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Research Article

# The paradox of popularity in mammography screening and quaternary prevention

## O paradoxo da popularidade no rastreamento mamográfico e a prevenção quaternária

## *La paradoja de la popularidad en las mamografías y prevención cuaternaria*

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## Abstract

**Introduction:** Although overdiagnoses (diagnoses of diseases that would not manifest clinically) in mammographic screening have made the balance between benefits and harms doubtful, its positive recommendations to women (>50 years) and professionals persists, which demands quaternary prevention — avoidance of iatrogenic injury and overmedication. Fictitious expectations, preventive moralistic culture, surveillance medicine, and biocapitalism (economic interests) are involved in this persistence. We argue that the "paradox of popularity" — paradoxical expansion of the popularity of screening fueled by the production of its iatrogenic injury — has more importance in this context than it has been taken into account. **Objective:** To describe and discuss some possible modes of operation of this paradox in healthcare professionals. **Methods:** Essay based on intentionally selected literature. **Results:** In addition to the synthesis of this paradox in populations, its operational feasibility in healthcare professionals involves cognitive factors (invisibility of overdiagnosed cases, dilution of severe cases among overdiagnosed ones, and only positive cognitive feedback in clinical experience), political factors (powerful corporate and commercial interests) and psychological factors (significant subjective reward of treating more people with excellent results and less emotional exhaustion derived from caring for overdiagnosed cases, in addition to other common psychocognitive biases). **Conclusions:** The discussed processes may be relevant for quaternary prevention and better clinical and institutional management of this screening, which should involve Primary Health Care professionals and several other social actors.

**Keywords:** Quaternary prevention; Primary health care; Disease prevention; Breast neoplasms; Mass screening.

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## Resumo

**Introdução:** Apesar dos sobrediagnósticos (diagnósticos de doenças que não se manifestariam clinicamente) no rastreamento mamográfico terem tornado duvidoso o balanço benefícios-danos, persistem suas recomendações positivas às mulheres (>50 anos) e aos profissionais, o que demanda prevenção quaternária — evitação de danos iatrogênicos e sobremedicalização. Nessa persistência, estão envolvidos expectativas fictícias, cultura moralista preventivista, medicina de vigilância e biocapitalismo (interesses econômicos). Argumentamos que o "paradoxo da popularidade" — expansão paradoxal da popularidade dos rastreamentos alimentada pela produção de seus danos iatrogênicos — tem mais importância nesse contexto do que se tem considerado. **Objetivo:** Descrever e discutir alguns modos de operação possíveis desse paradoxo nos profissionais de saúde. **Métodos:** Ensaio baseado em literatura selecionada intencionalmente. **Resultados:** Para além da síntese desse paradoxo nas populações, sua operacionalidade em profissionais de saúde envolve fatores cognitivos (invisibilidade dos casos sobrediagnosticados, diluição dos casos graves entre os sobrediagnosticados e feedbacks cognitivos apenas positivos na experiência clínica), políticos (interesses corporativos e comerciais poderosos) e psicológicos (significativa recompensa subjetiva de tratar mais pessoas com ótimo resultado e menor desgaste emocional derivado do cuidado aos casos sobrediagnosticados, além de outros comuns vieses psicocognitivos). **Conclusões:** Os processos discutidos podem ser relevantes para a prevenção quaternária e um melhor manejo clínico e institucional desse rastreamento, que deve envolver os profissionais da Atenção Primária à Saúde e vários outros atores sociais.


**Palavras-chave:** Prevenção quaternária; Atenção Primária à Saúde; Prevenção de doenças; Câncer de mama; Programas de rastreamento.


## Resumen

**Introducción:** Si bien los sobrediagnósticos (diagnósticos de enfermedades que no se manifestarían clínicamente) en el tamizaje mamográfico han puesto en duda el balance entre beneficios y daños, persisten sus recomendaciones positivas a mujeres (>50 años) y profesionales, lo que exige prevención cuaternaria — evitar daños iatrogénicos y sobremedicación. En esta persistencia intervienen expectativas ficticias, cultura moralista preventiva, medicina de vigilancia y biocapitalismo (intereses económicos). Argumentamos que la 'paradoja de la popularidad' — expansión paradójica de la popularidad del cribado alimentada por la producción de su daño iatrogénico — tiene más importancia en este contexto de lo que se ha considerado. **Objetivo:** Describir y discutir algunos posibles modos de operación de esta paradoja en los profesionales de la salud. **Métodos:** ensayo basado en literatura seleccionada intencionalmente. **Resultado:** Además de la síntesis de esta paradoja en poblaciones, su operatividad en los profesionales de la salud involucra factores cognitivos (invisibilidad de los casos sobrediagnosticados, dilución de casos graves entre los sobrediagnosticados y solo retroalimentación cognitiva positiva en la experiencia clínica), factores políticos (poderosos intereses corporativos y comerciales) y factores psicológicos (importante recompensa subjetiva de tratar a más personas con excelentes resultados y menor desgaste emocional derivado de la atención de casos sobrediagnosticados, además de otros sesgos psicocognitivos comunes). **Conclusiones:** los procesos discutidos pueden ser relevantes para la prevención cuaternaria y una mejor gestión clínica e institucional de este tamizaje, que debe involucrar a los profesionales de la Atención Primaria de Salud y a varios otros actores sociales.


**Palabras clave:** Prevención cuaternaria; Atención primaria de salud; Prevención de enfermedades; Neoplasias de la mama; Rastreo masivo.

# INTRODUCTION

Quaternary prevention (P4) means protecting users from iatrogenic injury (common and relevant)[1] and overmedicalization.[2] One of these injuries is overdiagnosis:[3] correct diagnosis of diseases that would not manifest themselves in the person's life. It occurs by screening (performing tests on asymptomatic people[4]), expanded definitions of diseases[5], and excessive testing in clinical investigation.[6] The greater sensitivity of technologies for small abnormalities,[7] inclusive changes in diagnostic criteria (merging increased risk with pathology[8]), and shifts in cut-off points for high risk have generated overdiagnoses.[5] Overdiagnosis is a public health issue[9] that operates at the level of healthcare systems, has implications for social justice[10] and is especially relevant for Primary Health Care (PHC).[11] Its (accepted[12]) reality shows that diseases may not progress to clinical manifestation, including cancer, which is counterintuitive.[13-15] Some cancer screenings produce a lot of overdiagnoses and overtreatment (treatment of overdiagnosed cases), both of which are serious iatrogenic injuries.

Paradoxically, the more overdiagnoses/overtreatments are generated, the more harmed people believe they have been saved, what Welch[7] and Raffle and Gray[4] called the "paradox of popularity." P4 in

screening requires better understanding and handling of the paradox of popularity. The objective of this essay is to hypothetically describe processes involved in the paradox of popularity and to point out some consequences and challenges, respectively, in the case of mammographic screening of breast cancer (well-studied and exemplifying of the issue, common to other cancers[16]).

## METHODS

Methodologically, this article is based on Welch[7] and on articles on mammographic screening, considering the scarce literature on the subject. It begins by contextualizing the complexity of P4 in this screening. Subsequently, the dynamics of the paradox are investigated, without covering all the controversy about this screening (unnecessary for the purpose of this study). Finally, some consequences and challenges are pointed out.

## RESULTS AND DISCUSSION

### The strength of preventivism and mammographic screening

The maxim “prevention is better than cure” is disseminated, intensified with longevity and chronic diseases. The call for prevention and healthy lifestyles has become a social rule and moral imperative,[17] criticized as sanitary imperialism,[18-20] for the medicalization and individualization of risks and responsibilities.

Early detection of cancer is a medical and institutional concern. There is consensus that the later the treatment of cancers, the worse the prognosis; the earlier, the better. Secondary prevention expanded from techniques that detected early stages of cancers.[21] The notion of its stages of development has been developed, whose nomenclature was made official in 1952 and absorbed by the scientific community.[22] In the case of mammography, there was enthusiasm[23,24] and it was claimed that it saves lives, which does not occur[25,26] or occurs in a very small proportion.[27]

The popular literature and much of the scientific literature emphasize the benefits of periodic mammography.[26,28] High-income individuals perform more screening[29] and reinforce the belief in its value. The media reports cancer in young women and celebrities, inflating fear and belief in the benefits of screening.[30,31] In medical handbooks, this is generally reinforced by the poor prognosis of advanced forms. For example: in ovarian cancer, the “5-year survival is approximately 17% with distant metastases, 36% with local spread, and 89% with early disease” (p. 794).[32] It is also possible that the great stress and emotional distress of oncological care[33-35] lead to the overvaluation of screening.

Conversely, part of the scientific literature shows that overdiagnoses are frequent in preventive mammography:[36-40] diagnoses via screenings select diseases with a slower evolution,[41] which would not manifest themselves.[11,42,43] Overdiagnosis was recognized as the greatest harm of this screening,[44] whose benefit was initially estimated at a 30% reduction in breast cancer mortality,[45] reduced to 20–25%,[46] and later to 10–15% in clinical trials.[38] In a review of observational studies, it was estimated at 10–12.5%,[47] with several reaching zero.[41,48,49] There are arguments for suspending screening[37,50-52] and for campaigns to change public opinion.[53]

Although there is polarized controversy[54] about the magnitude of overdiagnosis (0 to 50%)[55] and the benefit-harm balance, a conclusion or consensus is not necessary to decide on preventive mammography.

A positive recommendation demands a largely favorable benefit-harm balance with little harm, due to preventive ethics that demand a high valuation of non-maleficence.[56-60] The existence of controversy (in the literature) about benefits and harms raises doubts about this balance, and this is sufficient for its non-recommendation.[51] Furthermore, the ethical analysis by Rogers et al.[57] and the precautionary principle, applicable in situations with a high potential for extensive and significant damage when there are scientific doubts,[50,61] converge in this direction. Despite this doubt or failure,[62] medical and health institutions maintain a positive recommendation, including the Brazilian Ministry of Health;[63] requiring clarification of benefits and harms for an informed decision.[64]

For Carter,[52] this screening persists due to other complex factors: "fictitious expectations," a moralistic culture adhering to sanitary imperialism, surveillance medicine, and biocapitalism (economic interests). We argue that the paradox of popularity encourages this situation more than it has been taken into account, makes P4 difficult, and justifies its analysis for a better understanding.

## The perception of harms as benefits: the vicious circle of the paradox

The most common harms of mammography are false-positives, whose cumulative probability in ten years is 61% (annual mammography) and 42% (biannual).[65] Qualitative studies have shown uncertainty and stress experienced in false-positives, particularly anxiety, worries, and long-term psychosocial damage.[66,67] Other harms are unquantifiable: informing about risks can mean "putting a drop of ink into the clear water of the patient's identity; it can never be completely clear again" (p. 222)[68] Diagnosis through screening undermines self-confidence, with lasting consequences for identity.[69] It has been estimated that half of those thus diagnosed will suffer from chronic pain.[38]

Overdiagnosis is the most serious damage, but invisible and imperceptible: overdiagnosed individuals are not individually identifiable.[7] It is an epidemiological phenomenon:[70] the finding observed after screenings of an increase in the incidence of cancers without a proportional reduction in the incidence of advanced and metastatic forms and specific mortality over the years, which should occur if early-detected cancers were to progress to clinical manifestation.[7]

Post-screening observational studies have recorded: no return to pre-screening trend incidence levels;[48] absence or modest decreases in the rates of advanced cancer,[71] whose incidence has remained stable[48] instead of decreasing; absence of further proportional reduction in incidence above the screened age group;[40,72,73] absence of correlation between the onset of screening and the reduction in mortality and incidence of advanced cancer in different countries, between states of the same country, and between countries with different magnitudes of women's adherence.[40] Mastectomies have increased post-screening.[48,74-79]

In a clinical trial, 50% of invasive cancers identified via screening were overdiagnosed, rising to 72% when including ductal carcinomas *in situ* (DCIS).[80] After screening, 25% of all breast cancers are DCIS, more than 90% of which are detected by screening.[81] The increase in the number of DCIS follows the introduction of screening, but specific mortality has not decreased with its early treatment. The vast majority of DCIS will never progress to invasive cancer and will not manifest clinically, but nearly all are treated.[82-84] The reduction in specific mortality occurred equally in screened and unscreened populations[39] and is more associated with improvements in treatment.[40]

There is debate about how to estimate the number of overdiagnoses.[85-87] Several methods underestimate it, making adjustments according to the lead time (time for the tumor to appear if it had not

been detected by screening), assuming that all diagnosed cancers would appear later; which does not occur in most cases.[42]

Clinical trials, which have better control for confounding variables, tend to underestimate overdiagnosis.[40,88] There is an accumulation of data indicating that overdiagnosis is significant: 20% or more of all breast cancers among women invited to screening; and 30 to 50% of cancers detected by screening, which are approximately 70% of all diagnoses of screened women.[40]

To facilitate the understanding, it is recommended to use natural frequencies:[85] for each reduced death from breast cancer (assuming that screening reduces specific mortality by 20%), "X" women are overdiagnosed. In the leaflets of the English National Health Service (NHS),[89] of the Brazilian Ministry of Health[63], and of the Canadian Ministry of Health[90], X=3. In other words, diagnosing via mammographic screening has a 25% benefit and a 75% chance of harm.[31] This is without considering the non-reduction in total deaths from cancer[38] and the increase in cardiovascular mortality resulting from screening,[38] which nullify the supposedly positive effect of saving lives.[91] A recent systematic review estimated X=4,[92] worsening the chance of harm by 80%.

However, these numbers were not popularized. They seem not to have affected the professional representations[93] of those involved in the care of these patients. Clinical practice produces knowledge, called "experience," which influences decisions. What does this experience teach about mammographic screening? No studies were found with this focus, but deductions are tested. The increase in post-screening incidence may have generated the perception that this cancer has become more common, but without considering that much of this is produced by screening and its overdiagnosis.[48,75,76,94,95] Perceived benefits probably involve an increase in diagnoses of early cancers and a decrease in advanced cancers, with cures for most diagnosed women.

There would be a simple explanation: the increase in cases with better/excellent prognosis was mainly due to screening, diluting advanced cases into a larger group that absorbs a significant part of the time and attention of professionals. Advanced cases continue to exist and have slightly decreased, but they have been diluted in more early cancers (mostly overdiagnosed) and perceived, therefore, as rarer. A better overall prognosis was obtained by including in clinical care a large volume of cases that would not become clinically ill.

In clinical experience, noticeable harms are: false-positives (repairable with good news from repeat tests or negative biopsies[67]), unnecessary biopsies (whose good results hide that they were not necessary), and false-negatives (an inter-screening cancer is perceived like a disaster that was sought to be avoided). The possible balances are misleading: instead of comparing minor harm (false-positives and correlated biopsies) with perceived benefits (profusion of cures inflated by overdiagnosis), minor harm should be added to overdiagnosis and overtreatment, which is not possible in clinical experience.[96] This will always show a favorable benefit-harm balance. That is, the cognitive feedbacks derived from practice that reach professionals are all positive as well as the social and institutional ones.[97]

Another deduction: if screening was ended, there would be no dilution of advanced cases, and their relative increase would likely be perceived as absolute. Staging would show more severe cases, with more aggressive and less curative treatments, more adverse effects and complications: worse results in the perception of professionals.

As for the population, all the overdiagnosed (harmed) women, how they feel benefited (by the cure, although very few have been), faced with a supposed fatal evolution if they do not screen and treat it (nonexistent in the overdiagnosed ones), are induced to believe that screening has saved

them.[4,7] The more screenings, the more overdiagnoses and the more screening seems to save people who have been harmed by it (overdiagnosed).[98] All overtreatments are perceived as saving cures, instead of unnecessary diagnoses, surgical mutilations, serious chemotherapy and radiotherapy aggressions (Figure 1).[7]

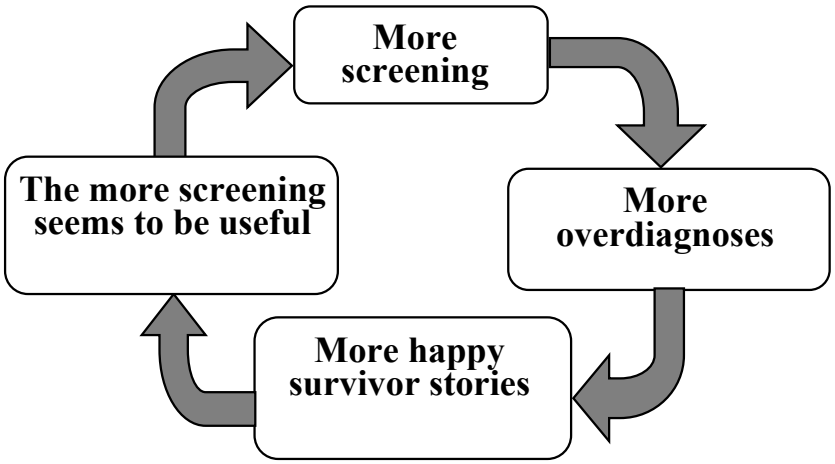


**Figure 1.** Vicious circle of production of the paradox of popularity.[7]

Such a vicious circle increases the demand for specialized cancer care and the clientele for gynecologists, oncologists, radiologists, and mastologists, generating greater economic gains in the private sector. The increased demand dilutes the severe cases into a more psychologically comfortable and rewarding set to attend to: lots of periodic negative screenings; many false positives with a happy ending; several confirmed diagnoses with happy staging and curative treatment, with a happy follow-up (many overdiagnoses). Screening makes the work lighter and emotionally satisfying, with greater healing power and less distress.

Financial gain does not exist for public service professionals. On the contrary, such increased demand is an additional cost for the Brazilian Unified Health System (SUS) and its users, and diverts resources and clinical care from those who need it most to many who do not (overdiagnosed), producing inequity in access to cancer care and emphasizing the law of inverse care.[99] However, in public services, there is the same psychological/emotional "gain" for professionals.

There is a close interface between the aforementioned processes, the cognitive and affective biases about screening[100,101] and the heuristics of Kahneman et al.[102] and Morgenstern,[103] summarized in Table 1[104], and which affect women and professionals.

There seems to be a positive feedback between the popularity paradox and these biases/heuristics. A detailed analysis of this interface is beyond our scope, but some points are worth mentioning. Biases of availability (recall of striking cases rather than population statistics), anchoring (for example, the prevalence of cancer in populations of hospitals and specialized services is erroneously applied to the entire population), and confirmation (cases reported in the media or somewhat striking) are probably feeders of the paradox. The cognitive effects of the aforementioned dilution of severe cases on professional perception seem to be anchoring biases. The aforementioned subjective rewards unconsciously pressure pro-screening practitioners.

These psychosociognoseological dynamics are worth of empirical investigations. In Brazil, the website of the Brazilian Society of Mastology (*Sociedade Brasileira de Mastologia* – SBM) attributes to its

**Table 1.** Biases and heuristics involved in the decision about screening.[104]

| Bias | Description | Relevance for Consent in Screening |
|---|---|---|
| Affect heuristic | The tendency to rely on emotions, rather than concrete information, when making decisions | Emotions not founded in evidence may lead to unjustified decisions |
| Ambiguity aversion (uncertainty aversion) | A preference for known risks over unknown risks | There are many unknown risks in screening |
| Anchoring bias | The tendency to insufficiently adjust subjective risk to the objective risk value communicated to people | Conceptions about the risks and benefits of participating in screening is not modified by factual information |
| Availability bias | The tendency to rely on immediate examples that come to a given person's mind when making decisions | Information applied in decisions may be anecdotal, unbalanced, or incomprehensive |
| Bandwagon effect | The tendency for people to adopt certain behaviors because others are doing so | Decisions are not based on comprehension or on own deliberation |
| Commission bias | The tendency toward action rather than inaction | Biases decisions toward accepting invitations |
| Confirmation bias | The tendency to interpret new information as confirmation of existing beliefs, conceptions, or theories | Interpreting new information as confirmation of existing beliefs may reduce critical assessment of the evidence and result in biased decisions |
| Decoy effect | Increasing the interest in a target action inclusion by introducing an inferior alternative choice (decoy) | Using decoys would be to lure people toward specific choices and would undermine deliberation |
| Default bias | The tendency to stay in or make the default choice | Providing a default choice undermines real informed choice |
| Framing effect | The tendency for people to decide based on how the information is presented (framed) | Framed information reduces the ability to comprehend and deliberate on information |
| Impact bias (Affective forecasting) | The tendency for people to overestimate the impact that future events will have on their lives | Overestimating the risk of cancer can bias decision making |
| Optimism bias | The tendency for people to underestimate their probability of experiencing adverse effects | Underestimating the risk of overdiagnosis and overtreatment can bias decision making |
| Order effects: primacy/recency | The tendency to pay more attention to information presented first (and last) | Unbalanced attention to information may bias decision making |
| Representativeness heuristic | The tendency to base present decisions on past events or experiences that appear similar to the current situation | Decisions can be based on knowledge of persons having screening experiences rather than own relevant risk assessments |

president the statement: "it is essential that women, especially those aged 40 years and older, undergo an annual mammogram" [free translation],[105] without mentioning harms or informed decision.

## Consequences and challenges of the paradox

It seems unreasonable to expect gynecologists, mastologists, oncologists, radiologists, and surgeons to change their conduct and guidelines if they have not yet done so. Such guidelines are associated with conflicts of interest, which also exist outside Brazil,[106,107] generate pro-screening pressure[108,109] and

represent a political challenge. No national institution, preventive task force, or group of experts took a stand for stopping or reviewing screening — except for the Swiss Medical Board[110] (which recommended to stop it), the French committee (which recommended either stopping or reforming the program[111]), and an editorial in the Spanish journal *Revista de Senologia y Patologia Mamária*.[112]

Most literature on screening[113,114] and most professionals continue to report more on benefits and less on harms.[115] Many public health booklets also provide insufficient information.[116-118] Usually, PHC professionals do not have "the capacity [...] to support informed choices about cancer screening for their patients" [free translation][119] Not surprisingly, physicians and patients have expectations that overestimate benefits and underestimate harm.[120]

When women receive information about harm in studies, there is an improvement in their knowledge,[121,122] but maintenance or minimal change in their decision.[123-127] Objective information seems to be surpassed in importance by factors such as trust (in the professional or authority), symbolic value (of the breasts), fear, because it is offered by the health system or is free of charge, and by routinization (screening becomes a routine beneficial component of care),[104] converging with the aforementioned cognitive and affective biases. Six categories of systematic pro-screening influence widely used by health authorities and professionals were also identified: misleading presentation of statistics, misrepresentation of harms and benefits, exclusion systems (examination is scheduled, requiring active cancellation action if non-adherence), recommendation for participation, appeals to fear and influence of healthcare professionals.[128]

Regardless of women's knowledge, it is possible that there is some resistance expressed as non-adherence, a way of circumventing the pressures to be screened. Some democratization of information via the Internet and, rarely, traditional media,[129] could be a mitigating factor of this pressure. Adherence is greater than 70% in several countries with organized programs (Denmark, Netherlands, Finland, Spain, Sweden, Slovenia), but lower in others (50–69%: France, Germany, Portugal, Poland, Italy, Ireland, Hungary).[130] In Brazil, without an organized program, the estimated coverage ranged from 74.4% (2011) to 78.0% (2020).[131]

The structure of the healthcare system can also influence the maintenance of screening, associated with the lack of coordination of care and the lack of monopoly of first contact by primary health care. We found no research on this, but there are suggestive indications: in addition to financial conflicts of interest,[132] corporate interests and professional experiences are important, which influence the conclusion of systematic reviews.[133,134] The presence of family doctors restricts recommendations, and the presence of radiologists expands these recommendations in committees that produce them.[135] This probably occurs in care practice as well.

The paradox of popularity worsens the "pathogenic vulnerability" created by overdiagnoses: a vulnerability that arises when an action aimed at improving a situation (reducing breast cancer mortality) exacerbates existing vulnerabilities or creates new ones, in which individuals' agency is limited by multiple factors. Women's agency is undermined by pressures to screen (including via official recommendations), controversies over efficacy and harm (when accessed), and practical barriers to an informed decision, making it an ethically unacceptable option.[53]

Carter[52] discusses pro-permanence factors of this screening, partly constituting and partly synergistic with the paradox of popularity: the "epistemic" issue, the "agency" issue, and the "fictional expectations" issue. We have already addressed the first: controversy over the balance between benefits and harm and the impossibility of personally identifying those who are overdiagnosed.

As for "expectations," there is a broad cultural resonance in contemporary times, in which imaginary futures are of great importance and decisions are made in profound uncertainty; which demands something to guide action: fictitious expectations provide that guidance. Such expectations fall somewhere between fact and imagination, are shareable, are serious, as opposed to made-up stories, and emphasize common exaggerations in fictional expectations. In the case of mammography, they emphasize the potential benefits while obscuring the harms.[52]

The problem with "agency" is that there is a plurality of human motivations, perspectives and interests (PHC physicians, various specialists, managers, media, patients, etc.) that disperses their agency in multiple directions, some of them pro-screening. This allows the agency of technology (of biocapital) to remain preponderant, in synergy with surveillance medicine,[136] which emphasizes the future (prevention). Biocapital reinforces this agency, also due to its performativity. A discourse is performative if it helps to accomplish what it refers to. In the economy, the power of performativity is well-known, which mobilizes large financial resources, social, and scientific forces. In health, great performativity was observed in promises of technological and medical revolution, boosting research, beliefs, and opinions (even if fallacious, exaggerated, and/or failed). In addition to the influence of interests and the power of money, biocapital operates via performativity intensifying fictitious pro-screening expectations.[52]

A management strategy for this situation is the aforementioned application of the precautionary principle to preventive mammography.[50,61] This would mitigate the epistemic problem, by screening contraindication; it would reinforce human agency, converging it toward the practical valuation of non-maleficence (consensual in theory, but little practiced); it would empower professionals, managers, social movements, and States in the opposite direction to biocapital.

Other powerful pro-screening forces are preventivism moralism and emotional manipulation through the use of salvationist words, which biasedly manipulate people's well-documented and widespread propensity to morally decide (do the right thing) and accept "trading" few valuable benefits ("saved lives" for many minor losses [overdiagnoses]).[137]

Therefore, patients will hardly lead changes or be able to make truly informed decisions, also due to lack of statistical literacy, which is also scarce among physicians;[138,139] although some social movements began to discuss the issue, such as the *Coletivo Feminista Sexualidade e Saúde* [Sexuality and Health Feminist Group], in Brazil.[140]

In any case, the paradox of popularity must be faced by managers, educators, and professionals. In the scientific literature, this discussion is rare. The closest topic is the attempt to minimize overdiagnoses.[141] There is a call to: optimize benefits and minimize harm; improve information; empower PHC physicians and users;[142] develop techniques to separate higher risk groups and intervene only in them.[143] This is relevant because new technologies added to mammography, such as magnetic resonance imaging [144] etc., have been proposed based on improvements in detection rates, without reduction in specific mortality,[145] potentially producing even more overdiagnoses.

P4 in this screening challenges PHC professionals in their daily lives,[146] demanding a protagonism for which some strategies were indicated[147] (Figure 2)

Professional protagonism is not enough. There is a need for institutional, political, and social mobilization.[141] It has been slowly starting on similar topics, such as the Choosing Wisely[148] and the Too Much medicine movements.[149] Regarding overdiagnosis, there are institutional and governmental initiatives in Australia.[150]

| Strategy | Description | Examples of action |
|---|---|---|
| **Reduce screening** | | |
| • Do not bring up the topic | For topics with negative recommendations, especially strong recommendations against screening, do not bring up the subject | For women younger than 50 y of age, choose to discuss other preventive issues, not mammography, unless the woman asks |
| • Reduce unnecessary testing | Screen only the population at sufficient risk so that the potential benefits are greater than the potential harms of screening | Do not screen people before the recommended interval, as they are at very low risk. There is minimal benefit, while the risk of harms is similar to when done at the appropriate interval (eg, false positives) |
| **Improve patient communication** | | |
| • Share decision making | Patient and physician need to discuss the harms and benefits of screening. Consider patient preferences and values | Share screening decisions with patients to reduce decisional conflict |
| • Effectively communicate both harms and benefits to patients | Use measures of outcome and effect size that are most easily understood by patients | Use natural frequencies and absolute risk reduction with baseline estimate (eg, mammography screening helps 1 woman in 1000) |
| • Use knowledge translation tools and patient decision aids | Tools improve patient understanding of harms and benefits of screening | Use 1000-person diagrams[34] or "fact boxes" (from the Harding Centre for Risk Literacy) that outline the harms and benefits of the action |
| • Manage emotional outcomes of harms | Prepare strategies to manage patients who have experienced harms associated with screening | Help patients who decided not to screen realize that their decision was sensible when they made it, and to understand that their outcome might be no different than if they had been screened |
| **Fully understand screening** | | |
| • Understand the limitations of the screening test and its variability | All laboratory tests, imaging, and clinical assessments have measurement variation | Understand that frequent repeat testing is not helpful (eg, DEXA bone density test results have greater variation than annual changes in bone density do) |
| • Understand screening test quality | Be aware of quality markers for screening (eg, positive results for mammography vary from 4% to 9% among radiologists) | Refer to the highest-quality laboratory or service. Focus on correct disease detection and excess positive rates |
| • Understand natural history of disease | Know the course a disease takes (without medical interference) in individual persons from its inception until its eventual resolution through complete recovery or death | Acknowledge the pool of undiagnosed disease that would never affect people's lives (overdiagnosis). The proportion depends on the disease and person's life stage |
| • Use knowledge of epidemiology of disease | Disease probability changes with age and risk factors, so chance of benefit changes accordingly | Decide whether to start screening for cervical cancer, about 10 years after first sexual activity, not based just on age 21 or 25 |
| **Adopt organizational strategies** | | |
| • Develop a follow-up approach to positive test results | Use less-invasive strategies to manage positive test results | Repeat marginally elevated tests (eg, cholesterol, blood pressure) to decide if it is a chance variation |
| • Develop recall processes | Processes can be developed in a practice, region, or province to proactively recall patients for screening | Advocate for such processes to recommend shared decision making between patient and physician not to simply tell patients to do the test |

**Figure 2.** Strategies to reduce the harm caused by screening in the daily lives of professionals.[147]

## CONCLUSION

Mammographic screening produces overdiagnosis/overtreatment in women that are indistinguishable from those with cancer that threatens them. Therefore, overdiagnoses are perceived as saviors and generate the misleading perception of their great benefit, inducing more screenings, closing the vicious circle of the paradox of popularity. It affects the population and probably professionals. In the latter, it involves commercial, intellectual and corporate interests; cognitive biases, among others, those derived from the apparently large reduction in advanced cancers; and subjective rewards in clinical practice, which is lighter and more curative during screening. In this screening, P4 demands that PHC professionals and their confederations, social movements, researchers (including Public Health), and managers join together in addressing the paradox of popularity and overdiagnoses.

## CONFLICT OF INTERESTS

Nothing to declare.

## REFERENCES


1. Makary MA, Daniel M. Medical error-the third leading cause of death in the US. BMJ 2016;353:i2139. https://doi.org/10.1136/bmj.i2139
2. Bentzen N. WONCA dictionary of general/family practice. Copenhagen: Maanedskift Lager; 2003
3. Barratt A. Overdiagnosis in mammography screening: a 45 year journey from shadowy idea to acknowledged reality. BMJ 2015;350:h867. https://doi.org/10.1136/bmj.h867
4. Raffle A, Gray M. Screening evidence and practice. Oxford: Oxford University Press; 2007
5. Brodersen J, Schwartz LM, Heneghan C, O'Sullivan JW, Aronson JK, Woloshin S. Overdiagnosis: what it is and what it isn't. BMJ Evid Based Med 2018;23(1):1-3. https://doi.org/10.1136/ebmed-2017-110886
6. Kale MS, Korenstein D. Overdiagnosis in primary care: framing the problem and finding solutions. BMJ 2018;362:k2820. https://doi.org/10.1136/bmj.k2820
7. Welch HG. Overdiagnosed: making people sick in the pursuit of health. Boston: Beacon Press; 2011.
8. Tesser CD, Norman AH. Differentiating clinical care from disease prevention: a prerequisite for practicing quaternary prevention. Cad Saúde Pública 2016;32(10):e00012316. https://doi.org/10.1590/0102-311X00012316
9. Bulliard JL, Chiolero A. Screening and overdiagnosis: public health implications. Public Health Rev. 2015;36:8. https://doi.org/10.1186/s40985-015-0012-1
10. Morrison M. Overdiagnosis, medicalisation and social justice: commentary on Carter et al (2016) 'A definition and ethical evaluation of overdiagnosis'. J Med Ethics 2016;42(11):720-1. https://doi.org/10.1136/medethics-2016-103717
11. Singh H, Dickinson JA, Thériault G, Grad R, Groulx S, Wilson BJ, et al. Overdiagnosis: causes and consequences in primary health care. Can Fam Physician 2018;64(9):654-9. PMID: 30209095
12. Brawley OW. Accepting the existence of breast cancer overdiagnosis. Ann Intern Med 2017;166(5):364-5. https://doi.org/10.7326/M16-2850
13. Welch GH. Should I be tested for cancer? Maybe not and here's why. Berkeley: University of California Press; 2004
14. Brodersen J, Schwartz LM, Woloshin S. Overdiagnosis: how cancer screening can turn indolent pathology into illness. APMIS 2014;122(8):683-9. https://doi.org/10.1111/apm.12278
15. Welch HG, Black WC. Overdiagnosis in cancer. J Natl Cancer Inst 2010;102(9):605-13. https://doi.org/10.1093/jnci/djq099
16. Carter SM, Barratt A. What is overdiagnosis and why should we take it seriously in cancer screening. Public Health Res Pract 2017;27(3):2731722. https://doi.org/10.17061/phrp2731722
17. Lupton D. The imperative of health: public health and the regulated body. London: Sage; 1995
18. Skrabanek P. The death of humane medicine and the rise of coercive healthism. London: Social Affairs Unit; 1994
19. Crawford R. Healthism and the medicalization of everyday life. Int J Health Serv 1980;10(3):365-88. https://doi.org/10.2190/3H2H-3XJN-3KAY-G9NY
20. Nogueira RP. Higiomania: a obsessão com a saúde na sociedade contemporânea. In: Vasconcelos EV. A saúde nas palavras e nos gestos: reflexões da rede educação popular e saúde. São Paulo: Hucitec; 2001. p. 63-72.
21. Cantor D. Introduction: cancer control and prevention in the twentieth century. Bull Hist Med 2007;81(1):1-38. https://doi.org/10.1353/bhm.2007.0001

22. Ménoret M. The genesis of the notion of stages in oncology: the French Permanent Cancer Survey (1943–1952). Soc Hist Med 2002;15(2):291-302. https://doi.org/10.1093/shm/15.2.291
23. Waller J, Osborne K, Wardle J. Enthusiasm for cancer screening in Great Britain: a general population survey. Br J Cancer 2015;112(3):562-6. https://doi.org/10.1038/bjc.2014.643
24. Schwartz LM, Woloshin S, Fowler Jr FJ, Welch HG. Enthusiasm for cancer screening in the United States. JAMA 2004;291(1):71-8. https://doi.org/10.1001/jama.291.1.71
25. Prasad V, Lenzer J, Newman DH. Why cancer screening has never been shown to "save lives"- and what we can do about it. BMJ 2016;352:h6080. https://doi.org/10.1136/bmj.h6080
26. Jørgensen KJ, Gøtzsche PC. Who evaluates public health programmes? A review of the NHS Breast Screening Programme. J R Soc Med 2010;103(1):14-20. https://doi.org/10.1258/jrsm.2009.090342
27. Welch HG, Frankel BA. Likelihood that a woman with screen-detected breast cancer has had her "life saved" by that screening. Arch Intern Med 2011;171(22):2043-6. https://doi.org/10.1001/archinternmed.2011.476
28. Rasmussen K, Jørgensen KJ, Gøtzsche PC. Citations of scientific results and conflicts of interest: the case of mammography screening. Evid Based Med 2013;18(3):83-9. https://doi.org/10.1136/eb-2012-101216
29. Welch HG, Fisher ES. Income and cancer overdiagnosis - when too much care is harmful. N Engl J Med 2017;376(23):2208-9. https://doi.org/10.1056/NEJMp1615069
30. Parker L, Carter S. Chapter 14 - Ethical and societal considerations in breast cancer screening. In: Houssami N, Miglioretti D, eds. Boston: Breast Cancer Screening Academic Press; 2016. p. 347-74
31. Luqmani YA. Breast screening: an obsessive compulsive disorder. Cancer Causes Control 2014;25(10):1423-6. https://doi.org/10.1007/s10552-014-0430-2
32. Papadakis MA, McPhee SJ, Rabow MW. Current medical diagnosis & treatment 2019. 58th ed. New York: McGraw-Hill Education; 2019.
33. Abusanad A, Bensalem A, Shash E, Mula-Hussain L, Benbrahim Z, Khatib S, et al. Burnout in oncology: magnitude, risk factors and screening among professionals from Middle East and North Africa (BOMENA study). Psychooncology 2021;30(5):736-46. https://doi.org/10.1002/pon.5624
34. Bui S, Pelosi A, Mazzaschi G, Tommasi C, Rapacchi E, Camisa R, et al. Burnout and Oncology: an irreparable paradigm or a manageable condition? Prevention strategies to reduce Burnout in Oncology Health Care Professionals. Acta Biomed 2021;92(3):e2021091. https://doi.org/10.23750/abm.v92i3.9738
35. James TA, Zhang JQ. ASO Author reflections: addressing the early onset of clinical practice distress in breast surgery. Ann Surg Oncol 2021;28(Suppl 3):850-1. https://doi.org/10.1245/s10434-021-10114-x
36. Adami HO, Kalager M, Valdimarsdottir U, Bretthauer M, Ioannidis JP. Time to abandon early detection cancer screening. Eur J Clin Invest 2019;49(3):e13062. https://doi.org/10.1111/eci.13062
37. Esserman L, Shieh Y, Thompson I. Rethinking screening for breast cancer and prostate cancer. JAMA 2009;302(15):1685-92. https://doi.org/10.1001/jama.2009.1498
38. Gøtzsche PC, Jørgensen KJ. Screening for breast cancer with mammography. Cochrane Database Syst Rev 2013;(6):CD001877. https://doi.org/10.1002/14651858.CD001877.pub5
39. Jørgensen KJ, Zahl PH, Gøtzsche PC. Breast cancer mortality in organised mammography screening in Denmark: comparative study. BMJ 2010;340:c1241. https://doi.org/10.1136/bmj.c1241
40. Autier P, Boniol M. Mammography screening: a major issue in medicine. Eur J Cancer 2018;90:34-62. https://doi.org/10.1016/j.ejca.2017.11.002
41. Heller DR, Chiu AS, Farrell K, Killelea BK, Lannin DR. Why has breast cancer screening failed to decrease the incidence of de novo stage IV disease? Cancers (Basel) 2019;11(4):500. https://doi.org/10.3390/cancers11040500
42. Zahl PH, Jørgensen KJ, Gøtzsche PC. Overestimated lead times in cancer screening has led to substantial underestimation of overdiagnosis. Br J Cancer 2013;109(7):2014-9. https://doi.org/10.1038/bjc.2013.427
43. Zahl PH, Mæhlen J, Welch HG. The natural history of invasive breast cancers detected by screening mammography. Arch Intern Med 2008;168(21):2311-16. https://doi.org/10.1001/archinte.168.21.2311
44. Migowski A, Silva GA, Dias MBK, Diz MDPE, Sant'Ana DR, Nadanovsky P. Diretrizes para detecção precoce do câncer de mama no Brasil. II - Novas recomendações nacionais, principais evidências e controvérsias. Cad Saúde Pública 2018;34(6):e00074817. https://doi.org/10.1590/0102-311X00074817
45. Wright CJ, Mueller CB. Screening mammography and public health policy: the need for perspective. Lancet 1995;346(8966):29-32. https://doi.org/10.1016/S0140-6736(95)92655-0
46. International Agency for Research on Cancer. Breast cancer screening. Lyon; IARC Press; 2002.
47. Harris RP. Chapter 4 – The importance of observational evidence to estimate and monitor mortality reduction from current breast cancer screening. In: Houssami N, Miglioretti D, eds. Breast Cancer Screening: An Examination of Scientific Evidence. London: Elsevier; 2016. p. 87-101. https://doi.org/10.1016/B978-0-12-802209-2.00004-8
48. Welch HG, Prorok PC, O'Malley AJ, Kramer BS. Breast-cancer tumor size, overdiagnosis, and mammography screening effectiveness. N Engl J Med 2016;375(15):1438-47. https://doi.org/10.1056/NEJMoa1600249
49. Zahl P, Kalager M, Suhrke P, Nord E. Quality of life effects of screening mammography in Norway. Int J Cancer 2020;146(8):2104-12. https://doi.org/10.1002/ijc.32539
50. Tesser CD, Norman AH, Gérvas J. Applying the precautionary principle to breast cancer screening: implications to public health. Cad Saúde Pública 2019;35(7):e00048319. http://dx.doi.org/10.1590/0102-311x00048319

51. Tesser CD, d'Ávila TLC. Por que reconsiderar a indicação do rastreamento do câncer de mama? Cad Saúde Pública 2016;32(5):e00095914. https://doi.org/10.1590/0102-311X00095914
52. Carter SM. Why does cancer screening persist despite the potential to harm? Science, Technology and Society 2021;26(1):24-40. https://doi.org/10.1177/0971721820960252
53. Rogers WA. Analysing the ethics of breast cancer overdiagnosis: a pathogenic vulnerability. Med Health Care Philos 2019;22(1):129-40. https://doi.org/10.1007/s11019-018-9852-z
54. Hofmann B. Fake facts and alternative truths in medical research. BMC Med Ethics 2018;19(1):4 https://doi.org/10.1186/s12910-018-0243-z
55. Bulliard JL, Beau AB, Njor S, Wu WY, Procopio P, Nickson C, et al. Breast cancer screening and overdiagnosis. Int J Cancer 2021;149:846-53. https://doi.org/10.1002/ijc.33602
56. Tesser CD, Norman AH. Differentiating clinical care from disease prevention: a prerequisite for practicing quaternary prevention. Cad Saúde Pública 2016;32(10):e00012316. https://doi.org/10.1590/0102-311X00012316
57. Rogers WA, Entwistle VA, Carter SM. Risk, overdiagnosis and ethical justifications. Health Care Anal 2019;27(4):231-48. https://doi.org/10.1007/s10728-019-00369-7
58. Segura-Benedicto A. Inducción sanitaria de los cribados: impacto y consecuencias. Aspectos éticos. Gac Sanit 2006;20 (Supl 1):88-95
59. Weingarten M, Matalon A. The ethics of basing community prevention in general practice. J Med Ethics 2010;36(3):138-41. https://doi.org/10.1136/jme.2009.032284
60. Elton L. Non-maleficence and the ethics of consent to cancer screening. J Med Ethics 2021;47:510-3. https://doi.org/10.1136/medethics-2020-106135
61. Tesser CD, Norman AH. Geoffrey Rose e o princípio da precaução: para construir a prevenção quaternária na prevenção. Interface (Botucatu) 2019;23:e180435. https://doi.org/10.1590/Interface.180435
62. Baum M. 'Catch it early, save a life and save a breast': this misleading mantra of mammography. J R Soc Med 2015;108(9):338-9. https://doi.org/10.1177/0141076815603563
63. Brasil. Instituto Nacional de Câncer José Alencar Gomes da Silva. Câncer de mama: vamos falar sobre isso? [Internet] Rio de Janeiro: INCA; 2022 [cited on June 11, 2023]. Available at: https://www.inca.gov.br/sites/ufu.sti.inca.local/files//media/document//cartilha_cancer_de_mama_2022_visualizacao.pdf
64. Woloshin S, Schwartz LM, Black WC, Kramer BS. Cancer screening campaigns--getting past uninformative persuasion. N Engl J Med 2012;367(18):1677-9. https://doi.org/10.1056/NEJMp1209407
65. Nelson HD, Pappas M, Cantor A, Griffin J, Daeges M, Humphrey L. Harms of breast cancer screening: systematic review to update the 2009 U.S. Preventive Services Task Force Recommendation. Ann Intern Med 2016;164(4):256-67. https://doi.org/10.7326/M15-0970
66. Brodersen J, Siersma VD. Long-term psychosocial consequences of false-positive screening mammography. Ann Fam Med 2013;11(2):106-15. https://doi.org/10.1370/afm.1466
67. Long H, Brooks JM, Harvie M, Maxwell A, French DP. How do women experience a false-positive test result from breast screening? A systematic review and thematic synthesis of qualitative studies. Br J Cancer 2019;121(4):351-8. https://doi.org/10.1038/s41416-019-0524-4
68. Sweeney K. Science, society, suffering and the self: a commentary on general practice for the twenty first century. New Zealand Family Practice 2005;32:221-4
69. Walker MJ, Rogers WA. Diagnosis, narrative identity, and asymptomatic disease. Theor Med Bioeth 2017;38(4):307-21. https://doi.org/10.1007/s11017-017-9412-1
70. Carter SM, Degeling C, Doust J, Barratt A. A definition and ethical evaluation of overdiagnosis. J Med Ethics 2016;42(11):705-14. https://doi.org/10.1136/medethics-2015-102928
71. Kalager M, Adami HO, Bretthauer M, Tamimi RM. Overdiagnosis of invasive breast cancer due to mammography screening: results from the Norwegian screening program. Ann Intern Med 2012;156(7):491-9. https://doi.org/10.7326/0003-4819-156-7-201204030-00005
72. Zahl PH, Gøtzsche PC, Mæhlen J. Natural history of breast cancers detected in the Swedish mammography screening programme: a cohort study. Lancet Oncol 2011;12(12):1118-24. https://doi.org/10.1016/S1470-2045(11)70250-9
73. Zahl PH. Overdiagnosis of invasive breast cancer due to mammography screening. Ann Intern Med 2012;157(3):220-1; author replay 221-2. https://doi.org/10.7326/0003-4819-157-3-201208070-00024
74. Jørgensen KJ, Gøtzsche PC. Overdiagnosis in publicly organised mammography screening programmes: systematic review of incidence trends. BMJ 2009;339:b2587. https://doi.org/10.1136/bmj.b2587
75. Surhke P, Mæhlen J, Schlichting E, Jørgensen KJ, Gøtzsche PC, Zahl PH. Effect of mammography screening on surgical treatment for breast cancer in Norway: comparative analysis of cancer registry data. BMJ 2011;343:d4692. https://doi.org/10.1136/bmj.d4692
76. Nederend J, Duijm LEM, Voogd AC, Groenewoud JH, Jansen FH, Louwman MWJ. Trends in incidence and detection of advanced breast cancer at biennial screening mammography in The Netherlands: a population based study. Breast Cancer Res 2012;14(1):R10. https://doi.org/10.1186/bcr3091
77. Autier P, Boniol M, Koechlin A, Pizot C, Boniol M. Effectiveness of and overdiagnosis from mammography screening in the Netherlands: population based study. BMJ 2017;359:j5224. https://doi.org/10.1136/bmj.j5224

78. Glas NA, Craen AJM, Bastiaannet E, Op 't Land EG, Kiderlen M, van de Water W, et al. Effect of implementation of the mass breast cancer screening programme in older women in the Netherlands: population based study. BMJ 2014;349:g5410. https://doi.org/10.1136/bmj.g5410
79. Jørgensen KJ, Gøtzsche PC, Kalager M, Zahl PH. Breast cancer screening in Denmark: a cohort study of tumor size and overdiagnosis. Ann Intern Med 2017;166(5):313-23. https://doi.org/10.7326/M16-0270
80. Miller AB, Wall C, Baines CJ, Sun P, To T, Narod SA. Twenty five year follow-up for breast cancer incidence and mortality of the Canadian National Breast Screening Study: randomised screening trial. BMJ 2014;348:g366. https://doi.org/10.1136/bmj.g366
81. Leung GM, Lam TH, Thach TQ, Hedley AJ. Will screening mammography in the East do more harm than good? Am J Public Health 2002;92(11):1841-6. https://doi.org/10.2105/ajph.92.11.1841
82. Groen EJ, Elshof LE, Visser LL, Rutgers EJT, Winter-Warnars HAO, Lips EH, et al. Finding the balance between over- and under-treatment of ductal carcinoma in situ (DCIS). Breast 2017;31:274-83. https://doi.org/10.1016/j.breast.2016.09.001
83. van der Borden CL, Stoffers S, Lips EH, Wesseling J. Avoiding overtreatment of ductal carcinoma in situ. Trends Cancer 2019;5(7):391-3. https://doi.org/10.1016/j.trecan.2019.05.005
84. van Seijen M, Lips EH, Thompson AM, Nik-Zainal S, Futreal A, Hwang ES, et al. Ductal carcinoma in situ: to treat or not to treat, that is the question. Br J Cancer 2019;121(4):285-92. https://doi.org/10.1038/s41416-019-0478-6
85. Houssami N. Overdiagnosis of breast cancer in population screening: does it make breast screening worthless? Cancer Biol Med 2017;14(1):1-8. https://doi.org/10.20892/j.issn.2095-3941.2016.0050
86. Carter JL, Coletti RJ, Harris RP. Quantifying and monitoring overdiagnosis in cancer screening: a systematic review of methods. BMJ 2015;350:g7773. https://doi.org/10.1136/bmj.g7773
87. Mandrik O, Zielonke N, Meheus F, Severens JL, Guha N, Acosta RH, et al. Systematic reviews as a 'lens of evidence': determinants of benefits and harms of breast cancer screening. Int J Cancer 2019;145(4):994-1006. https://doi.org/10.1002/ijc.32211
88. Gøtzsche PC. Mammography screening is harmful and should be abandoned. J R Soc Med 2015;108(9):341-5. https://doi.org/10.1177/0141076815602452
89. National Health Service. NHS breast screening. Helping you decide [Internet]. 2021 [cited on June 9, 2022]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1031049/BSP01_plain_text_A4_PDF.pdf
90. Klarenbach S, Sims-Jones N, Lewin G, Singh H, Thériault G, Tonelli M, et al. Recommendations on screening for breast cancer in women aged 40–74 years who are not at increased risk for breast cancer. CMAJ 2018;190(49):E1441-E1451. https://doi.org/10.1503/cmaj.180463
91. Baum M. Harms from breast cancer screening outweigh benefits if death caused by treatment is included. BMJ 2013;346:f385. https://doi.org/10.1136/bmj.f385
92. Canelo-Aybar C, Ferreira DS, Ballesteros M, Posso M, Montero N, Solà I, et al. Benefits and harms of breast cancer mammography screening for women at average risk of breast cancer: a systematic review for the European Commission Initiative on Breast Cancer. J Med Screen 2021;28(4):389-404. https://doi.org/10.1177/0969141321993866
93. Espíndola EBM, Maia LSL. As representações profissionais e suas especificidades teóricas: uma ferramenta de análise das práticas profissionais. Estud Psicol (Natal) 2021;26(2):139-47. https://doi.org/10.22491/1678-4669.20210014
94. Bleyer A, Welch HG. Effect of three decades of screening mammography on breast-cancer incidence. N Engl J Med 2012;367(21):1998-2005. https://doi.org/10.1056/NEJMoa1206809
95. Autier P, Boniol M, Middleton R, Doré JF, Héry C, Zheng T, et al. Advanced breast cancer incidence following population-based mammographic screening. Ann Oncol 2011;22(8):1726-35. https://doi.org/10.1093/annonc/mdq633
96. Puliti D, Miccinesi G, Paci E. Overdiagnosis in breast cancer: design and methods of estimation in observational studies. Prev Med 2011;53(3):131-3. https://doi.org/10.1016/j.ypmed.2011.05.012
97. Ransohoff DF, Collins MM, Fowler FJ. Why is prostate cancer screening so common when the evidence is so uncertain? A system without negative feedback. Am J Med 2002;113(8):663-7. https://doi.org/10.1016/s0002-9343(02)01235-4
98. Brodersen J, Kramer BS, Macdonald H, Schwartz LM, Woloshin S. Focusing on overdiagnosis as a driver of too much medicine. BMJ 2018:k3494. https://doi.org/10.1136/bmj.k3494
99. Hart JT. The inverse care law. Lancet 1971;1(7696):405-12. https://doi.org/10.1016/s0140-6736(71)92410-x
100. Blumenthal-Barby JS, Krieger H. Cognitive biases and heuristics in medical decision making: a critical review using a systematic search strategy. Med Decis Making 2015;35(4):539-57. https://doi.org/10.1177/0272989X14547740
101. Saposnik G, Redelmeier D, Ruff CC, Tobler PN. Cognitive biases associated with medical decisions: a systematic review. BMC Med Inform Decis Mak 2016;16(1):138. https://doi.org/10.1186/s12911-016-0377-1
102. Kahneman D, Slovic P, Tversky A. Judgments under uncertainty: heuristics and biases. Cambridge: University Press; 1982
103. Morgenstern J. Decision making in emergency medicine: we can't escape bias. First10EM 2022. https://doi.org/10.51684/FIRS.125798
104. Hofmann B. To consent or not to consent to screening, that is the question. Healthcare (Basel) 2023;11(7):982. https://doi.org/10.3390/healthcare11070982
105. Sociedade Brasileira de Mastologia. Outubro rosa [Internet]. 2021 [cited on June 10, 2022]. Available at: https://sbmastologia.com.br/outubrorosa/
106. Saitz R. 'We do not see the lens through which we look': screening mammography evidence and non-financial conflicts of interest. Evid Based Med 2013;18(3):81-2. https://doi.org/10.1136/eb-2013-101344

107. Norris SL, Burda BU, Holmer HK, Ogden LA, Fu R, Bero L et al. Author's specialty and conflicts of interest contribute to conflicting guidelines for screening mammography. J Clin Epidemiol 2012;65(7):725-33. https://doi.org/10.1016/j.jclinepi.2011.12.011
108. Wang Z, Bero L, Grundy Q. Understanding professional stakeholders' active resistance to guideline implementation: the case of Canadian breast screening guidelines. Soc Sci Med 2021;269:113586. https://doi.org/10.1016/j.socscimed.2020.113586
109. Biller-Andorno N, Jüni P. Abolishing mammography screening programs? A view from the Swiss Medical Board. N Engl J Med 2014;370(21):1965-7. https://doi.org/10.1056/NEJMp1401875
110. Swiss Medical Board. Systematic mammography screnning [Internet]. 2013 [cited on Sept. 13, 2019]. Available at: https://www.swissmedicalboard.ch/fileadmin/public/news/2013/bericht_smb_mammographie_screening_lang_2013.pdf
111. Barratt A, Jørgensen KJ, Autier P. Reform of the national screening mammography program in France. JAMA Intern Med 2018;178(2):177-8. https://doi.org/10.1001/jamainternmed.2017.5836
112. Schneider J. Mammographic screening: the beginning of the end? Rev Senol Patol Mamar 2018;31(1):1-3. https://doi.org/10.1016/j.senol.2018.03.001
113. Heleno B, Thomsen MF, Rodrigues DS, Jørgensen K, Brodersen J. Quantification of harms in cancer screening trails: literature review. BMJ 2013;347:f5334. https://doi.org/10.1136/bmj.f5334
114. Caverly TJ, Hayward RA, Reamer E, Zikmund-Fisher BJ, Connochie D, Heisler M, et al. Presentation of benefits and harms in US cancer screening and prevention guidelines: systematic review. J Natl Cancer Inst 2016;108(6):djv436. https://doi.org/10.1093/jnci/djv436
115. Hoffman RM, Lewis CL, Pignone MP, Couper MP, Barry MJ, Elmore JG, et al. Decision-making processes for breast, colorectal, and prostate cancer screening: the DECISIONS survey. Med Decis Making 2010;30(5 Suppl):53S-64S. https://doi.org/10.1177/0272989X10378701
116. Gummersbach E, Piccoliori G, Zerbe CO, Altiner A, Othman C, Rose C, et al. Are women getting relevant information about mammography screening for an informed consent: a critical appraisal of information brochures used for screening invitation in Germany, Italy, Spain and France. Eur J Public Health 2010;20(4):409-14. https://doi.org/10.1093/eurpub/ckp174
117. Spagnoli L, Navaro M, Ferrara P, Del Prete V, Attena F, Collaborative Working Group. Online information about risks and benefits of screening mammography in 10 European countries: an observational Web sites analysis. Medicine (Baltimore) 2018;97(22):e10957. https://doi.org/10.1097/MD.0000000000010957
118. Hersch J, Jansen J, McCaffery K. Informed and shared decision making in breast screening. In: Houssami N, Miglioretti DL, eds. Breast cancer screening: an examination of scientific evidence. London: Elsevier; 2016. p. 403-20. http://dx.doi.org/10.1016/B978-0-12-802209-2.00016-4
119. Forbes LJ, Ramirez AJ, Expert Group on Information about Breast Screening. Offering informed choice about breast screening. J Med Screen 2014;21(4):194-200. https://doi.org/10.1177/0969141314555350
120. Hoffmann TC, Del Mar C. Clinicians' expectations of the benefits and harms of treatments, screening, and tests: a systematic review. JAMA Intern Med 2017;177(3):407-19. https://doi.org/10.1001/jamainternmed.2016.8254
121. Varela PR, Cañada JMB, Cutillas AQ, Guerrero MG, Álvarez IE, Vera JN, et al. What do women think about screening mammography? Survey in a breast cancer screening programme. Rev Senol Patol Mamar 2018;31(1):4-11. https://doi.org/10.1016/j.senol.2017.06.001
122. Pérez-Lacasta MJ, Martínez-Alonso M, Garcia M, Sala M, Perestelo-Pérez L, Vidal C, et al. Effect of information about the benefits and harms of mammography on women's decision making: the InforMa randomised controlled trial. PLoS One 2019;14(3):e0214057. https://doi.org/10.1371/journal.pone.0214057
123. Martínez-Alonso M, Carles-Lavila M, Pérez-Lacasta MJ, Pons-Rodríguez A, Garcia M, Rué M, et al. Assessment of the effects of decision aids about breast cancer screening: a systematic review and meta-analysis. BMJ Open 2017;7(10):e016894. https://doi.org/10.1136/bmjopen-2017-016894
124. Yu L, Li P, Yang S, Guo P, Zhang X, Liu N, et al. Web-based decision aids to support breast cancer screening decisions: systematic review and meta-analysis. J Comp Eff Res 2020;9(14):985-1002. https://doi.org/10.2217/cer-2020-0052
125. Esmaeili M, Ayyoubzadeh SM, Javanmard Z, Kalhori SRN. A systematic review of decision aids for mammography screening: focus on outcomes and characteristics. Int J Med Inform 2021;149:104406. https://doi.org/10.1016/j.ijmedinf.2021.104406
126. Waller J, Whitaker KL, Winstanley K, Power E, Wardle J. A survey study of women's responses to information about overdiagnosis in breast cancer screening in Britain. Br J Cancer 2014;111(9):1831-5. https://doi.org/10.1038/bjc.2014.482
127. Hersch J, Jansen J, Barratt A, Irwig L, Houssami N, Howard K, et al. Women's views on overdiagnosis in breast cancer screening: a qualitative study. BMJ 2013;346:f158. https://doi.org/10.1136/bmj.f158
128. Rahbek OJ, Jauernik CP, Ploug T, Brodersen J. Categories of systematic influences applied to increase cancer screening participation: a literature review and analysis. Eur J Public Health 2021;31(1):200-6. https://doi.org/10.1093/eurpub/ckaa158
129. Park A. It's time to end mammograms, some experts say [Internet]. Time; 2017 [cited on May 5, 2023]. Available at: https://time.com/5050978/mammogram-breast-cancer/
130. Peintinger F. National breast screening programs across Europe. Breast Care (Basel) 2019;14(6):354-8. https://doi.org/10.1159/000503715
131. Saes-Silva E, Vieira YP, Viero VSF, Rocha JQS, Saes MO. Tendência de desigualdades na realização de mamografia nas capitais brasileiras nos últimos dez anos. Ciên Saúde Coletiva 2023;28(2):397-404. https://doi.org/10.1590/1413-81232023282.07742022

132. Nejstgaard CH, Bero L, Hróbjartsson A, Jørgensen AW, Jørgensen KJ, Le M, et al. Conflicts of interest in clinical guidelines, advisory committee reports, opinion pieces, and narrative reviews: associations with recommendations. Cochrane Database Syst Rev 2020;12(12):MR000040. https://doi.org/10.1002/14651858.MR000040.pub3
133. Raichand S, Dunn AG, Ong MS, Bourgeois FT, Coiera E, Mandl KD. Conclusions in systematic reviews of mammography for breast cancer screening and associations with review design and author characteristics. Syst Rev 2017;6(1):105. https://doi.org/10.1186/s13643-017-0495-6
134. Jørgensen KJ, Klahn A, Gøtzsche PC. Are benefits and harms in mammography screening given equal attention in scientific articles? A cross-sectional study. BMC Med 2007;5:12. https://doi.org/10.1186/1741-7015-5-12
135. Norris SL, Burda BU, Holmer HK, Ogden LA, Fu R, Bero L, et al. Author's specialty and conflicts of interest contribute to conflicting guidelines for screening mammography. J Clin Epidemiol 2012;65(7):725-33. https://doi.org/10.1016/j.jclinepi.2011.12.011
136. Armstrong D. The rise of surveillance medicine. Sociol Health Illn 1995;17(3):393-404. https://doi.org/10.1111/1467-9566.ep10933329
137. Carter SM. Overdiagnosis, ethics, and trolley problems: why factors other than outcomes matter-an essay by Stacy Carter. BMJ 2017;358:j3872. https://doi.org/10.1136/bmj.j3872
138. Gigerenzer G, Gaissmaier W, Kurz-Milcke E, Schwartz LM, Woloshin S. Helping doctors and patients make sense of health statistics. Psychol Sci Public Interest 2007;8(2):53-96. https://doi.org/10.1111/j.1539-6053.2008.00033.x
139. Baldi B, Utts J. What your future doctor should know about statistics: must-include topics for introductory undergraduate biostatistics. Am Stat 2015;69(3):231-40. https://doi.org/10.1080/00031305.2015.1048903
140. Coletivo Feminista Sexualidade e Saúde. Outubro rosa - o que existe além de câncer de mama e mamografia? [Internet]. [cited on June 12, 2022]. Available at: https://www.mulheres.org.br/outubro-rosa-o-que-existe-alem-de-cancer-de-mama-e-mamografia/
141. Pathirana T, Clark J, Moynihan R. Mapping the drivers of overdiagnosis to potential solutions. BMJ 2017;358:j3879. https://doi.org/10.1136/bmj.j3879
142. Welch HG, Passow HJ. Quantifying the benefits and harms of screening mammography. JAMA Intern Med 2014;174(3):448-54. https://doi.org/10.1001/jamainternmed.2013.13635
143. Wallis MG. How do we manage overdiagnosis/overtreatment in breast screening? Clin Radiol 2018;73(4):372-80. https://doi.org/10.1016/j.crad.2017.09.016
144. Bakker MF, Lange SV, Pijnappel RM, Mann RM, Peeters PHM, Monninkhof EM, et al. Supplemental MRI screening for women with extremely dense breast tissue. N Engl J Med 2019;381(22):2091-102. https://doi.org/10.1056/NEJMoa1903986
145. Jatoi I, Pinsky PF. Breast cancer screening trials: endpoints and overdiagnosis. J Natl Cancer Inst 2021;113(9):1131-5. https://doi .org/10.1093/jnci/djaa140
146. Treadwell J, McCartney M. Overdiagnosis and overtreatment: generalists--it's time for a grassroots revolution. Br J Gen Pract 2016;66(644):116-7. https://doi.org/10.3399/bjgp16X683881
147. Dickinson JA, Pimlott N, Grad R, Singh H, Szafran O, Wilson BJ, et al. Screening: when things go wrong. Can Fam Physician 2018;64(7):502-8. PMID: 30002025
148. Born KB, Coulter A, Han A, Ellen M, Peul W, Myres P, et al. Engaging patients and the public in Choosing Wisely. BMJ Qual Saf 2017;26(8):687-91. https://doi.org/10.1136/bmjqs-2017-006595
149. The BMJ. Too much medicine [Internet]. [cited on June 9, 2022]. Available at: https://www.bmj.com/too-much-medicine
150. Moynihan R, Barratt AL, Buchbinder R, Carter SM, Dakin T, Donovan J, et al. Australia is responding to the complex challenge of overdiagnosis. Med J Aust 2018;209(8):332-4. https://doi.org/10.5694/mja17.01138