A framework for re-evaluating established health screening practices

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Key messages

- Tests, treatments, delivery of care, and understanding of disease progression and impact change over time, potentially altering the nature and magnitude of the benefits and harms of population screening programmes.
- Re-evaluation of the benefits and harms of existing screening practices can therefore be essential to ensure that screening remains justified.
- Not all organisations have a structured approach to re-evaluate their practices, and if they do so they often do not consistently apply high quality methods.
- We suggest a framework for structured and transparent re-evaluation of established screening practices

Introduction

Screening practices should reduce morbidity and mortality from the target condition. However, they also cause harms and carry costs to individuals or societies. As screening targets asymptomatic individuals, its implementation and continued use deserve careful consideration. Wilson and Jungner outlined seven principles for introducing screening programmes for World health organisation (1), but there are no internationally agreed principles for when to re-evaluate existing screening practices.

Historically, the introduction of screening was often driven by the potential for benefit, recognising that there may be a gap between the effects observed under ideal study conditions versus those obtained in 'real-world' practice (1). Unfortunately, harms have often been inadequately considered (2). Even in an era of evidence-based medicine, drivers including financial interests, technological advances, and a belief that earlier detection is necessarily better, create pressures to introduce, extend, or refine screening practices, sometimes without comprehensive assessment. Additionally, factors that influence the potential impact of screening may change substantially.

Given the constantly evolving evidence base and limited healthcare budgets, we outline four major reasons to re-evaluate existing screening practices (Box 1) and suggest a framework for a structured re-evaluation process. We assume that screening programmes strive to provide an optimal balance between benefits and harms against acceptable cost. If benefits are believed to outweigh harms, this is referred to as net benefit. Even with robust evidence for the magnitudes of benefits and harms, we recognise that value judgments determine their relative importance, and thus what constitutes net benefit.

Box 1.

Reasons to re-evaluate existing screening practices
1. As more personalised risk information becomes available, the benefit-harm balance may be optimised by screening more selected groups.
2. Important premises may change after implementation of a screening programme, such as the incidence of the target condition, test performance, or therapeutic advances.
3. Estimates of the benefits, harms, and costs which informed the implementation of a screening programme may prove incorrect in the real-world setting due to limitations of the evidence. New evidence might necessitate re-evaluation.
4. Previously unrecognised harms of screening may come to light, necessitating a re-evaluation of net benefit of the screening practice.

Why do screening practices need to be re-evaluated?

Reason 1: The benefit-harm balance may be optimised by screening more select groups

Identification of important risk factors for the target disease may allow screening strategies to focus on those groups most likely to obtain a favorable benefit-to-harm ratio. For example, in cervical cancer screening, human papillomavirus (HPV) test results are used to inform optimal screening intervals for subgroups of women, e.g. a lengthened interval from five to 10 years in women aged 40 or older with a negative HPV test (3). Such a targeted approach optimises the use of limited resources.

Reason 2: Change in incidence of the target condition, test performance, or therapeutic advances

Primary prevention may decrease incidence, changes in test technology may alter test performance affecting benefits or harms and change the personal burden of testing, or its costs, and improvements in treatment can increase or reduce the benefit of early detection.

For instance, a 70% decline in abdominal aneurysm incidence and mortality has been observed in the UK and Sweden, likely due to reduced smoking (4). This decreases the benefit of screening in absolute terms. Another example is the HPV vaccine which may prove effective enough to allow those vaccinated to forgo or reduce cervical cancer screening.

Reductions in disease-specific morbidity and mortality due to therapeutic advances may affect the justification of screening. Since the introduction of systemic therapy there has been a large reduction in breast cancer mortality (5), with the greatest reductions seen in women below the age limit where screening is typically performed (6). New targeted therapies should further lower mortality.

Reason 3: Benefit or harm estimates that prompted implementation prove incorrect

Limiting analyses to high-quality evidence may demonstrate smaller benefits of screening than was previously thought.

An example is neuroblastoma screening in children, which was performed in Japan based on theoretical benefit and evidence from observational studies. Controlled trials performed in Canada and Germany showed no beneficial effect on mortality, but considerable overdiagnosis. This resulted in de-implementation of neuroblastoma screening in Japan (1).

Even when implementation is motivated by randomized controlled trial evidence, it can be difficult to achieve similar performance in real-world roll out (e.g. uptake, quality of testing). This can be detected by monitoring of performance measures. In initial cervical cancer screening programmes, monitoring revealed high overdetection rates against a moderate estimated cervical cancer related mortality, prompting service changes (1).

Monitoring attendance rates and behavior (e.g. regular, incidental or structural non- participation) may identify differences from anticipated participation rates. This influences evaluations of cost-effectiveness, which might be lower than projected (7).

Reason 4: Consideration of previously unrecognized harms of screening

Screening puts large numbers of healthy individuals at risk of physical and psychological harms, as well as individual financial and opportunity costs (8). Societal opportunity costs can be substantial and take away resources from more cost-effective health interventions such as primary prevention or societal investments, i.e. in education or the environment. An example of now more widely recognized harms is overtreatment of diseases, precursors, and risk factors caused by overdiagnosis, not only in oncology but in other conditions such as (pre-) diabetes (9). Incidental findings are another source of harms, as are the psychological consequences of false positive results and labelling (10). Unanticipated harms of screening are more often identified than additional benefits, because RCTs of screening are often not designed or powered to detect all harms.

Three important issues in screening re-evaluation

Systematic and independent evidence aggregation and appraisal

Conflicts of interest and personal beliefs affect the selection and interpretation of evidence and their influence must be minimised (11). Clinicians sometimes overestimate the magnitude or weight of benefits and underestimate harms (12). On the other hand, transparent systematic review and guideline methods such as GRADE may produce more conservative recommendations (13). Researchers in guideline panels sometimes end up evaluating their own work and conclusions and may not use standardized quality assessment tools or consult with end-users. This highlights the importance of systematic appraisal methods and management of financial, intellectual and professional conflicts of interest.

Involving citizens

As screening programmes aim to improve public health and use considerable resources with substantial opportunity costs (14), citizens should be included in decision-making. If their views are incorporated into recommendations on screening and how to inform future participants, this may increase acceptability of any resulting changes, reduce negative reactions from affected communities (15), and increase legitimacy and trust in health systems and providers. To aid involvement, data should be clearly presented to ensure citizens' understanding of screening effects.

Personal experience with screening has been demonstrated to increase acceptance of its harms, possibly by cognitive justification of an earlier decision to participate (16). Preferably, citizens that have not (yet) participated in screening should be involved.

Implementing the results of an evaluation

If after re-evaluation of a screening programme benefits are judged to be insufficient compared to harms and costs, adjustment of the programme is necessary. However, there are multiple barriers to de-implementation and reductions ranging from fear of rationing, endowment effect (feeling of entitlement to goods or services), vested interests, and individual beliefs (1). Strong leadership is required in both the re-evaluation process and for de-intensification or stopping existing screening practices.

Proposed framework

Many of the outlined issues in screening re-evaluation have been considered in the development of re-evaluation processes in other settings (17, 18). Initiatives like BMJ Rapid Recommendations demonstrate how new evidence may trigger structured re-evaluations of existing screening programmes (19).

However, there is no internationally accepted, transparent method for re-assessment of benefits, harms, and costs of existing screening practices specifically, which presents additional methodological and ethical challenges compared to other medical interventions. Our proposed process of re-evaluation for established screening programmes (Box 2) separates the processes of supervision (Steering Committee) , decision-making (Health Authority), evidence aggregation (Technical Committee), and input from stakeholders (citizens and professionals).

Step 1: Establish a Steering Committee

A health authority or designated monitoring group identifies the need for re-evaluation and establishes a Steering Committee. “Health authority” is used as a generic term for the relevant decision-making body in a jurisdiction. It will be too resource-intensive for health authorities to completely review all screening activities at regular intervals. However, we propose that an independent body should assess screening activities regularly to see whether any of the conditions outlined in Box 1 have arisen since the last review. If this has occurred, a full re-evaluation should be undertaken.

In order to minimize the influence of vested interests, while maintaining relevant input, we suggest that Steering Committee members should not be directly involved in screening but may have a relevant background in an adjacent field of medicine. Similarly, the citizen representatives on this Committee should not come from disease-specific patient organisations representing people with the target condition.

Instead, the Steering Committee may consult with professionals involved in screening and citizen representatives with the target condition to inform on how screening works in practice, how aspects of service delivery may affect the interpretation of evidence, to what extent international findings are applicable to local context, and the experience of participating in screening.

In addition to overseeing the systematic re-evaluation process, we advocate that the Steering Committee defines thresholds for acceptable levels of benefits, harms, and their balance, as well as for acceptable costs, before the evidence is aggregated.

Box 2

Proposed framework for Re-evaluation of screening practices	
Health Authority or monitoring group	
What	Identifies need for reassessment: either after periodical evidence review or triggered by advances in knowledge. Appoints Steering Committee.
Step 1: Steering Committee	
Who	Diverse leading experts, e.g. in public health, social science and ethics, plus citizen representatives with some knowledge of health systems and health decision making processes. Members are without financial or professional ties to the screening programme under review.
What	Establish a technical committee consisting of methods experts. Provide advice on formulating the research questions and assignments to the technical committee, ensure delivery of outputs, provide recommendations for how to optimize screening.
How	Define core outcomes and benefit-harm and cost thresholds for decision making. Provide support, guidance and oversight of the re-evaluation process. Is informed by various stakeholders including the wider public (see step 3) and experts involved in screening for the target condition.
Why	To ensure successful delivery of the re-evaluation process including maximising benefits, minimising harms and bias, and ensuring the framework for re-evaluation is correctly applied.
Step 2: Technical Committee	
Who	Committee of technical staff competent in systematic reviews and meta-analysis.
What	Construct a Summary of Findings Table and write a report on various screening options under the five domains of benefits, harms; costs, distribution, and community understanding of benefits, harms, and costs. Determine the magnitude and certainty of benefits, harms, and costs.

How	Conduct systematic reviews using monitoring data (if available) and other evidence that completes the Summary of Findings Table.
Why	Produce the evidence presented during the deliberative engagement with the public and to guide the decisions made by the Steering Committee.
Step 3: Deliberative engagement with citizens	
Who	Members of a community to provide an inclusive sample of citizens (ensuring no relevant group is systematically excluded)
What	Consider information from the Technical Committee, including the benefit, harm, and cost trade-off for each screening option. Provide recommendations or consensus answers to the Steering Committee.
How	Hear quantification and assessment of certainty of benefits, harms and costs based on the Technical Committee's findings and use a deliberative process to come to a consensus on questions about screening practices posed by Steering Committee. Rank available screening options and provide detailed reasons for ranking.
Why	To involve everyday people in the process of decision-making about screening for a target condition to improve legitimacy of and trust in the decision and provide a recommendation to the Steering Committee.
Step 4: Final Recommendations	
Who	The Steering Committee with input from stakeholders.
What	Make recommendations to the relevant health authority for or against changing screening practices based on steps 2 and 3.
How	Write a final report for the relevant health authority and present findings to the community.
Why	Synthesise and interpret evidence regarding screening practices to improve the benefit, harm, and cost trade-off at a societal level, being explicit about the values involved in making the trade-offs.
Health Authority	
What	Makes final decision.
	Includes opportunity costs and involves knowledge on barriers and facilitators in its assignment of implementation.

Step 2: Technical committee produces an evidence synthesis

The Technical Committee systematically assesses the evidence across five domains (Box 3) and the applicability to local conditions. It will provide estimates of effects in absolute numbers and the uncertainty around these. Ideally, prospectively-collected monitoring data will be available for each domain to supplement evidence from randomised trials. If not, monitoring and registries should be established as soon as possible to collect data and allow long-term follow-up. Ideally, countries work together to harmonise data collection to enable comparisons.

Box 3.

The Technical Committee synthesises and appraises evidence across five domains	
1.	the magnitude, uncertainty, and timing of benefits to the population of participants;
2.	the magnitude, uncertainty, and timing of harms to the population of participants;
3.	the financial costs of the entire screening cascade, including cost-effectiveness;
4.	the distribution of benefits, harms and costs in the population; and
5.	community understanding of the benefits, harms, and costs

Finally, the Technical Committee develops a Summary of Findings Table and prepare a report. Summary of Findings Tables should be constructed for the current screening strategy and, if

appropriate, present alternatives such as different screening frequencies, screening tests, target populations, and stopping screening. The Technical Committee then presents this to the Steering Committee.

Step 3: Deliberative engagement with citizens

Citizens will hear presentations based on the Technical Committee's findings. They will consider the trade-off of benefits, harms and cost, distribution of outcomes, and people's understanding, to reach collective decisions. They will rank the available screening options from most acceptable to least and transparently describe their reasoning. Secondary outputs may include recommendations for monitoring, implementation, and how potential screening participants should be informed.

Step 4: Final recommendations

Results from the Technical Committee and citizen deliberations (Steps 2 and 3) will be considered by the Steering Committee, which will gather feedback from experts involved in screening and other stakeholders (Box 2). The Steering Committee will then make recommendations to the relevant health authority (Box 4). The feasibility of implementing any changes will be discussed with the health authority to understand the effects on the broader health care system, including key organisational, political, social, and resource considerations.

Box 4. Options for final recommendations of the Steering Committee

- Sufficient evidence to recommend continuing with current screening practices;
- Insufficient evidence to recommend changing screening practices, which may lead to a recommendation to:
  a) gather and analyse observational data; or
  b) randomise invitees to different screening strategies (existing versus new)
- Sufficient evidence to change existing screening practices, which could include:
  a) Replacement test;
  b) Expand screening practices e.g. add-on or triage test, extend target population, reduce screening interval;
  c) Refine screening practices e.g. more focused target population, lengthen screening interval; or
  d) Stop screening.

Additional recommendations could focus on monitoring to facilitate future re-evaluations or research, or randomisation to different screening strategies when there is important uncertainty (20). Recommendations regarding how to inform potential participants should focus on how to improve people's understanding rather than to increase participation rates.

Challenges

Strong governance and leadership is necessary to ensure that the outlined framework will be followed and that recommendations by the Steering Committee are implemented, as these may not always be readily accepted by stakeholders.

Though our proposal involves financial investment, we think this is justified considering the costs of screening interventions and the potential for cost-saving with optimisation of current practice. Screening asymptomatic individuals comes with the responsibility to continuously monitor and evaluate the outcomes in a systematic, transparent, and independent fashion.

There may be no 'one-size-fits-all' approach to re-evaluating screening and our framework is meant as a starting point rather than a finished concept. It can be adapted to individual types of screening and local contexts, ideally with a regulatory requirement for both the re-evaluation framework and monitoring to assist in ensuring the feasibility and integrity of the process. The framework itself should be evaluated and refined.

Conclusion

Monitoring and re-evaluation of screening practices are essential to generate and incorporate new knowledge that informs the balance of benefits and harms. This ensures that screening practices maximize benefits, minimise harms and cost, and optimise societal resource use. Our framework proposes a systematic, independent and thorough process for evidence synthesis and assessment of existing screening practices.

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Conflicts of Interest

We have read and understood BMJ policy on declaration of interests and have no relevant interests to declare. The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions, or policies of the institutions with which they are affiliated.

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