



The
University
Of
Sheffield.

School
Of
Health And
Related Research.

Evaluation of Cancer screening and awareness programme in Leeds

Initial Report



Date: Friday 31st July 2020

Prepared for: Yorkshire Cancer Research

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1. Background

The School of Health and Related Research (ScHARR) is undertaking an evaluation of the Cancer Screening and Awareness Programme (Cancer Wise Leeds) on behalf of Yorkshire Cancer Research. The programme aims to increase cancer screening uptake in Leeds across the national breast, cervical and colorectal cancer screening programmes. The evaluation period runs from October 2019 to May 2022.

The purpose of the evaluation is to:

- Determine the effectiveness of the programme's interventions against the programme outcomes
- Assess the cost effectiveness of the programme
- Offer any recommendations that may subsequently improve the programme's delivery in the future and improve the programme's costs effectiveness

In order to evaluate this programme, ScHARR are undertaking an approach with a strong emphasis on stakeholder engagement and continuous learning cycles running throughout. We are drawing on a theory of change approach, working with stakeholders to develop a shared understanding of the system, goals, options for change and to inform priorities for action. Our evaluation is taking a systems perspective, exploring in depth the outcomes for and views and experiences of people with cancer and their families, together with outcomes relating to the workforce, and the system as a whole.

The evaluation aims to use cancer specific models for bowel, breast and cervical cancer to bring together evidence throughout the cancer pathway. This will enable predictions of clinical impact, for example cancer incidence, stage at diagnosis distribution, longer term patient outcomes including cancer mortality and quality of life, costs, resources and cost effectiveness. The evaluation also seeks to understand the pathway of change between interventions and impact, drawing on different forms of evidence to explore understandings and hypotheses regarding the way the Cancer Screening and Awareness Coordinators intervention is intended to operate in order to achieve optimal outcomes.

The Cancer Screening and Awareness Programme (Cancer Wise Leeds) has been affected by the unprecedented global Covid 19 crisis from March 2020 to the present time, and this has had inevitable impacts on the programme and its evaluation. This initial report describes the activities and progress for work undertaken in work package one of the evaluation (October 2019 to July 2020), and includes details of how the programme and the evaluation have been modified to take account of these changed circumstances.

The key activities of this work package encompassed the following four interlinking strands: (a) information from the programme metrics; (b) review of existing research evidence on the effectiveness of interventions to increase uptake; (c) review of economic evidence; (d) workshops with stakeholders.

Work completed within these different strands of the work package is detailed in the following sections.

2. Information from programme metrics

A data sharing agreement to facilitate the sharing of data relating to programme metrics from Leeds City Council to the University of Sheffield was fully executed on 21st February 2020. This agreement details the purpose of the sharing, the data to be shared and the planned provisioning of data. The planned dates for the provision of data were:

- 28th February 2020, ahead of the initial report
- 5th February 2021, ahead of the interim report
- 11th February 2022, ahead of the preparation of the final report.

Unfortunately, due to ongoing circumstances, no data has yet been supplied under this agreement. The evaluation team hope to participate in the 6th August 2020 meeting regarding the programme KPIs, arranged by Leeds City Council.

We present metrics based on publicly available data. However, publicly available data is limited and has considerable lag time.

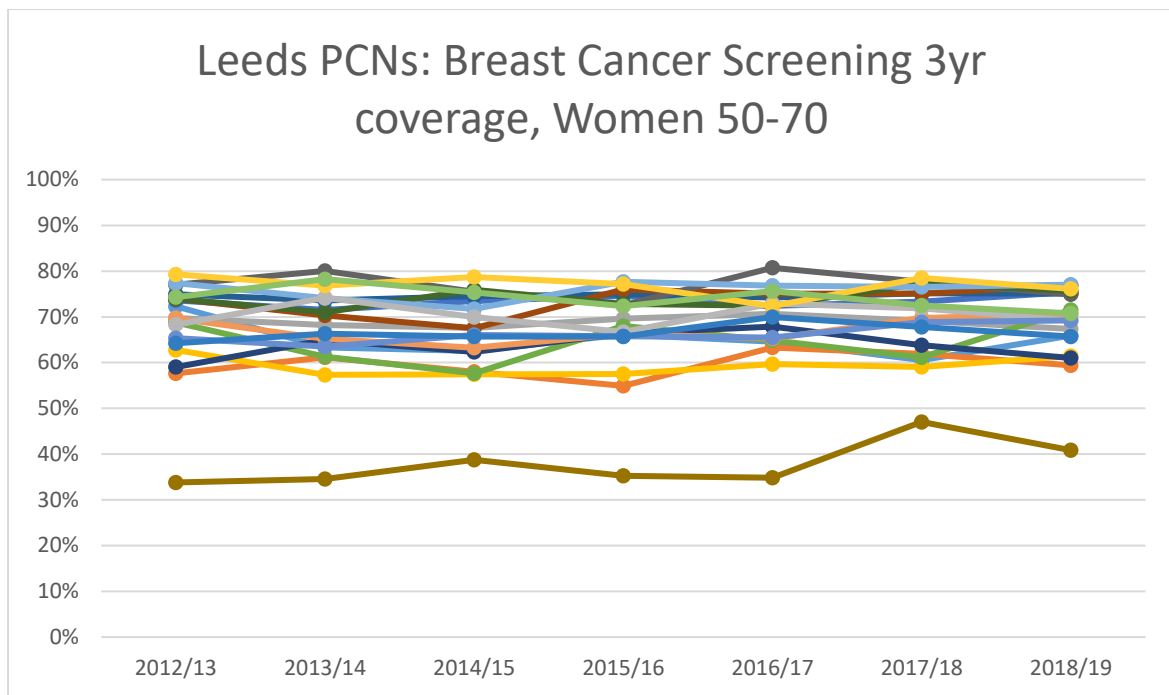
Legend

The line charts below all use the following legend:

PCN Name		
ARMLEY PCN	BEESTON PCN	BRAMLEY, WORTLEY & MIDDLETON PCN
BURMANTOFTS, HAREHILLS & RICHMOND HILL PCN	CENTRAL NORTH LEEDS PCN	CHAPELTOWN PCN
CROSSGATES PCN	HOLT PARK PCN	LS25/LS26 PCN
LSMP AND THE LIGHT PCN	MIDDLETON AND HUNSLET PCN	MORLEY PCN
OTLEY PCN	SEACROFT PCN	WEST LEEDS PCN
WETHERBY PCN	WOODSLEY PCN	YEADON PCN
YORK ROAD PCN		

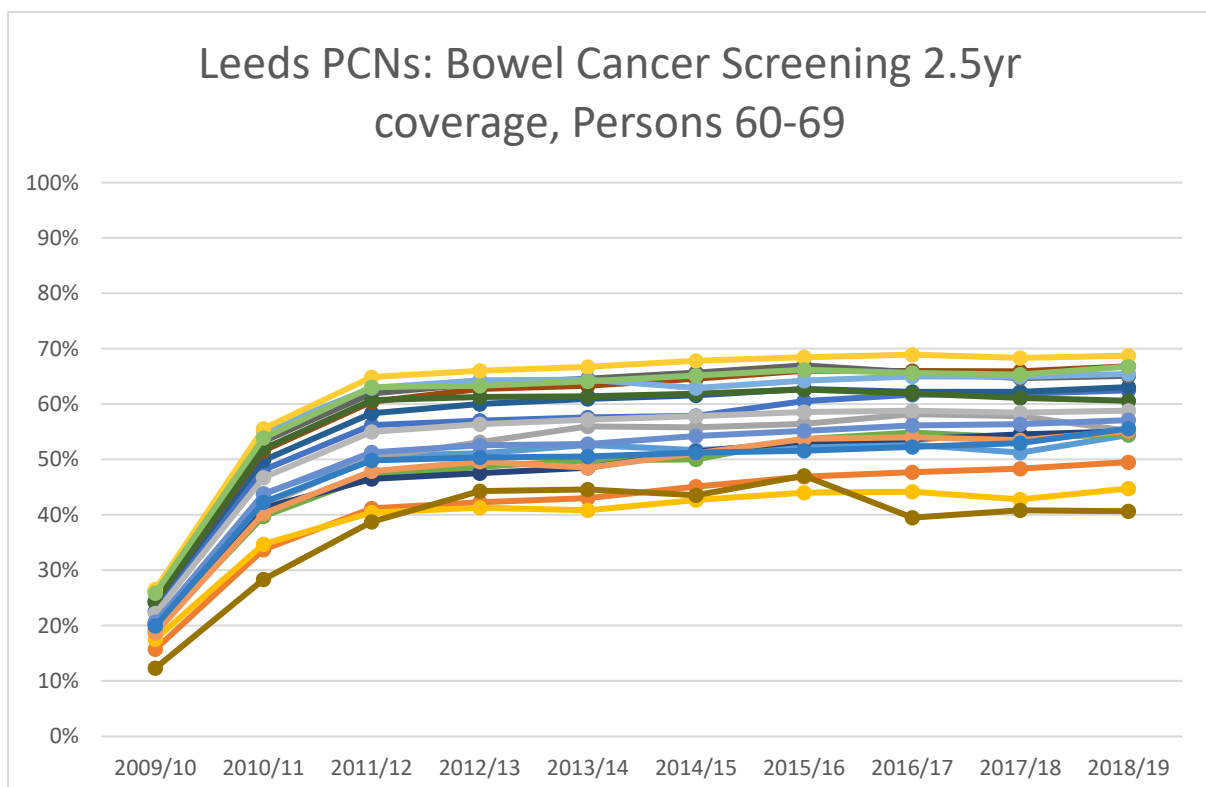
Breast Screening

Only annual data are publicly available with considerable (>1 year) lag to publication.

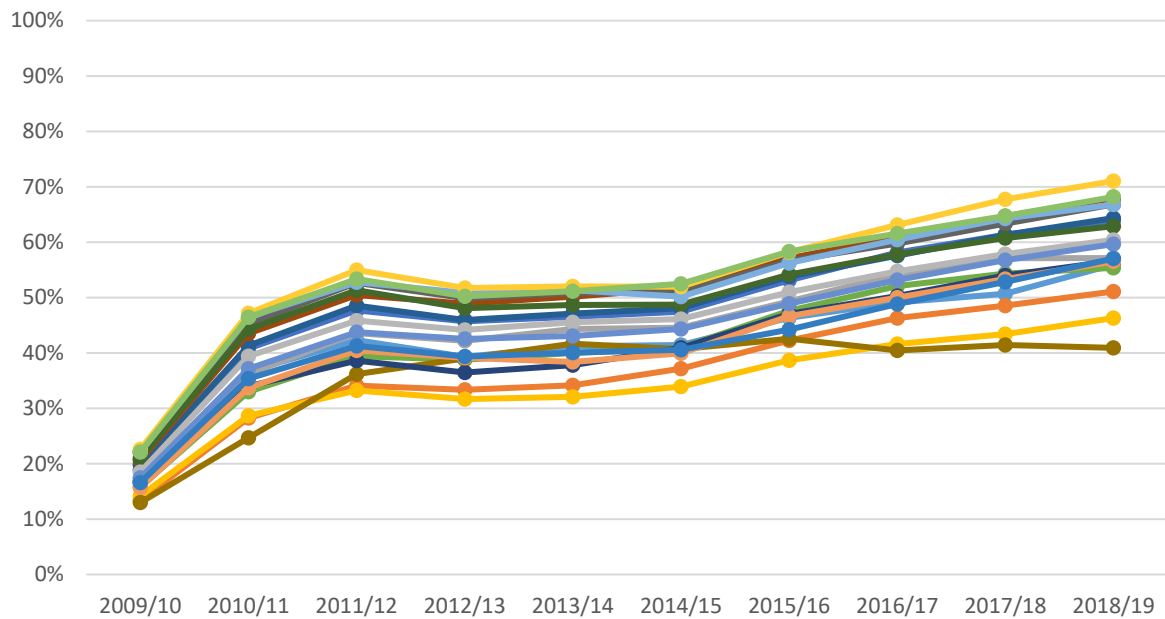


Bowel Screening

Only annual data are publicly available with considerable (>1 year) lag to publication.



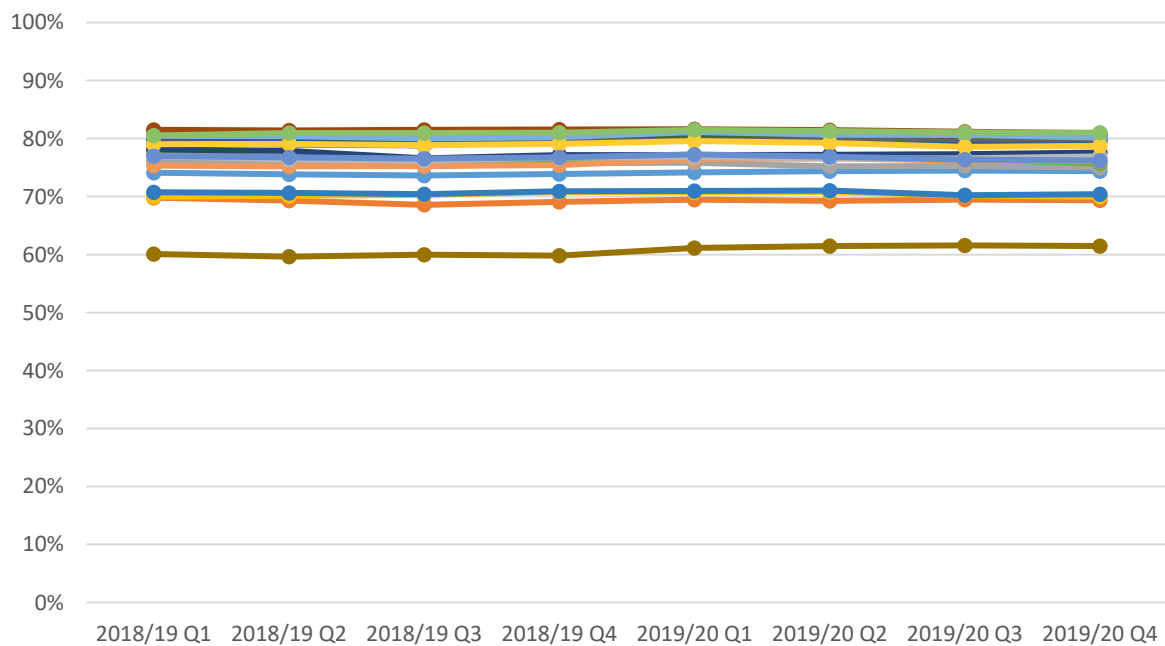
Leeds PCNs: Bowel Cancer Screening 2.5yr coverage, Persons 60-74



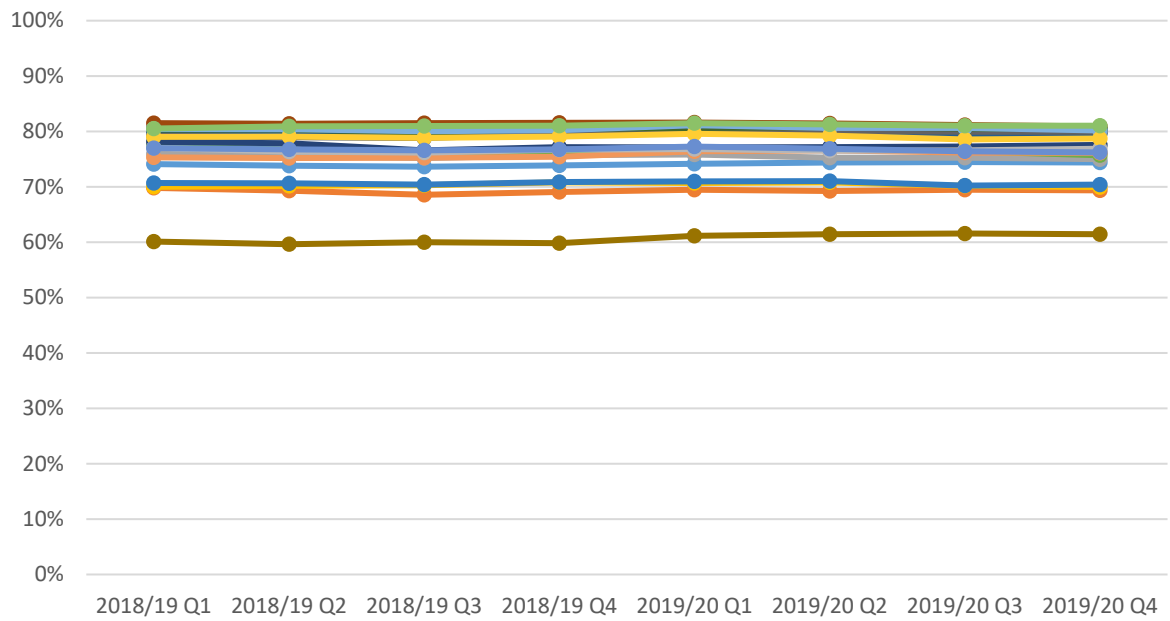
Cervical Screening

Quarterly data are available with only a two month lag to publication.

Leeds PCNs: Cervical Cancer Screening 3.5yr coverage, Women 22-49



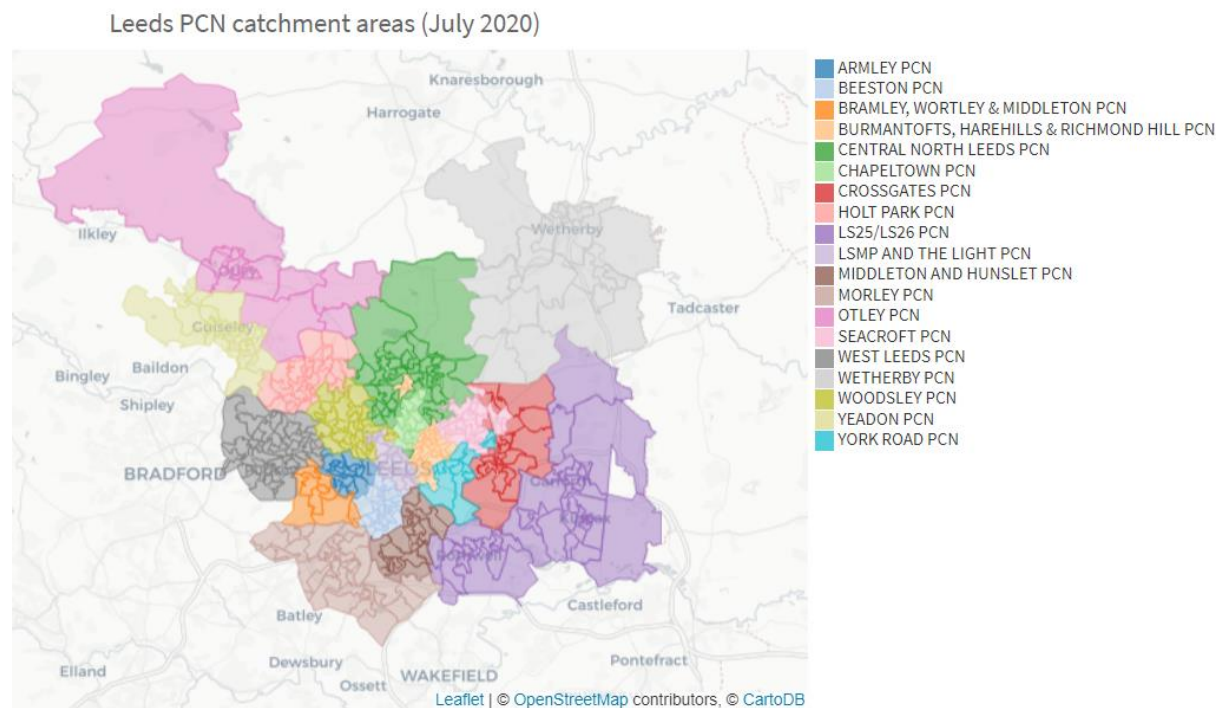
Leeds PCNs: Cervical Cancer Screening 5.5yr coverage, Women 50-64



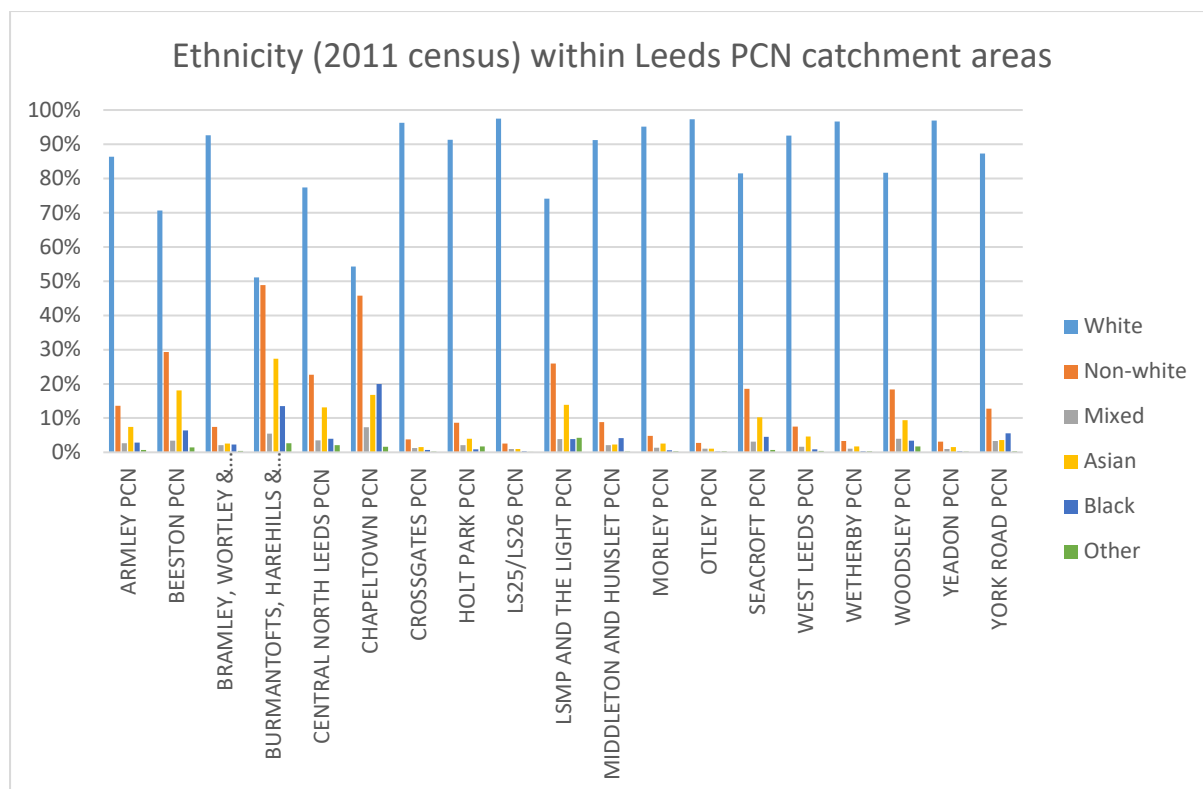
Ethnicity

In order to better understand the population we estimated catchment areas for each PCN within Leeds based on GP lists as at 1st July 2020. Using these catchment areas, 2011 census data and ONS 2018 population estimates we could better segment the resident population for each area

PCN. We recognise that these populations are not perfectly align with PCN-registered populations but in the absence of bespoke data these represent the best available estimates.



Data are from the 2011 census so may be out of date.



3. Developing a shared understanding of the role of the Screening Coordinators

To date we have carried out three workshops exploring the role of the Cancer Screening Coordinators; encompassing how and where this intervention may affect uptake in Leeds, and the effect of the Covid-19 pandemic on the role.

Workshop one: initial theory of change

The aim of the first workshop was to explore and begin to develop a shared understanding of how the screening Coordinator intervention was intended to work.

At the first workshop we began developing an initial theory of change model (figure 1), discussing with participants what the elements the Screening Coordinator role are intended to be, what the key ingredients of these elements might be in leveraging change, what might affect implementation and outcomes of the programme, what the target outcomes are for individual patients and services, and finally, what the intended impacts on population health and systems are as a result of the intervention.

We drew on available documentation about the programme to note elements within each part of the model on post it notes, and each was presented in turn for discussion and placing within an outline model (see below). Some elements of the programme were highlighted as being of particular importance (marked with a star) and other elements were queried and marked with question marks.

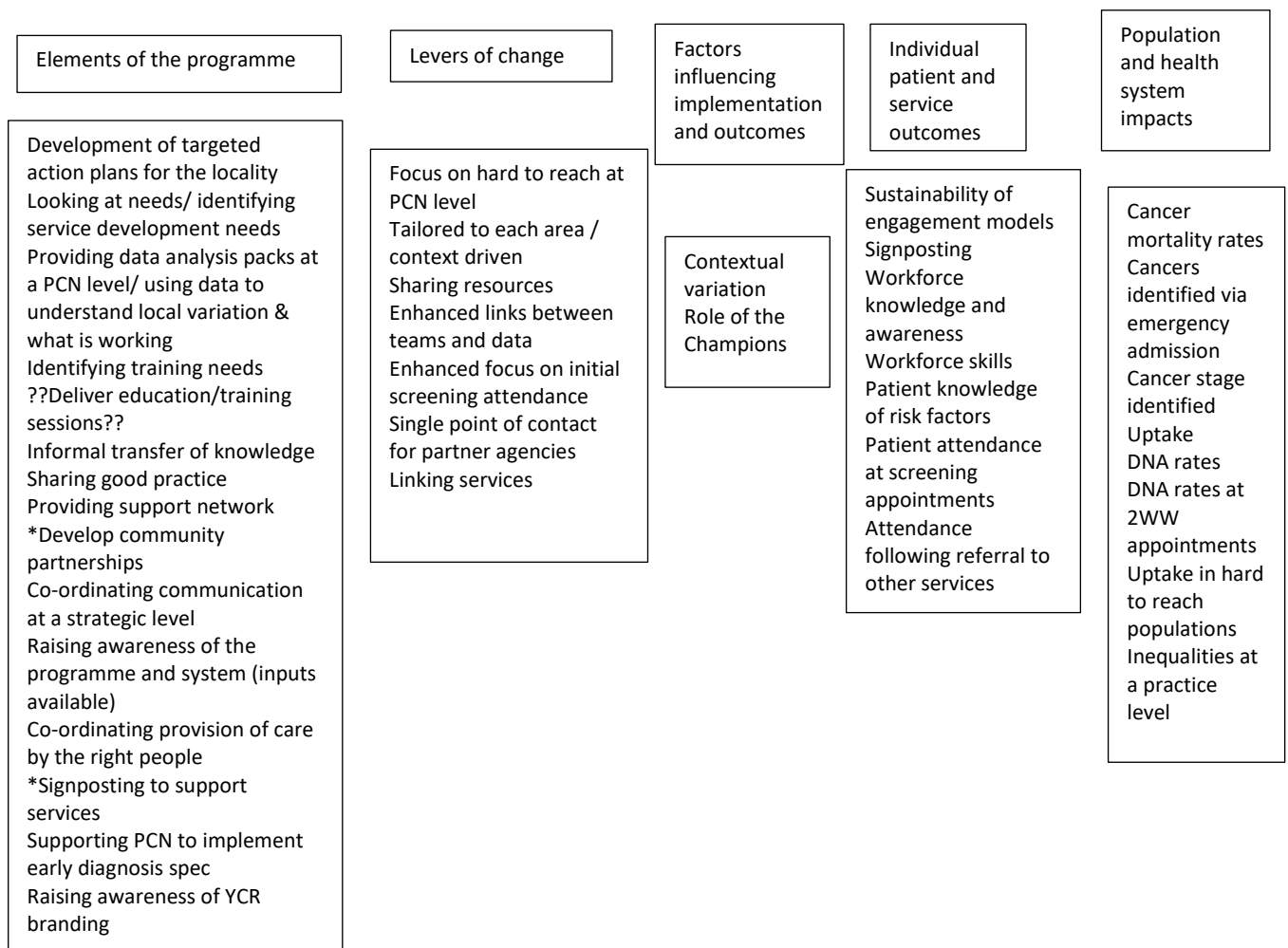


Figure 1. Initial theory of change

This model outlining the pathways from intervention to impacts will underpin further stages of the evaluation, by acting as a “start model” to enable exploration of how understandings change during the course of implementation of the programme, and as the evaluation progresses to underpin the building of evidence regarding how and what the outcomes and impacts have been, and to begin to draw associations between particular elements of the pathway.

One element of the factors influencing outcomes and impacts mentioned during the workshops was the challenge of unpicking what the Screening and Awareness Coordinator effects had been, versus the effects of other interventions which were currently in place such as the Leeds Cancer Champions. It was felt that it would be a useful next step to further explore what the Champions’ role was, and how they were operating in order to start to gain an understanding of how the two programmes might interact and act to complement each other.

Workshop two: understanding the role

A second workshop was therefore arranged with Cancer Champions on the 3rd March 2020. Two bowel screening Champions were able to attend, neither had heard of the Screening Coordinators. At this workshop we used similar methods to that above, using post it notes to record participant views and experiences of the elements of the Cancer Champions programme, the key elements that

they perceived “make the difference”, and reported factors which influenced how uptake of screening in Leeds and how effective their role was. The diagram produced from the workshop is presented below (figure 2).

For both individuals the Champion role was only a small part of their working life. As can be seen, some elements of the role varied between individuals for example one person used telephone calls to follow up whereas the other did not. The role described was more “patient-facing” than the more strategic elements of the Screening Coordinator brief detailed in the model above. Indeed, participants identified that the most important element of change was contact with patients. The other key lever of change they highlighted was increasing the ease of testing for patients. They highlighted that champions need to be proactive and opportunistic.

Barriers to uptake they identified were: personal choice; people moving away (a lot of people who are registered with the practice and then leave the country. This means they are still getting letters etc., which are not always returned); people being uncontactable e.g if they live in a shared address; a lack of understanding; a fear of finding out there is something wrong; people don’t like the test method – feel it is dirty. However, there is now an easier collection method which has increased uptake.

Perceived associations that were described were: patients having contact by phone and increasing their knowledge of cancer screening; completion of screening once and repeat uptake; having a community leader on board and increasing uptake in hard to reach groups; improving identification of cancer and a lower staging and reducing the age of screening; and funding issues which influenced what the set age of screening was.

They were asked what Cancer Screening and Awareness Coordinators could best do to help and the response was “get out there and be visible in the community. Places where people meet up, find your gatekeeper, sell it, and bring some tea and biscuits”.

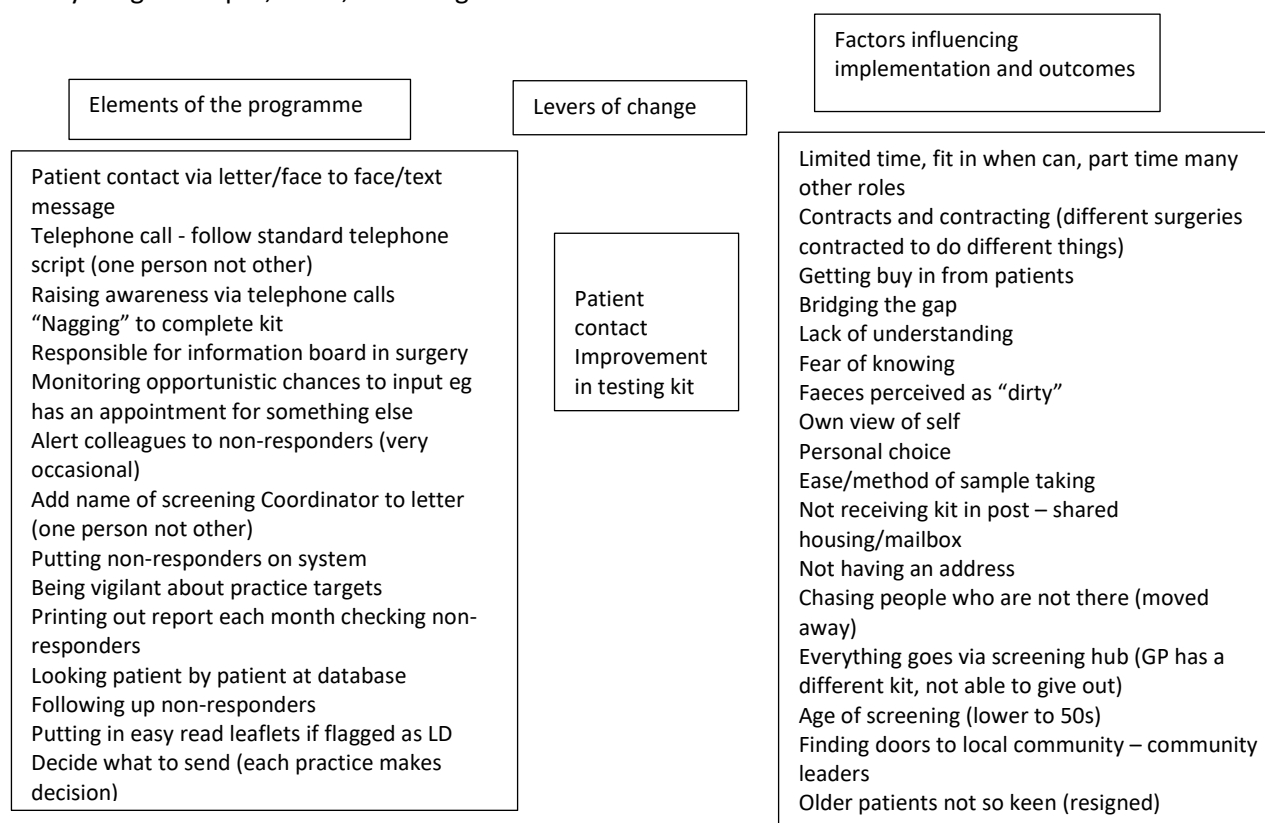


Figure 2. Workshop with Cancer Champions

Workshop three: the impact of Covid-19 on the role

The impact of Covid-19 became apparent in March 2020, and further in-person workshops became impossible. Instead, the team used webinar platforms to continue the intended workshop schedule. The role of the Cancer Screening and Awareness Coordinators had inevitably changed during the pandemic, and it was felt important to capture the changing purpose and activity to inform the evaluation. A virtual workshop was therefore held on the 28th May 2020 with the two Cancer Screening and Awareness Coordinators in post, to explore their perceptions and experiences. The following notes from the session describe where the role has remained unchanged, what differences there have been, any potential losses to the programme, and which of these changes may have long term effects on the role.

Which parts of your role have stayed the same during Covid?

- Bowel screening and breast screening have stopped, there is some cervical still taking place. Surgeries are variable in whether they are still offering any cervical.
- Cancer Screening and Awareness Coordinators continue to focus on the PCNs they were assigned and are looking at the in depth data (e.g. specific groups that haven't been attending screening). There have been some access issues with System1.
- Other PCNs have been in touch to ask what Cancer Screening and Awareness Coordinators are doing work wise – and whether they will be getting one.
- Cancer Screening and Awareness Coordinators have been looking at what resources are available – community assets, and 'virtually' attending the meetings they were going to before.

What are you doing that is different to how you worked pre Covid-19? What has the key difference been?

- The aim is now rather than increasing uptake, to get the uptake back to where it used to be, so restoring back to normality.
- It has made them review where they are. Fortunately, cancer is a priority in Quality outcomes framework, Direct Enhanced Services, Quality Improvement Framework.
- Focus on concentrating on getting the mechanisms in place for when screening starts up again.
- Supporting Champions - workshop with champions set up a peer group. So this has been an opportunity.
- Thinking differently around how they communicate with patients, publicity etc – thinking more along digital lines – rather than leaflets etc (which pose an infection control issue).
- People have been 'forced' to use communication such as Zoom, but this has made things easier as they don't have to travel to meetings. So has been a gain. People are more open to using digital means of communication than previously and now see the benefits of this. GP appointments being digital has 'pushed people on' - Providers and patient groups have had to use it. However, digital won't hit all target groups so there does need to be other methods used.
- Meeting virtually is time efficient – no travelling for meetings. Forced primary care to do virtual meetings. In the past there was a lot of push back to using digital, maybe in the future people will be open to using it more, it has pushed everyone forward with their digital skills. Can bring people in primary care together more easily via a virtual meeting.
- Given the opportunity to pause and take stock. A pause for reflection.

- Opportunity to prepare for having new staff in the programme which is very valuable. Develop resources for when they start recruiting new coordinators.
- Role has become more hands on and less strategic.
- Breathing space to enable them to do things they didn't have time for, such as looking at the recording of patient data and reviewing patients who are no longer at the practice (ghost patients).
- An opportunity to go through all the resources they have – look at what is happening on social media, which groups are active etc.
- Opportunity for PCNs to work together and perhaps offer a joint clinic for cervical screening. Some practices have had less capacity to undertake screening. So there may be inequality across the PCN – some patients may not be able to access just because of the practice they are registered at. So how they may want to work together to overcome this. The exploration of joint clinics has raised the issue of capacity across teams as it has brought staffing inequalities sharply to the fore.

Are there potential losses to the programme and its outcomes from the changes?

- Unable to go into practices at the moment. So missing out on the opportunistic conversations they would have in practices, a lack of corridor conversations.
- This can be applied to the community – community café can pick up local information so missing being in the communities.
- Can't do paper or flyers, so there is a missed group
- Re cervical screening – it is currently up to practices what they want to offer so there is variance across the city – some are doing no screening, some just the high risk women and some anyone can come in.
- Biggest loss is not being able to achieve the initial aim of project i.e. to increase screening uptake and will be struggling to restore back. So not able to achieve this. Maybe look at increasing uptake in certain groups.
- The barriers that are now having to be considered now are different to pre Covid e.g. access to PPE, how many patients can be seen. Previously it would have been about the barriers of working together.
- A loss for patients has been that it is harder to access primary care, the only booking system is not happening any more, people are now used to using online systems.
- Online booking for cervical screening making it easier to book appointments but since covid can't book anything online as they have to triage everyone. Which is a loss for patients and could be something that isn't restored.
- Additional barriers potentially for patients – car park, ring us – some with no phone – inequalities. Also locations for clinics, unless you have a car you can't get there.

Will this change your role?

- Initially, Cancer Screening and Awareness Coordinators role was less hands on, originally not seen as a practical resource, more coordinating/strategic. Early on encouraged to coordinate but now more hands on practical resource e.g. with the champions. Coordination role is still there but may just be more hands on / contacting patients etc.
- A key part of the role is about having knowledge of assets across Leeds, and bringing it all together. The coordinator role is therefore still there despite the changed circumstances.

Are there particular activities you are doing now you think should be continued/discontinued after Covid-19?

- Working with champions and having that peer group. The role of the champions and Cancer Screening and Awareness Coordinators has dovetailed more recently, the champions programme contract is due to end soon and may not be renewed. Exploration of how their role could 'dovetail' into the champions role. This has not been commissioned as yet
- Role has been about feeding needs into the system, and ensuring that services were keeping things sustainable.
- Use of digital methods of communication and also using data to determine how we look at restoring the programmes – and whether you want to do things differently depending on what the data is showing. Investigate whether GPs want to use this opportunity to come together within a collaborative hub and do they want to use the data to decide where the hub should be located – e.g. in areas of higher deprivation.
- Covid has brought different organisations together to work together – e.g. LCP who have other health and social care, third sector in their representation, so have come together as a common cause, which moving forward may be replicated with other things that come to the LCP. Opening doors.
- There is the opportunity for everyone to work the same way as before or for the GPs to come together and change, an opportunity to look at services afresh and consider whether they meet all patient's needs.

4. Developing a shared understanding of the screening pathways

A shared understanding of the screening pathways was developed through an iterative process. Firstly, the three economic modellers constructed draft pathway diagrams for each of the cancer screening pathways based on their own knowledge of national screening pathways and national publications that they were already aware of. They also developed a set of clarification questions relating to each pathway. Following this, the draft pathways and clarification questions were sent to stakeholders in Leeds for their response. Pathways were updated with additional information from stakeholders, and from further publications signposted to by stakeholders. Finally, a workshop was carried out (see below) in which pathways were presented and local variation in pathways and points for intervention were discussed. Screening pathways were then updated again in response to the workshop. The finalised screening pathways together with clarification questions, local variations specific for Leeds and links to all data sources used are available in the Excel document 'Screening Flow Charts – all Cancers' (Appendix 1).

Workshop four: presenting the pathways and obtaining feedback

A virtual workshop was held with key stakeholders on the 29th April 2020 (Appendix 2) to explore understandings of the cancer screening pathways in Leeds and any potential variation between National and local practice and any particular factors affecting implementation in local areas. Nine individuals were able to attend, representing the Cancer Screening and Awareness Coordinators currently in post, and leads for projects and programmes in Leeds.

Overall questions for the workshop were:

- Do the pathway descriptions for each cancer reflect the current implementation in Leeds? What is different? Are there any details of implementation to add?
- Which paths are likely to be affected by the work of Cancer Screening and Awareness Coordinators and how?
- How is information on non-attendance on each step of the pathways delivered to the primary care facility/local GP practices and how they might intervene at each step?
- Each pathway was presented in turn by the lead member of the ScHARR team with reactions and responses sought. After the workshop the notes made (Table 1) were circulated to those present to check that understandings and responses had been recorded correctly.

Table 1: Workshop notes and clarifications

Pathway	Questions	Responses	Clarification/additional comments
Breast	Besides the official literature is there anything sent out from Leeds GP practices?	P1: Nothing aware of	
		P2: BSU send out 1 initial invite then if the woman does not attend they send out another letter. They are not sent any reminders, just appointments	
	Slide 1: What other parts on this slide are affected by screening coordinators?	P1: Could be going forward that practices look at whether they send a reminder letter if they are notified of a non-responder – is a potential for this pathway.	
	Slide 2: Is this part of the pathway accurate and does it reflect what is happening in Leeds? Do Cancer Screening and Awareness Coordinators impact on this part of the pathway (if there is a positive test/confirmation of the diagnosis)	P3 The Cancer Screening and Awareness Coordinators role would be around awareness raising of the screening programme. P4: Agree with P3	
	How information on non-attendance on each step of the pathways is delivered to the primary care facility? How frequently? How the practices intervene here now?	P2: All routine results are sent to GPs on a weekly basis. This is within 2 weeks of the woman attending their appointment. Any women who are recalled once the assessment is completed will get the full assessment letter once the results are known. For any woman who does not attend, the GP is only informed of this once the woman has not attended for the 2nd time. Once the GP is informed of a woman who has DNA'd they could follow up on these women.	

		P1: We don't do anything in terms of follow up. It is noted on the system and that is as far as it goes.	P1: Practices I've spoken to don't do any follow up (not spoken to all the practices in PCN). Practices review report from Leeds Breast Screening Service and ?code non-attendance on to the practice system.
	Is there potential to intervene?	P1: Potential is there before the invitation is sent out to let women know that the screening round is going to be happening. Flag on the system etc so they could follow up if they wanted to.	
		P3: Yes there is absolutely potential to intervene at this point but depends on capacity etc. P5: Breast and Bowel all nationally organised. GPs have no contractual incentive. Could intervene, but this needs to be a local initiative organised by the CCG.	
		P4: Yes there is potential. I would agree too.	
	Other notes	Confirmed Leeds is participating in the NHS trial with participants from age 47 years	
Cervical	Slide 1: Taking us from the invitation list to screening appointment What are GPs currently doing and what can be done in relation to the 3 rd invitation and chasing up non-responders?	P4: From Workshops and speaking to Champions a mix of notification is used - text or letter or call.	
		P3: The follow up activity varies by practice to practice, there is no coordinated response at the moment. Although the Screening Champion programme has attempted to develop some best practice principles.	
		P1: Screening champions are not within all practices across Leeds, so there is some variance.	

		P5: Not all practices do something because they don't have to. Need to tackle this in Leeds at CCG level. To be able to track these women. Not contractually obliged to contact women.	
		P6 As part of QOF contract, GP practices are responsible for the 3 rd invitation (first two are done centrally). Women should be contacted 3 times. (link to guidance: england.nhs.uk/wp-content/uploads/2019/05/gms-contract-qof-guidance-april-2019.pdf).	<p>P6: My understanding is based on the following guidance: https://www.england.nhs.uk/wp-content/uploads/2019/05/gms-contract-qof-guidance-april-2019.pdf</p> <p>The web link provided outlines the GP QOF contract, please refer to pages 118-119 for clarification on the number of contacts and the preferred contact method. The contract specifies that women should be contacted 3 times for smears'</p> <p><i>Excerpt from guidance</i></p> <p><i>Invitations for cervical screening</i></p> <p><i>As noted above, the requirement for women to be invited on three separate occasions will continue in line with national screening programme requirements.</i></p> <p><i>Therefore:</i></p> <ul style="list-style-type: none"> <i>• In those areas where the first two invitations are sent via the central screening service, then contractors are responsible for offering the third invitation, or</i> <i>• Where the central screening service sends out only one letter, then contractors are responsible for offering the second and third invitation.</i> <i>• Where contractors have opted to run their own call/recall system then they are responsible for making all three invitations.</i> <p>As practices in Leeds have 2 letters sent from a central screening they are responsible for sending the 3rd. To identify the non-</p>

			<p>responders practices should be working though the FNR list within OE and follow up 1 final time with the patient to invite them for screening. Once this has been done the practice can code Excepted from cervical screening quality indicators - no response to three invitations (finding)' (1109911000000100). This code is built into the cervical smear QOF reports, once added the patient will be removed from the QOF missing patients lists for either 3/5yrs depending on their age.</p> <p>Some of the practices work from the QOF missing patients list instead of OE, this list identifies all patients that are eligible for smears however have not had one within the specified time period, from speaking with practices participating in the cervical screening programme, the majority of those that ran their own recalls from QOF also sent the patients 3 invitations (despite patients already receiving 2 from CSAS. In addition to this, there were also practices who followed the OE process, however also sent 3 invitations out from the practice with the aim of retaining/improving their smear figures.</p>
		P5: There are different guidelines which needs looking into.	
	Where do you see the role of the Cancer Screening and Awareness Coordinators in this part of the pathway?	P1: Similar to breast with input prior to women being invited and input when they don't respond. For example, one practice contacts women when they are coming up to 25 th birthday. So there is scope to work here. Include local text in the cervical letters.	
		P3: I think there is a key role for Cancer Screening and Awareness Coordinators in establishing 'best practice' for the 3rd point of contact. And to support practices to adjust how this contact is made based on the patient.	
		P4: Agreed with P1 and P3	

	<p>Slide 2: Following on from the appointment Attendance at colposcopy is high (90%) <i>based on data from a study looking at colposcopy attendance and deprivation using data from the East of England (Douglas et al 2015).</i></p> <p>Is there scope to involve Cancer Screening and Awareness Coordinators here?</p>	No comments to this question	
Bowel	<p>Slide 1: FIT Is there scope for local differences (information) at time of invitation? Is this currently happening in Leeds or could it happen?</p>	P1: No local information as far as she is aware. Other than pre 60 letter (for people about to start FIT screening) if they are on the Cancer Champions scheme, a letter is sent out.	
		P4: My practice puts the GP signature on the pre 60 letter (personalise it).	
		P6: Not all practices in Leeds are doing this.	
	Reminders for those not returning kits – is this central or is there potential for local at this point and is this something where Cancer Screening and Awareness Coordinators could have a role?	P1: Cancer champion scheme does up to 3 follow ups and it is personal choice how they send the contact. Could be by letter, text, phone call, flags on the system, opportunistically talk to patients if they are in practice for something else. Potential to look at how effective these methods are.	<p>P1: I'm not 100% sure if the screening hub in Newcastle sends out a reminder – I'll have to double check if we have any info on that from practice champion workshop slides.</p> <p>My viewpoint is that there is a role for Cancer Screening and Awareness Coordinators to look at the use of local reminders – both how effective one currently used are and for practices not currently using them.</p>

			<p>There have been reminders sent from some practices across Leeds who are contracted to do so under local cancer champion scheme. I think this is 48 practices with high deprivation scores.</p> <p>P1: A flag can be applied that allows staff to see that a patient is a bowel screening non-responder. Staff member may then have an opportunistic conversation whilst patient is in contact for other care. My understanding is that this opportunistic intervention can also be coded on practice system.</p> <p>P1: This is SystemOne for my practices. EMIS practices may be able to do the same however I'm not sure of this – Anna Bainbridge could probably answer that. There's not many practices in Leeds on Emis.</p> <p>P1: Leeds CCG has previously invited some practices to participate in bowel cancer champion scheme contract-at least last two years. The practices who take up that invitation are obliged to contact non-responders up to 3 times, 4 weeks between each contact. The practices run reports every 4 weeks/monthly to determine who is a non-responder and how many follow ups they've already had. Once a non-responder has been contacted 3 times, if they still haven't responded 2 weeks after the 3rd contact they are taken off the practice reports for follow up. The practice decides which contact methods they wish to use.</p> <p>We are expecting this contract to continue, however, I think due to COVID it may been put on hold.</p> <p>P1: Attached a document with this clarification email detailing her understanding of correspondence with patients in Leeds.</p>
		<p>P6: Once the hub has identified a person as a non responder it comes through as pathology link, code is added and the practice then knows who hasn't responded. How many contacted and how many need contacting. Practices can identify reasons patients are not responding – e.g. if English not first language and they have not understood.</p>	

		P3: I suppose it's worth clarifying that GPs on the Screening Champion programme do receive additional funding for being part of the programme, so this would need to be considered if we were going to ask practices outside of the programme to start making additional contacts	
	Is there an area for potential intervention where people do not attend the clinic appointment following a positive result or when they are referred to CTC or colposcopy?	P1: Personal understanding is that this is not currently in the scope of the Cancer Screening and Awareness Coordinators project	
	Bowel Scope Pathway Are all practices in Leeds live, or is there variation in those that have BSS or those that don't?	P1: There are 54/96 live practices in Leeds. No further information	
		P4: I have no local information on my practices	
	Is there any local variation in the appointment letter, information sheets and areas where Cancer Screening and Awareness Coordinators could intervene in? Are there significant differences for the Bowel Scope pathway compared with the FIT pathway or is it likely to be the same? Where is local intervention likely to happen?	P1: There is potential within the project. It has been mentioned at champions' workshops. GPs receive notification if patient hasn't responded to screening. Up to the practices.	

		Focus of programme is the FIT pathway but the Bowel Scope pathway is included in a workshop to make practices aware of it so they don't confuse it with the FIT pathway.	
	Is there scope for Cancer Screening and Awareness Coordinators to pick up on this?	P1: This needs clarification	
General comments on the pathways		P3: As P5 has indicated, there is a lack of clarity in GPs responsibility - I imagine this will be especially the case for Practices that are not part of the Champion programme.	
Breast		P3: I think it's worth stressing again the variety that exists at local levels and that this is often driven by the key member of staff in practices. As staff members change, the practice's approach can also change over time.	
		P1: Agrees with P3.	
		P4: Some put the GP signature on prescriptions, a named person. Depends on different practices and who is doing the work.	
Cervical	The national invitation letter allows for locally relevant information to be included. Is this done in Leeds?	P1: Not aware of any local information going out with the national invitation.	
Clarification	How do the Health Partnerships Team (HPT) fit in with Local Care Partnerships (LCP)		<p>The role of the HPT is to implement the Health & Care Plan on a city wide level and to facilitate services working together on a strategic level.</p> <p>The LCPs deliver the strategic ambition of the HPT.</p>

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5. Economic evidence

Breast screening

Is breast cancer screening cost-effective and beneficial to health?

We used a systematic review of reviews on cost-effectiveness of breast cancer screening (BCS)¹ and a narrative review of recent (<5 years) UK modelling studies to answer this question. Overall, screening with mammography was cost-effective in the age range 50-69 years in high-income countries comparing to no screening, though there are no consistency in studies whether screening of older or younger age groups is cost-effective¹. Two recent modelling studies assessed cost-effectiveness of BCS in the UK. While they applied different analytical approaches, their conclusions on cost-effectiveness of the current screening program (once in three years for 50-70 year olds) was similar - BCS moderately likely to be cost-effective at a standard threshold of £20,000 (Table 1). Both studies concluded that cost-effectiveness of BCS can be improved by proposing more screening to higher-risk women while decreasing (or not offering) screening to women of lower risk^{2,3}.

Table 1: Modelled lifetime incremental cost and health benefits of breast cancer screening compared to no screening per person in the English population.

Modelling study	Modelling	Scenario	Incremental Cost (£ per person)	Incremental QALYs (per person)	ICER (costs per QALY)
Pashayan (2018) ²	A life-table model	current screening program vs no screening	115	0.005	£21,854
Gray (2017) ³	A decision-analytic model (discrete event simulation)	current screening program vs no screening	408	0.018	£23,197

QALY = Quality-adjusted life year; ICER = Incremental cost effectiveness ratio;

How does uptake of screening and follow-up differ by subgroup?

A literature search for original and secondary evidence was carried out in Medline via Pubmed to identify information about uptake of screening and follow-up in different population subgroups in England.

Deprivation and screening uptake

The two original most recent studies conducted in England report 8-10% lower uptake among the most versus the least deprived groups (Table 2). Though a systematic review of the association between area-level deprivation and BCS uptake in Europe, including 4 studies from the UK ⁴, suggested that in the UK there is a reduction in area-based screening inequalities from the years 2007–2008 to 2012-2013 ⁴. The international evidence supports the conclusion on lower BCS participation rate among deprived groups⁵⁻⁷, with deprivation status defined by deprivation area, levels of education, income, the absence of health insurance and unemployment.

Table 2: Uptake of breast cancer screening in relation to socioeconomic deprivation

Factor	Subgroup	Unadjusted uptake	Adjusted odds ratio* (95% confidence interval)	Locality, date	Reference
Socioeconomic deprivation category (England)	Whole population (within 6 months of their invitation)	75%		England (2012–13)	Douglas (2016) ⁸
	1 (least deprived)	78%	1		
	5 (most deprived)	70%	0.90		
Socioeconomic deprivation category (London)	Whole population (within 6 months of their invitation)	61%		London, 31 March 2006 and 31 December 2009	Jack (2016) ⁹
	1 (least deprived)	66%	1		
	5 (most deprived)	56%	0.89		

Ethnicity and screening uptake

Similar reduction in inequalities in BCS uptake is observed among ethnic minorities¹⁰. For instance a difference in BCS uptake between South Asians and non-Asians in the UK was initially 60.8% vs. 75.4% (round 1 in 1989) and later 66.8% vs. 77.7% (round 5 in 2001-2004)¹¹. Thus, the disparity reduced gradually over time, alongside an overall trend of increased uptake. Moreover, the strength of any link between deprivation and screening uptake is less evident in the South Asian population¹¹. The rate of later-stage presentations in Asian women in the UK (previously similar to Black women) are now similar to those of White women¹⁰. Black minorities reported to have a lower uptake rate with 45% of black minority ethnic women of screening age have never attended screening in the UK¹².

Other factors and screening uptake

From the other factors influencing BCS behaviour in the UK, age and road travel distance of more than 10 km increase were negatively associated with uptake ^{11 13}, though these data are outdated.

The other factors attributed to lower participation rate on international level were low societal participation⁵, obesity, diabetes or other chronic comorbidities^{6 14 15}, and living in rural areas⁷.

How do the cost-effectiveness and health benefits of screening differ by subgroup?

A literature search was carried out to identify information about cost-effectiveness of screening in different population subgroups in England. No cost-effectiveness study was identified which defines this research question as the main study objective.

The trial- based evaluation of a mobile mammography (MM) program to increase participation in BCS and reduce geographic and social inequalities in France reported incremental cost-effectiveness ratio in subgroups per additional screen⁷. De Mil et al (2019) concluded that choice of attending BCS at mobile MM unit or radiologist's office was more cost-effective for women living more than 15 km away from a screening centre compared to those living less than 15 km (ICER €289.57 vs €923.07 per additional screen), as well as for women living in the most deprived areas (ICER €347.92 vs €15 235.47 per additional screen). This difference in cost-effectiveness was related to differences in uptake between the intervention group and the control: for instance, the increment in more deprived groups was 6-7% vs negative -2% in the least deprived groups, and the increment in groups living more than 15 km away was 7-10% vs close to zero among those who live on a distance 5-15km⁷.

No information on cost-effectiveness by other subgroups, such as ethnicity, was reported. We did not identify any information how costs of BCS differ by population subgroups.

To understand the direction of cost-effectiveness by these population subgroups, we analysed variability in clinical factors defining cost-effectiveness: advanced breast cancer (BC) detection, BC incidence, and BC mortality.

Incidence of breast cancer by deprivation

The data on incidence of BC by deprivation is outdated and so should be treated with caution. There is higher BC incidence among least deprived than more deprived groups in Scotland (1991 - 2000)¹⁶. The similar trend is reported by different government office regions in England¹⁷. These results are similar to another study reporting that in contrast to other cancers, BC incidence was highest in the least deprived groups with modest differences between socioeconomic groups (RR 0.84 95% CI: 0.82–0.85)¹⁸ (Figure 1).

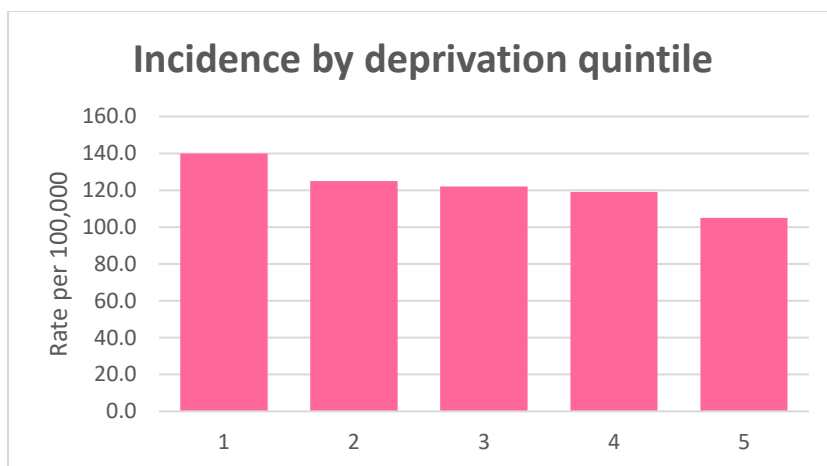


Figure 1. Incidence of breast cancer by deprivation

Incidence of breast cancer by ethnicity

The study of National Cancer Registry for England at the Office for National Statistics (ONS) on 3,230,279 persons diagnosed with a malignant neoplasm between 1986 and 2004 compared the incidences of cancer among South Asians to non-South Asians¹⁹. While incidence rose for BC over the period 1986–2004, it remained substantially lower among South Asians¹⁹. The incidence of BC was higher among affluent groups in both Asian and non-Asian groups¹⁹.

Another retrospective cohort study of personal data from the Scottish Census and NHS, and clinical data age standardised annual rates per 100 000 population/year by ethnic group came to similar conclusions²⁰. In comparison to White Scottish, lower Age adjusted risk ratio was reported for most of the ethnic subgroups (except “Other White British”, “any mixed background” and “Other ethnic group”). Meanwhile the confidence interval was significant for White Irish (RR 84.7 95%CI [78.1 to 91.9]) and Pakistani (RR 61.5 95% ci [51.7 to 73.1]) only. The relative risks of breast cancer incidence in other subgroups were the following: South Asian - RR 78.4 95%CI[59.0 to 104.3], Chinese 73.6 95%CI [49.5 to 109.5], and African 87.1 95%CI [63.9 to 118.7]²⁰.

The report of the Cancer Research UK “Cancer incidence and survival by major ethnic group, England, 2002–2006”²¹, suggests significantly lower rates of age-standardised incidence of BC among non-White ethnic groups for all ages (Figure 2). For example, ASR among White women (as known) reached 123.7 and in Asian 80.3 per 100,000. The similar trend was observed for population older than 65 years, with higher incidence among White (360 per 100,000 women) than other ethnic subgroups (213, 244, 147, and 208 per 100,000 women of Asian, Black, Chinese, and Mixed ethnicity respectively).

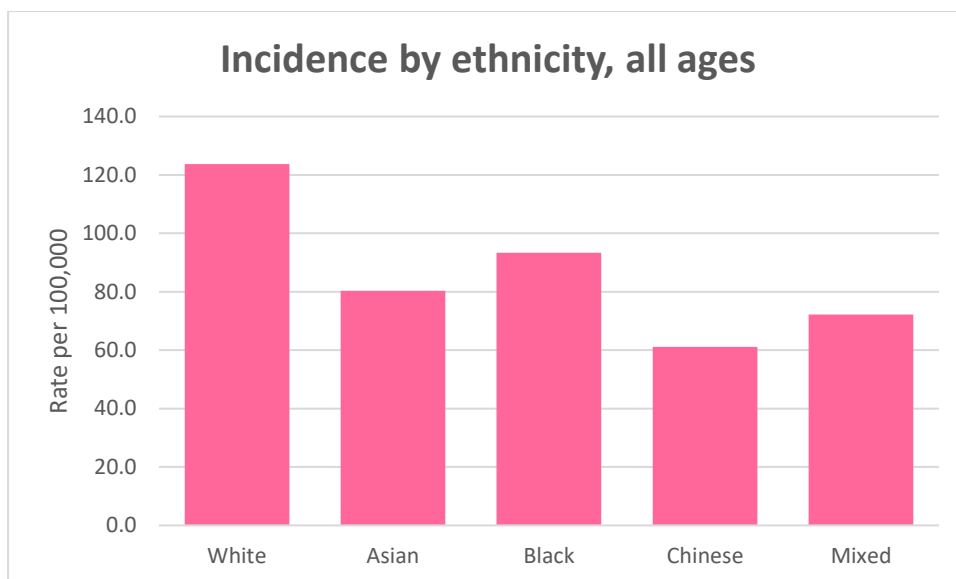


Figure 2. Incidence of breast cancer by ethnicity

Advanced cancer and mortality by deprivation

Women from the most disadvantaged areas had higher adjusted odds (OR 1.23 [95%CI 1.13, 1.32]) of advanced disease than those from least disadvantaged areas, with no evidence this association had changed over time. Living in less accessible areas independently increased the adjusted odds (OR 1.18 [1.09, 1.28]) of advanced disease, with some evidence that the geographical inequality had reduced over time²². The data from the East of England (2006–2010) also confirm that affluent women were less likely to be diagnosed in advanced stage of BC. The authors though concluded that “eliminating differences in stage at diagnosis could be expected to nearly eliminate differences in relative survival for women in deprivation groups 3 and 4, but would only approximately halve the difference in relative survival for women in the most deprived group (group 5)²³.”

Advanced cancer and mortality by ethnicity

An analysis of 86 852 BC records for women resident in England and diagnosed during 2012–2013 showed that Black BC patients had higher mortality than White patients (HR: 1.77; 95% CI: 1.48–2.13). Asian and Other and unknown groups of women had mortality rates very similar to White women (0.98 [0.81–1.18] and 0.99 [0.95–1.04], respectively). The excess mortality in Black women was attributable in sequence to recorded social and person-level characteristics (socio-economic status and comorbidity) (32% [23–45%]), then to recorded tumour stage (22% [14–34%]) and then to recorded biological characteristics (grade, morphology, receptors) (14% [8–25%]), leaving 31% (22–43%) unexplained.²⁴ The data on cancer incidence and survival by major ethnic group, England, 2002–2006 though reports no difference in mortality among all ethnic subgroups, acknowledging that data interpretation should be cautious because of large proportion of missing data (25%)²¹.

Is increasing uptake of screening and/or follow-up cost-effective?

The current BCS program was moderately cost-effective in the recent economic evaluations conducted in the UK. Gray et al (2017)³ reported that incremental cost-effectiveness ratios (ICERs)

were sensitive to natural history parameter values (and mean tumor size at clinical detection) and screening performance of MM³. Pashayan et al. (2018)² varied uptake to screening in modelling from 75% to 100% in high and low risk population. When identical uptake in both high- and low-risk groups is considered (both 75% or both 90%), ICER was lower with lower uptake if the proportion of population above the risk threshold (proportion of women invited to be screened in risk-stratified screening) was lower than 25%. If the proportion of population above the risk threshold was 25-70%, higher uptake in screening program was more cost-effective than lower uptake² (Table 3). These results are similar to the conclusions of cost-effectiveness analysis of personalized BCS program in Germany.²⁵ If uniform or risk-independent adherence (average uptake 72.4%) is assumed in population, the ICER in cost per incremental days of perfect health did not change. Though, if a positive adherence (higher risk population is screened more) is assumed, the ICER became slightly lower (35.2\$/day in perfect health vs 33.0\$/day in perfect health); the opposite trend is observed if lower-risk population is screened.²⁵ This suggests that increasing uptake will be cost-effective, if this increase in uptake will related to screening of higher-risk individuals.

Table 3. Incremental cost-effectiveness ratio by uptake and proportion of most-risky population invited to screening (Pashayan et al., 2018)²

Screening Scenario	Proportion of most-risky population invited to screening (%)			
	10%	25%	55%	90%
Uptake 100%	17,300	16,900	18,000	25,000
Uptake 90%	17,000	16,900	18,200	28,000
Uptake 75%	15,000	16,900	20,100	39,000

How does cost-effectiveness of increasing uptake of screening and/or follow-up differ by subgroup?

No literature was identified which to answer this question directly. The previous statements (items 1-4) suggest that it will be more cost-effective to screen subgroups with higher risk of BC (higher income and white population).

Which interventions are cost-effective to increase uptake?

Only two international and no UK studies were identified (Table 4). Saywell (2003) concluded that all tested interventions were more cost-effective to increase the uptake (defined as having lower costs per uptake) comparing to the control with a $p < 0.05$ and all except the telephone counselling with a $p < 0.01$ ²⁶. The most effective intervention - in-person counselling and physician's letter – was more cost-effective than telephone counselling alone, physician's reminder letter alone or telephone counselling and physician's reminder letter together with a $p < 0.05$.

Table 4: A summary of interventions to improve uptake of breast cancer screening and their economic outcomes.

Intervention/ Comparator	Country	Population / Design	Type of costs	Economic Outcomes	Citation
Tailored print intervention / a non-tailored print intervention	Japan	non-adherent population aged 51–	Only costs involving the implementation	The incremental costs of one mammography	Ishikawa (2012) ²⁷

		59 years / Control	of the intervention	screen – 22USD (52USD vs 30 USD)	
Control	USA	women between the ages of 50 and 85 years/ control group: with no counselling or letter	Mean intervention cost only	Cost - \$0 Adherence – 31.5% Cost - \$12.52 Adherence – 44.1% Cost - \$14.21 Adherence – 55.0% Cost - \$1.28 Adherence – 48.2% Cost - \$13.58 Adherence – 50.4% Cost - \$18.03 Adherence – 60.5%	Saywell (2003) ²⁶
Telephone counselling					
In-person counselling					
Physician's reminder letter					
Telephone and physician's reminder letter					
In-person counselling and physician's letter					

Which interventions are cost-effective to increase uptake by subgroup?

Only one study relevant to this question was identified, aiming to assess cost-effectiveness of a patient navigation program to improve breast cancer screening for Hispanic women in South Texas, US. The program included a health promotion media campaign, educational outreach, a patient navigation initiative, and the provision of mammography screening services. The media campaign and educational outreach activities aimed to modify behaviour through mass-media education, disseminating BC prevention messages often reinforced by peer role models, as well as by employing an outreach coordinator to educate small businesses, churches, and community groups in the targeted zip codes of the program. Simultaneously, the patient navigation and MM service components intended to remove social, cultural, and economic barriers by supporting patients through the screening system and providing free services for eligible women. The MM screening rate for the target population increased from 60% to 80% throughout the program²⁸.

The authors used a stochastic microsimulation model to evaluate the long-term health and economic consequences resulting to the estimated ICER 3,120 \$/QALY. Considering the threshold of \$50,000 per QALY, the authors concluded that the breast health program is highly cost-effective²⁸.

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Cervical screening

1. Is cervical cancer screening cost-effective and beneficial to health?

A systematic review was carried out to identify cost-effectiveness models of cervical cancer screening in the UK. As the cervical screening programme has been operating since 1988, and has undergone multiple changes since then, there are no studies that directly assess the cost-effectiveness of the current iteration of cervical screening programme against no screening in the UK. However, some studies assessing previous changes to the cervical screening programme in England have included a no screening option. These studies assessed the cost-effectiveness of using liquid based cytology (LBC) and/or human papillomavirus (HPV) testing strategies^{1 2} at 5 or 3 yearly intervals and found that compared to no screening, screening was likely to be highly cost-effective with a number of strategies under £5,000 per life year saved.

The cost-effectiveness of other recent changes to the screening programme, such as primary HPV testing, have been assessed against the English screening programme at the time of study and have been found to be cost-effective and improve health outcomes³. More recently the cost-effectiveness of screening for women who have been offered the HPV vaccination was estimated for four countries including the UK⁴. Strategies were compared to no screening and in the UK, it estimated that a screening strategy of 4 screens per lifetime would be considered cost-effective in the UK.

International evidence also suggests that screening is beneficial to health and cost-effective in most settings. The evidence suggests that screening has been instrumental in reducing the number of cases and deaths from cervical cancer. In the UK the incidence of cervical cancer has decreased by over a third since the introduction of the national screening programme in 1988⁵. In lower- and middle-income countries, that do not routinely have a population level screening programme, the incidence of cervical cancer is five times higher compared to high-income countries. A systematic review⁶ of cost-effectiveness studies in low- and middle-income countries found that screening strategies would be considered cost-effectiveness against no screening in most cases.

The evidence suggests that cervical cancer screening is very beneficial to health. It also suggests that a cervical screening programme is very cost-effective compared to no screening. However, the most cost-effective screening strategy, including technology, age ranges and screening interval, will depend on individual countries' circumstances and may change as cohorts of women who have received the HPV vaccination become eligible for screening programmes.

2. How does uptake of screening and follow-up differ by subgroup?

A literature search was conducted to identify evidence on the uptake of screening and follow up in different population subgroups in England. These included socioeconomic status, ethnicity, age, HPV vaccination status, learning disabilities, and women from traveller and/or roma communities.

As shown in Figure 1 the evidence indicates that women from the most deprived quintile have the lowest levels of screening uptake in England and Scotland. Women from the most deprived quintile had an adjusted odds ratio of 0.94 of attending screening compared to 1 for women in the least deprived quintile. This difference remained stable over the time period of the data (2008-2013) while the difference in uptake between deprivation quintiles in the breast cancer screening programme were found to decrease⁷. More recent routine data from the Scottish Cervical Screening Programme also finds a difference with uptake in the least deprived quintile at 78% compared to 67% in the most deprived quintile in 2018/19⁸.

Women from the most deprived quintile are also less likely to attend colposcopy following a positive screen result. A study of women in the east of England found that while attendance was generally high, 89% at 8 weeks and 94% by 4 months following referral, women living in most deprived areas were statistically less likely to attend. The odds ratios from the adjusted model were 0.83 (0.72–0.97) at 8 weeks and 0.81 (0.67–0.98) at 4 months compared to 1 for the least deprived group⁹.

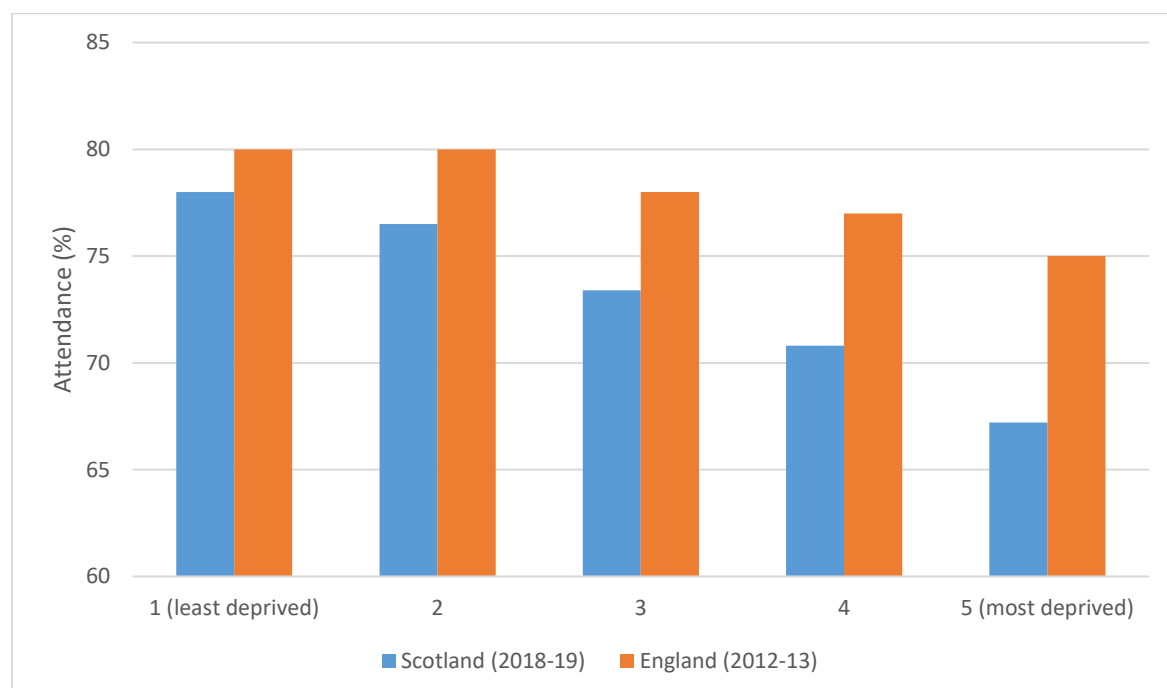


Figure 1: Attendance rates by deprivation quintile for England and Scotland (Douglas et al 2016⁷ and National Statistics Scotland⁸)

There is some evidence of difference in uptake rates between ethnicities. A cross sectional survey (women aged 40-74) found white women were more likely to have ever had a cervical screen than

women of other ethnicities (adjusted odds ratios of 1 vs 2.2). Educational level and socioeconomic status were also found to have an impact although this was not found to be statistically significant¹⁰. An earlier study had found little difference in likelihood of south Asian versus other women being recently screened when area and practice level differences including deprivation were included. The odds ratio for not recently screened was 1.02 (0.97, 1.08). However, a statistically significant difference was found between the proportion of women who had never been screened with an odds ratio of 1.2 (1.22-1.29)¹¹.

A recent modelling study of the effect of HPV vaccination and cervical cancer screening on outcomes by ethnicity has used more recent evidence on screening uptake by ethnicity. They reported on two datasets, one based on data from Natsal-3 (a national survey of sexual attitudes and lifestyles) and one on uptake data from Public Health England (PHE). As shown in Table 1, there was little difference in the proportion of women who had been recently screened in the Natsal-3 data by ethnicity, but larger differences were found in the PHE data. Similarly to the earlier studies, differences were found by ethnicity in the proportion of women who had ever been screened in both datasets¹². This indicates that ethnicity may have an impact on the number of women who have never been screened but the impact on the recent attendance is more mixed and may be explained by other demographic features such as deprivation.

Table 1: Screening and vaccination uptake rates by ethnicity

Intervention	Uptake	Ethnic Group			Data Source
		White	Black	Asian	
Screening Uptake	Recently screened (%)	80.5	79.5	81.9	Natsal-3
	Ever screened (%)	96.9	93.7	87	
	Recently screened (%)	80	75	65	Public Health England
	Ever screened (%)	92	82	80	
HPV Vaccination Uptake	HPV vaccination routine (All doses) (Aged 12-13) (%)	89	79	83	
	HPV catch up (all doses) (Aged 14-15) (%)	87	71	86	
	HPV catch up (all doses) (Aged 16-18)	69	26	36	

Johnson et al 2018¹²

Women with learning disabilities have a lower rate of cervical screening than women without^{13 14 15}. In 2017/18 31.2% of women with learning disabilities had been screened compared to 73.2% of women without a learning disability¹³.

There is little published evidence on uptake of screening among women from the roma/traveller communities but studies have shown overall they have worse health outcomes, lower uptake of vaccinations, and lower uptakes of other screening programmes¹⁶.

Other important subgroups to consider for the cervical screening programme include age and HPV vaccination status. Younger women have a lower uptake rate than older women. As shown in Figure 2, in 2018/19 women in the 25-29 year old age group had an uptake of 62% compared to 74% in the 45-49 year old age group¹⁷. Attendance rates have also fallen among all age groups (apart from the 25-29 year olds) in the last decade. Data from the Scottish screening programme has found that women who have received the HPV vaccination had a higher level of uptake of screening than women who had not received the vaccination. Women who had not received any doses of the vaccination had an odds ratio of 0.645 (0.637 - 0.654) of attending screening compared to women who had received all three doses¹⁸.

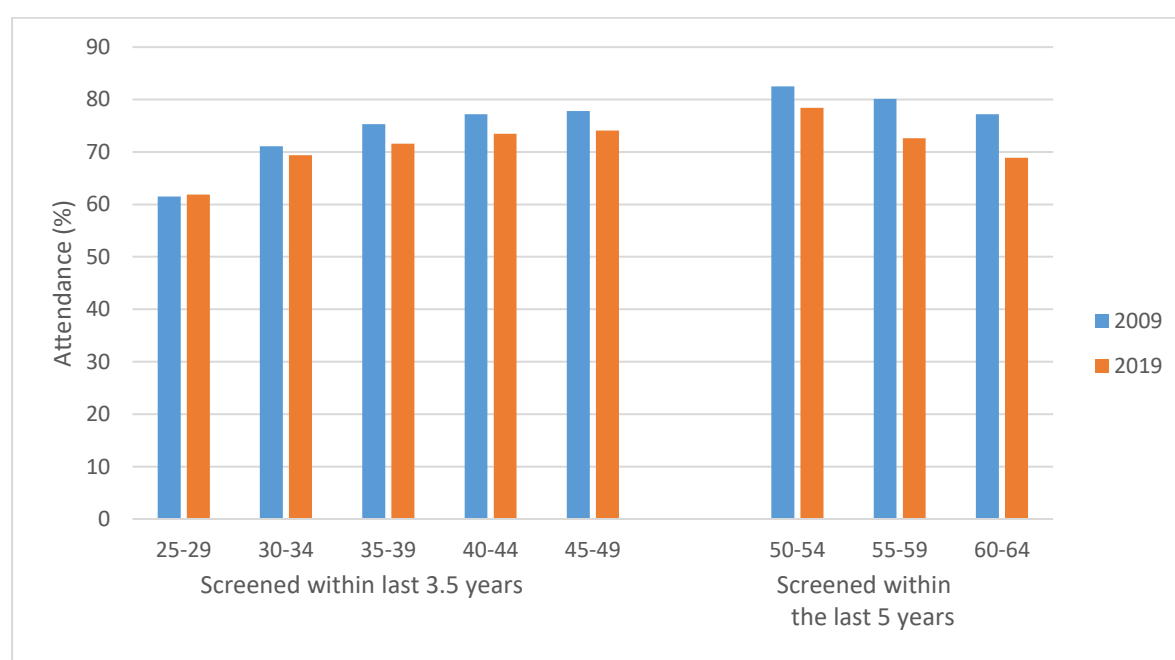


Figure 2: Attendance rates by age in England for 2008/9 and 2018/19 (NHS Digital: Screening and Immunisation Team¹⁷)

3. How does the cost-effectiveness and health benefits of screening differ by subgroup?

In general, higher cost-effectiveness and more health benefits are obtained by screening people who are at higher risk of cervical cancer. A literature review was carried out to identify the incidence of cervical cancer in different population subgroups in England. As the incidence rates will be affected by the uptake of the HPV vaccination, a search for evidence on the uptake of HPV vaccination by subgroup was also conducted.

Socioeconomic

As shown in Figure 3, incidence and mortality of cervical cancer are higher in the most deprived population¹⁹. This is also true for the incidence of HPV and precancerous changes (CIN)^{20 21}. There is also evidence of an impact of social deprivation on HPV vaccination uptake. In Scotland 90% of girls from the least deprived areas had received 2 doses of the vaccine compared to 82% of girls from the most deprived areas²².

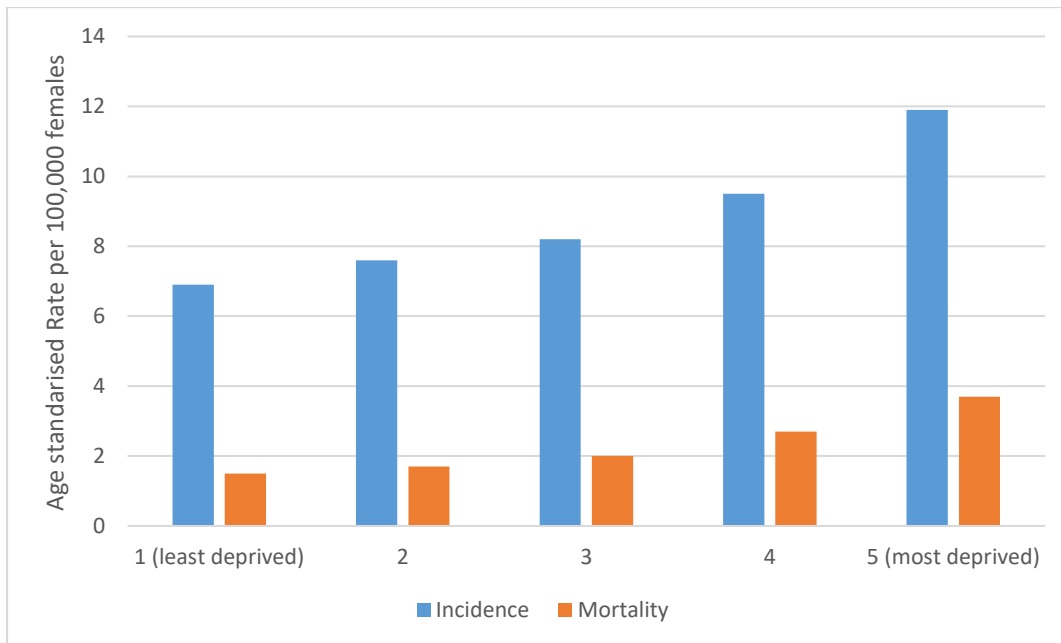


Figure 3: Incidence and mortality rates by deprivation quintile
(Cancer Research UK and National Cancer Intelligence Network 2014 ¹⁹⁾)

Ethnicity

Figure 4 shows the incidence of cervical cancer by ethnicity. Incidence in all ages is highest in the black ethnic group and this group also has a high incidence when broken down into the under 65 and over 65 age groups. However, the white ethnic group has the highest incidence in the under 65 year old age group. Whereas the Asian ethnic group has the highest incidence in the over 65 year old age group. However, the evidence used within Figure 4 is relatively old and is based on cancer registrations from 2002 to 2006 ²⁴. No newer evidence on actual incidence rates by ethnicity for the UK were found in the literature review. However, the results from the recent modeling study estimated that currently overall incidence is higher in Asian women (odds ratio of 1.7) compared to other ethnic groups¹². As shown in Table 1, there is also evidence that the uptake of HPV vaccination is lower in non-white ethnic groups. This is particularly evident in those that were older during the catch up vaccination (generally those born between 1990 and 1993).

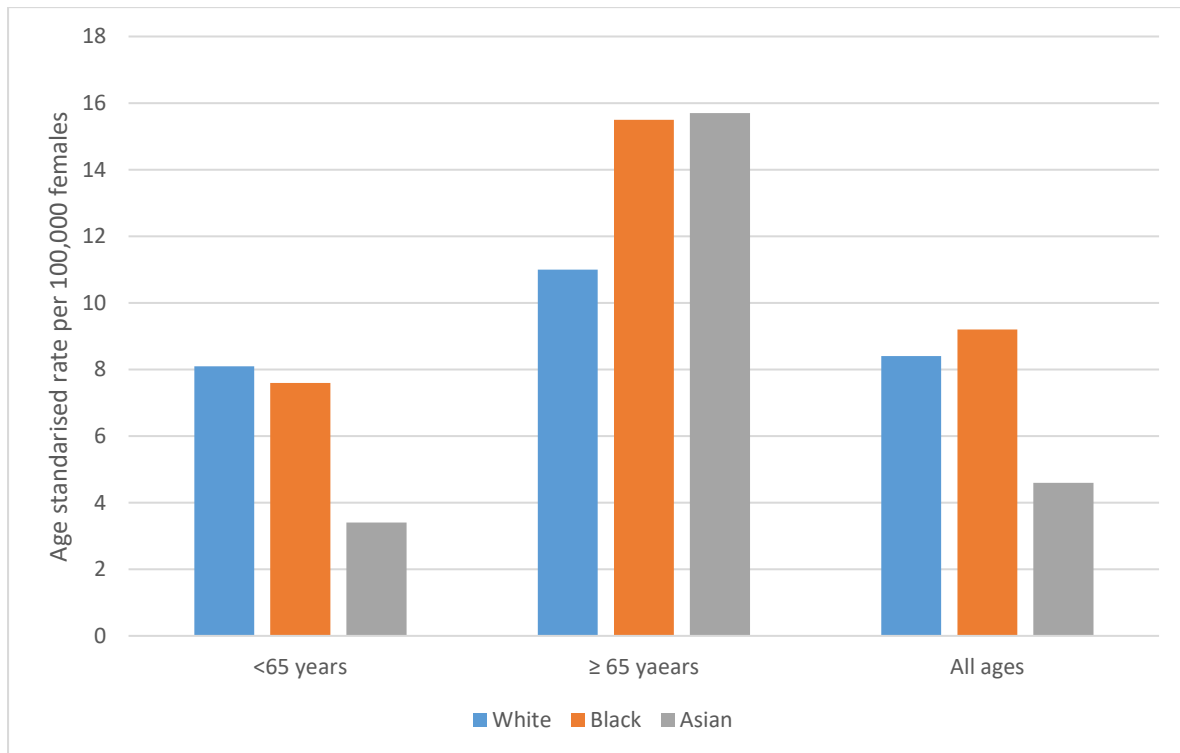


Figure 4: Incidence of Cervical Cancer by Ethnicity
(Cancer Research UK and National Cancer Intelligence Network 2009²³)

Learning disabilities

There is little evidence on the incidence of cervical cancer in women with learning disabilities. While no studies from the UK were identified, the international evidence found suggests that the incidence is lower than in the general population^{24 25}. In regards to HPV vaccination, a study of the UK Millennium Cohort Study found HPV vaccination coverage was lower, but not significantly so, at age 14 for girls with a learning disability with an uptake of 87.4% compared to 93.1% in girls without an intellectual disability²⁶.

Age

Incidence of cervical cancer is related to age with the highest incidence in the 30-34 year old age group as shown in Figure 5. The reduction in incidence after the age of 35 reflects both the impact of screening in identifying precancerous and cancerous changes and that the peak incidence of HPV infection is in women in their 20's. Incidence starts to increase again after the age of 65 and the end of routine screening. Mortality increase with age²⁷.

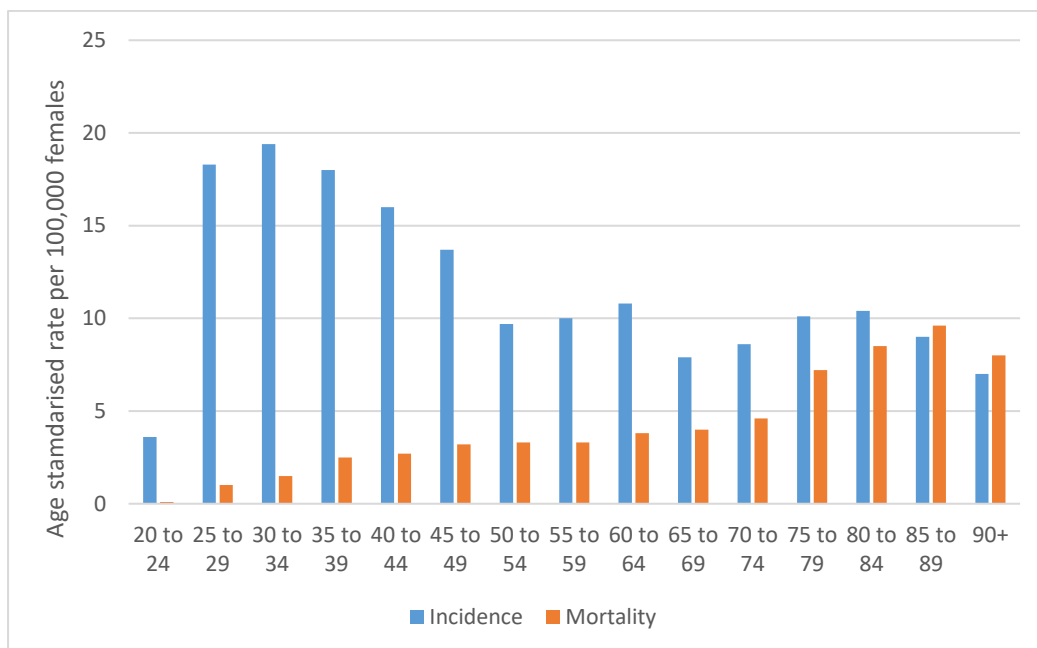


Figure 5: Incidence and mortality rates by age
(Cancer Research UK 2019 ²⁷)

4. Is increasing uptake of screening and/or follow-up cost-effective?

As part of the systematic review of UK cost-effectiveness studies, one study was identified which evaluated the cost-effectiveness of increasing uptake in women at the first invitation for screening²⁸. The study evaluated the cost-effectiveness of strategies used in the STRATEGIC trial. The STRATEGIC trial, a multicentre, cluster randomised controlled trial, enrolled all women registered with a general practice in Greater Manchester and Grampian into the trial at their first invitation to screening. The lifetime costs and quality adjusted life years (QALYs) were estimated for the change in uptake found in the STRATEGIC trial for the included interventions. In the first phase all women were randomised to receive a pre-leaflet and/or online booking. In the second phase women who had not attended following their first invitation to screening were randomised to the following interventions:

- A letter sent to women offering them the opportunity to request a human papilloma virus (HPV) self-sampling kit (RSS)
- An unrequested HPV self-sampling kit (USS)
- The services of a nurse navigator who was able to offer help and advice in attending a cervical screening test
- A letter with a timed appointment for a cytology test with the option to be rearranged at a more convenient time if needed
- A letter offering women the choice of either having access to an NN or an RSS

The lifetime costs and QALYs associated with an increase in uptake was estimated from a meta-analysis of studies reporting this for a screened and unscreened population. With an estimated increase in lifetime costs of £234 and lifetime QALYs of 0.043 for a screened woman compared to a non-screened woman.

The results found that both the unrequested self-sampler and timed appointments had statistically significant increases in QALYs and had ICERs of £11,033 and £9,070 respectively below conventional UK cost-effectiveness thresholds. Internet booking requested self-sampler, and the choice of requested self-sampler or nurse navigator all were estimated to increase QALYs but were not found to be statistically significant. The pre-leaflet and nurse navigator were not found to be effective with attendance lower in the intervention group compared to the control group²⁸.

This cost-effectiveness analysis indicates that increasing uptake is cost-effective at conventional thresholds. In this case the two interventions most likely to be cost-effective were the two most costly interventions with a cost of £62 per woman attending for the unrequested self-sampler and £24.85 for the timed appointment. All the other interventions had a cost below £6.50 per woman attending.

5. How does cost-effectiveness of increasing uptake of screening and/or follow-up differ by subgroup?

While no studies were identified that assess the cost-effectiveness of increasing uptake by subgroup the cost-effectiveness of such strategies would depend on the underlying incidence of cervical cancer in each subgroup. The potential health benefits of increasing uptake in a subgroup with a higher incidence would be greater than in a subgroup with a lower incidence and therefore the cost-effectiveness will be increased.

6. Which interventions are cost-effective to increase uptake?

From the STRATEGIC the two strategies that were estimated to have a statistically significant increase in QALYs were the unrequested self-sampler and timed appointments. With an ICER of £11,033 and £9,070 respectively both below the commonly accepted UK threshold of £20,000 - £30,000 per QALY²⁸.

7. Which interventions are cost-effective to increase uptake by subgroup?

No studies were identified that assessed the cost-effectiveness of interventions to increase uptake by subgroup. However, interventions that increase uptake in subgroups with a higher incidence of cervical cancer are likely to be more cost-effective for the same increase in uptake.

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Bowel screening

1. How does uptake of screening and follow-up differ by subgroup?

A literature search was carried out to identify information about uptake of screening and follow-up in different population subgroups in England. Note that FIT screening only started in England in 2019, so data for FIT uptake comes from the English FIT pilot¹, or is based on English Bowel Cancer screening data about guaiac faecal occult blood test (gFOBT) uptake (the screening modality that preceded FIT), normalised to the higher uptake anticipated with FIT from the FIT pilot. Equally, data about FS uptake that comes from the UK Flexible Sigmoidoscopy Screening Trial (UKFSST) has been normalised to the lower uptake seen in the English Bowel Cancer Screening Programme.

The data indicates that the most socioeconomically deprived and those with Asian ethnicity have lower uptake of screening than socioeconomically advantaged populations and people of non-Asian ethnicity (Table 2). This holds across the different screening and follow-up modalities. Men have lower uptake of FIT screening, but higher uptake of FS screening than women, whereas there are no sex differences in uptake of follow-up colonoscopy.

No data about other ethnic groups was available for FIT/gFOBT screening. Uptake of FS in people of black ethnicity was found to be slightly (but not significantly) higher than uptake of FS in people of white ethnicity². Data about uptake following colonoscopy was divided into quintiles of population by % non-white, rather than having specific ethnicity data. This means that the differences in uptake of follow-up colonoscopy between the Asian and non-Asian population is likely to be greater than the figures given in Table 2.

Table 2: CRC screening uptake in England by population subgroup.

Subgroup	Uptake FIT	Uptake FS	Uptake follow-up colonoscopy
Whole population	66% (FIT Pilot, 2016) ¹	43% (NHS BCSP) ³	88% (NHS BCSP) ⁴
Men	65% (FIT Pilot, 2016) ¹	45% (NHS BCSP) ³	88% (NHS BCSP) ⁴
Women	68% (FIT Pilot, 2016) ¹	42% (NHS BCSP) ³	88% (NHS BCSP) ⁴
IMD1 (least deprived quintile)	74% (FIT Pilot, 2016) ¹	53% (NHS BCSP) ³	89% (NHS BCSP) ⁴
IMD5 (most deprived quintile)	54% (FIT Pilot, 2016) ¹	33% (NHS BCSP) ³	85% (NHS BCSP) ⁴
Asian ethnicity	36% (based on gFOBT uptake, 2008) ⁵	34% (UKFSST) ²	86% (highest % non-white from NHS BCSP) ⁴
Non-Asian ethnicity	68% (based on gFOBT uptake, 2008) ⁵	43% (UKFSST) ²	90% (lowest % non-white from NHS BCSP) ⁴
IMD = Index of multiple deprivation; gFOBT = guaiac Faecal Occult Blood Test; FIT = Faecal Immunochemical Test; FS = Flexible sigmoidoscopy; BCSP = Bowel Cancer Screening Programme; UKFSST = UK Flexible Sigmoidoscopy Screening Trial.			

No specific data was found to inform uptake in gypsy/roma/traveller populations, although a qualitative study was identified that implies that uptake is likely to be low as this population often has low engagement with health services⁶.

No specific data was found to inform uptake in people with intellectual disabilities in England. However, a Canadian study was identified that found that uptake of bowel cancer screening was only 32% in people with intellectual disability compared with 47% in people without intellectual disability⁷.

2. Is bowel cancer screening cost-effective and beneficial to health?

We used our Microsimulation Model in Cancer of the Bowel (MiMiC-Bowel)⁸ to model the cost-effectiveness of current bowel cancer screening compared to no screening (assuming current levels of uptake and follow-up) in a deterministic analysis. For comparison, the two parts of the bowel cancer screening programme were modelled separately (biennial Faecal Immunochemical Test [FIT] from ages 60-74 cut-off at a threshold of 120ug/ml; and one-off Flexible Sigmoidoscopy [FS] at the age of 55). This analysis assumed uptake rates varying by age, sex, deprivation and ethnicity as seen in the programme and shown in section 1 above.

The current bowel cancer screening programme is very cost-effective compared to no screening, with an Incremental Cost-effectiveness Ratio (ICER) of under £7,000 per QALY for the current combined FS and FIT120 screening programme (Table 3). The FIT screening part of the programme is more cost-effective than the FS screening part, and accounts for most of the reduction in CRC, late stage CRC and CRC mortality produced by screening. However, the addition of FS to the current FIT screening programme produces further clinical benefits and is cost-effective (ICER of combined screening compared to FIT screening alone is £11,393 per QALY).

Table 3: Modelled lifetime incremental cost and health benefits of current bowel cancer screening compared to no screening per person in the English population, assuming current levels of uptake and follow-up.

Screening Scenario	Cost (£ per person)	QALYs (per person)	ICER	Total CRC prevented (per 1000)	Late stage CRC prevented (per 1000)	CRC deaths prevented (per 1000)
Combined FS and FIT120 Screening	£102	0.015	£6,882	14	17	12
Biennial FIT120 Screening Age 60-74	£45	0.010	£4,558	9	13	9
FS Screening Age 55	£61	0.006	£9,452	7	6	4
QALY = Quality-adjusted life year; ICER = Incremental cost effectiveness ratio; CRC = colorectal cancer; FIT = Faecal Immunochemical Test; FS = Flexible sigmoidoscopy.						

3. How do the cost-effectiveness and health benefits of screening differ by subgroup?

The MiMiC-Bowel model was used to model the cost-effectiveness of combined FIT and FS screening compared to no screening in subgroups that differ by sex, ethnicity and socioeconomic deprivation. In general, higher cost-effectiveness and more health benefits are obtained by screening people who are at higher risk of bowel cancer. This includes men and white people (Table 4). Women and ethnic minorities have a lower risk of bowel cancer and so the benefits of screening are lower.

Table 4: Modelled lifetime incremental cost and health benefits of current bowel cancer screening compared to no screening per person for different population subgroups (note only combined FS and FIT120 screening modelled), assuming current levels of uptake and follow-up.

Subgroup	Cost (£ per person)	QALYs (per person)	ICER	Total CRC prevented (per 1000)	Late stage CRC prevented (per 1000)	CRC deaths prevented (per 1000)
Men	£118	0.02	£6,482	17	21	15
Women	£87	0.01	£7,468	12	13	10
IMD1 (least deprived)	£115	0.02	£6,727	16	18	13
IMD5 (most deprived)	£85	0.01	£7,659	12	14	10
White ethnicity	£105	0.02	£6,652	15	18	13
Asian ethnicity	£88	0.01	£8,778	10	11	8
Black ethnicity	£71	0.01	£13,289	6	6	5
Other ethnicity	£95	0.01	£8,028	11	12	10
QALY = Quality-adjusted life year; ICER = Incremental cost effectiveness ratio; CRC = colorectal cancer; IMD = Index of multiple deprivation.						

Socioeconomically deprived people (IMD5) are also at higher risk of bowel cancer, but the modelling analysis indicates that screening is marginally less cost-effective in this subgroup than screening less deprived people from IMD1 (Table 4). There are two main reasons for this. Firstly, there is considerably lower screening uptake in this group (shown in Table 2), which is likely to counteract the benefits obtained. Indeed, if uptake of screening and follow-up is assumed to be 100% in all

individuals, a slightly greater reduction in CRC incidence and mortality is seen in the most deprived IMD quintile, compared to the least deprived quintile (Table 5).

Table 5: Modelled lifetime incremental cost and health benefits of 100% uptake of screening and follow-up of bowel cancer screening compared to no screening per person for different population subgroups.

Subgroup	Cost (£ per person)	QALYs (per person)	ICER	Total CRC prevented (per 1000)	Late stage CRC prevented (per 1000)	CRC deaths prevented (per 1000)
Men	£203	0.03	£6,813	30	31	23
Women	£175	0.02	£8,625	21	21	16
IMD1 (least deprived)	£189	0.03	£7,240	24.6	25.4	18.8
IMD5 (most deprived)	£189	0.02	£8,378	25.4	26.3	19.3
White ethnicity	£190	0.03	£7,253	26	27	20
Asian ethnicity	£182	0.02	£9,982	19	19	14
Black ethnicity	£181	0.01	£13,516	14	15	11
Other ethnicity	£182	0.02	£9,739	19	19	15
QALY = Quality-adjusted life year; ICER = Incremental cost effectiveness ratio; CRC = colorectal cancer; IMD = Index of multiple deprivation.						

Secondly, socioeconomically deprived people tend to have lower quality of life in general compared to less deprived people, due to a higher prevalence of other health conditions. This is reflected in our model through EQ-5D measurements from the Health Survey for England at baseline, which are then projected into lifetime QALYs over the course of a model run. As socioeconomically deprived people accumulate fewer QALYs in total throughout their lifetime, the QALY benefits of preventing CRC and early diagnosis are lower, making cost-effectiveness lower in the most deprived subgroups. Note that from an equity perspective this is a consequence of unfair disadvantage in other areas of health and should not be used as a reason to justify promoting screening in less deprived populations over more deprived ones.

We were unable to model people with intellectual disabilities or the gypsy/roma/traveller population as there is too little information about these subgroups to model them accurately. Instead, we searched the literature for information about CRC risk in these subgroups and applied what we know about the impact of CRC risk and uptake on cost-effectiveness to them.

Two papers were found about CRC risk in people with intellectual disabilities^{9 10}. These suggest that CRC risk is slightly higher in people with intellectual disabilities than in the general population, and particularly in women, likely to be due at least partly to more frequent overweight/obesity and lower physical activity. In addition, people with intellectual disabilities are often diagnosed late when tumours are advanced and survival poor, as clinical presentation is masked by challenging behaviours. This suggests that people with intellectual disabilities may benefit more from screening in terms of clinical outcomes than people without intellectual disability. However, we also know that people with intellectual disabilities are likely to have low uptake of screening and are likely to gain fewer QALYs throughout their lifetime due to other health conditions and shorter life expectancy. It

is therefore difficult to predict whether or not screening will be more or less cost-effective in this population subgroup compared to the general population.

No information about CRC risk in gypsy/roma/traveller populations was found in the literature. We cannot therefore predict how cost-effective CRC screening would be in this population.

4. Is increasing uptake of screening and/or follow-up cost-effective?

Given that the current screening programme is highly cost-effective, increasing uptake of screening is also likely to be cost-effective, dependent upon how much interventions to improve uptake might cost. To test this a series of modelling analyses were carried out using MiMiC-Bowel comparing current uptake and improved uptake of screening and follow-up for the combined FIT and FS screening programme against no screening.

Table 6 shows how much more cost-effective and beneficial to health screening would be if uptake of screening and follow-up colonoscopy could be increased by 10%, by 25% and to 100%, without spending any additional money on uptake interventions. Note that in these scenarios, probability of uptake for FIT screening, FS screening and colonoscopy follow-up is increased for each person individually, which means the modelling represents a combination of increased numbers of people taking up a single screening episode and increased numbers of episodes being taken up amongst people that already take up one or more.

As expected, both costs and health benefits increase with each increase in uptake modelled. Full incremental analysis (comparing each uptake scenario against the next lower uptake scenario) indicates that increasing uptake by 10% is cost-effective compared to current uptake, increasing uptake by 25% is cost-effective compared to increasing uptake by 10% and increasing uptake to 100% is cost-effective compared to increasing uptake by 25%.

Table 6: Modelled lifetime incremental cost and health benefits of different levels of uptake compared to no screening per person in the English population (note only combined FS and FIT120 screening modelled).

Screening Scenario	Cost (£ per person)	QALYs (per person)	ICER (compared with no screening)	ICER (compared with lower uptake scenario)	Total CRC prevented (per 1000)	Late stage CRC prevented (per 1000)	CRC deaths prevented (per 1000)
Current Uptake	£102	0.01	£6,882	N/A	14	17	12
10% Increase in Uptake	£112	0.02	£6,592	£4,548	16	19	14
25% Increase in Uptake	£123	0.02	£6,538	£6,044	18	21	16
100% Uptake	£189	0.02	£7,577	£10,759	25	26	19
QALY = Quality-adjusted life year; ICER = Incremental cost effectiveness ratio; CRC = colorectal cancer.							

In reality, it is likely that improvements in uptake will only come about through interventions that cost money. Using the MiMiC-Bowel model, it is possible to estimate the maximum cost that an intervention to improve uptake could be, whilst still ensuring that screening remains cost-effective, assuming a cost-effectiveness threshold of £20,000 per QALY. Note that for FIT screening, values represent the average outcomes of having one additional FIT screening episode invite taken up (this may represent a new person who wouldn't normally take up screening at all being screened for the first time, or someone who has been screened previously taking up a subsequent screening invite they wouldn't previously have taken up).

These results indicate that it is worth spending more money to ensure people attend follow-up colonoscopy than to ensure people attend at least one FIT screen, or to attend FS screening (Table 7). This is likely to be because people already identified through FIT or FS screening are at particularly high risk of CRC and can therefore benefit the most from attending their follow-up appointment.

Table 7: Modelled maximum cost that an intervention to improve uptake can be whilst still ensuring cost-effectiveness at the £20,000 per QALY threshold, per additional responder taking up screening/follow-up. All scenarios are compared against current (combined FS and FIT120) screening.

Screening Scenario	Maximum Cost of Intervention to increase uptake (£ per additional take up)	Lifetime Cost (£ per additional take up)	Lifetime QALYs (per additional take up)	Total CRC prevented (per 1000 additional take ups)	Late stage CRC prevented (per 1000 additional take ups)	CRC deaths prevented (per 1000 additional take ups)
Increased FIT Screening Uptake (per episode)	£96	£4	0.002	1	2	1
Increased FS Screening Uptake	£237	£136	0.012	14	10	7
Increased Follow-up Colonoscopy Uptake	£7,718	£306	0.127	123	168	123
QALY = Quality-adjusted life year; ICER = Incremental cost effectiveness ratio; CRC = colorectal cancer; FIT = Faecal Immunochemical Test; FS = Flexible sigmoidoscopy.						

5. How does cost-effectiveness of increasing uptake of screening and/or follow-up differ by subgroup?

The MiMiC-Bowel model was used to look at the impact of increasing uptake of screening and follow-up colonoscopy in population subgroups that differ by sex, ethnicity and socioeconomic deprivation. Subgroup results indicate that it is more cost-effective and would produce more health benefits to increase uptake in men and people of white ethnicity (Table 8). This is because these subgroups are at higher risk of CRC. Socioeconomically deprived people are also at higher risk of CRC

and slightly higher health benefits are produced in this group when uptake is increased to 100%. However, due to their lower baseline uptake of screening compared to less deprived people, fewer health benefits are expected in socioeconomically deprived groups when increasing uptake proportionally (e.g. by 10%). As mentioned previously, cost-effectiveness of increasing screening uptake is lower in more deprived groups due to their lower underlying health-related quality of life and therefore lower ability to accumulate QALY gains in response to screening.

Table 8: Modelled lifetime incremental cost and health benefits of different levels of uptake of screening and follow-up compared to no screening for different population subgroups (note only combined FS and FIT120 screening modelled).

Screening Scenario	Cost (£ per person)	QALYs (per person)	ICER	Total CRC prevented (per 1000)	Late stage CRC prevented (per 1000)	CRC deaths prevented (per 1000)
Men						
Current Uptake	£118	0.02	£6,482	17	21	15
10% Increase in Uptake	£130	0.02	£6,247	19	24	17
100% Uptake	£203	0.03	£6,813	30	31	23
Women						
Current Uptake	£87	0.01	£7,468	12	13	10
10% Increase in Uptake	£95	0.01	£7,094	14	15	11
100% Uptake	£175	0.02	£8,625	21	21	16
IMD1 (least deprived)						
Current Uptake	£115	0.02	£6,727	16	18	13
10% Increase in Uptake	£126	0.02	£6,485	18	20	15
100% Uptake	£189	0.03	£7,240	25	25	19
IMD5 (most deprived)						
Current Uptake	£85	0.01	£7,659	12	14	10
10% Increase in Uptake	£94	0.01	£7,237	14	17	12
100% Uptake	£189	0.02	£8,378	25	26	19
White Ethnicity						
Current Uptake	£105	0.02	£6,652	15	18	13
10% Increase in Uptake	£115	0.02	£6,372	17	20	15
100% Uptake	£190	0.03	£7,253	26	27	20
Asian Ethnicity						
Current Uptake	£88	0.01	£8,778	10	11	8
10% Increase in Uptake	£97	0.01	£8,426	11	13	10
100% Uptake	£182	0.02	£9,982	19	19	14
Black Ethnicity						
Current Uptake	£71	0.01	£13,289	6	6	5
10% Increase in Uptake	£78	0.01	£12,501	6	7	5
100% Uptake	£181	0.01	£13,516	14	15	11
QALY = Quality-adjusted life year; ICER = Incremental cost effectiveness ratio; CRC = colorectal cancer.						

The maximum cost that an intervention to improve uptake could incur, whilst still being cost-effective at the £20,000 per QALY threshold also differs between different population subgroups (Table 9). The maximum cost for an intervention to increase FS or FIT screening uptake is higher in men than women (due to greater sensitivity of FIT in men), but the maximum cost for an intervention to increase follow-up colonoscopy uptake is higher in women than men (due to the greater specificity of FIT in women), and these differences are reflected in the health benefits expected. Greater maximum intervention costs and larger health benefits are estimated in people of white ethnicity compared to other ethnicities. The most deprived people are expected to get more health benefits from increasing uptake of screening and follow-up than less deprived people, but the maximum intervention cost is lower, reflecting the lower cost-effectiveness of screening in this subgroup.

Table 9: Modelled maximum cost that an intervention to improve uptake can be whilst still ensuring cost-effectiveness at a threshold of £20,000 per QALY, per additional responder taking up screening/follow-up in each population subgroup. All scenarios are compared against current (combined FS and FIT120) screening.

Screening Scenario	Maximum Cost of Intervention to increase uptake (£ per additional take up)	Lifetime Cost (£ per additional take up)	Lifetime QALYs (per additional take up)	Total CRC prevented (per 1000 additional take ups)	Late stage CRC prevented (per 1000 additional take ups)	CRC deaths prevented (per 1000 additional take ups)
Men						
> FIT Uptake	£119	£6	0.00	2	2	2
> FS Uptake	£388	£111	0.01	17	11	8
> Follow-up	£6,893	£348	0.12	108	155	111
Women						
> FIT Uptake	£74	£2	0.00	1	1	1
> FS Uptake	£152	£142	0.01	11	8	6
> Follow-up	£8,959	£242	0.14	146	186	141
IMD1 (least deprived)						
> FIT Uptake	£106	£4	0.00	1	2	1
> FS Uptake	£249	£137	0.01	13	9	7
> Follow-up	£7,964	£300	0.13	119	160	118
IMD5 (most deprived)						
> FIT Uptake	£88	£4	0.00	1	2	1
> FS Uptake	£213	£138	0.01	15	10	8
> Follow-up	£7,005	£293	0.12	123	169	122
White Ethnicity						
> FIT Uptake	£105	£4	0.00	2	2	1
> FS Uptake	£298	£124	0.01	15	10	8
> Follow-up	£7,852	£307	0.13	124	169	125
Asian Ethnicity						
> FIT Uptake	£78	£3	0.00	1	1	1
> FS Uptake	£93	£143	0.01	11	8	6
> Follow-up	£5,968	£255	0.10	118	153	106
Black Ethnicity						
> FIT Uptake	£55	£3	0.00	1	1	1
> FS Uptake	£3	£147	0.01	9	7	5
> Follow-up	£5,652	£329	0.10	95	139	96
QALY = Quality-adjusted life year; ICER = Incremental cost effectiveness ratio; CRC = colorectal cancer; FIT = Faecal Immunochemical Test; FS = Flexible sigmoidoscopy.						

6. Which interventions are cost-effective to increase uptake?

We did a rapid literature review to search for economic evidence about interventions to increase screening uptake. This included sifting the studies identified in the rapid evidence review, plus additional rapid searching. Given the small number of papers found, any studies with economic evidence were included (e.g. intervention costs) even if the study did not specifically look at cost-

effectiveness. Extracted information included the targeted population/screening pathway, the intervention and comparator, and the economic and uptake outcomes (Table 10).

Six articles were found, three from the US, two from England and one from China. Most of these considered a target population eligible for screening. The three US studies all focussed specifically on individuals who were not up-to-date with screening¹¹⁻¹³, whereas one of the English studies¹⁴ was based on the general screening eligible population. The Chinese study was the only one to consider a population of people who had already been screened and were then eligible for screening follow-up colonoscopy¹⁵. Finally, one of the English studies was actually focussed on people with symptoms of CRC rather than the screening population¹⁶, but was included as it may have also had some impact on screening.

A range of interventions were included. Two studies were based on randomised controlled trials and both evaluated patient reminders; one evaluating enhanced reminder letters compared to standard reminder letters and the other evaluating twice monthly text messaging reminders compared to no text messaging^{14 15}. Other studies were based on observational data and evaluated a range of interventions including a public awareness campaign (e.g. press, TV, internet)¹⁶, patient navigation programmes (trained facilitator for improving uptake)¹², introduction of a new screening modality (FIT)¹¹, and combinatorial approaches combining reminder systems, feedback and support¹³. These studies generally compared uptake after intervention with that before intervention started, to obtain a measure of effectiveness.

All interventions were successful in improving uptake. Two of the studies reported cost-utility outcomes, with the UK awareness campaign being cost-effective at £13,496 per QALY¹⁶ and the US patient navigation programmes being cost-effective at \$26,400 per QALY¹². Other studies only reported a cost per increased uptake so it was not possible to determine whether the intervention was cost-effective using standard cost-effectiveness measures. However, in general the costs were relatively low for the increase in uptake obtained.

Table 10: A summary of interventions to improve uptake of bowel cancer screening and their economic outcomes.

Citation	Population/Targeted Screening Pathway	Intervention/Comparator	Economic and Uptake Outcomes
Kemper et al., 2018 ¹¹	People aged 50-75 not up-to-date with CRC screening in Washington State, US	New direct mail FIT programme and supplemental outreach events, patient reminders, sharing of good practice and provider assessment. No comparator.	Total intervention cost per FIT kit returned of \$39.81, with 31% of kits returned in total.
Ladabaum et al., 2015 ¹²	People aged ≥ 50 previously unscreened in New York, US	Patient navigation programmes (trained facilitator who helps with scheduling and answers questions) compared against uptake prior to programme.	One-off intervention cost of \$150 per completer to improve uptake from 40% to 45%, with an ICER of \$26,400/QALY. Cost-saving (dominant) if uptake increases to 65%.
Lara et al., 2018 ¹³	People aged 50-75 eligible for colonoscopy screening	Multiple interventions including patient &	Intervention cost of \$24 to \$29 for each

	(no screen within last 10 years) in regions of Colorado, US with low CRC screening uptake.	provider reminder systems, assessment & feedback, and support activities compared against uptake prior to intervention.	additional person screened (10% to 18% increase in uptake).
Raine et al., 2016 ¹⁴	People eligible for gFOBT screening in the English BCSP	Enhanced reminder letters compared with usual letter (randomised controlled trial)	One-off intervention cost of £78,000 to increase uptake from 25.1% to 25.8%.
Whyte et al., 2014 ¹⁶	People with CRC symptoms in two regions of England (note aimed at symptomatic detection, not screening but could also impact on screening uptake too)	Signs & symptoms awareness campaign (press, TV, online) compared against uptake prior to awareness campaign	One-off intervention cost of £5.5m to increase symptomatic presentation rates by 10% for a month, with an ICER of £13,496/QALY.
Wu et al., 2019 ¹⁵	People positive for FIT screening who are eligible for follow-up colonoscopy in China	Twice-monthly text message reminders for 6 months compared to no text messages (randomised controlled trial)	Intervention cost of \$2.70 to increase uptake of colonoscopy by 1 person.

7. Which interventions are cost-effective to increase uptake by subgroup?

We looked for subgroup information in the studies identified as part of the rapid literature review described above (specifically subgroups for sex, socioeconomic status, ethnicity and learning disabilities). Only two of the studies - both of the randomised controlled trials, looked at the results in different population subgroups (Table 11)^{14 15}.

Raine et al. (2016)¹⁴ found that enhanced reminder letters had no impact on uptake in the least deprived quintile of the population, whereas they significantly increased uptake in the most deprived quintile, thereby reducing the socioeconomic gradient in screening participation for a fairly minimal one-off cost. Wu et al. (2019)¹⁵ found that the text messaging intervention improved uptake more in men than women and more in people who were unemployed or rural than people who were employed or urban, suggesting greater effect in the most socioeconomically deprived. As the cost of intervention is identical for all individuals, this suggests that cost-effectiveness is likely to be higher in these subgroups.

Table 11: A summary of interventions to improve uptake of bowel cancer screening that give economic outcomes by subgroup.

Citation	Subgroups Included	Intervention/ Comparator	Economic and Uptake Outcomes by Subgroup
Raine et al., 2016 ¹⁴	IMD quintile (measure of socioeconomic status)	Enhanced reminder letters compared with usual letter (randomised controlled trial)	One-off intervention cost of £78,000 increases uptake from 13.3% to 14.1% in the most deprived quintile, but has no effect on the least deprived quintile.
Wu et al., 2019 ¹⁵	Sex; Education, occupation and rural vs urban (all measures of socioeconomic deprivation)	Twice-monthly text message reminders for 6 months compared to no text messages (randomised controlled trial)	Intervention improved uptake more in men than women, and more in people who were unemployed or rural than people who were employed or urban, for the same fixed cost per person.

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6. Systematic review of effectiveness

Summary

Screening identifies apparently healthy people who may be at increased risk of a disease or condition, enabling earlier treatment or better informed decisions, but not everyone who is offered screening takes it up. This rapid review forms the first stage of an evaluation of a three year cancer screening and awareness programme in Leeds, by seeking to examine existing research evidence regarding what works to increase screening uptake for three targeted cancers (breast, bowel, cervical).

We scrutinised a total of 3858 references and included 52 of these in our evidence summary. Given the large number of existing reviews available we carried out a review of these existing reviews, and supplemented this by examining studies carried out in the UK in the last four years to ensure that the evidence was up to date, and to consider factors of particular relevance to the UK.

We identified evidence relating to use of a wide range of interventions encompassing: reminders such as letters, telephone calls or texts (either before screening, or targeted at those who had not taken up prior offers of screening); enhancements to standard information provided to patients (either for all patients invited to screening or targeted at those who had not participated); the effectiveness of offering timed appointments versus open invitations; the addition of a GP endorsement (such as a signature) to an invitation letter; opportunistic brief interventions carried out by a health professional; use of pharmacies, community health workers or patient navigators; group health education sessions; public awareness campaigns and use of social media; financial incentives; and strategies to make testing easier such as self-testing kits.

The evidence indicates that multiple types of strategies can have the outcome of increasing uptake of cancer screening. There appeared to be commonality across the three types of cancer in terms of which strategies may be beneficial. The review highlights the potential of opportunistic interventions to reach people (especially non-attenders), and the “added value” of combining interventions. This may be particularly important for people from minority ethnicity groups. There was little evidence in the review which could be drawn on to identify optimal interventions specifically to address socio-economic inequalities in uptake. The UK literature highlighted how individual views and preferences and differences in systems at sites, can lead to variance in implementation of interventions.

BACKGROUND

Screening identifies apparently healthy people who may be at increased risk of a disease or condition, enabling earlier treatment or better informed decisions. It is estimated that every year in

the UK 5000 deaths are prevented by cervical screening, 2400 deaths are avoided through bowel cancer screening, and 1,300 women have avoided dying from breast cancer due to screening (1).

In the UK there is a national programme which offers screening tests to everyone in defined population groups. This includes a National Health Service (NHS) breast screening programme, a NHS bowel screening programme, and a NHS cervical screening programme.

Around 1 in 20 people in the UK will develop bowel cancer during their lifetime. Regular bowel cancer screening is estimated to reduce the risk of dying from bowel cancer by over 16% (2). Current recommendations are that faecal immunochemical testing (FIT) should be offered to everyone aged 50 to 74 years biennially (2). People are sent an information leaflet and invitation letter, followed one week later by a FIT kit, with a stool sample collected at home.

The cervical screening programme is currently offered to all women aged 25 to 64. Recent recommendations have been that services should be transitioning to testing for human papilloma virus as the primary screening test (2) rather than cytology which has been typically used. The HPV vaccination programme is expected to reduce the incidence of cervical cancer substantially in years to come.

Breast screening is currently offered to women with general risk of the disease and aged 50 to 71 triennially. Women who are eligible for breast screening are identified through GP registration systems, and selected in batches relating to their practice (3).

Not everyone who is offered screening takes it up. In particular uptake of cervical screening is known to be falling (3). Uptake of breast screening has also slightly reduced and varies between different regions and different breast screening units, indicating the potential for contextual variation to contribute to different uptake rates. A recent review of National Cancer Screening Programmes in England (3) called for people to be given much greater choice over when and where they are screened. It suggested that services should look at ways that appointments can be provided at locations that are easier to access, for example places close to where people work rather than having to attend their own GP practice. Also that local screening services should consider evening and weekend appointments and enable people to attend during lunchtime or other breaks.

The report highlighted that interventions aiming to increase uptake/coverage can be effective. For example text reminders have been found to result in an increase in uptake of over 4% amongst women attending for breast screening (4). Social media publicity has also been suggested as leading to increases in uptake.

It is known that groups who may be most at risk are often those which have low uptake. For example people from deprived groups are more likely to die from bowel cancer, but less likely to complete bowel screening, and women from ethnic minority groups are less likely to attend for cervical screening (1). Differences in uptake of screening between different groups of people therefore is a contributory factor to health inequalities, and it is important to examine the potential of interventions aiming to increase uptake to have differential effects amongst sub-population groups.

In Leeds a three year cancer screening and awareness programme is aiming to develop a city-wide network of screening and awareness coordinators. The intention is that these Cancer Screening and Awareness Coordinators will work with up to eighteen Primary Care Networks (including GP practices) to work towards increasing screening uptake. The aim of the programme is that Leeds will meet national targets for breast, bowel and cervical screening, increase awareness of cancer signs, symptoms and risk factors amongst the public, and reduce variation in rates of uptake within the city, especially amongst deprived and vulnerable populations. This rapid review forms the first stage of an evaluation of this programme, by seeking to examine existing research evidence regarding what works to increase screening uptake for the three targeted cancers.

METHODS FOR CARRYING OUT THE REVIEW

This review of existing literature was intended to inform data collection, analysis and interpretation of the study findings, rather than comprise a stand-alone systematic review. A rapid assessment approach was therefore adopted, to provide an overview of the main evidence within the field, and to identify key learning to inform the development, delivery and evaluation of the Screening and Awareness Coordinator intervention. The review was carried out between December 2019 and February 2020.

Aims of the review

1. To identify and summarise available research evidence on the effectiveness of strategies and approaches which have the intention of increasing rates of uptake of screening for breast, cervical and bowel cancer.
2. To examine evidence regarding implementation and outcomes in varying contexts and for differing population groups, and to consider whether and how approaches might impact on health inequalities.
3. To consider what the findings tell us about optimal implementation and effectiveness of Screening and Awareness Coordinator-type approaches.

Finding relevant research

- We searched for research which related to developed countries (members of the Organisation for Economic Co-operation and Development). We excluded literature from developing countries, as these studies have limited contextual relevance for interventions in the UK.
- As screening is aimed at apparently healthy people, we included research carried out in any adult population within these countries.
- We included both people who were receiving a first routine invitation for screening, and those who had not taken part previously (typically referred to as non-attenders). Where possible we aimed to distinguish findings for these two groups in the synthesis.
- Our focus was looking for research on programmes, interventions, or approaches which have the purpose of increasing the numbers of people taking part in screening for breast, bowel or cervical cancer. Given the focus of the Leeds programme on screening and awareness we also included literature which reported knowledge or awareness of cancer or cancer screening, either instead of or in addition to numbers taking part in screening.
- We adopted a broad definition of “uptake” as referring to people taking part in cancer screening, this may be via attending for screening in person or returning a self-sampled screening test.
- We included studies which evaluated either first participation in screening and/or repeat participation.
- We included research studies which used any measure to evaluate the effectiveness of the interventions. This could be measured outcomes following programmes or interventions, or the views and perceptions of people who had received programmes, or staff providing them.
- We excluded literature which related to screening only for cancers other than breast, bowel or cervical, although studies reporting screening in cancers including one or more of these were eligible for inclusion.

We looked for the best quality studies we could find, that were published in peer-reviewed journals, or were in the form of reports. As there is a sizeable volume of research on this topic, we sought to bring together the findings from other reviews which have already been carried out, and to supplement this with recent research from the UK. We looked only for research which has been carried out since 2015, in order to provide the most up-to-date information.

We developed a search strategy based on the aims of the review outlined above, and identified the most useful and relevant terms for the concepts which we were looking for. An information specialist based in SCHARR (Mark Clowes) carried out the searches. Searches were carried out in a

number of different relevant electronic databases (including Embase, Medline, PsycINFO). We also asked people with knowledge of the topic if they were aware of any additional relevant work.

Selecting research to include

All the references for the research studies identified from our searching were downloaded into a reference management computer programme. All the titles (and where required abstracts) were screened by a member of the team, and any research which looked potentially useful was given a tag. The tagged studies were then analysed in detail, with the key information from each summarised in a table. The information from all these studies was then compared and brought together into an overall summary (synthesis).

RESULTS

We screened a total of 3848 references found in our electronic database searching, and examined a further 10 potentially relevant reports. We looked in detail at 77 studies and eventually included 52 of these. Figure 1 outlines the process of study identification and selection.

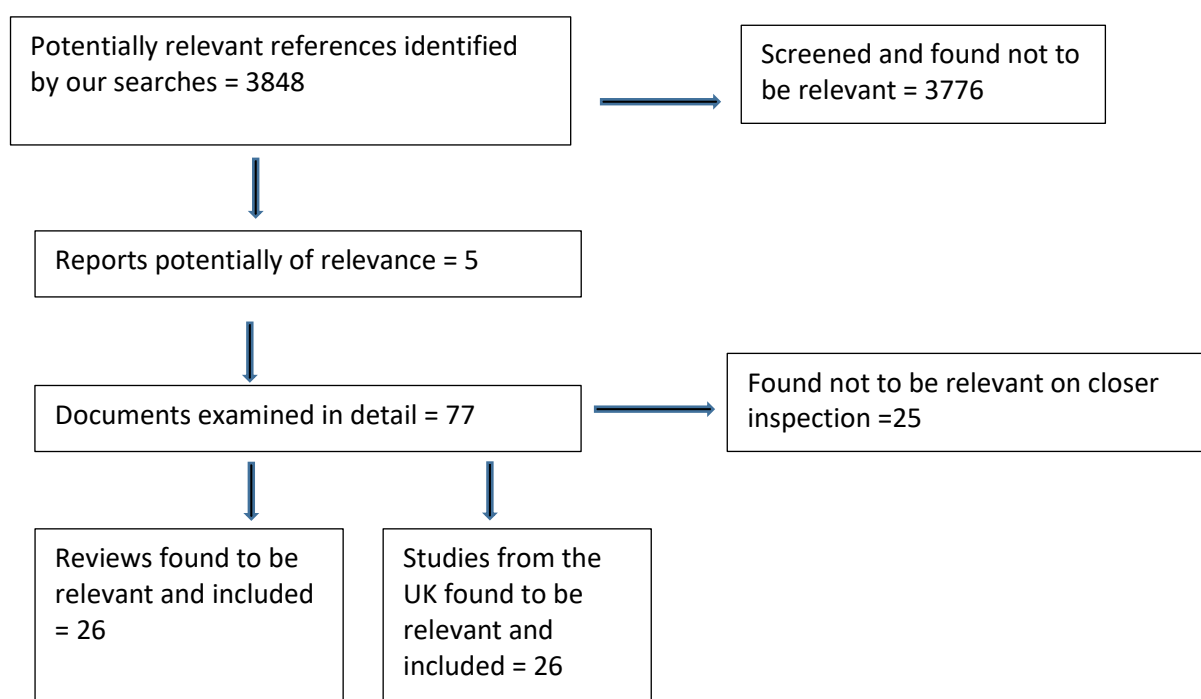


Figure 1. The process of study identification and inclusion

What sort of documents were included?

The evidence we examined comes from research reported from 2015 onwards in 50 papers published in peer-reviewed journals, and 2 reports (which outline the findings of a local project evaluation). Given the large number of existing reviews available we carried out a review of these existing reviews, and supplemented this by examining studies carried out in the UK in the last four

years to ensure that the evidence was up to date, and to consider factors of particular relevance to the UK.

The quality of the research in general was of reasonable standard, with the included reviews meeting the requirements of a good quality systematic review by pre-specifying inclusion criteria, detailing a rigorous search strategy, and carrying out a systematic analysis of data. Six of the reviews included only randomised controlled trials (RCTs), others included both experimental and observational studies, and one review included a synthesis of qualitative studies. The trustworthiness of the findings from the body of review evidence is therefore reasonable.

The studies from the UK represent a spread in hierarchy of design (see Table 1), with 15 of the highest quality randomised trial design. These studies provide particularly trustworthy evidence.

Table 1. Summary of included UK primary studies

Study design (UK primary)	Included studies
RCT	Allgood 2016 Chambers 2016 Hirst 2017 Kaushal 2017 Kerrison 2015/2016/2017 Marlow 2019 Shepherd 2018
Cluster RCT	Forster 2017 Kitchener 2018 Raine 2016 a/b Smith 2017 Smith 2019
Non RCT	Benton 2017
Mixed method	Calanzani 2017 Woodward 2018
Before and after	Campbell 2016 Hall 2015 Kaushal 2019
Cohort	Hudson 2016
Qualitative	Cavers 2018
Cross sectional	Lim 2017 Morling 2018 Ryan 2019

The included literature is spread across the three types of cancer of interest (see Table 2), with nine reviews and twelve UK primary studies relating to bowel (or colorectal) cancer, five reviews and six UK primary studies relating to breast cancer, and five reviews and six UK primary studies relating to

cervical cancer. Seven included reviews and one UK primary study related to multiple forms of cancer.

Table 2. Included studies listed by type of cancer

Type of cancer	UK primary	Systematic reviews
Bowel	Benton 2017 Calanzani 2017 Cavers 2018 Hall 2015 Hirst 2017 Kerrison 2016/2017 Morling 2018 Raine 2016 a/b Smith 2017 Smith 2019	Davis 2018 Dougherty 2018 Goodwin 2019 Issaka 2019 Martini 2016 Muliira 2016 Myers 2019 Rat 2018 Volk 2016
Breast	Allgood 2016 Campbell 2016 Chambers 2016 Hudson 2016 Kaushal 2019 Kerrison 2015	Anastasi 2019 Copeland 2018 Ivlev 2017 Martinez-Alonso 2017 Naz 2018
Cervical	Foster 2017 Kitchener 2018 Limb 2017 Marlow 2019 Ryan 2019 Shepherd 2018	Agide 2018 Nelson 2017 Rees 2018 Tsiachristas 2018 Verdoodt 2015
Multiple	Woodward 2018	Bellhouse 2017 Chan 2015 Duffy 2017 Escriba-Aguir 2016 Han 2018 Kelly 2018 Lindsey 2015

What types of interventions were evaluated?

Included reviews and primary studies encompassed those which examined evidence on different types of intervention for a particular cancer, and those which evaluated evidence of a particular group or type of intervention. The interventions reported related firstly to the use of reminders such as letters, telephone calls or texts either before screening, or targeted at those who had not taken up prior offers of screening. Several reviews and UK primary studies considered enhancements to standard information provided to patients, either for all patients invited to screening or targeted at those who had not participated. Other reviews examined the effectiveness of offering timed

appointments versus open invitations, the addition of a GP endorsement (such as a signature) to an invitation letter, or opportunistic brief interventions carried out by a health professional.

Interventions based in the community encompassed use of pharmacies, community health workers or patient navigators, and group health education sessions. Studies also evaluated general public awareness campaigns and use of social media, or providing financial incentives. Strategies to make testing easier included providing self-testing kits, and a device to aid faecal collection.

What is the evidence regarding the effectiveness of different types of intervention?

Reminder or advance notification letters

Five reviews provide evidence that sending advance notification or reminder letters increases uptake (either return of a kit for bowel screening or attendance at a screening appointment) amongst the general population and non-responders. Three of these reviews evaluated the use of letters in bowel screening, and two examined evidence regarding multiple forms of screening. The letters were either advance notification of a bowel screening kit being sent (5, 6), advance notification and a reminder letter in bowel screening (7), or reminder letters in multiple forms of screening (8, 9). One review reported that personalised reminders could be effective (8).

One primary study from the UK (10) echoed the effectiveness of sending a reminder letter to non-attenders (breast screening). The level of effect reported in the studies was in the range of 3% to 10% increase in uptake.

Reminder telephone calls

Five reviews reported evidence of increased uptake (return of a kit or attendance at an appointment) following telephone calls alongside a usual invitation. Three of the reviews focused on bowel screening (5, 6, 11) one cervical screening, (12) and one multiple forms of screening (8). One study highlighted that in-person telephone contact was more effective than an automated telephone reminder.(5) The level of effect reported was in the range of 5% to 7%, with the authors of one review commenting that the effect was smaller than that for reminder letters (8). It is important to note that this review found mixed evidence regarding the effectiveness of telephone reminders which specifically targeted non-participants in screening.(8)

One UK primary study examining telephone reminders alongside first appointments in breast screening found that differing forms of telephone call (simple reminder, support, support plus discussion of regret) were equally effective in increasing uptake (13).

Reminder text messages

One review, which included evaluations of text message reminders, reported an increase in uptake following the use of text message reminders alongside a usual invitation (8).

Three UK primary studies (one bowel, one cervical, one breast screening) also reported the value of text messages, with one calculating a 5% increase in attendance following a text reminder alongside a first breast screening appointment (4). Another of these UK studies evaluated the use of an app with text message reminders, and found an 11% increase in women making appointments for cervical screening appointments. The authors concluded that the text message reminders were the key element of the intervention, but evidence of the effect on uptake is limited as the study measured appointments made rather than attendance (14). The third UK study is of note as it evaluated a text reminder for non-returners of bowel screening kits and found an effect only for first time invitees rather than all the adult population (15).

Enhanced knowledge (decision aids, patient information)

Three reviews evaluated the use of decision aids in breast cancer screening or bowel screening (16-18). All reported increased knowledge outcomes, although the evidence regarding a positive effect on uptake is weaker. A review of bowel screening found that people were more interested and more likely to be screened if they had received decision aids (although of note is that they were no more likely to be screened than those receiving general cancer information) (18). The two reviews of decision aids in breast cancer screening found that women were more likely to make a decision not to be screened, or there was no effect. Decision aids increased the intention not to begin screening particularly in young women (16, 17).

Evidence from three reviews of bowel screening indicated little effect on uptake from enhancing written information/printed materials (5-7). One of these three reviews recommended use of a video as being superior to a patient pamphlet, with evidence of effectiveness in increasing cervical screening appointments (12). A review of breast screening recommended the use of health behaviour models to underpin educational interventions, although data regarding effectiveness was very limited in this paper (19).

Three UK primary studies echo doubts on the effectiveness of enhancing written information to patients in order to increase uptake of cervical and bowel screening (20-22). One additional study however, which provided enhanced information in a reminder letter for bowel screening non-responders, found a very small increase in uptake (23). There was a suggestion from another study which provided enhanced information for older women who did not intend to participate in cervical screening, of a change in perceived risk (although actual uptake was not evaluated) (24).

Timed versus open appointments

Three reviews provided evidence that offering timed appointments rather than open invitation increases uptake of screening. One of these reviews reported a figure of a 20% difference in favour of timed appointments across a range of cancer screening types (8). A review of cervical screening calculated that timed appointments were a cost effective as well as effective intervention for first invitation (25). Another review (breast screening) indicated that timed appointments were also more effective than open invitation (20% versus 7%) as a second invitation to increase uptake amongst non-attenders (26).

A UK study also supports offering further timed appointments rather than open invitations for non-attenders. This study compared multiple interventions to increase cervical screening amongst young non-responders and reported that a further timed appointment was one of the effective options for increasing screening (20).

GP endorsement

Evidence from three reviews (two of bowel screening (5, 6), one including multiple types of screening (8)) indicated that GP involvement (such as signing a letter or including the practice letterhead) increases uptake of screening. One review of multiple screening types concluded that GP endorsement strategies typically resulted in 2-3% increase in uptake, but that some studies reported as much as a 10-20% increase (8).

Opportunistic brief intervention

Two reviews (one of multiple types of screening, one of bowel screening) highlighted the value of inviting screening during attendance for other clinic visits (7, 8). UK studies emphasised the opportunities for providing knowledge and awareness during routine vaccination or other clinic visits amongst screening non-responders (27). One UK study found a small increase in non-responders taking part in bowel screening following a brief intervention during a routine clinic visit.(28) Two studies reported increased knowledge and awareness of breast cancer amongst women following receipt of a guided conversation and booklet during a primary care consultation (29, 30).

Interventions in the community

Authors of one review highlighted the potential to use community pharmacies to deliver education and screening interventions (31). However, a UK study used pharmacies and community health educators to offer a lifestyle and risk assessment, including signposting and information provision and development of personal goals and reported that only five people of the 1347 who took part completed additional cancer screening, with most already having high uptake.

Four reviews provided evidence of the effectiveness of community health worker interventions or lay health workers for increasing cervical screening uptake (12, 32), breast cancer screening (33), and attendance for other cancer screening (34). Similarly a review of “patient navigator” interventions in colorectal screening found evidence of improvement in rates of screening amongst minority populations (21). In contrast however, a review of colon, breast and prostate cancer screening concluded that lay health worker interventions were less successful than other approaches amongst minority populations.

The evidence regarding nurse navigator interventions in cervical screening was less positive, with one review finding that the likelihood of attending was reduced following this intervention (25), and a UK primary study similarly found that the offer of a nurse navigator was detrimental to uptake of cervical screening amongst young women (20).

Reviews indicated the value of community group education sessions and their superiority over one to one education. In a review of colorectal screening, group sessions increased intention to screen (uptake was not evaluated) (35). This finding regarding the effectiveness of group sessions was echoed in reviews of multiple types of screening (9, 36).

Other reviews evaluated multiple and diverse types of programmes taking place in community settings with complex and varying findings, but one reported a positive effect on knowledge of cancer or intention to be screened (37), and another similarly found increases in awareness and screening uptake (38).

Public awareness campaigns and social media

One review reported that media interventions for a range of screening were “broadly successful” (36). One review and one UK primary study however, provide caution that mass media campaigns in bowel cancer screening can increase screening amongst those from more advantaged backgrounds and the “worried well” and therefore have a negative impact on reducing inequalities (35, 39). One review highlighted that social media tools have potential to be used, but that there is currently a lack of rigour in studies (40).

Monetary incentive

Evidence from three reviews indicated that providing a payment incentive to take part in bowel screening is not effective (5, 7, 35). A UK study of providing a payment to incentivise girls to get their parents to sign a consent form for HPV vaccination however, did increase return rates (41).

Self-sampling kits

Five reviews evaluated the use of an HPV self-sampling kit rather than clinician sampling, and all reported that these increased participation in screening (8, 25, 32, 42, 43). One of these reviews reported an increase in participation rate of around 10% (8), although another cautioned that self-sampling kits should be sent to women at their home address, and that the size of the effect varied substantially between studies (43). It was highlighted that self-sampling may be particularly useful as an alternative for women who do not participate in traditional cytological screening (42, 43). Only sending unrequested kits was noted to be both effective and cost effective (25).

UK studies echoed that sending self-sampling kits increased uptake amongst women invited for first screen (20), and can be effective for non-attenders by nudging them to attend for screening (44). In an echo of the review findings, sending only to those who request, was reported to be ineffective (44). Offering kits to women who attend for unrelated clinic appointments was recommended, with authors of one study estimating that this might result in around 7% of screening non-attenders returning a self-sample.

Four reviews indicated that distributing tests for colorectal screening (faecal occult blood test/faecal immunochemical test) directly to patients via post was effective in increasing participation in screening (7, 8, 11, 45), and one of these reviews found that postal distribution was more effective than collection from a healthcare centre (8).

One review highlighted that the ease of the test procedure influences uptake, for instance adopting a test which does not require dietary restrictions, or providing gloves increases participation in mail-out colorectal screening (5). However, one UK study found that providing a stool collection device for bowel screening did not have potential to increase uptake (46).

Multiple strategies

Several reviews emphasised the “added value” of combining interventions. In one review of colorectal screening, it was noted that telephone calls and mailing, or telephone calls alone could be particularly effective when added to another intervention (11). Another review (of bowel cancer screening) echoed that while individual interventions may show modest gains, combining interventions leads to greater effectiveness (47). In one study, combinations (apart from patient education) such as clinician prompts, when added to mail-out faecal occult blood testing were associated with greater increases in uptake than single intervention components (11). The authors of one review echoed that patient education information may have limited effects, highlighting that additional print material should not be combined with other interventions, as this reduced participation in their analysis (47). A review of cervical screening echoed the finding that mixed

strategies are effective, for example combining lay health advisors with outreach and media support (32).

In a UK primary study, the combination of letter, telephone call, and text message was the only statistically significant combination of interventions to increase bowel screening uptake (48).

What is the evidence regarding effectiveness in different population groups?

What types of intervention may be most effective in sub-groups?

Two reviews noted that more successful breast cancer awareness and uptake interventions were those that were tailored to suit specific population groups (36, 38). This was echoed by a further review which noted that most studies of educational interventions aiming to increase breast screening uptake in African-American women used culturally tailored materials, with positive effects on uptake (33). A fourth review similarly recommended culturally targeted interventions for a range of screening types (9). In contrast, a review of bowel screening found that culturally tailored navigation interventions were not more effective than standard navigation (11).

The reviews of community health worker and other community interventions all focused on ethnic minority groups (in the USA) with authors reporting that this type of intervention was promising to address cancer screening disparities in this population (34). Authors of one of these reviews (breast and cervical screening in ethnic minority women) highlighted the importance of culturally relevant material and multiple intervention strategies including those to enable access and involvement in community networks (37). The use of multi-component interventions in low income populations was echoed in a review of bowel screening (45). Factors influencing success in a community programme using pharmacies and community health educators were itemised as being: using lay people to deliver the intervention; going out to people in the community; organisations delivering the intervention being embedded in the community; and having diversity in terms of gender, ethnicity and socio-economic status (49).

Authors of a review of many types of screening concluded that interventions which were found most consistently to improve participation in cancer screening in “underserved” populations were pre-screening reminders, general practice endorsement, personalised reminders for non-participants, and offering a more acceptable screening test in cervical and bowel screening (8). Patient navigator interventions were also reported as effective in urban minority ethnicity populations, with the authors of this study reporting an enhanced uptake of 11-91% for colorectal screening in these groups (44). The authors recommended that the use of language-concordant and ethnic-concordant patient navigators enhanced the intervention. A review of social media use in cancer prevention reported that interventions which targeted specific ethnic groups could be effective in reducing

health disparities, and highlighted that social media was used to a greater extent in some ethnic groups (40).

Are outcomes different for differing groups?

One review reported that where interventions were effective, their effectiveness did not differ by ethnic population (45). This finding was echoed by another review of bowel screening where the authors concluded that there was little evidence that targeting interventions at specific subpopulations will improve participation rates (47). This review examined the effects of a range of interventions on sub-populations, with only advance notification having a greater effect in males than females, and community drop off being more effective for those of a younger age. The effectiveness of GP endorsement, simplifying the procedure, additional materials, and financial incentive did not vary by age, gender or socio-economic status. Another study finding little difference in outcomes was a UK study of breast cancer screening, which reported that effectiveness of a reminder letter intervention alongside a first appointment was not significantly affected by age or socioeconomic status (10).

Other evidence however indicated sub-population differences in outcomes. A UK study of sending self-sampling HPV kits noted differential sub-group outcomes in that most previously non-attending women who returned kits were white and aged 25-49 (50). A UK study of text reminders prior to breast screening appointment reported that women living in the most deprived areas had the poorest record for registering their mobile phone number with their GP, but that the intervention had the greatest effect in this population (an increase of attendance at first appointment of 28%) (4). One UK study, which sent an enhanced reminder of bowel screening to non-responders, also reported a positive effect on people from deprived areas, with an 11% increase in the odds of people from these areas being screened (23). However, a similar study which evaluated an enhanced information leaflet found that it did not narrow the gap between uptake in the most, versus least deprived populations (21).

A UK study of GP endorsement in bowel screening reported that the intervention did not reduce the socio-economic gradient between those taking part and those not responding (51). This finding was echoed by a second UK study of text message reminders for colorectal screening, which noted that people in deprived areas were more likely to have a mobile phone, but less likely to take up screening (15).

A UK evaluation of a brief conversation during a routine primary care appointment found that the uptake of bowel screening was higher in non-responders who were younger or female (28). The authors noted reports of challenges with literacy, deprivation and ethnicity. A UK study of a

community pharmacy intervention noted that 66% of those taking part were female and that men's awareness of cancer symptoms was around half that of women (49). In contrast a UK study of a GP endorsement letter intervention also for bowel screening non-responders reported a significant lower effect in those aged below 65 years, although no other sub-group differences in response (52).

What is the evidence regarding the influence of context and implementation factors?

Authors of reviews noted that details of context and implementation were frequently lacking from the primary studies, for example whether new staff were hired or whether additional resources were required, (45) and also details of the intervention (31).

Evidence from the reviews relating to implementation included the recommendation that interventions should be more holistic. Authors of a review of interventions for African-American women for example reported that screening should be among several strategies for better health outcomes, and not just the only focus for health promotion (33). Another recommendation was that cancer screening programmes must address barriers along the entire screening continuum, including diagnostic follow-up, and treatment in order to achieve maximum benefits (9). Another review concluded that population-wide screening efforts should also consider tailored interventions based on prior screening behaviours and enhanced utilisation of electronic health records to identify patients due for screening, and track patients through the screening pathway (7). Authors of a further review highlighted that cancer awareness and screening interventions should be implemented at both community and clinical (healthcare) level to maximise effectiveness (35).

In regard to specific types of intervention, one review concluded that incorporating self-sampling strategies into cervical cancer screening programmes will reduce costs and may increase the number of women reached by these programmes. Attention to addressing practical and perceived barriers of self-sampling may further increase acceptability and usage among women (42). One included review provided an economic analysis of the costs of cervical cancer screening interventions (25). It found that the cost of sending a pre-leaflet was £4.62 per woman attending, and the cost of an online booking system was £3.88 per woman attending. Other intervention costs per screening round per woman attending varied from about £1.20 (2014 UK) to £62.

The UK primary studies highlighted the potential for varying outcomes between different sites and individuals implementing interventions (10). One evaluation of self-sampling HPV kits for non-attenders found that the proportion of eligible women offered kits varied considerably among practices (11–36%) and some clinicians offered none (50). The authors noted that some practitioners expressed concern that the test was inferior to cervical cytology, that test uptake did not contribute

to the annual reward and incentive programme, and some believed that women would eventually come for a smear.

A study of a GP endorsement added to a letter highlighted the system changes that may be required for an intervention - "letters sent from the Southern Hub were incorporated into the routine workload. The approach requires continued engagement from GP practices and thus extra work to check lists of patients for suitability to send a reminder which may affect feasibility" (52). Another study of a bowel cancer screening intervention (brief conversation) included discussion of reported challenges - work-related pressures, time constraints, practice priorities and differing systems of flagging non-responders, with the researchers regularly visiting practices to support implementation. The importance of regular contact to support implementation was echoed in a further study of a brief intervention for bowel screening, which noted the importance of brevity and simplicity to incorporate the intervention into routine clinical care. Practices had received a briefing session, support to set it up, and also regular contact (27). A study of a breast cancer awareness brief intervention had provided a one hour training session to nurses and GPs in order to deliver the intervention (30).

An evaluation of a letter and telephone call intervention which was delivered by "Cancer Screening Facilitators" reported that the most useful aspect of the project reported by GP practice staff was the support provided by the facilitators who assisted by 'highlighting the appropriate patients', 'reviewing the processes' and providing an 'opportunity to ask patients face to face to complete testing kits'.

The need to consider capacity within the system was highlighted by an evaluation of an enhanced invitation for flexible sigmoidoscopy, with the study authors outlining that there was an expectation of five more appointments each week being required, and participants were enrolled over a 20 week period to ensure there was workforce capacity (53, 54). A study evaluating a text message and app for non-responders to cervical screening outlined that patients were identified via the electronic patient record system. Staff selected a proportion to be contacted each week based on the number of appointment slots available (14).

The challenge of contacting individuals to provide reminders or prompts for screening was also highlighted (13). One study of a text message reminder for bowel screening reported that those aged over 65 were less likely to have a mobile phone registered with their GP. The authors also highlighted that there may need to be a change to infrastructure, requiring investment to enable text messaging (15). Another study reported that only 41% of women had a mobile number in their

GP record (4). A further study described there being large differences between practices in the number of mobile numbers registered (14).

One evaluation of a self-screening HPV kit provides an interesting conclusion; that non-attenders for first cervical screening often made a decision to attend over a period up to 18 months rather than immediately after the intervention. The authors of this study recommended that further intervention could be delayed for up to 18 months while the effect was being ascertained (20).

What do the findings tell us about Leeds Screening and Awareness Coordinator-type approaches?

Our searches of the literature identified a wide range of interventions to increase the uptake of cancer screening, but we were unable to locate any directly comparable interventions to the Leeds programme. We included one evaluation report from a “Screening Coordinator” intervention, but this has few similarities with the Leeds model where staff are providing a more strategic and oversight rather than “hands on” role within GP practices.

This review of the literature indicates that multiple types of strategies can have the outcome of increasing uptake of cancer screening. There appeared to be commonality across the three types of cancer in terms of which strategies may be beneficial. We endeavoured to distinguish findings from studies of interventions to encourage first attendance at screening, from those which specifically targeted non-attenders. We found that many studies included both types of patients or did not clearly specify the study population. The interventions which seemed to be particularly recommended for one more than the other group, were HPV self-sampling kits, and opportunistic brief interventions which studies identified as being of particular potential value for previous non-attenders.

While the review was unable to identify similar interventions to compare to the Leeds programme, it includes useful information in terms of providing evidence to underpin recommended strategies, and considerations for implementation. It highlights that while varying individual strategies may be effective, that there can be added value from multiple interventions. This may be particularly important when considering outcomes for people from minority ethnicity groups. The evidence largely supported the tailoring of interventions for minority ethnicity groups, and also highlighted the need to combine clinical (healthcare) and community strategies for maximum effectiveness. Most of the community interventions reported in the included literature had been targeted to minority groups in the USA, with a need to consider the applicability of this evidence to the UK context. The linking of community and healthcare strategies could be a valuable strategic Coordinator role.

While there was some evidence of beneficial effects for minority ethnicity sub-groups by adopting these tailoring and community-based strategies, there was little evidence in the review which could be drawn on to identify optimal interventions to address socio-economic inequalities in uptake. Some studies reporting outcomes by socio-economic sub-groups and identified positive effects across populations, but others highlighted that interventions had been unable to close the socio-economic gradient in uptake.

The UK literature highlighted the variance in implementation of interventions, with differences in systems at sites, and individual views and preferences affecting actions. It indicated the value of frequent contact to encourage and support interventions, and the provision of training. The review highlights the potential of opportunistic interventions to reach people (especially non-attenders) during routine visits, which could be a valuable emphasis in training. The reported variance in implementation could also reinforce the value of training, and be a valuable focus for a strategic Coordinator role.

Limitations

This work was carried out using rapid review methodology, therefore it is possible that some relevant literature was not identified and included. We searched a range of relevant electronic databases and used a search strategy developed by an information specialist however, we did not employ additional search methods such as citation tracking or reference list screening. The screening of the database was carried out by a single researcher, although a sample was double checked. Data extraction was carried out by two researchers. In line with rapid review methodology we did not carry out quality appraisal of individual studies but report the overall quality of literature based on the hierarchy of study design.

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7. Workshop five: sharing the evidence from the economic and effectiveness reviews

A virtual workshop was held on the 2nd July 2020 to feedback and discuss the results of the economic work and effectiveness review (Appendix 3). Twelve people were able to attend, and the feedback was very positive that attendees had found it interesting and useful. Notes from the workshop are provided in table 1.

Table 1: Workshop notes

Breast screening presentation	<p>Question: Is the national data mirroring what would happen locally?</p> <p>Comment: This demonstrates proportionality and how the focus should be on the most needy.</p>
Cervical	<p>Comment: ethnicity data is patchy and access to local data would be very helpful.</p>
Bowel	<p>Question: Regarding low uptake in Asian population, do we have local data to support this?</p> <p>Comment: There is a gap and this is something we need to look at</p> <p>Comment - these figures sound reasonable</p> <p>Comment – will use this data to focus on certain groups to take this forward.</p> <p>Comment: FIT positive population are most likely to benefit from colonoscopy – but need to encourage the population to have a FIT test. Would it be possible for the Cancer Screening and Awareness Coordinators to identify FIT positive patients from practice data?</p> <p>Comment: there is potential to target these patients to ensure they attend for colonoscopy.</p>
Effectiveness evidence	<p>Comment: Some of the findings are being implemented in practice, e.g., practice champions sending reminder letters and advance notifications, phone calls and text messages.</p> <p>Comment: It would be interesting to see which methods could be combined to provide the best outcomes.</p> <p>Comment: Cancer Screening and Awareness Coordinators could identify at risk groups and Leeds Cancer Awareness could do some work with them by going out and speaking to communities. Health and community coming together.</p> <p>Comment: If you are able to personalise information, there is good evidence that this is effective.</p> <p>Comment: Are there ways we can try out different approaches in Leeds? Mindful that national templates are used, but would there be ways of adapting information, trialling new things?</p> <p>Comment: It needs to be easy for people to access screening.</p>
Discussion: How does this evidence inform the role of Cancer Screening and Awareness Coordinators particularly post Covid-19?	<p>Comment: Reflect on post Covid time and disproportionate impact on deprivation and certain groups, which has shone a light on inequalities. Focus on groups where the need is highest.</p> <p>Comment: Secondary care will not be able to cope with an increased response and referrals into the services.</p> <p>Comment: Services will be going back over those that have been missed.</p> <p>Comment: HPV vaccination do we know who invites children in schools for HPV vaccination programme? Is this undertaken nationally or locally? Is there work for Cancer Screening and Awareness Coordinators to ensure girls receive the vaccination in the deprived areas?</p>

8 Conclusions and recommendations

1. The initial programme logic model indicated that the role of the Cancer Screening and Awareness Coordinators was intended to be strategic in nature. However, evidence from the economic and effectiveness reviews suggests that incorporating a more proactive 'hands on' approach to activities may be beneficial.
2. The review of effectiveness suggests that utilising multiple approaches including outreach into the community, flagging non responders, and viewing screening within a wider public health approach to tackling health and health inequalities may be helpful.
3. If Cancer Screening and Awareness Coordinators are to take a more strategic role moving forwards, there should be further development of the role across (not just within) the Primary Care Networks, to address the varying implementation and outcomes between different sites and individuals.
4. The pause in programme due to Covid-19 has provided an opportunity to reflect on and clarify the role of the Screening Coordinators, and to consider the specific aims and activities of the programme and where it fits into other initiatives in Leeds. This will be helpful clarification as further Cancer Screening and Awareness Coordinators are recruited.