A framework for re-evaluating established health screening practices

There is increasing awareness of the complexity of screening (earlier detection), including risks of harm to participants. The authors call for a systematic and transparent approach to re-evaluation of screening practices and suggest a framework to achieve this goal.

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Complete List of Authors:	Ropers, Fabienne; Leiden University Medical Center, Pediatrics Jacklyn, Gemma; The University of Sydney School of Public Health; quantium Barratt, Alexandra; The University of Sydney School of Public Health Wilt, Timothy; Minneapolis VA Center for Care Delivery and Outcomes Research; University of Minnesota Nicholls, Stuart; Ottawa Hospital Research Institute, Clinical Epidemiology Program Taylor-Phillips, Sian; University of Warwick, Warwick Medical School Kramer, Barnett; National Cancer Institute, Division of Cancer Control and Population Sciences Esserman, Laura; University of California San Francisco, Helen Diller Family Comprehensive Cancer Center Norris, Susan; Oregon Health & Science University Gibson, Lorna; University of Edinburgh, Usher Institute of Population Health Sciences and Informatics Harris, Russell; University of North Carolina at Chapel Hill, School of Medicine and Cecil G. Sheps Center for Health Services Research Carter, Stacy; University of Wollongong, Australian Centre for Health Engagement, Evidence and Values J&#65533;rgensen, Karsten; Rigshospitalet, The Nordic Cochrane Centre
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Fabienne G. Ropers[1], Gemma Jacklyn[2,3], Alexandra Barratt [2], Timothy J. Wilt[4], Stuart G. Nicholls[5], Sian Taylor-Phillips[6], Barnett S. Kramer[7], Laura J. Esserman[8], Susan L. Norris[9], Lorna M. Gibson[10], Russell P. Harris[11], Stacy M. Carter [12], Karsten Juhl Jørgensen[13]

Fabienne Ropers and Gemma Jacklyn contributed equally to this paper.

Affiliations:

1. Willem Alexander Children's Hospital, Leiden University Medical Center, Albinusdreef 2, 2300 RC Leiden, Netherlands
2. The University of Sydney, Sydney School of Public Health, Sydney, New South Wales, Australia
3. Quantium. Sydney, NSW, Australia
4. Minneapolis VA Center for Care Delivery and Outcomes Research and the University of Minnesota, Minneapolis, MN
5. Clinical Epidemiology Program, Ottawa Hospital Research Institute, Civic Campus, 1053 Carling Ave, Ottawa, ON, K1Y 4E9, Canada
6. Warwick Medical School, The University of Warwick, Coventry, CV4 7AL, UK
7. Division of Cancer Control and Population Sciences, National Cancer Institute, Bethesda, MD, USA
8. Helen Diller Family Comprehensive Cancer Center, University of California - San Francisco, San Francisco, CA, USA
9. Oregon Health & Science University, Portland, OR, USA
10. Usher Institute, University of Edinburgh, Edinburgh Bioquarter, 9 Little France Road, Edinburgh, EH16 4UX, UK
11. School of Medicine and Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, NC, USA
12. Australian Centre for Health Engagement, Evidence and Values (ACHEEV), School of Health and Society, University of Wollongong, Northfields Ave, Wollongong, New South Wales, 2522, Australia
13. Nordic Cochrane Centre, Rigshospitalet Dept. 7811, Blegdamsvej 9, DK-2100 Copenhagen, Denmark

Corresponding author: Fabienne Ropers. Telephone: +31 71 5262824. Email: f.g.ropers@lumc.nl

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Key messages

- Changes in disease incidence and the discovery of new tests, treatments and preventive possibilities can alter the balance of benefits, harms and costs of population screening practices. Yet no clear guidelines exist on how to monitor these changes and revise practices in light of them.
- Screening the general population comes with a responsibility to ensure that screening benefits are maximised and fairly distributed, and that harms, costs and waste are minimised and justified.
- We propose a framework to guide structured, independent and transparent re-evaluations of screening practices, with input from the full range of stakeholders, and management of conflicts of interest. Our framework is a starting point rather than a finished concept and we invite comment and debate.
- The framework outlines essential steps and attributes. It can be adapted to different types of screening and healthcare systems, ideally with regulatory requirements and accountabilities.

Introduction

From tentative beginnings over 70 years ago (1), screening (earlier detection) has become a well-established and familiar feature of modern healthcare, delivering a mix of health benefits, harms and costs (2, 3). Importantly, these benefits, harms, and costs are not constants, but differ with context and time. They change because of changes in disease incidence, new tests, treatments, and preventive possibilities.

Despite the changing circumstances, screening practices (whether organised as programmes or not) tend to be slow to react, and when change does come it is often delayed, resisted and controversial (4, 5). The reasons may be multiple: financial interests or a perception of sunk costs; lack of high-certainty evidence or proper evaluation of existing evidence; a belief that earlier detection is always better, or simple inertia. Yet screening programmes are often financed by finite collective healthcare budgets and target asymptomatic individuals. Continuation of screening in the face of changing circumstances deserves careful consideration, particularly when this potentially leads to harm and waste. Much like the principles for starting screening (1), there is an urgent need for clear, agreed methods for proactively re-evaluating existing programmes.

Over the past three years, our international group of experts from diverse disciplinary and practice backgrounds has discussed and developed a framework for regular re-evaluation of existing screening practices. The proposed framework involves a structured, transparent process, aimed at involving professionals with relevant expertise, members of the public, and patients, while managing conflicts of interest. It is intended for independent institutions that make national screening recommendations such as the U.S. Preventive Services Task Force and the UK National Screening Committee. This paper summarizes our framework and invites further comment and discussion.

Why do screening practices need re-evaluation?

We outline four major reasons why existing screening practices need re-evaluation (Box 1). This list is not exhaustive.

Box 1.

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

Reason 1: Change in the incidence of the target condition, new test methods, or therapeutic advances

Primary prevention may decrease disease incidence and the absolute benefit of screening, while the harms may be less affected, reducing net benefit. For instance, a 70% decline in abdominal aneurysm incidence and mortality was observed in the UK and Sweden, likely due to reduced smoking (6) and the introduction of the human papillomavirus (HPV) vaccine may reduce the disease

burden of cervical cancer. This will change the net benefit such that screening intensity can be reduced, or screening even be stopped as benefits become negligible or outweighed by harms. Conversely, increases in incidence may improve the net benefit of screening, e.g. in obesity-related conditions.

Improvements to outcomes at later disease stages, or across stages, tend to decrease screening benefits, whereas improvements to outcomes at earlier disease stages only may increase screening benefits. Since the introduction of systemic therapy and centralised care, there have been large reductions in breast cancer mortality across stages (7), with the greatest reductions (50% in many countries) seen in women below the typical age limit (8). Similarly, improvements in conventional tests or development of new tests may impact performance and change the benefit, harms or costs of screening.

Reason 2: Benefits, harms or cost estimates that prompted implementation may prove incorrect

Limiting reviews of screening practices to high-quality evidence may demonstrate small or absent benefit. Neuroblastoma screening in children was implemented in Japan based on theoretical benefit and evidence from observational studies. Studies in Canada and Germany showed no mortality benefit but considerable overdiagnosis, resulting in de-implementation of neuroblastoma screening in Japan (2).

Even when implementation is motivated by randomized trial evidence, it can be difficult to achieve similar performance with real-world roll out, e.g., due to uptake or quality of testing. This can be monitored with performance indicators: monitoring early cervical screening programmes revealed high overdetection rates and moderate mortality benefit, prompting service changes (2).

Monitoring attendance rates and behaviour (e.g., regular, incidental, or structural non-participation) may identify differences from anticipated estimates. This affects cost-effectiveness, which may be different than projected (9).

Reason 3: Consideration of previously unrecognised harms

Screening for cancer and (pre-) diabetes provide examples of overdiagnosis and overtreatment, previously unrecognised harms of screening. Note that overtreatment is not limited to the target disease, but may also affect its precursors and risk factors (10). Other underappreciated harms include psychological consequences of false positive results and labelling (11, 12). Often, important harms have been identified long after initial RCTs, which historically were rarely designed or powered to quantify them (3). Belated recognition of overdiagnosis and overtreatment in prostate cancer screening have reduced prostate specific antigen tests, especially in North America.

Reason 4: Net benefit may be optimised by screening more select groups

Advances in risk prediction, or identification of new risk factors, may result in optimised net benefit. For example, in cervical screening, HPV tests are used to inform optimal screening intervals for subgroups of women, e.g. increasing the screening interval from five to ten years in women aged 40 or older with a negative HPV test (13).

Three important elements in screening re-evaluation

1. Systematic and independent evidence aggregation and appraisal

Given the value judgements involved in assessments of benefits and harms, independent and systematic evaluation of evidence is necessary. People in general, but individuals with vested interests in particular, tend to overestimate the magnitude or weight of benefits and underestimate harms (14)(15). In contrast, systematic review and guideline methods such as GRADE may produce more conservative recommendations (16). Researchers on guideline panels sometimes evaluate their own work, and may not use standardised 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.

2. Public involvement

The public should be included in decisions because screening aims to improve public health, uses resources, and generates opportunity costs (17). If public views are incorporated into recommendations on screening and how to inform future participants, this may increase acceptability, reduce negative reactions from affected communities (4), and increase legitimacy and trust in health systems. To aid involvement, data should be clearly presented, with sufficient time and expert facilitation to support public understanding and deliberation (5). Personal experience with screening has been demonstrated to increase acceptance of its harms, possibly by cognitive justification of earlier decisions to participate (18). Care is required to ensure an inclusive sample not skewed for or against screening.

3. Implementing results

If the re-evaluation necessitates changes, a process for implementation is required. When the benefits of screening do not justify harms and costs, there are barriers to reducing or stopping screening, including that overdiagnosis can increase enthusiasm for screening (the popularity paradox), fear of rationing, endowment effect (feeling of entitlement to goods or services), vested interests, and individual beliefs. Strong leadership and clear communication are required during re-evaluation and for changing existing practices.

Proposed framework

Many issues raised have been considered in other settings (5, 19). For example, the BMJ Rapid Recommendations demonstrate how new evidence may trigger structured re-evaluations of existing screening practices (20).

Our proposed process of re-evaluation (Box 2) separates the processes of supervision and advice (Steering Committee), decision-making (Health Authority), evidence aggregation (Evidence Review and Synthesis Committee, ERSC), and input from stakeholders (citizens and professionals). A precondition for any re-evaluation is political will to endorse the process and act upon recommendations.

Step 1: Establish a Steering Committee

A standing independent government-recognised Steering Committee monitors key performance indicators and new evidence, and identifies the need for re-evaluation (Box 2). A secured budget for this Steering Committee, including funding for implementation of changes to screening practices and monitoring systems, is essential. It is too resource-intensive to review all screening activities

regularly. However, we propose that this independent Committee assesses screening practices to identify substantial changes (see Box 1) that would necessitate a full re-evaluation.

To minimize influence of vested interests while maintaining relevant input, we suggest that Steering Committee members have relevant expertise, but should not be involved in screening interventions under review through practice or research. Similarly, the public representatives on this Committee should not come from disease-specific patient organisations.

Instead, the Steering Committee may consult with professionals involved in the screening practice under review and people with the target condition to inform 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 addition to overseeing the systematic re-evaluation process, the Steering Committee should define 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	
Step 1: Steering Committee	
Who	Leaders in their field with diverse expertise in healthcare, e.g. in public health, methodology, social sciences, medicine, health economics, ethics, and public representatives with some knowledge of health systems and health decision making processes. Members are without financial or professional ties to the screening practice under review.
What	Identify need for reassessment: either after periodic evidence review or triggered by advances in knowledge. Establish a Evidence Review and Synthesis Committee consisting of methods experts. Formulate the research questions and assignments to the Evidence Review and Synthesis Committee, ensure delivery of outputs, provide recommendations for optimised screening.
How	Define core outcomes, net benefit 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), experts involved in the screening intervention under review, and people with the target condition.
Why	To ensure independent, successful delivery of the re-evaluation process to maximise benefits, minimise harms and bias, and ensure the framework for re-evaluation is correctly applied.
Step 2: Evidence Review and Synthesis Committee	
Who	Committee of technical staff competent in knowledge synthesis methods
What	Construct a Summary of Findings Table and write a report on screening options under the five domains: benefits, harms, costs, the distribution, and community understanding of those (Box 3). Determine the magnitude and certainty of benefits, harms, and costs.
How	Conduct systematic reviews, analyse monitoring data (if available) and synthesise other evidence that completes the Summary of Findings Table.
Why	Produce the evidence to be presented during the deliberative engagement with the public and to guide the decisions made by the Steering Committee.
Step 3: Deliberative engagement the public	
Who	An inclusive sample of members of the general public ensuring no relevant group is systematically excluded.
What	Consider information from the Evidence Review and Synthesis Committee, including the benefit, harm, and cost trade-off for each screening option and community understanding thereof. Provide recommendations or consensus answers to the Steering Committee.

How	Hear quantification and assessment of certainty of benefits, harms, and costs based on the Evidence Review and Synthesis Committee's findings and use a deliberative process to reach consensus on questions about screening practices posed by the Steering Committee. Rank available screening options and provide detailed reasons for ranking.
Why	To involve members of the public in the process of value judgement to improve legitimacy 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 (opportunity costs), being explicit about the values involved.
Health Authority	
Who	"Health authority" is used as a generic term for the relevant decision-making body in a jurisdiction
What	Makes final decision or makes recommendation to politicians. Oversees implementation of existing or changed screening practices. Ensures monitoring data are collected and available for regular analysis.

Step 2: Evidence Review and Synthesis Committee produce the evidence synthesis

The ERSC systematically assesses the evidence across five domains (Box 2 and 3) and 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 Evidence Review and Synthesis Committee synthesises and appraises evidence across five domains
1. Magnitude, uncertainty, and timing of benefits to the population of participants;
2. Magnitude, uncertainty, and timing of harms to the population of participants;
3. Financial costs of the entire screening cascade and cost-effectiveness;
4. Distribution of benefits, harms, and costs in the population; and
5. Community understanding of the benefits, harms, and costs

Finally, the ERSC develops a Summary of Findings (SoF) table and prepares a report. SoF tables should be constructed for the current screening strategy and, if appropriate, present alternatives such as different screening frequencies, screening tests, and target populations. The ERSC then presents them to the Steering Committee.

Step 3: Deliberative engagement with the public

Citizens will hear presentations based on the ERSCs findings. They will consider the trade-off of benefits, harms, and costs, distribution of outcomes, and people's understanding, to reach collective judgements. They will rank the available screening options from most to least desirable, 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 ERSC 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 use their pre-defined benefit-harm thresholds to make recommendations to the relevant Health Authority. These will depend on the quality of evidence and value judgments of the stakeholders and Steering Committee. Possible recommendations include no change, generate more evidence, or change current practice (Box 4). The feasibility and acceptability of implementing changes would 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 certainty of evidence and agreement on net benefit to recommend continuing current screening practices;
- Sufficient certainty of evidence and agreement of net benefit or net harm to change existing screening practices, which include:
    a) Changes to screening pathway, e.g. change communication with potential participants, replace test or treatment strategy;
    b) Changes to eligibility, e.g. expand or contract target population age range;
    c) Expand or contract screening interval;
    d) Stop screening.
- Insufficient certainty of 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).

Additional recommendations could focus on monitoring to facilitate future re-evaluations or research, or randomisation to different screening strategies when there is important uncertainty (21). Recommendations regarding information for potential participants should focus on improved understanding rather than increased participation.

Challenges

Strong governance and leadership by national health authorities are necessary to ensure that the outlined framework will be followed and recommendations implemented; these may not always be readily accepted by stakeholders.

Though our proposal requires resources, we believe this is justified considering the harms and costs of screening, and the potential for cost-saving and increased net-benefit with optimised practice. Screening healthy individuals comes with the responsibility to continually monitor and evaluate the outcomes systematically, transparently, and independently.

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

Conclusion

Monitoring and re-evaluation are essential to generate and incorporate new knowledge that informs the balance of benefits and harms, and should be a requirement for any screening practice. This will ensure that screening maximises benefits, and minimises the harms, cost, and waste of health resources.

This four-step framework is intended for health authorities to ensure systematic, consistent and independent processes that strengthen decisions and recommendations around change. By bringing together experts and public values in a process led by a standing committee that operates independently, society will benefit from transparent and evidence-based screening practices that ensure benefits outweigh harms at a reasonable cost and are acceptable to the majority.

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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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