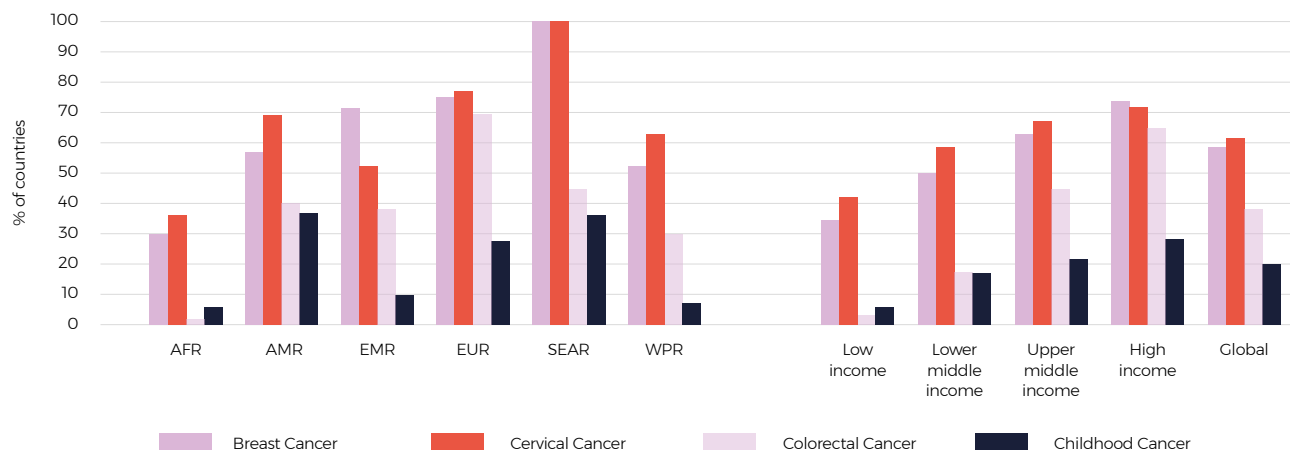
care for suspected cancer cases was reported in 69% of countries for cervical cancer, only 33% had a referral system for childhood cancers.

While a clearly defined system for referral from primary to secondary and tertiary

Fig. 4.5. Proportions of countries with guidelines for early diagnosis of cancer symptoms in primary health care by WHO region and income level in 2019

Source: reference 17

AFR: WHO African Region; AMR: WHO Region of the Americas; EMR: WHO Eastern Mediterranean Region; EUR: WHO European Region; SEAR: WHO South-East Asia Region; WPR: WHO Western Pacific Region.



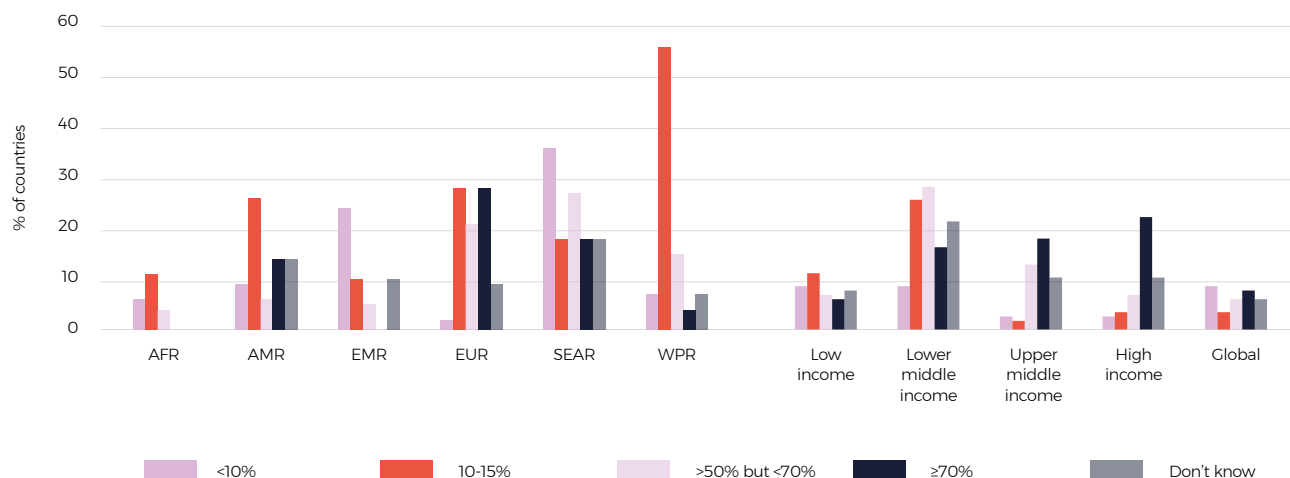
4.2.2 Current landscape of screening

Remarkable differences in participation, types of programmes and target ages in population-based screening policies are seen among countries. Of 177 countries with available data, the proportion of countries with cervical cancer screening decreased from 77% in 2015 to 69% in 2019 (17). Participation rates remain a major challenge to effectiveness (Fig. 4.6).

Only 18% of countries that provide screening for cervical cancer reached the recommended target of more than 70% (17).

Organized population-based programmes are far more prevalent in HIC (34 of 57 countries) than in LIC (5 of 31 countries).

Fig. 4.6. Cervical cancer screening participation rates by WHO region and income level in 2019



Source: reference 17

AFR: WHO African Region; AMR: WHO Region of the Americas; EMR: WHO Eastern Mediterranean Region; EUR: WHO European Region; SEAR: WHO South-East Asia Region; WPR: WHO Western Pacific Region.

Adherence to best practices in screening also varies, as shown by the age at screening initiation. Population-based breast cancer screening of women under 40 years of age has not been shown to be effective and is not considered best practice (9). In HIC, the choice of the target population was based on evidence in 82% (17).

Only 14 of 63 MIC adhered to current WHO recommendations for selecting the appropriate target population for breast cancer screening and 22 of 31 LIC adhered to WHO recommendation to not screen for breast cancer (17).

Many LMIC screen because of the incorrect perception that cancer is “more common” in younger women; however, the age of initiation of screening should be based on evidence and age-standardized rates and not on the unadjusted median or mean age at diagnosis. Furthermore, most LMIC do not have sufficiently well-

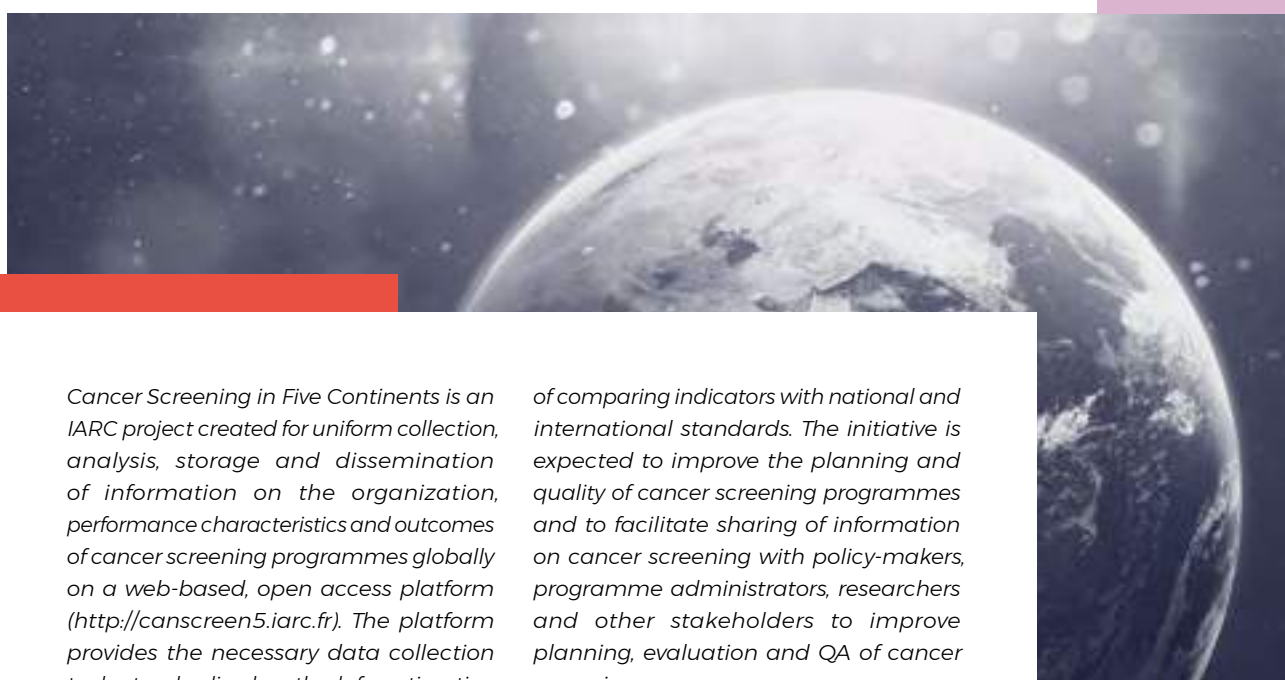
organized screening programmes or robust information systems to assess programme implementation and performance rigorously. Earlier studies reported low-quality or complete lack of data for evaluating cancer screening programmes in Latin America and other regions, despite a large volume of screening in many countries (18).

In a recent global analysis, the majority of countries that reported cervical or breast cancer screening did not have a documented QA strategy (19). An estimated 55% of LIC and 19% of MIC that reported offering cervical cancer screening but generally do not have accessible radiotherapy or surgery services (17). This harms individuals, because they undergo unnecessary tests, and harms the health system because of unnecessary diversion of resources. The absence of uniform reporting on screening performance is being addressed in an IARC project (Box 4.3).

Box 4.3. Cancer Screening in Five Continents

Cancer Screening in Five Continents is an IARC project created for uniform collection, analysis, storage and dissemination of information on the organization, performance characteristics and outcomes of cancer screening programmes globally on a web-based, open access platform (<http://canscreen5.iarc.fr>). The platform provides the necessary data collection tools, standardized methods for estimating performance indicators and the possibility

of comparing indicators with national and international standards. The initiative is expected to improve the planning and quality of cancer screening programmes and to facilitate sharing of information on cancer screening with policy-makers, programme administrators, researchers and other stakeholders to improve planning, evaluation and QA of cancer screening programmes.



4.2.3

Current landscape of pathology and diagnostic imaging

Early detection is limited by lack of pathology and other diagnostic capacity (Fig. 4.7)

More than 60% of LIC lack the basic pathology capacity necessary to diagnose a cancer (17).

The absence of public sector financing for diagnostics results in high out-of-pocket expenditure for diagnostic tests and/or treatment with targeted therapy, even without testing appropriateness for such treatment (20, 21). When pathology capacity is available, it varies significantly, with discordance rates as high as 40

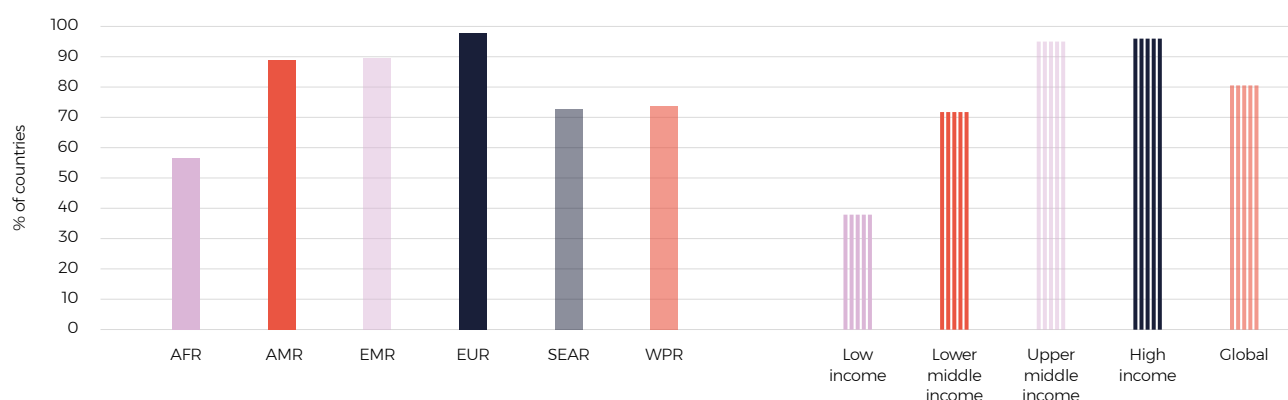
-50%, suggesting that the diagnoses communicated to patients and for which treatment is initiated are too often incorrect (22). Inadequate availability and optimization of a trained pathology workforce contribute to limited access and poor outcomes. The density of pathologists is approximately 1 per 15 000 or 20 000 in HIC, 1 per 1 million population in some African countries and even fewer in LIC in the Region (23).

The availability and quality of diagnostic imaging also differ significantly among countries. For example, the median density of mammography machines is 9 per 10 000 cancer patients among LIC and 49 per 10 000 cancer patients among HIC (24).

Fig. 4.7. Proportions of countries with generally available cancer diagnosis services in the public sector, by WHO region and income level in 2019

Source: reference 17

AFR: WHO African Region; AMR: WHO Region of the Americas; EMR: WHO Eastern Mediterranean Region; EUR: WHO European Region; SEAR: WHO South-East Asia Region; WPR: WHO Western Pacific Region.



4.3

Effective interventions for early diagnosis

An integrated approach for early diagnosis requires adequate health service capacity for referral, diagnosis, staging and treatment, organized from primary care through specialty care (25). Effective early diagnosis strategies overcome common barriers at each step in the pathway to treatment (see Fig. 4.2):

- Step 1: Empower and engage people and communities; improve health literacy and reduce stigmatization of cancer; and facilitate access to primary care.
- Step 2: Improve the capacity of providers at the first point of contact with the health system; strengthen diagnostic and pathology services; establish referral mechanisms and

integrated care; and provide supportive counselling and people-centred care.

- Step 3: Improve access to treatment by reducing financial, geographical, logistical and sociocultural barriers.

Programmes have been established to improve health literacy and the capacity to identify symptoms of suspected cancer. Although many symptoms are not specific (e.g. persistent headaches may be due to various illnesses), providers and the general population should be aware of symptoms that warrant evaluation by a trained professional (Box 4.4, 26).

Box 4.4. Case study: Rwanda – training primary care providers in early diagnosis

Training of primary health care providers can improve early diagnosis, as demonstrated in Rwanda. A programme that included mentorship of clinical examinations and appropriate referral of patients improved competence and timely referral, with 96% of patients properly referred for further evaluation. An early diagnosis training programme

promoted early identification of symptoms and increased the volume of patients seeking care at primary health centres for breast symptoms. Both studies showed that the capacity of nurses and physicians working in primary care can be improved for identifying stage of cancer at diagnosis (27,28).

Examples of this approach are the provision of adequate clinical diagnosis and referral for women with breast lumps. The “Alerta Rosa” initiative in Mexico included a multimedia campaign to increase awareness about breast cancer and a dedicated telephone line to orient patients for care. The intervention resulted in diagnosis of 59% of tumours in early stages and the start of treatment within an average of 30 days after diagnosis, a significant improvement over baseline (29). In other early diagnosis studies, a patient navigator programme and training of providers led to downstaging of disease from stage I to II from 23% to 74% (30) and to an approximately 50% reduction in time to diagnosis (31). Early diagnosis of childhood cancer and prompt referral for

treatment also improve outcomes. The Pan-American Health Organization/WHO has issued a guide on early diagnosis of childhood cancers for policy-makers and providers (32). Integration of early diagnosis initiatives within broader child health programmes, such as vaccination campaigns, has also proven effective. Such programmes, with clinical pathways and outreach programmes, when linked to scaled-up capacity in childhood cancer can significantly improve outcomes, as seen in the establishment of paediatric oncology programmes in Brazil, which improved 5-year survival after acute lymphoblastic leukaemia from about 30% to 63% (33).

4.4

Effective interventions for screening

Considerable political commitment, appropriate adoption of new screening technologies and sufficient resources are necessary to scale-up or reorganize cancer screening programmes. The basis of an effective screening programme is strong governance, with evidence-based planning, accountability, regulatory oversight and quality assurance. The governance structure should include representatives from the department of health, experts in screening and health professionals involved in diagnosis and treatment to provide guidance on organizational issues, coordinate activities and ensure its relation with the rest of the health care system.

Increasing participation in screening: Evidence from clinical trials shows consistently that individual invitations, usually by letter, and fixed appointments are most effective for increasing participation in cancer screening (34). Word of mouth and small media (pamphlets and short videos tailored to local conditions) also increase participation, whereas mass media have been shown to be effective only when they are part of a multicomponent intervention. Studies indicate that reductions in health system barriers are critical for participation, including economic (e.g. out-of-pocket expenditure) and cultural (e.g. language) and geographical barriers (35).

Maintaining high accuracy and availability of screening tests:

Comprehensive QA protocols should cover all the components of cancer screening, as the accuracy of a test in routine practice is critical. Specificity can be evaluated by comparing positive screening results with a diagnostic reference standard (histopathology or expert panel review); sensitivity generally cannot be easily measured, and alternative approaches should be used, such as review of a sample of negative screening results, audit of screening failures (in invasive cancer cases) and strict surveillance of positivity rates.

Measurable, continuous improvement of quality is important to maximize the benefits of cancer screening, reduce inequity and potential harm and ensure safety and efficient use of the available resources. QA is systematic evaluation of performance against predetermined standards and requires a linked information system (36). Every national cancer plan should have a QA strategy for screening programmes, with an allocated budget for implementation.

As a general estimate, 20% of programme costs should be devoted to monitoring and evaluation (37).

The availability and quality of screening tests should be assured, including the proficiency of staff and the condition of equipment. Robust procurement and supply chains for screening devices are necessary to promote access and minimize barriers. Strategies may include coordinated forecasting, increased market transparency, robust negotiations with manufacturers and ensuring WHO prequalification of products, as for HPV tests (38). As part of the initiative for cervical cancer elimination, for example, market-shaping is anticipated to improve the affordability and availability of HPV tests and related technologies (74).

Training and recertification are critical components of a QA programme, particularly for techniques for which there is high inter-observer variation, such as image-based, direct visual inspection and morphological screening. Indicators of quality and proficiency should be defined, with a reference value for accrediting trained staff (39). Other strategies include centralized reading of screening tests to ensure that readers read a minimum number of tests per period to maintain their proficiency and to facilitate quality control, and double-reading or computer-aided reading for mammography screening.

Following-up individuals: A well-organized programme should ensure access to confirmatory diagnosis and to treatment if precancer or cancer is diagnosed.

A common challenge, particularly in LMIC and underserved communities in HIC, is deficient follow-up of positive screening results (40).

Active follow-up and recall in tracking systems for individual patients, either automated or manual, are essential. Complementary patient navigation programmes might lower socioeconomic barriers. Economic models and data from clinical trials show that fewer visits during cancer screening result in greater cost-effectiveness, better compliance with a confirmatory diagnosis and higher treatment rates (41). Approaches to screen-and-treat or screen-diagnose-and-treat in one or two visits require reorganization of screening programmes, with a relevant role for point-of-care tests.

Minimizing harms in screening programmes: Harm that might derive from poorly delivered screening includes false-positive and false-negative test results, overdiagnosis and, in rare instances, significant injury or death associated with the examination or diagnosis. False-positive results require confirmation with additional diagnostics and raise unnecessary anxiety in participants, while overdiagnosis leads to unnecessary diagnostics and treatment. A proportion of individuals who undergo screening will experience emotional or physical adverse effects, and this risk increases with multiple rounds of screening. False-negative test results may reassure people who actually have the disease and delay early diagnosis and prompt treatment. Informed consent should be provided to the participating target population about such potential harm.

Overdiagnosis is detection of a cancer that might not have become clinically apparent during the person's lifetime and is a negative consequence of screening (42,43). For example, in one study, approximately 60% of men over the age of 79 had evidence of prostate cancer but showed no symptoms or harm during their lifetime (44). Diagnosis and treatment of indolent (slowly progressing) or non-threatening cancers can cause harm or diversion of resources. Overdiagnosis is difficult to measure. Potential harm can be reduced by targeting the most appropriate age cohorts and increasing understanding of the natural history of indolent cancers. Recent discussions on screening for prostate and lung cancers demonstrate the challenges of estimating overdiagnosis and programme effectiveness, although several additional aspects are unclear, such as feasibility in different settings, the optimal interval, the target age and the possible impact on population health.

The best measure of a health impact of screening is a reduction in cancer mortality in the entire target population. This outcome may take at least 10 years to detect. Other indicators, such as the numbers of cases diagnosed or surviving, could be misleading, because they might be the result of overdiagnosis or length and lead-time biases.

4.5

Effective strategies for access to high-quality pathology and diagnostic imaging

Cancer diagnosis and staging generally require laboratory services, imaging, endoscopy, fine-needle aspiration cytology, core needle biopsy, histopathology and immunohistochemistry. Histopathology is still the reference standard for final diagnosis of many cancers, and routine haematological and biochemical investigations and tumour marker testing play major roles in the treatment of cancer.

All cancer treatment plans and the vast majority of medical decisions for cancer patients rely on quality pathology and laboratory medicine (45).

The importance of pathology and laboratory medicine is not well appreciated at government level in LMIC, resulting in insufficient investment and infrastructure, inadequate workforce and fragmented services with no oversight or QA (46). Each of these challenges warrants a specific programme or policy response. A highly qualified pathology workforce, including biomedical laboratory scientists, can significantly increase the throughput of specimens and thus potentially increase access. Pre- and in-service training increase competence, and the efficacy of short-term expert visitor programmes and telepathology are well documented (46). Service organization is particularly important with a limited workforce, and a specimen transport network can allow diagnosis near patients' homes with advanced review at an appropriate laboratory in a tiered network.

The infrastructure of pathology and laboratory services should be strengthened by addressing the value chain (Annex 2), from selection and procurement to distribution and warehousing. Health products for cancer diagnostics should be selected from the evidence-based WHO lists of Essential In-vitro Diagnostics and Priority Medical Devices for Cancer Management (47,48). Programmes for QA and accreditation should be considered mandatory for all laboratories and embedded in the national laboratory strategic plan (49).

Imaging plays a critical role in cancer early diagnosis and management. Appropriate treatment cannot be prescribed if staging is not accurately performed.

The most effective imaging modality for a particular cancer type depends on health system capacity, and an appropriate health technology assessment should be performed before more advanced, complex and expensive imaging modalities, such as positron emission tomography, are adopted. Additionally, several imaging modalities can be used to guide interventional procedures (e.g. fluoroscopy-guided interventions) as well as external irradiation (i.e. computed tomography for image-guided radiotherapy). Standards of care should be set, and a well-trained workforce should have the necessary competence to interpret images (50). Essential technologies in cancer diagnostics and imaging must be tested and maintained routinely to optimize the value of the investment.

4.6

Integrated approach to early diagnosis and screening

Broad public health strategies to improve early diagnosis of cancer generally have three integrated elements: strengthening health literacy through awareness campaigns, augmenting primary care services and ensuring referral pathways.

Primary health care is at the centre of integrated strategies, both to increase access to services and potentially stabilize costs (51).

The role of primary care, defined by WHO as “first contact, accessible, continued, comprehensive and coordinated care”, in the continuum of cancer care includes encouraging screening and ensuring accurate, timely diagnosis, follow-up and end-of-life care (51; see also chapter 8). Integrated training programmes for NCDs or other disease for physicians and nurses in primary care can provide education on identifying suspicious cancer symptoms, performing initial examinations, applying simple diagnostic tests and referring suspected cases.

Strong primary care is also important in screening programmes, in functions that include inviting and motivating the eligible population to undergo screening, monitoring and coordinating referral of screen-positive individuals to higher-level health facilities and follow-up after treatment. Screening in primary care, rather

than in hospitals, has been found to be more acceptable to target populations and to increase uptake (51).

4.7

Emerging science and programmes

Rapid innovation has been seen in cancer early detection, particularly in cancer screening, pathology and laboratory

diagnoses, including biomarkers, circulating tumour cells and genetic testing, and medical imaging (Table 4.3).

Table 4.3. Emerging science: selected activities (from the IARC World Cancer Report)

Activity	Intervention	Detailed activity
Screening programmes	Profiling to inform cancer screening	Biomarkers to select risk stratify lung cancer (section 5.1)
		Gene-expression profile for lung cancer screening (section 5.1)
Early diagnosis	Service delivery model	Serological detection of antibodies for at-risk populations for head and neck cancers (section 5.3)
		Stratified screening programmes for higher-risk individuals (section 6.7)
		Innovative ways to deliver care to rural populations (section 4.3)
Pathology and laboratory medicine	Role of patient navigator	Increase access to services along care continuum (section 4.6)
	Biomarkers	Identify in early stages, predict tumour burden, detect recurrences early and offer prognostic information (Chapter 5.10)
	Liquid biopsy including circulating tumour cells	Detect early tumour cells, tumour-derived material, exosomes and microRNA (Chapter 5.3)
	Other blood tests for cancer	Test non-coding nucleic acids, extracellular vesicles or tumour-educated platelets analyses (Chapter 6.8)
	Artificial intelligence for review of imaging or pathology	Platforms for neural networks or auto-encoders, e.g. for mammogram-based breast cancer risk assessment (Chapter 5.9)

^a Section of IARC World Cancer Report in parentheses

References

- Guide to cancer early diagnosis. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/bitstream/handle/10665/254500/9789241511940-eng.pdf?sequence=1&isAllowed=y>, accessed January 2020).
- Brand NR, Qu LG, Chao A, Ilbawi AM. Delays and barriers to cancer care in low- and middle-income countries: a systematic review. *Oncologist*. 2019;24 (12):e1371–80.
- Wilson JMC, Jungner G, World Health Organization. Principles and practice of screening for disease. Geneva: World Health Organization; 1968 (<https://apps.who.int/iris/handle/10665/37650>, accessed January 2020).
- Andermann A, Blancquaert I, Beauchamp S, Déry V. Revisiting Wilson and Jungner in the genomic age: a review of screening criteria over the past 40 years. *Bull World Health Organ*. 2008;86 (4):241–320.
- Dobrow MJ, Hagens V, Chafe R, Sullivan T, Rabeneck L. Consolidated principles for screening based on a systematic review and consensus process. *Can Med Assoc J*. 2018;190 (14):E422–9.
- Cancer control: early detection. WHO guide for effective programmes. Geneva: World Health Organization; 2007 (https://www.who.int/cancer/publications/cancer_control_detection/en/, accessed January 2020).
- Cervix cancer screening (IARC Handbooks of cancer prevention, Vol. 10). Lyon: International Agency for Research on Cancer; 2005 (<http://publications.iarc.fr/Book-And-Report-Series/IARC-Handbooks-Of-Cancer-Prevention/Cervix-Cancer-Screening-2005>, accessed January 2020).
- Comprehensive cervical cancer control. A guide to essential practice. Second edition. Geneva: World Health Organization; 2014 (<https://www.who.int/reproductivehealth/publications/cancers/cervical-cancer-guide/en/>, accessed January 2020).
- WHO position paper on mammography screening. Geneva: World Health Organization; 2014 (https://www.who.int/cancer/publications/mammography_screening/en/, accessed January 2020).
- Colorectal cancer screening (IARC Handbooks of Cancer Prevention, Vol. 17; Lyon: International Agency for Research on Cancer; 2019 (<http://publications.iarc.fr/Book-And-Report-Series/IARC-Handbooks-Of-Cancer-Prevention/Colorectal-Cancer-Screening-2019>, accessed January 2020).
- Malone J, Perez M, Godse-Friberg E, Prokop M, Jung SE, MD, Griebel J, et al. Justification of CT for individual health assessment of asymptomatic persons: a World Health Organization consultation. *J Am Coll Radiol*. 2016;13:1447–57.
- Lee SJ, Boscardin WJ, Stijacic-Cenzer I, Conell-Price J, O'Brien S, Walter LC. Time lag to benefit after screening for breast and colorectal cancer: meta-analysis of survival data from the United States, Sweden, United Kingdom, and Denmark. *BMJ*. 2013;346:e8441.
- Whitaker K. Earlier diagnosis: the importance of cancer symptoms. *Lancet Oncol*. 2020;21 (1):6–8.
- Draft: Global strategy towards the elimination of cervical cancer as a public health problem. Geneva: World Health Organization; 2019 (<https://www.who.int/docs/default-source/documents/cervical-cancer-elimination-draft-strategy.pdf>, accessed January 2020).
- Cabanes A, Kapambwe S, Citorje-MSadabwwe S, Parham GP, Lishimpi K, Cruz TA, et al. Challenges, opportunities, and priorities for advancing breast cancer control in Zambia: a consultative meeting on breast cancer control. *J Glob Oncol*. 2019;5:1–7.
- Jedy-Agba E, McCormack V, Adebamowo C, Dos-Santos-Silva I. Stage at diagnosis of breast cancer in sub-Saharan Africa: a systematic review and meta-analysis. *Lancet Glob Health*. 2016; 4 (12):e923–35.
- WHO NCD Country Capacity Survey. 2019. (<https://www.who.int/hcds/surveillance/hcd-capacity/en/>, Accessed January 2020).
- Murillo R, Almonte M, Pereira A, Ferrer E, Gamboa OA, Jerónimo J, et al. Cervical cancer screening programs in Latin America and the Caribbean. *Vaccine*. 2008;26 (Suppl 11):L37–48.
- Romero Y, Trapani D, Johnson S, Tittenbrun Z, Given L, Hohman K, et al. National cancer control plans: a global analysis. *Lancet Oncol*. 2018;19(10):e546–55.
- Carbonnaux M, Souquet PJ, Meert AP, Scherpereel A, Peters M, Couraud S. Inequalities in lung cancer: a world of EGFR. *Eur Respir J*. 2016;47:1502–9.
- Eniu A, Cherny NI, Bertram M, Thongprasert S, Douillard JY, Bricalli G, et al. Cancer medicines in Asia and Asia-Pacific: What is available, and is it effective enough? *ESMO Open*. 2019;4 (4):e000483.
- Fleming K. Pathology and cancer in Africa. *Ecancermedicalscience*. 2019;13:945.
- Nelson AM, Milner DA, Rebbeck TR, Iiyasu Y. Oncologic care and pathology resources in Africa: survey and recommendations. *J Clin Oncol*. 2016;34(1):20–6.
- IMAGINE — IAEA Medical imAGING and Nuclear mEdicine global resources database. Vienna: International Atomic Energy Agency; 2020 (<https://humanhealth.iaea.org/HHW/DBStatistics/IMAGINE.html>, accessed January 2020).
- Prager GW, Braga S, Bystrycky B, Qvortrup C, Criscitiello C, Esin E, et al. Global cancer control: responding to the growing burden, rising costs and inequalities in access. *ESMO Open*. 2018;3 (2):e000285.
- Koo MM, Swann R, McPhail S, Abel GA, Elliss-Brookes L, Rubin GP, et al. Presenting symptoms of cancer and stage at diagnosis: evidence from a cross-sectional, population-based study. *Lancet Oncol*. 2020;21(1):73–9.
- Pace L, Dusengimana JMV, Shulman LN, Schleimer LE, Shyirambere C, Rusangwa C, et al. Cluster randomized trial to facilitate breast cancer early diagnosis in a rural district of Rwanda. *J Glob Oncol*. 2019;5:1–13.
- Pace LE, Dusengimana JMV, Keating N, Hategekimana V, Rugema V, Bigirimana JB, et al. Impact of breast cancer early detection training on Rwandan health workers' knowledge and skills. *J Glob Oncol*. 2018;4:1–10.
- Mireles-Aguilar T, Tamez-Salazar J, Muñoz-Lozano JF, Lopez-Martinez EA, Romero C, Platas A, et al. Alerta Rosa: novel alert and navigation breast cancer program in Nuevo Leon, Mexico, for reducing health system interval delays. *Oncologist*. 2018;23 (12):1461–6.
- De Angelis C, Pacheco C, Lucchini G, Arguello M, Conter V, Flores A, et al. The experience in Nicaragua: childhood leukemia in low income countries — the main cause of late diagnosis may be "medical delay". *Int J Pediatr*. 2012;2012:129707.
- Ngoma T, Mandeli J, Holland JF. Downstaging cancer in rural Africa. *Int J Cancer*. 2015;136 (12):2875–9.
- Early diagnosis. Washington DC: Pan-American Health Organization; 2014 (https://www.paho.org/hq/index.php?option=com_content&view=article&id=10277:2014-publication-early-diagnosis-of-childhood-cancer&Itemid=42042&lang=en, accessed January 2020).
- Howard SC, Pedrosa M, Lins M, Pedrosa A, Pui CH, Ribeiro RC, et al. Establishment of a pediatric oncology program and outcomes of childhood acute lymphoblastic leukemia in a resource-poor area. *JAMA*. 2004;291(20):2471–5.
- Review of the national bowel cancer screening program (phase 2). Final report, part one. 5. Opportunities to increase participation rates. Canberra: Department of Health; 2020 (<http://www.cancerscreening.gov.au/internet/screening/publishing.nsf/Content/rev-nbcs-prog-pt1-inc-part>, accessed January 2020).
- Breast cancer screening (IARC Handbooks of cancer prevention, Volume 15). Lyon: International Agency for Research on Cancer; 2015 (<https://publications.iarc.fr/Book-And-Report-Series/IARC-Handbooks-Of-Cancer-Prevention/Breast-Cancer-Screening-2016>, accessed January 2020).
- Mammography services quality assurance: baseline standards for Latin America and the Caribbean. Washington DC: Pan-American Health Organization; 2016 (<http://iris.paho.org/xmlui/handle/123456789/31402>, accessed January 2020).
- Determinants for a successful implementation of population-based cancer screening programmes Brussels: European Science Advisory Network for Health; 2011 (EuSANH-ISA, 229716) (<http://www.eusanh.eu/wp-content/uploads/2013/07/Booklet-EuSANH-determinants-for-a-successful-implementation-of-population-based-cancer-screening-programmes.pdf>, accessed 10 January 2020).
- Public reports of prequalified IVDs. Geneva: World Health Organization; 2019 (https://www.who.int/diagnostics_laboratory/evaluations/pq-list/public_report_hp/en/, accessed January 2020).
- Branca M, Longatto-Filho A. Recommendations on quality control and quality assurance in cervical cytology. *Acta Cytol*. 2015;59 (5):361–9.
- Doubeni CA, Gabler NB, Wheeler CM, McCarthy AM, Castle PE, Halm EA, et al. Timely follow-up of positive cancer screening results: A systematic review and recommendations from the PROSPR Consortium. *CA Cancer J Clin*. 2018;68(3):199–216.
- Goldie SJ, Gaffikin L, Goldhaber-Fiebert JD, Gordillo-Tobar A, Levin C, Mahé C, et al. Cost-effectiveness of cervical-cancer screening in five developing countries. *N Engl J Med*. 2005;353 (20):2158–68.
- Zahl PH, Jørgensen KJ, Gøtzsche PC. Overestimated lead times in cancer screening has led to substantial underestimation of overdiagnosis. *Br J Cancer*. 2013;109 (7):2014–9.
- Srivastava S, Koay EJ, Borowsky AD, De Marzo AM, Ghosh S, Wagner PD, et al. Cancer overdiagnosis: a biological challenge and clinical dilemma. *Nat Rev Cancer*. 2019;19 (6):349–58.
- Bell KJ, Del Mar C, Wright G, Dickinson J, Glasziou P. Prevalence of incidental prostate cancer: A systematic review of autopsy studies. *Int J Cancer*. 2015 Oct 1;137(7):1749–57. doi:10.1002/ijc.29538. Epub 2015 Apr 21. Review. PubMed PMID: 25821151; PubMed Central PMCID: PMC4682465.
- Kleinert S, Horton R. Pathology and laboratory medicine: the Cinderella of health systems. *Lancet*. 2018;391(10133):1872–1873. doi:10.1016/S0140-6736(18)30457-4.
- Sayed S, Cherniak W, Lawler M, Tan SY, El Sadr W, Wolf N, et al. Improving pathology and laboratory medicine in low-income and middle-income countries: roadmap to solutions. *Lancet*. 2018;391 (10133):1939–52.
- WHO list of priority medical devices for cancer management (WHO Medical device technical series). Geneva: World Health Organization; 2017 (https://www.who.int/medical_devices/publications/priority_med_dev_cancer_management/en/, accessed January 2020).
- Second WHO model list of essential in vitro diagnostics. Geneva: World Health Organization; 2017 (https://www.who.int/medical_devices/publications/EDL_2_0_Standalone_11_2019_v2.pdf?ua=1, accessed January 2020).
- Asia Pacific Strategy for Strengthening Health Laboratory Services (2010–2015). New Delhi: World Health Organization Regional Office for South-East Asia; 2010 (http://apps.searo.who.int/PDS_DOCS/B4531.pdf, accessed January 2020).
- Safety guide SSG-46. Radiation protection and safety in medical uses of ionizing radiation. Vienna: International Atomic Energy Agency; 2018 (https://www-pub.iaea.org/MTCD/Publications/PDF/PUB1775_web.pdf, accessed January 2020).
- Rubin G, Berendsen A, Crawford SM, Dommert R, Earle C, Emery J, et al. The expanding role of primary care in cancer control. *Lancet Oncol*. 2015;16 (12):1231–72.

Chapter 05.

Cancer management



Key messages

1. Over the next decade, cancer will be diagnosed in about 200 million people who will require care. Multi-modality treatment capacity must be scaled up to meet this need.
2. Treatment capacity varies widely between and within countries. In many LIC, cancer services, generic and low-cost medicines and health products and innovative products are not generally available.
3. Significant advances have been made in cancer management, and immunotherapy is now on the WHO EML. Only a minority of innovative therapies, however, have a clinically significant impact. Access, sustainability and system readiness must be evaluated before introducing new therapies.
4. Priorities for interventions should be selected according to cancer types and indications. Certain interventions, such as curative treatment for breast, colorectal, cervix and childhood cancers, are available in countries at all income levels. The quality of cancer treatment services should be monitored and improved by regulation, national policies, clinical practice guidelines and better training of health care workers. Treatment can be successful only when linked to supportive care services such as nutrition, infection prevention and control and rehabilitation.
5. A “value chain” approach could be used to conceptualize the components required for improving access to cancer medicines and health products. Common problems that impede patient access are inappropriate selection, disruption of supply, substandard and falsified medicines, improper prescribing and use and cost. Policy-makers should follow coherent, comprehensive policies in the “value chain”, including robust pricing policies to ensure broad population access to safe, efficacious, high-quality health products for optimal cancer care.
6. Most cancer patients do not have access to palliative care, especially in LMIC, resulting in unnecessary suffering. Palliative care should be a priority everywhere and integrated into health care at all levels.

5.1 Background

Cancer management must be scaled up to achieve the SDG targets for UHC and reduce premature mortality and suffering. Even with good prevention, cancer will be diagnosed in more than 15 million people each year in the next decade (1).

The guiding principles of cancer management should be patient-centred goals, framed by value (see section 6.4) (Fig. 5.1). Services should be of high quality and comprehensive, and investments must be efficient, providing value for money (2; see also Annex 2). Treatments are inefficient if they are expensive and offer only short-term, clinically insignificant outcomes (3; see also section 5.3.2). The correlation between high expenditure on cancer and better

survival is questionable; rather, such investment may exacerbate financial inequality (4,5). Low-quality services are also inefficient, significantly increasing costs and worsening outcomes.

Cancer management involves all levels of the health care system.

Effective and affordable cancer management systems can be built incrementally even in lower income countries with appropriate planning and implementation.

Fig. 5.1. Guiding principles for cancer management



See Annex 1.

High-quality cancer management comprises evidence-based, context-specific treatment and collaboration among facilities at all levels of care. Services must be comprehensive and coordinated at each step in cancer management. Multidisciplinary care should include core clinical services such as medical oncology, surgery, radiation oncology, pathology, palliative care, psycho-oncology, oncology nursing, nutrition and rehabilitation, as appropriate. Coordination is essential to avoid fragmentation of care and miscommunication among professionals, patients and their families. Multidisciplinary teams ensure patient-centred health care and clinical effectiveness.

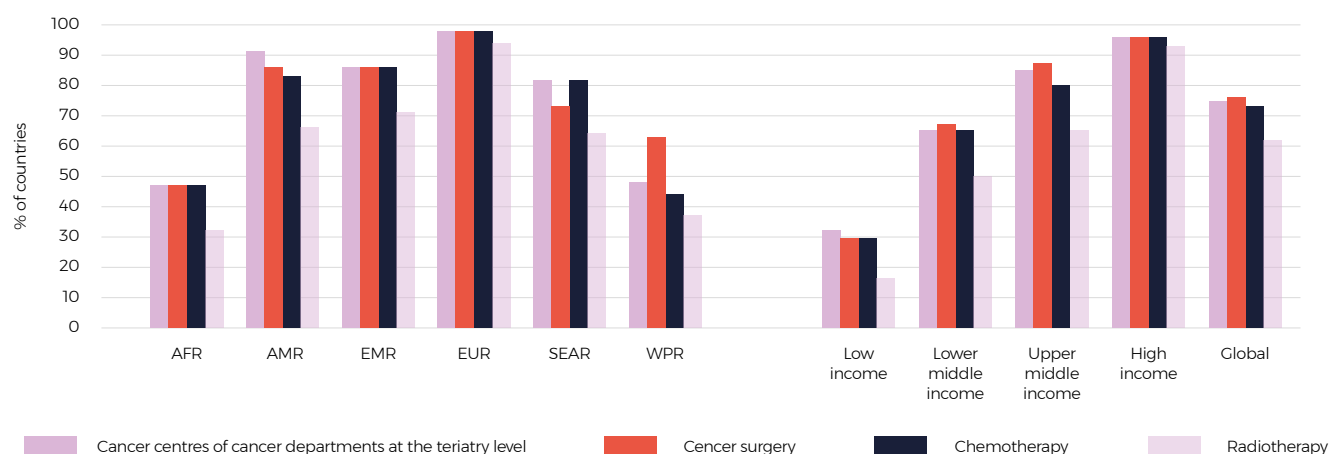
Special consideration should be given to populations that require tailored policies, approaches and medical equipment and devices. These include the special needs of disadvantaged populations, the aging population, children and attention to adolescents and young adults, who may be overlooked.

5.2

Current landscape of cancer management services

Access to cancer management services varies significantly among and within countries (Fig. 5.2).

Fig. 5.2. Proportions of countries that reported cancer treatment services generally available in the public sector, by WHO region and World Bank income group in 2019



Source: reference 6

The median and range of public sector cancer centres, by country, per 10 000 cancer patients is 3.3 in HIC (range 0.25-21.4), 2.6 in middle-income countries (range 0-55.4) and 0.8 in LIC (range 0-25.4). Such centres are available to the general population in only 32% of LIC and 65% of LMIC (6). For example, in sub-Saharan Africa, as many as 38% of women who presented to a facility did not receive treatment, probably because it was not accessible or affordable (7).

The current median and range of density of radiotherapy machines per million population is 5.1 in HIC (range 0.4-11.6) and 0 in LIC (range 0-0.4) (8).

The availability of both essential and new cancer medicines is also limited, particularly in LMIC. The WHO EML is a global reference for priority cancer medicines (9); however, national lists in LMIC showed less than 50% concordance with the EML, and lists in LIC included only about one third of EML cancer medicines and even fewer patented medicines (10,11). Cancer medicines on the WHO EML are effective and the majority can be afforded by countries of all income levels (see section 2.4).

Budgets for targeted therapy are rapidly rising and disproportionately oriented to a minority of patients, particularly in LMIC, at the expense of providing effective established, generic medicines and biosimilars to many more patients (12,13). The ESMO International Consortium found that many essential cancer medications were unavailable in LIC and LMIC; when they were available, the full cost was paid by patients, limiting their access. Furthermore, many recent targeted therapy agents are available without high out-of-pocket expenditure only in HIC (13).

The rates of introduction and approval of new cancer medicines are increasing at an all-time high, as are the costs (4,14,15). In the USA, for example, 91 cancer drugs were approved between 2014 and 2018 (16).

47% of all pharmaceutical clinical trials are on cancer medicines (4, 17).

The prices of newly approved cancer medicines have increased substantially (18), and per-capita expenditure on these medicines increased over per-capita expenditure on health by two to eight times between 2012 and 2016 (4).

Some innovative therapies have a sizeable impact on cancer outcomes, as indicated by the addition of seven targeted therapies to the latest WHO EML (9). These cancer medicines are very effective, with, for example, an absolute 30-40% gain in survival from metastatic melanoma after treatment with immunotherapy (9). Selected new cancer therapies are significantly improving life expectancy and quality of life, yet many innovative therapies confer only modest benefits. Less than one third of randomized controlled trials published between 2011 and 2015 showed clinically meaningful benefits, according to the ESMO Magnitude of Clinical Benefit Scale scores (19). Approved medicines are indicated for a minority of patients; for example, in HIC, only 13% of cancer patients benefited from immunotherapy and 4.9% from genome-targeted therapy (20). These medicines are unavailable and unaffordable to the vast majority of people globally (4,21) without insurance coverage or financial protection. The cost of targeted treatment on the WHO EML for early-stage HER2-positive breast cancer, for example, would represent about 10 years of average annual wages in India and South Africa and 1.7 years in the USA (4).

In comparison, established, effective older chemotherapy regimens can be prescribed at a fraction of that cost and are affordable to governments and individuals. The high prices and profits on cancer medicines have resulted in inefficient, unethical, illegal practices such as substandard and falsified medicines, antitrust practices, deceptive marketing of off-label products and waste (4).

Access to palliative care is also limited.

Currently, 58% of countries now have palliative care in their national NCD policies (6). In 2011, 86% of the world's population had little or no access to opioid pain relief (22). The general availability of oral morphine differs significantly by region and by income level, from 86% of HIC, 29% of MIC and 10% of LIC (6,23).

5.3 Setting priorities in cancer treatment

The investment cases for medical, radiation and surgical oncology are now well established (24-26). Investment is, however, insufficient and ineffective. It is difficult to set priorities, given rapidly changing

cancer treatment, capacity and public perceptions (27,28). Value-based cancer care should be the foundation of UHC (Fig. 5.3; see also section 6.4).

Fig. 5.3. Selection of interventions on the basis of WHO, IARC, IAEA and other UN guidance (Annex 1)



5.3.1

Identifying priorities in cancer care

The highest-impact, most feasible interventions should be selected for cancer surgery, systemic therapy and radiotherapy according to cancer type and stage (see section 6.5). The priorities established by WHO and the World Bank for all settings are treatment for early-stage cancers (particularly breast, cervical and colorectal cancers among others), childhood cancers and haematological malignancies that may be curative even at advanced stages at low cost (29,30).

The benefit of therapies should be considered by treatment modality, stage and cancer type. For example, the absolute 5-year survival benefit of radiotherapy has been estimated to be approximately 20% for cervical cancer and 1% for stomach cancer (25), and the absolute gain in survival from neoadjuvant or adjuvant chemotherapy is more than 35% for non-Hodgkin lymphoma and testicular cancer and may be less than 5-10% for others such as pancreas or brain cancer (31). Cytotoxic chemotherapy results in a much greater

gain in absolute survival from stage III (1-19%) than from stage I breast cancer (0-9%) (32).

The specific cancer types and stages that benefit from a particular therapy should be identified in order to set priorities at population level and provide high-quality patient care.

Barriers to both demand (e.g. ability to travel to a facility, awareness of service, willingness to pay) and supply (e.g. enough qualified providers and equipment) should be considered in selecting interventions. Demand may be inadequate to justify capital expenditure; for example, in a country with a small population or limited capacity to scale-up services immediately, patients could be sent to neighbouring countries or the private sector in a structured, regulated agreement (33).

5.3.2

Recent technologies for cancer treatment: setting priorities

Medical oncology: Medical oncology services must be strengthened in steps, according to the health system requirements and the impact and cost of treatments, some of which may offer little benefit to patients and have significant social costs (34). When setting priorities, consideration must be made of the medicine, its cost and the probability of a benefit for a specific indication.

Significant progress has been achieved in medical oncology by optimizing treatment (e.g. regimen, number of cycles and timing) with low-cost chemotherapy, as for acute lymphoblastic leukaemia in countries at all income levels. Targeted cancer medicines have been introduced in the past two decades. Some of these have an important therapeutic role and are thus included on the WHO EML; however, not all recent cancer medicines have a clinically meaningful benefit, and an effective new cancer therapy against one cancer should

not be assumed to be effective for all. For example, immunotherapy is listed for melanoma on the latest WHO EML but not currently for other indications based on uncertainties for other indications.

Decisions on the acquisition of new treatments should be based on clinical benefit, health system requirements and the local disease burden. As more affordable options become available, priorities should be re-evaluated. For example, WHO has a programme for prequalifying biosimilars, so that high-quality cancer medicines can be obtained at lower cost (35,36).

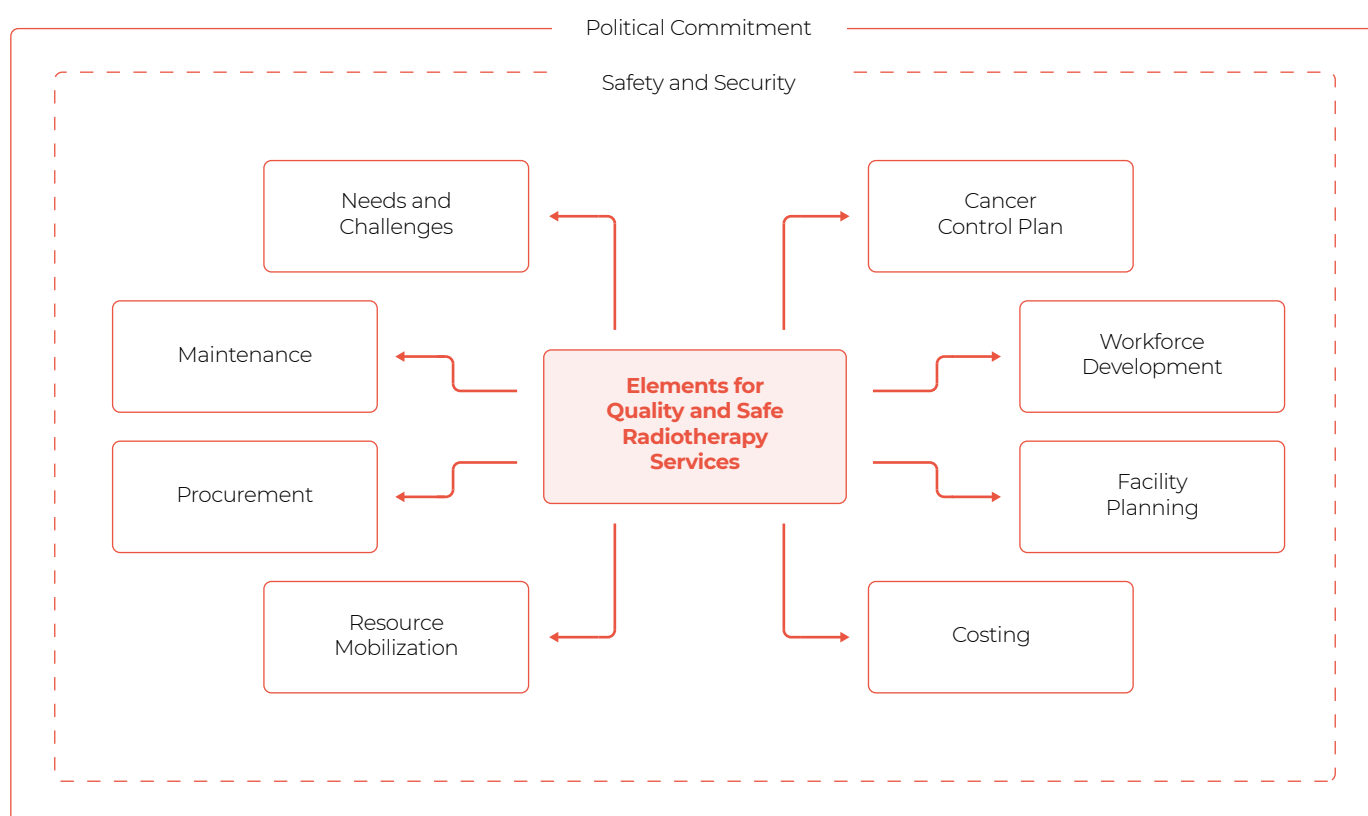
Many new treatments require special expertise, complex diagnostic technology, close monitoring of toxicity and sufficient financial resources. Accompanying diagnostics for recent cancer medicines also require considerable investment, expertise and planning. Interpretation of the results can be challenging, and

inappropriate medicines prescribed on the basis of an incorrect diagnosis can harm patients and result in inefficient expenditure. For example, some HIC commonly use next-generation sequencing technology to detect mutations in tumours in order to target treatment. Mutations detected by two different products can vary widely, however, confounding clinical decision-making while incurring high costs (37,38). Clinical expertise is also required for monitoring toxicity, as immunotherapy may have unique toxic side-effects during or for months after treatment, requiring

support from specialists and monitoring by all providers including in primary care.

Radiation oncology: Radiotherapy is a necessary treatment modality that saves lives and can be made available to patients at all income levels, as shown by the experience of the International Atomic Energy Agency (39). Building capacity in radiotherapy requires careful planning and a maintenance strategy, with the “milestone approach” proposed by the Agency. Fig. 5.3 shows the elements to be considered for safe, effective radiotherapy.

Fig. 5.3. Elements to ensure the quality and safety of radiotherapy services



Source: reference 39

Radiotherapy requires the necessary infrastructure, routine maintenance, sustainable financing and an appropriately trained workforce. Selection of appropriate technologies requires technical understanding of the different types and

effects. When the health care system is ill-prepared or unable to maintain radiotherapy capacity, investments are lost (39).

Between 1998 and 2017, seven countries in the African Region lost capacity to deliver external beam radiotherapy machines; there has been significant progress in some of these countries in the past two years (8,40).

Donation of radiotherapy machines to LMIC should include oversight and consideration of the broader system requirements to ensure sustainable use (41).

Selection of equipment should be based on detailed technical specifications and capacity for treatment planning and delivery, QA, radiation safety and maintenance capacity (42). Placing of additional machines should depend on the context, current use and waiting time, the type and age of existing equipment, infrastructure capacity, workforce availability and competence and geographical accessibility. To promote sustainability and minimize unplanned expenditure, service costs could be included with the cost of procuring the unit.

Innovations in radiotherapy techniques and delivery systems include stereotactic ablative radiotherapy, intensity-modulated radiation therapy and image-guided radiation therapy, and these are routinely used in HIC, generally with clinically meaningful therapeutic value (Annex 2). Some innovative technologies such as proton therapy may cost more than US\$ 100 million and improve survival only marginally, raising questions about its value. National-level health technology assessments should be conducted before

technology acquisition decisions are made, rather than relying on published cost-effectiveness studies from other countries (43).

Appropriate training of radiation oncology workers in use of new or updated technology should be considered. The International Atomic Energy Agency provides a collection of syllabi for training radiation oncologists, radiation therapy technicians, radiation oncology nurses and medical physicists as well as e-learning platforms such as the Advanced Medical Physics Learning Environment and Human health campus, among others (Annex 1).

Surgical oncology: Cancer surgery is generally feasible in all settings and has accepted evidence-based indications by cancer type and stage. Surgical capacity is affected by workforce expertise and hospital capacity for highly specialized procedures (e.g. radical liver resection) or technology (e.g. minimally invasive procedures). New technologies available for surgical oncology include robot-assisted procedures, which cost billions of dollars per year (44) but have not been shown conclusively to result in better outcomes than conventional minimally invasive or open surgery in improved survival (45,46). Regulatory agencies have recently cautioned the public about use of robot-assisted procedures for some cancer operations (47,48). Policies, particularly in LMIC, should be directed to building capacity rather than investing in new surgical technologies for which evidence is lacking.

5.4 Supportive, survivorship and palliative care

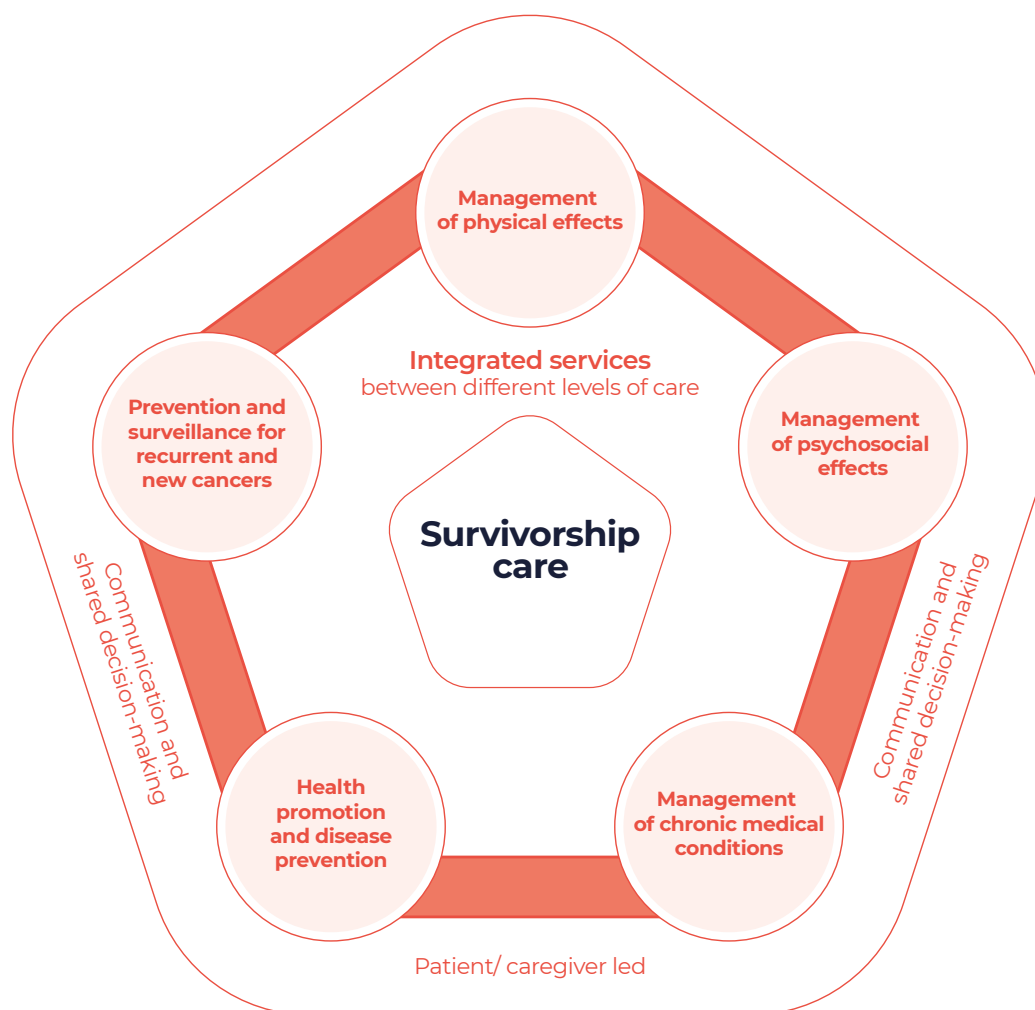
Survivorship and palliative care are critical elements of comprehensive cancer care. Care for late adverse effects of cancer and the psycho-social needs of long-term cancer survivors are increasingly important as treatment improves.

Palliative care — the prevention and relief of physical, psychological, social or spiritual suffering — of adults and children is essential to optimize their quality of life and maintain their dignity. Palliative care includes end-of-life care and should continue when treatment

is no longer beneficial or possible. Populations that require tailored policies and approaches include disadvantaged groups, the ageing population and adolescents and young adults, who have unique desires and needs, such as maintaining fertility. People with cancer embark on a journey involving complex, long-term, integrated care

(Fig. 5.4). Supportive, survivorship and palliative care should be integrated into broader health services, with clear communication among different levels of care to improve overall outcomes and efficiency (49,50).

Fig. 5.4. Elements of integrated care



Source: reference 50

5.4.1 Supportive care during treatment

Cancer patients at all stages of their disease require supportive services. Distress occurs in 20-50% of cancer patients (51), and symptoms such as pain, fatigue and nutritional problems should be systematically evaluated and addressed. Teaching self-help strategies to patients during and after treatment contributes to this approach. A psycho-oncologist should therefore be part of a multidisciplinary team.

Unmanaged depression and fear can worsen tolerance of treatment and discourage treatment completion (52). Similarly, malnutrition in all its forms (undernutrition, inadequate vitamins or minerals, overweight, obesity) is associated with poorer prognoses, including a greater likelihood of recurrence or death during or after treatment (53,54). Poor nutritional status is also associated with increased risks for toxic effects of chemotherapy,

lower quality of life and distress. Early clinical assessment, dietary counselling and, if necessary, nutritional supplements can improve quality of life and completion of treatment (55).

The aim of rehabilitation is to reduce the disabling effects of cancer and its treatment

and to facilitate early reintegration into social life, particularly for those who have morbidity associated with surgery (e.g. amputation) or tumour-related effects such as paralysis or loss of sight (56).

5.4.2

Survivorship care after treatment

In 2018, an estimated 43.8 million people were alive 5 years after a cancer diagnosis (57). As early diagnosis and treatment improve, the number of survivors will increase, and their health needs must be addressed by health systems. Survivorship care includes prevention and surveillance for recurrent and new cancers, management of long-term toxicity and co-morbid conditions and surveillance and management of psychosocial effects (Box 5.3).

Survivorship care should be adapted to the needs, preferences and resources of each patient and the health system and be delivered after completion of treatment,

coordinated by care teams that include a primary care physician (58). Particular consideration should be given to children. The cumulative burden of chronic health conditions resulting from cancer and its treatment at early ages is even more significant among survivors of childhood cancer, requiring a comprehensive approach for care transition as they grow from childhood into adulthood (59). Furthermore, approximately 12% of childhood cancer survivors are expected to carry alterations in cancer-predisposing genes, requiring close long-term follow-up and counselling (60).

Box 5.3. Survivor care and workforce re-integration in Japan

In Japan, 2-4% of the population are cancer survivors. With improvements in cancer management and high life expectancy, survivorship care has become a public health priority for policy-makers, providers and the general public. The 2007 national cancer plan required that all Government-designated cancer centres provide integrated care for cancer patients, from primary to specialty care. Recent national strategies provide support for returning to work, education for survivors and their relatives, support groups and survivorship courses and increasing public awareness. Relevant policies include the obligations of employers during and after cancer treatment (61,62).



5.4.3

Improving access to palliative care

The World Health Assembly has called for universal access to palliative care as part of UHC (63).

Therefore, palliative care should be included in national disease policies and strategic plans and as an essential component of comprehensive cancer care.

National policies that include palliative care should define it; affirm the medical and ethical necessity of universal access to palliative care for patients with serious illness; describe how palliative care will be integrated into cancer care and into the general health care system; and assure uninterrupted access to oral immediate-release and injectable morphine for all patients with moderate or severe pain or terminal dyspnoea. Strategic action plans should ensure access to all essential palliative medicines and to clinical guidelines on pain management. Regulations should be enacted to minimize diversion of opioids and other controlled medicines for non-medical uses, including a secure supply chain and safe storage, administration, dispensing and disposal.

Palliative care improves the quality of life of patients and families facing life-threatening illness and may improve survival (64,65). It involves preventing and relieving suffering by early identification, assessment and

treatment of physical, psychosocial and spiritual problems, maintenance of dignity (66) and controlling symptoms (67,68). A novel example of palliation is the provision of self-expanding stents for dysphagia in advanced oesophageal cancer that can be delivered in LMIC with a high incidence of this tumour (69). Palliative care networks that include home care also reduce overcrowding in hospitals, protect patients' families from financial risk and reduce costs to health care systems by reducing hospital admissions and length of stay (70,71).

A competence framework should require at least basic training (≥ 35 h) in palliative care for all primary care providers and intermediate training (≥ 70 h) for oncologists and other specialists who care for people with serious illness (72). Service delivery models should promote appropriate capacity in palliative care, at basic level in home and community health centres, intermediate level in hospitals and specialist level in cancer centres, with procedures for communication and smooth patient transfer among levels (see also Chapter 8).

5.5

Effective interventions for ensuring equitable access to high-quality care

Promoting access to cancer care as part of UHC requires appropriate selection of priority interventions, wise investment

to meet unmet need and policies to ensure high-quality health services (Table 5.1; see also section 6.4.3; 73).

Table 5.1. Domains of quality with examples of barriers to quality in cancer management (73)

Effective	Efficient	Accessible	Acceptable and patient-centred	Equitable	Safe
Evidence-based care results in better outcomes	Delivery of care so as to maximize use of resources and avoid waste	Delivery of care that is timely, at a reasonable distance and with appropriate skills and resources	Delivery of care according to the preferences and aspirations of people living with cancer and local culture	Delivery of care of the same quality for all	Delivery of care that minimizes risk and harm to people living with cancer and others
Examples of low-quality care					
Inadequately trained surgical workforce resulting in positive surgical margins	Inappropriate selection of medicines on national EML	Overly centralized system not accessible to geographically remote communities	Failure to include patient or family perspective in decision-making	High out-of-pocket payments	Treatment-related toxicity because of poor infection prevention and control
Unavailable or unused treatment guidelines or standards	Screening for thyroid cancer with no benefit, high rate of overdiagnosis, overtreatment		Poor communication of outcomes or prognosis	Discrimination by gender, age, race, religion or other characteristics	Unsafe handling or disposal of chemotherapy Lack of nuclear safety
Example of national strategies (beginning with assessment and coherence with broader strategies)					
Accreditation of facilities and providers	National standards of care	Strengthen referral pathways, build specimen transport networks	Engage cancer survivors and civil society Measure patient-reported outcomes and experience	Focus on UHC and customized programmes for disadvantaged populations	Set up or strengthen appropriate regulatory agencies and/or functions
Example of facility-based interventions					
Invest in in-service training	Use high-performing teams	Coordinate care within care network	Strengthen cadre with competence in patient navigation, psycho-oncology	Train staff in communication	Set up QA teams and platforms

5.5.1

National strategies and interventions to increase access to services

To improve outcomes, national activities should include clinical practice standards, service delivery structures, regulatory standards and sustainable procurement and supply chains (see also Chapters 7 and 8; 5, 74). Adherence to evidence-based treatment standards improves the quality of cancer care and outcomes (74), and national clinical practice guidelines reduce the likelihood of unacceptable deviations from standard care. Rapid innovations and new management strategies for particular molecular subtypes of cancer make it difficult to keep clinical practice guidelines up to date. For example, in the US National Cancer Center Network guidelines,

nearly 2000 different clinical decision-making points must be considered in managing cancer (75).

The complexity is increasing as patients receive additional lines of therapy

(Fig. 5.2) Furthermore, the evidence for clinical decisions is often of low quality or inconsistent, including case reports or “clinical experience only” (75), resulting in wide variation in clinical practice and off-label prescribing, particularly of third-line therapies and beyond (76). Adherence to guidelines in LMIC may be compromised by cost and availability (77).

Lack of standardization and insufficient oversight can result in inappropriate use of cancer medicines, proliferation of products, challenges to forecasting and supply planning for essential medicines (4,76). This results in higher costs and more frequent stock-outs (78). National cancer policies should ensure sustainable procurement and robust supply chains (see also section 8.2.4), and procurement practices should promote standardization and ensure adherence to best practices and cost-sensitive procurement, such as of biosimilars.



Standardization, accreditation and regulatory oversight of public and private facilities can promote quality and coordination (Box 5.1). High-quality outcomes are consistently correlated with high volume centres and providers,

probably because of better adherence to evidence-based processes of care, greater specialization or competence in team-based care and more advanced technologies (79–81; see also section 8.2.1).

Box 5.1. National cancer grid in India

The National Cancer Grid was established by the Government of India in 2012 to improve cancer outcomes. Its mandate is also to produce uniform evidence-based standards of care and facilitate exchanges of expertise and collaborative research to promote quality and coordination. The initiative began with 14 cancer centres

and now includes more than 200 centres, research institutes, patient groups and philanthropic organizations. The National Health Authority of India, responsible for implementing the national health insurance scheme, is discussing cancer treatment packages and pricing of services to be covered in the programme (80-82).



5.5.2

Facility strategies to improve the quality of care

WHO promotes establishment of cancer centres to centralize many components of an NCCP and to coordinate care delivery at peripheral sites. Cancer centres can have different capacities and functions, as there is no standard definition. Cancer centres may be separate, comprehensive cancer centres offering leadership, normative, coordinative and/or research function, or there may be a matrix of cancer centres, basic oncology units in secondary hospitals or a dedicated unit or facility for childhood cancer or other cancer types. A key element of cancer centres is the availability of multidisciplinary care.

Cancer treatment facilities under government supervision improve access and quality by ensuring that high-performing multidisciplinary teams follow standards of care. Multidisciplinary tumour boards ensure better clinical decisions by adhering to best practice and promoting an integrated, people-centred approach. Patients with cancer often see many specialists (83); if the specialists are not coordinated, the result may be fragmented, inefficient care.

As cancer care becomes more complex, teams are increasingly important for optimal delivery of high-quality care.

Tumour boards bring together all the health professionals involved in the care of a patient in periodic meetings to review all cases. As multidisciplinary tumour boards might be difficult to establish in LIC, global partnerships have been formed for online review of cases in institutions in various settings.

The main aspects of a multidisciplinary approach to the organization of cancer care have been well defined (84). High-performance, multidisciplinary cancer teams should have mechanisms for QA and quality improvement, such as morbidity and mortality conferences, teleconferencing with local, regional or international experts and a diverse team. Communication with cancer patients is necessary to orient services and ensure optimal decision-making (85). Many cancer patients are unaware of the goals or objectives of their treatment, which can result in inferior outcomes and inefficient use of resources (86).

Cancer treatment facilities should consider how to minimize toxicity and encourage completion of treatment, including by offering information and supportive services to them and their families and tracking patients by scheduling appointments and notifications.

Monitor and manage symptoms such as depression, that are commonly associated with cancer treatment can improve the quality of life of patients with advanced cancer (87).

Providing temporary housing for cancer patients and families as well as outpatient day care services for systemic therapy or radiotherapy can facilitate treatment, particularly for patients travelling long distances (88).

The rate of treatment-related toxicity can be greater than 30%, particularly in settings without QA or quality improvement programmes (89). It should be minimized to encourage completion of treatment, including scheduling appointments and notifications and offering information and supportive services to patients and their families. A call-back system for children who missed appointments in El Salvador reduced abandonment of treatment from 12% to 2%, and a systematic review found that routine communication with patients receiving oral chemotherapy improved their adherence and management of toxicity (90,91). Infection control, a blood

bank and pharmacy and nutritional and psychosocial support reduce treatment-related toxicity, and hospital protocols for managing life-threatening symptoms or toxicity such as febrile neutropenia can also improve outcomes.

In some settings, more than 50% of patients do not complete therapy because of increasing indirect costs or the physical, financial or emotional strain of treatment (92).

Supportive services, such as psycho-oncology, housing or vouchers, can improve treatment completion, particularly for populations of lower socioeconomic status or who live far from their treatment facility. Small investments in supportive services can have a major impact for individuals, families and communities.

Policies for safe handling and disposal of chemotherapy are necessary for the health of staff and for minimizing harm to the community. Lack of personal protective equipment can also expose staff to harm (93,94).

5.5.3 Engaging communities and people with cancer and their families in cancer management

Coalition-building and community engagement should be ensured to assess goals and priorities, particularly as cancer therapies become more individualized and complex. Patients with cancer, survivors and caregivers can provide insight into goals and gaps in current care. Communities can advocate for better knowledge, practice, policy and services and empower patients and communities (95).

Social factors also influence community perspectives of cancer. For example, the public may use “celebrity narratives” as a source of information (96), whereby well-known people with cancer can create perceptions about the best treatment, although their experience may not be

generalizable (97). Government, providers and communities should establish shared understanding and priorities.

Cancer patients and their families in countries at all income levels should be involved in decision-making with providers about their clinical care. They should be supported in making informed decisions by proper understanding of the disease, treatment, potential adverse effects and expected outcome (98). Programmes for shared decision-making include increasing patient engagement and training providers in positive action and behaviour (99). Support by civil society organizations and patient groups for caregivers, who are usually family members, reduces their physical and

psychological burden. Transparency and clear rules are essential for engagement and collaboration (100), based on principles of participatory governance. Any conflict of

interests in community involvement should be managed, while maintaining the integrity of the regulatory process (see also section 6.3.3).

5.6 Coordinated cancer management

Fragmentation of care is pervasive along the cancer care continuum and among levels of care, increasing costs, delaying treatment and obviating patient-centred care, which is the core objective of an integrated approach.

Standardized care pathways reduce variations in practice and improve coordination (74).

They should cover procedures and the level and location of care for each type of cancer. Transitions among providers and levels of care are particularly sensitive, and flexible agreements can ensure the best interests of patients. Education and training of providers in communication, teamwork and processes of care can improve

capacity and outcomes (101). Multidisciplinary teams facilitate dialogue among all providers. “Patient navigators” and “nursing case managers” can help patients through the care pathway and improve coordination and effectiveness (102).

The outcomes of care should be evaluated before and after coordinated care to identify any problems and evaluate their effectiveness. Electronic health records are helpful for organizational change and its evaluation (58). Furthermore, reimbursement systems that recognize the importance of integrated care and quality indicators support implementation of coordinated care.

5.7 Emerging science and programmes

The pace of innovation and resources in cancer treatment has implications for cancer patients and the stability of health systems. Every element of cancer care is affected, from systemic to radiation therapy, surgery and diagnostic imaging to use of real-world data and machine learning to improve clinical decisions. Positive effects, including reduced cancer mortality, have been seen, particularly in HIC (103).

These achievements reflect years of investment in cancer research and innovation. A high return on investment has, however, also had negative effects on the market (104; see also section 5.3.2), including medicines of little therapeutic value but high potential profit (4). CAR-T therapy is an example of an innovation now being used in HIC (Annex 2). The types of challenges for implementation are similar to those for other recent therapies: defining and selecting high-impact indications, delivering high-quality care with an appropriately trained workforce and diagnostic and support

services, promoting access and ensuring financial sustainability for the system without financial hardship for individuals (Annex 2). The promises of innovation, including precision cancer care, have, however, been available to only a very small minority of the global population (13), and the future policy response to innovative cancer therapy must be based on UHC. Most essential cancer therapies are effective and affordable; scaling-up essential services to every patient in the world remains a priority (see section 2.4).

References

1. Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Piñeros M, et al. Global Cancer Observatory: cancer tomorrow. Lyon: International Agency for Research on Cancer; 2019.
2. Cylus J, Papanicolas I, Smith PC. How to make sense of health system efficiency comparisons? (Policy brief 27). Copenhagen: World Health Organization Regional Office for Europe; 2017 (http://www.euro.who.int/_data/assets/pdf_file/0005/362912/policy-brief-27-eng.pdf, accessed January 2020).
3. Cyawali B, Hey SP, Kesselheim AS. Assessment of the clinical benefit of cancer drugs receiving accelerated approval. *JAMA Intern Med.* 2019;179 (7):906–13.
4. Technical report: pricing of cancer medicines and its impacts: a comprehensive technical report for the World Health Assembly Resolution 70.12: operative paragraph 2.9 on pricing approaches and their impacts on availability and affordability of medicines for the prevention and treatment of cancer. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/277190>, accessed January 2020).
5. Callahan R, Darzi A. Five policy levers to meet the value challenge in cancer care. *Health Affairs.* 2015;34 (9):1563–8.
6. WHO NCD Country Capacity Survey. 2019. (<https://www.who.int/ncds/surveillance/ncd-capacity/en/>, Accessed January 2020)
7. Foerster M, Anderson BO, McKenzie F, Galukande M, Anele A, Adisa C, et al. Inequities in breast cancer treatment in sub-Saharan Africa: findings from a prospective multi-country observational study. *Breast Cancer Res.* 2019;21 (1):93.
8. Directory of radiotherapy centres. Vienna: International Atomic Energy Agency; 2020 (<https://dirac.iaea.org/>, accessed January 2020).
9. WHO model lists of essential medicines. Geneva: World Health Organization; 2019 (<https://www.who.int/medicines/publications/essentialmedicines/en/>, accessed January 2020).
10. Bazargani YT, de Boer A, Schellens JHM, Leufkens HGM, Mantel-Teeuwisse AK. Selection of oncology medicines in low-and middle-income countries. *Ann Oncol.* 2014;25 (1):270–6.
11. Robertson J, Barr R, Shulman LN, Forte GB, Magrini N. Essential medicines for cancer: WHO recommendations and national priorities. *Bull World Health Organ.* 2016;94 (10):735–42.
12. Martel YM, Chiyapo S, Grover S, Hanna C, Dryden-Peterson S, Pusoentsi M, et al. Methodology to forecast volume and cost of cancer drugs in low- and middle-income countries. *J Glob Oncol.* 2018;4:1–8.
13. Cherry NI, Sullivan R, Torode J, Saar M, Eniu A. ESMO International Consortium Study on the availability, out-of-pocket costs and accessibility of antineoplastic medicines in countries outside of Europe. *Ann Oncol.* 2017;28 (11):2633–47.
14. Giyawali B, Kesselheim AS. Reinforcing the social compromise of accelerated approval. *Nat Rev Clin Oncol.* 2018;15:596–7.
15. Giyawali B, Sharma S, Booth CM. Is the number of cancer drug approvals a surrogate for regulatory success? *J Cancer Policy.* 2019;22:100202.
16. FDA approved drugs. Falls Church (VA): wcg CenterWatch; 2020 (<https://www.centerwatch.com/directories/1067-fda-approved-drugs/topic/103-oncology>, accessed January 2020).
17. Long G. The biopharmaceutical pipeline: innovative therapies in clinical development. Boston (MA): Analysis Group Inc; 2017 (<https://www.analysisgroup.com/Insights/publishing/the-biopharmaceutical-pipeline--innovative-therapies-in-clinical-development/>, accessed January 2020).
18. Dusetzina SB, Huskamp HA, Keating NL. Specialty drug pricing and out-of-pocket spending on orally administered anticancer drugs in Medicare Part D, 2010 to 2019. *JAMA.* 2019;321(20):2025–7.
19. Del Paggio JC, Azariah B, Sullivan R, Hopman WM, James FV, Roshni S, et al. Do contemporary randomized controlled trials meet ESMO thresholds for meaningful clinical benefit? *Ann Oncol.* 2017;28(11):157–62.
20. Haslam A, Prasad V. Estimation of the percentage of US patients with cancer who are eligible for and respond to checkpoint inhibitor immunotherapy drugs. *JAMA Netw Open.* 2019;2 (5):e192535.
21. Kandolf Sekulovic L, Peris K, Hauschild A, Stratigos A, Grob JJ, Nathan P, et al. More than 5000 patients with metastatic melanoma in Europe per year do not have access to recommended first-line innovative treatments. *Eur J Cancer.* 2017;75:313–22.
22. Seya MJ, Gelders SFAM, Achara OU, Milani B, Scholten WK. A first comparison between the consumption of and the need for opioid analgesics at country, regional and global level. *J Pain Palliative Care Pharmacother.* 2011;25:6–18.
23. Narcotic Drugs — technical report. International Narcotics Control Board. (https://www.incb.org/incb/en/narcotic-drugs/Technical_Reports/narcotic_drugs_reports.html, Accessed January 2020)
24. Sullivan R, Peppercorn J, Sikora K, Zalcberg J, Meropol NJ, Amir E, et al. Delivering affordable cancer care in high-income countries. *Lancet Oncol.* 2011;12(10):933–80.
25. Atun R, Jaffray DA, Barton MB, Bray F, Baumann M, Vikram B, et al. Expanding global access to radiotherapy. *Lancet Oncol.* 2015;16(10):1153–86.
26. Sullivan R, Alatisse OI, Anderson BO, Audisio R, Autier P, Aggarwal A, et al. Global cancer surgery: delivering safe, affordable, and timely cancer surgery. *Lancet Oncol.* 2015;16(11):1193–224.
27. Donnelly L. Thousands of cancer cases to be denied treatment. *The Telegraph*, 4 September 2015 (<https://www.telegraph.co.uk/news/health/11844314/Thousands-of-cancer-patients-to-be-denied-treatment.html>, accessed January 2020).
28. Crowe K. Will price be a barrier to new cancer immunotherapy? *CBC News*, 19 January 2019 (<https://www.cbc.ca/news/health/car-t-immunotherapy-cadt-provinces-health-canada-all-non-hodgkin-lymphoma-14984943>, accessed January 2020).
29. Saving lives, spending less. A strategic response to noncommunicable diseases. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/bitstream/handle/10665/272534/WHO-NMH-NVI-18-8-eng.pdf>, accessed January 2020).
30. Gelband H, Sankaranarayanan R, Gauvreau CL, Horton S, Anderson BO, Bray F, et al. Costs, affordability, and feasibility of an essential package of cancer control interventions in low-income and middle-income countries: key messages from Disease Control Priorities, 3rd edition. *Lancet.* 2016;387(10033):2133–44.
31. Morgan C, Ward R, Barton M. The contribution of cytotoxic chemotherapy to 5-year survival in adult malignancies. *Clin Oncol R Coll Radiol.* 2004;16(8):549–60.
32. Predict breast cancer. Cambridge: University of Cambridge; 2020 (<https://breast.predict.nhs.uk/tool>, accessed January 2020).
33. Hanappe M, Nicholson LT, Elmore SNC, Fehr AE, Bigirimana JB, Borg RC, et al. International radiotherapy referrals from rural Rwanda: implementation processes and early clinical outcomes. *J Glob Oncol.* 2018;4:1–12.
34. Cyawali B, Sullivan R, Booth CM. Cancer groundshot: going global before going to the moon. *Lancet Oncol.* 2018;19 (3):288–90.
35. Pilot procedure for prequalification of biotherapeutic products and similar biotherapeutic products. Geneva: World Health Organization; 2019 (https://www.who.int/medicines/regulation/biotherapeutic_products/en/, accessed January 2020).
36. Biosimilars: a new era in access to breast cancer treatment (editorial). *Lancet.* 2020;395(10217):2.
37. Kuderer NM, Burton KA, Blau S, Rose AL, Parker S, Lyman GH, et al. Comparison of 2 commercially available next-generation sequencing platforms in oncology. *JAMA Oncol.* 2017;3(7):996–8.
38. Stetson D, Ahmed A, Xu X, Nuttall BRB, Lubinski TJ, Johnson JH, et al. Orthogonal comparison of four plasma NGS tests with tumor suggests technical factors are a major source of assay discordance. *JCO Precision Oncol.* 2019;3:1–9.
39. International Atomic Energy Agency, World Health Organization. Roadmap towards a national cancer control programme. Milestones for establishing nuclear medicine, diagnostic imaging and radiotherapy services. Vienna: International Atomic Energy Agency; 2019 (<https://www.iaea.org/sites/default/files/19/10/milestones-document-2019.pdf>, accessed January 2020).
40. Balogun O, Rodin D, Ngwa W, Grover S, Longo J. Challenges and prospects for providing radiation oncology services in Africa. *Semin Radiat Oncol.* 2017;27(2):184–8.
41. Medical device donations: considerations for solicitation and provision. WHO. (https://apps.who.int/iris/bitstream/handle/10665/44568/9789241501408_eng.pdf?sequence=1, Accessed January 2020)
42. Setting up a radiotherapy programme: clinical, medical physics, radiation protection and safety aspects. Vienna: International Atomic Energy Agency; 2008 (https://www-pub.iaea.org/MTCD/Publications/PDF/pub1296_web.pdf, accessed January 2020).
43. Jones DA, Smith J, Mei XW, Hawkins MA, Maughan T, van den Heuvel F, et al. A systematic review of health economic evaluations of proton beam therapy for adult cancer: appraising methodology and quality. *Clin Transl Radiat Oncol.* 2019;20:19–26.
44. Childers CP, Maggard-Gibbons M. Estimation of the acquisition and operating costs for robotic surgery. *JAMA.* 2018;320(8):835–6.
45. Jayne D, Pigazzi A, Marshall H, Croft J, Corrigan N, Copeland J, et al. Effect of robot-assisted vs conventional laparoscopic surgery on risk of conversion to open laparotomy among patients undergoing resection for rectal cancer. The ROLARR randomized clinical trial. *JAMA.* 2017;318(16):1569–80.
46. Roh HF, Nam SH, Kim JM. Robot-assisted laparoscopic surgery versus conventional laparoscopic surgery in randomized controlled trials: a systematic review and meta-analysis. *PLoS One.* 2018;13(1):e0191628.
47. Caution when using robotically-assisted surgical devices in women's health including mastectomy and other cancer-related surgeries. FDA safety communication. White Oak (MD): Food and Drug Administration; 2019 (<https://www.fda.gov/medical-devices/safety-communications/caution-when-using-robotically-assisted-surgical-devices-womens-health-including-mastectomy-and>, accessed January 2020).
48. Computer-assisted surgical systems. White Oak (MD): Food and Drug Administration; 2019 (<https://www.fda.gov/medical-devices/surgery-devices/computer-assisted-surgical-systems>, accessed January 2020).
49. Tonorezous ES, Conigliaro J. Integration of cancer survivorship care and primary care practice. *JAMA Intern Med.* 2017;177(12):1732–4.
50. Nekhyudov L, Mollica MA, Jacobsen PB, Mayer DK, Shulman LN, Geiger AM. Developing a quality of cancer survivorship care framework: implications for clinical care, research, and policy. *J Natl Cancer Inst.* 2019;111(11):1120–30.
51. Riba M, Donovan K, Andersen B, Braun I, Breitbart WS, Brewer BW, et al. Distress management, version 3.2019, NCCN Clinical Practice Guidelines in Oncology. *J Natl Comp Cancer Netw.* 2019;17 (10):1229–49.
52. Katon W, Lin EHB, Kroenke K. The association of depression and anxiety with medical symptom burden in patients with chronic medical illness. *Gen Hosp Psychiatry.* 2007;29:147–55.
53. Zhang X, Sun M, Geng Y, Dinney CPN, Popat UR, Champlin RE, et al. Malnutrition and overall survival in older patients with cancer. *J Clin Oncol.* 2018;36(15):e22015.
54. Parekh N, Chandran U, Bandera EV. Obesity in cancer survival. *Annu Rev Nutr.* 2012;32:311–42.
55. van Cutsem E, Arends J. The causes and consequences of cancer-associated malnutrition. *Eur J Oncol Nurs.* 2005;9:51–63.
56. Weis J, Geisler J. Rehabilitation of cancer patients. *Recent Res Cancer Res.* 2018;210:105–22.
57. Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Piñeros M, et al. Global Cancer Observatory: cancer today. Lyon: International Agency for Research on Cancer; 2019.
58. Albrecht T, Borrás Andrés JM, Dalmas M, De Lorenzo F, Ferrari C, Honing C. Chapter 7. Survivorship and rehabilitation: policy recommendations for quality improvement in cancer survivorship and rehabilitation in EU Member States. In: Albrecht T, Kiasuwa R, Van den Bulcke M, editors. European guide on quality improvement in comprehensive cancer control. Ljubljana: National Institute of Public Health; Brussels: Scientific Institute of Public Health; 2017 (https://cancercontrol.eu/archived/uploads/images/Guide/042017/CanCon_Guide_7_Survivorship_LR.pdf, accessed January 2020).
59. Bhakta N, Liu Q, Ness KK, Baassiri M, Eissa H, Yeo F, et al. The cumulative burden of surviving childhood cancer: an initial report from the St Jude Lifetime Cohort Study (SJLIFE). *Lancet.* 2017;390(10112):2569–82.
60. Wilson CL, Wang Z, Liu Q, Ehrhardt MJ, Mostafavi R, Easton J, et al. Estimated number of adult survivors of childhood cancer in United States with cancer-predisposing germline variants. *Pediatr Blood Cancer.* 2020;67(2):e28047.
61. Cancer survivorship country profile Japan. London: The Economist Intelligence Unit Ltd; 2017 (<http://cancersurvivorship.eiu.com/wp-content/uploads/sites/36/2017/07/Japan.pdf>, accessed January 2020).
62. Takahashi M. Cancer survivorship: current status of research, care, and policy in Japan. *Jpn J*

References

- Clin Oncol. 2016;599 -604.
63. Strengthening of palliative care as a component of comprehensive care throughout the life course (WHA67.19). Geneva: World Health Organization; 2014 (http://apps.who.int/gb/ebwha/pdf_files/WHA67/A67_R19-en.pdf, accessed January 2020).
64. Haun MW, Estel S, Rücker G, Friederich HC, Villalobos M, Thomas M, et al. Early palliative care for adults with advanced cancer. *Cochrane Database Syst Rev*. 2017;6:CD011129.
65. Knaul FM, Farmer PE, Krakauer EL, De Lima L, Bhadelia A, Jiang Kwete X, et al. Alleviating the access abyss in palliative care and pain relief — an imperative of universal health coverage: the Lancet Commission report. *Lancet*. 2018;391(10128):1391-454. Erratum in: *Lancet*. 2018; PubMed PMID: 29032993.
66. WHO definition of palliative care. Geneva: World Health Organization; 2019 (<https://www.who.int/cancer/palliative/definition/en/>, accessed January 2020).
67. Kaasa S, Loge J, Aapro M, Albrecht T, Anderson R, Bruera E, et al. Integration of oncology and palliative care: a Lancet Oncology Commission. *Lancet Oncol*. 2018;19:e588 -653.
68. White RE, Parker RK, Fitzwater JW, Kasepoi Z, Topazian M. Stents as sole therapy for oesophageal cancer: a prospective analysis of outcomes after placement. *Lancet Oncol*. 2009;10(3):240 -6.
69. Chalkidou KP, Marquez PK, Dhilon Y, Teerawattananon Y, Anothaisintawee T, Gadelha CA, et al. Evidence-informed frameworks for cost-effective cancer care and prevention in low, middle, and high-income countries. *Lancet Oncol*. 2014;15(3):e119 -31.
70. DesRosiers TC, Cupido E, Pitout L, van Niekerk L, Badri M, Gwyther L, et al. A hospital-based palliative care service for patients with advanced organ failure in sub-Saharan Africa reduces admissions and increases home death rates. *J Pain Symptom Manage*. 2014;47 (4):786 -92.
71. Integrating palliative care and symptom relief into primary health care: a WHO guide for planners, implementers and managers. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/274559>, accessed January 2020).
72. Handbook for national quality policy and strategy. A practical approach for developing policy and strategy to improve quality of care. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/bitstream/handle/10665/272357/9789241565561-eng.pdf?ua=1>, accessed January 2020).
73. Quality of care. A process for making strategic choices in health systems. Geneva: World Health Organization; 2006 (https://www.who.int/management/quality/assurance/QualityCare_B.Def.pdf, accessed January 2020).
74. Cancer care. Assuring quality to improve survival. Paris: Organization for Economic Cooperation and Development; 2013 (<https://www.oecd.org/health/cancer-care-9789264181052-en.htm>, accessed January 2020).
75. Liu X, Tang LL, Mao YP, Liu Q, Sun Y, Chen L, et al. Evidence underlying recommendations and payments from industry to authors of the National Comprehensive Cancer Network Guidelines. *Oncologist*. 2019;24(4):498 -504.
76. Saiyed MM, Ong PS, Chew L. Off-label drug use in oncology: a systematic review of literature. *J Clin Pharm Ther*. 2017;42 (3):251 -8.
77. Vijaykumar DK, Arun S, Abraham AG, Hopman W, Robinson AG, Booth CM. Breast cancer care in South India: Is practice concordant with national guidelines? *J Glob Oncol*. 2019;5:1 -7.
78. Giordano SH, Niu J, Chavez-MacGregor M, Zhao H, Zorzi D, Shih YT, et al. Estimating regimen-specific costs of chemotherapy for breast cancer: observational cohort study. *Cancer*. 2016;122(22):3447 -55.
79. Horne AWB, McMenemy M, Holly E, Rigglesford N, Linksted P, Murdoch L, et al. Real-world treatment sequencing patterns in secondary breast cancer (SBC): pathway visualisation using national datasets. *Ann Oncol*. 2019;30 (Suppl 5):378P.
80. Pramesh CS, Badwe RA, Sinha RK. The national cancer grid of India. *Indian J Med Paediatr Oncol*. 2014;35(3):226 -7.
81. Cousins S. Hospital trains on different tracks. *Bull World Health Organ*. 2020;98:6 -7.
82. National cancer grid. Mumbai: Tata Memorial Centre; 2019 (<https://tmc.gov.in/ncg/index.php>, accessed January 2020).
83. Smith SD, Nicol KM, Devereux J, Cornbleet MA. Encounters with doctors: quantity and quality. *Palliat Med*. 1999;13 (3):217 -23.
84. European Partnership Action Against Cancer Consensus Group. Policy statement on multidisciplinary cancer care. *Eur J Cancer*. 2014;50:476 -80.
85. Slavova-Azmanova N, Newton JC, Hohnen H, Johnson CE, Saunders C. How communication between cancer patients and their specialists affect the quality and cost of cancer care. *Support Care Cancer*. 2019;27 (12):4575 -85.
86. Faricy-Anderson KE, Allen SM, Freeman NJ, Bishop KD, Mor V. Patient expectations f palliative cancer treatment. *J Clin Oncol*. 2017;33(15):e17703.
87. Denis F, Lethrosne C, Pourel N, Molinier O, Pointreau Y, Domont J, et al. Randomized trial comparing a web-mediated follow-up with routine surveillance in lung cancer patients. *J Natl Cancer Inst*. 2017;109(9):djt029. Corr. *J Natl Cancer Inst*. 2018;110(4):436.
88. Israels T, Ribeiro RC, Molyneux EM. Strategies to improve care for children with cancer in Sub-Saharan Africa. *Eur J Cancer*. 2010;46(11):1960 -1966. doi:10.1016/j.ejca.2010.03.027
89. National Cancer Control Programmes Policies and Managerial Guidelines, 2nd Edition. Geneva: World Health Organization; 2002 (<https://apps.who.int/iris/bitstream/handle/10665/42494/9241545577.pdf?sequence=1>, accessed January 2020).
90. Howard SC, Davidson A, Luna-Fineman S, Israels T, Chantada G, Lam CG, et al. A framework to develop adapted treatment regimens to manage pediatric cancer in low- and middle-income countries: The Pediatric Oncology in Developing Countries (PODC) Committee of the International Pediatric Oncology Society (SIOP). *Pediatr Blood Cancer*. 2017;64(Suppl 5):e26879.
91. Zerillo JA, Goldenberg BA, Kotecha RR, Tewari AK, Jacobson JO, Krzyzanowska MK. Interventions to improve oral chemotherapy safety and quality: a systematic review. *JAMA Oncol*. 2018;4(1):105 -17.
92. Friedrich P, Lam CG, Itriago E, Perez R, Ribeiro RC, Arora RS. Magnitude of treatment abandonment in childhood cancer. *PLoS One*. 2015;10(9):e0135230.
93. Safe handling of hazardous chemotherapy drugs in limited-resource settings. Washington DC: WHO Regional Office for the Americas; 2013 (<https://www.paho.org/hq/dmdocuments/2014/safe-handling-chemotherapy-drugs.pdf>, accessed January 2020).
94. Pergert P, Sullivan CE, Adde M, Afungchwi GM, Downing J, Hollis R, et al. An ethical imperative: safety and specialization as nursing priorities of WHO Global Initiative for Childhood Cancer. *Pediatr Blood Cancer*. 2019:e28143.
95. Schear RM, Manasco L, McGoldrick D, Kajana K, Rosenthal L, McMikel A, et al. International framework for cancer patient advocacy: empowering organizations and patients to create a national call to action on cancer. *Global Oncol*. 2015;1(2):83 -91.
96. Yerramilli D, Charrow A, Caplan A. How should clinicians respond when patients are influenced by celebrities' cancer stories? *J Ethics*. 2018;20(1):E1075 -81.
97. Evans DGR, Barwell J, Eccles DM, Collins A, Izatt L, Jacobs C, et al. The Angelina Jolie effect: how high celebrity profile can have a major impact on provision of cancer related services. *Breast Cancer Res*. 2014;16(5):442.
98. Elwyn G, Laitner S, Coulter A, Walker E, Watson P, Thomson R. Implementing shared decision making in the NHS. *Br Med J*. 2010;341:c5145.
99. Covey JR, Kamal KH, Gorse EE, Mehta Z, Dhumal T, Heidari E, et al. Barriers and facilitators to shared decision-making in oncology: a systematic review of the literature. *Supportive Care Cancer*. 2019;27:1613 -37.
100. Greer SL, Wismar M, Pastorino G, Kosinska M. Civil society and health. Contributions and potential (Health Policy Series 48). Copenhagen: World Health Organization Regional Office for Europe; 2017 (http://www.euro.who.int/_data/assets/pdf_file/0011/349526/Civil-society-web-back-cover-updated.pdf, accessed January 2020).
101. Patient Safety A World Alliance for Safer Health Care World Health Organization https://www.who.int/patientsafety/education/curriculum/course4_handout.pdf Accessed January 2020.
102. Gilbert JE, Green E, Lankshear S, Hughes E, Burkowski V, Sawka C. Nurses as patient navigators in cancer diagnosis: review, consultation and model design. *Eur J Cancer Care*. 2011;20(2):228 -36.
103. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. *CA Cancer J Clinicians*. 2020;70(1):7 -30.
104. Huang KB, NambudiriVE. How Is money changing medicine? Venture capital investment in oncology. *JAMA Oncol*. 2020;doi:10.1001/jamaoncol.2019.5348.

Putting it all together:

decision-making and implementation

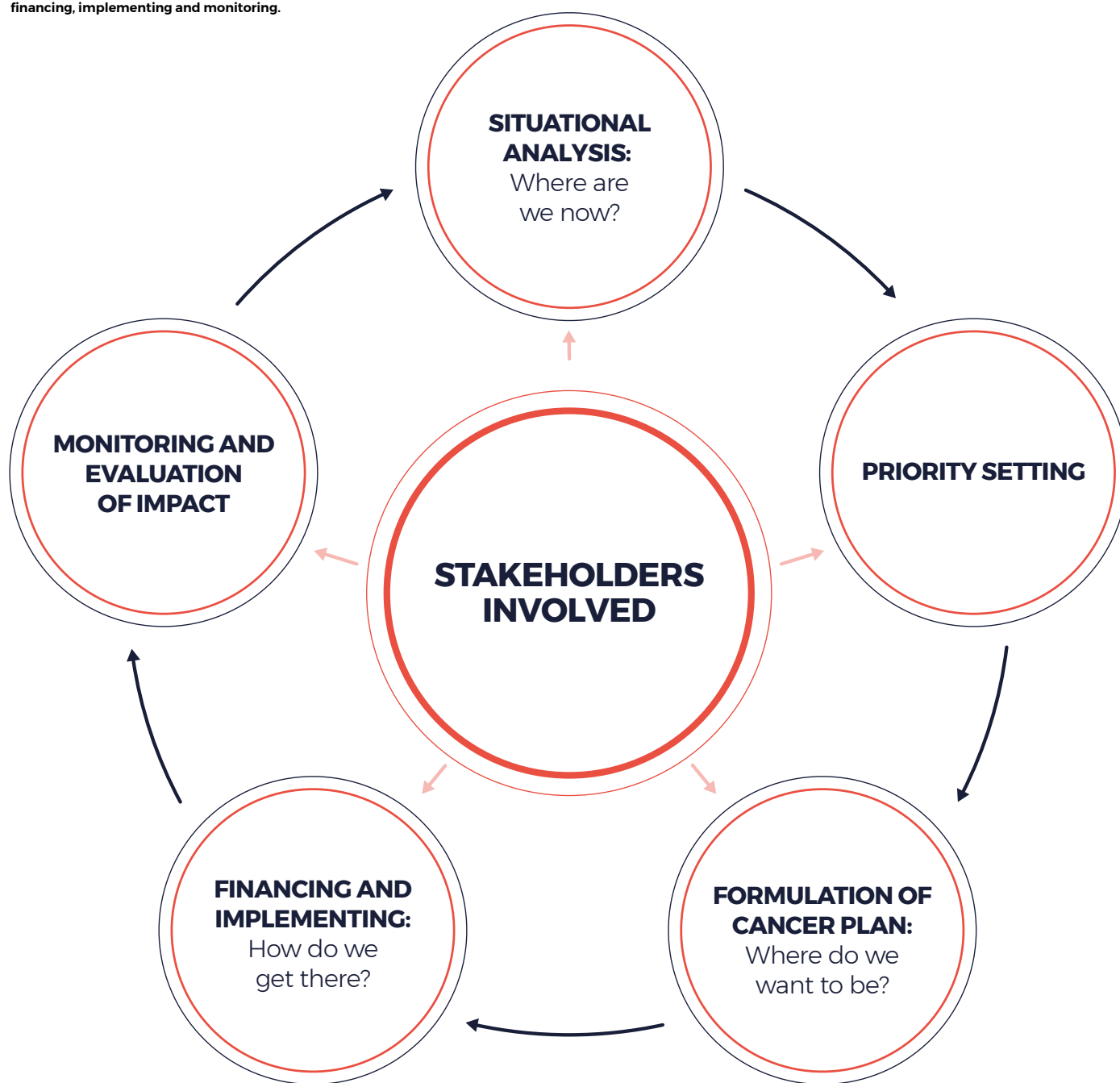
Robust cancer control planning and implementation should be pursued in steps framed by (Fig. III.1.):

- strong governance;
- collecting and analysing data;
- establishing an evidence-based NCCP that is resource appropriate and sustainable;
- ensuring financing; and
- effective implementation involving relevant stakeholders with monitoring and accountability.

Only 108 countries have an operational cancer control plan (1).

1. WHO NCD Country Capacity Survey, 2019. (<https://www.who.int/ncds/surveillance/ncd-capacity/en/>, Accessed January 2020)

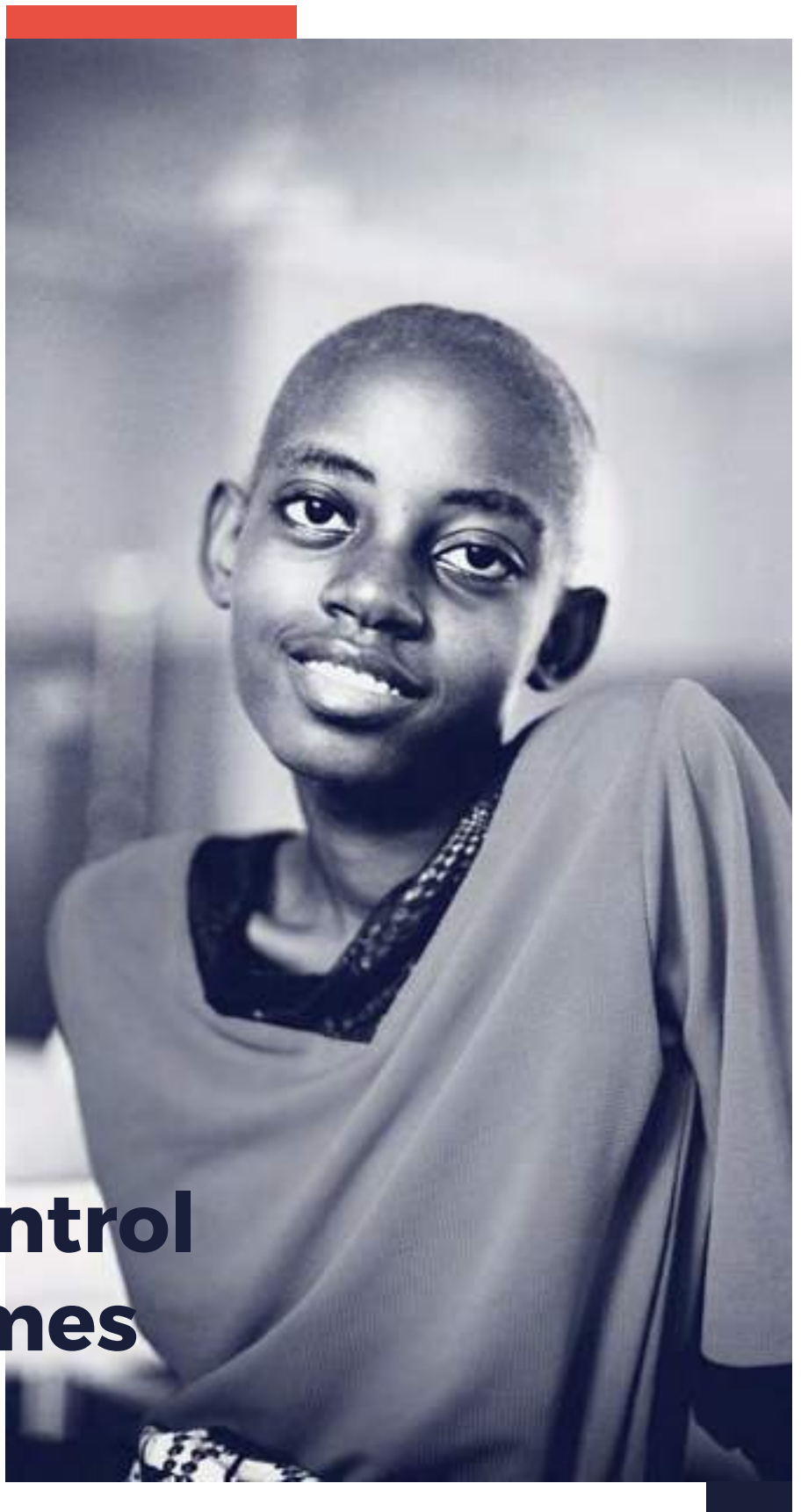
Fig. III.1. Process of cancer control planning, financing, implementing and monitoring.



This section demonstrates the importance of a solid cancer control plan, informed by evidence-based approaches discussed in section II, sound financing strategy and robust implementation to ensure access to effective prevention and treatment of cancer.

Chapter 06.

Planning cancer control programmes



The background of the page is a dark blue field filled with numerous handprints of varying sizes and orientations, all in a lighter blue shade. At the top left, there is a solid orange rectangular bar. At the bottom right, there is a solid light purple rectangular bar.

Key messages

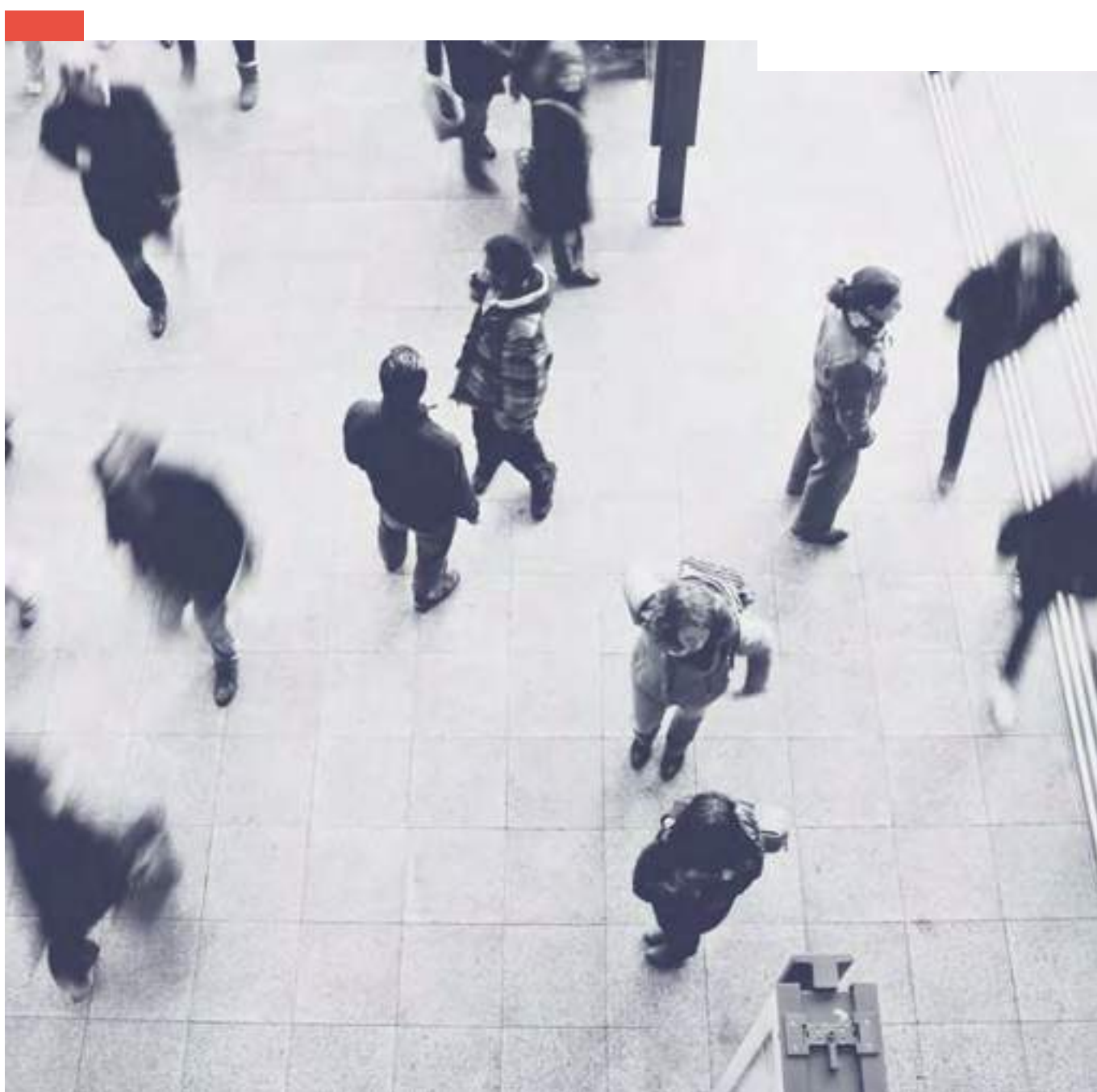
- 1.** Planning of cancer control starts with the collection and analysis of data on incidence and mortality, the prevalence of risk factors and the current system capacity and performance.
- 2.** Increasing investment in information systems, strengthening governance structures and coordinating stakeholder input will increase capacity to plan programmes and translate them into practical results. National cancer programmes should consider their broader planning perspective and base their plans on comprehensive, realistic targets.
- 3.** Relevant stakeholders should be identified and engaged in planning, implementation and evaluation of national programmes. Stakeholder engagement requires a robust governance structure within ministries of health and requires working with other government agencies and non-State actors.
- 4.** Cancer services for all ages should be included in UHC benefits packages. The specific services included depend on the country context, epidemiological burden, health system capacity and priorities. An extension path should be planned as more resources become available.

6.1

Approach to planning and programmes

WHO defines national cancer control programmes as “public health programmes designed to reduce cancer incidence and mortality and to improve quality of life of cancer patients, through the systematic and equitable implementation of evidence-based strategies for prevention, early diagnosis, treatment and palliation making the best use of available resources” (Annex 2). Plans are

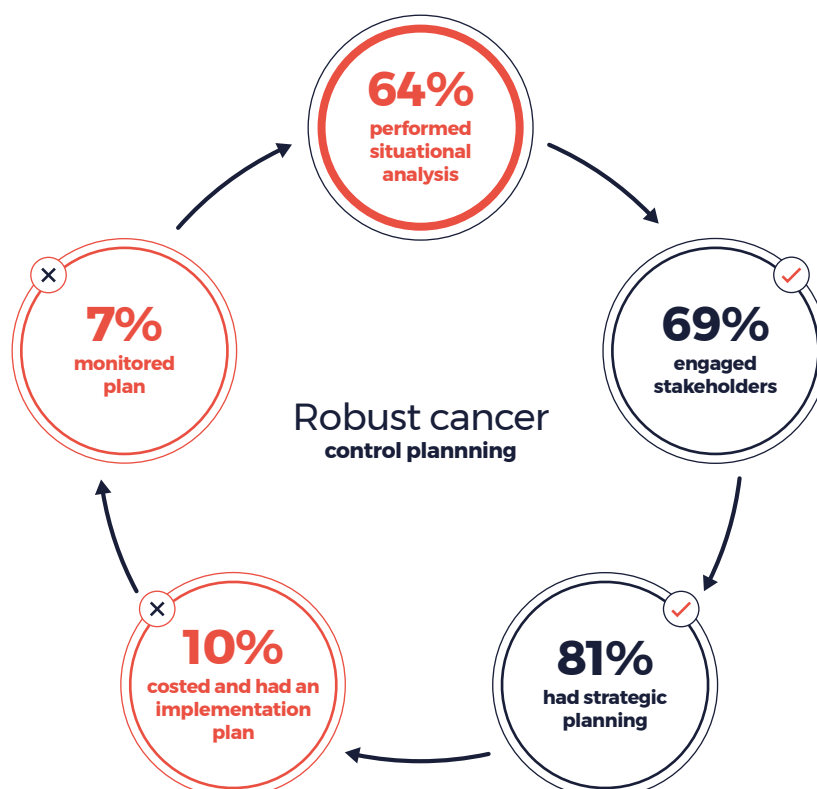
necessary to proactively address the growing burden of cancer. They should be based on a careful, systematic analysis of the burden of cancer and the resources and capacity available to inform policy, define the priorities for intervention and evaluate their impact.



While 158 countries (81% of WHO Member States) had a cancer plan or an NCD plan that included cancer, the quality of the plan varies (7) (Fig. 6.1). Countries with a dedicated cancer control plan tend to have more comprehensive, coherent, consistent policies than those with a cancer strategy within a broader NCD plan, reflecting the importance of a dedicated strategy for cancer.

The main limitations identified in cancer plans were unrealistic priorities and lack of robust costing and sustainable budgeting. While reports from HIC show the value of an NCCP in improving population outcomes, failure to cost, finance and implement plans, particularly in LMIC, has resulted in plans with little impact (1,2).

Fig. 6.1: Common gaps in cancer control plans and lack of evidence of implementation



6.2 Cancer Intelligence and information systems

6.2.1 Building cancer intelligence: from registries to integrated information systems

A population-based cancer registry is the gold standard and an essential component of cancer information systems (Fig. 6.2). It collects data from multiple sources (including hospitals, diagnostic laboratories and vital statistics) on all reportable neoplasms in a geographically defined population and reflects diagnostic and treatment services accessed by reported

cases. A population-based cancer registry, linked to death records, is integral to measuring the scale and profile of cancer in a country and assessing the effectiveness of interventions, including evaluation of survival, trends in treatment outcomes for specific types of cancer and potential differences among populations (Box 6.1).

Box 6.1. IARC and cancer registries

IARC has a mandate from WHO to provide technical assistance to countries in collecting standard, quality-assured data on cancer to inform national policy and to use the information to estimate the global cancer burden. IARC ensures the consistency of the methods used by registries throughout the world to permit international comparisons of incidence, adjusted by age; similar comparisons can be made of mortality rates. Both measures can be used to set national priorities for cancer control. All cancer registries that are active and comply with the IARC criteria for quality are listed in the database of the Global Cancer Observatory at IARC (www.gco.iarc.fr).

An IARC-led global partnership of international organizations, the Global Initiative for Cancer Registry Development (<http://gicr.iarc.fr>) is strengthening cancer registries by establishing hubs for collaboration, training trainers and promoting standardization of cancer registration practice.



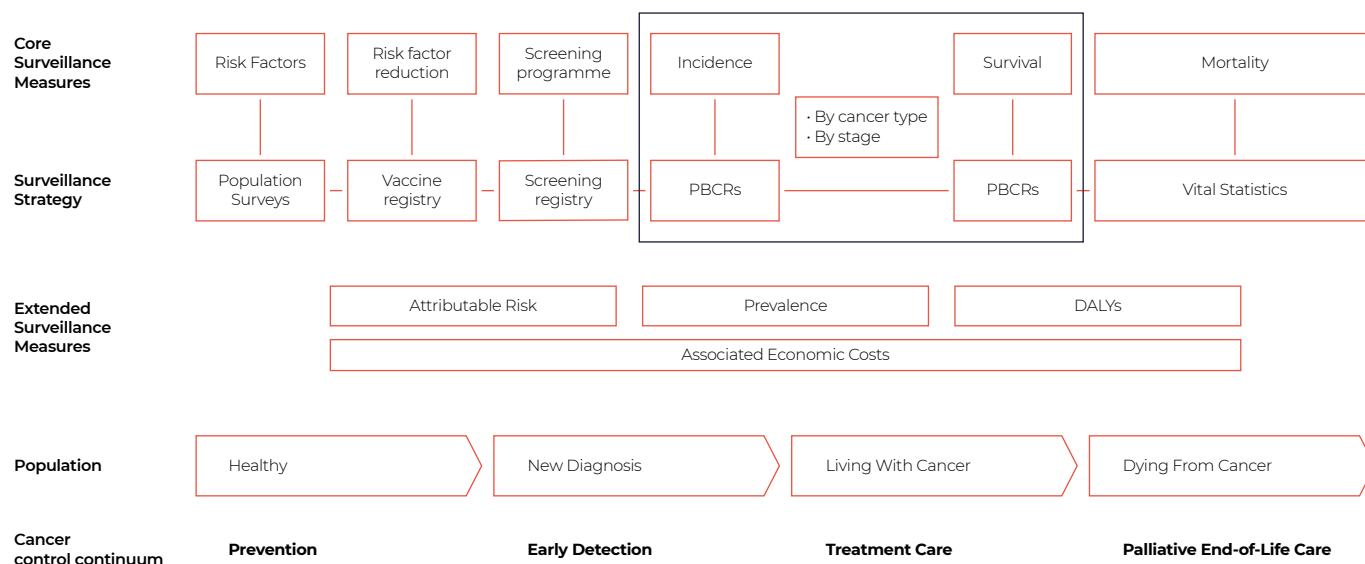
Coverage of both cancer registries and mortality statistics is limited and unequal. Approximately one in three countries has high-quality incidence data (Fig. 6.3).

Only one in four countries has high-quality mortality statistics to inform decision-making in cancer planning (3).

Investments in information systems are important for setting accurate priorities, optimizing programme effectiveness and ensuring efficient expenditure. As cancer information systems develop, opportunities will emerge to link cancer registry databases to cancer-related vaccine

registries, cancer screening registries and treatment records in public and private health care systems to make optimal use of the data in monitoring programmes and for research on the causes and control of cancer (Box 6.2). Progressive introduction of electronic health records has opened possibilities for integrated information systems and evaluation of health services.

Fig. 6.2. Domains on which research can be conducted with data from basic and from advanced, data-enhanced cancer registries



Source: reference 3.

PBCR, population-based cancer registry; DALY,

disability-adjusted life-year

Linkage of all the information collected on any patient with a unique identifier permits analysis of health service use, the treatment received and outcomes, giving a realistic view of the types and quality of

services offered. Real data have also been instrumental for assessing the quality of care, organizing services and assessing the outcomes of new cancer therapies and programme performance (6,7).

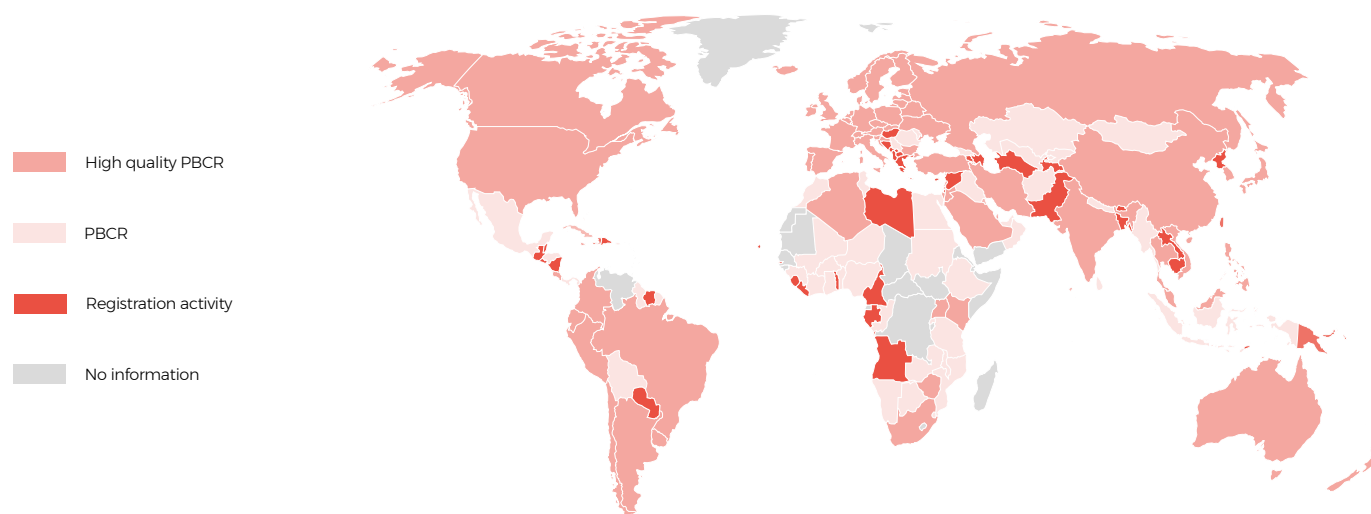
Box 6.2. Cancer Intelligence in the United Kingdom

The National Cancer Intelligence Network, now the National Cancer Registration and Analysis Service (5), represents intelligent use of cancer data derived from national and regional registries. The objectives of the service are to audit quality, improve cancer care and clinical outcomes, provide a national repository for cancer datasets, conduct analyses to monitor cancer

care and promote efficient, effective data collection. Cancer intelligence from routinely collected data provides a service to clinicians for auditing and improving the quality of cancer care, to registries for better linkage of data and analysis and to policy- and decision-makers for planning and benchmarking.



Fig. 6.3. Countries with population-based cancer registries



Source: reference 8.

6.2.2

Cancer intelligence for analysing cancer control systems

Priorities in cancer control planning and targets are set after an analysis of the available resources and their use. Information that can be collected and analysed for this purpose includes (9):

- current activities for all age groups in prevention, early diagnosis, diagnosis, including staging, treatment and palliative care, with data on the coverage of the intended population, the quality of performance, outcomes and any overlap with other plans for prevention of NCDs;
- policies and regulations to mitigate exposure to risk factors and to promote access to high-quality care;
- standardized algorithms and criteria for health technology assessment to select the most effective, efficient interventions.
- the available infrastructure by type of technology (e.g. radiation therapy equipment, histology) and facility, from primary care to highly specialized units, with population covered and territory;
- numbers and distribution of professionals by medical specialty for cancer diagnosis and care, including nurses and allied health care professionals;

- funding for cancer by the public health care service and other organizations, such as private insurance, and any co-payment;
- legislation and regulations on access to health services and the role of private insurers; and
- population use of each resource to assess actual use against needs.

The results of such analyses should reveal any policy or programme gap between resources and their use. Such gap analyses can indicate policy priorities, how services are organized and how resources are allocated. The analysis should include access to palliative care, to analgesic and other drugs on the WHO EML and to diagnostic services on the list of Essential In-vitro Diagnostics. The data available in a country should be compared with data from international sources for more-informed designation of priorities and for monitoring progress against cancer.

6.3 Strengthening stewardship and leadership in cancer control

6.3.1 Governance in cancer control planning

Development of a cancer control plan usually begins with a government commitment to formulate a response (due to recognition of the disease burden and through benchmarking exercises) and/or advocacy by national or international stakeholders (10).

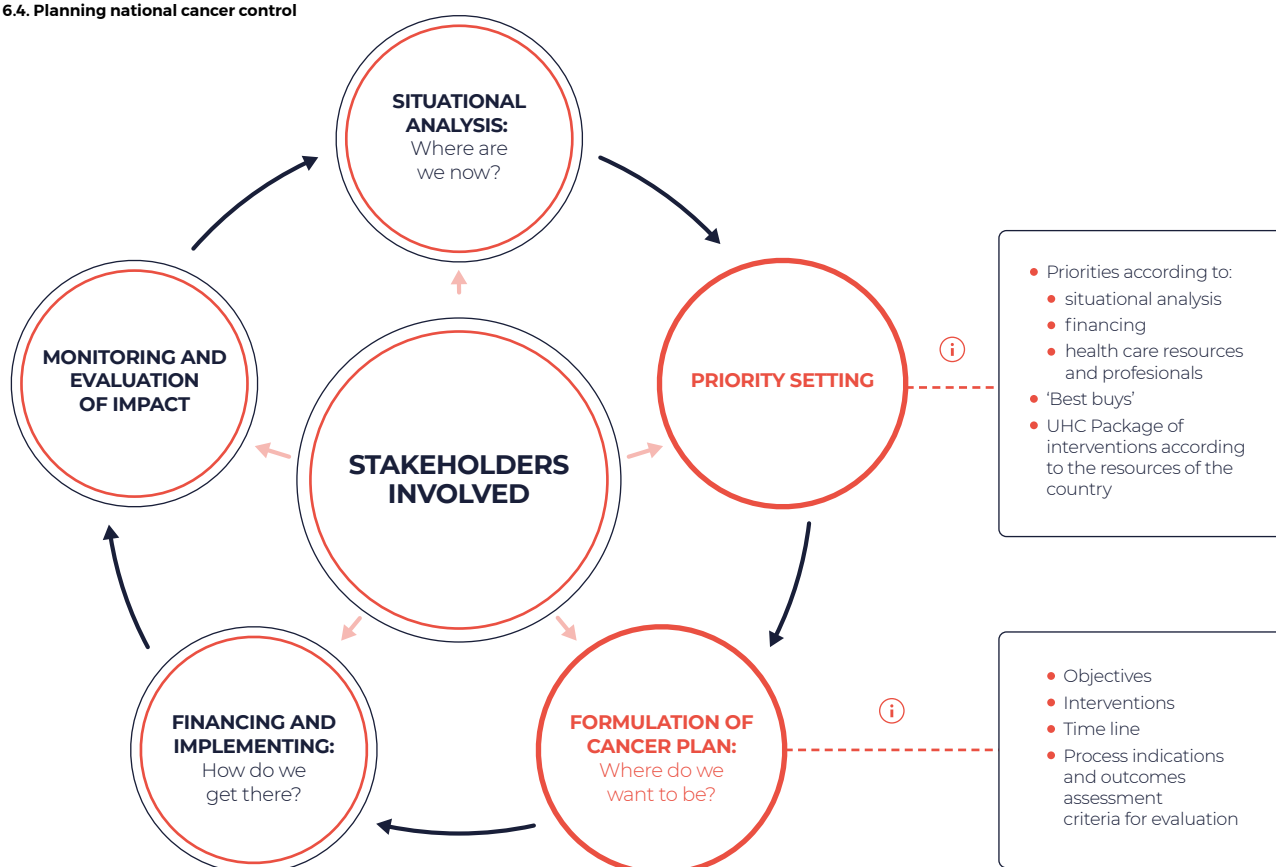
Political will can be activated to formulate a cancer plan. The exact governance structure will depend on the context, although lessons can be learnt from best practice (Fig. 6.6). The ministry of health should interact with all other relevant government agencies in cancer control planning (see also section 2.2.2). An executive board may be formed of representatives of public health agencies, a national institute of public health, health care service management and financing

agencies. The executive board generally consists of cancer leaders in the public sector, while the advisory board has broad, multisectoral representation. A leader or a focal point for the plan is useful for coordination and stewardship (Box 6.3).

158 countries reported having a ministry of health staff who dedicated a significant proportion of their time to cancer (11).

Once a commitment has been made, a small group of national experts in epidemiology, cancer services and policy-making should be assembled; international support could be sought to elaborate the plan (Fig 6.4).

Fig. 6.4. Planning national cancer control



General elements of good governance include (9,12,13):

- transparency: making clear decisions, specifying their rationales and who made them;
- participation: ensuring that people affected by a decision can express their views and that they are heard;
- accountability: ensuring that everybody takes responsibility for their actions;
- integrity: ensuring a system in which organizations and jobs are clearly defined, and procedures such as hiring and contracting are regulated and clear;
- capacity: employing the necessary expertise to ensure that policy failures and unintended consequences are avoided or are identified and remedied.

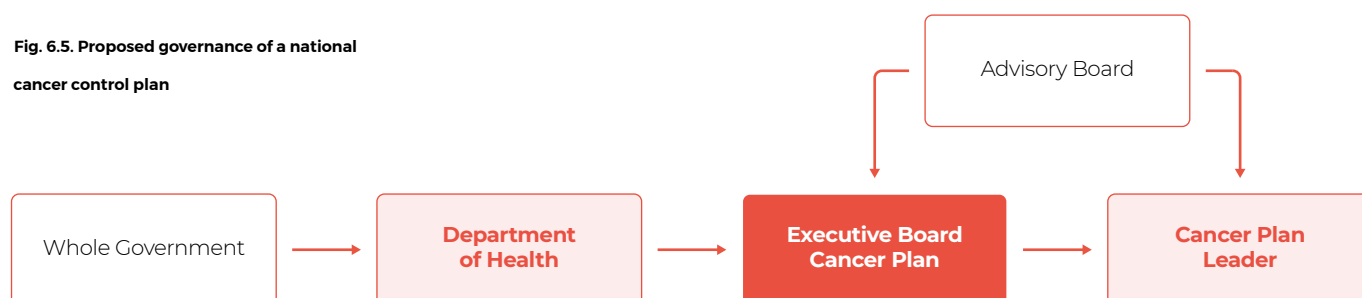
Box 6.3. NCCP governance in Sri Lanka



Sri Lanka has a strong NCCP. The National Advisory Committee on Cancer Prevention and Control of the Ministry of Health is chaired by the Secretary of Health, with 50 members from various domains. The National Cancer Policy and Strategic Framework on cancer prevention and control was approved by the Cabinet in 2015. Provincial and regional directors, hospital directors, hospital directors and dedicated cancer control focal points and consultants oversee the implementation of cancer control activities, while, at district level and in health facilities, cancer services are integrated with other health services.

The successful governance of cancer care activities by the NCCP can be attributed to the National Advisory Committee through which the NCCP collaborates with other health and non-health sectors. Governance by a dedicated programme has contributed to overcoming fiscal and administrative barriers to implementation.

Fig. 6.5. Proposed governance of a national cancer control plan



6.3.2 Integration of local stakeholders into cancer control plans

The impact of cancer on society has motivated many organizations, institutions and citizens to contribute to cancer control plans. Governmental officials, under the leadership of the relevant health authority, should invite local partners and stakeholders for membership on the advisory board, using transparent selection criteria and exercising due diligence by reviewing potential conflicts of interest. Consultations to define priorities for a cancer control plan should include civil society, scientific societies, other professional organizations, managers of cancer services in the private sector and other relevant experts (9). Particular consideration should be given to cancer survivors and patient support groups.

Population consultations are an important contribution to any national health planning process. The expectations and opinions of stakeholders are gathered to ensure the inclusion of public opinion in decision-making, policy design and policy implementation modalities and to assess any unintended consequences of policy decisions (14). Conflicts of interest and bias can be avoided by involving stakeholders from diverse backgrounds, which will increase the credibility, transparency and fairness of the consultation.

6.3.3 Global entities and potential support

Resolution WHA70.12 of the World Health Assembly, adopted in 2017, states that the growing public health problem of cancer should be prioritized by governments and international organizations (15). Broad multisectoral collaboration has emerged to support policy formulation and implementation. WHO, with the International Atomic Energy Agency, supports Member States in conducting comprehensive analyses of current capacity in cancer control to formulate cancer control plans and strengthen capacity (Box 6.4). Over 100 missions have been conducted and 90 countries assisted over the past 15 years in preparing evidence-based cancer plans and policies.

The WHO Knowledge Action Portal is an innovative means to enhance global dialogue across sectors on fulfilling commitments to NCD prevention and control, including World Health Assembly resolutions, as an interactive community platform (17). It serves as a resource for NCD information and amplifies voices of stakeholders from governments, United Nations agencies and non-State actors. International partnerships of non-State actors, such as the International Cancer Control Partnership or the International Cancer Screening Network, may be valuable resources to strengthen programmes and build regional alliances for implementation

Box 6.4. imPACT missions



imPACT missions

The aim of the **integrated missions** of the **Programme of Action for Cancer Therapy (imPACT)** is to provide governments and their partners with a baseline situation analysis and recommendations to guide cancer control planning and investments, from prevention to palliative care (16). The recommendations provided to Member State can benefit them by:

- supporting national cancer control planning;
- prioritizing strengthened cancer registration systems;
- improving diagnosis;
- advocating for better access to treatment (curative and palliative);

- guiding the establishment of safe, high-quality radiation medicine services; and
- providing information on opportunities for resource mobilization and partnerships.

The imPACT report identifies strengths, challenges, opportunities and needs in the field of cancer control for Member States. National and international partners also provide technical support to governments in preparing a cancer control plan that is aligned with international, evidence-based recommendations and adapted to the local situation and policy.

6.4 Value and priority-setting

The main elements to be included in a cancer control plan are:

- the background, including the cancer burden, current cancer control activities, governance structure and stakeholder mapping;
- goals and objectives, with a “results chain”;
- priority interventions along the cancer continuum, the requirements and the impact on the health system;
- costing and financing; and
- monitoring and impact evaluation.

Plans should be structured to achieve:

- consistency: evidence-based policies aligned with global norms and standards;

- coherence: links to other national or regional health-related plans or strategies; and
- comprehensiveness: critical components of cancer care along the continuum and key related health system functions.

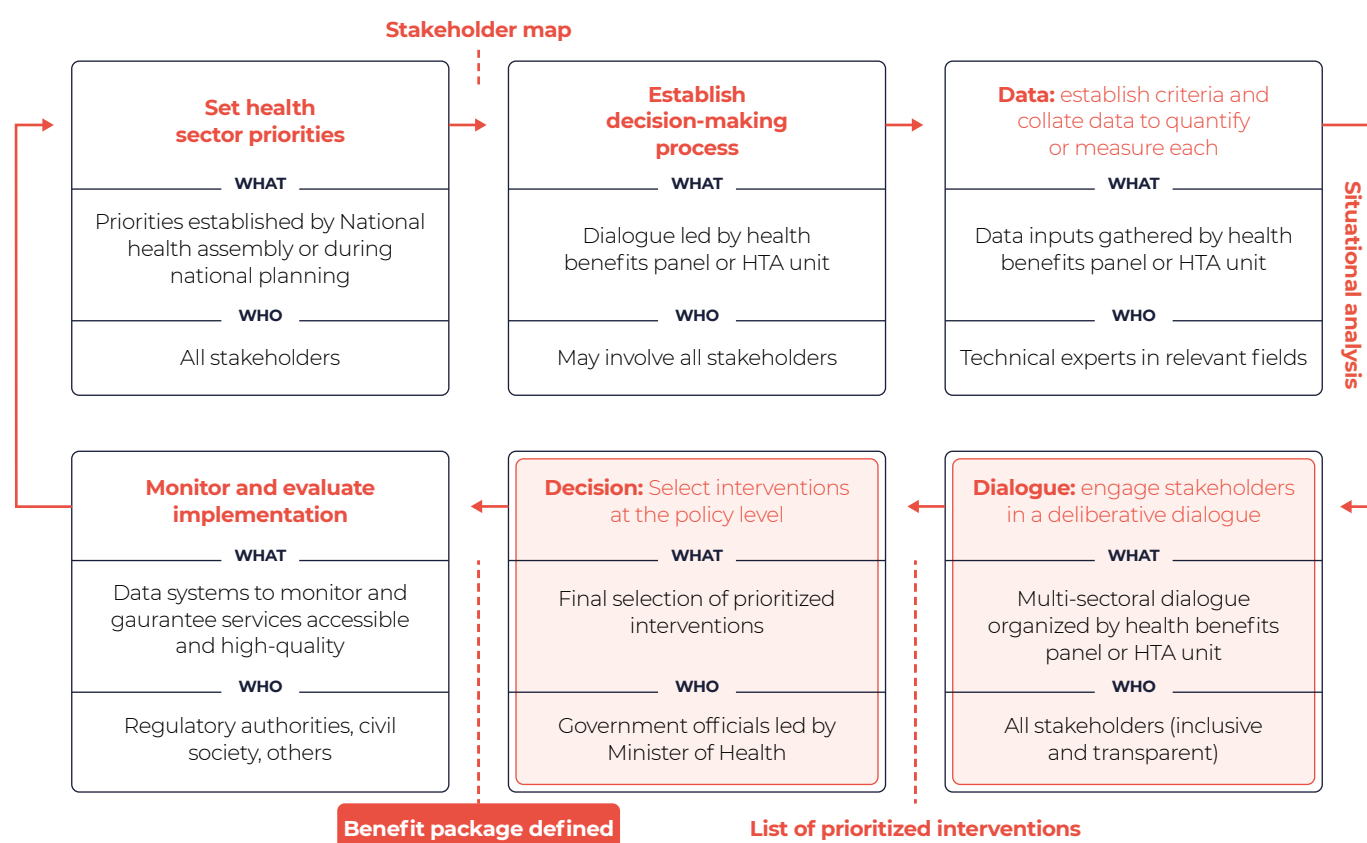
When possible, cancer plans should be formulated in synchrony with national health planning cycle to optimizing coherence. Plan duration varies by setting. On average, they are approximately 5 years though can range from 3-10 years (1).

6.4.1 Principles for planning cancer control programmes within universal health coverage

The three dimensions of UHC to be addressed in designing a plan for cancer control are: the interventions and services to be covered by the plan, the coverage of each intervention and the proportion of costs to be covered by the public health system and any co-payments or indirect

costs to patients (18, see section 2.2.3) (Fig. 6.6). The coverage and specification of the services offered should be appropriate for local resources, but countries should plan for step-wise improvements.

Fig. 6.6. Process for formulating national cancer control programme with focus on dialogue and decision for defining UHC benefit package



Some LMIC have incorporated cancer into UHC benefit packages and found improved population outcomes. In Mexico, for example, increased health care coverage through a system of social protection has improved access to and

survival from breast and childhood cancers (19). In Thailand, introduction of a national UHC programme doubled the proportion of early-stage cancers identified, reflecting improved primary care service provision for early diagnosis (20).

6.4.2 Setting priorities

The gaps identified in the assessment and the time-bound actions proposed to close them should be discussed with stakeholders, including funders, in order to assess budgetary implications. National cancer plans initiate new programmes or

services, reorganize existing services and de-implement ineffective programmes. Priority should be given to actions with the greatest expected impact and best use of resources and include (13):

- the public health importance of the cancer type and the potential impact of the intervention;
 - the budgetary implications;
 - the cost-effectiveness of the proposed intervention;
 - the feasibility of implementation, including the expertise required, whether adequate numbers of health professionals and resources will be available and whether coverage with equitable access can be assured;
 - the promotion of equity and fairness; and
 - the agreement of and acceptability for relevant stakeholders, including public representatives and scientific and clinical societies.
- The proposed actions should be aligned with the aims of the cancer control plan and coherent with other NCD strategies. A deadline should be set for each short-, medium- and long-term activity, and an evaluation should be planned.

6.4.3

Value of cancer control measures

A primary objective of cancer care should be to maximize value, i.e. outcome relative to cost (27). Value is multidimensional and differs by context (Table 6.1). Assessment of the contribution of a new or existing treatment should be based not only on evidence but also on the situation,

resources and capacity of the health care system and patient perspectives (Box 6.5; see also section 5.3.2). Reference to global norms in best practice should be informed by priority interventions, medicines and diagnostics defined by WHO.

Table 6.1. Perspectives of value by various stakeholders

Stakeholder	Sample perspective	Mechanism for assessment
Patients (personal value)	Will it increase longevity? Will it affect quality of life?	Published studies and clinical trials
Society (public health value)	Are there competing health priorities? Is it an investment priority?	Comparative investment cases
Governments (economic and political value)	Budget impact? Cost-effective? Political priority?	Health technology assessment (economic value) Public dialogue, polling (political value)
Private sector (investment value)	Revenue? Return on investment? Market landscape?	Market research
Health care providers (clinical value)	Measurable impact? Unmet need?	Published studies

*To sustain equitable access to affordable patient-centred, high-quality cancer care, Cancer Australia has proposed a value-based approach. "Statements" outlining appropriate and inappropriate practices were prepared with experts, clinical organizations and consumers. One of the statements, *Influencing best practice in breast cancer*, outlines 12 practices to promote uptake of value-based care and reduce low-value care. Four surgical and one radiological practice were reframed as research questions and are being measured longitudinally. Since publication of the statements, 2 years ago, changes have been observed in all five practices towards alignment with the statement, with regional reductions in variations in practice. Endorsement of the practices by clinical organizations and consumers contributed to practice change (22).*

Box 6.5. Value-based care in Australia



Health technology assessment has been proposed for evaluating each innovation before its use by local health services. This consists of systematic evaluation of the properties, effects and cost of health technology to inform policies regarding their uptake and avoidance of technologies of doubtful value. Health technology assessment is one of three complementary functions for ensuring appropriate introduction and use of health technology; the other two are regulation, to ensure safety and efficacy by identifying significant intended and unintended consequences of technology use, and management of the procurement and maintenance of the technology during its life-cycle (23).

Patient-reported outcomes measures are central to progressive development of patient-centred cancer care and recognition of personal value. Outcomes are elicited directly from the patient to assess his or her quality of life, symptoms or response to therapy. Their use has been proposed by drug evaluation agencies to improve drug assessment (24). A complementary perspective is patient-reported experience, which is the perception of the patient of the process of care, such as satisfaction with services and coordination among professionals. Patient-reported experience could be influenced by expectations about care, and the results should be evaluated accordingly.

6.5

Stepwise priorities in cancer control

A stepwise approach should be used in implementing cancer control programmes (10). All countries can start by focusing on WHO “best buys”, which can be implemented at low cost and are feasible for all health systems. The priorities should include

palliative care as a human right (25). Incremental capacity can then be considered as resources increase. Building on existing WHO guidance, a sample three-tier approach can be considered that links diagnostic capacity with treatment capacity (Table 6.2).



The readiness of the health system must be considered throughout step-wise implementation of cancer programmes: Are there a sufficient workforce, infrastructure and resources? Further, in line with UHC and the established principle of progressive realization, population coverage should be maximized and financial risk minimized before advancing to more complex services is considered (see also chapter 7).

Small-island states and countries with fragile health systems due to conflict or emergencies require different approaches to cancer control planning and priority-setting. Neighbouring small-island states, such as in the Pacific, often have similar cancer epidemiology, risk factors and capacity to respond. A recent analysis of Pacific island countries and territories found that few had public health programmes for cancer, including prevention, early diagnosis and palliative care (26). For countries with small populations and therefore small numbers of cancer cases, regional collaboration could augment capacity, timely access to care and

allocative efficiency, particularly for capital expenditure (27).

In countries in conflict, the background burden of cancer persists and contributes significantly to the burden of disease (28). The challenges for cancer policy development and implementation include lack of data for planning, insufficient international support or commitment, geographical barriers to care and high financial and emotional burdens on refugees and displaced populations (29). Long-term political strategies and financial contributions are necessary to support service provision (Box 6.6) (30). In the short term, the priorities include coordination and knowledge-sharing among external partners working under national health agencies, strengthened early diagnosis (particularly health literacy and referral pathways) and palliative care. With the support of global stakeholders, these are achievable.

**Table 6.2. Framework for a three-tier prioritization
for selection of cancer interventions.**

	Tier 1	Tier 2	Tier 3
Prevention	WHO “best buys”	WHO “good buys”	Can include risk-adapted strategies
Screening	Cervical cancer screening and treatment	Mammography-based screening Colorectal cancer screening	Can include other evidence-based screening strategies
Pathology	WHO List of Essential In-vitro Diagnostics Priority medical devices for cancer management	Can include selected molecular pathology services	Can include expanded molecular pathology services
Imaging	X-ray, ultrasonography, computed tomography (selected indications)	Broader use of computed tomography and selected nuclear medicine	Expanded nuclear medicine services and magnetic resonance imaging
Surgery	For priority diagnostic, curative and palliative interventions	Can be extended to more complex procedures	Minimally invasive procedures for broad indications
Radiation therapy	Selected high-impact indications with technology of low complexity	Extended indications with higher complexity	All relevant indications from evidence-based, high-quality clinical guidelines at the highest level of complexity
Medicines	WHO Essential Medicines List	High-impact threshold (informed by MCBS and other references)	Evidence-based impact threshold (informed by MCBS and other references as used in HIC)
Palliative care	Home-based essential interventions in primary care and select hospital-based services	Expanded hospital services	Can include broad inpatient and outpatient palliative care, including hospices

*Modified by patent status or budgetary impact

MCBS, Magnitude of Clinical Benefit Scale, version 1.1 of the European Society for Medical Oncology; EMA, European Medicines Agency; FDA, US Food and Drug Administration

Box 6.6. Cancer control in Yemen (32)

Ongoing conflict and more than 8 years of instability in Yemen have weakened the health system to the point of near collapse with deterioration of social safety needs, adverse health outcomes, and expanding health needs coupled with high out-of-pocket expenditure. NCDs continue to exert a significant burden in Yemen, even during this period of conflict, and are responsible for an estimated 70–80% of deaths (31). In particular people with cancer, renal failure, and cardiovascular diseases have been unable to access services and as a result become the silent victims of war.

Resources provided by Germany, Japan, Kuwait, Saudi Arabia, the United Arab Emirates and the United Nations Office for the Coordination of Humanitarian Affairs, has enabled WHO and local health authorities to ensure some assistance for cancer and dialysis patients. This support includes establishment of cancer registries to assess the burden and monitor implementation, incentives for 250 professional cancer health workers in 12

cancer care centres throughout the country, provision of mammography machines to Sana'a and Aden for earlier diagnosis and laboratory reagents for pathology.

In 2019 alone, approximately 31 500 patients, including almost 2000 children, received cancer care. In line with WHO's mission statement, the most vulnerable are being served and protected from physical, emotional and financial harms through these services and global collaboration. WHO believes that more investment in cancer care, such as provision of radiation therapy equipment is needed to guarantee multidisciplinary approach to achieve UHC for this category of patients (32).

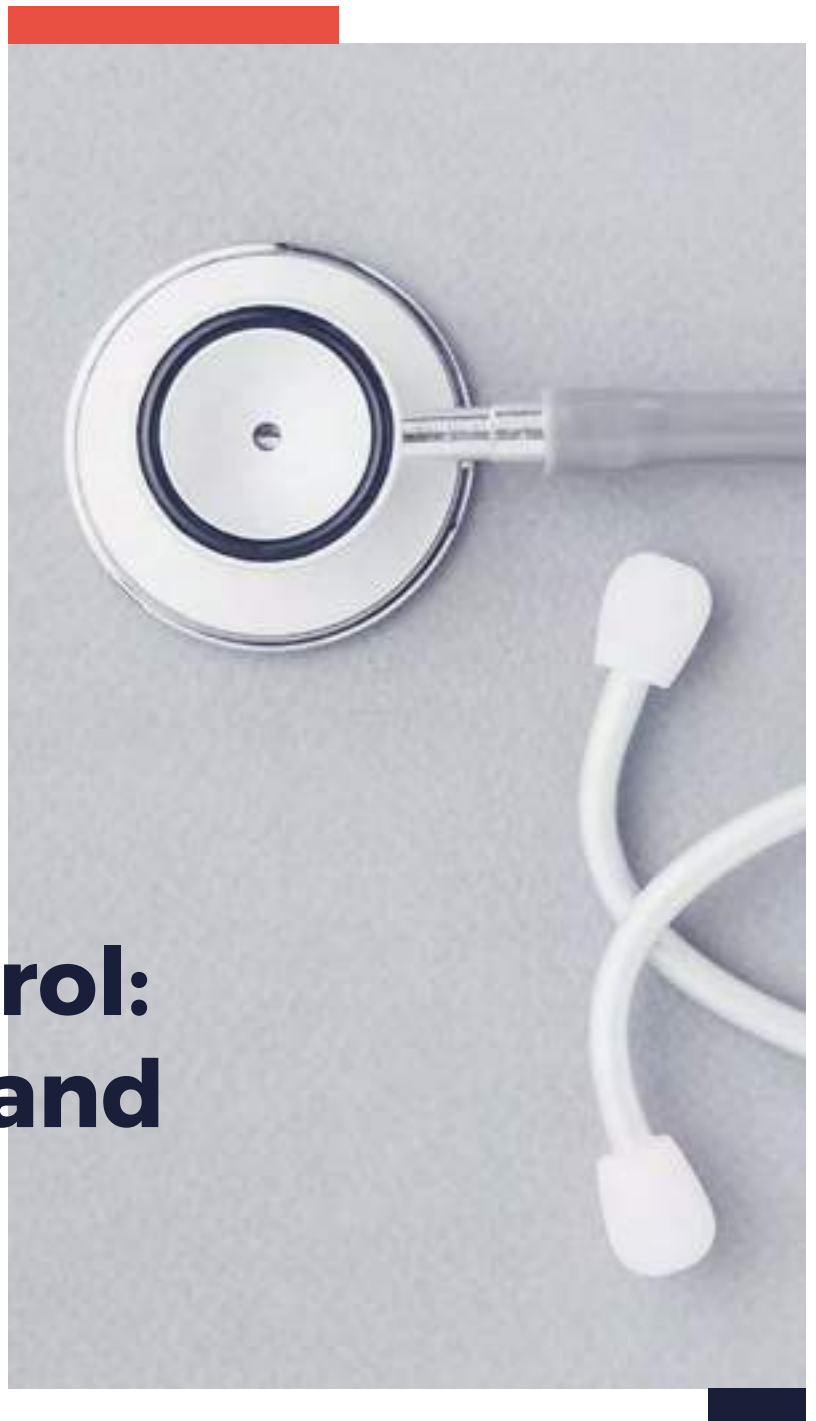


References

- Romero Y, Trapani D, Johnson S, Tittenbrun Z, Given L, Hohman K, et al. National control plans: a global analysis. *Lancet Oncol*. 2018;19:e546–55.
- Cancer care. Assuring quality to improve survival. Paris: Organization for Economic Co-operation and Development; 2013 (<https://www.oecd.org/health/cancer-care-9789264181052-en.htm>, accessed January 2020).
- World health statistics 2018: monitoring health for the SDGs, sustainable development goals. Geneva: World Health Organization; 2018.
- Coebergh JW, van den Hurk C, Louwman M, Comber H, Rosso S, Zanetti R, et al. EUROCOURSE recipe for cancer surveillance by visible population-based cancer Registrees in Europe: from roots to fruits. *Eur J Cancer*. 2015;51(9):1050–63.
- National Cancer Registration and Analysis Service. London: Public Health England; 2010 (<http://www.ncin.org.uk/home>, accessed February 2020).
- Khozin S, Blumenthal G, Pazdur R. Real-world data for clinical evidence generation in oncology. *JNCI*. 2017;109:djx187.
- Olsen LA, Ginnis JM, editors. Redesigning the clinical effectiveness research paradigm: innovation and practice-based approaches: workshop summary. Washington DC: Institute of Medicine and National Academy Press; 2010.
- Cancer surveillance. In: Jemal A, Torre L, Soerjomataram I, Bray F, editors. The cancer atlas, 3rd edition. New York City (NY): American Cancer Society; 2019 (<https://canceratlas.cancer.org/taking-action/>, accessed January 2020).
- National health policies, strategies, plans. Geneva: World Health Organization; 2019 (<https://www.who.int/nationalpolicies/nationalpolicies/en/>, accessed January 2020).
- National cancer control programmes. Policies and managerial guidelines. Geneva: World Health Organization; 2002 (<https://www.who.int/cancer/publications/nccp2002/en/>, accessed January 2020).
- WHO NCD Country Capacity Survey. 2019. (<https://www.who.int/ncds/surveillance/ncd-capacity/en/>, Accessed January 2020)
- Albrecht T, Borrás Andrés JM, Dalmas M, De Lorenzo F, Ferrari C, Honing C. Chapter 7. Survivorship and rehabilitation: policy recommendations for quality improvement in cancer survivorship and rehabilitation in EU Member States. In: Albrecht T, Kiasuwa R, Van den Bulcke M, editors. European guide on quality improvement in comprehensive cancer control. Ljubljana: National Institute of Public Health; Brussels: Scientific Institute of Public Health; 2017 (https://cancercontrol.eu/archived/uploads/images/Guide/042017/CanCon_Guide_7_Survivorship_LR.pdf, accessed January 2020).
- Elwood M, Sutcliffe SB, editors. Cancer control. New York City (NY): Oxford University Press; 2010.
- Schmets G, Rajan D, Kadandale S, editors. Strategizing national health in the 21st century: a handbook. Geneva: World Health Organization; 2016 (<https://apps.who.int/iris/handle/10665/250221>, accessed January 2020).
- Cancer prevention and control in the context of an integrated approach. World Health Assembly resolution WHA70.12. Geneva: World Health Organization; 2017 (<http://apps.who.int/medicinedocs/en/m/abstract/Js23233en/>, accessed January 2020).
- imPact review. Programme of Action for Cancer Therapy (PACT). Vienna: International Atomic Energy Agency; 2019 (<https://www.iaea.org/services/review-missions/impact-review>, accessed January 2020).
- Knowledge action portal. Geneva: World Health Organization; 2019 (<https://www.knowledge-action-portal.com/>, accessed January 2020).
- Universal coverage – three dimensions. Geneva: World Health Organization; 2020 (https://www.who.int/health_financing/strategy/dimensions/en/, accessed January 2020).
- Reynoso-Noverón N, Villarreal-Garza C, Soto-Perez-de-Celis E, Arce-Salinas C, Matus-Santos J, Ramírez-Ugalde M, et al. Clinical and epidemiological profile of breast cancer in Mexico: results of the Seguro Popular. *J Glob Oncol*. 2017;3(6):757–64.
- Sungwalee W, Vatanasapt P, Suwanrungruang K, Promthet S. Comparing survival of oral cancer patients before and after launching of the universal coverage scheme in Thailand. *Asian Pac J Cancer Prev*. 2016;17(7):3541–4.
- Sorenson C, Drummond M, Kanavos P. Ensuring value for money in health care. The role of health technology assessment in the European Union (Observatory Studies Series No. 11). Copenhagen: World Health Organization Regional Office for Europe; 2008 (http://www.euro.who.int/_data/assets/pdf_file/0011/98291/E91271.pdf, accessed January 2020).
- Cancer Australia statements. Influencing best practice in cancer care. Strawberry Hills (NSW): Cancer Australia; 2020 (<https://the.statement.canceraustralia.gov.au>, accessed January 2020).
- Health technology assessment of medical devices (WHO Medical Device Technical Series). Geneva: World Health Organization; 2011 (<https://apps.who.int/medicinedocs/en/m/abstract/Js21560en/>, accessed January 2020).
- Reflection paper on the use of patient reported outcome (PRO) measures in oncology studies. London: European Medicines Agency (EMA/CHMP/292464/2014).
- Palliative care. Geneva: World Health Organization; 2020 (<https://www.who.int/news-room/fact-sheets/detail/palliative-care>, accessed January 2020).
- Sarafat D, Dyer R, Amosa-Lei Sam F, Barton M, Bray F, Buadromo E, et al. Cancer control in the Pacific: big challenges facing small island states. *Lancet Oncol*. 2019;20(9):475–92.
- Hanappe M, Nicholson LT, Elmore SNC, Fehr AE, Bigirimana JB, Borg RC, et al. International radiotherapy referrals from rural Rwanda: implementation processes and early clinical outcomes. *J Glob Oncol*. 2018;4:1–12.
- Beyond the bullets and bombs: Saving the lives of chronic disease patients living in conflict settings. Geneva: World Health Organization; 2017 (<http://www.emro.who.int/eha/news/beyond-the-bullets-and-bombs-saving-the-lives-of-chronic-disease-patients-living-in-conflict-settings.html>, accessed January 2020).
- Marzouk M, Kelley M, Fadhill I, Slama S, Longuere KS, Ariana P, et al. "If I have a cancer, it is not my fault I am a refugee": a qualitative study with expert stakeholders on cancer care management for Syrian refugees in Jordan. *PLoS One*. 2019;14(9):e0222496.
- Spiegel P, Khalifa A, Mateen FJ. Cancer in refugees in Jordan and Syria between 2009 and 2012: challenges and the way forward in humanitarian emergencies. *Policy Rev*. 2014;15(7):E290–7.
- Global Health Observatory. Geneva: World Health Organization; 2016 (<http://www.who.int/gho/database/en/>, accessed January 2020).
- Cancer control in Yemen. Cairo: WHO Regional Office for the Eastern Mediterranean; 2019 (<http://www.emro.who.int/yem/yemen-news/who-responds-to-the-cancer-care-crisis-in-yemen.html>, accessed January 2020).

Chapter 07.

Financing cancer control: challenges and strategies



The background of the slide is a dark blue field filled with numerous handprints of varying sizes and orientations, all in a lighter blue shade. At the top left, there is a solid orange rectangular bar. At the bottom right, there is a solid pink rectangular bar.

Key messages

- 1.** Financing of cancer control has lagged severely behind the large, growing burden of disease in LMIC. Failure to invest in cancer control continues to leave many patients impoverished after paying out of pocket for largely poor-quality services.
- 2.** Financing for both services and population coverage should be extended in steps, in line with the principle of progressive realization of UHC. At each step, equity of access and financial risk protection should guide decisions.
- 3.** Efficiency is required to mobilize funds in order to lower barriers for individuals, minimize the cost to health care systems, obtain a good return on investment in cancer services and ensure health system and regulatory infrastructure for strategic purchasing of high-cost inputs.
- 4.** The objective of funding cancer control is to promote equitable financial and geographical access to high-quality cancer services by making capital investments and funding services with the best value for the greatest good. Extension of services will depend on the strengths and weaknesses of each country's health care system, disease burden, economic conditions and other local factors.

7.1

Background of cancer financing

NCDs currently pose one of the greatest threats to health and development globally, particularly in the developing world (see section 2.4). Failure to implement proven interventions is a significant missed opportunity to diminish a large, chronic health and cost burden, and continued lack of investment will have steadily increasing health, economic and social consequences. The broader cost of illness includes indirect social costs, negative impact on national economies and catastrophic expenditures by individuals.

Effective cancer prevention, screening, diagnosis and treatment will save lives, mainly of adults during their most productive years. In addition, all cancer services, including palliative care for those who will not survive, create high-quality employment, which adds to GDP. A budget for cancer control services should therefore be regarded not simply as expenditure but as an investment that will result in economic and broader gains (see also section 2.4). The availability of treatment services for an entire population improves uptake of services across the care continuum (7).

7.2

Financing cancer services within progressive universal health coverage

Financing of cancer control is part of financing for all health services. Moving towards UHC, cancer services should expand progressively with appropriately increasing resources. Some extensions will be incremental, and others will require quantum increases in funding. For example, access to clinical diagnosis and therapy for breast cancer can be increased incrementally to ever larger segments of the population or be extended geographically; however, a radiotherapy unit requires substantial capital expenditure and substantial recurring costs for personnel, supplies and maintenance. Ensuring equitable access to centralized facilities, such as for radiotherapy, may require funding for travel and accommodation of patients and their families on site.

Appropriate increases in funding for extending cancer services require collaboration among planners and health and finance ministries, guided by understanding of the importance of investing in cancer, the corresponding value proposition and awareness of cost-effectiveness and sustainability.

Health financing consists of the mobilization, accumulation and allocation of money to cover the health needs of the population, individually and collectively (2). In practice, financing a complex set of services such as those in cancer control requires considerable analysis and contextualization if the objectives of UHC are to be met. How much money should be allocated for cancer within the overall UHC envelope? What benefits accrue from the allocation, and who will benefit from it? These are the questions to be addressed in an investment case (see section 2.4). To date, in many LMIC, funding of services for cancer and other NCDs has been accorded much less priority than funding for other diseases with similar burdens and costs for control.

7.3

Current sources of funding for cancer control

Health care services are paid from tax revenue, pooled, prepaid funding or out of pocket. Out-of-pocket payments have consistently been shown to be an inefficient, regressive form of health financing (3), as patients have to spend money when they are least capable of doing so. Without price controls, they are often charged higher rates, as their bargaining potential is less than that of pooled purchase. Lower-income groups spend a greater proportion of their income on health care than groups with higher income and often forgo preventive services and potentially curative treatment (4).

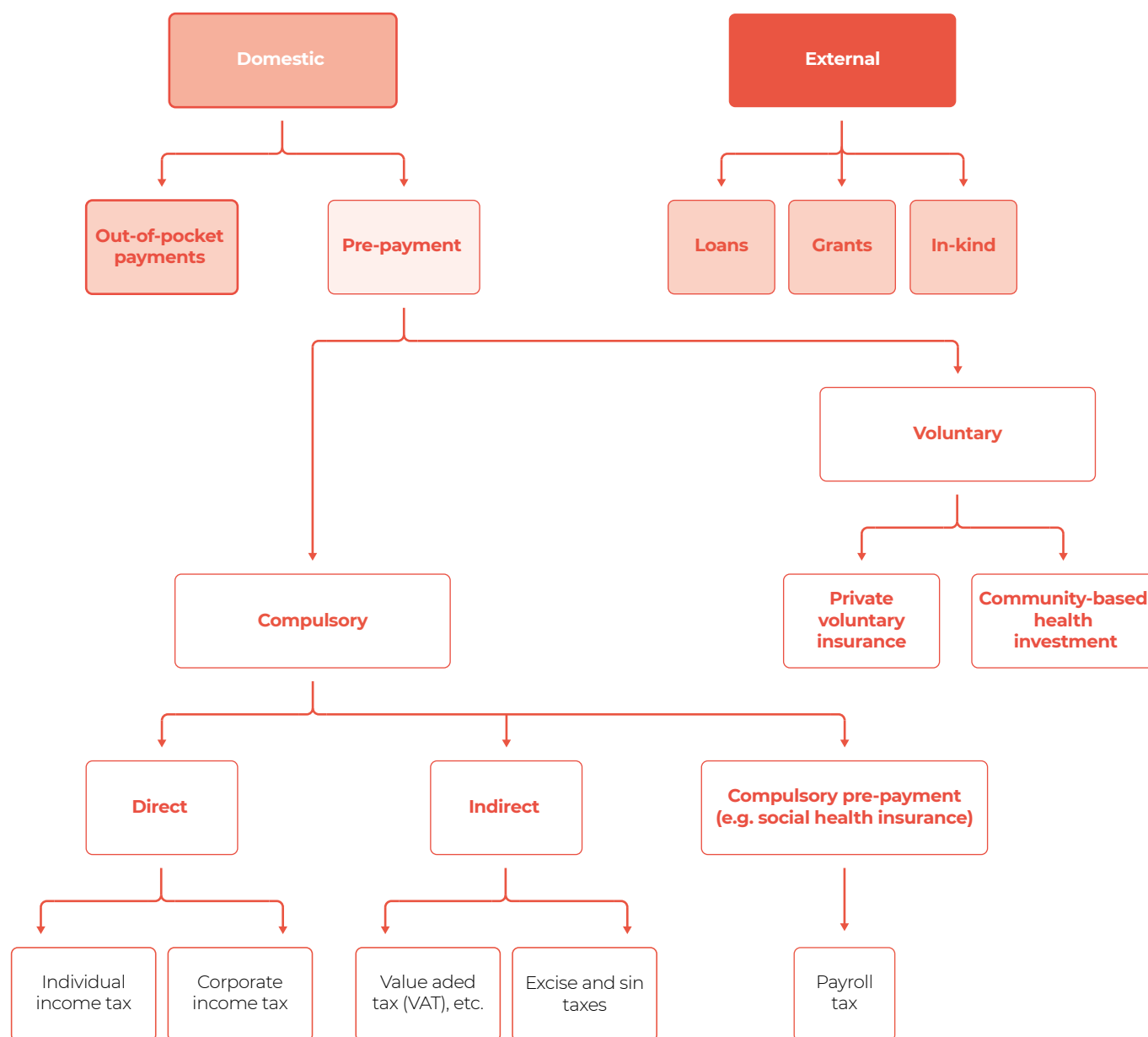
Early experience and the broader debate about funding national UHC has resulted in consensus that pooled pre-financed funding, which results in risk pooling, is the preferred approach. Pre-financing may be either public or private, but recent evidence (5) indicates that public, pre-paid compulsory health financing is the most successful strategy for progressing towards UHC. Cancer patients will clearly benefit from pooled pre-financing, without which they are faced with high, often catastrophic, out-of-pocket payments. The lowest-income groups should receive the greatest benefit from pooled pre-financing, which will increase equity in the population and improve access.

Funding for NCDs in LMIC is often expected to come mainly from budgeted domestic funds. Reliance solely on domestic financing would, however, be a major constraint in the extension of cancer services, particularly where the necessary infrastructure and human resources are limited. While little official bilateral or multilateral aid is available for cancer, uncatalogued external support is provided by private cancer centres in HIC and by universities and various professional and advocacy groups. The role of these groups has been mainly to build capacity and infrastructure and to provide expertise, but they also provide and raise funds for these purposes, freeing domestic funding for patient services. Cataloguing such collaborations, including public-private partnerships, could promote dissemination of best

practices; their monetary and in-kind contributions have not been estimated systematically nor analysed for integration into NCCPs. No reliable estimate has been published of how much is spent globally on cancer control, particularly in LMIC. Public spending on all health care worldwide has been increasing consistently since 2000, both as a share of total spending and in absolute terms. Nationally, growth has largely paralleled GDP growth and increased public spending but generally not as increases in the percentage of GDP. An analysis of 40 LMIC showed that expenditure for NCDs accounted for increasingly larger proportions of public funding, estimated to be about 27% in 2016 (6). This may indicate some increase in spending on cancer, but it cannot be quantified or confirmed. National health accounts should report specifically on spending for cancer control.

The main sources of revenue and mechanisms for contribution are shown in Fig. 7.2. The vast majority of official bilateral and multilateral development aid is for infectious diseases programmes, and only about 2% is for NCDs, including cancer (9–11). Additional relevant sources of external funding are the important contributions to cancer control from private cancer centres, universities, global and national professional societies and non-profit organizations working in cancer.

Fig. 7.1. Main sources of revenue and mechanisms of contribution



There is a growing interest in the use of innovative financing to mobilize additional revenue to fund cancer services. Defining innovative financing can be challenging, but it encompasses a wide range of both global and domestic financing instruments, such as solidarity taxes on airline tickets, taxes on tobacco and unhealthy foods and results-based financing models such as development impact bonds. Like more traditional revenue sources, innovative financing instruments should be evaluated in terms of their revenue-generating potential in absolute terms, the associated administrative costs of collecting the revenue and how each instrument will affect the guiding principles of UHC. Potential innovative revenue sources include:

- taxes on tobacco and other unhealthy products (“sin” taxes);
- airline levies;
- independent global financing facilities, such as the International Financing Facility for Immunization;
- development impact bonds;
- corporate social responsibility;
- lotteries;
- private “top ups” from insurance schemes;
- results-based (or performance-based) financing; and
- public–private partnerships

7.4

Spending on cancer control: effectiveness, cost-effectiveness, affordability and feasibility

7.4.1

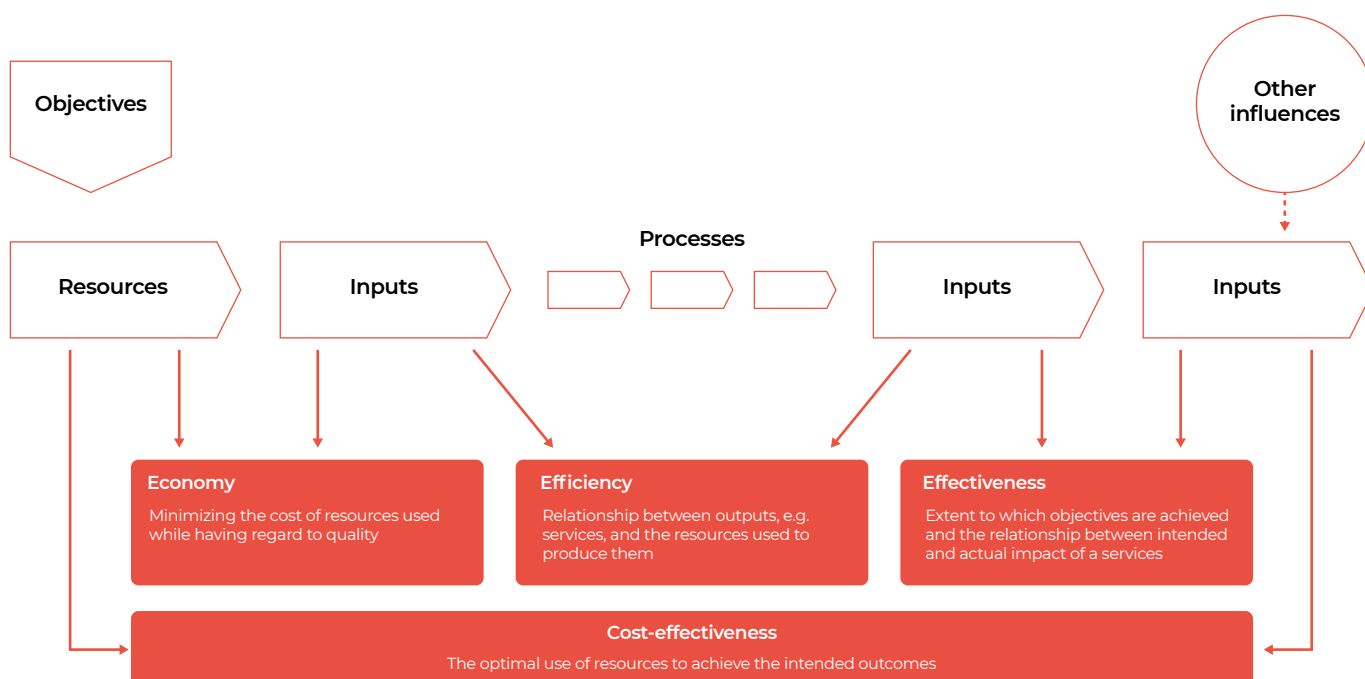
Financing benefits packages

Countries progressing towards UHC are faced with several important policy decisions. A guiding principle is that progress towards UHC increases the breadth of services in the health benefits package, spreading coverage of services to a larger proportion of the population and reducing out-of-pocket payments while increasing pre-payments.

To ensure the financial sustainability of the health system, the economy and efficiency aspects of an assessment of value for money (conventionally, cost-effectiveness analysis) should be highlighted (Fig. 7.2). Thus, the cost of the services to be included in the health benefits package must be within the financial and health resources available to the government. All countries

have limits on their resources and must make choices about the services to be provided or excluded. The set of services to be included in the health benefits package should be decided in a systematic, explicit, transparent way (13) to avoid inefficient spending on interventions that do not maximize value for money. Two common examples of inefficient spending are offering screening services without providing treatment (chapter 3) and providing expensive targeted therapies without the necessary diagnostics or other essential medicines (chapter 5).

Fig. 7.2. Value for money assessments: economy, efficiency, effectiveness



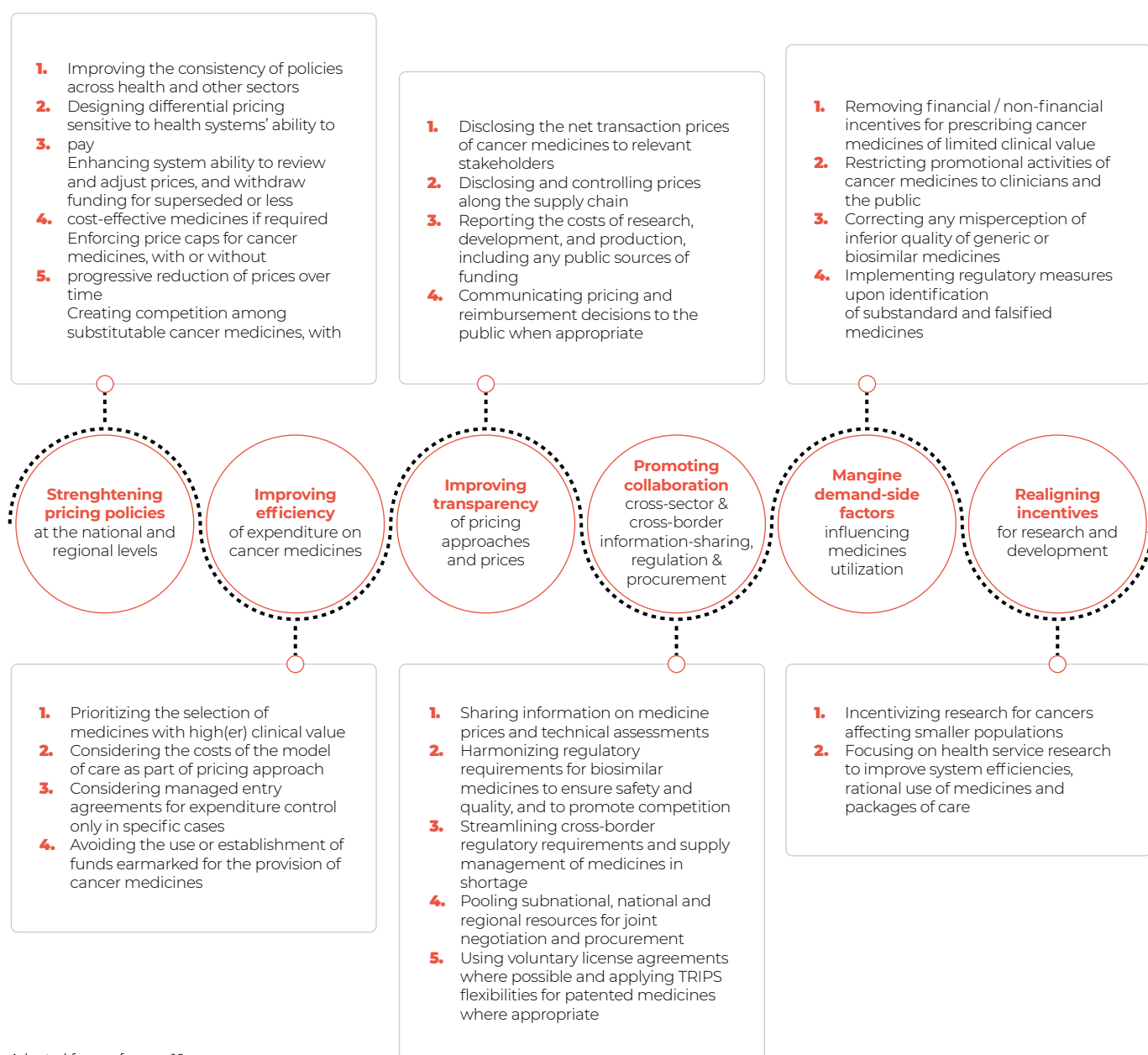
7.4.2

Price and procurement of essential medicines and health products

Governments can also improve their financial sustainability, and financing requirements by extension, by ensuring the affordability cancer-related health products. They should consider various policy options (Fig. 7.3) (14,15), including enhancing the possibility to review and adjust prices and to withdraw funding for superseded or less cost-effective medicines if required; enforcing price caps on medicines, with or without progressive reduction of prices over time; creating competition among therapeutically similar medicines, including generic and

biosimilars; and using voluntary license agreements and applying the flexibility of TRIPS for patented medicines, where appropriate. In accordance with the country context, these options should be used in combination in a holistic approach to achieving affordable prices for and broad access to health products.

Fig. 7.3. Pricing approaches for cancer treatment



For example, with the exception of HPV vaccines and HPV DNA tests, global and regional procurement initiatives have not specifically addressed the growing demand for medicines and health products required for essential cancer care in LIC.

When relevant and feasible, pooled procurement initiatives that are effective in addressing other health care priorities should extend their scope to include cancer medicines and related health products.

This would take advantage of economies of scale and scope and ensure efficient procurement. Pooled procurement can result in lower prices for medicines and stable supplies. Through pooled purchasing, participating countries could also potentially participate in financing facilities.

Another means of improving the affordability of cancer products is increasing the transparency of pricing approaches and prices of cancer medicines, as per the resolution adopted by WHO Member States on improving the transparency of markets for medicines, vaccines and other health products (76). Health systems should disclose the net transaction prices of cancer medicines to relevant stakeholders in order to strengthen the governance of procurement. Countries should also disclose and control prices along the supply chain to avoid excessive mark-ups. Section 8.2.4 provides further discussion on strategies for pooled procurement.

7.4.3 Remuneration of medical personnel

One of the largest cost components of health care budgets in HIC is the remuneration of medical personnel (17). When these services are purchased strategically, governments can improve access to cancer care while tempering expenditure, even when the budgetary space is not enlarged. Therefore, only services for the defined benefits package are purchased, and the payment system provides incentives to specified providers to offer those services. Performance should be monitored to maintain this alignment and to make any necessary re-alignment when coverage of services expands with progress towards UHC.

The architecture of strategic purchasing depends on many factors, including the

availability of providers of cancer care, which is limited in most LMICs, and facilities, the content of the benefits package and financial resources (18).

7.4.4

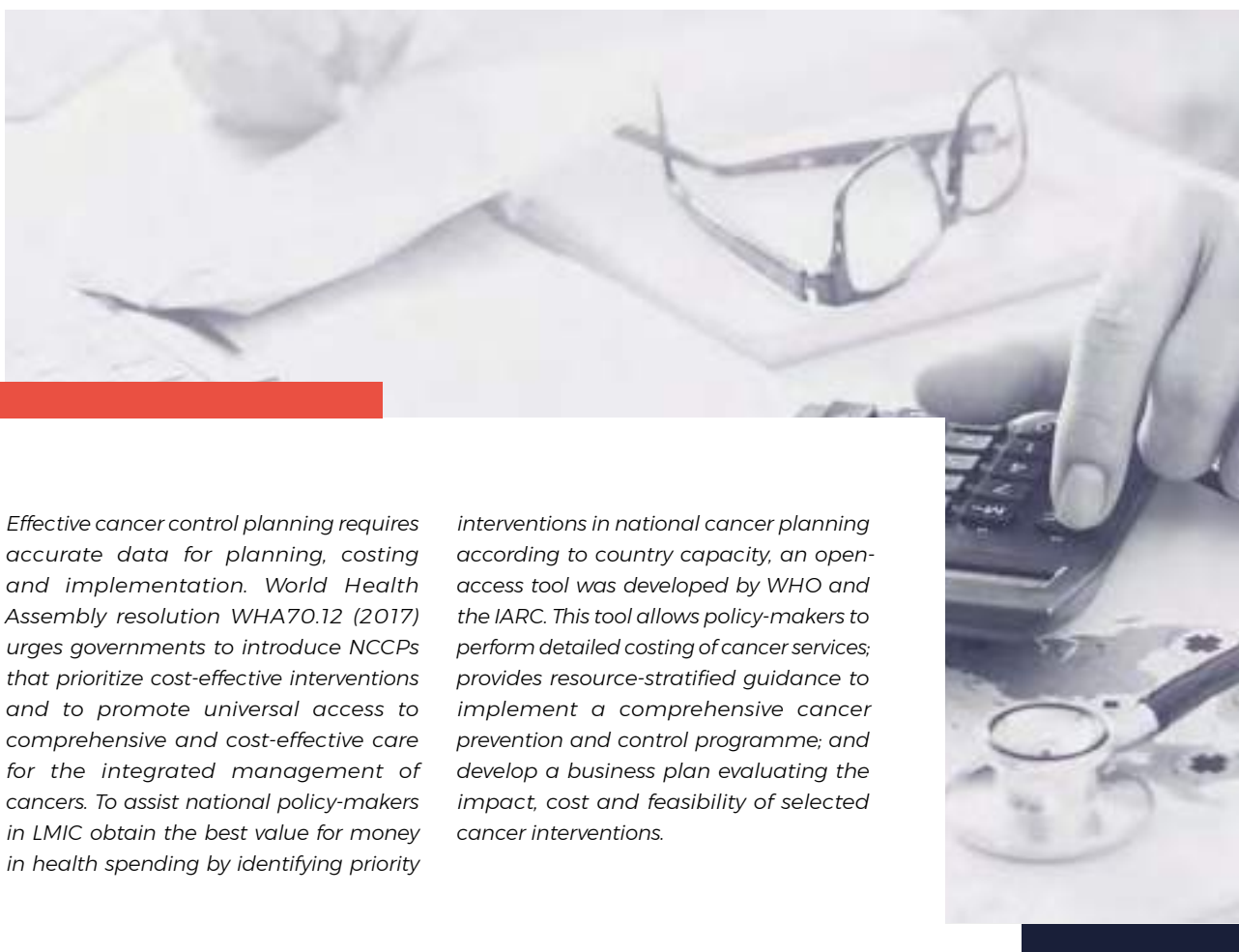
Additional tools to improve efficiency and equity in financing cancer services

Cost-effectiveness analysis should be complemented by other analyses to attain UHC goals. Other outcome criteria may include equity, feasibility, affordability at national (or subnational) level and the extent of individual financial protection. These form the analytical framework for the recommendations of the Disease Control Priorities Project for financing effective cancer interventions (79). Although equity is variously defined and difficult to measure, health economists now formally include this value in traditional methods with a societal perspective (20). For example, “extended cost-effectiveness analysis” can

be used to determine the distribution of costs and benefits by income quintile. Vaccination against HPV and tobacco taxation were found to be “pro-poor” in this framework (21,22).

In a forthcoming interactive tool for setting priorities, developed by WHO and IARC, users can enter the capacity of local cancer services and obtain recommended resource-stratified packages of interventions for cancer services and the potential health and economic outcomes of each package (Box 7.1).

Box 7.1. WHO and IARC tool for setting cancer priorities and costing cancer control plans



Effective cancer control planning requires accurate data for planning, costing and implementation. World Health Assembly resolution WHA70.12 (2017) urges governments to introduce NCCPs that prioritize cost-effective interventions and to promote universal access to comprehensive and cost-effective care for the integrated management of cancers. To assist national policy-makers in LMIC obtain the best value for money in health spending by identifying priority

interventions in national cancer planning according to country capacity, an open-access tool was developed by WHO and the IARC. This tool allows policy-makers to perform detailed costing of cancer services; provides resource-stratified guidance to implement a comprehensive cancer prevention and control programme; and develop a business plan evaluating the impact, cost and feasibility of selected cancer interventions.

References

1. HIV Prevention in the Era of Expanded Treatment Access. UNICEF. 2004. (<https://www.unicef.org/aids/files/HIV-Prevention-in-the-Era-of-Expanded-Treatment-Access.pdf>, Accessed January 2020)
2. World health report, 2000. Health systems: improving performance. Geneva: World Health Organization; 2000.
3. Mills A, Ataguba JE, Akazili J, Borghi J, Garshong B, Makawia S, et al. Equity in financing and use of health care in Ghana, South Africa, and Tanzania: implications for paths to universal coverage. *Lancet*. 2012;380(9837):126 -33.
4. Foerster M, Anderson BO, McKenzie F, Galukande M, Anele A, Adisa C, et al. Inequities in breast cancer treatment in sub-Saharan Africa: findings from a prospective multi-country observational study. *Breast Cancer Res*. 2019;21(1):93.
5. Reeves A, Courtsoyannis Y, Basu S, McCoy D, McKee M, Stuckler D. Financing universal health coverage – effects of alternative tax structures on public health systems: cross-national modelling in 89 low-income and middle-income countries. *Lancet*. 2015;386(9990):274 -80.
6. Xu K, Soucat A, Kutzin J, Brindley C, van de Maele, Toure H, et al. Public spending on health: a closer look at global trends. Geneva: World Health Organization; 2018 (https://www.who.int/health_financing/documents/health-expenditure-report-2018/en/, accessed January 2020).
7. McIntyre, D. & Kutzin, J., 2012. Revenue collection and pooling arrangements in financing. In R. D. Smith & K. Hanson, eds. *Health systems in low- and middle-income countries*. New York, NY: Oxford University Press Inc., pp. 77 -101.
8. A system of health accounts 2011. OECD publishing. (https://read.oecd-ilibrary.org/social-issues-migration-health/a-system-of-health-accounts-2011_9789264270985-en#page164, Accessed January 2020).
9. Collins TE, Nugent R, Webb D, Placella E, Evans T, Akinawo A. Time to align: development cooperation for the prevention and control of non-communicable diseases. *BMJ*. 2019;366:4499.
10. Financing global health 2018: countries and programs in transition. Seattle (WA): Institute for Health Metrics and Evaluation; 2019.
11. Global Burden of Disease Health Financing Collaborator Network. Trends in future health financing and coverage: future health spending and universal health coverage in 188 countries, 2016 -20. *Lancet*. 2018;391(10132):1783 -98.
12. National Audit Office, UK framework for assessing value for money. <https://www.nao.org.uk/successful-commissioning/general-principles/value-for-money/assessing-value-for-money/> Accessed January 14, 2020.
13. Baltussen R, Jansen MP, Bijlrmakers L, Tromp N, Yamin AE, Norheim OF. Progressive realisation of universal health coverage: what are the required processes and evidence? *BMJ Glob Health*. 2017;2 (3):e000342.
14. WHO guideline on country pharmaceutical pricing policies. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/bitstream/handle/10665/153920/9789241549035_eng.pdf?sequence=1).
15. Technical report: pricing of cancer medicines and its impacts: a comprehensive technical report for the World Health Assembly Resolution 70.12: operative paragraph 2.9 on pricing approaches and their impacts on availability and affordability of medicines for the prevention and treatment of cancer. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/277190>, accessed January 2020).
16. Improving the transparency of markets for medicines, vaccines, and other health products (WHA72.8). Geneva: World Health Organization; 2019 (https://apps.who.int/gb/ebwha/pdf_files/WHA72/A72_R8-en.pdf, accessed January 2020).
17. Atun R, Jaffray DA, Barton MB, Bray F, Baumann M, Vikram B, et al. Expanding global access to radiotherapy. *Lancet Oncol*. 2015;16(10):1153 -86.
18. Mathauer I, Dale E, Jowes M, Kutzin J. Purchasing of health services for universal health coverage: How to make it more strategic? Policy brief. Geneva: World Health Organization; 2019 (WHO/UHC/HCF/PolicyBrief/19.6).
19. Gelband H, Jha P, Sankaranarayanan R, Horton S, editors. *Cancer. Disease control priorities*, Third edition, Vol. 3. Washington DC: World Bank; 2015 (<https://www.ncbi.nlm.nih.gov/books/NBK343628/>, accessed January 2020).
20. Lakdawalla DN, Doshi JA, Garrison LP Jr, Phelps CE, Basu A, Danzon PM. Defining elements of value in health care – a health economics approach: an ISPOR Special Task Force Report [3]. *Value Health*. 2018;21(2):131 -9.
21. Verguet S, Gauvreau CL, Mishra S, MacLennan M, Murphy SM, Brouwer ED, et al. The consequences of tobacco tax on household health and finances in rich and poor smokers in China: an extended cost-effectiveness analysis. *Lancet Glob Health*. 2015;3(4):e206 -16.
22. Levin CE, Sharma M, Olson Z, Verguet S, Shi JF, Wang SM, et al. An extended cost-effectiveness analysis of publicly financed HPV vaccination to prevent cervical cancer in China. *Vaccine*. 2015;33(24):2830 -41.

Chapter 08.

Effective implementation: improving capacity and capability



The background of the slide is a dark blue field filled with numerous handprints of varying sizes and orientations, all in a lighter blue shade. At the top left, there is a solid orange rectangular bar. At the bottom right, there is a solid pink rectangular bar.

Key messages

1. Effective implementation is based on:

- 1st step: Preparedness for implementation: service delivery models must be re-oriented through a primary care approach to promote early diagnosis; current infrastructure (equipment, procurement, supply chain) must be augmented to meet demand for services for the entire population and linked to a robust regulatory environment; a focus on additional human resource capability is essential to optimize quality.
- 2nd step: Implementation and scale-up: programmes and policies should be sustainably financed and maintained with scale-up through a gradual, resource-appropriate stepwise approach that integrates new cancer interventions into broader health sector activities and reforms
- 3rd step: monitoring, evaluation and sustainability: quality of care and safety must be monitored and maintained with accountability to learn from implementation and plan quality improvement

2. Enabling factors that allow durable improvements in capability and capacity are broad stakeholder engagement in implementation and research and innovation to promote and accelerate progress. These are essential elements of any cancer control interventions.

8.1

Delivering comprehensive cancer control: background

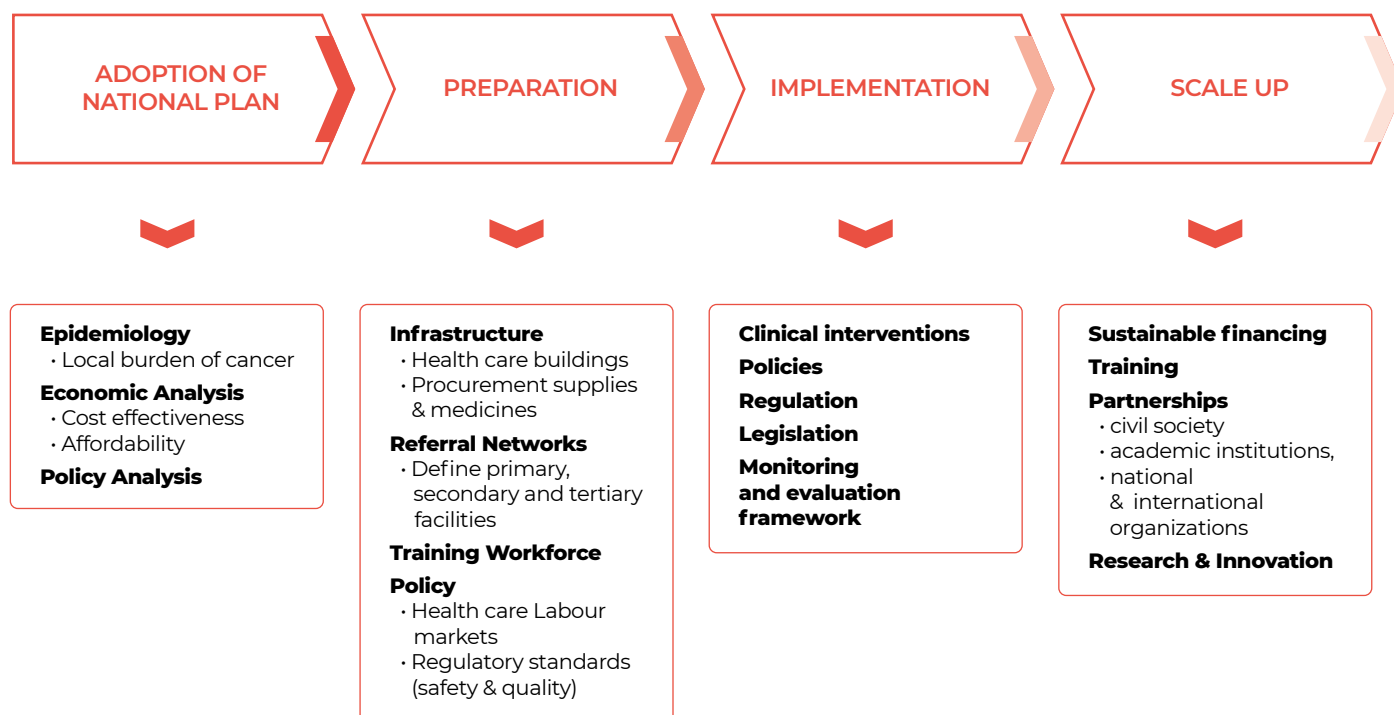
To be effective, the goals, objectives and targets of NCCPs must be turned into implementable actions by a host of actors, including government agencies, led, in most countries, by the ministry of health. Action plans must define the steps required, resource allocation, roles and responsibilities. Stakeholder support is vital to facilitate linkages.

Effective cancer systems should provide comprehensive services, from prevention to palliation, adapted to the setting and available resources (1). Major new programmes or services should be introduced in steps according to health system capacity and capability. Implementation should be based on rigorous evaluation of existing interventions; implementation science has an important role, particularly as demonstration sites are used to assess the feasibility and sustainability of programmes (2).

Implementation should comprise sequential steps (Fig. 8.1). Once a prioritized plan has been adopted (see chapter 6), a cancer cares system can be put into place or strengthened to provide comprehensive services by:

- analysing preparedness, which includes defining the model and organization of delivery of care, setting up the necessary infrastructure, ensuring the workforce capability and enabling the regulatory environment;
- implementing and scaling-up when the initial evaluation shows positive results, in steps and with due consideration of financial needs; and
- monitoring and evaluating to ensure the quality and safety of delivery of care. Without this component, the expected outcomes will not be achieved. Monitoring and evaluation of implementation ensure efficient use of resources and learning to improve planning and delivery of care continuously.

Fig. 8.1. Stages of implementation



8.2

Preparedness for implementing activities

8.2.1

Design of a service organization model

Ministries of health should design optimal care pathways, mapping patients' journey from the first contact with the health system to completion of treatment and survivor care and designating where new services will be introduced (3).

Organized service delivery models can improve outcomes, reduce costs and promote access and equity.

Referral networks link defined patient pathways through primary, secondary and tertiary facilities for prompt, accurate diagnosis and treatment (see chapters 4 and 5). While no one cancer control system can be recommended, it is generally accepted that detection and diagnosis are done in primary and secondary health

service facilities, expert treatment in tertiary centres and maintenance therapy and care for survivors in outpatient settings (4; Annex 2). A balance of centralized and decentralized services is required, to benefit from the assets of each level and integrated care (Table 8.1). Quality criteria should be established for the delivery of services according to the capacity and volume of facilities. Substandard cancer services can result in inferior cancer outcomes, with as much as 20% lower stage-specific survival in absolute terms, which is potentially equivalent to millions of lives lost each year from low-quality cancer care (5).

Table 8.1. Balance of centralized and decentralized services in cancer control

Centralized	Decentralized
Benefits <ul style="list-style-type: none"> • Bring patients from district to high-volume hospitals with specialist surgical practice • Standardized care, larger volume, allowing better evaluation of outcomes • Economies of scale • Availability of all cancer services • Specialized multidisciplinary team • Research and training to improve practice 	Benefits <ul style="list-style-type: none"> • Better coverage and access for greater equity • Reduced direct nonmedical and indirect costs to patients and families due to reduced travel time and productivity loss • Specific pathways can be designed and followed • Reduced delays in referral between presentation and definitive care • Specialized multidisciplinary teams more complex but feasible with information technology • Regular evaluation of treatment and outcomes only for the network
Risks <ul style="list-style-type: none"> • Reduced access and greater inequity for rural as compared with urban populations • May encourage super-specialization and unbalanced distribution of the workforce 	Risks <ul style="list-style-type: none"> • Inefficient clinical services and duplication • Poor coordination and access to higher-level centres and other oncology disciplines, resulting in delayed or no adjuvant care • Low-quality care

Centralized cancer centres can provide leadership in care networks, concentrate expertise for training professionals and formation of multidisciplinary teams, promote efficient use of technology and evaluate outcomes more systematically. Secondary hospitals can manage less complex, more frequent diagnostic and therapeutic procedures. The organization of cancer care pathways for easy referral within the network and coordination of clinical guidelines are key components of this model of care.

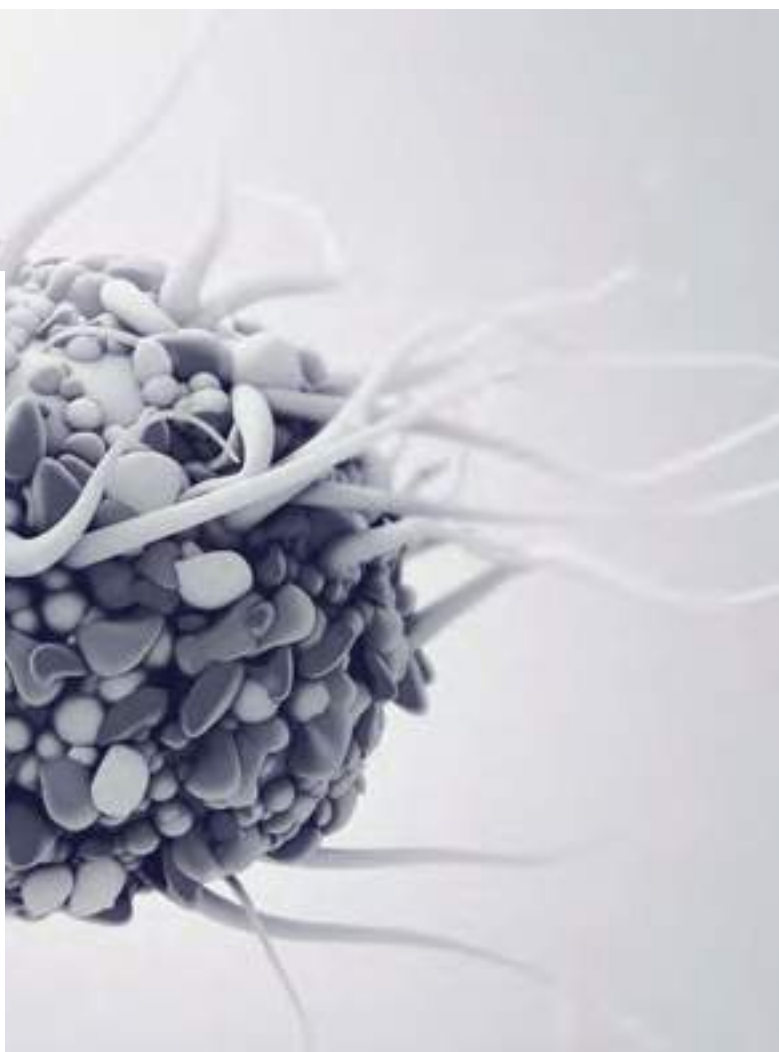
Until recently, centralization of cancer care in a limited number of facilities was practical, as, in the absence of rapid information flow or electronic health records, it allowed health care providers

to follow care pathways longitudinally and to coordinate care. Moreover, hyper-specialization of medicine and frequent reliance on advanced technology and expensive therapy required aggregating services with high fixed costs and expertise in managing adverse effects (6).

Centralized models of care, however, are prone to be inequitable as specialized facilities may not be easily accessible (7,8). Patients may have multiple fruitless contacts with the health system until they are referred to a specialized facility, which adds time and expense while increasing the probability of late-stage diagnosis. Alternative models of formally organized networks are necessary to increase access (Box 8.1).

Box 8.1. Alternative models of cancer care

- Sweden.** In 2010, the Swedish Government funded six regional cancer centres, which are regional hubs for cancer management. The centres developed supportive activities in collaboration with health care providers and regional health administrators. In 2015, the Government launched a standardized cancer care pathway, in which diagnostic procedures and treatment options are allocated for each cancer, with a time frame for detection, diagnosis and treatment. Care providers hold to each “time slot”, which creates a time-bound clinical guideline (9).



Addressing shortfalls in capacity and infrastructure is not straightforward; while central treatment facilities are necessary, without strengthened primary care and effective referral systems (10), patients will continue to present at late stages. Strengthening primary health care and

decentralizing care can reduce delays. Primary care has several critical functions in cancer control (see Table 8.2; 11). Barriers to strengthening primary and secondary care include the cost of appropriate technology, lack of training for needed tasks and dysfunctional referral systems.

Table 8.2. Examples of services that can be delivered in primary care

Cancer continuum	Examples of activities
Cancer prevention and health promotion	<ul style="list-style-type: none"> • Comprehensive services for tobacco cessation • Provide counselling on physical activity • Provide brief psychosocial interventions for people with hazardous, harmful alcohol use • Provide nutrition education and counselling • HPV, hepatitis B virus vaccination
Early diagnosis of cancer and screening for cervical cancer	<ul style="list-style-type: none"> • Counselling on symptoms of cancer, evaluation of family history • Identification of suspect signs and symptoms of cancer • Timely referral after a cancer diagnosis • Counsel, provide and/or refer for screening services
Routine care during cancer treatment	<ul style="list-style-type: none"> • Provide comprehensive primary care, including management of co-morbid conditions
Survivorship care	<ul style="list-style-type: none"> • Support management of long-term and late effects of treatment • Prevent second cancers, including with health promotion • Detect early recurrence
Palliative care	<ul style="list-style-type: none"> • Manage symptoms, including pain, nausea • Basic psychosocial support • Enable social support systems, including care at home

Service delivery models should include strategies to address variations in cancer outcomes among populations of different socioeconomic status, gender, age, race or other factors. Patient navigators, for example, may improve timely access to and completion of cancer treatment, as can programmes to promote culturally

appropriate communication (12,13) with a more personalized approach to communication to increase coverage and to update services (14). Programmes and approaches to provide a supportive environment and address social stressors and financial difficulties may facilitate access to and completion of therapy (15,16).

8.2.2

Scaling-up workforce capacity

Lack of trained health workers is a global problem, particularly in LMIC. In a survey of 93 countries in 2017, 8.6% did not have a single clinical oncologist; in 29%, an oncologist cared for approximately 1000 patients with a new diagnosis of cancer (25 countries in Africa, two in Asia, none in Europe or the Americas); in 42%, oncologists provided care for approximately 500 patients; and in 24%, an oncologist cared for approximately 150 patients (17). Demand for service will increase with the increasing number of patients and cancer survivors who require follow-up care (18).

For LIC, workforce strengthening may require international training to increase competence in oncological care. Such training should be suitable for the country with respect to differences in the scope of clinical practice (19). Strategies in MIC may be to optimize competence and increase capacity.

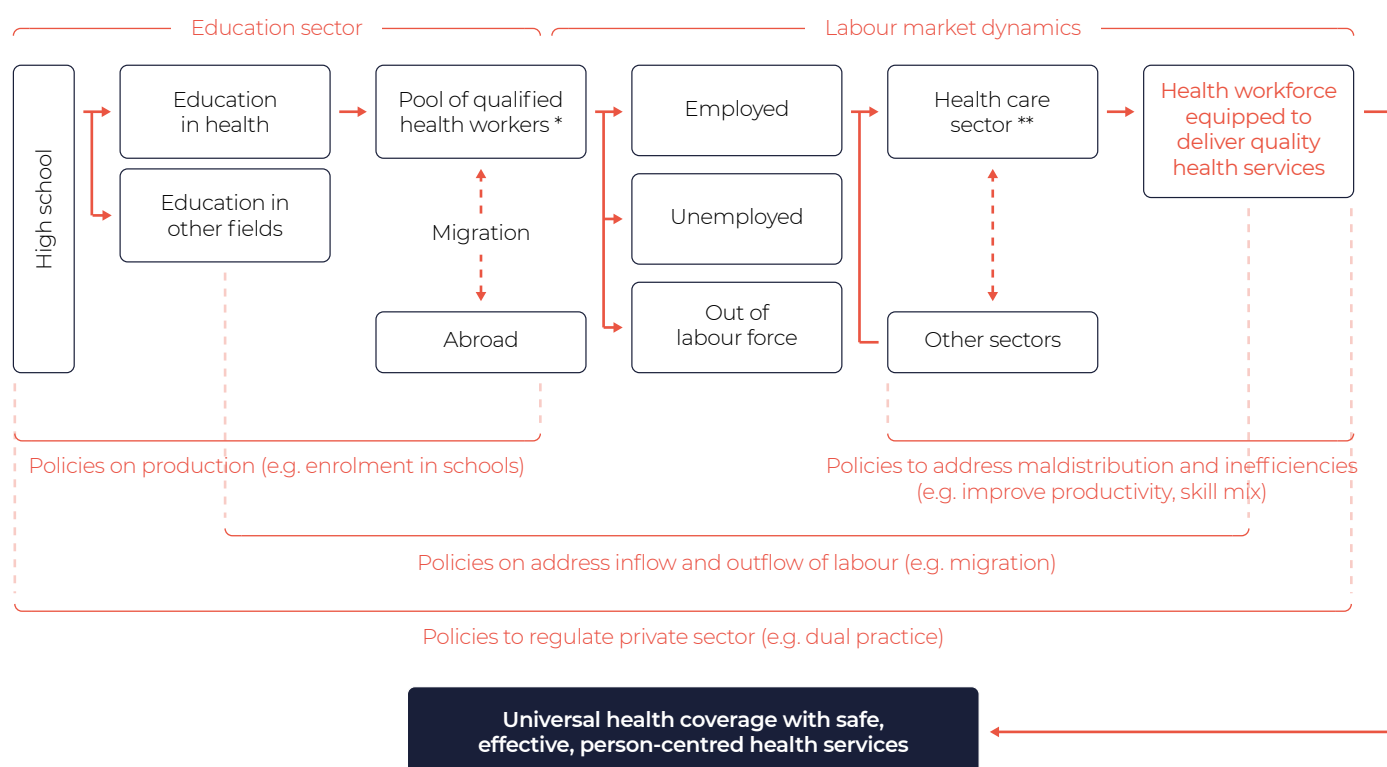
The WHO Global strategy on human resources for health, formulated in response to resolution WHA67.24 adopted during the Sixty-seventh World Health Assembly in 2014, proposes a paradigm shift in planning, educating, deploying, managing and rewarding health workers (Fig. 8.2) (21). Governments and stakeholders are encouraged to:

- optimize the health workforce to accelerate progress towards UHC and the SDGs;
- understand and prepare for future requirements of health systems, using the rising demand to maximize job creation and economic growth;
- build institutional capacity to implement the agenda; and
- strengthen monitoring and ensure accountability for implementation of both national strategies and the Global strategy.

The current and anticipated workforce shortages will compromise the ability of systems, particularly in LMIC, to provide high-quality cancer care (20).

Fig. 8.2. Planning, educating, deploying, managing and rewarding health workers

Adapted from reference 21



Policy-makers should consider the future demand that will be created by a growing, aging population in making a long-term plan. Training may be required at each level of care and for diverse competences, including law, economics and communications. All providers should have the competence to communicate across disciplines and service levels for integrated care.

Policy-makers may consider role delegation and optimization strategies, particularly when human resources are limited. In this approach, specific tasks are delegated,

where appropriate, from highly qualified health workers to health workers with shorter training and fewer qualifications in order to make more efficient use of the available human resources. To date, most studies on role delegation have been conducted among nurses and advanced practice nurses to scale-up the capacity for core competence, such as palliative care (22). There is little or no evidence on whether non-specialists can safely and effectively prescribe systemic therapy or radiotherapy.

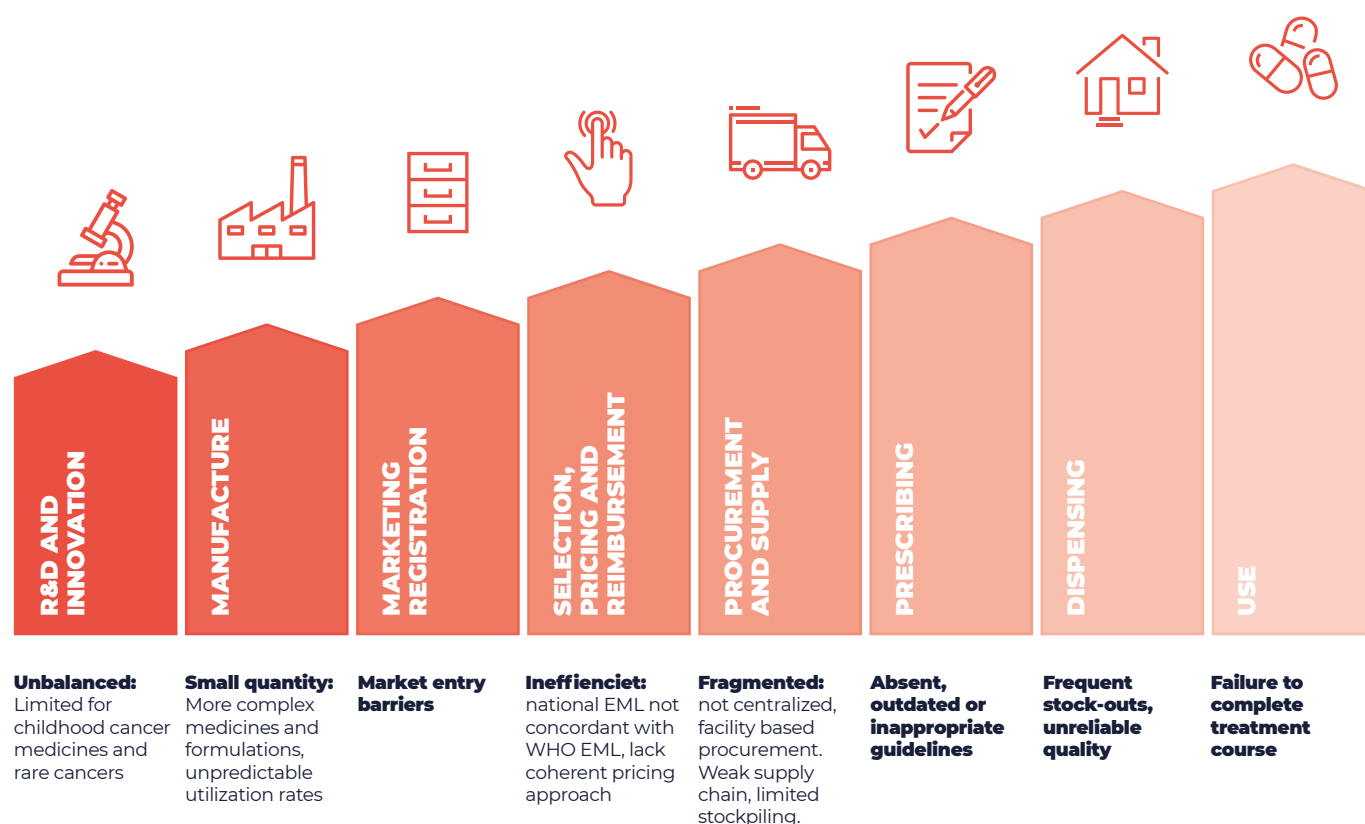
8.2.3

Access to cancer medicines and health products

Weak links along the “value chain” could disrupt patient access to health products (Fig. 8.3). Some common problems include lack of transparency in tendering, emergence of substandard and falsified products due to poor regulatory oversight, high costs of health products due to suboptimal pricing approaches, frequent shortages because of a fragmented supply chain and poor inventory management and abandoned treatment because of lack of patient follow-up. To mitigate these risks and to enhance patient access to cancer products, an implementation strategies should include the “value chain” approach. For example, an implementation strategy should ensure judicious selection of cancer products for inclusion in benefits packages, particularly with the increasing number of high-cost products. The selection should be evidence-based, with consideration of a range of relevant factors, such as the context; the efficacy, safety and quality of the products; cost-effectiveness; and the available budget. As noted in a WHO technical report on pricing of cancer medicines and its impacts (23), “a policy

of trying to fund the same number of cancer medicines as are available in other countries will not result in substantive health improvements, but will result in significantly higher costs”. Accordingly, when considering use of high-cost health products for specific patient groups, the policy should strike a balance between individual benefit and population needs. New products should not be introduced at the expense of interventions that represent better value for money in cancer care.

Fig 8.3. Value chain with common challenges associated with patient access to cancer products



Robust pricing policies should be integrated into the implementation strategy. Health systems should consider options for ensuring better value for money and affordable cancer products, ranging from strengthening pricing policies to managing factors that influence medicine demand (Fig. 7.3, see also section 7.4.2).

Procurement should comply with the WHO Operational principles for good pharmaceutical procurement (24), which include transparent processes and limiting public procurement to products on an official formulary list from qualified suppliers. This safeguards against unauthorized purchase of non-essential products and protects the supply chain from contamination with substandard or falsified products.

In the WHO Global surveillance and monitoring system, neoplastic agents are the most commonly reported class of substandard and falsified medical products among NCDs medicines (25).

With reliable estimates of actual need, health facilities can avoid waste of stockpiles of unused products, prevent stock-outs with a stable supply and achieve efficient, responsible financial control. Given the low volume of some cancer medicines, centralized, pooled procurement may be advantageous for consolidating demand, thereby taking advantage of economies of scale and scope.

Implementation strategies must involve clinicians and patients, adequate investment in a skilled workforce and adequate infrastructure to guarantee high-quality clinical practice and health products. To avoid abandonment of care, clinicians should clearly communicate treatment plans to patients so that they and their families understand the anticipated benefits and risk. Health authorities should restrict direct promotion of cancer products to clinicians and patients and promote the use of generic

and biosimilar medicines as appropriate. Authorities should investigate and rectify any misperception that such products are of inferior quality. When substandard and falsified medicines are suspected or proven, strong regulatory measures must be applied immediately to protect the public and to build trust.

8.2.4

Working with private health care sector services

The private sector (both non-for-profit and for-profit) participates in cancer care in almost every country.

Of 102 LMICs that reported cancer centres in the public and private sectors, the median proportion of facilities that were in the private sector is 33% (26).

The quality and extent of services vary, depending on the resources of the population, the health system model, coverage, quality and accessibility.

Although each government establishes its relations with private health care by policy, engagement may be considered when the public health sector has inadequate resources to meet the demand for cancer care. Cooperative agreements could be arranged to reduce the waiting lists while further investment is planned in the public sector (27). Such agreements should be transparent and avoid or manage conflicts of interest and unintended consequences, mainly with regard to access and costs incurred by patients.

8.3

Scaling-up cancer control

An implementation strategy is successful only when it is scaled up to provide the benefits of the programme to a wider population, beyond the demonstration site. Scaling-up is complex, involving evaluation of the initial experience of changed services, followed by a strategy to extend the programme. This should be considered as continuous learning in applying practical knowledge from initial experience. The objective is to build “a learning cancer care system”. Scaling-up involves estimating the required funding, training professionals and assessing the impact of changes in wider health care. Such decisions are not based on technical criteria only; in many cases, political values and the personal characteristics of the decision-makers also play a role. Furthermore, political uncertainty and economic constraints are relevant in a decision to scale up (2).

Therefore, alliances should be built with relevant stakeholders and partners in implementation. Local stakeholders include civil society organizations, academic institutions and consortia with experience in local settings who are acceptable to community leaders (Box 8.2). Such collaboration is increasing and is likely to continue.

Box 8.2. Strengthening national and global capacity for childhood cancer control: The importance of international partnerships

Partnerships between centres in HIC and centres and governments in LMIC play a significant role in advancing cancer control programmes for children. St Jude Children's Research Hospital (Memphis, USA; WHO Collaborating Centre for Childhood Cancer; www.stjude.org/global) works with collaborators around the world to build local capacity, expand training programmes, improve quality and conduct implementation research to sustainably improve the care and outcomes for children with cancer. Building on work with partners in LMIC for more than 25

years, St Jude Global engages stakeholders in regional and transversal networks to build capacity for care and share skills, knowledge and technology. Programme scale-up is guided by assessments of local needs, with training, resources and support, from master's and certificate programmes on-site and at a distance for LMIC candidates to hospital-wide clinical services along the care continuum and system dimensions such as metrics and performance evaluation, measuring disease burden and planning health systems and national cancer control.

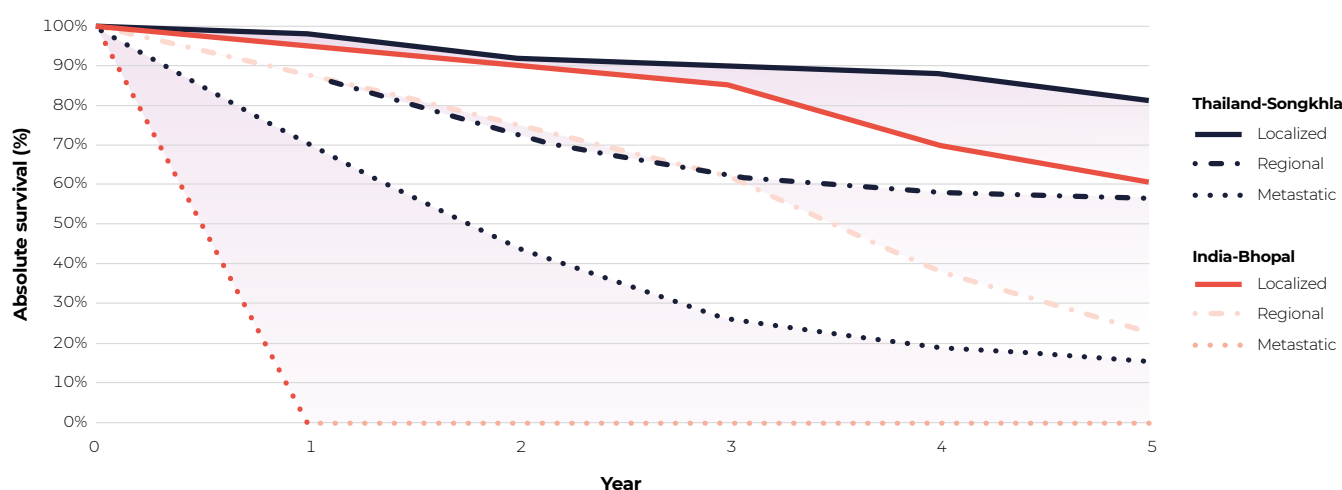


8.4 Monitoring and evaluation

Cancer care systems must adhere to standards of quality to ensure the best possible outcomes for patients. Poorly acquired or incorrectly interpreted images, for example, add cost without benefit and may be misleading or even injurious. Pathology and surgical, radiotherapeutic and pharmaceutical services should be monitored continuously to ensure safety and efficacy and should meet the guidelines and standards of national or international bodies, such as the International Atomic Energy

Agency (28) and WHO (29). The importance of high-quality care is shown by differences in stage-specific survival (Fig. 8.4), which should be similar in different jurisdictions if similar treatment is given. Lower survival at national or facility levels may indicate substandard treatment, such as surgery with positive margins, incorrect radiation treatment field or inappropriate protocols for systemic therapy.

Fig. 8.4. Variations in stage-specific survival from cervical cancer from two registries (Thailand-Songkhla, 1990-1999 and India-Bhopal, 1991-1995)



Standards of clinical practice and guidelines are the pillars of quality of care and have been shown to improve outcomes (30). Resource-stratified guidance is a method for evidence-based, standardized clinical management that can be applied in settings with different resource levels and can allow for step-wise capacity-building (31). Guidelines are not, however, enough. They are useful only if they are widely known, applied and evaluated for adherence. Hence, in parallel to clinical guidelines, an information system should be built to monitor the quality of cancer care, in which relevant information is collected with indicators ranging from the process of care (e.g. interval between diagnosis and treatment, adherence to clinical guidelines) to short-term and medium-term outcomes (e.g. 30-day and 90-day mortality after surgical procedure, re-interventions and/or readmission to hospital within 90 days, survival by stage).

Reports by patients on their outcomes and experiences may be obtained by various methods, from focus groups on experiences to surveys of their satisfaction with care received or perceived quality of life. Quality of care is also measured by monitoring and ensuring safety in delivery, including the common problems of safety in hospitals such as handling and disposing of chemotherapy, radioactive waste, treatment complications and misunderstandings among care professionals. Systematic monitoring of these incidents and the design and implementation of improvements are essential (32).

8.5

Enablers of successful cancer control

8.5.1

Collaboration with non-State actors

Sustained improvements in capability and capacity for cancer care require the participation of non-State actors for successful implementation of programmes and optimization of the cancer eco-system (33). Participatory governance should include the voices of users of health services and of the general population (34,35). Civil society organizations have a long record of support for programme planning and implementation at both national and international levels, providing technical support, training, support for patients and other activities (Table 8.3).

They are more effective if their activities are conducted within the framework of an NCCP, in order to avoid duplication of activities or investment of resources in non-priority areas. To engage them effectively, these organizations and patient groups should be represented on the advisory committee for drafting the responsibilities and activities of the NCCP.

Table 8.3. Examples of activities of civil society to support implementation of cancer control programmes

Domain	Example of activities	Impact
Political advocacy	<ul style="list-style-type: none"> • Research and training to support governments to fulfil international commitments in tobacco control • Campaigns (media involvement, public awareness) to increase knowledge and uptake of cancer screening services • Building coalitions to lobby for national cancer legislation 	<ul style="list-style-type: none"> • Stronger tobacco control legislation • Higher attendance in cancer screening programmes • Cancer control laws and policies adopted
Convening	<ul style="list-style-type: none"> • Convening leaders in policies, public and private sectors (e.g. World Cancer Leaders' Summit) • Hosting national cancer coalitions 	<ul style="list-style-type: none"> • Defining global and national agendas on cancer control priorities • Participatory multi-stakeholder engagement in cancer control activities
Meeting patient needs	<ul style="list-style-type: none"> • Providing and organizing psychosocial support, including patient peer support groups • Offering financial support • Housing caregivers close to the place of treatment • Providing services, including medicines and palliative care, to support governments in addressing gaps in health care provision 	<ul style="list-style-type: none"> • Improved quality of life • Improved access to information • Reduced financial burden on patients and other socio-economic effects (e.g. addressing gender inequality and burden on female caregivers) • Improved access to treatment and care

Meeting the needs of communities and patients is particularly important as the complexity of cancer treatment increases. Misinformation about cancer prevention and control is common and affects exposure to risk factors, awareness of cancer symptoms, stigmatization and treatment access and completion (see also section 5.5.3). By working with the media and other influencers of public perception, civil society can mitigate against

misinformation such as false promises of cancer cures or untested over-the-counter remedies claimed to prevent or treat cancer. Civil society has an important role in advocating for dialogue with providers about cancer diagnosis, goals of care and supportive services. These functions are essential to integrated, patient-centred cancer care.

8.5.2

Prioritizing research and innovation

Research is key to the long-term improvement of cancer control. The types of research required along the cancer continuum include the biology, epidemiology, prevention, screening, diagnosis, treatment and symptom management of cancers. Economic, health service and implementation research are also needed. Government facilitation of research, particularly implementation and clinical research, are in the public interest (30,36).

Building clinical trial capacity has broader benefits, including augmenting workforce competence with salary support and training, improving facility equipment and potentially providing services at lower cost (37). Research infrastructure can also support regional collaboration among cancer centres, strengthen information systems and improve standards of care. Priorities in implementation and health service research are based on evaluation of innovations in health service delivery, such as the feasibility of a programme in a particular context, determinants of uptake

of prevention, approaches to reducing inequality in access to cancer services or improving early referral. Research on technologies such as telemedicine and telepathology (38,39; see also section 4.7) can indicate the method to be chosen according to the context and policy.

Research is instrumental for health service strategies to increase quality of life and cancer outcomes while reducing inequality.

Specific research priorities are listed in the IARC World Cancer Report, including for selected countries. Funding cancer research and enabling innovation are important for understanding the burden of cancer today and reducing the burden tomorrow (40).



References

1. Sirohi B, Chalkidou K, Pramesh CS, Anderson BO, Loeher P, El Dewachi O, et al. Developing institutions for cancer care in low-income and middle-income countries: from cancer units to comprehensive cancer centres. *Lancet Oncol*. 2018;19(8):e395–406.
2. Murillo R, Robles C. Research needs for implementing cancer prevention and early detection in developing countries: from scientists' to implementers' perspectives. *Biomed Res Int*. 2019;2019:9607803.
3. van Hooft JC, Elferink MA, Klaase JM, Kouwenhoven EA, Schiphorst PP, Siesling S. Long-term effects of a regional care pathway for patients with rectal cancer. *Int J Colorectal Dis*. 2015;30(6):787–95.
4. Shah SC, Kayamba V, Peek RM, Heimbürger D. Cancer control in low- and middle-income countries: Is it time to consider screening? *J Glob Oncol*. 2019;5:1–8.
5. Cancer survival in Africa, Asia, the Caribbean and Central America. Lyon: International Agency for Research on Cancer; 2020 (<http://survcan.iarc.fr/survivalstats/cd10.php?CD10=C53&table=Table5b&submission=subm>, accessed January 2020).
6. Wiler JL, Harish NJ, Zane RD. Do hospitals still make sense? The case for decentralization of health care. *NEJM Catalyst*. 2017 (<https://catalyst.nejm.org/hospitals-case-decentralization-health-care/>, accessed January 2020).
7. Dare A, Anderson B, Sullivan R, Pramesh C, Yip C, et al. Surgical services for cancer care. In: Gelband H, Jha P, Sankaranarayanan R, Horton S, editors. *Disease control priorities*. Third edition, Vol. 3, Cancer. Washington DC: World Bank; 2015.
8. Brandts CH. Innovating the outreach of comprehensive cancer centers. *Mol Oncol*. 2019 Mar;13(3):619–623. doi: 10.1002/1878-0261.12451. Epub 2019 Feb 2. Review. PubMed PMID: 30657632; PubMed Central PMCID: PMC6396353.
9. Wilkens J, Thulesius H, Schmidt I, Carlsson C. The 2015 National Cancer Program in Sweden: Introducing standardized care pathways in a decentralized system. *Health Policy*. 2016;120(12):1378–82.
10. De Angelis C, Pacheco C, Lucchini G, Arguello M, Conter V, Flores A, et al. The experience in Nicaragua: childhood leukemia in low income countries — the main cause of late diagnosis may be "medical delay". *Int J Pediatr*. 2012;2012:129707.
11. Rubin G, Berendsen A, Crawford SM, Dommert R, Earle C, Emery J, et al. The expanding role of primary care in cancer control. *Lancet Oncol*. 2015;16(12):1231–72.
12. Tho PC, Ang E. The effectiveness of patient navigation programs for adult cancer patients undergoing treatment: a systematic review. *JBI Database System Rev Implement Rep*. 2016;14(2):295–321.
13. Dalton M, Holzman E, Erwin E, Michelen S, Rositch AF, Kumar S, et al. Patient navigation services for cancer care in low- and middle-income countries: a scoping review. *PLoS One*. 2019;14(10):e0223537.
14. Escribà-Agüir V, Rodríguez-Cómez M, Ruiz-Pérez I. Effectiveness of patient-targeted interventions to promote cancer screening among ethnic minorities: a systematic review. *Cancer Epidemiol*. 2016;44:22–39.
15. Rana RH, Alam K, Gow J, Ralph N. Predictors of health care use in Australian cancer patients. *Cancer Manag Res*. 2019;11:6941–57.
16. Byrne J, Campbell H, Gilchrist M, Summersby E, Hennessy B. Barriers to care for breast cancer: a qualitative study in Ireland. *Eur J Cancer Care*. 2018;27(5):e12876.
17. Mathew A. Global survey of clinical oncology workforce. *J Glob Oncol*. 2018;4:1–12.
18. Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Piñeros M, et al. *Global Cancer Observatory: cancer tomorrow*. Lyon: International Agency for Research on Cancer; 2019. Vanderpuye V, Hammad N, Martel Y, Hopman WM, Fundytus A, Sullivan R, et al. Cancer care workforce in Africa: perspectives from a global survey. *Infect Agent Cancer*. 2019;14:11.
19. Yang W, Williams JH, Hogan PF, Bruinooge SS, Rodríguez GI, Kosty MP, et al. Projected supply of and demand for oncologists and radiation oncologists through 2025: an aging, better-insured population will result in shortage. *J Oncol Pract*. 2014;10(1):39–45.
20. Institute of Medicine, Committee on the Robert Wood Johnson Foundation Initiative on the Future of Nursing, at the Institute of Medicine. Washington DC: National Academies Press; 2011.
21. Global strategy on human resources for health: workforce 2030. Geneva: World Health Organization; 2016 (<https://apps.who.int/iris/bitstream/handle/10665/250368/9789241511131-eng.pdf?sequence=1/>, accessed January 2020).
22. Technical report: pricing of cancer medicines and its impacts: a comprehensive technical report for the World Health Assembly Resolution 70.12: operative paragraph 2.9 on pricing approaches and their impacts on availability and affordability of medicines for the prevention and treatment of cancer. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/handle/10665/277190>, accessed January 2020).
23. Barraclough A, Clark M. Managing procurement. Chapter 18. In: MDS-3: Managing access to medicines and health technologies, third edition. Geneva: World Health Organization; 2012 (<http://apps.who.int/medicinedocs/documents/s19577en/s19577en.pdf>, accessed January 2020).
24. WHO global surveillance and monitoring system for substandard and falsified medicines. Geneva: World Health Organization; 2017 (<https://apps.who.int/iris/bitstream/handle/10665/326708/9789241513425-eng.pdf?ua=1>, accessed January 2020).
25. WHO NCD Country Capacity Survey. 2019. (<https://www.who.int/ncds/surveillance/ncd-capacity/en/>, Accessed January 2020).
26. Smith E, Brugha R, Zwi A. Working with private sector providers for better health care. An introductory guide. Geneva: World Health Organization; 2001 (<https://www.who.int/management/partnerships/private/privatesectorguide.pdf>, accessed January 2020).
28. Applying radiation safety standards in radiotherapy (Safety reports series No. 38). Vienna: International Atomic Energy Agency; 2006 (<https://www.iaea.org/publications/7114/applying-radiation-safety-standards-in-radiotherapy>, accessed January 2020).
29. WHO guide for the stepwise laboratory improvement process towards accreditation in the African Region (with checklist). Brazzaville: World Health Organization Regional Office for Africa; undated (<https://www.who.int/tb/laboratory/afro-slipta-checklist-guidance.pdf>, accessed January 2020).
30. Cancer care. Assuring quality to improve survival. Paris: Organization for Economic Co-operation and Development; 2013 (<https://www.oecd.org/health/cancer-care-9789264181052-en.htm>, accessed January 2020).
31. Anderson BO, Duggan C. Resource-stratified guidelines for cancer management: correction and commentary. *J Glob Oncol*. 2016;3(1):84–8.
32. Handbook for national quality policy and strategy. A practical approach for developing policy and strategy to improve quality of care. Geneva: World Health Organization; 2018 (<https://apps.who.int/iris/bitstream/handle/10665/272357/9789241565561-eng.pdf?ua=1>, accessed January 2020).
33. Everybody's business: strengthening health systems to improve health outcomes: WHO's framework for action. Geneva: World Health Organization; 2007 (https://www.who.int/healthsystems/strategy/everybodys_business.pdf, accessed January 2020).
34. Rohrer K, Rajan D, Schmets G. Population consultation: a powerful means to ensure that health strategies are oriented towards universal health coverage. *World Health Popul*. 2017;17(2):5–15.
35. Promoting participatory governance, social participation and accountability. Geneva: World Health Organization; 2020 (<https://www.who.int/activities/promoting-participatory-governance-social-participation-and-accountability>, accessed January 2020).
36. Gelband H, Sankaranarayanan R, Gauvreau CL, Horton S, Anderson BO, Bray F, et al. Costs, affordability, and feasibility of an essential package of cancer control interventions in low-income and middle-income countries: key messages from Disease Control Priorities, 3rd edition. *Lancet*. 2016;387(10033):2133–44.
37. Bentley C, Cressman S, van der Hoek K, Arts K, Dancey J, Peacock S. Conducting clinical trials—costs, impacts, and the value of clinical trials networks: A scoping review. *Clin Trials*. 2019 Apr;16(2):183–193.
38. Muvugabigwi G, Nshimiyimana I, Greenberg L, Hakizimana E, Ruhangaza D, Benewe O, et al. Decreasing histology turnaround time through stepwise innovation and capacity building in Rwanda. *J Glob Oncol*. 2018;4:1–6.
39. Huang Y, Lei Y, Wang Q, Li D, Ma L, Guo L, et al. Telepathology consultation for frozen section diagnosis in China. *Diagn Pathol*. 2018;13(1):29.
40. The global strategy and plan of action on public health, innovation and intellectual property. Geneva: World Health Organization; 2020 (https://www.who.int/phi/implementation/phi_globstat_action/en/, accessed January 2020).

Conclusions and recommendations

Key findings

- 1. The cancer burden is high and increasing.** Cancer is diagnosed in more than 18 million people each year, and this number will increase to 29.4 million by 2040. The most rapid increases will occur in LMIC, where there will be an 80% increase, reaching 19.6 million new cancer diagnoses each year.
- 2. Progress is inequitable and is insufficient to reach the SDG targets.** While cancer outcomes are improving and the probability of premature death is decreasing in HIC, progress in most LMIC has been slow, highlighting greater global inequity. There are significant deficits in the capacity to manage cancer in LMIC, which results in inaccessible care and financial hardship. Less than 15% of LIC currently have comprehensive services available. Significant investments in cancer control are required to achieve national and global targets for NCDs and UHC.
- 3. Investing wisely will save lives.** Priority cancer control interventions are affordable for countries at all income levels. By investing US\$ 2.70–8.15 per capita, more than 7 million lives can be saved over the next decade. Efficient investments in cancer control can yield substantial human and economic returns.

Activate political will

- 1. Strengthen governance, make a plan.** National cancer plans and strong governance are the basis of an effective response and can improve outcomes. They must be based on priorities, have a budget and be financed, implemented and monitored. The perspectives of all stakeholders must be included in order to meet the needs of diverse communities, including disadvantaged groups.

Set priorities and invest wisely

- 2. Identify priorities that are feasible, evidence-based and can be financed.** Priority-setting should be informed by current capacity and health technology assessments and include the needs of all populations. Priorities should be aligned with the development of benefits packages for UHC or formulation of a national plan.
- 3. Invest in WHO “best buys” for primary prevention.** While priorities should be set according to the country context, in most settings, high-priority, feasible strategies will be tobacco control and HPV vaccination. Obesity and alcohol use are persistent risk factors and may also require action.
- 4. Invest in early diagnosis.** One of the most effective strategies in cancer management is early diagnosis, which requires population awareness, primary care capacity, strong referral systems and diagnostic capacity. Screening is much more complex and expensive than early diagnosis, except screening for cervical cancer, which is a global priority (in line with the WHO programme for elimination of cervical cancer).
- 5. Implement effective, feasible cancer management.** Cancer treatment can be provided at low cost and save lives with use of therapies that provide value for money. Childhood cancer, for example, is a feasible priority, and the target of the WHO global initiative for childhood cancer is to save the lives of one million children with cancer by 2030. Supportive and survivorship care must be scaled up to promote treatment completion and reintegration into workplaces and communities. Palliative care must be a priority in all countries.

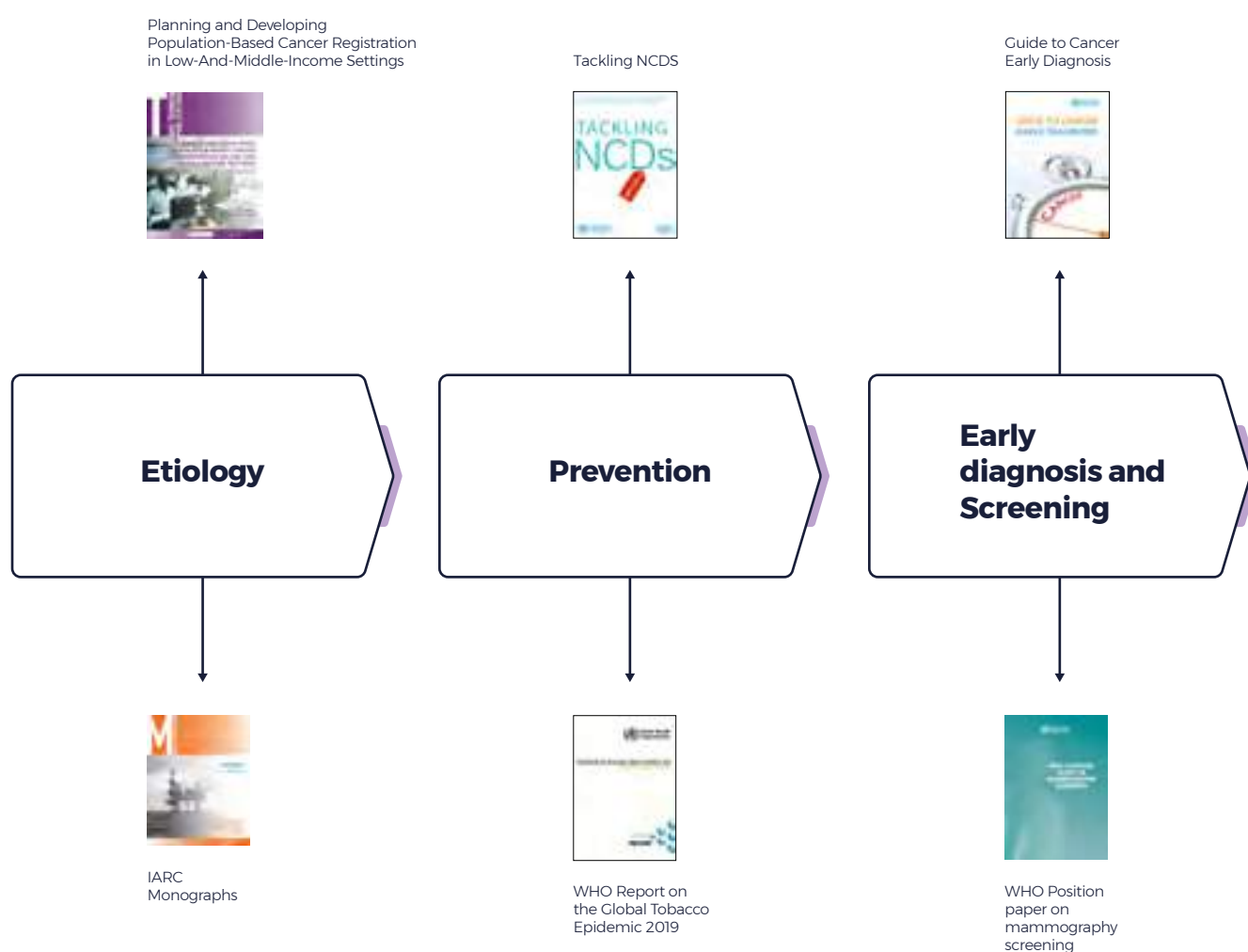
Key actions

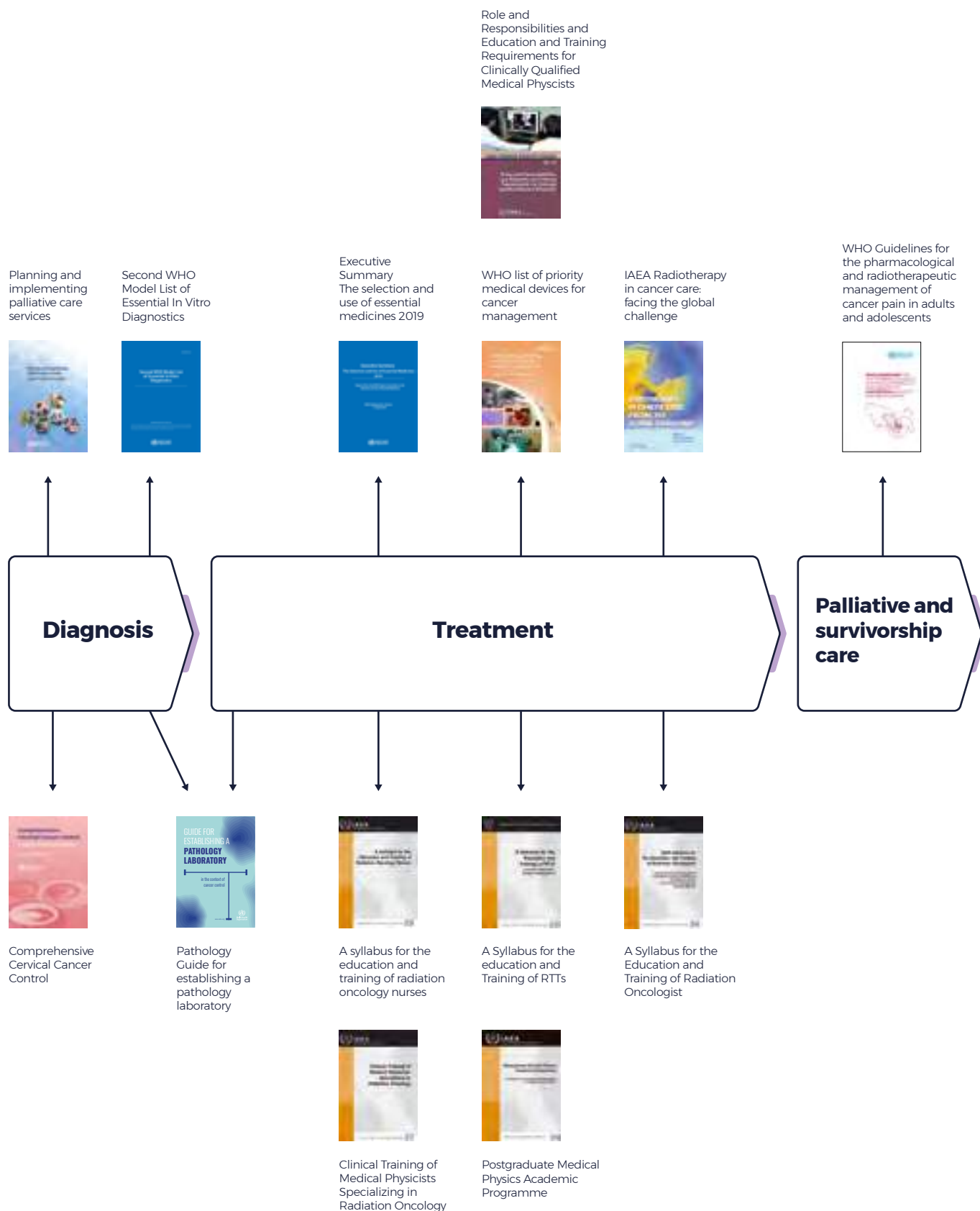
Provide care for all

- 6. Strengthen information systems.** Robust information systems are required for informed decision-making, monitoring implementation with quality assurance and accountability and for research and innovation.
- 7. Fund priorities in cancer interventions, and ensure financial protection.** While the scale of investment will differ by country, efficient investments in cancer can save lives and provide a positive return. The current fiscal space and projected requirements should be evaluated, increasing expenditure for higher levels of coverage, increasing costs of care and greater numbers of patients in the short and medium terms.
- 8. Build capacity through cancer centres and networks.** Enhancing care coordination and using care pathways can improve outcomes and gain efficiency. Centralized services can improve quality, although equity and geographical accessibility must be ensured through care networks.
- 9. Optimize the workforce and access to reliable, sustainable medicines and health products.** Cancer management requires a high-performing system, in which the workforce requirements are diverse and demanding. Access to medicines and health products should be managed through a value chain approach, focusing on selection, pricing approaches, supply chain management and coherent guidelines
- 10. Partner with communities and civil society.** An empowered, enabled civil society, including cancer survivors, and their networks can have a major impact on cancer policies and programmes, including in setting priorities, increasing implementation and maintaining accountability to improve cancer care together.

Select publications in cancer control from UN agencies

Annex 1. WHO tools and resources





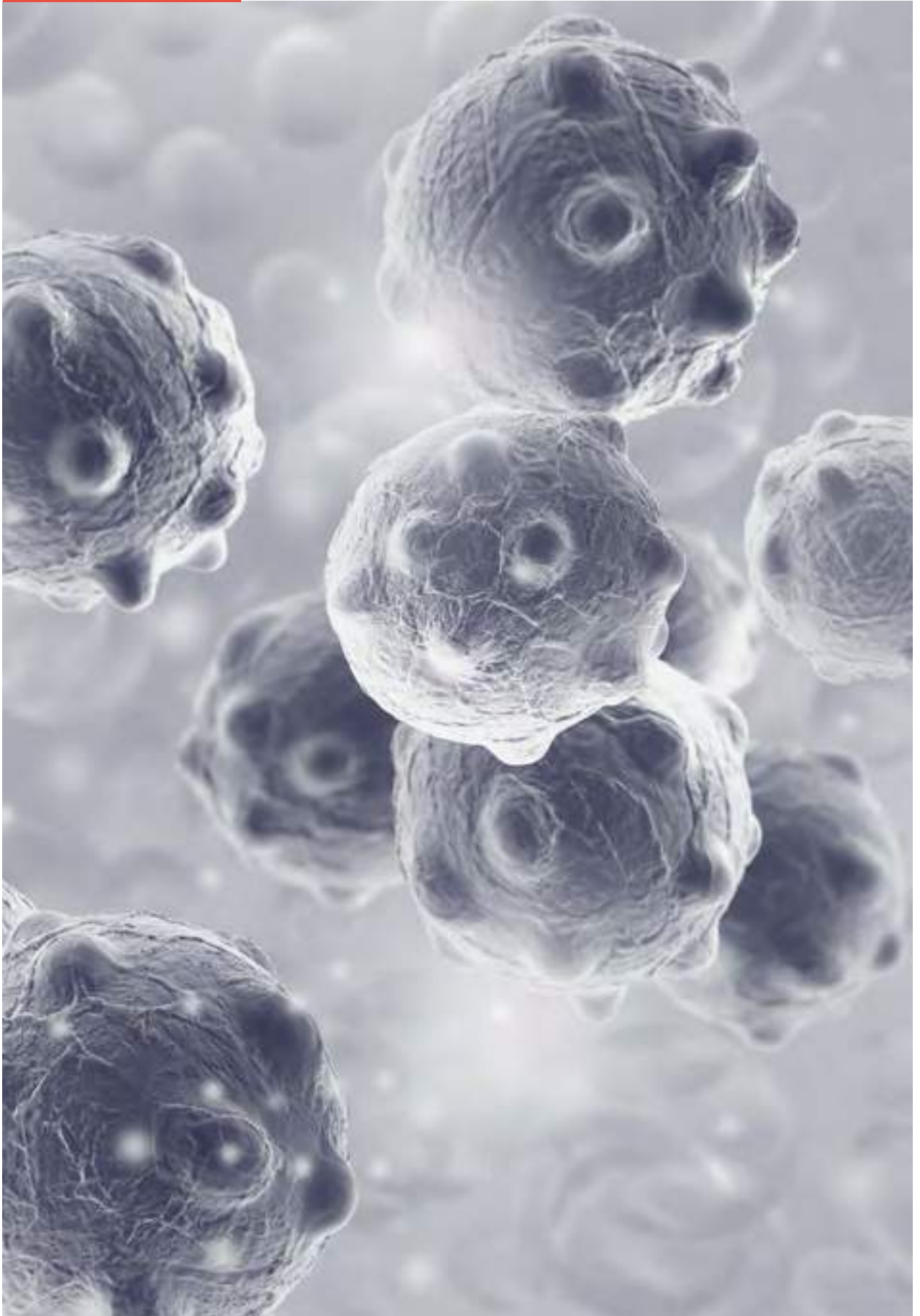
Annex 2.

Glossary and key terms

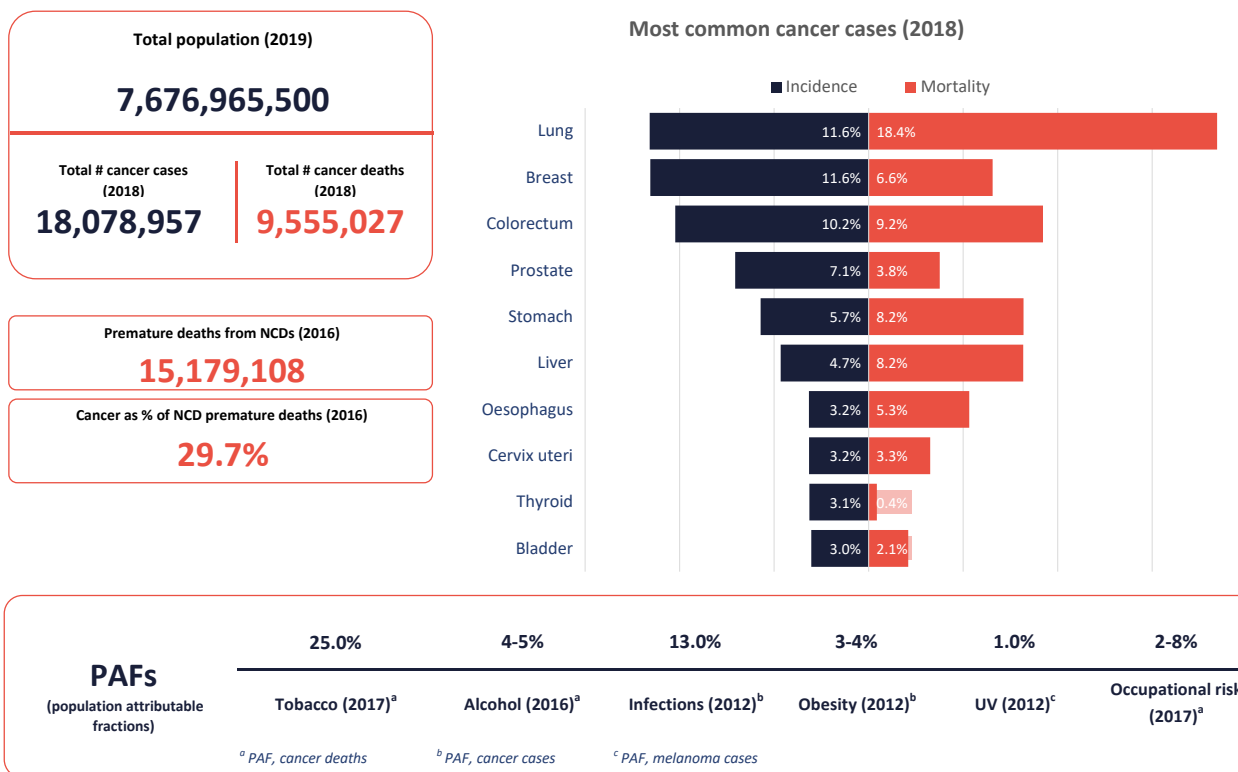
Term	Definition
Cancer control	Reduction in the incidence, morbidity and mortality from cancer and improvement in the quality of life of cancer patients and their families. Achieved through systematic implementation of evidence-based interventions for prevention, early detection, diagnosis, treatment and palliative care.
Carcinogen	Any agent – chemical, physical or biological – that causes cancer.
Cancer continuum	A concept that describes the spectrum of cancer care from cancer biology and aetiology, prevention, early diagnosis and screening, treatment, survivorship care, palliative care and end of life care.
CAR-T therapy	An innovative treatment modality in which a patient's healthy immune cells (T cells) are engineered in the laboratory to attack cancer cells
Cost-effectiveness analysis	A form of economic evaluation in which costs are expressed in monetary terms and the consequences are expressed in physical units. Used to compare different ways of achieving the same objective or to assess the comparative value for money across different investment options.
Cost-benefit analysis	A method of economic evaluation that values all benefits against all costs. The resulting cost-benefit ratio gives an indication of whether or not the benefits outweigh the costs of an intervention, and hence provides a decision-making tool with a broad societal perspective.
Early detection	Early detection comprises of two distinct strategies: early diagnosis in symptomatic populations and screening in asymptomatic, but at risk, populations.
Early diagnosis	A public health initiative that encompasses three steps in a cancer pathway: awareness of cancer symptoms and access to care, diagnostic examination of symptomatic patients and treatment of detected cases.
Effectiveness	The extent to which an intervention, procedure, regimen or service deployed in the field in routine circumstances does what it is intended to do for a specified population.
Elimination of cervical cancer as a public health problem	Elimination as a public health problem is defined by achievement of measurable global targets set by WHO in relation to a specific disease. Broadly, elimination can be related to an infection or disease. Cervical cancer elimination as a public health problem is defined as a threshold rate of less than 4 cases per 100 000 women.
Evaluation	Systematic, objective assessment of the relevance, adequacy, efficiency, effectiveness and impact of a course of action in relation to the objectives and the resources and facilities deployed.
Hazard vs. risk	A hazard is an inherent (built-in) property of a material or exposure. Risk is the extent to which that material or exposure can cause harm.
Health inequality and inequity	Differences in health status or in the distribution of health determinants among population groups. Health inequalities are attributable to biological variations or free choice, and health inequities to the external environment and conditions mainly outside the control of the individual.
Human development index	Summary measure of average achievement in key dimensions of human development. The scores for the three HDI dimension indices are aggregated into a composite index using geometric mean. The burden of cancer evolves as countries undergo major transitions as measured by HDI.
Incidence rate	Number of new cases of a disease in a defined population within a specified time.
Individual health assessment	Investigations for asymptomatic individuals have been made available to those who may consider they are at risk of a disease. It is generally outside of a government programme and may be without government oversight.

Term	Definition
Length bias	The fact that screening detects more slowly growing tumours (which have a longer asymptomatic phase) than rapidly progressive cancer; thus, less aggressive, less deadly disease is over-represented.
Mortality rate	Proportion of a population who die from a particular disease in a specified time.
Negative predictive value	Likelihood of not having the disease when the test is negative.
Off-label prescribing	Occurs when a medicine is used for a disease or medical condition not approved to treat by a regulatory commission.
Opportunistic case detection	Application of a screening test to asymptomatic individuals non-systematically; also referred to as opportunistic screening.
Opportunity cost	Loss of benefits that could be obtained if resources were invested in an alternative activity (use of finite resources displaces other use).
Organized screening programme	Programme that achieves all predefined criteria. Organized programmes comprise systematic testing with a standardized test, centralized call and recall of a well-defined target population, delivery of test results as well as investigations, treatment and follow-up care if necessary.
Overdiagnosis	Detection of cancers that will not present clinically in the person's lifetime.
Overtreatment	Treatment of a cancer that would have gone away on its own or never caused any problems and are usually found on a screening test. Overtreatment may lead to harmful side effects from cancer therapies that are not needed.
Palliative care	An approach that improves the quality of life of patients and their families facing the problem associated with any life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual.
Participation rate	Proportion of people invited who receiving screening examination.
Pilot study	A project in a limited population, usually to provide information on performance but not necessarily on outcome.
Positive predictive value	Likelihood of having a disease when a test is positive.
Population-attributable fraction	Estimated proportion of cases of a disease that could be avoided if exposure to an agent or risk factor is fully reduced or eliminated.
Prevention	Eliminating or minimizing exposure to the causes of cancer, and includes reducing individual susceptibility to the effects of such causes.
Primary prevention	Elimination or reduction of exposure to recognized risk factors in susceptible populations to prevent a disease. Primary prevention of cancer comprises a broad spectrum of strategies, from legislation and policies to minimize or eliminate exposure to carcinogens to promotion of healthy behaviour and health sector programmes.
Secondary prevention	Secondary prevention of cancer involves the use of examinations and tests to detect a cancer as early as possible, before signs and symptoms would cause a patient to seek care. It has previously been used synonymously with screening.
Precancerous lesion	Abnormal change in tissues in an early stage of cancer that could progress to invasive cancer if left untreated.
Prevalence rate	Proportion of people in a defined population with a condition or disease at a specific time.

Term	Definition
Screening programme	A governmental public health programme that may comprise of invitations to a defined target population, application of a screening test to asymptomatic individuals, notification of the results, diagnostic examination of positive cases and treatment of cases detected.
Screening coverage	Proportion of people in the target population who attend for screening.
Screening test	Tests that look for the presence of cancer or pre-cancer in people without symptoms of cancer.
Screen-positive	Results of a screening procedure that shows an abnormality.
Sensitivity	Proportion of people who have a disease who are identified correctly by a test (true positives).
Specificity	Proportion of people who do not have a disease who are identified correctly by a test (true negatives).
Survivorship care	Care received after active treatment for cancer to monitor for cancer recurrence, to follow-up for and management of health problems related to cancer care and to assess for development of other types of cancer.
Survival	Proportion of all people with a condition who are still alive after a certain time.
Value chain	Activities required to bring medicines to patients, from research and development to service delivery.

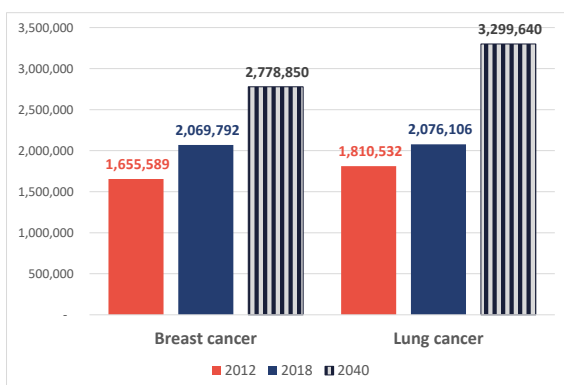


BURDEN OF CANCER

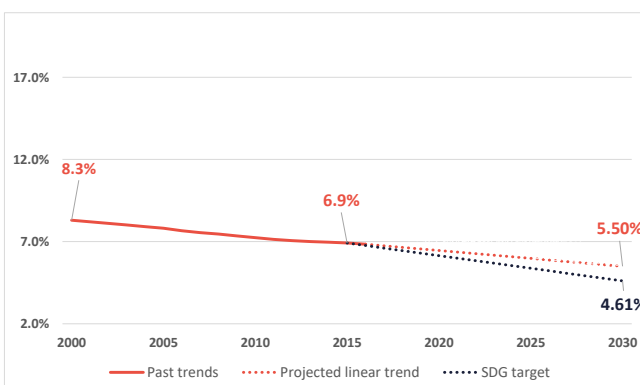


TRENDS

Estimated past and future trends in total cases per year (breast and lung)



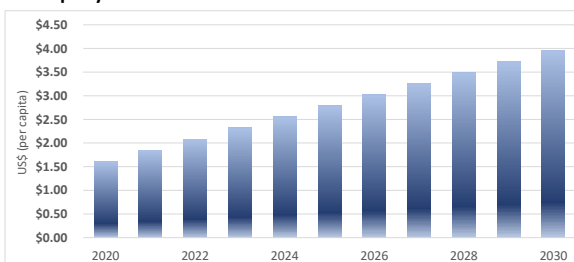
Probability of premature death from cancer per year



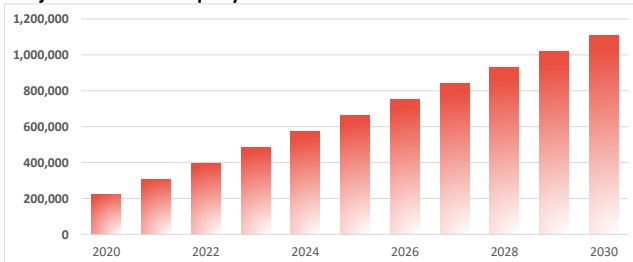
INVESTMENT CASE (2019)

At this income level, investing in a package of essential services and scaling-up coverage will:

Costs per year



Projected lives saved per year



HEALTH SYSTEM CAPACITY

^a per 10,000 cancer patients

Availability of population-based cancer registry (PBCR)**	2019	35% of countries have high-quality PBCR
Quality of mortality registration***	2007-2016	25% of countries have high quality coverage
# of external beam radiotherapy (photon,electron) ^a	2019	6.5 (median), 0-23.8 (range)
# of mammographs ^a	2020	24.5 (median), 0-429.5 (range)
# of CT scanners ^a	2020	30.3 (median), 0-422.8 (range)
# of MRI scanners ^a	2020	14.8 (median), 0-373.9 (range)
# of PET or PET/CT scanners ^a	2020	0.7 (median), 0-30.7 (range)

WORKFORCE

^a per 10,000 cancer patients

Available staff in Ministry of Health who dedicates significant proportion of their time to cancer	2019	81% of countries have MoH staff with dedicated time for cancer
# of radiation oncologist ^a	2019	14 (median), 0-180 (range)
# of medical physicist ^a	2019	12 (median), 0-286 (range)
# of surgeons ^a	2019	319 (median), 11-2854 (range)
# of radiologist ^a	2019	128 (median), 0-1502 (range)
# of nuclear medicine physician ^a	2019	6 (median), 0-140 (range)
# of medical & pathology lab scientists ^a	2019	393 (median), 3-4000 (range)

FORMULATING RESPONSE

Integrated NCD plan	2019	74% of countries have operational integrated NCD plans	# Public cancer centres per 10,000 cancer patients	2019	2 (median), 0-700 (range)
NCCP (including cancer types)	2019	56% of countries have operational cancer plan	Early detection programme/ guidelines for 4 cancers (breast, cervix, colon, childhood)	2019	16% of countries have all 4 cancer early detection programme/guidelines
MPOWER measures fully implemented and achieved	2018	1 (median), 0-5 (range)	Pathology services	2019	81% of countries have generally available pathology services
Cancer management guidelines	2019	70% of countries have cancer guideline	Bone marrow transplantation capacity	2019	31% of countries have generally available BMT
Palliative care plan	2019	48% of countries have operational NCD integrated plan that includes palliative care	Palliative care availability: community/home-based care	2019	40% of countries have generally available palliative care
# of treatment services (surgery, radiotherapy, chemotherapy)	2019	60% of the countries have generally available treatment capacity	Availability of opioids* for pain management	2015-2017	69 (median), 0-32,394 (range)
Breast cancer screening program	2019	62% of countries have breast cancer screening programme	*Defined daily doses for statistical purposes (S-DDD) per million inhabitants per day		
Breast cancer screening program: Starting age, target population	2019	43% of countries adhere to best practice			

GLOBAL INITIATIVES

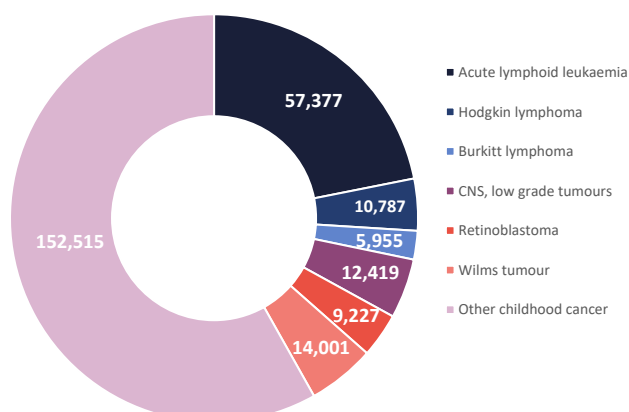
Elimination of Cervical Cancer

HPV vaccination programme coverage	2018	23% of countries have ≥ 50% coverage; 3% have ≥ 90% coverage
Cervical cancer screening	2019	65% of countries have cervical cancer screening programme
Screening programme type	2019	40% of countries have organized, population-based programme
Screening programme method	2019	7% of countries use HPV test as their screening programme method
Screening participation rates	2019	12% of countries have >70% coverage
Early detection programme/guidelines	2019	62% of countries have early detection programme/guidelines
Defined referral system	2019	69% of countries have defined referral system

Global Initiative for Childhood Cancer

Annual cancer cases (0-14 years old)	2020	262,281
Early detection programme/guidelines	2019	20% of countries have early detection programme/guidelines
Defined referral system	2019	33% of countries have defined referral system

Annual cancer cases (0-14 years old)





together

ISBN 978-92-4-000129-9

