

POLICY BRIEF 35

Screening

When is it appropriate
and how can we get it right?

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This policy brief is one of a new series to meet the needs of policy-makers and health system managers. The aim is to develop key messages to support evidence-informed policy-making and the editors will continue to strengthen the series by working with authors to improve the consideration given to policy options and implementation.

What is a Policy Brief?

A policy brief is a short publication specifically designed to provide policy makers with evidence on a policy question or priority. Policy briefs

- Bring together existing evidence and present it in an accessible format
- Use systematic methods and make these transparent so that users can have confidence in the material
- Tailor the way evidence is identified and synthesised to reflect the nature of the policy question and the evidence available
- Are underpinned by a formal and rigorous open peer review process to ensure the independence of the evidence presented.

Each brief has a one page key messages section; a two page executive summary giving a succinct overview of the findings; and a 20 page review setting out the evidence. The idea is to provide instant access to key information and additional detail for those involved in drafting, informing or advising on the policy issue.

Policy briefs provide evidence for policy-makers not policy advice. They do not seek to explain or advocate a policy position but to set out clearly what is known about it. They may outline the evidence on different prospective policy options and on implementation issues, but they do not promote a particular option or act as a manual for implementation.

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Acronyms

AAA	abdominal aortic aneurysm
AI	artificial intelligence
ApoE	apolipoprotein E
CRC	colorectal cancer
CT	computerized tomography
CVD	cardiovascular disease
DTC	direct to consumer
FFS	fee for service
GP	general practitioner
HPV	human papilloma virus
HTA	health technology assessment
MISCAN	microsimulation screening analysis
MRI	magnetic resonance imaging
NCD	noncommunicable disease
PSA	prostate specific antigen
QA	quality assurance
RCT	randomized controlled trial

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How do Policy Briefs bring the evidence together?

There is no one single way of collecting evidence to inform policy-making. Different approaches are appropriate for different policy issues, so the Observatory briefs draw on a mix of methodologies (see Figure A) and explain transparently the different methods used and how these have been combined. This allows users to understand the nature and limits of the evidence.

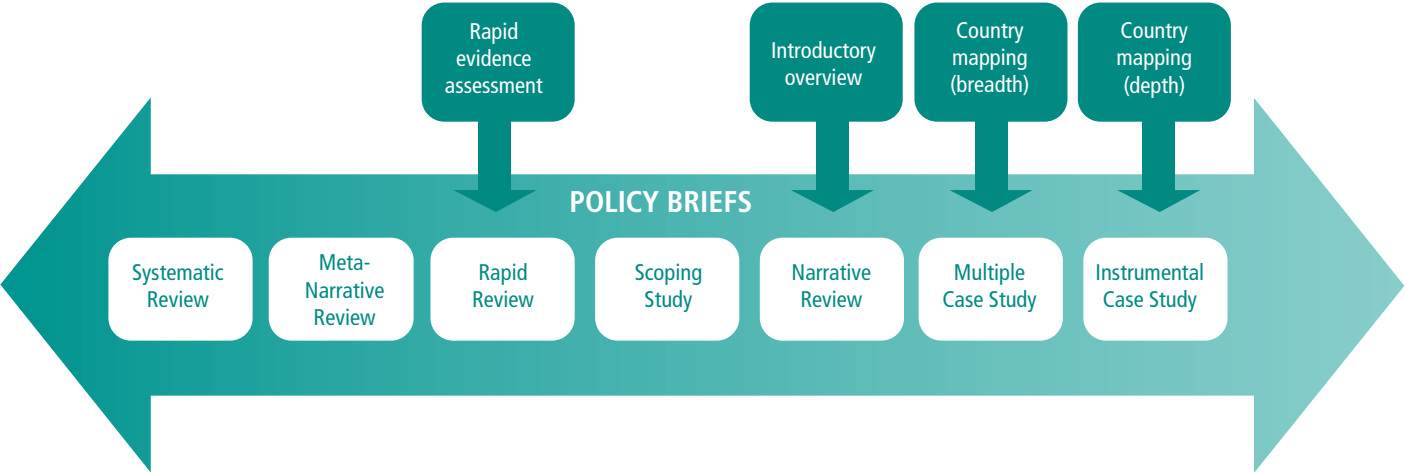
There are two main ‘categories’ of briefs that can be distinguished by method and further ‘sub-sets’ of briefs that can be mapped along a spectrum:

- A rapid evidence assessment: This is a targeted review of the available literature and requires authors to define key terms, set out explicit search strategies and be clear about what is excluded.

- Comparative country mapping: These use a case study approach and combine document reviews and consultation with appropriate technical and country experts. These fall into two groups depending on whether they prioritize depth or breadth.
- Introductory overview: These briefs have a different objective to the rapid evidence assessments but use a similar methodological approach. Literature is targeted and reviewed with the aim of explaining a subject to ‘beginners’.

Most briefs, however, will draw upon a mix of methods and it is for this reason that a ‘methods’ box is included in the introduction to each brief, signalling transparently that methods are explicit, robust and replicable and showing how they are appropriate to the policy question.

Figure A: The policy brief spectrum



Source: Erica Richardson

Key messages

- Screening may bring benefits but also harm; just because it can be done does not mean that it should be done – and the same resources may be better used in other ways.
- Population screening should be done within an organized *screening programme* that includes certain core elements, from identifying target populations, through treatment, to monitoring and evaluation. There is no justification for unorganized screening. While it may seem simple, putting together a screening programme is a complex task and requires many things to work both inside and beyond the health system.
- Wilson & Jungner's screening principles remain the gold standard when deciding on implementing, continuing or discontinuing screening programmes, although they often require expert judgement as well as high quality evidence, including consideration of resource implications, effectiveness and cost effectiveness, as well as adaptation to country context.
- Care is needed when deciding to implement a screening programme to protect against the potential for commercially driven vested interests and supplier-induced patient demand. It is essential that decisions to implement, continue, or discontinue screening programmes are made transparently, setting out clearly the arguments for and against.
- It is also important to identify barriers to maximizing the effectiveness of programmes and put in place measures to overcome them. Potential barriers may relate to health system structures, such as payment models and availability of human, physical and financial resources. Potential solutions include financing models that encourage appropriate use, improving information flows, ensuring health workers have appropriate skills, and removing logistical barriers.

Executive summary

Screening may bring benefits but also harm; just because it can be done does not mean that it should be done

The WHO defines screening as “the presumptive identification of unrecognized disease in an apparently healthy, asymptomatic population by means of tests, examinations or other procedures that can be applied rapidly and easily to the target population. A screening programme must include all the core components in the screening process (...).”

Where there is good evidence that detecting a condition early will, overall, benefit those who are screened, then it may be appropriate to design and implement a formal screening programme. But if interventions for early detection are not effective or even harmful, those same resources could be better used in other ways to improve the health of the population.

Screening should always mean a *screening programme* that includes all the steps in the screening pathway

The decision about whether to implement a screening programme should be based on sufficient, continuously updated, evidence, including an economic analysis to consider cost effectiveness and implications for human resources, finances and other resource use. This is particularly important given the emergence of new technologies, such as biomarkers or smart technologies, as these may lack a strong evidence base. Where possible, decisions on screening should be supported by modelling to estimate costs and benefits in different populations.

Once the decision to implement a screening programme has been made, this should always involve creating a series of sequential steps on a pathway, from identifying the population eligible for screening, through ensuring that all those who require treatment receive it in the most effective, appropriate and timely way, to ensuring that there is a system for monitoring and evaluation to identify whether the overall programme is meeting its objectives and whether the different elements are functioning as well as they should.

While these steps may seem simple, creating a comprehensive population-level, organized, quality-assured screening programme is a complex task, requiring many resources and the development of capacity both inside and beyond the health system.

Wilson & Jungner’s screening principles remain the gold standard in deciding on implementing screening programmes, but they are not always followed

The 1968 WHO report by Wilson and Jungner set out the principles for determining whether a screening programme

is appropriate. In short, the condition should be important and there should be an effective means to treat it to prevent progression, mitigate its effects or, ideally, cure it. Critically, there should also be a screening process that is effective, acceptable and affordable.

Although the opportunities for screening have changed greatly since these principles were established, they continue to be regarded as the gold standard for making decisions on screening programmes. Yet they are not always followed and programmes that are ineffective or even harmful exist or are being implemented. This may be due to various pressures, related to both the demand and supply sides of screening, including commercial interests from the health care industry, such as manufacturers of equipment used in screening, whose marketing strategies seek to drive demand from the general public, policy-makers and health professionals.

There are different ways to ensure that a screening programme is appropriate

There are different ways to ensure that a screening programme is appropriate. Strategies should examine the role played by the different actors driving demand and supply, among which are: patients and the public, political decision-makers, health professionals and the health care industry.

Some strategies, such as ensuring that the evidence base for screening is included in undergraduate and continuing medical and nursing education, may be used to support specific stakeholder groups, such as health professionals. Other strategies, such as public awareness and education campaigns, can target a wider group of stakeholders including the general public, patients and decision-makers. Shared decision-making and other strategies to improve transparency, such as ensuring an effective separation between the purchasers and providers of screening programmes, will also have a broader reach.

It is also important to identify barriers to maximizing the effectiveness of appropriate screening programmes and put in place measures to overcome them. Potential barriers may relate to health system structures, such as payment models and availability of human, physical and financial resources. Potential solutions include financing models that encourage appropriate use, improving information flows, ensuring health workers have appropriate skills and removing logistical barriers.

All strategies need to be mindful of broader contextual differences, such as economic development, socioeconomic inequalities, cultural and religious diversity, health system structures and national infrastructure, such as the availability of medical technologies.

Policy brief

Why this brief?

Too often, a patient given a diagnosis of a problem with their health will say, “If only I’d known sooner, things would have been different.” But would they have been?

Sometimes they are right. For example, early detection of a localized cancer or, preferably, a premalignant lesion may allow definitive treatment that will prevent the disease from progressing. The same is true for new-borns with some inherited disorders, such as one that causes profound hearing loss, which if identified and compensated for early in life will lead to a much improved chance of language development and integration into a mainstream school. In the first of these cases, appropriate treatment will prevent disability and premature death, while the second not only improves health but potentially improves life chances by reducing the likelihood of exclusion from education and employment due to disability.

Where there is a disorder that can be detected early and there is a treatment that will make a difference, there may be an argument for screening some or all of the population. But this is not always the case. What if the subsequent investigation and treatment harm more people than they help, for example by subjecting them to painful and unpleasant interventions or causing them unnecessary anxiety for no additional benefit?

Where there is good evidence that detecting a condition early will, overall, be beneficial for those who are screened, then it may be appropriate to design and implement a formal screening programme. However, before making this decision, it is necessary to have much more information. Just because something can be done does not mean that it should be done. This is important to remember in a world where technological and other scientific advances have made possible so many things that were once inconceivable. Advances in understanding of human metabolism and biotechnology make it possible to screen for ever larger numbers of molecules that may be involved in disease processes. Advances in imaging make it possible to see inside the human body with a level of detail that was once unimaginable. It is now also possible to track an individual’s physiological parameters over long periods of time. Collectively, these have brought enormous benefits. However, they also risk identifying variants that are entirely harmless or where nothing can or should be done.

This problem has been recognized for many years. In 1976, the philosopher Ivan Illich wrote about the dangers of overinvestigation, coining the term *iatrogenesis*, or doctor-created disease (Illich, 1976). Since then, there have been a number of high-profile examples of screening programmes that have either failed to reduce the burden of disease or have done harm.

Currently, most organized screening programmes for adults focus on cancer, although screening programmes for a wider range of conditions, such as inherited metabolic disorders or hearing impairments, for instance for infants and children, also exist. In some countries, there are also informal (and not necessarily quality-assured) screening activities that seek to

identify those at risk for noncommunicable diseases (NCDs), such as cardiovascular disease (CVD) or diabetes. Examples include the dispensarization¹ programme in the Russian Federation or the health checks undertaken in middle-aged adults in primary care in England, United Kingdom. Given the enormous burden of disease attributable to these conditions, any intervention that is effective in preventing their progression to disability or premature death will be highly desired, provided there are sufficient resources. This not only includes money but also the human resources and equipment necessary for implementation. However, if such informal activities are not effective, those same resources could be better used in other ways to improve the health of the population.

In this brief we start by explaining the core components of a screening programme. We then ask when screening should be done. We will also look at the pressures to implement screening and, where screening is inappropriate, suggest ways to reduce it. Where screening programmes are warranted, we shall consider how best to achieve optimal results, inevitably drawing to a large extent on cancer screening, where there is more longstanding experience with organized screening programmes, but acknowledging also that the principles apply more widely as well.

To do this we must first consider what is meant by screening. The WHO defines screening as “the presumptive identification of unrecognized disease in an apparently healthy, asymptomatic population by means of tests, examinations or other procedures that can be applied rapidly and easily to the target population. A screening programme must include all the core components in the screening process from inviting the target population to accessing effective treatment for individuals diagnosed with disease” (WHO, 2019).

In line with this definition, this brief is only concerned with (universal or targeted) population-level, organized, quality-assured screening programmes, in which everyone who is eligible is invited to attend. It deliberately does not cover unorganized opportunistic screening or case-finding within clinical practice, where individuals are investigated for specific conditions if they are known to have one or more risk factors, often when attending a health facility for another reason. Both should, however, meet the same criteria and be subject to the same scrutiny as organized screening (McCartney et al., 2019). Opportunistic screening is invariably less appropriate than organized screening. Case-finding among individuals known to be at risk of something may be appropriate, but if scaled up indiscriminately to individuals without such risk factors, it rarely provides any benefit for the population. In fact, in many cases, it risks creating harm and widening existing inequalities even further because of the lack of quality assurance (QA) mechanisms. Finally, we do not look at direct-to-consumer (DTC) smart apps and tests that are bought and used by individuals, as these are not used in population-wide organized screening programmes.

¹ The term *dispansertizatsiya* in the Russian context denotes ‘periodic health checks’.

A systematic approach to screening

The decision to implement, continue or discontinue a screening programme should always be based on the best available evidence. Analysis should include the epidemiology of the condition in the population concerned, and in groups within it, defined for example by age, gender or other characteristics. It will also include an assessment of the performance of the screening test, including its ability to predict the presence of the condition being sought and its acceptability to the public. The latter will require detailed qualitative research to understand how the condition is perceived and to elicit attitudes to the proposed investigation.

In some cases, where appropriate data are available, it may be possible to estimate the impact of screening on the population using one of the various modelling tools (Box 1). However, these must be based on empirical evidence, ideally from clinical trials. In some cases, as science advances, the evidence will change, which can mean that adaptations and additional or different resources are required to continue to deliver the screening programme effectively (Box 2).

Box 1: Modelling a screening programme

While randomized controlled trials (RCTs) remain the gold standard for determining the effectiveness of screening, they are very expensive and time-consuming, and usually have short durations of follow-up (Barzi et al., 2017; Getaneh, Heijnsdijk & de Koning, 2019). Moreover, an RCT undertaken under research conditions may not be easily generalizable to ‘real-life’ settings or to other contexts, for example because of differences in disease prevalence. This is especially problematic when there is only one RCT.

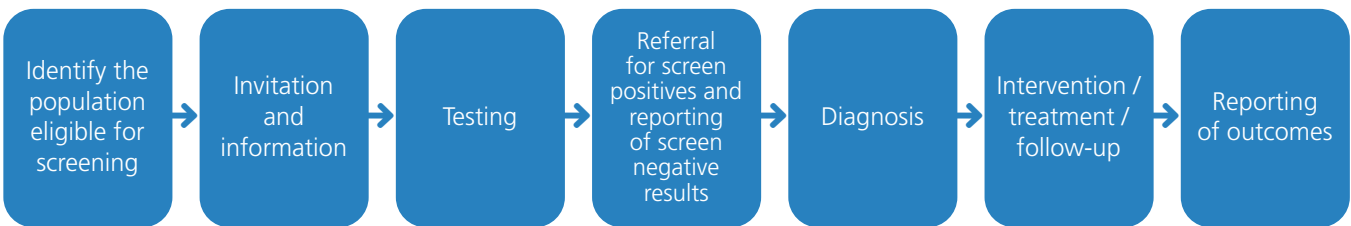
In response to these limitations, simulation models such as microsimulation screening analysis (MISCAN) models have been used to inform the development of screening policies. These have been used (and increasingly refined) since the 1980s to inform breast cancer and cervical cancer screening recommendations (van den Broek et al., 2018) and are increasingly being used for other cancers, such as colorectal cancer (CRC) (Barzi et al., 2017; Buskermolen et al., 2018). Modelling has normally been used for deciding which screening strategy is optimal given local conditions (such as cancer risk, life expectancy, resource availability and population preferences) but it is also valuable in the phases afterwards: the planning, implementation and evaluation of a screening programme (van Hees et al., 2015).

Box 2: Scientific advances and their impact on screening programmes

Clinical and technological advances have important implications for the implementation of screening programmes. For example, screening for cervical cancer once involved examination of cervical cells taken during a cervical screening test but is increasingly being undertaken using artificial intelligence (AI) with rapid image processing. Cervical screening is changing from cytology (sampling cervical cells) to screening using a self-test that can be done at home to detect the presence of human papilloma virus (HPV), the agent that causes cervical cancer. Looking ahead, the introduction of vaccination programmes against HPV is already reducing the incidence of cervical cancer in younger women and, in due course, will require a reassessment of the value of a screening programme. Another example is abdominal aortic aneurysms (AAA), which are asymptomatic swellings of the aorta that can expand and rupture, at which stage they are often fatal. AAA are easily detected using ultrasound, which is both cheap and painless. Now treatable with minimally invasive or open surgery (depending on what is available in local centres), there is strong evidence that screening for AAA in men over the age of 65 can reduce mortality. Programmes have been implemented in Monaco, Sweden and the United Kingdom. Yet, despite currently meeting all the criteria for implementing a screening programme, there are concerns that, as the prevalence of CVD continues to fall, the risks may soon outweigh the harms (Svensjö, Björck & Wanhainen, 2014).

Screening is often viewed as the set of activities that include undertaking an investigation, having a sample analysed and then reporting it back to the individual concerned. If these are the only components of a screening programme, then they are unlikely to lead to any significant health benefits. If the evidence is in favour of the decision to implement a screening programme, it should always be conducted as a series of sequential steps that form a pathway (Figure 1), which is described in greater detail in the screening guide published by the WHO Regional Office for Europe (WHO Regional Office for Europe, 2020).

Figure 1: Core steps of a screening pathway



Source: Adapted from WHO Regional Office for Europe, 2020.

For screening to be effective, each step of the pathway must be supported by substantial resources, including financial, human and technological resources, with engagement of multiple organizations both within and beyond the health system. It also requires a high level of expertise that is often lacking in the health sectors of many countries and, most importantly, it must adhere to systematized external and internal QA standards, including failsafe systems that provide back-up and reduce the risks of errors. (QA is described in greater detail in the screening guide referred to above and is thus not covered in this brief (WHO Regional Office for Europe, 2020).)

As shown in Figure 1, the first step in any screening pathway involves **determining who the target population should be**, whether this be new-born babies, women, adults between certain ages or people already suffering from a health condition such as diabetes. It is important to recognize that this target population may change over time depending on the evidence.

Subsequently, it is important to **establish how individuals in the target population will be identified**, whether this is through disease registers or other means such as the census. Although this may seem simple, many countries lack an up-to-date population register. Some groups may be excluded, such as migrants. Others may be included, but the register is not updated regularly enough to capture changes of address. The register will often fail to identify those who will not benefit from screening, such as women invited for cervical cytology who have had a hysterectomy. Within a country, the registration system may be fragmented, for example across different local government areas or insurance funds. All of these can reduce the coverage (which is the percentage of people who are eligible to be screened that actually participate) (Public Health England, 2019). Moreover, in many cases, it will be those who are most vulnerable who are not screened (Marlow et al., 2019; Solmi et al., 2020).

The second step seeks to **invite eligible individuals to participate**. This requires a considerable degree of organization to ensure that the invitation gets to the right person and failure to do so can cause mistrust and media outcry (BBC, 2018). This was seen in the UK in 2018, when 450,000 women who should have been invited for breast cancer screening were not (Public Health England, 2018b) leading to widespread consternation, speculation and anxiety among members of the public about the potential consequences. With technological advances, the potential to communicate has diversified and screening programmes now use an array of modalities. However, screening always involves a trade-off between harms and benefits, and it is important to emphasize that for it to be ethical, participation must also be informed. The harms can include the discomfort of undergoing the screening investigation, anxiety provoked by a false positive result, or invasive investigations resulting from it. There is a substantial literature on different ways of ensuring that those being screened are able to make a fully informed decision about whether they wish to participate, with opportunities to discuss uncertainties. These include different types of educational interventions and the design and distribution of appropriate printed and electronic materials. In general, there is evidence in support of educational measures, delivered via one-to-one sessions, by peers or health workers, or in the framework of community interventions.

The success of any screening programme will be determined by its uptake, which is the proportion of people who were invited that actually got screened. The QA process will usually measure this and could be supported by a number of measures to improve uptake, discussed later.

The third step includes **testing**, which depends on facilities having adequate capacity, including both the venues where the screening takes place, the technology and people skilled in its use and maintenance, and (where relevant) any laboratories or other places where the results are analysed. This step is also an important opportunity to check understanding to minimize anxieties later on. The QA process is particularly important at this stage, to accurately record and monitor trends by operator, centre, or even region, and to ensure that screening results, including ambiguous ones, are appropriately managed and categorized.

The fourth step includes the appropriate management of screen positive and negative results, ensuring that there is an adequate and accessible **referral system** for those identified as possibly having the condition being screened for. A screening programme will have limited value if those who are identified as requiring further investigation and treatment are unable to access these services, e.g. if children with potential hearing impairment are then unable to access appropriate audiology services. Moreover, a screening programme should ensure that the system for referring participants is as seamless as possible to ensure that no one falls through the gaps, with failsafe checks in place to catch those who do (see, for example, Public Health England, 2018a). This then paves the way for step five, in which those who are identified as screen positive promptly access adequately staffed **diagnostic services**.

The sixth step involves ensuring that all those who require **treatment** receive it, and do so in the most effective, appropriate and timely way. Ultimately, there is no point in offering a screening programme if there are insufficient facilities or health personnel to provide treatment for those who need it. For example, in the case of a hearing impairment screening programme for school children, this potentially would lead to the use of hearing aids, cochlear implants or access to special educational needs services. In some cases, these patients will require follow-up at specified intervals to repeat screening as part of a wider surveillance exercise.

The final component of an organized screening programme is the reporting of outcomes through a system for **monitoring and evaluation**, to identify whether the overall programme is meeting its objectives and whether the different elements are functioning as well as they should. These include ensuring: a high level of uptake by different groups in the population; that those undergoing screening have a positive experience so that they will encourage others to participate; and that those in whom problems are identified are referred for further investigation and treatment, leading to health gains. This will often require linkage to other data sources. For example, a cancer screening registry should always be linked to the relevant cancer registry. Monitoring and evaluation should also take account of changes in technology, such as new investigations that perform better than those that preceded them (Box 2).

When is screening appropriate?

In 1968, a WHO report set out what are termed the Wilson and Jungner principles for determining whether a screening programme is appropriate (Wilson & Jungner, 1968) (Box 3). Although the opportunities for screening have changed greatly in the intervening period, these principles continue to apply. In brief, the condition should be important and there should be an effective means to treat it to prevent progression, mitigate its effects or, ideally, cure it. Critically, there should also be a screening process that is effective, acceptable and affordable.

Box 3: Wilson & Jungner principles

- (1) The condition sought should be an important health problem.
- (2) There should be an accepted treatment for patients with recognized disease.
- (3) Facilities for diagnosis and treatment should be available.
- (4) There should be a recognizable latent or early symptomatic stage.
- (5) There should be a suitable test or examination.
- (6) The test should be acceptable to the population.
- (7) The natural history of the condition, including development from latent to declared disease, should be adequately understood.
- (8) There should be an agreed policy on whom to treat as patients.
- (9) The cost of case-finding (including diagnosis and treatment of patients diagnosed) should be economically balanced in relation to possible expenditure on medical care as a whole.
- (10) Case-finding should be a continuing process and not a 'once and for all' project.

Even though these principles are well established they are not always followed. Why does this happen?

One reason is that the natural history of the disease may not be adequately understood. For example, our understanding of some cancers is based on following up patients whose lesions were identified using technology that has now been superseded. Historically, most kidney cancers were identified as a result of symptoms such as blood in the urine, which led to a specific radiological examination of the kidneys. Now, with the widespread use of abdominal imaging from computerized tomography (CT) or magnetic resonance imaging (MRI), it is possible to detect small cancers that would previously have been missed. These may behave in quite a different way from those identified in the more traditional way. Similarly, the advent of prostate specific antigen (PSA) testing has identified many more prostate cancers than would have been the case previously; the ways in which these should be managed need to vary, as some of these cancers may progress extremely slowly, if at all (Hayes & Barry, 2014). Another prime example of how care needs to be exercised was a mass screening programme for thyroid cancer in South Korea in 1999, which led to the number of cases being detected increasing 15-fold and yet no reduction in mortality from thyroid cancers. Most of these were in fact common papillary cancers, which are frequently asymptomatic (Ahn et al., 2014).

Screening programmes can only be effective if there are suitable tests to identify problems. Any diagnostic test should be sensitive, in that it should identify a high proportion of those with the condition and minimize the number of false negatives. It should also be specific, so that those identified actually do have the condition, thereby minimizing false positives. The sensitivity and specificity can only be calculated with appropriate data, based on measurement of the proportion of the population known to have the condition using a gold standard test. This can be particularly challenging for conditions that do not involve examination of biological materials, such as screening programmes for mental health disorders, including depression.

Even if there is an accurate screening procedure available, it must be acceptable to the population being screened. Thus, very few people would consent to a screening investigation that involved a major surgical procedure. Even investigations that might appear to be relatively simple, such as collecting faeces to be examined for the presence of blood, may be unacceptable to some people, while even more will have reservations about undergoing a procedure such as a sigmoidoscopy, in which a flexible endoscope is passed into their rectum (Koo et al., 2017).

A screening programme can only be justified if there is an effective treatment and there are adequate resources to provide it. There is no point in establishing population screening programmes if there is nothing to offer them because there is no treatment, or because of a lack of skilled health professionals or equipment in a country. One example of this concerns screening for mild cognitive impairment; these tests are expensive and interventions to prevent or slow progression to dementia have very limited efficacy (Brayne & Davis, 2012; Le Couteur et al., 2013).

The treatment that is provided for the condition being screened for should improve survival or improve quality of life. For example, detecting a cancer early may seem to prolong survival but may simply mean that the individual concerned is aware of their diagnosis for longer (a phenomenon termed 'lead time bias'). Also, for every diagnosis and subsequent treatment that is provided, there may be unintended consequences or side effects, so treating some diseases which may or may not progress may cause more harm than benefit.

It is also essential to have a clear, evidence-based policy about whom to screen. The sensitivity and specificity of an investigation will depend on several factors, including the prevalence in different groups within the population. Thus, while mammography screening will obviously be restricted to women because of their much higher risk than men, screening may also be affected by a woman's age and thus the density of her breast tissue. Screening for a condition in a population in whom it is extremely rare is likely to increase the share of results that are false positives. Moreover, disease prevalence can change. Thus, mass radiological screening for tuberculosis, once widespread, has largely been abandoned.

Finally, in any health system with finite resources, anything that is used for one initiative is no longer available to use for other purposes. It is important to take account of the ability to achieve health gains in different ways. One of these ways might be a screening programme, but in many cases it might not be. Not only is it important to identify short–mid– and long-term costs and benefits to health systems, but it

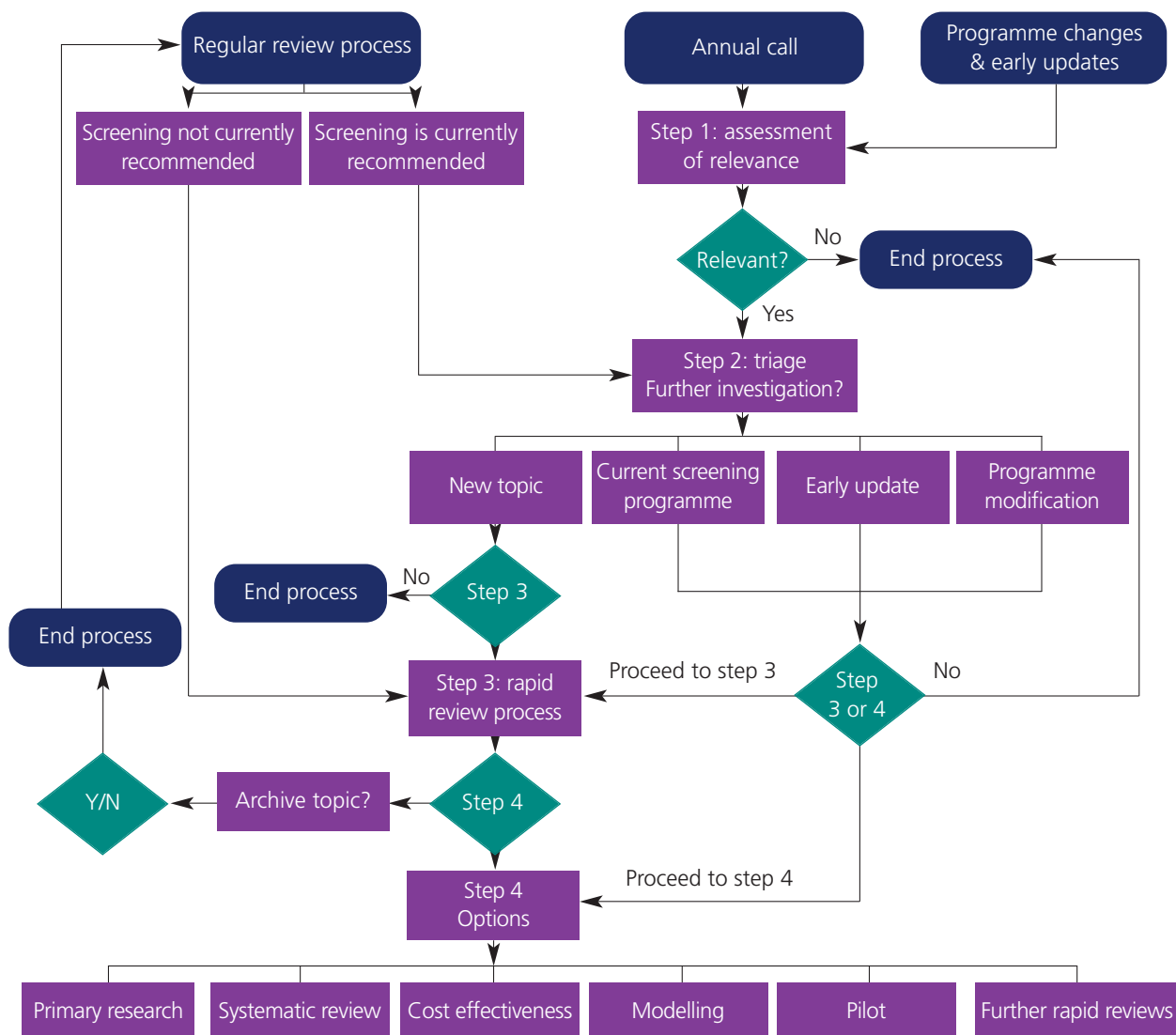
can also be helpful to identify benefits that fall outside of the health system that may arise from screening programmes; for instance, early action in life to address or prevent hearing loss not only has benefits to the health care system, but also improves development and educational outcomes, which ultimately impact on adult employment and other life chance outcomes (Korver et al., 2010; Pimperton et al., 2016).

Evaluation of a proposed screening programme should therefore be accompanied by an economic analysis to consider budgetary impacts and cost effectiveness. In the UK, for example, where the National Screening Committee takes decisions on population screening programmes, the impact on resources and cost effectiveness are explicitly considered (Figure 2). For instance, new-born screening programmes for hearing impairment were judged to be cost effective because of the long-term health and wider benefits of early detection of hearing impairment (Korver et al.,

2010). In the UK, there are currently 11 screening programmes that take place throughout the life course (antenatal, new-born, adult periods) covering more than 30 conditions. This process is subject to regular review. Even in countries where cost effectiveness is not formally part of the decision-making process, such as the United States, evidence on the economic benefits of these screening programmes appears to have been a factor that has influenced the adoption of universal new-born hearing screening programmes (Grosse et al., 2018).

The decision about whether to implement a screening programme must therefore be based on appropriate evidence. This is particularly important as there is often considerable pressure to implement screening programmes across many areas of medicine, or to use new and emerging screening technologies, such as biomarkers or smart technologies, which lack an evidential basis. Boxes 4 and 5 provide examples.

Figure 2: UK National Screening Committee review process for screening programmes



Source: UK National Screening Committee, 2019

Box 4: Examples of screening with poor evidential basis

Health checks are used in several countries to detect those at risk of CVD. This type of screening is often popular with patients because it consists only of simple questions, blood pressure measurement, a blood test and the hopeful intent of averting a well-recognized cause of death. While this may encourage patients to consider lifestyle changes and increase the prescription of preventative medicines (Robson et al., 2017), a recent Cochrane review found that health checks conferred no benefits on mortality, CVD incidence or any other markers of morbidity, including hospitalizations and absence from work (Krogsbøll, Jørgensen & Gøtzsche, 2019). Despite this and earlier evidence to the same effect, health checks continue to be used in some countries, often at great expense. In fact, systematic population screening for CVD is more likely to lead to overdiagnosis and therefore overtreatment of individuals who may not actually need it. This is in part because those with the least risk are more likely to use it (Krska, du Plessis & Chellaswamy, 2016; Martin et al., 2018), while the individuals who might derive any real benefit from it often do not (Public Health England, 2019).

Screening for prostate cancer has been promoted extensively in some countries using a blood test to detect PSA. However, most Western European and North American countries as well as Australia have stopped promoting it after realizing the important harms associated with PSA screening and the consequent decisions by their health authorities not to encourage this screening any more (see Box 6). Any small benefit of delayed mortality is at a considerable cost in terms of harm caused by investigations and treatment.

In the United States, commercial interests have promoted screening for low testosterone (marketed as 'low-T'), including the use of questionnaires that purport to identify those at risk of the condition. However, evidence that testosterone supplementation of those whose levels are found to be low is beneficial is lacking (Huo et al., 2016).

More recently, there has been increasing interest in screening for mental disorders. These conditions often remain undiagnosed but can be severely disabling. Yet, this is an extremely diverse set of conditions. The benefits of screening for alcohol-use disorder in primary care are fairly well articulated for adults, who can then be treated with brief interventions (NICE, 2011; Curry et al., 2018). In some countries screening for depression in new and expectant mothers is now being implemented, as in Israel (Glasser et al., 2018).

There is not as yet an effective treatment to halt disease progression for Alzheimer's disease. Although there has been extensive research to identify biomarkers that could be used to screen for it, this is not likely to add any health-related benefit in the absence of effective treatments, but policy-makers may have to consider other factors; it has been argued that earlier detection may give individuals more time to put in place plans for the future, including advanced legal and medical directives.

Box 5: New and emerging screening technologies

Biomarkers

There are a few examples of biomarker-based technologies that can accurately predict early cancers. CancerSEEK, for example, uses biomarkers to detect eight early cancers and 99% of those with a positive result have been shown actually to have cancer (Cohen et al., 2018), seemingly a promising result. However, even if these cancers are detected early, it is not yet clear whether treatment will be appropriate and in whom, and whether any given health system will be equipped to provide the interventions, counselling and follow-up required. It is also necessary to take account of false negatives.

There are other biomarkers, such as apolipoprotein E (ApoE) variants for late onset Alzheimer's disease mentioned earlier, that have been promoted as screening tests. However, given there is no treatment, it is difficult to justify screening.

Genetic and genomic markers

Genetic screening itself is not new but has historically been limited to single gene defects, such as phenylketonuria, where specific interventions exist that can change the course of disease, such as avoiding or supplementing dietary intake. There are also specific scenarios where genetic screening is appropriate, such as screening for certain inherited disorders in pregnancy or for BRCA genes in women with a strong family history of breast cancer. In such cases, women can be offered the choice, respectively, to terminate a pregnancy (in some countries) early or undergo a mastectomy, given the often serious and disabling nature of these diseases.

Advances in genomics and big data processing may create new opportunities for genetic tests to detect conditions that pose a future risk to those affected. Genomics provides information that may indicate an individual's risk of or resistance to future disease, thereby offering potential to stratify populations according to their genetic disease risk. New applications that are being explored include identifying susceptibility to certain diseases in the general population, such as venous thrombosis linked to factor V (Leiden) mutation and lactose intolerance, and risk profiling for multiple diseases (genetic profiling) to help identify high-risk individuals who are not identified by traditional indicators. Yet, although these are exciting developments that have received considerable attention and funding, genomics so far has fallen short when measured against the Wilson and Jungner criteria. Whilst risk stratification is useful, it is less helpful for conditions for which we do not have available treatments. For this reason, very few of these tools and technologies have so far been fully translated into health care and public health practice (Molster et al., 2018), beyond the introduction of new-born screening for genetic conditions. This has led to a number of concerns about the relevance of each discovery to clinical outcomes (Chin et al., 2011) and calls into question policies that advocate for their inclusion into organized screening programmes.

Smart technologies

There has also been a dramatic increase in smart technologies, which can monitor health-related physiology and thus, at least in theory, predict future illness. These kinds of mobile or 'mHealth' technologies include wearable devices such as FitBits and Apple Watches, which can detect irregular heart rhythms and atrial fibrillation (Ip, 2019), while some wearable devices are marketed for their ability to detect heat changes indicative of breast cancer (Cyradia Health, 2019). There are a number of risks associated with using such technology to screen for diseases. Firstly, as we have described above, screening for some NCDs, such as atrial fibrillation, has not yet been shown to produce any benefit at a population level, particularly in young people, and should therefore not be implemented until such evidence is available. Secondly, these technologies depend on sensors, often different, which may or may not be accurate. This increases the chance of false positive alerts, with both psychological and economic consequences. Finally, there are major implications for data protection and careful consideration must be given to the fact that these apps have the functionality to track many other things, including physical activity. This has the potential for misuse by, for example, insurance companies who may penalize patients with disabilities who are less active. There are also major concerns about issues of intellectual property related to these data. Thus, it is possible to imagine a scenario in which a national health system provides data on its population to a commercial company that uses them to develop an algorithm that it patents and charges the health system to use, or even blocks the health system from developing its own version.

Supporting implementation of appropriate screening programmes

Although the principles underlying decisions about screening are well-established, there is still much screening (including outside of organized screening programmes) that is ineffective or even has the potential to be harmful (Prasad, Lenzer & Newman, 2016). Many different factors can contribute to this, most of which are relevant when considering why appropriate screening programmes are not always implemented. Here we highlight some of the factors considered to influence both the demand for and supply of appropriate screening programmes. Implementation strategies will need to look at the role played by the different actors behind these demand and supply factors, the most significant of which are: patients and the public, political decision-makers, health professionals and the health care industry. Given the scope for personal or corporate gain, it is essential that regulatory processes and decisions are fully transparent. Decisions must also take account of broader contextual factors, such as level of economic development, socioeconomic inequalities, health system structures and national infrastructure, such as the availability of high-speed broadband and medical technologies. National differences in approaches to women's rights issues may be relevant when deciding in some countries on certain forms of antenatal screening that would lead to termination of pregnancy in the event of a major foetal anomaly.

Patients and the public

Screening programmes, in common with other public health strategies, are unlikely to have an impact unless they appeal to and engage their target populations. This is equally relevant when seeking to curb demand for inappropriate programmes or increasing the uptake of appropriate screening programmes. Public attitudes towards the seriousness of illnesses like cancer and programmes designed to prevent them vary enormously and these perceptions can either increase or reduce demand (see, for example, Douma, Uiters & Timmermans, 2018). There may be campaigns from certain groups, including those affected by rare diseases, for whom a screening programme may be perceived to be particularly important. Examples include calls from some advocacy groups to introduce screening programmes for cognitive impairment for healthy older people, despite a lack of evidence for the benefits of such programmes (Chambers, Sivanathan & Brayne, 2017). Those with such an interest, including those who stand to benefit financially, may also seek to influence advocacy groups to campaign for a change in screening policy, as for instance seen with atrial fibrillation, where patient associations that have received industry funding have sought to amplify concern by means of carefully targeted public relations campaigns, such as placing stories in the traditional media or promoting them through social media (Mahase, 2019).

While it is entirely legitimate for public and patient groups to seek to influence the policy-making process, steps can be taken to facilitate investment only in screening programmes supported by evidence. This means that patient groups should be fully consulted and invited to make submissions to relevant bodies that make decisions on screening programmes. These submissions can then be considered

along with any other evidence. It is also helpful to include lay members of the public within committees that advise on the appropriateness of screening programmes. However, in doing this, regulatory measures need to be in place so that any conflicts of interest, including funding from industry and any other financial interests, are fully disclosed. Using deliberative democratic methods such as community juries to support policy decisions may also be helpful (Box 6).

Box 6: Using community juries to support decisions on screening

Community or citizens' juries and other forms of deliberative democracy can support policy decisions by gathering informed public responses about disputed issues in public policy, such as the values and trade-offs involved in decisions about screening programmes (McCaffery et al., 2016). For example, community juries have considered PSA testing in Australia and mammographic screening in New Zealand. In Australia, the jury concluded that the government should not invest in PSA testing and recommended an education programme for general practitioners (GPs) to enable them to provide better quality, consistent information to patients (Rychetnik et al., 2014). Also in New Zealand, participants changed their recommendation and voted against government provision of mammography screening in the 40–49 age group (Paul et al., 2008). The main reasons reported were the inaccuracy of the test and the potential for harm, and the lack of firm evidence of saving lives in this age group. Disseminating findings from juries could potentially enhance community health literacy, leading to better informed citizens and more transparent decision-making.

It is also important to engage directly with the wider public, through both traditional and social media, in order to influence demand for and uptake of screening programmes by providing clear information on the benefits, costs and risks associated with programmes. These include different types of educational intervention and the design and distribution of appropriate printed and electronic material. The disadvantages of investing in programmes that have little or no benefit at a population health level also need to be highlighted, so as to challenge any misconceptions on the value of screening. This information, for example, could also provide further information and advice on where to seek help for individuals worried about specific conditions.

There is a need to develop specific strategies to increase uptake by the intended target population of any screening programme (Box 7). There also needs to be effective communication with individuals and their families post-screening. This must include clear information on the results of any screening test and how these should be interpreted. It is also important to have good procedures in place, as recently reported in Ireland, if likely false positive or false negative results are identified through record review (Scally, 2018). A lack of timely release of such information may lead to a worse prognosis, plus additional stress and anxiety. Poor communication and adverse media publicity might also undermine confidence in any screening system and thus reduce future uptake.

Box 7: Strategies to increase uptake of screening programmes

There are several strategies that can improve the uptake of screening programmes. There is evidence in support of educational measures, delivered via one-to-one sessions, by peers or health workers, or in the framework of community interventions. Appropriately written invitation letters are important, ideally signed by or otherwise identified with someone who is trusted, such as their primary care physician, and linked to a system to monitor attendances and send reminders when needed. These are increasingly easy to deliver through methods such as SMS (text) messaging. The second strategy involves monitoring uptake of the service and taking appropriate action if problems are identified. An example of this is the use of call and recall systems to remind non-responders to participate. This component is often lacking in screening programmes but is extremely important. A third set of measures seeks to eliminate logistical barriers, making it easy to attend an appointment. There are two broad approaches. The first is to offer a specified appointment to those who are eligible to be screened, but with the option to change it to one that is more convenient. The second is to ask them to call to make an appointment, which may be more suitable for specific groups. There is some evidence that the former approach is more effective, at least in those who missed a first appointment (Allgood et al., 2017). People may not attend screening for several reasons other than the ability to organize an appointment, such as the possession of personal beliefs that reject screening in general or one specific form thereof. While it is important that people have the autonomy to decide for themselves, it is also important that someone is seeking to understand the nature of these health beliefs and, if erroneous, to develop mechanisms to address them, whilst respecting patient autonomy. Monitoring may also identify certain groups among whom uptake is especially low. These may be characterized by having low levels of education, experiencing language barriers or facing logistical barriers, for example because a facility is only open at times that are inconvenient for those in full-time work. Again, it is important that, somewhere within the screening programme, someone is seeking to understand these problems and address them.

Given that screening may involve inviting people who have no symptoms to undergo an examination that may be uncomfortable, and which will require them to take time away from their other activities, it is important that any direct and indirect costs of being screened are reduced to the minimum. Consequently, if screening is felt to be appropriate, it should if possible be included for free within the benefit package. In some cases, there may be an argument for compensating the individual being screened, using a system of conditional cash transfers.

Logistical barriers can also be reduced by ensuring that screening facilities are easily accessible, which may involve placing them in non-traditional settings, such as shopping malls or marketplaces. This is facilitated by the growth of new forms of technology that are much more mobile than those in the past. For example, cervical screening is increasingly being undertaken by self-sampling for HPV infection². Facilities should also be open at times that are appropriate for people leading busy lives, which means that they should be accessible outside normal working hours. Similarly, those attending should have to wait for as short a time as possible. This requires adequate capacity but also good management to ensure that patient flows function well. It may be necessary, in some cases, to provide transport for those invited. In some cases, home testing may be possible, where the individual concerned obtains their own sample, for example a cervical swab for detection of HPV or a faecal sample, and then sends it for analysis.

Source: Authors, drawing on Priaux et al. (2018, 2019a and b).

Political decision-makers

We have already noted the role that advocacy campaigns seek to play. In addition, there may be many different public and professional opinions, cultural and religious views, and sensitive political circumstances that will influence political decision-makers' willingness to invest in screening programmes. This means that, in making decisions about funding a screening programme, policy-makers will have to contend not only with many different and often competing sources of scientific evidence but also with many other interests as well.

Having a transparent and arms-length process can help reduce the risk of decisions being viewed as overtly political rather than focused on meeting population health needs and based on sound scientific evidence, as well as other concerns including undue industry and public pressure. We have already explained that there should be full public disclosure of interests as part of this process. This can help to avoid creating the conditions where financial and non-financial conflicts of interest may be perceived to influence decisions on screening programmes.

Furthermore, in order to increase the likelihood of investing resources in appropriate screening programmes, policy-makers can establish independent scientific bodies, the objective of which is to assess whether there is a case for investing (or disinvesting) in a screening programme. This can include assessment not only of effectiveness, but also of whether programmes meet national criteria for cost effectiveness, as well as their budgetary impact (Box 8). This will, inevitably, be challenging for small countries, which may wish to find ways to work with countries that have greater capacity.

Box 8: The role of scientific bodies in decisions on screening programmes

Many countries in Europe and beyond have national or subnational bodies responsible for making decisions on screening, such as a unit which assesses evidence on screening within the Danish Health Authority or located within a national health technology assessment (HTA) organization. There may also be screening specific advisory committees, such as the National Screening Committee in the UK.

Some of the key characteristics of such bodies are summarized in a 2014 systematic review (Seedat et al., 2014). Although there are some common features, there is also considerable variation, some of which relates to the organizational structure of health systems. Thus, in some countries, a central body can both evaluate and implement screening programmes, while in others these roles are separate. Most will have transparent systems for selecting topics for review, reflecting urgency, need, importance of the health problem and quality of evidence.

When making recommendations, they typically consider: the burden of disease; ethical issues such as acceptability, risk of overdiagnosis, and consequences of false positives and negatives; the forms of evidence that can be used to determine effectiveness (e.g. is a RCT essential?); considerations of planning and implementation; and how

² Self-sampling requires individuals to obtain a kit, collect their own samples and send their specimens to a laboratory. It can be conducted either at the clinic or outside the health system, and can be initiated either by health providers or by the eligible members of the population themselves.

the quality of any programme might be assured. Increasingly, such bodies will also consider cost effectiveness, given the potential substantial costs of population screening programmes.

It is important to consider the power that such independent screening assessment bodies have (or do not have) if they conclude that the evidence to support a screening programme is insufficient. In one example from Switzerland, the Swiss Medical Board (an independent group of medical experts) advised the suspension of the Swiss systematic mammography screening programme for breast cancer in 2014, after reviewing the evidence for its effectiveness (Arie, 2014). In line with other studies (Miller et al., 2014), they reported that, despite saving 1–2 women's lives for every 1000 screened, breast cancer screening also led to unnecessary investigations and treatment for around 100 women in every 1000. They were criticized by the Swiss Cancer League among others and ultimately the Federal Public Health Office did not heed the advice (Arie, 2014).

Difficulties can arise when screening programmes are implemented against the advice of such independent screening bodies and without the necessary evidence to justify the opportunity costs. For example, although some studies have demonstrated an ability of low dose CT scanning to reduce lung cancer mortality when used to screen selected individuals (Field et al., 2019), there are serious concerns about high levels of overdiagnosis (over 67% in a Danish study) (Heleno, Siersma & Brodersen, 2018) and this form of screening remains highly controversial. The 2019 English NHS Long Term Plan has committed to extending pilot lung cancer screening programmes across the country, deploying mobile CT scanners to people in supermarket car parks, but initial results included a false positive rate of 48%. This commitment has been pledged without the endorsement of the National Screening Committee and despite a national shortage of radiologists, against a background of underinvestment in prevention activities and warnings of the potential for lengthening waiting times for symptomatic patients (McCartney et al., 2019).

Another challenge to the implementation of appropriate screening programmes can be significant resistance to disinvestment in inappropriate screening programmes within the health care system, especially where there is a perception that this may potentially lead to a loss of jobs within the health care system. This not only applies to the complete closure of programmes but also to changes in the way in which programmes operate, such as reducing the age range covered by a screening programme, changes in how screening tests are administered (e.g. self-testing for HPV), or reducing the number of times an individual is screened. For example, modelling in Australia shows that colposcopy volumes are expected to fluctuate and eventually fall, which will have substantial resource and workforce implications (Smith et al., 2016). Politicians might be concerned about adverse publicity associated with any disinvestment in health services and may even view screening as a means to sustain facilities and health system employees that are no longer required because the condition they were established to look after has become rare or disappeared. An example is the use of x-ray facilities, initially created as one of the modalities for the diagnosis of tuberculosis (WHO, 2016), but, despite the lack of evidence supporting its use, subsequently justified in some countries as a way of mass screening for lung cancer.

Where recommendations are made to disinvest in screening programmes, it is helpful to consider whether it may be possible to reassign or retrain staff to perform other functions within the health system, such as a different appropriate screening programme, or to phase in disinvestment so as to reduce resistance to change.

Economic analysis and decision models can also be used to assess the costs and benefits of disinvestment, as well as investment, in screening programmes (Karnon et al., 2009). To date, there has been limited focus by many HTA agencies on modelling the costs and benefits of ending programmes, with one recent example looking at the potential consequences of changes to vision screening programmes for children (Sloot et al., 2017). More evidence of this type might provide a further catalyst for action (Calabrò et al., 2018).

Health professionals and health systems

Health professionals based in public health and health care services are key actors that can influence investment and uptake of screening programmes. A lack of up-to-date information and incentives to change practice may be factors in the persistence of inappropriate screening programmes; outdated practices may persist, despite evidence that they are ineffective, especially if, for instance in the case of some former Soviet countries, access to international scientific evidence had historically been limited (Rechel et al., 2011). In all countries, health systems have a critical role to play in ensuring effective communication with health care professionals, perhaps as part of continuing medical education and through their professional associations, to continue to update evidence and recommendations concerning different screening programmes. There may also be an understandable desire among health professionals to do all they can to minimize diagnostic uncertainty, but this again could lead to the inappropriate use of investigations. Health systems should consider covering these issues in initial and ongoing training, as well as through measures to monitor adherence to guidelines.

Another way in which health systems can influence health professional behaviour is to make use of financial incentives, for instance the payment of additional fees in primary care, either linked to performance of appropriate screening tests and/or any role they play in inviting individuals to screening (Box 9). Behaviour can also be influenced by indirect as well as non-financial incentives, e.g. a study of GP preferences in France indicates the importance of having additional staff who can support the screening process, as well as access to training on the impact of screening in doctor–patient relationships and improved patient information systems (Sicsic, Krucien & Franc, 2016). Various interest groups might also make use of both financial and non-financial incentives, such as support to attend international conferences to influence professional behaviour. Having procedures in place both to declare any interests and, where appropriate, restrict these interests, for instance through terms in employment contracts, can help counter these concerns.

Financing mechanisms used by health systems will also influence the deployment of staff. While this can be positive, it is important to be aware that badly designed financial incentives may mean that resources for screening are poorly

used. One example of this is when more highly skilled (and expensive) health care professionals perform screening tasks that could be performed equally easily, and often more appropriately, by less expensive health professionals. Health system planners may also wish to consider whether task sharing may be appropriate. This would involve transferring responsibility for some aspects of screening away from specialists and towards primary and community health professionals, as well as technicians trained in the specific process in question (EXPH, 2019). In doing this, system planners will have to look carefully at existing financial incentives. In health systems where physicians are paid on a fee-for-service (FFS) basis, they may be more resistant to task sharing.

The ways in which health systems are structured and funded may have a significant impact on professional behaviours, while the ways in which public health services are funded may have a bearing on the availability of screening programmes. Nationwide dedicated public health funding streams which specify the screening services that should be funded can help to standardize access to services, whereas if responsibility for public health is fragmented (for instance, split between individual insurance funds, local health organizations and local government), coverage may be more uneven. For example, in Sweden, where health is the responsibility of 21 regions, only 16 of the 21 regions were implementing national guidelines on screening four-year olds for hearing impairment (Stenfeldt, 2018). Moreover, there were variations in the procedures used. In more fragmented systems, careful monitoring is required so that policy-makers are aware that remedial measures may need to be taken to address geographical inequalities in access to services.

Health care industry

Many different actors within health care systems may have a vested interest in the expansion of screening programmes. This obviously includes the health care industry, including manufacturers of the equipment used in screening and developers of new screening technologies. They may have significant marketing and advocacy resources, which may be extremely persuasive, especially in countries with limited internal HTA capacity.

These actors may also seek to expand the boundaries of what is considered abnormal. Thus, they may seek to encourage the adoption of programmes to identify people with physiological parameters that have, at best, an uncertain association with illness, such as low testosterone levels, or to encourage the treatment of individuals with what are sometimes called pre-diseases. This is becoming increasingly popular with the emergence of new, often unregulated, technologies (see Box 5). These initiatives are also driven by commercial profit and the potential for kickbacks as described earlier and must be approached with care.

Again, the ideal way to counter industry pressure is to make use of independent screening assessment bodies that can make decisions on the basis of transparent criteria (Box 8). This may not always be possible, especially in countries with more limited resources. In this case, however, it is important to raise awareness of the potential availability of evidence on the appropriateness of screening from HTA in other countries, taking account of their own local context, including differences in capital infrastructure and human resources.

Box 9: Use of financial incentives to influence health professional behaviour

FFS payment mechanisms linked to screening are designed to encourage physicians to screen their patients, which is appropriate as long as patients provide consent without coercion. However, if the aim is to increase uptake of a cost-effective appropriate screening procedure, it will have precisely the opposite effect if it is linked to inappropriate screening. This can be seen in some countries where FFS payments encourage cervical screening on an annual basis or at even shorter intervals (Eurostat, 2019), despite evidence that this is inappropriate. Another example was thyroid cancer screening in South Korea. In 1999, the South Korean government introduced a national screening programme for a number of cancers, either free of charge or with a small co-payment for those with higher incomes. Thyroid cancer screening was not included in the programme, but providers, including GPs, often performed an ultrasound for thyroid cancer for an additional \$30 to \$50 (Ahn et al., 2014). This did not ultimately provide any benefit at a population level but was carried out for profit and without consideration of the potential unintended consequences.

The way forward

Looking ahead, advances in scientific knowledge will offer many new opportunities for population-based screening, but also many challenges to ensure that what seems like a promising idea can actually deliver health gains, and in a way that is cost-effective and equitable. The well-established principles set out by Wilson & Jungner continue to apply, but decisions based on them should be evidence-based, regularly reviewed and executed by an independent body to ensure that they incorporate changing evidence. This evidence may suggest either introduction or expansion of a new programme or discontinuation of an existing one. These decisions should be supported by the best available evidence, including the views of the public. However, the large sums of money involved mean that it is essential to avoid influence by vested interests, which can take many forms. If screening is to be implemented, it should only be done within the framework of an organized, well-managed programme that can deliver health gains for the population.

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