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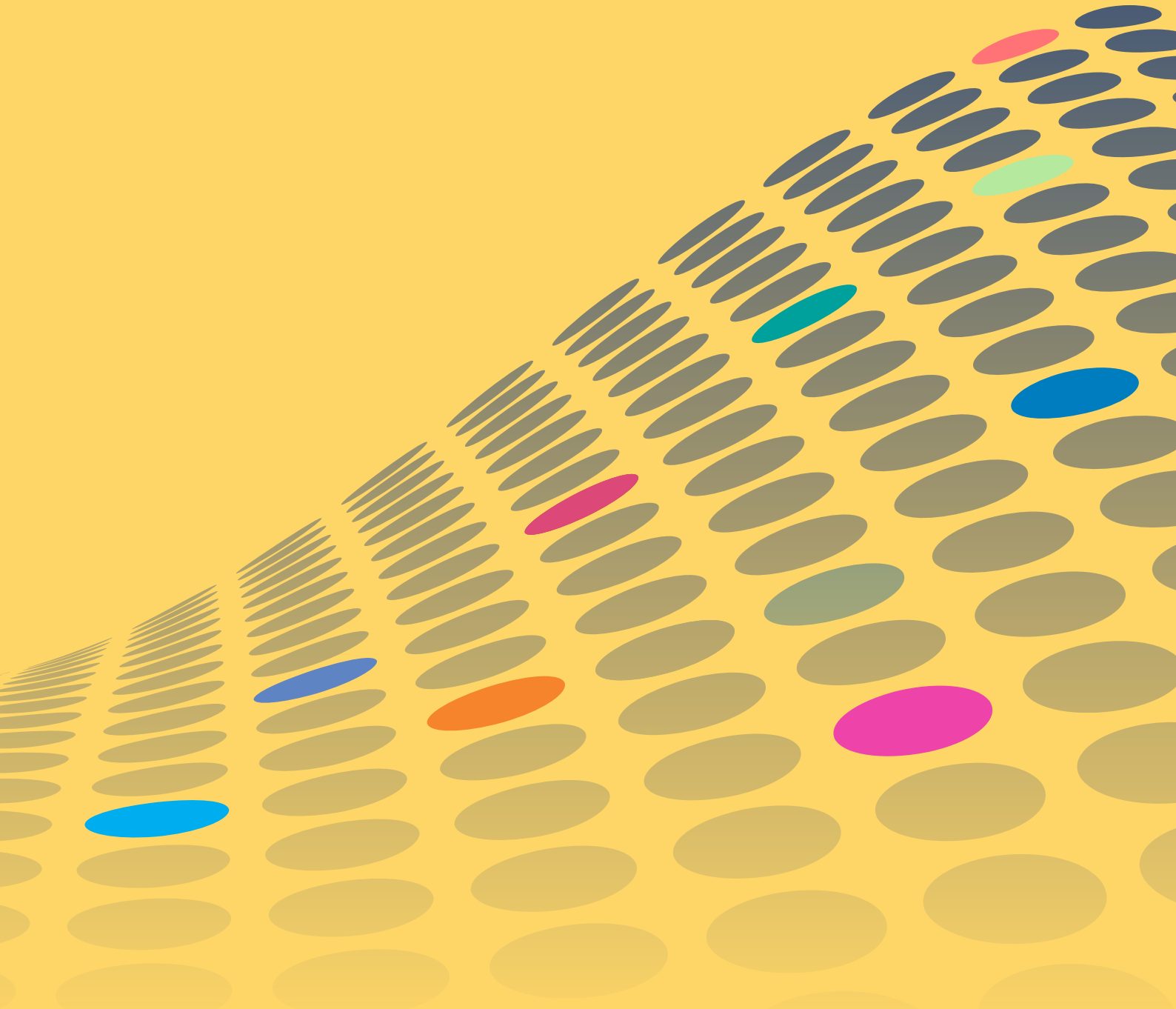

A short guide to cancer screening

Increase effectiveness, maximize benefits and minimize harm

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Abstract

The purpose of cancer screening tests is to detect pre-cancer or early-stage cancer in asymptomatic individuals so that timely diagnosis and early treatment can be offered, where this treatment can lead to better outcomes for some people. The aim of a cancer screening programme is either to reduce mortality and morbidity in a population by early detection and early treatment of a cancer (for example, breast screening) or to reduce the incidence of a cancer by identifying and treating its precursors (such as cervical and colorectal screening). This short guide is designed to be a quick reference that contains the important ideas about cancer screening. Readers should refer to other publications for comprehensive discussion and detailed guidance on cancer screening programmes.

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Foreword

Cancer is one of the major causes of mortality and morbidity in the WHO European Region. On average, one person in four in the Region will develop cancer in their lifetime. This proportion is expected to increase – in western Europe, it already has reached one in three.

Fortunately, the experience of some countries shows that even when more and more people get cancer, cancer mortality can decrease due to various actions, among which is cancer screening.

Evidence-based cancer screening programmes have great potential to improve cancer outcomes. When organized effectively and quality-assured, they can reduce mortality and even prevent certain cancers. Yet as public and commercial pressure for more cancer screening increases in the Region, professionals and policy-makers must give greater consideration to whether "doing more" actually means "doing better". As Gray et al. put it, "All screening programmes do harm. Some do good as well and, of these, some do more good than harm at reasonable cost" *(1)*.

Some questions should be answered before deciding to implement a screening programme. What is the balance of benefits versus harms? Are decisions based on strong evidence? Are vested interests influencing the decision? Are existing cancer diagnoses and care pathways strong and resilient enough to bear the extra effort of a high-quality screening programme? Are the necessary extra financial and human resources available? Introduction of cancer screening should be based on clear and transparent criteria and follow careful objective appraisal of evidence of efficacy and effectiveness.

Marking the first year of the WHO Regional Office for Europe United Action Against Cancer pan-European cancer movement *(2)*, this guide on cancer screening is designed to be a practical tool for policy-makers and cancer professionals dealing with screening. It comes at a time when a worrying increase of non-evidence-based cancer screening is being seen in the Region and beyond. This trend – partly attributable to commercial determinants but also to limited awareness of the harms of screening – can be reversed. This guide is a key tool for doing so.

Together, we can ensure that only effective, high-quality cancer screening programmes are developed, in tandem with strengthening of early diagnosis, treatment, palliative care and data collection. We are hopeful that this guide will inform cancer screening in the countries of the Region, helping to improve quality, achieve the best possible cancer outcomes and leave no one behind.

Marilys Corbex
Senior Technical Officer, Noncommunicable Disease Management, Division of Country Health Programmes
WHO Regional Office for Europe

Nino Berdzuli
Director, Division of Country Health Programmes
WHO Regional Office for Europe

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Acknowledgements

The guide is part of the WHO Regional Office for Europe's United Action Against Cancer initiative, a pan-European cancer movement, to join forces against cancer in the WHO European Region with the long-term vision of eliminating cancer as a life-threatening disease. With this guide, the aim is to improve cancer screening practice to increase effectiveness, maximize benefits and minimize harm.

This guide was technically and conceptually led by Marilys Corbex and produced under the guidance of Jill Farrington and Nino Berdzuli (all WHO Regional Office for Europe). Sue Cohen wrote the guide, with contributions from Marilys Corbex and María Lasierra Losada (all WHO Regional Office for Europe).

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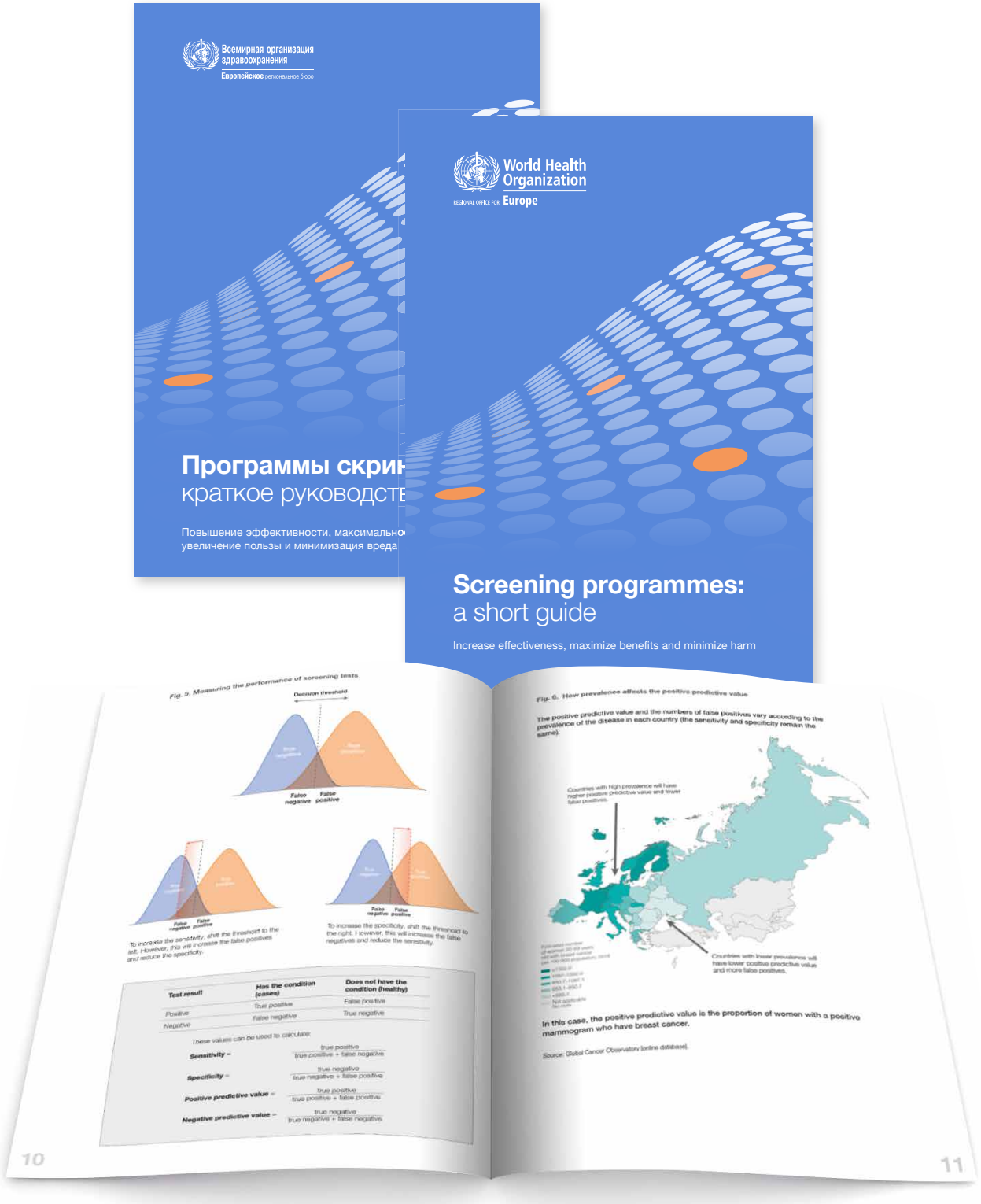
1

Introduction

This short guide to cancer screening is designed for policy-makers. It is based on a previous WHO guide, *Screening programmes: a short guide*, published in 2020 *(1)*.

The short guide is designed to be a quick reference that contains the important ideas about cancer screening. Readers should refer to other publications for comprehensive discussion and detailed guidance on cancer screening programmes.



What is cancer screening?

The purpose of cancer screening tests is to detect **pre-cancer** or **early-stage cancer** in **asymptomatic** individuals so that timely diagnosis and early treatment can be offered, where this treatment can lead to better outcomes for some people.

The aim of a cancer screening programme is either to **reduce mortality and morbidity** in a population by early detection and early treatment of a cancer (for example, breast screening) or to **reduce the incidence of a cancer** by identifying and treating its precursors (such as cervical and colorectal screening).

Some cancer screening programmes are **targeted to people who are at higher risk of a particular cancer because of a behaviour or genetic predisposition (sometimes called targeted screening),** such as lung cancer screening targeting people with high use of tobacco.

Screening is a pathway

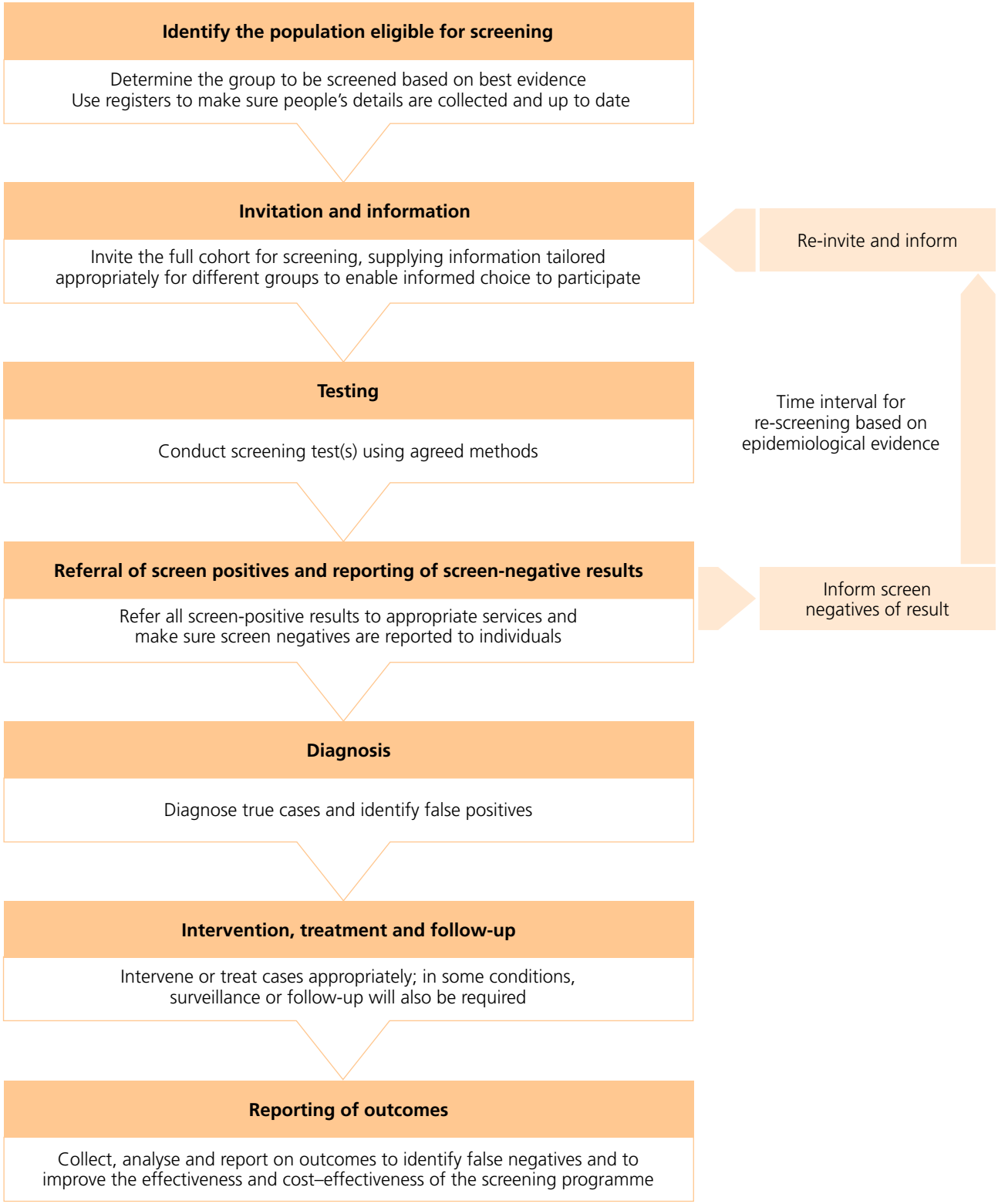
A screening programme is not just a single test but a process and a pathway. It starts by identifying the people who are eligible for screening, referred to as the target population or cohort. **The screening pathway includes diagnosis and treatment**.

Sometimes the pathway operates as a cycle, with people who have a normal screening test being invited back in an agreed time frame (such as two years) to be screened again.

The final step in the pathway is the reporting of outcomes and evaluation of the screening programme.

A screening programme will only be effective if all parts of the screening pathway are provided correctly (Fig. 1).

Fig. 1. The steps in the screening pathway



Source: adapted from WHO Regional Office for Europe *(1)*.

Key message

For cancer screening to be effective, it must be delivered as a pathway. Before starting or scaling up a screening programme, policy-makers must ensure that all steps of the screening pathway can be provided.

2

Screening compared to early diagnosis

Early diagnosis and screening for cancer are two different but related strategies to promote the **early detection of cancer**.

Screening invites people in a target population who do not have symptoms (asymptomatic) to undergo testing, whereas **early diagnosis** is the recognition of **symptomatic cancer at an early stage**. WHO has produced a guide to cancer early diagnosis that provides more information on this topic *(2)*.

The differences between screening and early diagnosis are explained in Table 1 and illustrated in Fig. 2.

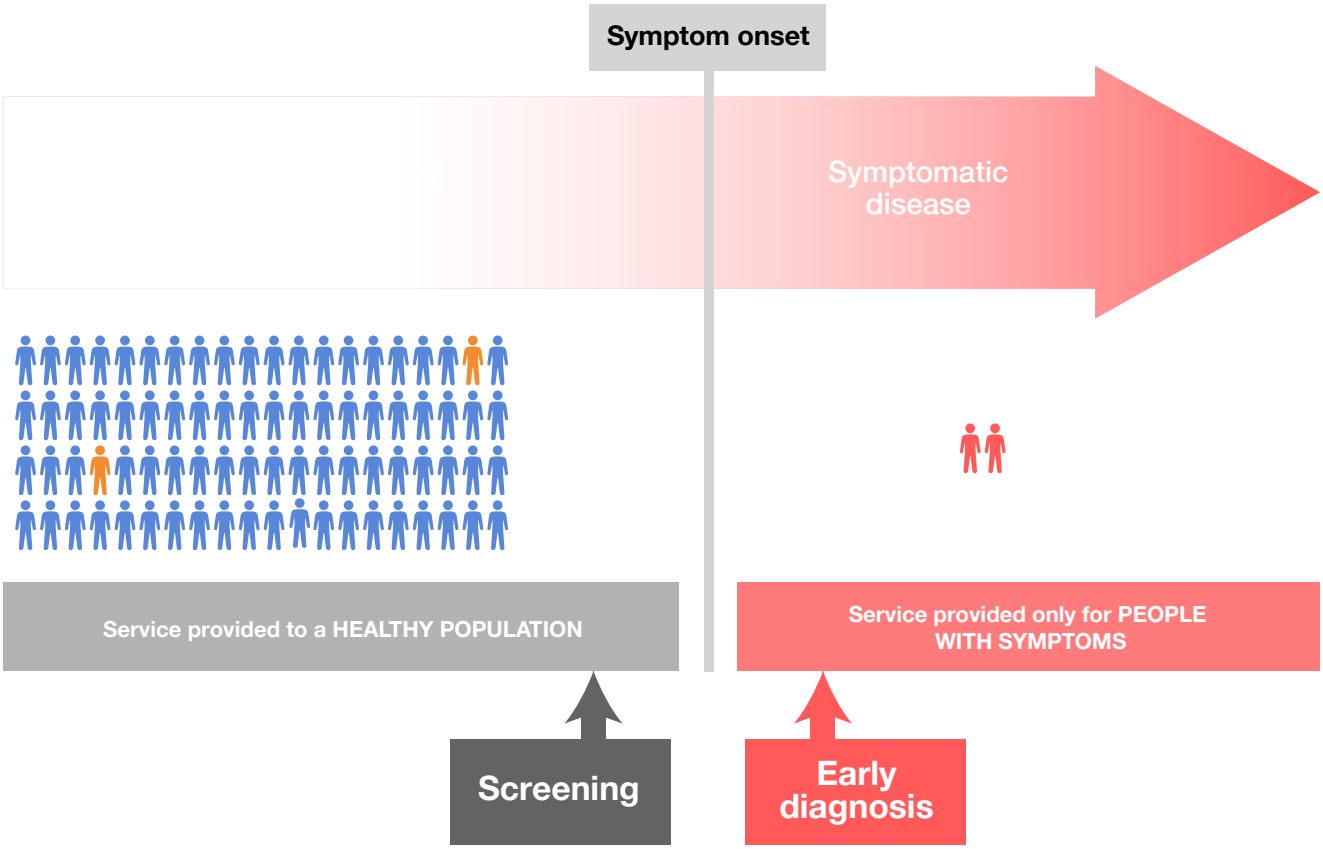
It is important to remember that where cancers are commonly diagnosed at a late stage in a country, an early diagnosis programme should be prioritized over screening as a first strategy. A well structured early diagnosis programme strengthens the screening pathway and facilitates its implementation, increasing its cost–effectiveness *(3)* (Box 1).

Table 1. Comparison of cancer screening and early diagnosis strategies

Issue	Cancer screening	Cancer early diagnosis
Number of people to be tested	Screening programmes test large numbers of asymptomatic people.	Early diagnosis programmes focus only on people with symptoms, which is a much smaller number (approximately one person examined compared to thousands of people screened).
Resource requirements	Screening programmes require a lot of staff, equipment and resources. These need to be available at the start of the programme.	Early diagnosis programmes use fewer resources and can be started while investment is made in appropriate technology and capacity to diagnose and treat cancer.
Implementation	Screening programmes can lead to improved clinical pathways and increase diagnostic and treatment capacity. However, to be effective they require upfront investment and are not suited to incremental implementation over a long period of time.	Early diagnosis programmes can support incremental improvement in delivering clinical services. Individual projects on topics such as community engagement, improving health literacy, training professionals to recognize signs and symptoms of cancer, increasing diagnostic capacity and strengthening referral mechanisms can lead to better outcomes.
Complexity	Cancer screening is a complex public health strategy that requires significant additional resources, infrastructure and coordination.	Early diagnosis programmes are fewer complex to deliver and require fewer resources and central coordination.

Source: based on information contained in WHO *(2)*.

Fig. 2. Comparison of cancer screening and early diagnosis strategies



Source: adapted from WHO Regional Office for Europe *(1)*.

Box 1. Choosing early diagnosis in Ukraine

A recent study in Ukraine showed that one in four breast cancers present at a late stage when cure is not possible. Ukraine looked in depth at mass breast screening and early diagnosis programmes and concluded that an early diagnosis programme would offer the best chance of rapidly reducing mortality from breast cancer.

Source: author, based on WHO Regional Office for Europe *(4)*.

Key message

An early diagnosis programme should be considered before starting a cancer screening programme.

3

How do cancer screening programmes work in practice?

An ideal cancer screening test would perfectly separate people who have cancer from those who do not. In real life, however, screening tests cannot do this – they can only suggest the likelihood that a person is at risk (or risk-free) of cancer (Fig. 3).

Even with the best technology, there will always be people whose cancer is not detected by the screening test (**false-negative result**) and people who do not have cancer but are given an abnormal result (**false-positive result**).

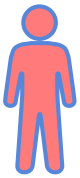
Understanding the implications of this is crucial when designing and implementing a cancer screening programme.

Fig. 3. Measures used to evaluate the performance of a screening test

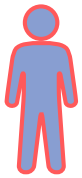
Most people who have cancer will have an abnormal result – this is called **a true positive**

Most people without cancer will receive a normal result – this is called a **true negative**

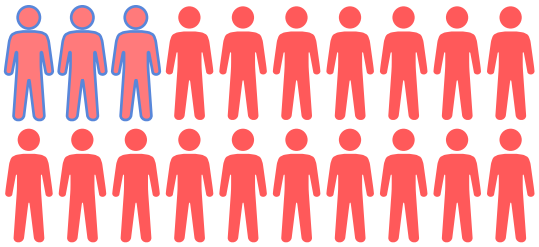
BUT, some people with cancer will receive a normal or negative screening result – this is called a **false negative**



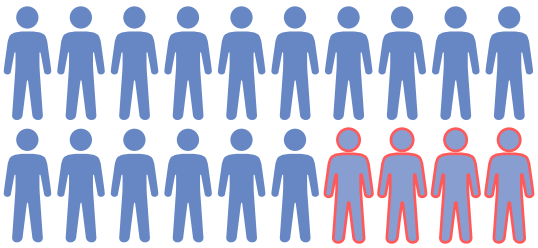
BUT, some people without cancer will receive an abnormal or positive test result – this is called a **false positive**



All these people have cancer, but a few people have a negative screening test



All these people don't have cancer, but some have a positive screening test



These definitions can be used to explain measures of test performance

Sensitivity
The ability of the screening test to identify people with cancer as positive (abnormal result)

Specificity
The ability of the screening test to identify people without cancer as negative (normal result)

Positive predictive value
This is a measure of the ratio of true positives to all positive results – it indicates the chance of having a cancer if a person is told they have a positive (abnormal) result, and is dependent on the sensitivity, specificity and prevalence of cancer in the population

Source: author.

Key message

There are no perfect screening tests; there will always be false positives and false negatives.

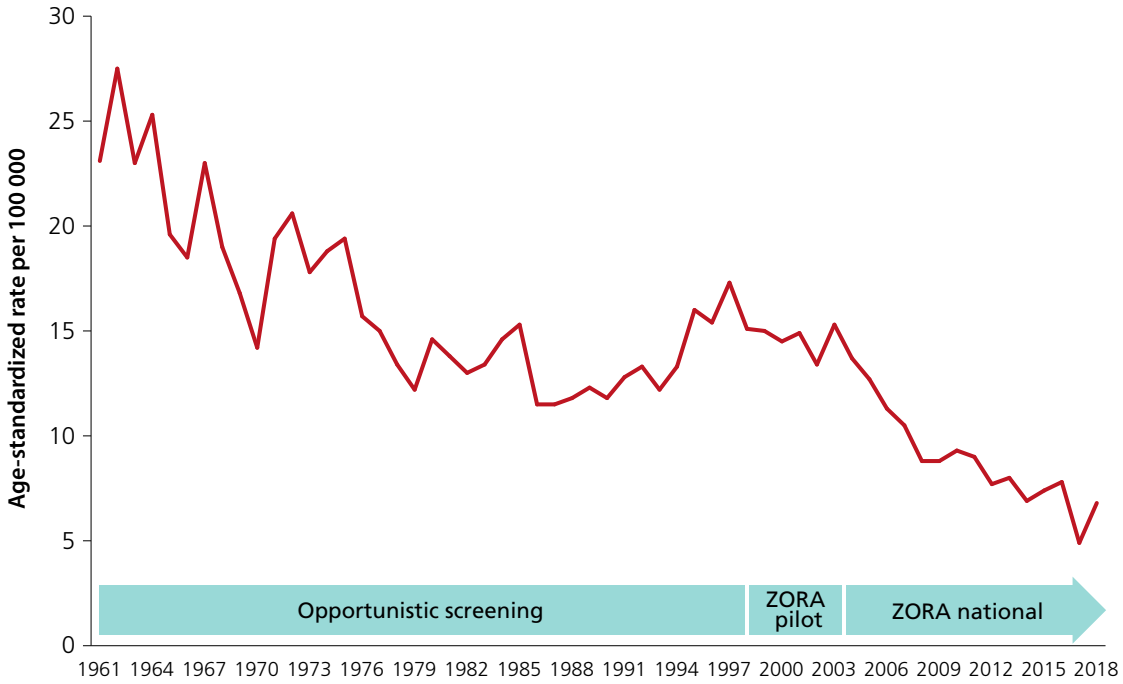
4

Benefits and harms of screening

Benefits

The benefit of evidence-based screening is to detect cancer at an early or pre-cancerous stage to reduce the incidence or mortality and morbidity associated with the cancer. Other benefits may be the use of less aggressive interventions because treatment can occur at an earlier stage and lead to improved quality of life. Fig. 4. illustrates the impact cervical cancer screening had on the incidence of cervical cancer in Slovenia.

Fig. 4. Impact of introducing an organized population-based screening programme (ZORA) on the incidence of cervical cancer in Slovenia



Source: author, based on data from the Cancer Registry of Slovenia *(5)*.

Harms

Screening can also lead to harm. Harms can be more significant than is often appreciated.

Most people who are screened do not have cancer, so many people can be exposed to the harms of screening without benefiting from it.

Harms can be due to:

- the physical or psychological effects of the screening test (such as the discomfort of mammography);
- the consequences of false positives and false negatives; and/or
- the consequences of overdiagnosis and/or overtreatment.

False-positive results can lead to:

- people having unnecessary investigations and being put at risk from their complications, such as perforation of the bowel after a colonoscopy; there may also be financial costs to the patient associated with these investigations;
- adverse psychosocial effects, such as anxiety and stress; and
- a strain on the health system because the false-positive result leads to the need for further investigations, potentially putting more pressure on already stretched diagnostic services such as endoscopy.

False-negative results can lead to:

- people or physicians ignoring important symptoms, resulting in delayed diagnosis;
- the public having decreased trust and confidence in the screening programme.

Screening for cancer can lead to overdiagnosis – the detection of cancer that would never harm the individual in their lifetime. The reasons for this include:

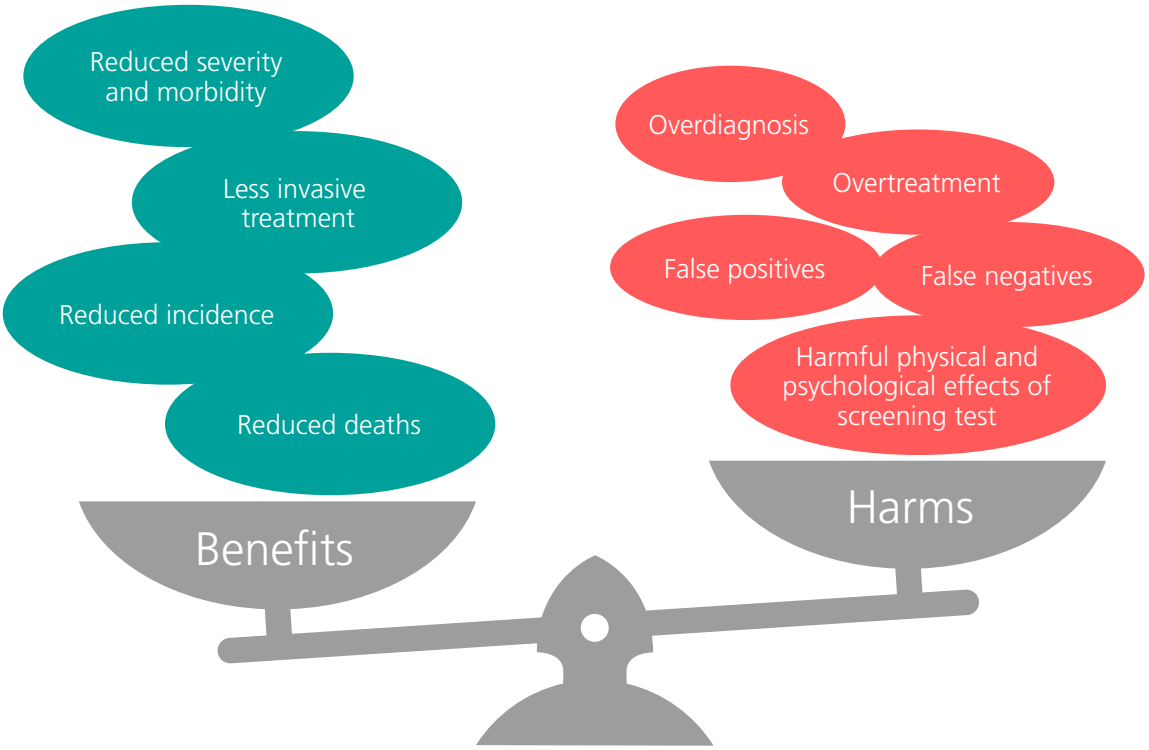
- detection of slow-growing or indolent cancers;
- high-resolution technologies detecting smaller and often the least aggressive types of cancer; and
- people dying from other causes (competing mortality).

It is not possible to distinguish between individuals who are overdiagnosed and those who have been correctly diagnosed with a clinically relevant condition that could be life-threatening if left untreated. Once a screening programme starts, everyone who is found to have cancer must be offered treatment – even though some of these people do not need treatment.

Overtreatment (more extensive treatment than required to improve results) can occur alongside overdiagnosis. Prostate cancer screening, for example, may lead to the detection of very slow growing cancers for which men are subjected to surgery and/or radiotherapy with concomitant major problems such as impotence and urinary incontinence. These cancers, detected through screening, are unlikely to have caused the men harm in their lifetimes. Overtreatment can also occur because benign conditions found as part of screening are treated unnecessarily, such as surgical removal of small benign breast lumps.

Policy-makers need to make sure that benefits outweigh harms before proceeding with a cancer screening programme. Fig. 5 shows the harms and benefits of cancer screening.

Fig. 5. Making sure the benefits of cancer screening outweigh the harms



Source: based on information contained in WHO Regional Office for Europe *(1)*.

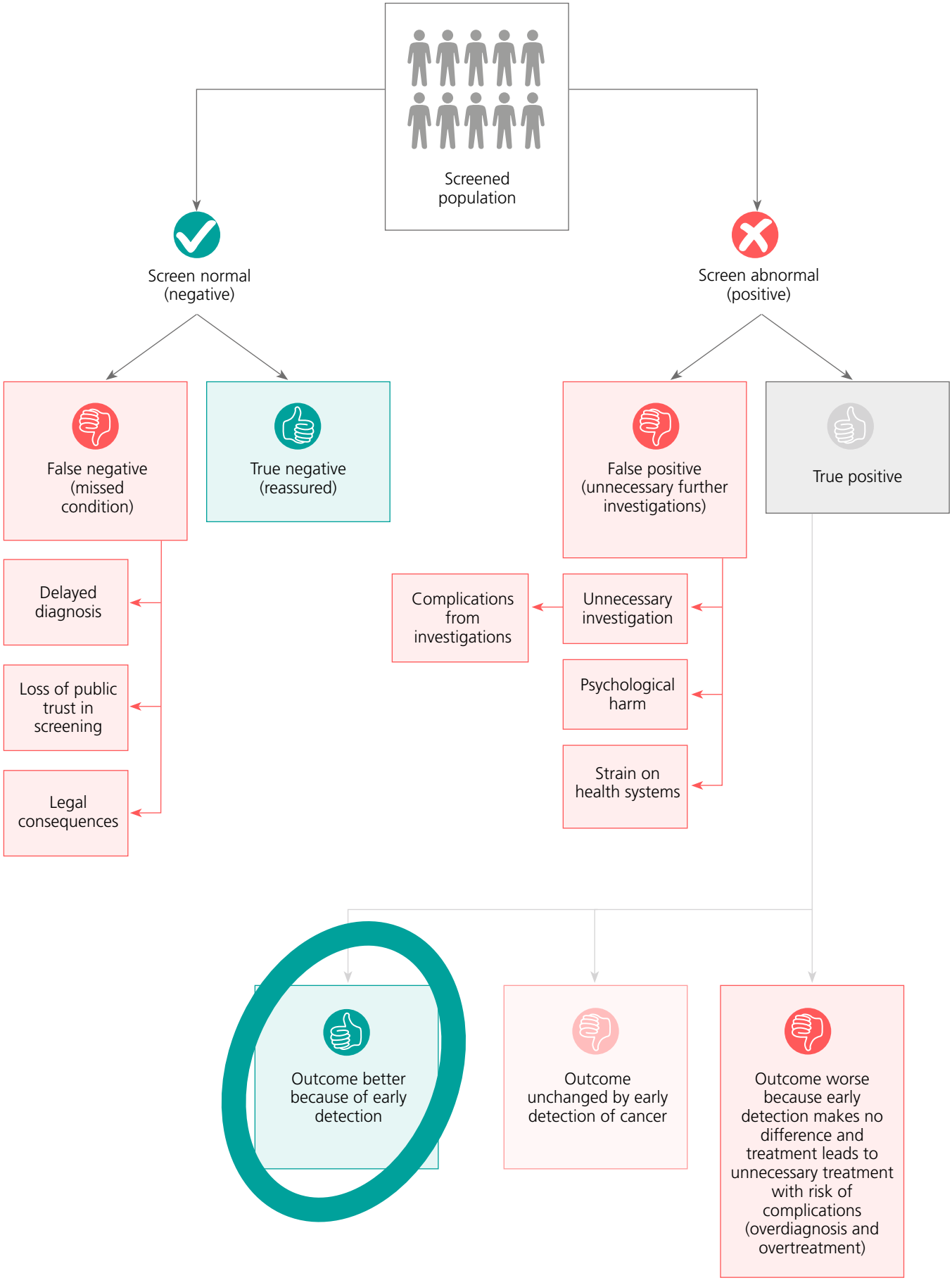
Understanding the possible consequences of a cancer screening test result

When deciding whether to implement a screening programme, it is important to consider all the potential consequences of cancer screening, both benefits and harms, along the entire screening pathway (Fig. 6).

Even when a person receives a true positive result, the consequences can differ.

- For some people, screening will not alter whether they survive or die from their cancer. The length of their life is unchanged despite earlier treatment for cancer.
- For some people, screening will result in overdiagnosis. They will be harmed because they receive unnecessary treatment and can experience psychological harm associated with a diagnosis of cancer.
- For some people, screening will result in more effective treatment and reduced morbidity and mortality from the cancer.

Fig. 6. Possible consequences of a screening test



Source: WHO Regional Office for Europe *(1)*.

Key message

Working through all the potential consequences is an important step in developing a reasonable estimate of the true effect of a screening programme.

5

Using the Wilson & Jungner principles to guide decision-making

The era of modern screening began in 1968 with a landmark publication by **Wilson & Jungner, who proposed 10 principles to guide whether screening is an appropriate course of action to improve public health** *(6)* (Box 2).

Policy-makers still use these principles as the basis of the criteria for deciding whether they should start or stop a cancer screening programme.

Box 2. Simplified Wilson & Jungner principles

The condition should be an important health problem with a latent or early detectable symptomatic phase (such as cervical and colorectal cancers). All practicable, cost–effective preventive strategies should be implemented first.

The test should be simple, safe, precise, validated and acceptable to the population. There should be an agreed policy on test values for screen-positive and negative results.

There should be a treatment with evidence to show that early treatment leads to better outcomes than late treatment. There should be adequate facilities for diagnosis and treatment.

The screening programme should have evidence from high-quality randomized controlled trials that it is effective in reducing mortality or morbidity and the benefit from the screening programme should outweigh the physical and psychological harms. The cost of the entire screening programme should represent value for money and be affordable within available resources.

Source: author, based on Wilson & Jungner *(6)*.

Policy-makers also have to consider the ethics of cancer screening before deciding whether to implement a new cancer screening programme. For example, it is considered unethical to promote screening if it is difficult for the population to access effective treatment if required.

For further discussion on how to decide whether to start or stop a screening programme, see the WHO screening programmes short guide *(1)*.

Key message

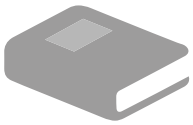
Using an agreed set of criteria (such as the Wilson & Jungner principles) can guide policy-makers in deciding whether to introduce a new screening programme in their country.

6

Implementing a cancer screening programme

Before starting or scaling up a screening programme, policy-makers should review the Wilson & Jungner criteria, making sure in particular that **all practicable, cost–effective preventive strategies have been implemented.** WHO's *Tackling NCDs: 'best buys' and other recommended interventions for the prevention and control of noncommunicable diseases (7)* and its 2020 update *(8)* provide policy-makers with further information.

Implementing a new screening programme is a major undertaking and requires considerable planning and human and financial resources. Here are some of the main workstreams that should be part of an implementation plan.



A legal or governance framework should be put in place at an early stage of programme development. The framework will be influenced by a country's regulatory and legal system and may require legal endorsement in some countries.

The framework needs to address who is responsible for different aspects of the screening programme, including clinical guidelines, monitoring performance and delivery of the screening service at local level. It should also cover financing and payment systems for screening services and treatment. This will be particularly important where models for delivery include civil society or independent practitioners.

The framework should also cover access to personal data for programme implementation and monitoring and be linked to a quality assurance system that has processes in place for dealing with errors and false negatives.

Leadership, coordination and management need to be in place at all levels of screening provision. There must be a team leading the operation of the programme, either nationally or regionally. Leadership is also needed at the level of service provision – for example, in a breast screening programme, this might be a clinical director of a breast screening service in a hospital.

Intersectoral collaboration and partnership working at national, regional and local levels is also essential. Screening pathways frequently cross primary and secondary care and rely on third sector or private sector organizations. All partners involved in the pathway need to work together closely, sharing data and participating in quality assurance activities.

Mapping the screening pathway to a country's health system is necessary to describe how people move through the screening pathway, from identification of the target population to diagnosis and treatment. Each step of the pathway should be supported by standards, protocols and guidance using the best available evidence.

The pathway is also used to design the information system, plan who needs to be trained and estimate the expected numbers of people who will be screened and will require diagnosis and treatment.

Training of personnel is key. The quality of screening largely depends on the skills of those who deliver it. All personnel needed for the screening pathway should be trained and receive regular training updates.

Health information systems are essential to operating an effective screening programme. A well organized health information system that links steps in the screening pathway is also known as a **cancer screening register** (Box 3). Screening registers can be used for programme implementation and reporting on quality assurance.

Box 3. Cancer screening registries

A cancer screening registry is an information system (computerized, paper-based or a combination) that collects, utilizes and stores cancer screening data on individuals for programme management and reporting.

The registry supports screening programmes by:

- maintaining a database of screening records of individuals along the screening pathway;
- inviting eligible persons to commence screening;
- holding a single, consistent screening record for each participant;
- maintaining records of screen-positive individuals related to their participation to evaluate outcomes;
- holding a record of diagnosis (both pre-cancer and cancer as applicable) and treatment;
- reminding participants when they are due or overdue for screening;
- providing a safety net/failsafe mechanism for participants who are screened positive and who have not attended for further follow-up by prompting them and/or their health-care providers to have follow-up tests; and
- linking with other relevant information systems to enable quality assurance, monitoring and evaluation of the screening programme.

A cancer screening register can be **population-based** if it holds data on everyone in the target population in a geographically defined area. It can also be based on a **provider** and hold data on all individuals who attend for screening and/or diagnostic evaluation at a particular service. For a screening register to be population-based, the linkages have to be established between population registers (such as a population database, electoral rolls and insurance databases), provider-level registers and the hospitals managing cancer cases. A screening register and a population-based cancer registry can be complementary.

Source: adapted from International Agency for Research on Cancer (IARC) *(9)*.

Identifying adequate **funding** for all the components needed to run a screening programme is crucial. Funding needs to be sustainable. It is not possible to run a screening programme with intermittent and uncertain funding. In some countries, funding for parts of the pathway may come from different sources, which may create barriers to running a cost–effective service. Adequate funding should be allocated for the information system, data collection and implementation of quality assurance.

Health system capacity needs to be considered. Screening programmes can cause health-care resources to be reallocated, which can negatively affect other health-care areas and potentially lower the quality of care for people with symptomatic conditions. Health administrators need to plan adequately to prevent this from happening. If health resources are already scarce and people with symptoms do not receive optimum care because of these constraints, a screening programme is not the right course of action.

Information and communication on the screening programmes should be unbiased and easy to understand so people can make an informed decision on whether to participate.

Explanations of risk using absolute numbers rather than relative risk can help, as relative risk can be misleading (see the example in Box 4).

Since health literacy and understanding of complex topics such as risk can vary across a population, information should be carefully developed and tested with different groups to ensure it is correctly understood. Professionals should be trained in communication skills, and there may also be a need for community advocates to support understanding of screening and its harms and benefits.

Box 4. Comparing relative and absolute risk reduction in cancer screening programmes

There are two ways to express the reduction in mortality due to screening (that is, the difference in mortality with and without screening). A simple way to express the difference is as follows:[a]

- **relative risk reduction** compares the difference as the mortality rate in those screened as a proportion of the mortality rate without screening; and
- **absolute risk reduction** expresses the difference in mortality as the number of people whose lives are saved as a percentage of all the people who were screened.

Relative risk reduction may be misleading. If cancers are not very common, a big percentage change can represent a small number of people. This can lead to people overestimating the benefits of a screening programme.

For example, consider a theoretical example of a cancer screening programme in which:

- in the screened group, 50 people of 10 000 die (a mortality rate of 500 in 100 000); and
- in the non-screened group, 75 people of 10 000 die (a mortality rate of 750 in 100 000).

In this example, the relative risk reduction is 33% (75 – 50/75), **which appears to show screening as being effective.** The absolute risk reduction, however, is **0.25%** ((75 – 50)/10 000), **which shows in fact that screening will not make a very big difference.**

Policy-makers must always establish the absolute risk reduction if they are to understand whether screening will make a significant difference for their population.

An early trial of colorectal cancer screening offers an example where researchers provided both the absolute and relative risk reduction *(10)*. This does not always happen.

[a] Epidemiological texts should be consulted for detailed definitions of terms and their calculation.

Source: author.

Several countries have produced materials for the public based on careful research. Box 5 shows an example from the breast screening programme in the United Kingdom (England) *(11).*

Box 5. Excerpt from an information leaflet for women from the breast screening programme in the United Kingdom (England)

Making a choice: the possible benefits and risks of breast screening
It is your choice whether or not you have breast screening. There are many different reasons why women decide whether or not to have screening. To help you decide, we have included information on the possible benefits and risks.

Screening saves lives from breast cancer
Lives are saved because cancers are diagnosed and treated earlier than they would have been without screening.

Screening finds breast cancers that would never have caused a woman harm
Some women will be diagnosed and treated for breast cancer that would never otherwise have been found and would not have become life-threatening. This is the main risk of screening. ...

Weighing up the possible benefits and risks of breast screening

. . . . . .

... There is debate about how many lives are saved by breast screening and how many women are diagnosed with cancers that would never have become life-threatening. The numbers below are the best estimates from a group of experts who have reviewed the evidence.

Saving lives from breast cancer
Screening saves about 1 life from breast cancer for every 200 women who are screened. ...

Finding cancers that would never have caused a woman harm
About 3 in every 200 women screened every 3 years from the age of 50 up to their 71st birthday are diagnosed with a cancer that would never have been found without screening and would never have become life-threatening. ...

Source: Public Health England *(12).* Contains public sector information licensed under the Open Government Licence v3.0.

Key message

Implementation of an effective cancer screening programme is a complex task requiring strong leadership and coordination.

7

Running a successful screening programme

Achieving successful screening programmes requires:

- **systems to enable the population to participate in the screening programme and reduce health inequalities; and**
- **systems to ensure high-quality screening programmes.**

Enabling participation and addressing health inequalities

Cancer screening programmes will only make a substantial difference to population health if a sufficient proportion of the eligible population uses them. Care should be taken to enable informed consent and protect individual autonomy.

There are many reasons why participation in screening programmes might be low, which may include culturally framed perceptions about health and health care that can affect individuals' engagement with screening services.

Barriers to accessing services can include *(13–15)*:

- availability, location and convenience of services – for example, mammography units may only be available in towns rather than rural areas and people may not be able to take time off work to attend screening;
- costs – people may be deterred from screening because of the cost of the screening test or its follow-up and potential treatment or travel costs;
- low health literacy – people may not understand what conditions are screened for or the process of screening, so may not want to attend;
- stigma and anxiety about the process of screening may deter some people; and
- social and cultural factors can influence screening participation, which tends to be lower among disadvantaged and underprivileged populations and people from ethnic minority communities.

Reasons for low participation will be context- and country-specific, so addressing them requires an understanding of barriers and drivers to participation and then use of evidence-based initiatives such as reminders or self-collected samples (in cervical or colorectal cancer screening, for example) to address them *(16)*.

The screening programme should be designed to ensure that all segments of society can benefit. It is particularly important to address barriers in access for the most disadvantaged individuals and groups, who usually experience higher morbidity and mortality from cancer, so the screening programmes do not accentuate health inequalities.

Ensuring high-quality screening programmes

The four activities to ensure a high-quality cancer screening programme that maximizes benefits and minimizes harms are:

- checking the quality of individual screening service providers (such as hospitals, polyclinics and family doctors) through **continuous monitoring of screening processes** by, for example, quarterly reporting of numbers of screen positives and referral times to diagnostic services;

- **monitoring the performance of the screening programme** annually at national or regional level to assess the provision and quality of screening activities using measures such as coverage and participation rates;

- **evaluating outcomes** of screening programmes can be carried out less frequently, such as every five years, to assess whether the programme is meeting its aims by, for example, measuring invasive cancer detection rates or interval cancer rates at national or regional level; and
- periodically **evaluating new evidence or changes to the population** to check that a screening programme continues to be effective and cost–effective; an example would be when a new effective primary prevention strategy, such as the human papillomavirus vaccine (HPV) or new tests or treatments that change the balance of benefits and harms or change the target population, becomes available.

Together, this set of activities is often referred to as a **quality assurance system**. Terminology in this field can be confusing, however, and use of terms can vary between countries. There is a preference in some settings for terms such as quality management, quality assessment and quality control *(17)*. The scope of quality assurance also may vary. In some health-care systems, it may overlap with accreditation systems for health-care services and in others evaluation of screening programmes may be carried out as a separate activity.

A quality assurance system

The principles of a quality assurance system are:

1. specification of high-quality screening processes in a quality assurance guideline that covers all the critical processes in the screening pathway;
2. development of key performance indicators (KPIs) and quality standards to measure if the screening processes meet the specification;
3. collection and analysis of good-quality data to check if the KPIs meet the quality standards; and
4. action to improve quality if screening processes do not meet the expected standards through quality improvement activities such as use of failsafe systems and provision of training and peer-to-peer support.

Measurement of performance with KPIs relies on good-quality data collected through an effective information system. Further qualitative information on the quality of services can be collected through visits to facilities, self-assessment questionnaires, patient surveys and audits of screening processes and cancer cases. This additional information can be very helpful in assessing quality of services and can also be combined with quality-improvement activities.

A dedicated team should be responsible for carrying out all such activities.

Box 6 gives examples of measures used in quality assurance systems that can be derived from health information systems.

Box 6. Examples of measures used in quality assurance systems

Some useful KPIs to measure performance in cancer screening programmes (when measuring these values, it should be for a specified time or reporting period):

- **Participation rate** (%): the proportion of individuals screened of individuals who were invited.
- **Examination coverage** (%): the proportion of individuals of the eligible population screened.
- **Further assessment rate** (%): the proportion of individuals of those screened with a positive test requiring further investigations (for whom test outcomes are available).
- **Detection rate** (per 1000): the proportion of individuals among those screened with pathologically proven pre-cancer/cancer detected.

Other important measures to monitor and evaluate screening programmes are cancer incidence and mortality, but it may take many years to detect a change in these values in a population.

Source: International Agency for Research on Cancer (IARC) *(9)*.

Key message

For a screening programme to be successful, it must be of high quality and have good population participation.

8

Types of cancer screening programmes

How a cancer screening programme operates can profoundly influence its effectiveness and cost–effectiveness.

Organized cancer screening programmes

A cancer screening programme will only be effective if it is organized.

There are seven components to its organization, all of which must be in place for the programme to be effective.[1]

1. There should be a documented policy to provide equitable, quality-assured screening, diagnostic and treatment services to the eligible population. The policy should also specify the structure of management, organization of services and coordination between all stakeholders.
2. The screening test should be part of a pathway of care that includes further assessment of screen positives and treatment.
3. The screening pathway should be described in a written document and operated in accordance with documented evidenced-based protocols and guidelines.
4. The eligible/target population should be defined according to evidence based on the balance of benefits versus harms.
5. The eligible/target population should be invited to screening at regular intervals determined by the evidence, using a call-and-recall (invitation) system.
6. The diagnosis and treatment of screen-positive individuals, including referral times, should be evidence-based.
7. A quality assurance system should be in place. Screening services' performance should be monitored using a set of validated indicators and standards and appropriate actions should be taken if any deficiencies are detected. A good proportion of the total screening programme budget should be allocated to implementation of quality assurance.

An organized screening programme is expected to fulfil all of these criteria.

Opportunistic screening is screening that does not have systematic invitation mechanisms and is offered:

- during service user–service provider interactions; or
- on demand or on an ad hoc basis; or
- to individuals outside of the eligible group.

Opportunistic screening is not only much less effective, but also drains public health resources (Box 7).

[1] Adapted from IARC definition of organized cancer screening programmes used in CanScreen5 *(9)*.

Box 7. Slovenia – moving on from opportunistic screening

Slovenia established its national cancer registry in the 1960s, which enabled Slovenian health authorities to track cancer incidence. A notable increase in cervical cancer rates in the 1990s sounded the alarm among experts and led to the establishment of ZORA, Slovenia's national cervical cancer screening programme.

Through ZORA, the practice of opportunistic screening – offering ad hoc screening tests to women visiting health centres for other reasons – was abandoned. Opportunistic screening has proven to have very limited impact on cervical cancer incidence. Instead, ZORA started screening women once every three years.

Slovenia managed to invite and screen more women, monitor results more efficiently, report back better to screening providers and women, and achieve better overall results through initiation of the ZORA programme.

Source: WHO Regional Office for Europe *(18)*.

Multiple screening tests carried out at the same time

Some health-care systems carry out multiple screening tests at the same time as part of, for example, adult health checks or a **dispensarization** service that is used in some countries. Carrying out multiple screening tests at the same time may reduce costs, but each test needs to be assessed on its own merits.

When more than one test is offered as part of a health check, each test should be:

- subject to the same stringent criteria used to determine whether to start a screening programme;
- part of a pathway of care; and
- provided in a way that fulfils the requirements of an organized screening programme.

Expanding the scope of clinical examinations beyond evidence-based screening tests (including offering tests to age groups in which the evidence does not show any benefit) increases the costs and administrative burden for health-care systems. There is consistent evidence that offering general adult health checks compared with routine case-finding work in primary care is unlikely to be beneficial and may lead to unnecessary tests and treatments *(19,20)*.

Key message

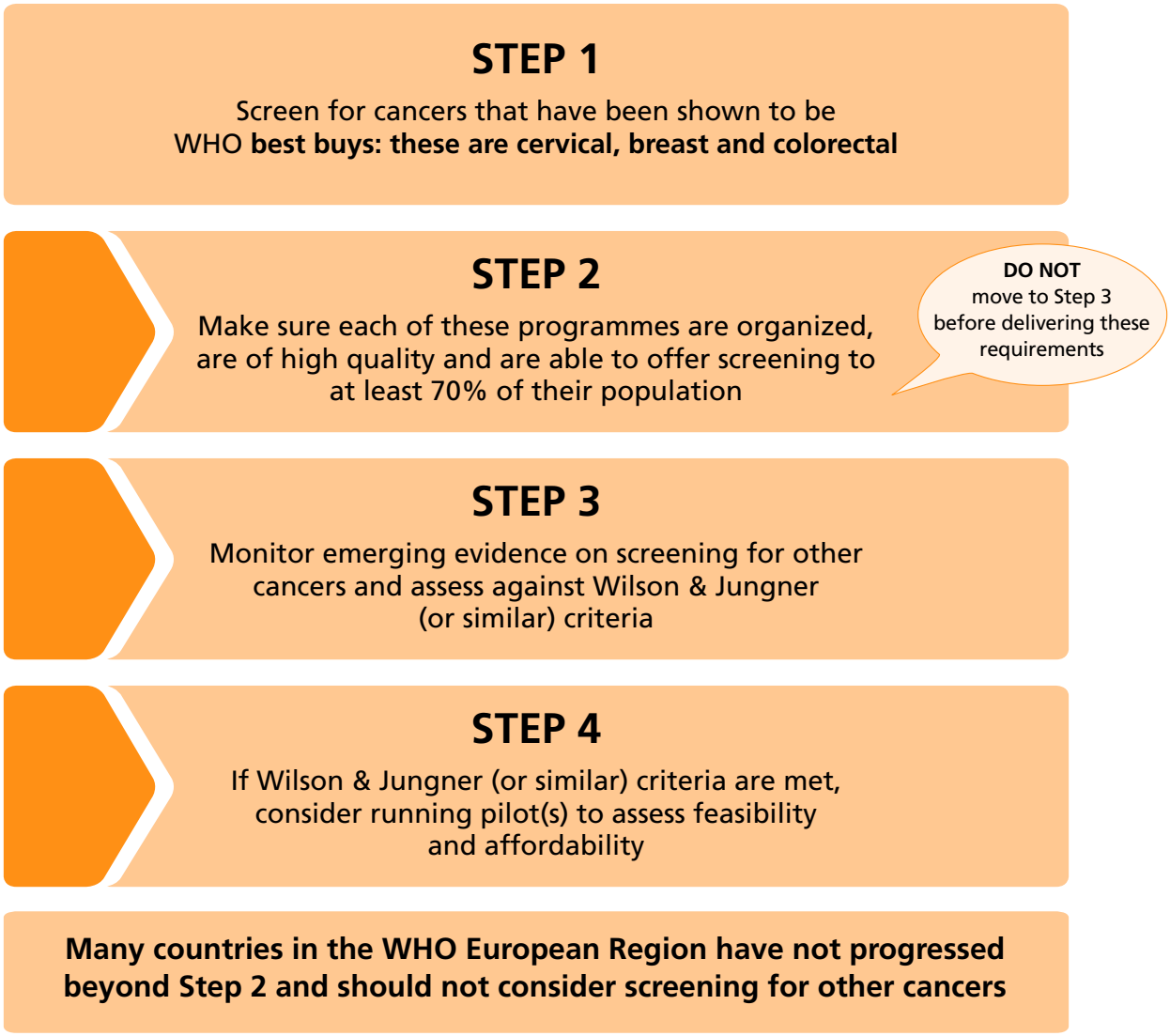
Cancer screening programmes must be organized if they are to be cost–effective in reducing mortality from cancer.

9

Common cancers and options for screening

Evidence on effectiveness of screening for different cancers is continually emerging. The following presents a suggested strategy for countries to employ in deciding whether to consider screening for a cancer (summarized in Fig. 7).

Fig. 7. A stepwise approach to implementing cancer screening programmes



Source: author.

WHO recommendations for cancer screening

The WHO tackling noncommunicable diseases best buys guidance *(7,8)* recommends screening for **cervical**, **breast** and **colorectal cancers** with organized and high-quality programmes that are linked to timely treatment.

WHO recommends starting regular **cervical cancer** screening at the age of 30 years among the general population of women. Detailed recommendations, including appropriate use of HPV DNA-based tests and cytology, use of screen-and-treat strategies and recommendations for women living with HIV, are available in the *WHO guideline for screening and treatment of cervical pre-cancer lesions for cervical cancer prevention, second edition (19).*

WHO recommends breast cancer screening using mammography in women aged 50–69 years only in countries with strong health systems. In limited resource settings with weak health systems and where most women are diagnosed in late stages, it is preferable first to implement early diagnosis programmes *(20).*

Cancer sites where there is ongoing interest or research in screening

There are many cancer sites for which there is active research or interest in screening. Often there is insufficient evidence to support screening or further work is needed to assess the feasibility or affordability of screening for these cancers. Some countries, however, offer screening for some of these cancers even though they are not providing organized and high-quality screening for cervical, breast and colorectal cancer to most of their population. This does not represent best use of limited resources.

Cancers that fall into this category are:

- liver cancer
- lung cancer
- oral cancer for general population
- ovarian cancer
- prostate cancer
- skin cancer
- stomach cancer
- thyroid cancer
- whole-body CT scans (individual health assessment)

Some screening, such as thyroid screening or whole-body scans for detection of cancers, are offered in some sectors even though the harms of such interventions are very significant. These practices should be actively discouraged or even prohibited.

Cancer sites not under consideration for screening

Screening is not under consideration as an appropriate strategy for some cancer sites because the balance of benefits and harms is not expected to be positive. This includes:

- bladder cancer
- childhood cancers
- gynaecological cancers other than cervical cancer
- neuroblastoma cancer
- oesophageal cancer.

Further information on each cancer site is available from the cancer webpage on the WHO Regional Office for Europe website *(21)*.

Key message

Countries should focus on delivering WHO best buys screening programmes, prioritizing cervical cancer, followed by breast and colorectal cancers (with high-quality and good coverage) before considering starting new screening programmes for other cancers.

10

Conclusion

It is hoped that this guide will support policy-makers to decide whether cancer screening programmes are an appropriate strategy to reduce incidence and mortality from cancer in their country.

It encourages policy-makers to think of the harms associated with screening as well as the benefits and, in the specific context of their country, whether benefits outweigh harms sufficiently to justify starting a screening programme.

The guide focuses on key messages for policy-makers, including the importance of investing in primary prevention and early diagnosis before diverting resources to screening programmes.

It shows that starting a screening programme is complex and demands many resources. For this reason, policy-makers are encouraged to take advice from independent experts in screening and clinicians.

It is hoped that this guide will enable policy-makers to make the best use of their country's limited resources to tackle cancer and that, where appropriate, cancer screening is used to improve the lives of their populations.

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The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

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World Health Organization Regional Office for Europe
UN City, Marmorvej 51, DK-2100 Copenhagen Ø, Denmark
Tel.: +45 45 33 70 00 Fax: +45 45 33 70 01
Email: eurocontact@who.int
Website: www.euro.who.int