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# The influence of health systems on breast, cervical and colorectal cancer screening: an overview of systematic reviews using health systems and implementation research frameworks

## **Abstract**

**Objectives:** Screening for breast, cervical and colorectal cancer in an average-risk population is widely recommended in national and international guidelines although their implementation varies. Using a conceptual framework that draws on implementation and health systems research, we provide an overview of systematic literature reviews that address health system and service barriers or facilitators to effective cancer screening.

**Methods:** Using a systematic approach, we searched Cochrane Database of Systematic Reviews, Ovid Medline, Ovid Embase, Web of Science, PsychInfo and other internet sources. We included systematic reviews of screening interventions (i.e. targeting people at average risk) for breast, cervical and colorectal cancer. The analysis included 90 systematic reviews.

**Results:** This review identified a multitude of barriers and facilitators affecting the health system, the capabilities of individuals in the system and their intentions. A large proportion of the available evidence focused on uptake. The reviews demonstrated that health system factors influenced participation, as well as quality and effectiveness of the service provided. The barriers with the biggest impact were knowledge/education, mainly of clients but also providers (capability barriers) and beliefs and values (intention barriers) of the eligible population. These findings complement the usual focus on psychological and social barriers to informed participation by individuals that dominate the screening literature. The facilitators with the most supporting evidence were educational interventions (overcoming capability and intention barriers), invitation letters and

reminders and appointments. These were mainly directed at eligible individuals and, to a lesser extent, to providers and healthcare professionals. Only a small number of reviews, mainly from Europe, specified organised, rather than opportunistic, screening programmes. In those, low participation was the most frequently cited barrier and invitation letters (including physician endorsement, phone calls, and reminders to non-responders and healthcare professionals) were the most prevalent facilitators.

**Conclusion:** Despite evidence of barriers and facilitators to screening participation and opportunistic screening, further health systems research covering the entire screening system for organised programmes is required.

## Introduction

The European Union recommends population-based screening programmes for breast, cervical and colorectal cancer(1), while various guidelines set out how to implement such programmes(2-6).

However, implementation varies greatly(7) and many programmes fall short of the ideal(8, 9). While much research examines the characteristics of individuals undergoing screening, there is, to our knowledge, much less focus on the characteristics of health systems that support or inhibit effective screening programmes.

In this article we report the findings from an umbrella review of existing systematic reviews seeking to identify barriers and facilitators to population-based screening that are related to characteristics of health systems. We use the World Health Organisation's (WHO) definition of health systems as consisting of 'all organizations, people and actions whose primary intent is to promote, restore or maintain health' (10). Firstly, we identify barriers that have been reported in the literature and, where possible, assess their impact. Secondly, we identify measures that have been suggested to overcome these barriers and, where possible, assess their effectiveness. Thirdly, we seek to understand the influence that these barriers and facilitators have on organised screening programmes. We use frameworks(11) that draw on theories from behaviour change(12) and implementation research,(13) including those used by Michie et al.(14) who propose 12 subthemes for investigating implementation of evidence-based practice, organized within three main themes. *Health system barriers* include availability of resources, affordability, and acceptability of health services. *Capability barriers* relate to knowledge or skills to implement effective screening programmes. *Intention barriers* relate to motivations of providers to achieve effective screening. When looking at health systems barriers we draw on two related frameworks. The first was used in previous systematic reviews of barriers and facilitators to effective hypertension management(11,

15) and considers the contribution of health system inputs, including physical, human, intellectual and social resources, on outcomes. The second is the WHO's health systems building blocks, with service delivery, the health workforce, health information systems, leadership and governance, and financing most relevant to screening(16). However, in practice, many of the barriers we identify involve a combination of elements, for example where locations are underserved by facilities, it reflects both weaknesses in service delivery and inability to recruit and retain staff.

## Objectives

We reviewed systematic literature reviews that identify, explore and evaluate barriers and facilitators to establishing effective cancer screening programmes at health system and health service level. We sought to identify gaps and make recommendations for future research. Individual cultural, psychological and social obstacles to informed participation lay outside the scope of this review.

## Methods

A protocol was registered '*a priori*' on PROSPERO, the international prospective register of systematic reviews(17).

## Search strategy and selection

We searched for relevant systematic reviews in the following databases: Cochrane Database of Systematic Reviews; Ovid Medline; Ovid Embase; Web of Science; PsychInfo; and Google Scholar. We reviewed project websites (for example, Evidence for Policy and Practice Information Centre; Health Systems Evidence; Health Evidence Network; Agency for Healthcare Research and Quality) and contacted experts participating in the EU-TOPIA (TOwards imProved screening for breast,

cervical and colorectal cancer In All of Europe) project(18), of which this research forms a part, to identify relevant grey literature. Reference lists of publications retrieved were manually searched. Selected databases were searched from 1<sup>st</sup> January 2000 to 9<sup>th</sup> June 2017 using relevant search terms (Appendix 1, online supplement). Two reviewers independently assessed the titles and abstracts of the identified publications according to pre-defined inclusion criteria (Appendix 2, online supplement) and differences were resolved by discussion.

## Data collection and analysis

Data from included systematic reviews were extracted using a predefined data extraction sheet. Fields included: authors; year of publication; objectives; selection criteria; information about barriers and facilitators; and impact on the effectiveness of screening. Authors were contacted where full texts were not available (only one responded). Data were extracted by one reviewer and checked by a second reviewer who extracted data on study design and applied the AMSTAR (A Measurement Tool to Assess systematic Reviews). Reviews were not excluded from data extraction on grounds of quality.

A narrative synthesis using the conceptual framework (Figure 1) was conducted. The heterogeneous nature of the included data precluded quantitative synthesis or formal assessment of publication bias. We collated the data for all cancer sites together but noted where items were relevant to only one cancer site. We analysed differences between organised screening programmes and other screening interventions.

## Results

### Study characteristics and quality

From 536 identified titles, 90 articles were included in the review (Figure 2). As summarised in Table 1, of the 90 included articles, 75 were in English and 15 had abstracts available in English. A summary of the characteristics of the included systematic reviews is presented in Appendix 3 (online supplement) and a list of excluded reviews is reported in Appendix 4 (online supplement). A summary of the quality of the included systematic reviews, assessed using the AMSTAR instrument, is presented in supporting information Appendix 5 (online supplement). Whilst generally of good quality, included reviews used slightly different reporting criteria to those in the AMSTAR checklist, for quantitative meta-analysis studies and controlled trials.

Drawing on the first conceptual framework, as shown in Figure 3, we found that whilst health system resources, financing and delivery were mentioned in some included systematic reviews, the vast majority were interested in 'other factors' that acted as barriers or facilitators to screening, most notably the target population's health knowledge, the effectiveness of appointment reminders, personal and cultural beliefs, and physician recommendations.

In the following sections, the second framework allows us to describe the barriers and ways to overcome those barriers in more detail using the health system, capability and intention categories, and their sub-categories, described in Figure 4.

## Barriers to effective screening

### Health system barriers

Much of the literature addresses barriers that reduce uptake of screening. These can be geographical, temporal, procedural, financial, or related to perceived quality.

Geographical barriers to services and facilities are especially important, but not exclusively so, for those in remote areas. Screening facilities were sometimes in inconvenient locations(A1-A3), involving long travel distances(A2-A4), and posing transportation difficulties(A1, A2, A5-A8).

Temporal barriers include inconvenient appointment times(A2, A5, A9), long waits before appointments were available(A1, A5), unsuitable appointment times(A3, A10), and waiting room delays(A5, A11). Delay in receiving results may reduce participation in subsequent screening or intervention rounds (A5, A12). Procedural barriers relate to problems sending screening invitations(A1, A2), limited access to primary care(A11, A13), and a variety of organisational barriers(A4, A10, A13-A15) including cumbersome administrative processes(A12,A16). Financial barriers featured in many systematic reviews, especially where many in the target population lacked health insurance or other forms of coverage(A6, A9, A11, A13, A17-A20) or among those whose insurance excludes coverage of screening(A1, A2, A6, A7, A11, A13, A14, A17, A21, A22). Some reviews also identified financial constraints affecting providers(A4, A11, A13, A23, A24), including the cost of screening tests(A1, A2, A7, A9, A11, A15), which have implications for the ability to deliver services – for example where constraints affect the ability to recruit and retain staff. Perceptions of quality also matter(A1, A25), indicated by objective measures of screening test performance(A1) or subjective patient experiences(A1, A3, A25).

Only two reviews considered inappropriate screening due to overuse(A26, A27), which is most often associated with opportunistic screening, although several reviews did highlight features of health systems that made it difficult to implement organised population-based screening programmes in place of opportunistic screening (A18, A28-A31).

In general, these reviews did not take a health systems perspective – in other words, they did not seek explanations for the reported barriers in the design of the health systems in which they were embedded. However, the findings do suggest weaknesses in relation to all the inputs to health systems and their building blocks, in particular leadership and governance, but also service delivery, workforce, and information systems.

## Capability barriers



Only a few reviews examined the knowledge of health care providers(A11, A13, A32). Instead, most of the available evidence related to the capability of those being screened, with many studies identifying lack of awareness of either the rationale for screening or how to be screened(A2, A4, A8, A9, A11, A13, A15, A17, A27, A32-35).

## Intention barriers

Multiple reviews identified a failure by providers to recommend screening(A2, A4, A8, A9, A11-13, A17, A19). Some described this as negligence(A32), while others attributed it to a lack of awareness of the need for screening(A1, A2), particularly for older adults, suggesting an implicit ageism(A21). Several pointed to inadequate communication between clinicians, providers and eligible individuals(A4, A11, A15, A18) but also, and arguably of greater concern, the spread of misinformation among the lay public(A1). These findings, and those relating to capabilities, point to weaknesses in leadership and governance, in particular poor recognition of the need to understand public knowledge and perceptions and to put in place measures to address knowledge gaps and misconceptions.

Whilst this umbrella review explicitly excluded non-health system barriers specific to individuals or particular subgroups and cultures – for example barriers related to knowledge, attitudes and practices among a target population – it was notable that these issues dominated many of the included reviews. These factors affecting informed participation, or intention to participate, are therefore summarised in the online supplementary information (Appendix 6). These factors also have implications for the leadership and governance of health systems, highlighting the requirement to put in place systems to identify unmet need and facilitate equitable uptake.

## The impact of health system barriers versus other barriers

Assessing the impact of barriers was challenging as most of the included systematic reviews reporting barriers (24 of 36 reviews) included studies using a variety of methods, not all of which could quantify impact. Those that focused on particular study designs included qualitative (4 reviews), observational (1 review), quantitative (3 reviews), and interventional studies (including randomised controlled trials (RCT) and comparative studies) (4 reviews). Hence, quantitative syntheses evaluating the impact of barriers were limited. Only the review of observational studies calculated effect sizes for different factors affecting compliance(A32).

Of the seven reviews including quantitative and interventional studies, only one described the most frequently cited barriers,(A21) while another counted the number of studies showing significant association between specific factors and screening uptake(A36).

Ten of the reviews that included mixed study designs reported the number identifying each barrier, a very indirect measure of importance. Otherwise, the importance of barriers can only be inferred from the narrative syntheses of results of included studies and author conclusions (see Supplementary Information).

Once again, most of the reviews focused on the consequences of weaknesses in screening programmes rather than causes related to the health system. Thus, many reviews sought to understand and provide reasons for non-participation, including in specific population groups (Korean Americans, Hmong Americans, African Americans, Arabic women, Latinas) or in particular countries (Asia, Africa). In general, the barriers identified as most important in the narrative reviews reflect those with most supporting evidence (Figure 3), with most attention paid to characteristics of the target population rather than the system itself. Thus, the most important barriers identified were knowledge/education (capability barriers), and beliefs and values (intention barriers) of the population. Next in importance were financing/access barriers, including characteristics of the health workforce (training and knowledge). Service delivery barriers (infrastructure and supplies) were cited to a lesser extent.

These findings point to a failure of much of the literature on screening to look upstream at the health system characteristics that contribute to uptake by the target population or to use a health systems frameworks to analyse or interpret findings.

## Ways to overcome barriers

### Health system facilitators

Some of the most frequently cited interventions evaluated as means to overcome health system barriers involved specific practical measures rather than wider changes to health systems (such wider changes might include new financing models, professional roles, or settings for service delivery). Thus, many examined measures to improve screening invitations(A37-A39), with the aim of increasing uptake(A1, A2, A5, A9). Examples included having letters(A37-A39) endorsed by a physician(A7, A40-A42), personalised(A7, A43), accompanied by a phone call(A37), or linked to special events promoting screening(A44). In addition, reminder letters and follow-up phone calls to those invited(A10, A16, A18, A23, A28, A30, A37, A40-A42, A45-A49) and reminders to physicians(A40, A47, A50-A53) were also frequently mentioned as facilitators. These reminders could be computer-generated(A50), part of a recall system(A16), chart-based(A53), or paper-based (requiring responses)(A50).

Some interventions that did take a health system approach addressed the service delivery building block. Examples included: seeking to reduce geographic barriers to screening (including reducing distance needed to travel and increasing the number of facilities per person or in an area)(A54); providing assistance with transportation(A7, A10, A55) or free transport(A42); organising clinic-based outreach services to deliver screening nearer areas with low participation(A56); offering alternative screening sites(A10); or introducing mobile screening units(A57, A58). Other aspects of service delivery examined included procedures. Improvements in this regard included having

scheduled appointment times (as opposed to open appointments, where the onus is on the recipient of the invitation to make their own appointment)(A41), flexible appointment times (for example, offering an option to change to out-of-hours or to meet individual needs)(A12, A46), more convenient out-of-hours appointments(A10), measures to decrease waiting times(A1, A25) and assistance for individuals to help schedule appointments(A45, A55, A58).

A few interventions addressed the health workforce, for example, employing staff of the same gender or minority group(A3-A5, A20). Others transferred roles to the person being screened, for example with self-sampling by post(A31, A40, A41, A48, A59-A61) where technically possible (for example, colon and cervical self-sampling).

Two interventions addressed health system financing, in terms of increasing insurance coverage(A17, A55). However, most that sought to overcome financial barriers looked at more targeted approaches,(A16, A32, A53, A62) including providing monetary incentives(A10, A30) or vouchers, or otherwise reducing out-of-pocket costs(A1, A7, A10, A47, A48, A57).

Human resource strategies featured in a few reviews, including task shifting, using nurse specialists(A10, A12, A30, A47, A49, A63, A64), screening in the community setting (lay or outreach workers)(A28, A42, A49, A56, A58, A65) and involving primary care workers (A8, A39, A43, A45, A51). The concepts of ‘patient navigation’(A29, A42, A45, A52, A55) and aiding patients to make informed decisions(A84-A86) were evaluated in several reviews.

## Capability facilitators

Some studies considered methods for facilitating improvement in provider capabilities. Ways of overcoming knowledge and skill barriers among providers included cascading of guidelines(A69), education and training(A31, A58), and measures to increase the extent to which providers recommend screening(A8, A24, A32, A42, A70, A71). A few studies examined measures to enhance

the quality of screening, including improved training of those conducting screening tests(A1, A10, A12, A25), double reading of samples(A72, A73), audit and feedback(A47).

However, most reviews focused on measures to improve uptake by those in target populations(A29, A56, A74), such as: one-to-one education(A10, A16, A23, A42, A48); mailed educational material(A18, A31, A37, A42); face-to-face or phone communication(A29, A31, A33, A52, A66, A74-A76); counselling(A18, A31, A38, A42, A63, A66, A67, A75-A77); education delivered by lay health workers(A31, A42, A57, A75, A76); multi-media information(A47, A66, A67, A76); print material(A67, A76); in-clinic education(A31); audio education materials (A67); personalised materials(A7, A29, A33); tailored information(A66, A76); small group education(A10, A16, A42, A48, A77); community-based education(A28, A58, A66); education delivered by media(A28, A42); targeted media(A10, A16, A23, A77); and mass media(A10, A16, A56).

### Intention facilitators

Measures to motivate providers inevitably addressed the health workforce building block. Examples included improving communication between primary care and other care providers(A5) and better mechanisms to enable coordination among clinicians, public health, cultural and religious organisations, advocacy and community groups(A78). As one study noted, the time and cost constraints involved in such measures need to be recognised(A32).

Again, however, most measures to improve motivation were focused on the target populations, including the linguistic(A45, A55), cultural(A47, A49, A53, A55, A58, A1, A12), socioeconomic(A62), cognitive(A49) and other characteristics(A33, A53 , A62) of individuals.

### Effectiveness of interventions to overcome barriers

The systematic reviews reporting facilitators included studies with a range of methodologies but few summarised quantitative data or sought to establish causality. Forty one reviews provided some kind of synthesis, of which 14 presented the number of studies reporting a positive effect. The lack of standardisation across the reviews – regarding the interventions tested, reported outcomes, different characteristics of the target populations, and differences in the health care organization – limited the synthesis of results. There is also likely to be overlap between the reviews of similar interventions, even though each of the systematic reviews analysed and reported the results differently. Some reviews reported factors positively influencing screening uptake without measuring effectiveness(A4, A36, A55, A78, A79).

As shown in Figure 3, much of the available evidence (focusing on systematic reviews that provide a collated summary of results rather than a report of individual studies) measuring impact on effectiveness relates to one of three measures, each directed at individuals in the target populations. These are educational interventions (overcoming capability and intention barriers)(A23, A29, A30, A36-A38, A44, A45, A48, A49, A56, A57, A66-A68, A74, A80-A83), invitation letters and reminders(A16, A18, A23, A29, A30, A36-A41, A43, A48, A49, A80, A81) (to a lesser extent, to providers and healthcare professionals(A36, A50, A51)) and measures to improve access to appointments (enabling access to the health system)(A41).

The evidence is generally supportive of educational measures(A8, A29, A30, A38, A52), particularly of education delivered via one-to-one sessions(A18, A23, A29, A48, A74, A81), peers, lay health workers(A49, A56, A57) or community interventions(A56, A65, A66, A84), telephone(A29, A36, A66, A74), decision aids(A52, A67, A68, A83), small media(A16, A23, A81), and mail(A37, A60, A66), although there are some other areas that require further investigation(A8, A36, A38). Multi-faceted interventions also found support(A29, A49, A57, A80). There is less evidence (either single reviews or mixed results) to support multi-media(A36, A66), mass media(A74, A81), special events(A44), mailed/printed materials(A36, A74), patient navigation(A45), personalised risk communication(A36,

A82) or stage-based promotion(A85), home visits(A36), tailored(A29) and group education(A48, A81).

The evidence is positively supportive of invitation letters(A36-A39), including those with general practitioner involvement(A39, A41)(except cervical(A40) or multiple screening examinations(A37)) and/or personalised letters(A43) or telephone invitation(A36, A37), client reminders(A16, A18, A23, A30, A36, A37, A40, A41, A48, A49, A81), telephone reminders(A40, A41, A49) and physician reminders(A36, A40, A50, A51). Scheduled appointments(A36, A41) and self-sampling/mailed outreach are effective(A40, A41, A59, A60, A86). In contrast, there was a paucity of evidence on measures to overcome structural health system barriers, such as removal of financial, geographical, or other barriers.

## Organised cancer screening programmes and other arrangements

The inclusion criteria accepted any systematic reviews that included population-based screening in the population at average risk and did not differentiate between organised programmes (where invitations are dispatched to all those eligible, with uptake and outcomes monitored at a national or regional level) and other approaches, such as opportunistic screening or screening at regular health check-ups. However, these approaches are quite different in their mode of operation and effectiveness. In general, population-based organised programmes are more effective than opportunistic screening in obtaining higher uptake(A39, A41) and in reducing disparities in the access to screening(A39). Thus, we examined the extent to which they are differentiated in the reviews.

Of the 90 included systematic reviews, the vast majority did not define 'screening' in terms of organised versus other screening arrangements. Only two reviews, from Italy and the UK, specified 'organised' screening programmes(A3, A41). The word 'programme' was interpreted in various ways. Systematic reviews by authors from Europe tend to use it in the sense of organised

programmes(A36, A39, A72), although it was not always clearly defined(A38), using terms such as 'community'(A37, A38) 'average risk'(A22) or 'mass screening'(A40, A51). The type of programme was also not specified in an Australian review(A4). In the USA, programmes include community-based interventions to promote uptake of screening(A56, A58, A66).

## Discussion

### Summary of evidence

This review identified numerous barriers and facilitators to effective screening for breast, cervical and colorectal cancer. The literature shows that all three cancer sites have been the subject of studies, with no one category particularly dominating. More systematic reviews examined facilitators than barriers. The overall quality of the included systematic reviews was good although it was difficult to fully assess quality using the AMSTAR scoring mechanism given the broad range of review types included, particularly qualitative reviews.

Although we were interested primarily in characteristics of health systems that impeded or facilitated effective screening programmes, and particularly things that could be done to improve the situation, it soon became clear that the literature is dominated by research on the decision by individuals to undergo screening. Barriers associated with characteristics of the health system were frequently cited, including geographical, temporal, and informational barriers. However, responses were largely confined to specific interventions to deal with particular problems, with little attention paid to health system changes that might overcome them. Such changes might include, for example, new ways of paying for services, reducing costs on the individual or even paying them to attend, as with conditional cash transfers, or new approaches to professional regulation that might support task shifting.



The majority of evidence was from the USA, where there are few organised population-based screening programmes, unlike in many European countries. Instead, target groups in the USA are mainly defined in terms of membership of a specific health insurance plan or the lack of insurance coverage. There was very little evidence on how health systems might promote equitable access to screening. We do know that organised, rather than opportunistic screening programmes are more effective in this respect(19, 20), but it is important to consider not just the screening process but the entire pathway from invitation to eventual treatment, if needed(21). Importantly, few systematic reviews differentiated studies undertaken within organised and opportunistic screening activities, although as one review has noted, even when differentiated, there is often a lack of clarity about the meaning of the term 'organised' in the context of cancer screening(22).

## Limitations

This review is potentially subject to English language and other publication bias. Whilst quality and reporting standards were generally good, some information was missing, particularly for conference posters and presentations. Moreover, reporting styles varied among reviews. The scope of this review did not include consideration of the impact of personal or cultural beliefs. These are important factors that need to be explored in depth using appropriate psychological or sociological methods. Due to the heterogeneous and qualitative nature of much of the included evidence, quantitative synthesis and statistical testing was not feasible. There is insufficient space within this paper to fully evaluate the effectiveness of each of the interventions included in the systematic reviews, given the large number and diversity of studies, populations, interventions and outcomes evaluated. This overview did not consider the impact on equity of access or cost effectiveness of facilitators to screening, although this would be important in considering the sustainability of interventions to improve screening(20).

## Implications

While the present review brings together evidence on barriers to effective screening programmes, there is a need for much more research on the complementary activities required to maximise health gain, including how to ensure that the appropriate people are invited for screening, how to reduce opportunistic screening, and how to improve follow-up and monitoring of people once they have been screened.

## Conclusion

Whilst many systematic reviews have been conducted on the topic of barriers and facilitators to cancer screening, much of the evidence is focused on the USA and on individual participation. There is a need for further research into barriers and facilitators from a health systems perspective, all along the pathway from offering screening through to follow-up interventions for those that need them.

## List of attached tables and figures

**Table 1:** Summary of included systematic review characteristics

**Figure 1:** Health systems conceptual framework for barriers and facilitators to effective cancer screening

**Figure 2:** Flow diagram of study selection process

**Figure 3:** Barriers or facilitators from the included systematic reviews organised within the first conceptual framework

**Figure 4:** Health system, capability and intention barriers or facilitators within the second conceptual framework

## Appendices (online-only)

Appendix 1 – Database search strategy and results

Appendix 2 - Search strategy inclusion criteria

Appendix 3 – Table of included systematic reviews

Appendix 4 - Excluded studies and primary reason for exclusion

Appendix 5 – Quality Assessment of Included Studies using the AMSTAR tool

Appendix 6 – Box - Individual barriers to uptake of screening

Appendix 7 – References of included reviews

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