



REVIEW

The implementation and mechanisms of advance notification for cancer screening: A scoping review

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Abstract

Objective: To describe and synthesise information on the content and delivery of advance notifications (information about cancer screening delivered prior to invitation) used to increase cancer screening participation and to understand the mechanisms that may underlie their effectiveness.

Methods: Searches related to advance notification and cancer screening were conducted in six electronic databases (APA PsycINFO, CINAHL, Cochrane Library, Embase, PubMed, Web of Science) and results were screened for eligibility. Study characteristics, features of the advance notifications (cancer type, format, delivery time, and content), and the effect of the notifications on cancer screening participation were extracted. Features were summarised and compared across effective versus ineffective notifications.

Results: Thirty-two articles were included in this review, reporting on 33 unique advance notifications. Of these, 79% were sent via postal mail, 79% were distributed prior to bowel cancer screening, and most were sent 2 weeks before the screening offer. Twenty-two full versions of the advance notifications were obtained for content analysis. Notifications included information about cancer risk, the benefits of screening, barriers to participation, social endorsement of cancer screening, and what to expect throughout the screening process. Of the 19 notifications whose effect was tested statistically, 68% were found to increase screening (by 0.7%–16%). Effectiveness did not differ according to the format, delivery time, or content within the notification, although some differences in cancer type were observed.

Conclusion: Future research should explore the effectiveness of advance notification via alternative formats and for other screening contexts and disentangle the intervention- and person-level factors driving its effect on screening participation.

KEYWORDS

advance notification, cancer, early detection of cancer, intervention, oncology, pre-notification, scoping review, screening

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1 | INTRODUCTION

Cancer is a leading cause of death worldwide.¹ In 2020 alone, there were an estimated 19.3 million new diagnoses, and almost 10 million deaths attributed to cancer.² Screening is a highly effective means of reducing cancer-related morbidity, mortality, and associated health care costs.³ As such, population-level screening initiatives, typically targeting breast, bowel, and cervical cancer, have been implemented in many countries including Australia, Ireland, Scotland, the Netherlands, and Italy.^{4,5} These programs aim to increase detection of early-stage cancers or precancerous abnormalities within the target population, increasing the likelihood of effective treatment.⁶ The effectiveness of cancer screening programs worldwide is hindered by suboptimal participation, with screening rates as low as 16% for bowel,⁵ 11% for breast,⁷ and 4% for cervical cancer screening.⁸ Optimising screening programs to increase uptake of cancer screening tests is critical to reducing the burden of cancer.

One strategy used to increase screening rates is 'advance notification', wherein eligible invitees are informed of an upcoming opportunity to screen for cancer, *prior* to invitation. This strategy is used in bowel cancer screening programs in many countries around the world, including Denmark, England, and Australia. The Australian National Bowel Cancer Screening Program (NBCSP) distributes advance notification letters four to six weeks prior to the arrival of the at-home screening kit, briefly informing recipients about the risk of bowel cancer, the benefits of screening, and to expect their test kit in the mail in the coming weeks. Compared to no advance notification, the Australian NBCSP's advance notification letter is estimated to account for an additional 54 per 100,000 bowel cancer deaths avoided and incurs less than \$4000 in costs per life year gained, well below the Australian standard for intervention cost effectiveness.^{9,10} Although advance notification has been repeatedly shown to increase participation in screening, especially for bowel cancer,^{11–15} these increases are small to moderate, between 4% and 9%,^{16,17} suggesting room for further enhancement. One study has also demonstrated its effectiveness in increasing adherence to prostate screening, although the size of this increase is unclear.¹⁸ Currently, there is a lack of knowledge regarding how advance notification increases screening participation. A deeper understanding of the mechanisms of advance notification can lead to the development of improved interventions with the potential to further increase screening rates.

There are several theoretical models that describe the psychological processes that underly the motivation to engage in a health behaviour (e.g., screening) and the behaviour itself, such as the Transtheoretical Model,¹⁹ the Health Action Process Approach,²⁰ and the Precaution Adoption Process Model.²¹ Research has consistently demonstrated that interventions based on psychological and behaviour change theory are more effective than atheoretical interventions.^{22,23} For example, a 2016 Australian study examined the effectiveness of an advance notification letter including messaging informed by the Transtheoretical Model, compared to the standard letter implemented as part of the Australian NBCSP.^{19,24} The results showed that the theory-driven advance notification letter

elicited a 4% increase in bowel cancer screening participation compared to the standard letter.²⁴ This theoretical approach is an exception to the norm, however. Most existing bowel cancer screening interventions do not make explicit reference to behavioural theory in their design.²⁵ The integration of psychological and behaviour change theory into the design of advance notifications may increase its effectiveness and facilitate further increases in cancer screening participation.

Advancing the current knowledge about *how* advance notification improves cancer screening participation holds potential benefit to intervention design. This understanding could lead to the development of advance notification interventions directly targeting evidence-based mechanisms of behaviour change, driving further increases in screening participation. However, current knowledge regarding how advance notification is used and the components of this intervention, which may account for its effectiveness, has not been comprehensively reviewed. The present study utilises a scoping review methodology to examine the content and delivery of advance notifications used to increase cancer screening participation. This review aims to gather a preliminary understanding of the potential mechanisms of advance notification and highlight gaps in the literature to inform the design of future primary research investigating potential mechanisms of advance notification.

2 | METHODS

This scoping review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).²⁶ A PRISMA-ScR checklist is provided in Supporting Information S1. A protocol was developed a priori by the research team using the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis,²⁷ and pre-registered via Open Science Framework (<https://doi.org/10.17605/OSF.IO/S65HK>).

2.1 | Eligibility criteria

Inclusion and exclusion criteria for the articles were designed in alignment with the Population, Concept, Context (PCC) framework²⁸ and are provided in Supporting Information S2. Only published, peer-reviewed research in English was eligible for inclusion. All study designs were eligible; however, secondary research such as systematic reviews were excluded. No eligibility criteria were specified based on participant demographics and no date limits were applied. Included articles needed to involve the implementation of an advance notification intervention. This was defined as an intervention wherein (i) participants are informed of an upcoming opportunity to screen for cancer (ii) *before* they can take steps to participate (e.g., booking an appointment, completing a screening kit). The latter criterion was included to prevent conceptual overlap with other invitational strategies such as reminders. Further, studies examining advance notification in the context of any type of cancer screening were included,

wherein screening was defined as a test aiming to detect early signs of cancer and/or precancer amongst asymptomatic individuals from the general population. Studies wherein screening tests were utilised for diagnostic purposes amongst symptomatic patients, or for surveillance purposes of cancer survivors, were thus excluded.

2.2 | Information sources and search strategy

Six databases (APA PsycINFO, CINAHL, Cochrane Library, Embase, PubMed, and Web of Science) were selected and searched on 30 May 2023, using keywords and subject headings (e.g., MeSH) relevant to advance notification and cancer screening (see Supporting Information S3 for search syntax). The search strategy was developed in consultation with an experienced research librarian and refined by the research team. Searches were adapted manually for each database. Five articles already known to meet the eligibility criteria^{13,14,24,29,30} were selected and used to test that the search strategy identified relevant records across each of the databases. Hand searching (i.e., perusing key journals and reference list scanning) was also used to locate relevant studies. As this review aimed to examine the content of advance notifications, study authors of included articles were contacted to request full versions of the advance notifications distributed to study participants, if not already publicly available.

2.3 | Study selection

Following the search, identified citations were uploaded into EndNote X7 citation management software³¹ and duplicates removed. Articles were then uploaded into Rayyan for screening.³² Title and abstract and full text screening were based on the PCC eligibility criteria and performed by two independent reviewers (KC, AT-S), with disagreements resolved through discussion.

2.4 | Data analysis

A data extraction template was developed based on the JBI template source of evidence details, characteristics, and results extraction instrument (<https://jbi-global-wiki.refined.site/space/MANUAL/4687579>; see Supporting Information S4). Data from a selection of 10 included articles were re-extracted by another researcher (AT-S) for accuracy. In this review, we report study characteristics (Table 1) and features of the advance notifications implemented within the included articles (Table 2).

Study characteristics and the features of the distributed advance notifications, including target cancer type, format (e.g., letter), delivery time (e.g., 2 weeks in advance of screening invitation), and key content (i.e., statements or messages within the notifications) were summarised and compared between effective and ineffective

notifications (i.e., those that significantly increased screening vs. those that did not). It has been suggested that advance notification is particularly effective in people who have not been invited to participate or have not participated in a screening program before.⁵⁵ Therefore, we also examined the proportions of participants in each sample that had been invited to participate in screening before.

The full versions of the distributed advance notifications, where available, were analysed via relational qualitative content analysis⁵⁶ to identify latent meaning from text.⁵⁷ First, text within each of the advance notifications were read and coded line-by-line to generate an initial set of subcodes reflecting semantic meaning of the message communicated to screening invitees. Then, these subcodes were organised based on shared meaning to produce a set of overarching codes, representing the broad messaging strategy utilised (e.g., 'screening prevents cancer' and 'screening saves lives' subcodes were organised under a single code, 'benefits of screening'). In line with PRISMA-ScR guidelines, a formal quality assessment of the included articles was not conducted.²⁶

3 | RESULTS

The database searches retrieved a total of 8228 records, of which 25 articles were eligible for inclusion (see Figure 1). A further seven articles were identified and included via hand search methods. A total of 32 articles were included in this review, reporting on 33 unique advance notifications. Twenty-two full versions of these unique advance notifications were obtained for content analysis; the remaining 11 were unable to be obtained from study authors.

3.1 | Study characteristics

The key characteristics of the 32 included articles are summarised in Table 1.^{9,11-13,15,18,24,29,30,33-55} Of these, the majority originated in the United States of America (41%), with others from the United Kingdom (25%), Australia (13%), Denmark (3%), Italy (3%), Latvia (3%), the Netherlands (3%), New Zealand (3%), Spain (3%), and Sweden (3%). The median sample size was $N = 4430$ (range: 25–597,414). Studies were published from 1986 to 2023, with 44% published within the last 5 years. Most studies were randomised controlled trials (RCT; $n = 23$; 72%). Studies utilised quantitative analysis methods, with the exception of five studies which analysed qualitative interview data.^{30,37,49,52,53} The most common outcome measured in quantitative studies was completion of screening tests ($n = 25$; 78%). Qualitative studies focused on participant feedback regarding the implementation of advance notifications within organised cancer screening programs.

In most studies (72%), no information was reported regarding the proportion of participants in the sample who had previously been invited to participate in cancer screening. Two studies examined advance notifications among a sample of only participants who had

TABLE 1 Characteristics of the 32 studies included for review.

Author (year) (ref)	Sample size	Region	Study design	Primary outcome	% previously invited to screen
Brewer (2021) ³³	3553	New Zealand	RCT	Screening completion	NR
Cole (2007) ¹¹	2400	Australia	RCT	Screening completion	NR
Coronado (2020) ³⁴	2825	USA	RCT	Screening completion	NR
Coronado (2023) ³⁵	27,585	USA	Cluster RCT	Screening completion	NR
Crane (1998) ³⁶	NR	USA	RCT	Enrolment in screening program	NR
Cronin (2013) ⁹	NA ^a	Australia	Cost effectiveness analysis	Cost effectiveness (life-years gained, deaths avoided)	NA ^a
Davis (2021) ³⁷	41	USA	Interview study	Participant feedback on advance notification text messages	NR
Deeds (2022) ³⁸	5667	USA	Program evaluation	Screening completion	NR
Gierisch (2010) ³⁹	3547	USA	RCT	Screening completion (length of time before adherence)	100%
Goshgarian (2022) ¹²	2339	USA	RCT	Screening completion	NR
Hardcastle (1986) ⁴⁰	26,975	UK	RCT	Screening completion	NR
Huf (2021) ⁴¹	440	USA	RCT	Screening completion	NR
Kitchener (2016) ⁴²	20,879	UK	Cluster RCT	Screening completion	NR
Koitsalu (2018) ¹⁸	28,134	Sweden	Quasi-RCT	Screening completion	NR
Larsen (2022) ⁴³	59,041	Denmark	RCT	Screening completion	NR
Levin (2020) ⁴⁴	56,490	USA	Prospective cohort study	Screening completion	0%
Libby (2011) ¹³	59,953	UK	RCT	Screening completion	44%
Myers (1991) ⁴⁵	2201	USA	RCT	Screening completion	NR
O'Carroll (2015) ⁴⁶	60,000	UK	RCT	Screening completion	NR
Pye (1988) ⁴⁷	3860	UK	RCT	Screening completion	NR
Quaife (2020) ⁴⁸	2012	UK	RCT	Screening completion	NR
Sadler (2013) ³⁰	31	UK	Interview study	Participant feedback on advance notification leaflet	0%
Santare (2015) ²⁹	15,000	Latvia	RCT	Screening completion	NR
Schneider (2023) ⁴⁹	70	USA	Interview study	Participant feedback on advance notification text message/phone call	NR
Selva (2019) ⁵⁰	512	Spain	RCT	Screening completion	0%
Senore (2015) ¹⁴	44,198	Italy	RCT	Screening completion	46%
Somsouk (2020) ⁵¹	5386	USA	RCT	Screening completion	100%
Sultana (2015) ⁵²	34	Australia	Interview study	Participant feedback on advance notification letter	NR
Thompson (2019) ⁵³	25	USA	Interview study	Participant feedback on advance notification text message	NR
van Roon (2011) ¹⁵	5000	Netherlands	RCT	Screening completion	NR
Wardle (2016) ⁵⁴	597,439	UK	Cluster RCT	Screening completion	NR
Zajac (2016) ²⁴	9216	Australia	RCT	Screening completion	NR

Abbreviation: NR, not reported.

^aStudy was an economic analysis of the cost-effectiveness of the use of an advance notification letter in the Australian National Bowel Cancer Screening Program and was based on a simulated population.

TABLE 2 Features and effect on cancer screening participation of the advance notification interventions ($n = 33$).

First author (year) (ref)	Result	% increase in screening	Cancer type	Screening method	Format	Delivery time	Content ^a
Cole (2007) ¹¹	↗	8.8%	Bowel	FOBT	Mail (letter)	2 weeks	<ul style="list-style-type: none"> Healthcare professional endorsement Reducing barriers (cost) Screening prevents cancer Susceptibility to cancer When to expect your invitation Where to learn more
Goshgarian (2022) ¹²	↗	5.5%	Bowel	FOBT	Digital (electronic message)	1–2 weeks	<ul style="list-style-type: none"> Healthcare professional endorsement Reducing barriers (cost, difficulty) Susceptibility to cancer When to expect your invitation Where to learn more
Hardcastle (1986) ⁴⁰	↗	8.7%	Bowel	FOBT	Mail (letter)	2 weeks	NR
Hardcastle (1986) ⁴⁰	↗	16%	Bowel	FOBT	Phone call	2 weeks	NR
Koitsalu (2018) ¹⁸	↗	NR	Prostate	PSA test	Mail (postcard)	1 week	<ul style="list-style-type: none"> How to identify your screening invitation Reducing barriers (cost) Screening prevents cancer When to expect your invitation Where to learn more
Libby (2011) ¹³	↗	5.1%	Bowel	FOBT	Mail (letter)	2 weeks	<ul style="list-style-type: none"> Healthcare professional endorsement Screening prevents cancer Severity of cancer Susceptibility to cancer When to expect your invitation Where to learn more
Santare (2015) ²⁹	↗	0.04%–7.7% ^c	Bowel	FOBT	Mail (letter)	2 weeks	NR
Selva (2019) ⁵⁰	↗	11%	Bowel	FOBT	Phone call	NR	<ul style="list-style-type: none"> Healthcare professional endorsement Reducing barriers (cost, difficulty) Screening saves lives Susceptibility to cancer What to do when you receive your invitation What to expect after the screening test
Senore (2015) ⁵⁵	↗ ^c	3.6%–4.7% ^d	Bowel	FOBT, FS	Mail (letter)	1 month	NR
Senore (2015) ⁵⁵	↗ ^c	2.8%–4.7% ^d	Bowel	FOBT, FS	Mail (letter)	1 month	NR
van Roon (2011) ¹⁵	↗	3.3%	Bowel	FOBT	Mail (letter)	2 weeks	NR
Wardle (2016) ⁵⁴	↗ ^b	0.7%	Bowel	FOBT	Mail (letter)	8–10 days	<ul style="list-style-type: none"> Healthcare professional endorsement Reducing barriers (difficulty) Screening prevents cancer When to expect your invitation Where to learn more
Zajac (2016) ²⁴	↗ ^b	3.2%	Bowel	FOBT	Mail (letter)	2 weeks	<ul style="list-style-type: none"> Healthcare professional endorsement Reducing barriers (difficulty, disgust, privacy) Screening saves lives Severity of cancer Susceptibility to cancer What to expect during the screening test When to expect your invitation
Crane (1998) ³⁶	—	0.3%	Breast	Mammogram	Mail (postcard)	2–8 weeks	NR

(Continues)

TABLE 2 (Continued)

First author (year) (ref)	Result	% increase in screening	Cancer type	Screening method	Format	Delivery time	Content ^a
Larsen (2022) ⁴³	—	0.6%	Bowel	FOBT	Digital (email)	10 days	<ul style="list-style-type: none"> • Screening saves lives • Susceptibility to cancer • When to expect your invitation • Where to learn more
Myers (1991) ⁴⁵	—	1%	Bowel	FOBT	Mail (letter)	NR	NR
Kitchener (2016) ⁴²	—	0.4%	Cervical	Self-sampling, Pap test	Mail (leaflet)	3 months	<ul style="list-style-type: none"> • Reducing barriers (embarrassment, fear) • Screening prevents cancer • Susceptibility to cancer • What to expect during the screening test • Where to learn more
Wardle (2016) ⁵⁴	—	0.3%	Bowel	FOBT	Mail (letter)	8–10 days	<ul style="list-style-type: none"> • Reducing barriers (fear) • Screening saves lives • Susceptibility to cancer • What to expect after the screening test • What to expect during the screening test
Wardle (2016) ⁵⁴	—	1.8%	Bowel	FOBT	Mail (letter)	8–10 days	<ul style="list-style-type: none"> • Reducing barriers (autonomy, difficulty, disgust, fear) • Screening prevents cancer • Screening saves lives • Susceptibility to cancer • Where to learn more
Brewer (2021) ³³	NA	NA	Cervical	Self-sampling	Mail (letter)	2 weeks	<ul style="list-style-type: none"> • Reducing barriers (cost, difficulty) • When to expect your invitation • Where to learn more
Coronado (2020) ³⁴	NA	NA	Bowel	FOBT	Digital (text message)	1–2 days	<ul style="list-style-type: none"> • Reducing barriers (cost) • Screening saves lives • Where to learn more
Coronado (2020) ³⁴	NA	NA	Bowel	FOBT	Phone call	≤3 weeks	<ul style="list-style-type: none"> • Healthcare professional endorsement • Planning how to reduce barriers • Reducing barriers (difficulty) • Screening saves lives • Severity of cancer • Susceptibility to cancer • Where to learn more
Cronin (2013)	NA	NA	Bowel	FOBT	Mail (letter)	2 weeks	NR
Deeds (2022)	NA	NA	Bowel	FOBT	Mail (postcard)	2 weeks	<ul style="list-style-type: none"> • Reducing barriers (cost, difficulty) • Screening saves lives • Susceptibility to cancer • Urgency • What to expect after the screening test • When to expect your invitation • Where to learn more
Gierisch (2010) ⁹	NA	NA	Breast	Mammogram	Mail (letter)	NR	NR
Huf (2021) ⁴¹	NA	NA	Bowel	FOBT, colonoscopy	Digital (text message)	1 week	<ul style="list-style-type: none"> • Screening maintains good health • Where to learn more
Levin (2020) ⁴⁴	NA	NA	Bowel	FOBT	Mail (postcard)	1 week	NR
Pye (1988) ⁴⁷	NA	NA	Bowel	FOBT	Mail (leaflet)	2 weeks	<ul style="list-style-type: none"> • Reducing barriers (cost, difficulty, fear) • Severity of cancer • Susceptibility to cancer

TABLE 2 (Continued)

First author (year) (ref)	Result	% increase in screening	Cancer type	Screening method	Format	Delivery time	Content ^a
Quaife (2020) ⁴⁸	NA	NA	Lung	LDCT	Mail (letter)	3–4 weeks	<ul style="list-style-type: none"> Reducing barriers (cost) When to expect your invitation Where to learn more
Somsouk (2020) ⁵¹	NA	NA	Bowel	FOBT	Mail (postcard)	NR	<ul style="list-style-type: none"> Healthcare professional endorsement Reducing barriers (difficulty) Screening prevents cancer Susceptibility to cancer
Somsouk (2020) ⁵¹	NA	NA	Bowel	FOBT	Phone call	NR	<ul style="list-style-type: none"> Healthcare professional endorsement Live Q&A Planning how to reduce potential barriers Reducing barriers (cost, difficulty, disgust, embarrassment, fear) Screening is normative Screening maintains good health Severity of cancer What to expect during the screening test When to expect your invitation
Sultana (2015) ⁵²	NA	NA	Cervical	Self-sampling	Mail (letter)	NR	<ul style="list-style-type: none"> Reducing barriers (cost, difficulty) Screening prevents cancer Screening saves lives Susceptibility to cancer When to expect your invitation Where to learn more
Zajac (2016) ²⁴	NA	NA	Bowel	FOBT	Mail (letter)	2 weeks	<ul style="list-style-type: none"> Reducing barriers (difficulty, privacy) Screening saves lives Severity of cancer Susceptibility to cancer What to do when you receive your invitation When to expect your invitation

Note: Result refers to the direction of the effect of the advance notification on cancer screening adherence compared to control, where \nearrow = significant increase; $-$ = no significant effect; NA = not applicable, effect of advance notification (alone) not statistically tested; NR = not reported.

^aFor definitions of the subcodes referenced in the "Content" column, see Table 3.

^bEffectiveness of a modified advance notification relative to standard advance notification procedure, not inert control.

^cLarger effects for guaiac FOBT screening; effect on uptake of faecal immunochemical test non-significant.

^dLarger effects for FS than FOBT screening.

been previously invited to screen,^{39,51} and three studies examined only first-time screening invitees.^{30,44,50} Two studies included samples of 44% and 46% previously invited participants, respectively.^{13,55}

3.2 | Features of advance notifications

Of the 32 included articles (detailed in Table 1), six described the same advance notification,^{34,35,37,46,49,51} and six described more than one different advance notification.^{24,40,47,51,54,55} This resulted in 33 unique advance notifications included in this review. Key features of each unique notification are provided in Table 2.

Most advance notifications informed participants of an upcoming invitation to screen for bowel cancer (79%) via faecal occult blood test (FOBT). Colonoscopy and flexible sigmoidoscopy (FS) were the target of two studies.^{41,55} Other notifications related to cervical cancer screening (9%) via self-sampling and/or Pap test, breast cancer screening (6%) via mammogram, lung cancer screening (3%) via low dose computed tomography scan, and prostate cancer screening (3%) via prostate specific antigen testing. The most common format used for advance notifications was a printed mailout (79%), such as a letter, postcard, or leaflet. The remainder were digital communications (12%) including text messages and emails, and phone calls (12%). Advance notifications were delivered from one day to 3 months prior to the screening invitation, with a median of 2 weeks

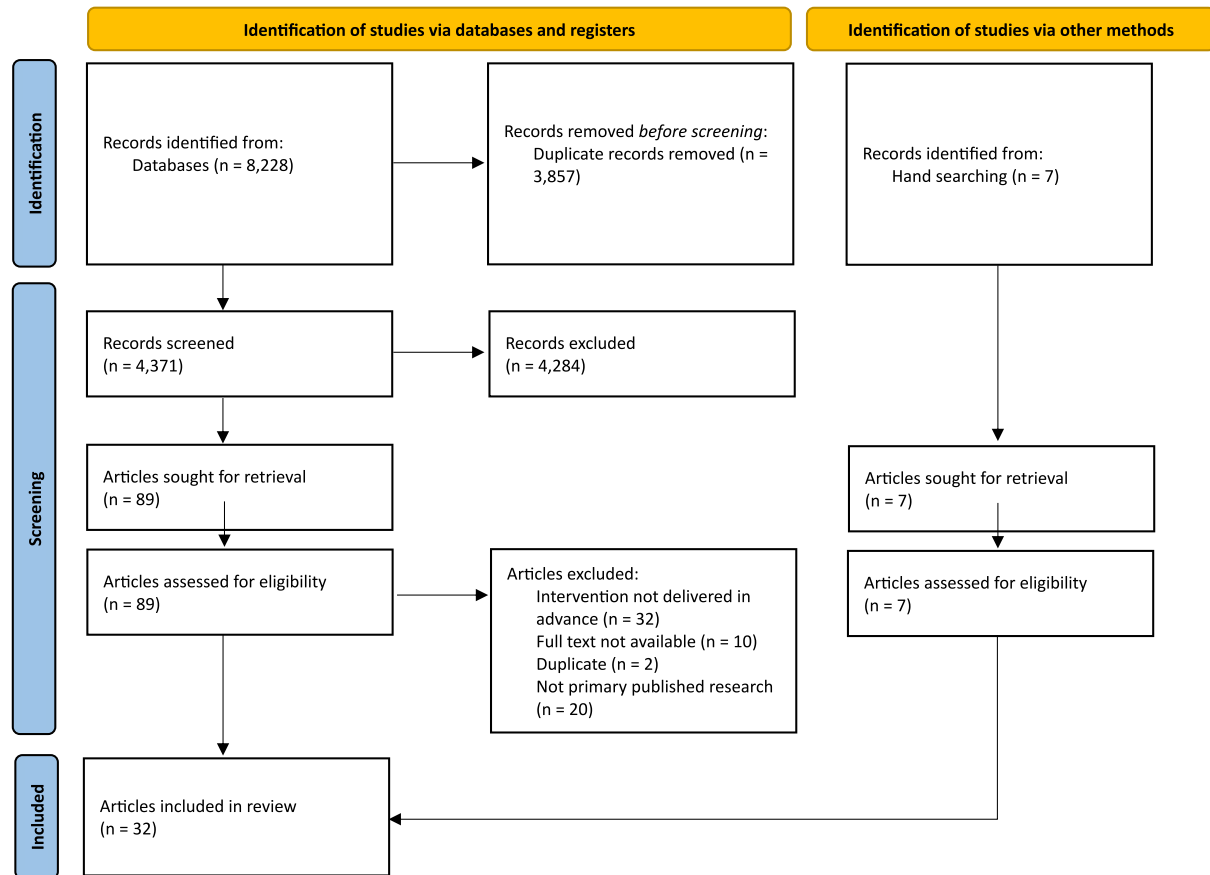


FIGURE 1 PRISMA flow diagram of systematic searches.

in advance (interquartile range: 0.7 weeks). Six of the 33 notifications did not specify how far in advance they were sent.

3.3 | Inductive content analysis

Twenty-one subcodes were created to capture the specific information provided within the advance notifications. These subcodes were organised based on shared meaning into five major codes capturing overall messaging strategies. Throughout the coding process, we identified that the major codes could be mapped to evidence-based mechanisms of behaviour change. These proposed mechanisms and the associated theoretical models are presented in Table 3. Messaging strategies commonly addressed barriers to screening such as perceived difficulty of the test by highlighting the ease and simplicity of home bowel screening kits. Others addressed feelings of embarrassment, for example, by reassuring invitees that they could request a female practitioner for cervical screening,⁴² and disgust, where bowel cancer screening invitees were informed of the cleanliness of the self-sampling procedure.^{24,51,54} Other barriers addressed related to the cost of screening, fear of a possible cancer diagnosis, and privacy of personal information. Notably, in two notifications delivered via phone call^{34,51} invitees engaged in a discussion with the caller about their past and present barriers to screening

and received information and strategies to help overcome these barriers upon receipt of their next screening offer.

Advance notifications also highlighted the risk of cancer. This included addressing the severity of a cancer diagnosis (i.e., risk of mortality), highlighting personal susceptibility to cancer, and promoting urgency around screening completion. Complementing these risk messages, however, was information about the benefits of screening, including increased early detection and decreased risk of mortality, and the possibility of preventing cancer all together. Reinforcement of positive social norms was also used. For example, one notification described screening as a normal part of patient care at the recipient's medical practice.⁵¹ Others included more explicit endorsements by healthcare providers, typically when notifications were provided via phone, where the caller framed the screening offer as on behalf of the recipient's primary care provider.^{34,51}

Advance notifications were also used to navigate the overall screening process. The invitation process was described, including when to expect the screening offer, what to do upon its arrival, and in the case of one mailed notification, how to distinguish the screening invitation from other mail,¹⁸ presumably to prevent misplacement. Details of what to expect during the screening procedure, for example, a description of how to complete the bowel cancer screening kit^{24,51,54} or how a cervical screening test is performed,⁴² as well as what to expect after the test, such as the outcomes of a

TABLE 3 Types of information reported in advance notifications from inductive content analysis (n = 22).

Proposed mechanism of behaviour change (theoretical model)	Code	Sub-code	Example quote (format, cancer type)
Negative outcome expectancies, self-efficacy (Health Action Process Approach, ²⁰) Perceived barriers (Health Belief Model, ⁵⁸) Perceived behavioural control (Theory of Planned Behaviour, ⁵⁹)	Barriers to screening	Reducing barriers (cost)	"I understand that medical procedures can be expensive. The stool test we are offering you is free." (phone call, bowel)
		Reducing barriers (difficulty)	"Screening takes minutes at home." (mail, bowel)
		Reducing barriers (disgust)	"My first thought about the test was that it was going to be messy, but it didn't actually turn out to be." (mail, bowel)
		Reducing barriers (embarrassment)	"This is a routine [cervical screening] test, and you can ask for a female doctor or nurse." (mail, cervical)
		Reducing barriers (fear)	"If there is blood in the stool sample, it doesn't mean you have cancer. It just means your doctor will talk with you about doing another test to find out what's causing the blood." (phone call, bowel)
		Reducing barriers (privacy)	"The test will be completely confidential to you and your doctor." (mail, bowel)
		Planning how to reduce barriers	"Can you think of any reason why you wouldn't do the test when it arrives in a few weeks?" (phone call, bowel)
Positive outcome expectancies (Health Action Process Approach, ²⁰) Perceived benefits (Health Belief Model, ⁵⁸)	Benefits of screening	Screening maintains good health	"We care about your health so we will mail you a free home test." (digital, bowel)
		Screening prevents cancer	"Screening with this test can actually prevent colon cancer." (mail, bowel)
		Screening saves lives	"Doing the FOBT every 2 years lowers the risk of dying from bowel cancer." (mail, bowel)
Cues to action (Health Belief Model, ²⁰) Consciousness raising (Transtheoretical Model, ¹⁹)	Navigating the screening process	How to identify your screening invitation (mail only)	"Please be on the lookout for a large envelope." (mail, prostate)
		Live Q&A (phone only)	"Before I let you go, do you have any questions about the test or anything else?" (phone call, bowel)
		What to do when you receive your invitation	"Please take the time to read the invitation package when you receive it." (mail, bowel)
		What to expect after the screening test	"If we find blood in the stool, we will ask you to undertake a colonoscopy." (phone, bowel)
		What to expect during the screening test	"The test will take about five minutes. During the test, a sample of cells will be taken from your cervix using a small specially designed brush." (mail, cervical)
		When to expect your invitation	"We are mailing you a colon cancer screening test called a FIT kit within the next week." (digital, bowel)
		Where to learn more	"A leaflet with information about the [screening test] is included with this letter." (mail, lung)
Perceived severity/susceptibility (Health Belief Model, ⁵⁸)	Risk of cancer	Severity of cancer	"Did you know that around 80 Australians die each week from bowel cancer?" (mail, bowel)
		Susceptibility to cancer	"Bowel cancer is one of the most common cancers in Australia. The risk of developing the disease is increased in those aged 50 years and over." (mail, bowel)
		Urgency	"Please complete and return the kit as soon as you can." (mail, bowel)

(Continues)

TABLE 3 (Continued)

Proposed mechanism of behaviour change (theoretical model)	Code	Sub-code	Example quote (format, cancer type)
Normative beliefs (Theory of Planned Behaviour, ⁵⁹)		Healthcare professional endorsement	"Your doctor asked me to call you because it is time to get your colon cancer screening test." (phone call, bowel)
Social liberation (Transtheoretical Model, ¹⁹)	Social endorsement of screening	Screening is normative	"At [this clinic], everyone over 50 gets screened every year to check for colon cancer." (mail, bowel)

positive test result,^{38,50,54} were also sometimes provided. Advance notifications commonly provided facts about where to access more information about screening, usually providing helplines, websites, and other printed materials for reference, or in the case of phone calls, the opportunity to seek answers directly from the caller.^{34,50,51}

3.4 | Comparing features of effective and ineffective advance notifications

The features of the advance notifications are listed alongside the effect of the notification on screening participation in Table 2. The effect of the advance notification on cancer screening participation was tested for 19 of the notifications. Most of these notifications ($n = 13$; 68%) significantly improved cancer screening uptake. Absolute increases in uptake were between 0.7% and 16%.^{11-13,15,18,29,40,50,54,55} The remaining notifications had no significant effect on screening.^{36,42,43,45,54} Overall, effective and ineffective notifications could not be differentiated by their characteristics or content, with some exceptions. Advance notifications delivered prior to bowel cancer screening generally increased screening uptake^{11-13,15,24,29,40,50,54,55}; whereas the two notifications sent prior to breast and cervical cancer screening were ineffective.^{36,42} The one notification sent prior to prostate cancer screening also increased participation, although the size of this increase is unclear.¹⁸ Effectiveness did not tend to vary by format, delivery time, or content included within the notification.

4 | DISCUSSION

This scoping review described the content and delivery of advance notifications implemented to increase cancer screening participation. Notifications reviewed were typically delivered via postal mail, 2 weeks before an invitation, and targeted bowel cancer screening. Notifications included information about the benefits and barriers of screening, the risks of cancer, social endorsement of screening, and navigating the screening process. Their effect on screening uptake did not tend to vary based on the content and format of the notification; however, most notifications targeting bowel cancer screening were effective, whereas the few notifications trialed for other cancer types were ineffective.^{36,42}

Most research examining advance notification to date has focused on its application to bowel cancer screening, typically via FOBT, raising generalisability concerns. FOBT is a non-invasive, self-sampling test, often sent directly to the recipient's home.⁶⁰ Insufficient research has examined advance notification for other types of cancer screening, such as breast, cervical, lung, and prostate, which unlike FOBT, typically involve booking and attending a medical appointment. Although notifications in this review targeting breast³⁶ and cervical cancer⁴² did not increase screening uptake, there is currently insufficient evidence to conclude whether the effects of advance notification generalise to contexts where screening involves a visit to a health professional. Interestingly, however, evidence suggested that for bowel cancer screening, advance notification yielded greater increases in FS adherence (5%, which involves a medical appointment and other pre-screening steps such as bowel preparation) compared to the at home FOBT (3%–4%;³⁹). Advance notification affords invitees an increased period of awareness of screening, thus it may be particularly useful to increase participation in screening tests involving additional preparatory steps. Further research is needed to establish the effectiveness of advance notification in these screening contexts.

Various messaging strategies were utilised in the notifications reviewed, many of which were aligned with the processes theorised to underly intention formation.^{19,20,58,59} Due to their design, advance notifications have limited capacity to directly induce behaviour, arriving before the individual is able to screen; however, it has been theorised that advance notifications may provide a "head start" to intention formation, providing invitees the opportunity to contemplate the screening offer ahead of time, thus facilitating a more effective transition into behaviour upon invitation.^{11,61} While this may explain the prevalence of messaging targeting intention formation in advance notifications, to date no research has empirically investigated which latent psychological processes drive increased screening intention following exposure to advance notification. Furthering this understanding may enable the redesign of advance notifications to target mechanisms underlying their effectiveness.

Surprisingly, despite prior evidence that modification of the contents of advance notification can enhance their effect on screening uptake,²⁴ the content of notifications in this review did not tend to vary by effectiveness. In discerning the mechanisms of advance notification, it may be important to consider both intervention-level and person-level factors. For example, for first-

time screening invitees the receipt of advance notification may be their first exposure to a cancer screening test, and thus the notification may be particularly crucial in informing the decision to screen (or abstain), compared to subsequent, familiarised invitees. Less than a third of studies (28%) in this review reported any information about receipt of previous screening invitation.^{13,30,39,44,51,55} More research is needed to understand the direct and interactive effects of person-level factors on uptake of cancer screening following advance notification. This knowledge may inform the tailoring of intervention approaches in future, to effectively increase participation among invitees of varying screening statuses.

4.1 | Clinical implications

The reliable effectiveness of advance notification and the commonly employed messaging strategies used in these notifications can inform the practice of healthcare professionals working to promote preventative health and cancer screening. For example, general practitioners are well placed to facilitate advance notification of cancer screening opportunities to their patients. In fact, text message advance notifications delivered by general practitioners to encourage bowel cancer screening show promise for increasing participation in national programs.^{62,63} In general, digital advance notifications, such as text messages and emails are highly efficient, convenient, and have widespread reach for promoting screening. While the effect of the four digital notifications captured in this review was mixed,^{12,34,41,43} text message reminders (i.e., sent post-screening invitation) have been consistently shown to increase uptake of breast, bowel, and cervical screening,^{64–67} suggesting that the use of electronic notifications may be a viable alternative to the dominant postal mail format. The use of digital advance notifications appears to be a topic of growing interest in literature, with included studies published from 2020 to 2022, and more research is needed to confirm their effects on screening uptake. While the shift to digitalised advance notifications may increase the cost-effectiveness of screening communications (e.g., reducing printing and posting costs), further work is needed to understand the potential drawbacks of this approach, particularly for screening invitees who are less inclined to engage with technology, such as older populations and those with disabilities.⁶⁸

Further to this, unique motivational strategies can be applied through phone call advance notifications. Methods identified in the current review included encouraging recipients to reflect on barriers to screening and assisting them in devising strategies to overcome them.^{34,51} This process is known as coping planning, and according to the Health Action Process Approach, is key to facilitating the transition from *intending* to screen to screening *participation*.²⁰ Primary care providers such as general practitioners can apply these coping planning strategies to allay patient concerns about screening and increase their likelihood of participation upon screening invitation.

Although only three phone call notifications were captured in this review, they were associated with screening uptake increases of

up to 16%,^{40,50} compared to notifications of mailed and digital modalities, which increased screening by up to 9%.^{11,40} It should be cautioned however, that while phone call reminders have indeed been shown to be more effective in increasing screening participation than reminders sent via mail, they are also more cost- and resource-intensive⁶⁹ and thus may not be as feasible for integration into routine medical care nor population-level cancer screening programs. At the population level, there may be scope for future research to explore the use of artificial intelligence-assisted approaches to advance notifications in national screening programs, such as the distribution of links to chatbots capable of simulating the collaborative problem-solving approach of phone calls in a more cost-effective, scalable manner.

4.2 | Study limitations

The findings of this scoping review should be interpreted in the context of its limitations. The content analysis was constrained by the availability of the full versions of the advance notifications. Although all reasonable attempts were made to obtain the materials from the study authors, several were not retrievable, including all notifications delivered prior to breast cancer screening.^{36,39} This review therefore may not have captured the full breadth and variability of the content included within these interventions, especially those targeting breast cancer screening.

4.3 | Conclusion

This review found that most research to date has examined advance notifications sent via mail, prior to bowel cancer screening. Future research would benefit from investigation of advance notification sent via alternative, cost-effective modalities, prior to more complex screening procedures (particularly for non-bowel cancers), and including strategies theorised to bridge the intention-behaviour gap (such as coping planning). This would provide insight into the modifications most likely to enhance the intervention's effectiveness. It is important to note that the success of advance notification may also depend on the characteristics of the recipients, such as receipt of a previous screening invitation. Person-level factors should also be explored in relation to its effect on screening uptake. These avenues of research can inform understanding of the mechanisms that underly advance notification and the design of future interventions targeting cancer screening participation.

AUTHOR CONTRIBUTIONS

Katelyn E. Collins: Conceptualization, data curation, formal analysis, investigation, resources, visualization, writing – original draft, writing – review and editing. **Larry S. Myers:** Conceptualization, supervision, writing – review and editing. **Belinda C. Goodwin:** Conceptualization, supervision, writing – review and editing. **Alyssa**

Taglieri-Sclocchi: Resources, writing – review and editing. **Michael J. Ireland:** Supervision, writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no potential conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this review are presented in Supporting Information S4. Further enquiries can be directed to the corresponding author.

ETHICS STATEMENT

The authors assert that all procedures relating to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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