Established ~~A framework for re-evaluating established~~ health screening practices need independent regular re-evaluation

~~*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 the re-evaluation of screening practices and suggest a framework to achieve this goal.*~~

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Word count including headings: 210927

Key messages

Changes in disease incidence and the discovery of new tests, treatments and preventive possibilities ~~can~~ alters the balance of benefits, harms and costs of population screening practices. Yet no clear practice~~guidelines~~ exists ~~on how~~ to monitor these changes and revise practices in light of them.

- Screening the general population comes with a responsibility to maximise~~ensure that screening~~ benefits with a focus on fair distribution, to minimise ~~are maximised and fairly distributed, and that~~ harms, costs and waste, and justify net benefit and cost ~~are minimised and justified~~ in relation to healthcare in general.

- We propose ~~a framework to guide~~ regular, structured, independent and transparent re-evaluations of existing screening practices, with input from the full range of stakeholders, and effective 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)~~to detect disease or risk factors at an asymptomatic ~~-~~stage has become a well-established and familiar feature of modern healthcare, delivering a mix of health benefits, harms and costs [2, 3]. Importantly, these outcomes ~~benefits, harms, and costs~~ are not constants: ~~, but can changes become apparent with new evidence, differ with context and time. Screening outcomes~~They they change with new evidence, vary between contexts, and over time, with~~because of~~ changes in disease incidence, new tests, treatments, and preventive possibilities.

S~~Despite the changing circumstances, s~~creening practices (whether organised as programmes or not) tend to be slow to react to these changes; alterations to ~~, and when change does come it is~~ screening practices are often ~~delayed,~~ resisted and controversial [4, 5]. The reasons may be multiple: financial interests, attention to ~~or a perception of~~ sunk costs,~~;~~ lack of high-certainty evidence or proper evaluation of existing evidence,~~;~~ a problematic belief that earlier detection is always better ~~[6, 7]~~, or simple inertia or preference for the status quo [6, 7].

S~~Yet s~~creening programmes are often financed ~~by~~ within finite collective healthcare budgets. ~~and~~ They target asymptomatic individuals, the ~~-~~majority of whom are not those that need healthcare most. This means screening ~~C~~continuation ~~of screening~~ in the face of changing circumstances deserves careful consideration, ~~particularly~~ ~~when this~~as it potentially leads to harm to healthy citizens and waste of scarce resources.

While there are well-established principles for starting screening [1], none exists for stopping it [8]. ~~Much like the principles for starting screening,~~ As experts who have worked on screening over many years, we see ~~there is~~ an urgent need for clear, agreed methods for ~~pro~~actively re-evaluating existing practices, that address inherent biases towards maintaining the status quo.~~ogrammes.~~

~~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
• Important premises may change after implementation, such as the incidence of the target condition, new test methods, or therapeutic advances.
• 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 or improved evidence synthesis may ~~thus~~ necessitate re-evaluation.
• Previously unrecognised harms may come to light, necessitating a re-evaluation of net benefit.

- 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 thus the absolute benefit ~~of~~ from screening~~.~~ ~~Meantime, while the its harms may be less affected, reducing net benefit~~. For instance, a 70% decline in abdominal aortic aneurysm incidence and mortality was observed in the UK and Sweden, likely due to reduced smoking [9]~~,~~ and ~~the introduction of~~ the human papillomavirus (HPV) vaccine ~~may~~ will likely ~~greatly~~ reduce ~~the disease burden of~~ cervical cancer disease burden greatly. The potential benefit of screening for these conditions is thus reduced, while the potential harms of screening will likely be less affected. ~~This will change the n~~Net benefit will diminish, because benefits become ~~are~~ clinically less important or are outweighed by harms. This could justify reducing ~~such that~~ screening intensity ~~can be reduced~~, ~~or~~ stopping screening altogether, or screening only~~even be stopped~~ select groups. ~~, 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, e.g. due to improved treatment,~~,~~ also tend to decrease screening benefits, whereas improvements to outcomes mainly at ~~primarily~~ earlier disease stages ~~only~~ may increase screening benefits. Since the introduction of systemic therapy and with more centralised care, there have been large reductions in breast cancer mortality across stages [10], with the greatest reductions (50% in many countries) ~~seen~~ in women below the typical age ~~limit~~ for screening [11]. Similarly, improvements in conventional tests or development of new ones~~tests~~ may impact performance and change screening~~the~~ benefits, harms or costs ~~of screening~~.

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

Implementation of screening practices have sometimes been based on low-quality evidence. When new reviews are conducted, ~~Lli~~mited to ~~ing reviews of screening practices to~~ high-quality evidence, ~~may~~ ~~demonstrated small or absent~~ benefits may prove~~are revealed~~ to be small or even absent. For example, ~~N~~neuroblastoma screening in children was implemented in Japan based on a theoretical benefit and evidence from observational studies. Studies in Canada and Germany, and re-synthesis of data that took the observed incidence increases into account, showed no mortality benefit but considerable overdiagnosis, resulting in de-implementation of neuroblastoma screening in Japan [2].

Even when implementation is motivated by randomized trials ~~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 a moderate mortality benefit, prompting important service changes [2].

Monitoring attendance rates and behaviour (e.g., regular, incidental, or structural non-participation) may identify substantial differences from anticipated attendanceestimates. This may meanaffects cost-effectiveness is lower than estimated, which may be different than projected [12].

Reason 3: Consideration of previously unrecognised harms

Screening for cancer and (pre-) diabetes provide examples of overdiagnosis and overtreatment that were, previously unrecognised screening harms of screening. Note that oOvertreatment is not limited to athe target disease, but may also affect its precursors and risk factors [13]. Other underappreciated harms include psychological consequences of false positive results and labelling [14, 15]. Often, important harms have been identified long after initial RCTstrials, which historically were rarely designed or powered to quantify them [3]. Belated recognition of overdiagnosis and overtreatment in prostate cancer screening, for example, haves reduced the use of prostate specific antigen tests, especially in North America. Inclusion of previously unrecognised harms such as overdiagnosis in health economic evaluation may significantly reduce the number of Quality Adjusted Life Years saved, significantly altering the Incremental Cost Effectiveness Ratio[16].

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

Advances in risk prediction, or identification of new risk factors, may suggest screening changes to 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 [17].

How can we ensure that screening re-evaluation is robust and conclusions are implementable?Three important elements in screening re-evaluation

The *sine qua non* for re-evaluation is commitment to transparent processes with minimal bias, and pre-acceptance that this may lead to substantial changes. Re-evaluation also requires proper funding, and commitment to high-quality implementation of changes and ongoing monitoring.

It is too resource-intensive to comprehensively review all screening activities regularly: instead regularregularpeated, rapid initial assessments of all screening practices could identify those requiring a full re-evaluation.

with pre-acceptance that it may lead to substantial changes. C, are also prerequisites, initialfor each practice to prioritise efforts likely necessary, issues that can be identified

We propose a re-evaluation process (Box 2) based on previous work in this field [5, 18] [19], dealingthat deals with known barriers.

In our proposal, 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) are separated, to allow counterbalance and limit the influence of interests.

~~1. Systematic and independent evidence aggregation and appraisal~~

Screening recommendations rest on ~~Given the~~ value judgements of ~~involved in assessments of~~the benefits and harms ~~associated with the screening practice~~. ~~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/~~importance of screening benefits and underestimate its harms [19, 20]. In contrast, systematic review and guideline methods such as GRADE may produce more conservative recommendations [21]. Researchers on guideline panels sometimes ~~evaluate~~ find themselves evaluating their own work, which highlights conflicts between expertise and independence, requiring effective management.~~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.~~

To minimize influence of vested interests while maintaining relevant input, we suggest participants in the re-evaluation process have relevant expertise but should not be involved in screening interventions under review through practice or research. Similarly, 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 and research, as well as ~~and~~ people with the target condition, to understand how screening works in practice, how service delivery may affect evidence interpretation, to what extent international findings are applicable to local context, and the experience of participating.

An ERSC ~~should~~may then systematically assess the evidence of benefits and harms, provide information on the magnitude, uncertainty, timing and distribution of those in the population of participants, and interpret applicability of results to local conditions. Information on costs of the entire screening cascade and in relation to outcomes is needed for decision making. Data on community understanding of harms, benefits and costs are assessed and provided to identify the need for improved participant information to allow for informed decision making.

Ideally, prospectively collected monitoring data will be available for each domain to supplement evidence from randomised trials. If not, screening databases and registries should be established to collect data and allow long-term follow-up. C~~Ideally, c~~ountries should work together to harmonise data collection to enable comparisons.

Because weighing benefits against harms is values-dependent and ~~as the balance~~ can shift considerably with results of the evidence synthesis, thresholds for acceptable levels of benefits, harms, and their balance, as well as for acceptable costs, should be defined before the evidence is aggregated and the balance should be regarded in the perspective of the healthcare system as a whole.

~~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.~~

2. Public involvement

We believe it is paramount The for the public should be included to be involved in decisions because screening aims to improve public health, but uses resources, and generates opportunity costs [22]. If public views are incorporated into recommendations on screening of change and how to informinformation for future participants, this may increase their acceptability of changes, 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 [23]. Care is therefore required to ensure an inclusive sample that is 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, t

The possible recommendations following from a re-evaluation includePossible recommendations include no change, to generate more evidence, or to change current practice (Box 4), dependent on the certainty of evidence and level of agreement on the net benefit of the screening practice. Practice changes can range from changes in communication to potential participants, to changing test strategies or target population, to stopping screening. . If a change is recommended, it may be relevant to introduce such changes in a randomised fashion to gain knowledge and clarify uncertain effects[24]. 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. Recommendations regardingFor any screening programme, information for potential participants should focus on improved understanding rather than increased participation.

here 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, 18]. For example, the BMJ Rapid Recommendations demonstrate how new evidence may trigger structured re-evaluations of existing screening practices [19].

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~~ approach 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 [25]. Recommendations regarding information for potential participants should focus on improved understanding rather than increased participation.

Challenges and ways to move forward

Strong governance, ~~and~~ leadership, public involvement, and support from ~~by~~ national health authorities are necessary to ensure that re-evaluation of screening is possible and that ~~that the outlined framework will be followed and~~ recommendations~~, although they may be unwelcome,~~ will be implemented; these may not always be readily accepted by stakeholders and can be politically volatile.

Should a re-evaluation indicate that screening does not confer the benefits previously thought then there may be substantial barriers to reducing or stopping screening. Overdiagnosis can counterintuitively increase enthusiasm for screening because overdiagnosed people understand themselves to be 'saved by screening' (called the 'popularity paradox') [2]. Other barriers include fear of rationing, the endowment effect (feeling of entitlement to goods or services), financial and intellectual~~vested~~ interests, and beliefs in the paradigm that earlier detection must be better. That the latter~~is~~ is not always the case was recently demonstrated again for ovarian cancer screening [6].

Clinicians are involved in screening out of a genuine desire to prevent morbidity and mortality. Therefore, it can be difficult to accept new evidence that screening efforts had smaller benefits than assumed and may have caused important harms. To increase acceptance and reduce such barriers, de-implementation strategies include interventions aimed at addressing emotions and resistance brought forward by change. Arguments that anticipate feelings of distrust, e.g. that screening is de-implemented for the 'wrong reasons' such as cost cuts, help all stakeholders to accept necessary changes. Further strategies that help successful change are stakeholder involvement, removing financial and organisational barriers, e.g. by helping to restructure health practices to avoid loss of revenue, and leadership 'buy-in' [25]~~(~~. Professional support and overall agreement may bolster political action and decrease public resistance.

Though rigorous re-evaluation~~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 cost-savings through~~with~~ optimised practices. In our view, s~~S~~creening asymptomatic~~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, but we need~~and our framework is~~ a starting point for a discussion ~~rather than a finished concept~~. Re-evaluations may need to~~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 assessment of the balance of benefits and harms~~,~~ and should be required for almost all screening practices~~., with very few exceptions.~~ This is meant to~~will~~ ensure ~~that~~ screening practices with the best balance of benefits, harms, cost, and use of health resources.

We need discourse on how best to re-evaluate current screening practices in a way that is not biased towards maintaining the status quo. Effective management of vested interests ~~are~~is central, but so are ~~consideration of~~pre-defined thresholds for effects, methodological rigour, and public involvement.

~~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~~Developing a robust framework that effectively deals with barriers to necessary changes will be the next important step forward; here we present a first attempt. For society to benefit, ~~t~~the process must operate~~s~~ independently and transparently with the support of stakeholders, experts, and politicians~~,will .~~ If not,~~from transparency~~t and evidence-based so that s screening practices will not necessarily continue to provide~~that ensure~~ benefits that outweigh harms at a reasonable cost while acceptable to the majority.

Acknowledgements

We dedicate this ~~ese series of~~ paper~~s~~ to ~~the late~~ Lisa M Schwartz, a Professor at the Dartmouth Institute for Health Policy and Clinical Practice, and leader in the field of overdiagnosis. She devoted her career to helping people make more informed healthcare decisions and provided invaluable support and assistance with these papers.

Contributors and sources

This initiative to improve the evaluation and monitoring of existing screening practices was supported by many people around the globe who attended the Preventing Overdiagnosis Conferences between 2016 and 2018 and volunteered to write a paper together to summarise the issues. KJJ conceptualised the initial research idea, which was developed further by GJ. FR and KJJ were main authors of the draft.~~and GJ. wrote the draft~~~~and GJ wrote the draft and are joint first authors~~. AB, STP, SMC, RPH and KJJ are senior authors. All authors contributed intellectual content, edited the manuscript and approved the final version for submission.

~~Dr~~ Professor Taylor-Phillips is supported by an NIHR Career Development Fellowship (CDF-2016-09-018). The opinions are those of the authors and not the NIHR, the NHS, ~~or the~~ Department of Health and Social Care or the UK National Screening Committee. Dr Lorna M. Gibson was supported by a Wellcome Trust Clinical Research Training Fellowship (107190/Z/15/Z).

No patients or members of the public were involved in the creation of this article. Dissemination to these groups is not applicable.

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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