Review

Social Media and mHealth Technology for Cancer Screening: Systematic Review and Meta-analysis

Arlinda Ruco^{1,2}, MPH; Fahima Dossa³, MD; Jill Tinmouth^{1,4,5}, MD, PhD, FRCPC; Diego Llovet^{1,4}, PhD; Jenna Jacobson^{1,6}, PhD; Teruko Kishibe⁷, MISt; Nancy Baxter^{1,2,8}, MD, PhD, FRCSC

⁶Ted Rogers School of Management, Ryerson University, Toronto, ON, Canada

⁷Library Services, St. Michael's Hospital, Unity Health Toronto, Toronto, ON, Canada

⁸Melbourne School of Population and Global Health, University of Melbourne, Melbourne, Australia

Corresponding Author:

Nancy Baxter, MD, PhD, FRCSC Melbourne School of Population and Global Health University of Melbourne 207 Bouverie Street Melbourne, 3053 Australia Phone: 61 39035551 Email: <u>Nancy.baxter@unimelb.edu.au</u>

Abstract

Background: Cancer is a leading cause of death, and although screening can reduce cancer morbidity and mortality, participation in screening remains suboptimal.

Objective: This systematic review and meta-analysis aims to evaluate the effectiveness of social media and mobile health (mHealth) interventions for cancer screening.

Methods: We searched for randomized controlled trials and quasi-experimental studies of social media and mHealth interventions promoting cancer screening (breast, cervical, colorectal, lung, and prostate cancers) in adults in MEDLINE, Embase, PsycINFO, Scopus, CINAHL, Cochrane Central Register of Controlled Trials, and Communication & Mass Media Complete from January 1, 2000, to July 17, 2020. Two independent reviewers screened the titles, abstracts, and full-text articles and completed the risk of bias assessments. We pooled odds ratios for screening participation using the Mantel-Haenszel method in a random-effects model.

Results: We screened 18,008 records identifying 39 studies (35 mHealth and 4 social media). The types of interventions included peer support (n=1), education or awareness (n=6), reminders (n=13), or mixed (n=19). The overall pooled odds ratio was 1.49 (95% CI 1.31-1.70), with similar effect sizes across cancer types.

Conclusions: Screening programs should consider mHealth interventions because of their promising role in promoting cancer screening participation. Given the limited number of studies identified, further research is needed for social media interventions.

Trial Registration: PROSPERO International Prospective Register of Systematic Reviews CRD42019139615; https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=139615

International Registered Report Identifier (IRRID): RR2-10.1136/bmjopen-2019-035411

(J Med Internet Res 2021;23(7):e26759) doi: 10.2196/26759

KEYWORDS

RenderX

social media; mHealth; cancer screening; digital health; mass screening; mobile phone

¹Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, ON, Canada

²Li Ka Shing Knowledge Institute, St. Michael's Hospital, Unity Health Toronto, Toronto, ON, Canada

³Division of General Surgery, Department of Surgery, University of Toronto, Toronto, ON, Canada

⁴Prevention & Cancer Control, Ontario Health (Cancer Care Ontario), Toronto, ON, Canada

⁵Department of Medicine, Sunnybrook Health Sciences Centre, Toronto, ON, Canada

Introduction

Background

The use of mobile health (mHealth) technologies and social media in the health care sphere has now become widespread [1-6] and has enabled the rapid sharing of health information, the launching of health promotional campaigns, access to peer support groups, and facilitation of appointment reminders [1,2,4,6]. The World Health Organization has defined mHealth as the use of mobile wireless devices for medical and public health practice [1]. Social media allows those with access to information and communication technology to become content creators and share content with others in virtual communities or networks in addition to accessing information and connecting communities [1,6]. The use of mHealth and social media for health presents an important opportunity to reach health consumers, as these technologies and platforms can provide more frequent interactions, deliver tailored material, and increase accessibility to health information [1], and they now constitute a major way of communicating and advertising. In addition, as access to mobile devices and the internet in low- and middle-resource nations is reported to be comparable with those in developed countries, mHealth and social media may play a role in closing the gap in health disparities between high- and low-resource nations [1,7].

With almost 19 million people expected to be diagnosed with cancer in 2020, cancer is one of the leading causes of death globally [8]. Cancer screening has been shown to reduce disease-specific mortality for a number of cancers [9-12], and as a result, many jurisdictions have implemented population-based screening programs [13,14]. However, screening participation remains suboptimal across jurisdictions and cancer types [13-16]. Emerging research has explored the use of social media and mHealth for cancer screening [17-21]. However, we currently lack an understanding of how effective mHealth and social media can be for cancer screening participation.

Objectives

This systematic review and meta-analysis aims to explore the effectiveness of social media and mHealth interventions to increase cancer screening participation and intention for screen detectable cancers.

Methods

Study Design and Registration

This systematic review was registered with the International PROSPERO (Prospective Register of Systematic Reviews; registration #CRD42019139615) and was written and reported according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist [22].

Inclusion and Exclusion Criteria

Studies included in this systematic review were randomized controlled trials (RCTs) or quasi-experimental studies with a pre- and postintervention design reporting on the effectiveness of an mHealth or social media intervention on cancer screening

```
https://www.jmir.org/2021/7/e26759
```

participation or intention. We included studies pertaining to breast, cervical, colorectal, prostate, or lung cancer, as guidelines for screening exist for these cancers. We defined mHealth interventions as those that delivered health-related information via telecommunication or other wireless technologies (eg, smartphones and tablets) [4]. Social media interventions included those delivered on an already established or new purpose-built social media platform where users could create a profile and share content with other users (virtual communities) [1]. Any comparator was acceptable, including a nonintervention group; an alternate, nonsocial media, non-mHealth intervention; or studies with a pre- and postintervention design. We included studies with multifaceted interventions if at least one component involved a social media- or mHealth-based strategy. Studies were restricted to those conducted in adults aged 18 years or older and articles published in English. In case we were unable to access full-text articles for relevant abstracts, we contacted study authors to obtain the articles. If the authors did not respond, we included the abstract if we could ascertain the eligibility criteria and if the data on the primary or secondary outcome were available. Commentaries, editorials, letters, and reviews were excluded. We also excluded articles published before 2000 because the use of social media was not widespread before this time [4].

Search Strategy

The search strategy was developed by a senior information specialist (TK) and used a combination of text words and MeSH (Medical Subject Headings) terms depending on the database to capture the following concepts: cancer, screening, and social media or mHealth interventions. The search strategy was peer reviewed by a second information specialist in accordance with the Peer Review of Electronic Search Strategies checklist [23] and has been previously published [24].

Information Sources

The search was conducted using the following databases: MEDLINE, Embase, PsycINFO, Scopus, CINAHL, the Cochrane Central Register of Controlled Trials, and Communication & Mass Media Complete from inception to May 31, 2019. The search was updated on July 17, 2020.

Data Management

We used systematic review software (DistillerSR, Evidence Partners Incorporated) to manage records during the screening and study selection phases.

Study Selection

Two independent reviewers (AR and FD) used a piloted data collection form and screened the studies in three stages: title, abstract, and full text. Citations that either reviewer considered potentially eligible at the title stage were included to maximize sensitivity in the early stages of screening. Inclusion in the abstract and full-text screening stages required consensus between the reviewers. Discrepancies between the reviewers at the abstract or full-text stages were resolved by discussion.

Data Extraction

Two reviewers independently extracted data from the included studies using a piloted data collection form in Excel (Version

```
XSL•FO
RenderX
```

15.0; Microsoft). Any discrepancies were resolved by discussion. Information extracted from each study included study characteristics (authors, date of publication, location or country, funding, and study design), participant characteristics (sample size, age, sex, ethnicity, and eligibility), intervention details (type of intervention, components, comparator or control group interventions, follow-up or duration, technology platform, and delivery of intervention by whom), and outcomes of interest (screening participation or intention including timeframe).

Outcomes

Screening participation (primary outcome) was defined as the proportion of adults who participated in the screening. This included self-reported outcomes as well as those confirmed through administrative records. Screening intention (secondary outcome) was defined as per the primary study authors. Typically, this is measured as the written intention to undergo screening within a specified timeframe (eg, within the next 3 months or 6 months).

Assessment of Bias

The Cochrane Risk of Bias 2 tool [25] was used to assess the quality of RCTs, and the Cochrane Effective Practice and Organization of Care framework was used to assess bias in preand postintervention studies [26]. The risk of bias assessment was independently completed for each study by 2 reviewers (AR and FD). Discrepancies were resolved by discussion or by a third investigator if needed. The *Robvis* tool was used to create a risk of bias plot [27].

Data Synthesis and Analysis

The study, participant, and intervention characteristics and the risk of bias assessments are presented descriptively. We categorized interventions based on their nature, including (1) reminders, (2) education or awareness, (3) navigation or counseling, (4) peer support, (5) decision aids, and (6) mixed. We report on the outcomes of interest in absolute and relative terms and pooled odds ratios (ORs) for screening participation from RCTs using the Mantel-Haenszel method in a random-effects model. If the outcome was measured at several time points, we used the values from the longest follow-up for our study. In RCTs where several intervention arms had a social media or mHealth component, we included them in our analysis and divided the proportion screened of the control or comparison

group equally by the number of intervention arms of interest to maintain the same proportion of those screened while not counting the sample size of the control group more than once, as recommended by Cochrane [28]. Forest plots were created to graphically display results stratified by cancer type and the nature of the intervention. Statistical heterogeneity was calculated using the I² statistic, where a cutoff of \geq 75% was defined as considerable heterogeneity [28]. We conducted a sensitivity analysis in which we excluded articles that were assessed to have a high risk of bias. In addition, we conducted sensitivity analyses to explore whether the overall pooled effect estimate would differ for studies measuring the outcome of cancer screening participation through self-reporting compared with objective or administrative records and for studies conducted in low- and middle-income countries (LMICs). We checked for publication bias for the primary outcome among the RCTs using a funnel plot. Statistical significance was set at a two-tailed P<.05. Meta-analyses were performed using Review Manager (RevMan, The Cochrane Collaboration) 5.0.

Results

Search Results and Characteristics of Included Studies

A total of 18,008 records were identified in the search. After duplicates were removed, 17,788 titles, 2607 abstracts, and 687 full-text articles were screened. After all the eligibility criteria were applied, 39 articles were included [29-67] (Figure 1). Table 1 presents a summary of the included RCTs (n=30), and Table 2 presents an overview of the included pre- and postintervention studies (n=9). Briefly, the studies that were included were published between 2011 and 2020 and conducted in North America, Europe, Asia, and Africa. Most of the studies (35/39, 90%) described mHealth interventions, and 10% (4/39) of them included social media. The most common type of intervention was mixed (n=19), followed by reminders (n=13), education or awareness (n=6), and peer support (n=1). Mixed interventions were most commonly a combination of reminder and education strategies. There were 16 studies focused on cervical cancer, 14 on colorectal cancer (CRC), 7 on breast cancer, and 1 each on lung and prostate cancer screening. The interventions were implemented by public or private screening programs, university-based research teams, or health care centers or units.



Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram outlining the steps involved in identifying screened and included studies in the meta-analysis.

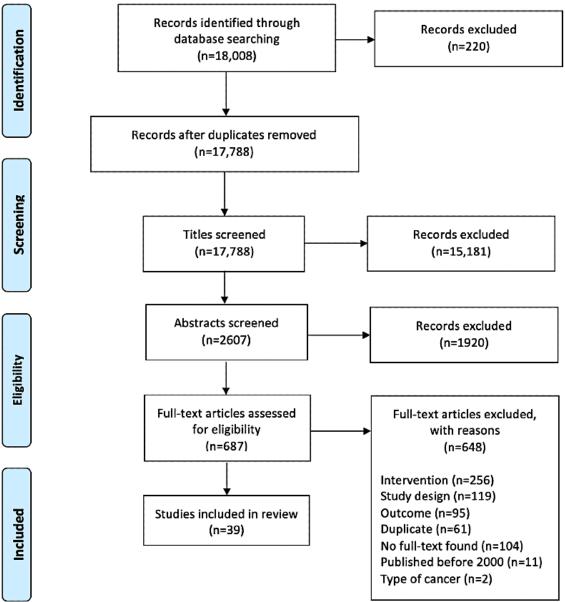




 Table 1. Summary of included randomized controlled trials (n=30).

Study	Location	Type of cancer	Intervention type	Nature of in- tervention	Total sample size	Population	Summary of inter- vention	Outcomes
Arcas et al [29]	Spain	Breast	mHealth ^a	Reminder	703	Women (aged 50- 69 years) with a registered mobile phone number	Invitation letter and text message reminder 2 days before the mam- mography appoint- ment	• Proportion that screened for brea cancer during the 2-month rescreen- ing period
Vidal et al [51]	Barcelona, Spain	Breast	mHealth	Reminder	12,786	Breast cancer screening target population of the southern Barcelona metropolitan area	Text message re- minder 3 days be- fore a scheduled appointment with or without a mes- sage, with a new appointment date if requested	• Proportion attending an appoint- ment before October 31, 2011 (3-1 months after the intervention)
Kerrison et al [41]	United King- dom	Breast	mHealth	Reminder	2240	Women (aged 47- 53 years) who were due to be in- vited for their first routine breast screen	Text message re- minder 48 hours before the appoint- ment and an addi- tional text message if they did not at- tend the initial ap- pointment	• Proportion attending the appointment within 60 days of the initia appointment
Rashid et al [47]	Klang, Malaysia	Cervical	mHealth	Reminder	1000	Women (aged 20- 65 years) residing in Klang who had a nonpositive Pa- panicolaou test in the previous year and were due for repeat screening	Text message re- minder for a repeat Papanicolaou test within a month from the date of re- call	 Proportion com- pleting the Papan colaou test withi 8 weeks
Wanyoro and Kabiru [52]	Thika, Kenya	Cervical	mHealth	Reminder	286	Women (aged 25- 70 years) attending the general outpa- tient clinic who had never had cer- vical cancer screening, who owned a mobile phone, and who had normal cervi- cal Papanicolaou test after the initial baseline screening	4 text message re- minders in a period of 2 weeks	• Proportion screened for cerv cal cancer at the same site within weeks
Huf et al [39]	United King- dom	Cervical	mHealth	Reminder	14,587	Women (aged 24- 64 years)	1 of 6 text message reminders: a sim- ple reminder, gener- al practice endorse- ment, total and proportional social norms messages, and gain- and loss- framed messages	• Proportion who screened within 1 weeks after the re- minder



Ruco et al

Study	Location	Type of cancer	Intervention type	Nature of in- tervention	Total sample size	Population	Summary of inter- vention	Out	comes
Sly et al [50]	New York, United States	CRC ^b	mHealth	Reminder	24	Adults (aged >50 years) with referral for screening colonoscopy with no personal or family history of CRC or any chron- ic gastrointestinal disorder, with tele- phone service, and who spoke English	Standard naviga- tion, a scheduling telephone call and 2 text message ap- pointment re- minders	•	Colonoscopy com- pletion within 3 months
Hagoel et al [36]	Israel	CRC	mHealth	Reminder	48,091	Adults (aged 50-74 years) with no diag- nosis of an inflam- matory bowel dis- ease or a bowel malignancy, who had not undergone colonoscopy with- in the previous 3 years, and who had not performed FOBT ^c in the previ- ous year	Text message re- minders including interrogative or noninterrogative messages	•	Proportion com- pleting FOBT at 6 months
Coronado et al [32]	United States	CRC	mHealth	Reminder	2010	Adults (aged 50-75 years) not up to date with CRC screening and with a clinic visit in the previous year	2 text message re- minders with or without a live phone call	•	FIT ^d kit return rate
Hirst et al [38]	United King- dom	CRC	mHealth	Reminder	8269	Adults (aged 60-74 years)	Usual care and a text message re- minder if they had not returned their test kit within 8 weeks	•	Proportion return- ing test kit at the end of an 18-week screening episode
Lam et al [61]	Hong Kong	CRC	mHealth	Reminder	500	Adults (aged 40-70 years) who were asymptomatic and had a previous negative FIT test and who were ex- pected for an annu- al FIT screening in the subsequent year	A WhatsApp mes- sage reminder sent 1 month before the due date for subse- quent FIT	•	Proportion success- fully returning the FIT kit
Coronado et al [33]	Los Angeles, United States	CRC	mHealth	Reminder	1767	Adults (aged 50-75 years) who were overdue for CRC screening and had attended at least two clinic visits within the past 24 months	Text message prompt before re- ceipt of the FIT kit with 2 automated phone call re- minders or with 2 automated phone calls and up to 3 live phone call re- minders	•	Proportion com- pleting the FIT kit within 6 months
Hwang et al [40]	United States	CRC	Social media	Peer support	306				



Ruco et al

Study	Location	Type of cancer	Intervention type	Nature of in- tervention	Total sample size	Population	Summary of inter- vention	Outcomes
						Adults (aged 50-75 years) who had no previous diagnosis of CRC, had no history of inflam- matory bowel dis- ease, and were not up to date with CRC screening	Study-specific web-based <i>Spark-Team</i> to access the narratives and inter- act with the narra- tors (positive role models) and other participants	 Proportion screened for CRC at 6 months (FOBT, sigmoi- doscopy, or colonoscopy)
Lakkis et al [43]	Beirut, Lebanon	Breast	mHealth	Mixed (edu- cation and reminder)	385	Women (aged 40- 75 years) who had not undergone a mammogram in the past 2 years	Educational and general invitation text message for mammography and 3 additional text reminders	• Completion of a mammography
Chung et al [31]	Republic of Korea	Breast	mHealth	Mixed (edu- cation and reminder)	202	Women (aged 20- 65 years) who un- derwent surgery for breast cancer, excluding those with distant metas- tasis or recurrent breast cancer	Usual care and 1 text message re- minder and 1 edu- cational text mes- sage	• Adherent to monthly BSE ^e fo 5 out of 6 months
Heydari and Noroozi [37]	Bushehr, Iran	Breast	mHealth	Mixed (edu- cation and reminder)	120	Women (aged ≥40 years) who were elementary school teachers, were not pregnant or breast- feeding, had no history of cancer, had no family histo- ry of breast cancer, had not had breast biopsy experience and mammography in the past 3 years	Multimedia educa- tion session through a CD and text messages; 1-2 educational text messages sent on a weekly basis for 1 month and a re- minder about mammography	pleting mammogra phy
Lee et al [44]	Minnesota, United States	Breast	mHealth	Mixed (edu- cation and navigation)	131	Korean American immigrant women (aged 40-79 years) who had not re- ceived a mammo- gram in the past 2 years	mMammogram mobile app deliver- ing 8-21 messages over a 7-day period	 Proportion receiving mammography or with a sched- uled appointment within 6 months Intention to re- ceive a mammography in the future on a 4-point scale (1=not within a year, 2=within a year, 3=within 3 months, and 4=within 1 month
Khademolhos- seini et al [42]	Bushehr, Iran	Cervical	mHealth	Mixed (edu- cation and reminder)	95		Educational train- ing through text messaging, elec- tronic posters, info- graphics, podcasts, and video tutorial and a reminder to perform a Papanico- laou smear test	• Completion of the Papanicolaou test within 3 months



Ruco et al

Study	Location	Type of cancer	Intervention type	Nature of in- tervention	Total sample size	Population	Summary of inter- vention	Out	comes
						Women who were able to read and write, were mar- ried for at least 6 months, had a smartphone, had no history of geni- tal tract cancer in their family, and had no experience of doing a Papani- colaou smear test in the past 3 years			
Richman et al [49]	North Caroli- na, United States	Cervical or rectal	mHealth	Mixed (edu- cation and reminder)	264	Adults (aged 18-26 years) who attend- ed the university and who were vol- untarily initiating the first HPV ^f vac- cine dose from the campus student health center	7 electronic email or text messages once per month for 7 months	•	Proportion com- pleting HPV dose 3 vaccine
Adler et al [62]	United States	Cervical	mHealth	Mixed (edu- cation and reminder)	95	Women (aged 21- 65 years) with no past hysterectomy with cervical re- moval or known HIV infection	Referral and 3 text messages delivered at 30-day intervals over a period of 90 days after enroll- ment	•	Proportion who underwent cervi- cal cancer screen- ing 150 days after enrollment
Erwin et al [34]	Kilimanjaro and Arusha regions, Tan- zania	Cervical	mHealth	Mixed (edu- cation and reminder)	851	Women (aged 25- 49 years) with ac- cess to a mobile phone living in the catchment areas of Mawenzi Regional Referral Hospital and Meru District Hospital	15 unique text messages delivered over 21 days with or without a trans- portation e -vouch- er covering return transportation to the nearest screen- ing clinic	•	Proportion attend- ing cervical cancer screening within 60 days
Firmino- Machado et al [35]	Portugal	Cervical	mHealth	Mixed (edu- cation and reminder)	1220	Women (aged 25- 49 years) eligible for screening and registered at prima- ry health care units that perform sys- tematic written let- ter invitations for screening	Automated or cus- tomized text mes- sages and phone calls, followed by text message re- minders of the ap- pointment (step 1), phone calls by clinical secretaries (step 2), and phone calls or face-to- face interviews by doctors (step 3)	•	Proportion adher- ent to cervical cancer screening at 45 (step 1), 90 (step 1+2), and 150 days after the initial invitation (step 1+2+3)
Linde et al [65]	Tanzania	Cervical	mHealth	Mixed (edu- cation and reminder)	689	Women (aged 25- 60 years) who had tested positive for HPV during a pa- tient-initiated op- portunistic screen- ing 14 months ear- lier	10 educative text messages (1 per month) and 5 re- minders (14, 7, and 1 day before the scheduled screen- ing appointment) over a 10-month period	•	Proportion attend- ing the scheduled screening appoint- ment within 30 days
Romli et al [63]	Kedah, Malaysia	Cervical	mHealth		210		-		



Ruco et al

Study	Location	Type of cancer	Intervention type	Nature of in- tervention	Total sample size	Population	Summary of inter- vention	Out	comes
				Mixed (edu- cation and reminder)		Women en- trepreneurs (aged 20-65 years) who received financial help from Amanah Ikhtiar Malaysia and who were or had been previous- ly married	A 30-minute educa- tional talk, a 5- minute video on Papanicolaou smear test proce- dures, experience sharing from a cer- vical cancer sur- vivor, distribution of pamphlet on cervical cancer and Papanicolaou smear testing, and 2 text message re- minders sent over a 3-month period	•	Proportion having a Papanicolaou smear test
Baker et al [30]	Chicago, United States	CRC	mHealth	Mixed (edu- cation, re- minder, and navigation)	450	Adults (aged 51-75 years) with pre- ferred language listed as English or Spanish and with a negative FOBT	A mailed reminder letter and FIT kit with postage-paid envelope, automat- ed telephone and text message re- minders, and per- sonal telephone outreach by a screening naviga- tor after 3 months	•	Proportion com- pleting either FOBT or colonoscopy with- in 6 months of the date the patient was due for annual screening
Muller et al [46]	Anchorage, Alaska	CRC	mHealth	Mixed (edu- cation and reminder)	2386	Alaska Native or American Indian adults (aged 40-75 years) with no his- tory of CRC or colectomy enrolled with the Southcen- tral Foundation health care system and eligible for screening	A maximum of 3 text messages over 2 months	•	Proportion screened (FIT, FOBT, flexible sigmoidoscopy, or colonoscopy)
Miller et al [45]	North Caroli- na, United States	CRC	mHealth	Mixed (edu- cation and decision aid)	450	English-speaking adults (aged 50-74 years) who were scheduled to see a primary care provider and were due for CRC screening	mPATH-CRC, an iPad app providing screening informa- tion, help with screening decision, <i>self-ordering</i> a screening test, and automated electron- ic messages to complete the cho- sen test	•	CRC screening completed within 24 weeks Intention to re- ceive screening within the next 6 months
Reiter et al [48]	United States	Rectal	mHealth	Mixed (edu- cation and reminder)	150	Gay or bisexual men (aged 18-25 years) residing in the United States who had not re- ceived any HPV vaccine doses	Population-target- ed, individually tailored content about HPV and monthly HPV vac- cination reminders sent via email and/or text mes- sage	•	Proportion com- pleting all 3 doses of the HPV vac- cine
Wong et al [53]	Hong Kong	CRC	mHealth	Mixed (edu- cation and reminder)	629				

Ruco et al

Study	Location	Type of cancer	Intervention type	Nature of in- tervention	Total sample size	Population	Summary of inter- vention	Outcomes
						Adults (aged 40-70 years) at average risk of CRC who had a negative FIT result in their first screening round for the study	Generic text mes- sage about the im- portance of regular CRC screening and the time and venue of FIT tube re- trieval	• Proportion success- fully returning completed FIT specimen within 6 months
Mahmud et al [64]	United States	CRC	mHealth	Mixed (edu- cation and reminder)	71	Adults (aged 18-75 years) scheduled for outpatient colonoscopy with- in 2 months of ini- tial contact	9 text messages sent in the week before the sched- uled procedure	• Proportion who at- tended their scheduled appoint- ment

^amHealth: mobile health.

^bCRC: colorectal cancer.

^cFOBT: fecal occult blood test.

^dFIT: fecal immunochemical test.

^eBSE. breast self-exam.

^tHPV: human papilloma virus.

The most common reminder strategies used were text message reminders [29-39,41-43,46-55,57-65]. Educational strategies most commonly included general health information about the specific cancer and information about cancer screening, including the importance of screening. Although text messages were commonly used to deliver educational information [34,35,37,42-44,46,48,49,53-55,59,62,64,65], some studies also used electronic posters or infographics, CDs, videos, mobile apps, and podcasts [37,42,44,45,55,59,63]. Education was also provided through in-person educational or training sessions in some cases in addition to a social media or mHealth strategy or in the comparison groups [55,63]. Educational interventions using social media included social media campaigns [56] or sharing information or daily posts about screening or cancer with participants who were members of a group (virtual community) on a social media platform [66,67]. Peer support interventions on social media also leveraged groups to support participants of that virtual community through the sharing of personal stories and narratives [40]. Outcomes were measured at several time points, including the proportion attending a scheduled appointment or those participating in screening within 2 weeks [52], a month [65], 45 days [35], 60 days [29,34,41,47], 3 months [35,42,50], 3-5 months [38,39,51], or 6 months [30,31,33,36,40,45,53].

There was wide variability in the study participants. For example, the included participants were targeted based on geographical region in some studies [34,51,56] or by their profession as elementary school teachers [37], entrepreneurs [63], or university students [49,59]. Some studies were targeted to specific racial and cultural groups [44,46,54,58,67], whereas others included gay and bisexual men only [48] or women who were HIV positive [60]. The intervention intensity also differed between the studies. For example, some interventions included sending only single text message reminder а [29,31,33,38,39,41,51], whereas others included sending 22 text messages over 16 days [54] or 21 messages over a 7-day period [44]. For social media interventions, participants in one study received three daily posts over a 12-week period [67] or as many as 20 posts per day over 5 days [66].



Ruco et al

 Table 2. Summary of included pre- and postintervention studies (n=9).

Study	Location	Type of cancer	Intervention type	Nature of in- tervention	Total sam- ple size	Population	Summary of inter- vention	Outc	omes
Ganta et al [60]	Nevada, United States	Cervical	mHealth ^a	Reminder	473	HIV-infected women (aged ≥18 years) at the HIV Well- ness Center	Reminders to schedule a Papan- icolaou test via 3 sequential text messages and subsequently by 3 phone call at- tempts		Proportion complet- ing the Papanico- laou test
Lee et al [58]	Minnesota, United States	Cervical	mHealth	Education or awareness	30	Korean Ameri- can women (aged 21-29 years) with no previous receipt of a Papanico- laou test with up-to-date health insurance	7-day text mes- sage–based inter- vention including quizzes and ques- tions and engage- ment in conversa- tion	•	Proportion receiving a Papanicolaou test within 3 months Intent to receive a Papanicolaou test within a year
Lemos et al [59]	Madeira, Portu- gal	Cervical	mHealth	Education or awareness	144	Female college students recruit- ed from various undergraduate courses of Madeira Univer- sity	5 structured text messages deliv- ered over 5 weeks and an edu- cational video in- tervention lasting 12 minutes		Intention to get a Papanicolaou test measured on a 5- point Likert scale from 1 (definitely will not do) to 5 (definitely will do)
Le and Holt [54]	United States	Cervical	mHealth	Education or awareness	52	Church-attend- ing African- American wom- en (aged 21-65 years) with no previous medi- cal history of cervical cancer or hysterectomy	22 text messages delivered over 16 days, containing health-specific and spiritually based content		Intent to get a Papan- icolaou smear test in the next 6 months
Lyson et al [66]	United States	Cervical	Social media	Education or awareness	782	Women (aged ≥18 years) who lived in the United States, spoke English as their primary language, and did not have cervical cancer	Health Connect web-based plat- form where partic- ipants were as- signed to groups of 9 and where each participant was randomly distributed a set of 20 tweets or messages per day over 5 days in a personalized message feed	•	Proportion ever had a Papanicolaou test Proportion ever re- ceived the HPV ^b vaccine
Key et al [67]	Kentucky, Unit- ed States	CRC ^c	Social media	Education or awareness	60	Appalachian Kentuckians (aged ≥50 years) noncom- pliant with cur- rent screening guidelines	Participants joined a closed Facebook group and were present- ed with 3 daily Facebook posts during the 12- week intervention		Proportion ever re- ceived a colonoscopy or FOBT ^d



Study Type of Intervention Nature of in-Total sam-Location Population Summary of inter-Outcomes cancer tervention ple size vention type Jessup et Variable Massachusetts. Lung Social media Education or Patients, care-Patient awareness Number of LDCT^e al [56] United States awareness depending givers, and campaign on examinations per on plathealth care Facebook and week before and afform providers with-Google and ter the campaign in a 60-mile raprovider camdius of a large paign on LinkedIn and quaternary medical center and Twitter 2 affiliated offcampus imaging sites. Patient campaign targeted current and former smokers (aged ≥55 years), females (aged ≥55 years), patients and employees of the academic medical center (aged ≥18 years), and caregivers (aged ≥18 years) Fornos et Texas, United Cervical mHealth Mixed (edu-32,807 Women (aged Newsletters, pub-3-year cervical canal [57] States cation, re-≥18 years) enlic service ancer screening rate minders, and rolled in Carenouncements, aunavigation) Link who were tomated client renot up to date minders includwith Papanicoing text meslaou screening sages, and comor actively obmunity outreach taining Papanicolaou test appointments Capik Mixed (edu-75 Proportion having Erzurum. Prostate mHealth Men (aged 41-Poster announce-• and Turkey cation and 65 years) workments, interactive had a PSA^f test in Gozum ing in 2 public reminders) educational sesthe last 3 months [55] institutions who sion, access to Proportion having had not rewebsite, desk calhad a prostate examceived a endar information ination in the last 3 prostate cancer and reminders, months diagnosis monthly email reminders, flyers, and 1 text message

JOURNAL OF MEDICAL INTERNET RESEARCH

Ruco et al

^amHealth: mobile health.

^bHPV: human papilloma virus.

^cCRC: colorectal cancer.

^dFOBT: fecal occult blood test.

^eLDCT: low-dose computed tomography.

^fPSA: prostate-specific antigen.

Quality Assessment

Risk of bias assessments for the included studies are shown in Figures 2 and 3. Briefly, 27% (8/30) of the included RCTs were classified as high risk, 23% (7/30) as having some concerns, and the remainder (15/30, 50%) were classified as low risk. Common reasons for being classified as high risk included

```
https://www.jmir.org/2021/7/e26759
```

RenderX

having some concerns in several domains, including bias arising from the randomization process, effect of assignment to intervention, and measurement of the outcome. All pre- and postintervention studies were classified as high risk. Figure 4 displays the funnel plot used to check for publication bias. The x-axis represents the effect estimates, whereas the y-axis represents the study size or precision. The funnel plot generated

may suggest some publication bias because of the lack of studies small effect sizes and variances. in the bottom left corner of the plot representing studies with

Figure 2. Risk of bias assessment for the included randomized controlled trials (n=30) created using the Robvis tool.

			_	Risk of bia	s domains		
		D1	D2	D3	D4	D5	Overall
	Adler et al [62]	-	-	×	-	-	×
	Arcas et al [29]	+	-	×	+	-	×
	Baker et al [30]	+	+	+	+	+	+
	Chung et al [31]	+	-	+	-	+	-
	Coronado et al [32]	+	+	+	+	+	+
	Coronado et al [33]	+	+	+	+	+	+
	Erwin et al [34]	+	+	+	+	+	+
	Firmino-Machado et al [35]	-	+	+	+	+	-
	Hagoel et al [36]	+	+	+	+	+	+
	Heydari and Noroozi [37]	-	-	+	-	+	X
	Hirst et al [38]	+	+	+	+	+	+
	Huf et al [39]	+	+	+	+	+	+
	Hwang et al [40]	-	+	+	+	+	-
	Kerrison et al [41]	+	+	+	+	+	+
ď	Khademolhosseini et al [42]	-	-	+	-	+	X
Study	Lakkis et al [43]	+	•	+	-	+	-
	Lam et al [61]	-	+	+	+	+	-
	Lee et al [44]	+	+	+	-	+	-
	Linde et al [65]	X	X	+	+	-	X
	Mahmoud et al 64]	-	+	-	+	+	-
	Miller et al [45]	+	+	+	+	+	+
	Muller et al [46]	+	+	+	+	+	+
	Rashid et al [47]	+	+	+	+	+	+
	Reiter et al [48]	+	+	+	+	+	+
	Richman et al [49]	+	+	+	+	+	+
	Romli et al [63]	X	-	+	-	+	X
	Sly et al [50]	-	-	+	+	+	X
	Vidal et al [51]	-	+	+	+	-	X
	Wanyoro and Kabiru [52]	+	+	+	+	+	+
	Wong et al [53]	+	+	+	+	+	+
		Domains: D1: Bias ar	ising from the	randomizatio	on process.	Judge	
		D2: Bias du	le to deviation	is from intend	led interventic	on. 💇 '	

D1: bias ansing from the randomization process. D2: Bias due to deviations from intended intervention. D3: Bias due to missing outcome data. D4: Bias in measurement of the outcome. D5: Bias in selection of the reported result.



 Some concerns 🕂 Low

Figure 3. Risk of bias assessment for the included pre- and postintervention studies (n=9).

Study	D1	D2	D3	D4	D5	D6	D7	Overall*
Capik and Gozum [55]								
Fornos et al [57]		•						
Ganta et al [60]								
Jessup et al [56]								
Key et al [67]								
Le and Holt [54]								
Lee et al [58]								
Lemos et al [59]								
Lyson et al [66]								

*Overall risk of bias judgement was assigned low risk if the study was judged to be at low risk for all individual domains; medium/unclear risk if the study was judged to be at medium/unclear risk in at least one domain, but not at high risk of bias for any domain; and high risk of bias if the study was judged to bet at high risk in at least one domain or at medium/unclear risk in multiple domains in a way that substantially lowers confidence in the result.

Domains:

- D1: Intervention independent of other changes
- D2: Shape of intervention effect pre-specified
- D3: Intervention unlikely to affect data collection
- D4: Knowledge of the allocated interventions adequately prevented during the study
- D5: Incomplete outcome data
- D6: Selective outcome reporting
- D7: Other risk of bias

Judgement:

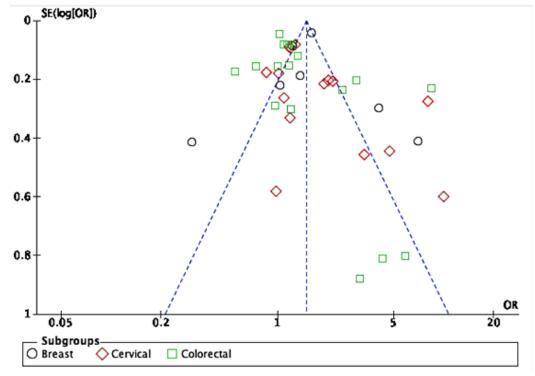
High risk

Medium/Unclear risk

🔵 Low risk



Figure 4. Funnel plot of publication bias for the randomized controlled trials reporting on the primary outcome. OR: odds ratio.



Primary and Secondary Outcomes

The absolute effect of being screened in the intervention arms was 22.22% (13,115/59,017). There was an absolute risk difference of 14% (95% CI 13.12-14.33) between the intervention and comparison arms, with the proportion screened in the comparison arms being 35.94% (12,524/34,872). When stratified by cancer type, the absolute proportion screened in the intervention arms was 71.68% (3935/5489) for breast cancer compared with 64.11% (7096/11,067) in the comparison arms (risk difference 8%; 95% CI 6.08-9.06). For cervical cancer, there were 35.23% (2382/6760) screened in the intervention arms compared with 28.26% (1548/5478) in the comparison arms was 14.53% (6798/46,768) and 21.17% (3880/18,327) in the comparison arms, with a risk difference of 6% (95% CI 5.96-7.31).

The overall pooled OR for cancer screening participation among the included RCTs was 1.49 (95% CI 1.31-1.70; Figure 5), indicating that the odds of getting screened increased by 49% for those who received a social media or mHealth intervention. However, considerable heterogeneity was observed (I^2 =88%). Similar effect estimates were observed when stratified by cancer type, with the largest effect observed for cervical cancer screening studies (OR 1.71, 95% CI 1.34-2.19; Figure 5). Stratification by cancer type did not reduce the heterogeneity. When we conducted a sensitivity analysis excluding trials assessed to have a high risk of bias, the overall pooled OR and I² remained stable (OR 1.54, 95% CI 1.33-1.78; Figure 6). The overall pooled OR was not significant when including only studies measuring screening participation through self-reporting (OR 2.09, 95% CI 0.96-4.53). The overall pooled effect estimate remained stable when including only studies that captured the outcome through administrative records (OR 1.46, 95% CI 1.28-1.66). When we included only studies conducted in LMIC settings (n=3), the overall pooled OR was 3.29 (95% CI 1.02-10.60) with considerable heterogeneity ($I^2=93\%$). However, the pooled OR increased to 5.50 (95% CI 3.19-9.51) with only moderate heterogeneity ($I^2=38\%$) when only studies with a low risk of bias were included (n=2). We also conducted subgroup analyses by meta-analyzing studies based on the nature of the intervention. The results showed an overall pooled effect estimate of 1.23 (95% CI 1.08-1.41) for reminder interventions (Figure 7) and 2.07 (95% CI 1.49-5.83) for mixed interventions (Figure 8). Heterogeneity did not change when subgroup analyses were conducted.



Figure 5. Forest plot for the randomized controlled trials reporting on the primary outcome of cancer screening participation categorized by type of cancer (n=30).

Study or Subgroup	Interve	ntion	Compa	rison		Odds Ratio	Odds Ratio
study of Subgroup	Events	Total	Events	Total	Weight M-	H, Random, 95% CI	M-H, Random, 95% Cl
2.1 Breast							
/idal et al [51]	2785	3719	5893	9067	3.6%	1.61 [1.47, 1.75]	+
Lee 2017	45	60	18	60	1.5%	7.00 [3.13, 15.64]	
akkis et al [43]	61	193	59	192	2.6%	1.04 [0.68, 1.60]	
Kerrison et al [41]	759	1122	703	1118	3.5%	1.23 [1.04, 1.47]	
Heydari and Noroozi [37]	33	60	48	60	1.5%	0.31 [0.14, 0.69]	· · · · · · · · · · · · · · · · · · ·
Chung et al [31]	70	102	35	100	2.1%	4.06 [2.26, 7.30]	
Arcas et al [29]	182	233	340	470	2.8%	1.36 [0.94, 1.98]	
Subtotal (95% CI)		5489		11067	17.7%	1.54 [1.11, 2.13]	•
Total events	3935		7096				
Heterogeneity: Tau ² = 0.14; (Chi ² = 50.	00, df =	6 (P < 0	.00001)	$l^2 = 88\%$		
Test for overall effect: Z = 2.5	58 (P = 0.	010)					
1.2.2 Cervical							
Wanyoro and Kabiru [52]	96	143	29	143	2.3%	8.03 [4.70, 13.73]	
Romli et al [63]	83	105	80	105	1.9%	1.18 [0.62, 2.26]	
Richman et al [49]	44	130	43	134	2.3%	1.08 [0.65, 1.81]	_
Rashid et al [47]	54	250	183	750	2.9%	0.85 [0.61, 1.20]	-+
Linde et al [65]	84	350	80	335	2.9%	1.01 [0.71, 1.43]	<u> </u>
Khademolhosseini et al [42]	23	48	4	47	0.9%	9.89 [3.07, 31.89]	
Huf et al [39]	580	1522	270	784	3.4%	1.17 [0.98, 1.40]	↓
luf et al [39]	575	1493	270	784	3.4%	1.19 [1.00, 1.43]	
luf et al [39]	466	1493	384	1453	3.5%	1.28 [1.09, 1.50]	
Firmino-Machado et al [35]	400	201	53	205	2.7%	1.28 [1.09, 1.30]	
Firmino-Machado et al [35]	98	201	63	205	2.7%	2.14 [1.43, 3.22]	
irmino-Machado et al [35]	103	202	70	205	2.7%	2.01 [1.35, 2.99]	
Erwin et al [34]	35	272	6	140	1.4%	3.30 [1.35, 8.04]	
Erwin et al [34]	54	313	6	141	1.4%	4.69 [1.97, 11.18]	
Adler et al [62]	7	48	7	47	1.0%	0.98 [0.31, 3.03]	
Subtotal (95% CI)		6760		5478	35.5%	1.71 [1.34, 2.19]	•
Total events	2382		1548				
Heterogeneity: Tau ² = 0.16; C Test for overall effect: Z = 4.2			14 (P <	0.00001	.); 1* = 85%		
1.2.3 Colorectal							
Wong et al [53]	189	209	374	412	2.2%	0.96 [0.54, 1.70]	
	8	11	6	13	2.2% 0.5%	0.96 [0.54, 1.70] 3.11 [0.56, 17.33]	
Wong et al [53]							
Nong et al [53] Sly et al [50] Reiter et al [48]	8	11	6	13	0.5%	3.11 [0.56, 17.33]	
Vong et al [53] Sly et al [50] Reiter et al [48] Muller et al [46]	8 8	11 76	6 2	13 74	0.5% 0.6%	3.11 [0.56, 17.33] 4.24 [0.87, 20.66]	
Wong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Miller et al [45]	8 8 181	11 76 1193	6 2 142	13 74 1193	0.5% 0.6% 3.3%	3.11 [0.56, 17.33] 4.24 [0.87, 20.66] 1.32 [1.05, 1.68]	
Nong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Willer et al [45] Mahmoud et al [64]	8 8 181 67	11 76 1193 223	6 2 142 34	13 74 1193 227	0.5% 0.6% 3.3% 2.5%	3.11 [0.56, 17.33] 4.24 [0.87, 20.66] 1.32 [1.05, 1.68] 2.44 [1.53, 3.88]	
Wong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Willer et al [45] Mahmoud et al [64] Lam et al [61]	8 181 67 19	11 76 1193 223 21	6 2 142 34 31	13 74 1193 227 50	0.5% 0.6% 3.3% 2.5% 0.6%	3.11 [0.56, 17.33] 4.24 [0.87, 20.66] 1.32 [1.05, 1.68] 2.44 [1.53, 3.88] 5.82 [1.22, 27.85]	
Vong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Miller et al [45] Mahmoud et al [64] .am et al [61] Hwang et al [40]	8 8 181 67 19 199 29	11 76 1193 223 21 250 153	6 2 142 34 31 142 25	13 74 1193 227 50 250 153	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1%	3.11 [0.56, 17.33] 4.24 [0.87, 20.66] 1.32 [1.05, 1.68] 2.44 [1.53, 3.88] 5.82 [1.22, 27.85] 2.97 [2.00, 4.41] 1.20 [0.66, 2.16]	
Wong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Miller et al [45] Mahmoud et al [64] .am et al [61] Hvang et al [40] Hirst et al [38]	8 181 67 19 199 29 1674	11 76 1193 223 21 250 153 4134	6 2 142 34 31 142 25 1648	13 74 1193 227 50 250 153 4135	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6%	3.11 [0.56, 17.33] 4.24 [0.87, 20.66] 1.32 [1.05, 1.68] 2.44 [1.53, 3.88] 5.82 [1.22, 27.85] 2.97 [2.00, 4.41] 1.20 [0.66, 2.16] 1.03 [0.94, 1.12]	
Vong et al [53] ily et al [50] keiter et al [48] Muller et al [46] Mahmoud et al [64] .am et al [61] Hwang et al [40] Hirst et al [38] Hagoel et al [36]	8 181 67 19 199 29 1674 942	11 76 1193 223 21 250 153 4134 9631	6 2 142 34 31 142 25 1648 204	13 74 1193 227 50 250 153 4135 2400	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5%	3.11 [0.56, 17.33] 4.24 [0.87, 20.66] 1.32 [1.05, 1.68] 2.44 [1.53, 3.88] 5.82 [1.22, 27.85] 2.97 [2.00, 4.41] 1.20 [0.66, 2.16] 1.03 [0.94, 1.12] 1.17 [1.00, 1.37]	
Wong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Mahmoud et al [64] .am et al [61] Hwang et al [40] Hirst et al [38] Hagoel et al [36]	8 181 67 19 199 29 1674 942 988	11 76 1193 223 21 250 153 4134 9631 9596	6 2 142 34 31 142 25 1648 204 204	13 74 1193 227 50 250 153 4135 2400 2401	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5%	3.11 [0.56, 17.33] 4.24 [0.87, 20.66] 1.32 [1.05, 1.68] 2.44 [1.53, 3.88] 5.82 [1.22, 27.85] 2.97 [2.00, 4.41] 1.20 [0.66, 2.16] 1.03 [0.94, 1.12] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45]	
Vong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Miller et al [45] Mahmoud et al [64] Lam et al [61] Hwang et al [40] Hirst et al [38] Hagoel et al [36] Hagoel et al [36]	8 181 67 199 29 1674 942 988 884	11 76 1193 223 21 250 153 4134 9631 9596 9630	6 2 142 34 31 142 25 1648 204 204 204	13 74 1193 227 50 250 153 4135 2400 2401 2400	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5%	3.11 [0.56, 17.33] 4.24 [0.87, 20.66] 1.32 [1.05, 1.68] 2.44 [1.53, 3.88] 5.82 [1.22, 27.85] 2.97 [2.00, 4.41] 1.20 [0.66, 2.16] 1.03 [0.94, 1.12] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28]	
Wong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Miller et al [45] Mahmoud et al [64] .am et al [61] Hwang et al [40] Hirst et al [38] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36]	8 181 67 199 29 1674 942 988 884 923	111 76 1193 223 21 250 153 4134 9631 9596 9630 9632	6 2 142 34 31 142 25 1648 204 204 204 204	13 74 1193 227 50 250 153 4135 2400 2401 2400 2401	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5%	$\begin{array}{c} 3.11 \left[0.56, 17.33 \right] \\ 4.24 \left[0.87, 20.66 \right] \\ 1.32 \left[1.05, 1.68 \right] \\ 2.44 \left[1.53, 3.88 \right] \\ 5.82 \left[1.22, 27.85 \right] \\ 2.97 \left[2.00, 4.41 \right] \\ 1.20 \left[0.66, 2.16 \right] \\ 1.03 \left[0.94, 1.12 \right] \\ 1.17 \left[1.00, 1.37 \right] \\ 1.24 \left[1.06, 1.45 \right] \\ 1.09 \left[0.93, 1.28 \right] \\ 1.14 \left[0.97, 1.33 \right] \end{array}$	
Wong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Miller et al [45] Mahmoud et al [64] .am et al [61] Hwang et al [40] Hirst et al [38] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Coronado et al [33]	8 181 67 199 29 1674 942 988 884 923 210	11 76 1193 223 21 250 153 4134 9631 9596 9630 9632 589	6 2 142 34 31 142 25 1648 204 204 204 204 205 95	13 74 1193 227 50 250 153 4135 2400 2401 2400 2401 295	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5% 3.5% 3.1%	$\begin{array}{c} 3.11 \left[0.56, 17.33 \right] \\ 4.24 \left[0.87, 20.66 \right] \\ 1.32 \left[1.05, 1.68 \right] \\ 2.44 \left[1.53, 3.88 \right] \\ 5.82 \left[1.22, 27.85 \right] \\ 2.97 \left[2.00, 4.41 \right] \\ 1.20 \left[0.66, 2.16 \right] \\ 1.03 \left[0.94, 1.12 \right] \\ 1.17 \left[1.00, 1.37 \right] \\ 1.24 \left[1.06, 1.45 \right] \\ 1.09 \left[0.33, 1.28 \right] \\ 1.14 \left[0.97, 1.33 \right] \\ 1.17 \left[0.87, 1.57 \right] \end{array}$	
Wong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Mahmoud et al [64] Lam et al [61] Hwang et al [40] Hirst et al [38] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Coronado et al [33]	8 8 181 67 19 199 29 1674 942 988 884 923 210 153	11 76 1193 223 21 250 153 4134 9631 9596 9630 9632 589 589	6 2 142 34 31 142 25 1648 204 204 204 204 205 95 95	13 74 1193 227 50 250 153 4135 2400 2401 2400 2401 295 294	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5% 3.5% 3.5% 3.1%	$\begin{array}{l} 3.11 \left[0.56, 17.33 \right] \\ 4.24 \left[0.87, 20.66 \right] \\ 1.32 \left[1.05, 1.68 \right] \\ 2.44 \left[1.53, 3.88 \right] \\ 5.82 \left[1.22, 27.85 \right] \\ 2.97 \left[2.00, 4.41 \right] \\ 1.20 \left[0.66, 2.16 \right] \\ 1.03 \left[0.94, 1.12 \right] \\ 1.17 \left[1.00, 1.37 \right] \\ 1.24 \left[1.06, 1.45 \right] \\ 1.09 \left[0.93, 1.28 \right] \\ 1.14 \left[0.97, 1.33 \right] \\ 1.17 \left[0.54, 1.00 \right] \end{array}$	
Wong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Mahmoud et al [64] .am et al [61] Hwang et al [40] Hirst et al [38] Hagoel et al [36] Hagoel et al [36] Coronado et al [33] Coronado et al [33]	8 8 181 67 19 199 29 1674 942 988 884 923 210 153 52	11 76 1193 223 21 250 153 4134 96516 9630 9632 9632 589 589 307	6 2 142 34 31 142 25 1648 204 204 204 204 204 205 95 95 189	13 74 1193 227 50 250 153 4135 2400 2401 2400 2401 295 294 702	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5% 3.5% 3.1% 3.1% 2.9%	$\begin{array}{l} 3.11 \left[0.56, 17.33 \right] \\ 4.24 \left[0.87, 20.66 \right] \\ 1.32 \left[1.05, 1.68 \right] \\ 2.44 \left[1.53, 3.88 \right] \\ 5.82 \left[1.22, 27.85 \right] \\ 2.97 \left[2.00, 4.41 \right] \\ 1.20 \left[0.66, 2.16 \right] \\ 1.03 \left[0.94, 1.12 \right] \\ 1.71 \left[1.00, 1.37 \right] \\ 1.24 \left[1.06, 1.45 \right] \\ 1.09 \left[0.93, 1.28 \right] \\ 1.14 \left[0.97, 1.33 \right] \\ 1.17 \left[0.87, 1.57 \right] \\ 0.74 \left[0.54, 1.00 \right] \\ 0.55 \left[0.39, 0.78 \right] \end{array}$	
Vong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Miller et al [45] Mahmoud et al [64] Lam et al [61] Hwang et al [40] Hirst et al [38] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Coronado et al [33] Coronado et al [32] Coronado et al [32]	8 8 181 67 19 199 29 1674 948 884 923 210 153 52 81	111 76 1193 223 21 250 153 4134 9596 9630 9632 589 589 307 299	6 2 142 34 31 142 25 1648 204 204 204 204 205 95 95 189 190	13 74 1193 227 50 250 153 4135 2400 2401 2400 2401 294 702 702	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5% 3.5% 3.5% 3.1% 2.9% 3.1%	$\begin{array}{c} 3.11 \left[0.56, 17.33 \right] \\ 4.24 \left[0.87, 20.66 \right] \\ 1.32 \left[1.05, 1.68 \right] \\ 2.44 \left[1.53, 3.88 \right] \\ 5.82 \left[1.22, 27.85 \right] \\ 2.97 \left[2.00, 4.41 \right] \\ 1.20 \left[0.66, 2.16 \right] \\ 1.03 \left[0.94, 1.12 \right] \\ 1.71 \left[1.00, 1.37 \right] \\ 1.24 \left[1.06, 1.45 \right] \\ 1.09 \left[0.93, 1.28 \right] \\ 1.14 \left[0.97, 1.33 \right] \\ 1.17 \left[0.87, 1.57 \right] \\ 0.74 \left[0.54, 1.00 \right] \\ 0.55 \left[0.39, 0.78 \right] \\ 1.00 \left[0.74, 1.36 \right] \end{array}$	
Wong et al [53] Siy et al [50] Reiter et al [48] Wuller et al [46] Willer et al [45] Wahmoud et al [64] .am et al [61] Hwang et al [40] Hirst et al [38] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Coronado et al [33] Coronado et al [32] Coronado et al [32]	8 8 181 67 19 199 29 1674 942 988 884 923 210 153 52	11 76 1193 223 21 250 153 4134 9631 9596 9630 9632 589 589 589 307 299 225	6 2 142 34 31 142 25 1648 204 204 204 204 204 205 95 95 189	13 74 1193 227 50 2500 153 4135 2400 2401 2400 2401 295 294 702 702 225	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5% 3.5% 3.1% 2.9% 3.1% 2.9%	$\begin{array}{c} 3.11 \left[0.56, 17.33 \right] \\ 4.24 \left[0.87, 20.66 \right] \\ 1.32 \left[1.05, 1.68 \right] \\ 2.44 \left[1.53, 3.88 \right] \\ 5.82 \left[1.22, 27.85 \right] \\ 2.97 \left[2.00, 4.41 \right] \\ 1.20 \left[0.66, 2.16 \right] \\ 1.03 \left[0.94, 1.12 \right] \\ 1.17 \left[1.00, 1.37 \right] \\ 1.24 \left[1.06, 1.45 \right] \\ 1.09 \left[0.93, 1.28 \right] \\ 1.14 \left[0.97, 1.33 \right] \\ 1.17 \left[0.87, 1.57 \right] \\ 0.74 \left[0.54, 1.00 \right] \\ 0.55 \left[0.39, 0.78 \right] \\ 1.00 \left[0.74, 1.36 \right] \\ 8.43 \left[5.36, 13.24 \right] \end{array}$	
Wong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Mahmoud et al [64] .am et al [61] Hwang et al [40] Hirst et al [38] Hagoel et al [36] Hagoel et al [36] Coronado et al [33] Coronado et al [33] Coronado et al [32] Coronado et al [32] Saker et al [30] Subtotal (95% CI)	8 8 181 67 199 29 1674 942 988 884 923 210 153 52 81 191	111 76 1193 223 21 250 153 4134 9596 9630 9632 589 589 307 299	6 2 142 34 31 142 25 1648 204 204 204 204 205 95 95 189 190 90	13 74 1193 227 50 2500 153 4135 2400 2401 2400 2401 295 294 702 702 225	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5% 3.5% 3.5% 3.1% 2.9% 3.1%	$\begin{array}{c} 3.11 \left[0.56, 17.33 \right] \\ 4.24 \left[0.87, 20.66 \right] \\ 1.32 \left[1.05, 1.68 \right] \\ 2.44 \left[1.53, 3.88 \right] \\ 5.82 \left[1.22, 27.85 \right] \\ 2.97 \left[2.00, 4.41 \right] \\ 1.20 \left[0.66, 2.16 \right] \\ 1.03 \left[0.94, 1.12 \right] \\ 1.71 \left[1.00, 1.37 \right] \\ 1.24 \left[1.06, 1.45 \right] \\ 1.09 \left[0.93, 1.28 \right] \\ 1.14 \left[0.97, 1.33 \right] \\ 1.17 \left[0.87, 1.57 \right] \\ 0.74 \left[0.54, 1.00 \right] \\ 0.55 \left[0.39, 0.78 \right] \\ 1.00 \left[0.74, 1.36 \right] \end{array}$	
Wong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Muller et al [45] Mahmoud et al [64] .am et al [61] Hwang et al [40] Hirst et al [38] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Coronado et al [33] Coronado et al [32] Coronado et al [30] Subtotal (95% CI) Fotal events	8 8 181 67 19 29 1674 942 988 884 923 210 153 52 81 191 6798	11 76 1193 223 250 153 4134 9631 9630 9630 9630 9632 589 589 307 299 225 46768	6 2 142 34 31 142 25 1648 204 204 204 204 205 95 95 189 190 90 3880	13 74 1193 227 50 153 4135 2400 2401 2401 2401 295 294 702 702 225 18327	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5% 3.5% 3.5% 3.1% 3.1% 2.9% 3.1% 2.6% 46.8%	$\begin{array}{c} 3.11 \left[0.56, 17.33 \right] \\ 4.24 \left[0.87, 20.66 \right] \\ 1.32 \left[1.05, 1.68 \right] \\ 2.44 \left[1.53, 3.88 \right] \\ 5.82 \left[1.22, 27.85 \right] \\ 2.97 \left[2.00, 4.41 \right] \\ 1.20 \left[0.66, 2.16 \right] \\ 1.03 \left[0.94, 1.12 \right] \\ 1.17 \left[1.00, 1.37 \right] \\ 1.24 \left[1.06, 1.45 \right] \\ 1.09 \left[0.93, 1.28 \right] \\ 1.14 \left[0.97, 1.33 \right] \\ 1.17 \left[0.87, 1.57 \right] \\ 0.74 \left[0.54, 1.00 \right] \\ 0.55 \left[0.39, 0.78 \right] \\ 1.00 \left[0.74, 1.36 \right] \\ 8.43 \left[5.36, 13.24 \right] \end{array}$	
Vong et al [53] kiy et al [50] teiter et al [48] Muller et al [46] Miller et al [45] Mahmoud et al [64] .am et al [61] Hwang et al [40] Hirst et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Coronado et al [33] Coronado et al [32] Coronado et al [32] Laker et al [30] Subtotal (95% Cl) Fotal events Heterogeneity: Tau ² = 0.11; C	8 8 181 67 19 29 1674 988 884 923 210 153 52 81 191 6798 Chi ² = 150	111 76 1193 223 250 153 4134 9596 9630 9632 589 307 299 225 46768	6 2 142 34 31 142 25 1648 204 204 204 204 205 95 95 189 190 90 3880	13 74 1193 227 50 153 4135 2400 2401 2401 2401 295 294 702 702 225 18327	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5% 3.5% 3.5% 3.1% 3.1% 2.9% 3.1% 2.6% 46.8%	$\begin{array}{c} 3.11 \left[0.56, 17.33 \right] \\ 4.24 \left[0.87, 20.66 \right] \\ 1.32 \left[1.05, 1.68 \right] \\ 2.44 \left[1.53, 3.88 \right] \\ 5.82 \left[1.22, 27.85 \right] \\ 2.97 \left[2.00, 4.41 \right] \\ 1.20 \left[0.66, 2.16 \right] \\ 1.03 \left[0.94, 1.12 \right] \\ 1.17 \left[1.00, 1.37 \right] \\ 1.24 \left[1.06, 1.45 \right] \\ 1.09 \left[0.93, 1.28 \right] \\ 1.14 \left[0.97, 1.33 \right] \\ 1.17 \left[0.87, 1.57 \right] \\ 0.74 \left[0.54, 1.00 \right] \\ 0.55 \left[0.39, 0.78 \right] \\ 1.00 \left[0.74, 1.36 \right] \\ 8.43 \left[5.36, 13.24 \right] \end{array}$	
Wong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Muller et al [45] Mahmoud et al [64] .am et al [61] Hwang et al [40] Hirst et al [38] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Coronado et al [33] Coronado et al [33] Coronado et al [32] Subtotal (95% CI) Fotal events Heterogeneity: Tau ² = 0.11; C Fest for overall effect: Z = 3.	8 8 181 67 19 29 1674 988 884 923 210 153 52 81 191 6798 Chi ² = 150	111 76 1193 223 250 153 4134 9596 9630 9632 589 307 299 225 46768	6 2 142 34 31 142 25 1648 204 204 204 204 205 95 95 189 190 90 3880	13 74 1193 227 50 250 153 4135 2400 2401 2400 2401 2400 2401 2400 2401 2400 2401 2402 240 702 295 294 702 205 18327	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5% 3.5% 3.5% 3.1% 3.1% 2.9% 3.1% 2.6% 46.8%	$\begin{array}{c} 3.11 \left[0.56, 17.33 \right] \\ 4.24 \left[0.87, 20.66 \right] \\ 1.32 \left[1.05, 1.68 \right] \\ 2.44 \left[1.53, 3.88 \right] \\ 5.82 \left[1.22, 27.85 \right] \\ 2.97 \left[2.00, 4.41 \right] \\ 1.20 \left[0.66, 2.16 \right] \\ 1.03 \left[0.94, 1.12 \right] \\ 1.17 \left[1.00, 1.37 \right] \\ 1.24 \left[1.06, 1.45 \right] \\ 1.09 \left[0.93, 1.28 \right] \\ 1.14 \left[0.97, 1.33 \right] \\ 1.17 \left[0.87, 1.57 \right] \\ 0.74 \left[0.54, 1.00 \right] \\ 0.55 \left[0.39, 0.78 \right] \\ 1.00 \left[0.74, 1.36 \right] \\ 8.43 \left[5.36, 13.24 \right] \end{array}$	
Wong et al [53] Siy et al [50] Reiter et al [48] Muller et al [46] Muller et al [45] Mahmoud et al [64] .am et al [61] Hwang et al [40] Hirst et al [38] Hagoel et al [36] Hagoel et al [36] Coronado et al [33] Coronado et al [32] Saker et al [30] Subtotal (95% CI) Fotal (95% CI)	8 8 181 67 19 199 29 1674 942 988 884 923 210 153 52 81 191 6798 Chi ² = 150 17 (P = 0.	11 76 1193 21 250 153 4134 9631 9630 9632 589 9632 589 307 299 225 46768 0.72, df 002)	6 2 142 34 31 142 25 1648 204 204 204 204 205 95 189 190 90 3880 = 17 (P -	13 74 1193 227 50 250 153 4135 2400 2401 2400 2401 2400 2401 2400 2401 2400 2401 2402 240 702 295 294 702 205 18327	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5% 3.1% 3.1% 2.9% 3.1% 2.6% 46.8% (1); ² = 89%	3.11 [0.56, 17.33] 4.24 [0.87, 20.66] 1.32 [1.05, 1.68] 2.44 [1.53, 3.88] 5.82 [1.22, 27.85] 2.97 [2.00, 4.41] 1.20 [0.66, 2.16] 1.03 [0.94, 1.12] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.17 [0.54, 1.00] 0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 8.43 [5.36, 13.24] 1.35 [1.12, 1.63]	
Vong et al [53] kiy et al [50] keiter et al [48] Muller et al [46] Muller et al [45] Mahmoud et al [64] .am et al [61] Hwang et al [40] Hirst et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Coronado et al [33] Coronado et al [32] Coronado et al [32]	8 8 181 67 199 299 1674 988 884 923 2100 153 52 81 191 6798 Chi ² = 150 17 (P = 0./ 13115	11 76 1193 223 21 250 153 4134 9596 9630 9632 589 307 299 225 46768 0.72, df 002) 59017	6 2 142 34 31 142 25 1648 204 204 204 204 205 95 189 190 90 3880 = 17 (P -	13 74 1193 227 50 250 153 4135 2400 2401 2400 2401 2400 2401 2400 2401 294 702 225 18327 <0.0000 34872	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5% 3.5% 3.5% 3.1% 2.9% 3.1% 2.9% 3.1% 2.6% 46.8% (1); I ² = 89%	3.11 [0.56, 17.33] 4.24 [0.87, 20.66] 1.32 [1.05, 1.68] 2.44 [1.53, 3.88] 5.82 [1.22, 27.85] 2.97 [2.00, 4.41] 1.20 [0.66, 2.16] 1.03 [0.94, 1.12] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.17 [0.54, 1.00] 0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 8.43 [5.36, 13.24] 1.35 [1.12, 1.63]	
Vong et al [53] kiy et al [50] keiter et al [48] Muller et al [46] Mahmoud et al [64] Aam et al [61] Hwang et al [40] Hirst et al [36] Hagoel et al [36] Hagoel et al [36] Lagoel et al [36] Coronado et al [33] Coronado et al [32] Coronado et al [32] Laker et al [30] Subtotal (95% CI) Fotal events Heterogeneity: Tau ² = 0.11; C Fest for overall effect: Z = 3.	8 8 181 67 19 199 29 1674 942 988 884 923 210 153 52 81 191 6798 Chi ² = 150 17 (P = 0.) 13115 Chi ² = 335	111 76 1193 223 21 250 153 4134 9631 9596 9630 9632 589 307 299 225 46768 0.72, df 002) 59017 5.45, df	6 2 142 34 31 142 25 1648 204 204 204 204 205 95 189 190 90 3880 = 17 (P -	13 74 1193 227 50 250 153 4135 2400 2401 2400 2401 2400 2401 2400 2401 294 702 225 18327 <0.0000 34872	0.5% 0.6% 3.3% 2.5% 0.6% 2.7% 2.1% 3.6% 3.5% 3.5% 3.5% 3.5% 3.5% 3.1% 2.9% 3.1% 2.9% 3.1% 2.6% 46.8% (1); I ² = 89%	3.11 [0.56, 17.33] 4.24 [0.87, 20.66] 1.32 [1.05, 1.68] 2.44 [1.53, 3.88] 5.82 [1.22, 27.85] 2.97 [2.00, 4.41] 1.20 [0.66, 2.16] 1.03 [0.94, 1.12] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.17 [0.54, 1.00] 0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 8.43 [5.36, 13.24] 1.35 [1.12, 1.63]	0.05 0.2 Favours comparison Favours intervention



Figure 6. Sensitivity analysis for the primary outcome of interest of cancer screening participation without inclusion of randomized controlled trials with a high risk of bias (n=22).

Study or Subgroup		ntion	Compa			Odds Ratio	Odds Ratio
· · ·	Events	Total	Events	Total	Weight M	-H, Random, 95% Cl	M-H, Random, 95% CI
.2.1 Breast							
Arcas et al [29]	182	233	340	470	0.0%	1.36 [0.94, 1.98]	
Chung et al [31]	70	102	35	100	2.5%	4.06 [2.26, 7.30]	
Heydari and Noroozi [37]	33	60	48	60	0.0%	0.31 [0.14, 0.69]	
Kerrison et al [41]	759	1122	703	1118	4.0%	1.23 [1.04, 1.47]	
akkis et al [43]	61	193	59	192	3.1%	1.04 [0.68, 1.60]	
_ee 2017	45	60	18	60	1.8%	7.00 [3.13, 15.64]	
/idal et al [51]	2785	3719	5893	9067	0.0%	1.61 [1.47, 1.75]	
Subtotal (95% CI)		1477		1470	11.5%	2.27 [1.12, 4.64]	
Fotal events	935		815				
Heterogeneity: Tau ² = 0.46; (Chi ² = 31.	90, df =	3 (P < 0	.00001);	$l^2 = 91\%$		
Test for overall effect: $Z = 2.2$	26 (P = 0.)	02)					
1.2.2 Cervical							
Adler et al [62]	7	48	7	47	0.0%	0.98 [0.31, 3.03]	
Erwin et al [34]	35	272	6	140	1.6%	3.30 [1.35, 8.04]	
Erwin et al [34]	54	313	6	141	1.7%	4.69 [1.97, 11.18]	
Firmino-Machado et al [35]	80	201	53	205	3.1%	1.90 [1.24, 2.89]	
irmino-Machado et al [35]	98	201	63	205	3.2%	2.14 [1.43, 3.22]	_ →
Firmino-Machado et al [35]	103	202	70	205	3.2%	2.01 [1.35, 2.99]	
Huf et al [39]	580	1522	270	784	4.0%	1.17 [0.98, 1.40]	-
Huf et al [39]	575	1493	270	784	4.0%	1.19 [1.00, 1.43]	-
Huf et al [39]	466	1482	384	1453	4.1%	1.28 [1.09, 1.50]	
Khademolhosseini et al [42]	23	48	4	47	0.0%	9.89 [3.07, 31.89]	
Linde et al [65]	84	350	80	335	0.0%	1.01 [0.71, 1.43]	
Rashid et al [47]	54	250	183	750	3.5%	0.85 [0.61, 1.20]	
Richman et al [49]	44	130	43	134	2.8%	1.08 [0.65, 1.81]	
Romli et al [63]	83	105	80	105	0.0%		
Wanyoro and Kabiru [52]	96	143	29	143	2.7%	1.18 [0.62, 2.26] 8.03 [4.70, 13.73]	
Subtotal (95% CI)	90	6209	29	4944	34.0%	1.77 [1.35, 2.32]	
	2105	0205	1077		34.070	1.77 [1.55, 2.52]	-
Fotal events	2185	70.10	1377				
Heterogeneity: Tau ² = 0.16; ($cn^{-} = 77.$	70, ar =	10 (P <	0.00001); 1° = 87%		
Foot for succesly offerets 7 4	17/0 / 0	0001)					
Test for overall effect: $Z = 4.2$	13 (P < 0.	0001)					
	13 (P < 0.	0001)					
1.2.3 Colorectal			90	225	3.0%	8 43 [5 36 13 24]	
1.2.3 Colorectal Baker et al [30]	191	225	90	225	3.0%	8.43 [5.36, 13.24]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32]	191 52	225 307	189	702	3.5%	0.55 [0.39, 0.78]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32]	191 52 81	225 307 299	189 190	702 702	3.5% 3.6%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33]	191 52 81 210	225 307 299 589	189 190 95	702 702 295	3.5% 3.6% 3.6%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33]	191 52 81 210 153	225 307 299 589 589	189 190 95 95	702 702 295 294	3.5% 3.6% 3.6% 3.6%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36]	191 52 81 210 153 942	225 307 299 589 589 9631	189 190 95 95 204	702 702 295 294 2400	3.5% 3.6% 3.6% 3.6% 4.1%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37]	
1.2.3 Colorectal Jaker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36]	191 52 81 210 153 942 988	225 307 299 589 589 9631 9596	189 190 95 95 204 204	702 702 295 294 2400 2401	3.5% 3.6% 3.6% 4.1% 4.1%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36]	191 52 81 210 153 942 988 884	225 307 299 589 589 9631 9596 9630	189 190 95 204 204 204	702 702 295 294 2400 2401 2400	3.5% 3.6% 3.6% 4.1% 4.1% 4.1%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36]	191 52 81 210 153 942 988 884 923	225 307 299 589 589 9631 9596 9630 9632	189 190 95 204 204 204 204	702 295 294 2400 2401 2400 2401	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36]	191 52 81 210 153 942 988 884 923 1674	225 307 299 589 589 9631 9596 9630	189 190 95 204 204 204 205 1648	702 702 295 294 2400 2401 2400	3.5% 3.6% 3.6% 4.1% 4.1% 4.1%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38]	191 52 81 210 153 942 988 884 923	225 307 299 589 589 9631 9596 9630 9632	189 190 95 204 204 204 204	702 295 294 2400 2401 2400 2401	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36]	191 52 81 210 153 942 988 884 923 1674	225 307 299 589 9631 9596 9630 9632 4134	189 190 95 204 204 204 205 1648	702 295 294 2400 2401 2400 2401 4135	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.1%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40]	191 52 81 210 153 942 988 884 923 1674 29	225 307 299 589 9631 9596 9630 9632 4134 153	189 190 95 204 204 204 205 1648 25	702 702 295 294 2400 2401 2400 2401 4135 153	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5%	$\begin{array}{c} 0.55 \; [0.39, 0.78] \\ 1.00 \; [0.74, 1.36] \\ 1.17 \; [0.87, 1.57] \\ 0.74 \; [0.54, 1.00] \\ 1.17 \; [1.00, 1.37] \\ 1.24 \; [1.06, 1.45] \\ 1.09 \; [0.93, 1.28] \\ 1.14 \; [0.97, 1.33] \\ 1.03 \; [0.94, 1.12] \\ 1.20 \; [0.66, 2.16] \end{array}$	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Caronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61]	191 52 81 210 153 942 988 884 923 1674 29 199	225 307 299 589 9631 9530 9632 9632 4134 153 250	189 190 95 204 204 204 205 1648 25 142	702 702 295 294 2400 2401 2400 2401 4135 153 250	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61]	191 52 81 2100 153 942 988 884 923 1674 29 199 19	225 307 299 589 9631 9536 9630 9632 4134 153 250 21	189 190 95 204 204 205 1648 25 142 31	702 702 295 294 2400 2401 2400 2401 4135 153 250 50	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2% 0.7%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61] Mahmoud et al [64] Willer et al [45]	191 52 81 210 153 942 988 884 923 1674 29 199 199 67 181	225 307 299 589 9631 9596 9630 9632 4134 153 250 21 223 1193	189 190 95 204 204 204 205 1648 25 142 31 34 142	702 702 295 294 2400 2401 2400 2401 4135 153 250 50 227	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2% 0.7% 3.0% 3.9%	$\begin{array}{c} 0.55 \; [0.39, 0.78] \\ 1.00 \; [0.74, 1.36] \\ 1.17 \; [0.87, 1.57] \\ 0.74 \; [0.54, 1.00] \\ 1.17 \; [1.00, 1.37] \\ 1.24 \; [1.06, 1.45] \\ 1.09 \; [0.93, 1.28] \\ 1.14 \; [0.97, 1.33] \\ 1.03 \; [0.94, 1.12] \\ 1.20 \; [0.66, 2.16] \\ 2.97 \; [2.00, 4.41] \\ 5.82 \; [1.22, 27.85] \\ 2.44 \; [1.53, 3.88] \\ 1.32 \; [1.05, 1.68] \end{array}$	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Caronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61] Mahmoud et al [64] Miller et al [45] Reiter et al [48]	191 52 81 210 153 942 988 884 923 1674 29 199 19 67 7181	225 307 299 589 9631 9596 9632 4134 153 250 21 223 1193 76	189 190 95 204 204 205 1648 205 1648 205 142 31 34 142 2	702 702 295 294 2400 2401 4135 153 250 50 227 1193 74	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2% 0.7% 3.0% 3.9% 0.7%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hwang et al [40] Lam et al [61] Mahmoud et al [64] Willer et al [45] Reiter et al [46] Reiter et al [48]	191 52 81 210 153 942 988 884 923 1674 29 199 19 67 181 181 8 8 8	225 307 299 589 9631 9596 9632 4134 153 250 21 223 1193 76 11	189 190 95 204 204 205 1648 25 142 31 34 142 2 6	702 702 295 294 2400 2401 4135 153 250 50 227 1193 74 13	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2% 0.7% 3.0% 3.9% 0.7% 0.0%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [41] Mahmoud et al [64] Miller et al [45] Muller et al [48] Sily et al [53]	191 52 81 210 153 942 988 884 923 1674 29 199 19 67 7181	225 307 299 589 9631 9596 9630 9632 4134 153 250 21 223 1193 76 11 209	189 190 95 204 204 205 1648 205 1648 205 142 31 34 142 2	702 702 295 294 2400 2401 4135 153 250 50 227 1193 74 13 412	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2% 0.7% 3.0% 3.9% 0.7%	$\begin{array}{c} 0.55 \; [0.39, 0.78] \\ 1.00 \; [0.74, 1.36] \\ 1.17 \; [0.87, 1.57] \\ 0.74 \; [0.54, 1.00] \\ 1.17 \; [1.00, 1.37] \\ 1.24 \; [1.06, 1.45] \\ 1.09 \; [0.93, 1.28] \\ 1.14 \; [0.97, 1.33] \\ 1.03 \; [0.94, 1.12] \\ 1.20 \; [0.66, 2.16] \\ 2.97 \; [2.00, 4.41] \\ 5.82 \; [1.22, 27.85] \\ 2.44 \; [1.53, 3.88] \\ 1.32 \; [1.05, 1.68] \\ 1.32 \; [1.05, 1.68] \\ 4.24 \; [0.87, 20.66] \\ 3.11 \; [0.56, 17.33] \\ 0.96 \; [0.54, 1.70] \end{array}$	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61] Wahmoud et al [64] Willer et al [45] Muller et al [46] Reiter et al [48] Soly et al [50] Wong et al [53] Subtotal (95% CI)	191 52 81 210 153 942 988 884 923 1674 29 199 67 181 8 8 8 8 189	225 307 299 589 9631 9596 9632 4134 153 250 21 223 1193 76 11	189 190 95 204 204 205 1648 205 1648 25 142 31 34 142 2 6 374	702 702 295 294 2400 2401 4135 153 250 50 227 1193 74 13	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2% 0.7% 3.0% 3.9% 0.7% 0.0% 2.6%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61] Mahmoud et al [64] Willer et al [45] Muller et al [46] Reiter et al [48] Siy et al [50] Wong et al [53] Subtotal (95% CI) Fotal events	191 52 81 210 153 942 988 884 923 1674 29 199 67 181 8 8 8 189 6790	225 307 299 589 9631 9560 9632 4134 153 250 21 223 1193 76 11 209 46757	189 190 95 204 204 205 1648 25 1648 25 1648 25 142 2 31 34 142 2 6 374	702 702 295 294 2400 2401 4135 153 250 50 227 1193 74 13 412 18314	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2% 0.7% 3.0% 3.9% 0.7% 0.0% 2.6% 54.5%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70] 1.34 [1.11, 1.62]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Caronado et al [33] Coronado et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61] Mahmoud et al [64] Willer et al [46] Reiter et al [48] Siy et al [50] Wong et al [53] Subtotal (95% CI) Fotal events	191 52 81 210 153 942 988 884 923 1674 29 199 67 181 8 8 8 189 6790 Chi ² = 149	225 307 299 589 9631 9596 9632 4134 153 250 21 223 1193 76 11 209 46757 9.40, df	189 190 95 204 204 205 1648 25 1648 25 1648 25 142 2 31 34 142 2 6 374	702 702 295 294 2400 2401 4135 153 250 50 227 1193 74 13 412 18314	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2% 0.7% 3.0% 3.9% 0.7% 0.0% 2.6% 54.5%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70] 1.34 [1.11, 1.62]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61] Mahmoud et al [64] Willer et al [45] Muller et al [46] Reiter et al [48] Siy et al [50] Wong et al [53] Subtotal (95% CI) Fotal events	191 52 81 210 153 942 988 884 923 1674 29 199 67 181 8 8 8 189 6790 Chi ² = 149	225 307 299 589 9631 9596 9632 4134 153 250 21 223 1193 76 11 209 46757 9.40, df	189 190 95 204 204 205 1648 25 1648 25 1648 25 142 2 31 34 142 2 6 374	702 702 295 294 2400 2401 4135 153 250 50 227 1193 74 13 412 18314	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2% 0.7% 3.0% 3.9% 0.7% 0.0% 2.6% 54.5%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70] 1.34 [1.11, 1.62]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [36] Hirst et al [36] Hirst et al [46] Mahmoud et al [64] Miller et al [45] Muller et al [46] Reiter et al [46] Reiter et al [48] Sily et al [50] Wong et al [53] Subtotal (95% CI) Total events Heterogeneity: Tau ² = 0.11; C Fest for overall effect: Z = 3.0	191 52 81 210 153 942 988 884 923 1674 29 199 67 181 8 8 8 189 6790 Chi ² = 149	225 307 299 589 9631 9536 9630 9632 4134 153 250 21 223 1193 76 11 209 46757 9.40, df 002)	189 190 95 204 204 205 1648 25 1648 25 1648 25 142 2 31 34 142 2 6 374	702 702 295 294 2400 2401 4135 153 250 50 227 1193 74 13 412 18314	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2% 0.7% 3.0% 3.9% 0.7% 0.0% 2.6% 54.5%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70] 1.34 [1.11, 1.62]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61] Mahmoud et al [64] Willer et al [45] Muller et al [46] Reiter et al [48] Sily et al [50] Wong et al [53] Subtotal (95% CI) Fost for overall effect: $Z = 3.0$	191 52 81 210 153 942 988 884 923 1674 29 199 67 181 8 8 8 189 6790 Chi ² = 143 06 (P = 0.	225 307 299 589 9631 9596 9632 4134 153 250 21 223 1193 76 11 209 46757 9.40, df	189 190 95 204 204 205 1648 25 142 31 34 142 2 6 374 3874 = 16 (P -	702 702 295 294 2400 2401 4135 153 250 50 227 1193 74 13 412 18314	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2% 0.7% 3.0% 3.9% 0.7% 0.0% 2.6% 54.5%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70] 1.34 [1.11, 1.62]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61] Mahmoud et al [64] Willer et al [45] Muller et al [46] Reiter et al [48] Sily et al [53] Subtotal (95% CI) Fotal events Heterogeneity: Tau ² = 0.11; C Fest for overall effect: Z = 3.0 Total events How Source Sou	191 52 81 210 153 942 988 884 923 1674 29 199 67 181 8 8 8 189 6790 Chi ² = 149 06 (P = 0.	225 307 299 589 9631 9596 9630 9632 4134 153 250 21 223 1193 76 11 209 46757 9.40, df 002) 54443	189 190 95 204 204 205 1648 25 142 31 34 142 2 6 374 3874 = 16 (P -	702 702 295 294 2400 2401 2400 2401 153 250 50 227 1193 74 13 412 18314 < 0.0000 24728	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2% 0.7% 3.0% 3.9% 0.7% 0.0% 2.6% 54.5% 1); I ² = 89%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70] 1.34 [1.11, 1.62] 4.54 [1.33, 1.78]	
1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [36] Hirst et al [36] Hirst et al [46] Mahmoud et al [64] Miller et al [45] Muller et al [46] Reiter et al [46] Reiter et al [48] Sily et al [50] Wong et al [53] Subtotal (95% CI) Total events Heterogeneity: Tau ² = 0.11; C Fest for overall effect: Z = 3.0	191 52 81 210 153 942 988 884 923 1674 29 199 19 67 181 8 8 8 189 6790 Chi ² = 14 06 (P = 0. 9910 Chi ² = 27 ⁴	225 307 299 589 9631 9596 9630 9632 4134 153 250 21 223 1193 766 11 209 46757 9.40, df 002) 54443	189 190 95 204 204 205 1648 25 142 31 34 142 2 6 374 3874 = 16 (P -	702 702 295 294 2400 2401 2400 2401 153 250 50 227 1193 74 13 412 18314 < 0.0000 24728	3.5% 3.6% 3.6% 4.1% 4.1% 4.1% 4.1% 4.2% 2.5% 3.2% 0.7% 3.0% 3.9% 0.7% 0.0% 2.6% 54.5% 1); I ² = 89%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70] 1.34 [1.11, 1.62] 4.54 [1.33, 1.78]	0.05 0.2 1 5 Favours comparison Favours intervention



Ruco e	et al	l
--------	-------	---

Figure 7. Forest plot for the reminder interventions reporting on the primary outcome of cancer screening participation (n=12).

	Interve		Compa			Odds Ratio	Odds Ratio
tudy or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% Cl	M-H, Random, 95% Cl
.2.1 Breast							
Arcas et al [29]	182	233	340	470	4.5%	1.36 [0.94, 1.98]	
Chung et al [31]	70	102	35	100	0.0%	4.06 [2.26, 7.30]	
Heydari and Noroozi [37]	33	60	48	60	0.0%	0.31 [0.14, 0.69]	
Kerrison et al [41]	759	1122	703	1118	6.1%	1.23 [1.04, 1.47]	-
Lakkis et al [43]	61	193	59	192	0.0%	1.04 [0.68, 1.60]	
Lee et al [44]	45	60	18	60	0.0%	7.00 [3.13, 15.64]	
Vidal et al [51]	2785	3719	5893	9067	6.6%	1.61 [1.47, 1.75]	•
Subtotal (95% CI)		5074		10655	17.3%	1.42 [1.16, 1.73]	•
Total events	3726		6936				
Heterogeneity: Tau ² = 0.02; 0	Chi ² = 7.3	9, df = 3	2 (P = 0.0)	02); $I^2 =$	73%		
Test for overall effect: Z = 3.3	B7 (P = 0.)	0007)					
1.2.2 Cervical							
Adler et al [62]	7	48	7	47	0.0%	0.98 [0.31, 3.03]	
Erwin et al [34]	35	272	6	140	0.0%	3.30 [1.35, 8.04]	
Erwin et al [34]	54	313	6	141	0.0%	4.69 [1.97, 11.18]	
Firmino-Machado et al [35]	80	201	53	205	0.0%	1.90 [1.24, 2.89]	
Firmino-Machado et al [35]	98	201	63	205	0.0%	2.14 [1.43, 3.22]	
Firmino-Machado et al [35]	103	202	70	205	0.0%	2.01 [1.35, 2.99]	
Huf et al [39]	580	1522	270	784	6.1%	1.17 [0.98, 1.40]	
Huf et al [39]	575	1493	270	784	6.1%	1.19 [1.00, 1.43]	-
Huf et al [39]	466	1482	384	1453	6.2%	1.28 [1.09, 1.50]	
Khademolhosseini et al [42]	23	48	4	47	0.0%	9.89 [3.07, 31.89]	
Linde et al [65]	84	350	80	335	0.0%	1.01 [0.71, 1.43]	
Rashid et al [47]	54	250	183	750	4.7%	0.85 [0.61, 1.20]	
Richman et al [49]	44	130	43	134	0.0%	1.08 [0.65, 1.81]	
Romli et al [63]	83	105	80	105	0.0%	1.18 [0.62, 2.26]	
Wanyoro and Kabiru [52]	96	143	29	143	3.3%	8.03 [4.70, 13.73]	
Subtotal (95% CI)	50	4890	29	3914	26.4%	1.52 [1.05, 2.19]	
Total events	1771	.050	1136	552.	2011/0	1.52 [1.65] 2.15]	\bullet
Heterogeneity: Tau ² = 0.15; (.71. df =		.00001)	: I ² = 92%		
Test for overall effect: $Z = 2.2$	23 (P = 0.)	03)					
1.2.3 Colorectal							
Baker et al [30]	191	225	90	225	0.0%	8.43 [5.36, 13.24]	
Coronado et al [32]	52	307	189	702	4.7%	0.55 [0.39, 0.78]	
Coronado et al [32]	81	299	190	702	5.1%	1.00 [0.74, 1.36]	_ _
Coronado et al [33]	210	589	95	295	5.1%	1.17 [0.87, 1.57]	
Coronado et al [33]	153	589	95	294	5.0%	0.74 [0.54, 1.00]	
Hagoel et al [36]	942	9631	204	2400	6.2%	1.17 [1.00, 1.37]	
Hagoel et al [36]	988	9596	204	2401	6.2%	1.24 [1.06, 1.45]	-
Hagoel et al [36]	884	9630	204	2400	6.2%	1.09 [0.93, 1.28]	+
Hagoel et al [36]	923	9632	205	2401	6.2%	1.14 [0.97, 1.33]	
Hirst et al [38]	1674	4134	1648	4135	6.6%	1.03 [0.94, 1.12]	+
Hwang et al [40]	29	153	25	153	0.0%	1.20 [0.66, 2.16]	
Lam et al [61]	199	250	142	250	4.3%	2.97 [2.00, 4.41]	
Mahmoud et al [64]	19	21	31	50	0.0%	5.82 [1.22, 27.85]	
Miller et al [45]	67	223	34	227	0.0%	2.44 [1.53, 3.88]	
Muller et al [46]	181	1193	142	1193	0.0%	1.32 [1.05, 1.68]	
Reiter et al [48]	8	76	142	74	0.0%	4.24 [0.87, 20.66]	
	8		6		0.0%		
Sly et al [50] Wong et al [53]		200		13		3.11 [0.56, 17.33]	
Wong et al [53] Subtotal (95% CI)	189	209 44668	374	412 15993	0.0% 56.4%	0.96 [0.54, 1.70] 1.10 [0.95, 1.27]	
	6114	11000	2102	13333	30.4/0	1.10 [0.33, 1.27]	
Total events	6114	05 46	3182	0.00001	1. 12 0.10		
Heterogeneity: Tau² = 0.04; 0			10 (P <	0.00001	.); I* = 819	76	
Test for overall effect: 7 - 1	-5(r = 0.	- 1/					
Test for overall effect: $Z = 1.2$							
Test for overall effect: Z = 1.7 Total (95% CI)		54632		30562	100.0%	1.23 [1.08, 1.41]	◆
Total (95% CI)	11611	54632	11254	30562	100.0%	1.23 [1.08, 1.41]	•
	11611 Chi ² = 16		11254 = 18 (P -				◆ 0.05 0.2 1 5 2

Test for subgroup differences: $Chi^2 = 5.42$, df = 2 (P = 0.07), $I^2 = 63.1\%$



Figure 8. Forest plot for the mixed interventions reporting on the primary outcome of cancer screening participation (n=17).

Study or Subarous	Events	ntion Total	Compar Events		Weight M	Odds Ratio -H, Random, 95% Cl	Odds Ratio M-H, Random, 95% Cl
Study or Subgroup L.2.1 Breast	events	Total	events	rotal	weight M	-n, Kanuom, 95% Cl	M-n, Kandom, 95% Ci
Arcas et al [29]	182	233	340	470	0.0%	1.36 [0.94, 1.98]	
Chung et al [31]	70	102	340	100	5.4%		
	33		48	60		4.06 [2.26, 7.30]	
Heydari and Noroozi [37] Kerrison et al [41]	759	60 1122	703	1118	4.7% 0.0%	0.31 [0.14, 0.69]	
	61	193		192		1.23 [1.04, 1.47]	
Lakkis et al [43]			59		5.9%	1.04 [0.68, 1.60]	
ee 2017	45	60	18	60	4.7%	7.00 [3.13, 15.64]	
/idal et al [51] Subtotal (95% CI)	2785	3719 415	5893	9067 412	0.0% 20.6%	1.61 [1.47, 1.75] 1.74 [0.53, 5.68]	
	209	413	160	412	20.0%	1.74 [0.35, 5.06]	
Fotal events		42 df -		00001	12 - 0.2%		
Heterogeneity: Tau ² = 1.34; C Fest for overall effect: Z = 0.9			1 5 (P < U	.00001,	i; I [*] = 95%		
1.2.2 Cervical							
Adler et al [62]	7	48	7	47	3.7%	0.98 [0.31, 3.03]	
Erwin et al [34]	35	272	6	140	4.4%	3.30 [1.35, 8.04]	
Erwin et al [34]	54	313	6	141	4.5%	4.69 [1.97, 11.18]	
Firmino-Machado et al [35]	80	201	53	205	5.9%	1.90 [1.24, 2.89]	
Firmino-Machado et al [35]	98	201	63	205	5.9%	2.14 [1.43, 3.22]	
Firmino-Machado et al [35]	103	202	70	205	6.0%	2.01 [1.35, 2.99]	
Huf et al [39]	580	1522	270	784	0.0%	1.17 [0.98, 1.40]	
Huf et al [39]	575	1493	270	784	0.0%	1.19 [1.00, 1.43]	
Huf et al [39]	466	1482	384	1453	0.0%	1.28 [1.09, 1.50]	
Khademolhosseini et al [42]	23	48	4	47	3.6%	9.89 [3.07, 31.89]	
inde et al [65]	84	350	80	335	6.1%	1.01 [0.71, 1.43]	
Rashid et al [47]	54	250	183	750	0.0%	0.85 [0.61, 1.20]	
Richman et al [49]	44	130	43	134	5.6%	1.08 [0.65, 1.81]	
Romli et al [63]	83	105	80	105	5.2%	1.18 [0.62, 2.26]	
Wanyoro and Kabiru [52]	96	143	29	143	0.0%	8.03 [4.70, 13.73]	
Subtotal (95% CI)	50	1870		1564	50.8%	1.88 [1.34, 2.64]	•
lotal events	611		412				-
	011						
Heterogeneity: Tau ² = 0.19; 0	Chi ² = 32.			.0002);	$I^2 = 72\%$		
	Chi ² = 32.			.0002);	l ² = 72%		
Heterogeneity: Tau ² = 0.19; C Test for overall effect: Z = 3.6 1.2.3 Colorectal	Chi ² = 32. 62 (P = 0.0	0003)	9 (P = 0				
Heterogeneity: Tau ² = 0.19; C Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30]	Chi ² = 32. 62 (P = 0.0	225	9 (P = 0 90	225	5.8%	8.43 [5.36, 13.24]	
Heterogeneity: Tau ² = 0.19; (Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32]	Chi ² = 32. 62 (P = 0.0 191 52	225 307	9 (P = 0 90 189	225 702	5.8% 0.0%	0.55 [0.39, 0.78]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32]	Chi ² = 32. 62 (P = 0.0 191 52 81	225 307 299	9 (P = 0 90 189 190	225 702 702	5.8% 0.0% 0.0%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33]	Chi ² = 32. 62 (P = 0.0 191 52 81 210	225 307 299 589	9 (P = 0 90 189 190 95	225 702 702 295	5.8% 0.0% 0.0% 0.0%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33]	Chi ² = 32. 62 (P = 0.0 191 52 81 210 153	225 307 299 589 589	9 (P = 0 90 189 190 95 95	225 702 702 295 294	5.8% 0.0% 0.0% 0.0% 0.0%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36]	Chi ² = 32. 62 (P = 0.0 191 52 81 210 153 942	225 307 299 589 589 589 9631	90 (P = 0 189 190 95 95 204	225 702 702 295 294 2400	5.8% 0.0% 0.0% 0.0% 0.0%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37]	
Heterogeneity: Tau ² = 0.19; C Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36]	Chi ² = 32. 62 (P = 0.0 191 52 81 210 153 942 988	225 307 299 589 589 9631 9596	90 (P = 0 189 190 95 95 204 204	225 702 702 295 294 2400 2401	5.8% 0.0% 0.0% 0.0% 0.0% 0.0%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Hagoel et al [36] Hagoel et al [36]	Chi ² = 32. 62 (P = 0.0 191 52 81 210 153 942 988 884	225 307 299 589 9631 9596 9630	9 (P = 0 90 189 190 95 95 204 204 204	225 702 295 294 2400 2401 2400	5.8% 0.0% 0.0% 0.0% 0.0% 0.0%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36]	Chi ² = 32. 62 (P = 0.0 191 52 81 210 153 942 988 884 923	225 307 299 589 9631 9596 9630 9632	9 (P = 0 90 189 190 95 95 204 204 204 204	225 702 295 294 2400 2401 2400 2401	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 Alexer et al [30] Coronado et al [32] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hist et al [38]	Chi ² = 32. 62 (P = 0.0 191 52 81 210 153 942 988 884 923 1674	225 307 299 589 9631 9596 9630 9632 4134	9 (P = 0 90 189 190 95 95 204 204 204 204 205 1648	225 702 295 294 2400 2401 2400 2401 4135	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0%	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12]	
Heterogeneity: Tau ² = 0.19; C Fest for overall effect: Z = 3.6 A.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40]	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 884 884 923 1674 29	225 307 299 589 9631 9596 9630 9632 4134 153	9 (P = 0 90 189 190 95 95 204 204 204 204 205 1648 25	225 702 295 294 2400 2401 2400 2401 4135 153	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [38] Hwang et al [40] Lam et al [61]	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 884 923 1674 29 199	225 307 299 589 9631 9596 9630 9632 4134 153 250	9 (P = 0 90 189 190 95 95 204 204 204 205 1648 25 142	225 702 295 294 2400 2401 2400 2401 4135 153 250	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61] Mahmoud et al [64]	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 884 923 1674 29 199 199	225 307 299 589 9631 9630 9630 9632 4134 153 250 21	9 (P = 0 90 189 190 95 204 204 204 205 1648 205 1648 231	225 702 295 294 2400 2401 2400 2401 4135 153 250 50	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Huang et al [40] Lam et al [41] Mahmoud et al [64] Willer et al [45]	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 884 923 1674 29 199 19 67	225 307 299 589 9631 9596 9630 9632 4134 153 250 21 223	9 (P = 0 90 189 190 95 95 204 204 204 204 205 1648 25 1648 25 1423 31 34	225 702 702 295 294 2400 2401 2400 2401 4135 153 250 50 227	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61] Mahmoud et al [64]	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 884 923 1674 29 199 199 199 67 7181	225 307 299 589 9631 9596 9630 9632 4134 153 250 21 223 1193	9 (P = 0 90 189 190 95 95 204 204 204 204 204 205 1648 25 142 31 34	225 702 295 294 2400 2401 2400 2401 4135 153 250 50 227 1193	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85]	
Heterogeneity: Tau ² = 0.19; C Fest for overall effect: Z = 3.6 L2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Huang et al [40] Lam et al [61] Mahmoud et al [64] Miller et al [45] Muller et al [46] Reiter et al [48]	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 884 923 1674 29 199 19 67	225 307 299 589 9631 9596 9630 9632 4134 153 250 21 223	9 (P = 0 90 189 190 95 95 204 204 204 204 205 1648 25 1648 25 1423 31 34	225 702 702 295 294 2400 2401 2400 2401 4135 153 250 50 227	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 1.77 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 I.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61] Mahmoud et al [64] Miller et al [46]	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 884 923 1674 29 199 199 199 67 7181	225 307 299 589 9631 9596 9630 9632 4134 153 250 21 223 1193	9 (P = 0 90 189 190 95 95 204 204 204 204 204 205 1648 25 142 31 34	225 702 295 294 2400 2401 2400 2401 4135 153 250 50 227 1193	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 I.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [46] Hwang et al [40] Lam et al [61] Mahmoud et al [64] Miller et al [45] Muller et al [46] Reiter et al [48] Sily et al [50] Wong et al [53]	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 884 923 1674 29 199 19 9 181 8	00003) 2255 307 299 589 9631 9596 9630 9632 4134 153 250 21 223 1193 76 11 209	9 (P = 0 90 189 190 95 95 204 204 204 204 204 204 204 204	225 702 295 294 2400 2401 2400 2401 4135 153 250 20 50 227 1193 74 13 412	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 I.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] Lam et al [61] Mahmoud et al [64] Willer et al [46] Reiter et al [48] Sily et al [50]	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 884 923 167 181 29 199 19 67 181 8 8 8	225 307 299 589 9631 9596 9632 4134 153 250 21 223 1193 76 11	9 (P = 0 90 189 190 95 95 204 204 204 204 204 205 1648 25 142 31 34 142 2 6	225 702 295 294 2400 2401 2400 2401 4135 153 250 50 227 1193 74 13	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 3.11 [0.56, 17.33]	
Heterogeneity: Tau ² = 0.19; C Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Huang et al [40] .am et al [61] Mahmoud et al [64] Miller et al [46] Reiter et al [48] Siy et al [53] Subtotal (95% CI) Fotal events	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 884 923 1674 29 199 199 199 19 19 181 8 8 8 8 189	225 307 299 589 9631 9536 9630 9632 4134 153 250 21 223 1193 76 11 209 1947	9 (P = 0 90 189 190 95 95 204 204 204 204 204 204 204 204	225 702 295 294 2400 2401 4135 153 250 227 1193 74 13 412 2181	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70]	
Heterogeneity: Tau ² = 0.19; G Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [40] Lam et al [61] Mahmoud et al [64] Miller et al [45] Muller et al [48] Sily et al [50] Wong et al [53] Subtotal (95% CI) Total events Heterogeneity: Tau ² = 0.75; G	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 884 923 167 88 89 199 199 19 67 181 8 8 8 8 189 Chi ² = 60.	2255 307 299 589 9631 9596 9630 9632 4133 250 21 223 1193 76 11 209 1947 43, df =	9 (P = 0 90 189 190 95 95 204 204 204 204 204 204 204 204	225 702 295 294 2400 2401 4135 153 250 227 1193 74 13 412 2181	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70]	
Heterogeneity: Tau ² = 0.19; C Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hirst et al [38] Hwang et al [40] am et al [61] Mahmoud et al [64] Miller et al [48] Siy et al [50] Nong et al [53] Subtotal (95% CI) Fotal events Heterogeneity: Tau ² = 0.75; C Fest for overall effect: Z = 2.5	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 884 923 167 88 89 199 199 19 67 181 8 8 8 8 189 675 Chi ² = 60.	225 307 299 589 9631 9596 9630 9632 4134 153 250 21 223 1193 76 11 209 1947 43, df = 01)	9 (P = 0 90 189 190 95 95 204 204 204 204 204 204 204 204	225 702 295 294 2400 2401 4135 153 250 227 1193 74 13 412 2181	$\begin{array}{l} 5.8\%\\ 0.0\%\\ 0.0\%\\ 0.0\%\\ 0.0\%\\ 0.0\%\\ 0.0\%\\ 0.0\%\\ 0.0\%\\ 0.0\%\\ 0.0\%\\ 2.6\%\\ 5.8\%\\ 6.3\%\\ 2.6\%\\ 5.5\%\\ 28.6\%\\ 2.6\%\\ 0.0\%\\ 5.5\%\\ 28.6\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%\\ 3.1^2=92\%$	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 1.32 [1.05, 1.68] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70] 2.70 [1.25, 5.83]	
Heterogeneity: Tau ² = 0.19; C Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [46] Mahmoud et al [64] Miller et al [45] Muller et al [46] Reiter et al [48] Sily et al [50] Wong et al [53] Subtotal (95% CI) Fotal events Heterogeneity: Tau ² = 0.75; C Fotal (95% CI)	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 844 923 1674 29 199 197 181 8 8 189 655 Chi ² = 60. 52 (P = 0.	2255 307 299 589 9631 9596 9630 9632 4133 250 21 223 1193 76 11 209 1947 43, df =	9 (P = 0 90 189 190 95 204 204 204 204 205 1648 25 142 31 34 142 2 6 374 673 5 (P < 0	225 702 295 294 2400 2401 4135 153 250 227 1193 74 13 412 2181	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70]	
Heterogeneity: Tau ² = 0.19; C Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Huang et al [40] Lam et al [61] Mahmoud et al [64] Willer et al [45] Wuller et al [48] Siy et al [53] Subtotal (95% CI) Fotal events Heterogeneity: Tau ² = 0.75; C Fotal (95% CI) Fotal events	Chi ² = 32. 62 (P = 0. 191 52 81 210 153 942 988 884 923 1674 29 199 199 199 199 199 199 199 199 57 181 8 8 8 8 55 5Chi ² = 60. 52 (P = 0.)	225 307 299 589 9631 9596 9630 9632 4134 153 250 21 223 1193 76 11 209 1947 43, df = 01) 4232	9 (P = 0 90 189 190 95 95 204 204 204 204 204 204 204 204	225 702 295 294 2400 2401 4135 153 250 227 1193 74 13 412 2181 .00001)	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70] 2.70 [1.25, 5.83] 2.07 [1.49, 2.88]	
Heterogeneity: Tau ² = 0.19; C Fest for overall effect: Z = 3.6 1.2.3 Colorectal Baker et al [30] Coronado et al [32] Coronado et al [33] Coronado et al [33] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [36] Hagoel et al [46] Mahmoud et al [64] Miller et al [45] Muller et al [46] Reiter et al [48] Sily et al [50] Wong et al [53] Subtotal (95% CI) Fotal events Heterogeneity: Tau ² = 0.75; C Fotal (95% CI)	Chi ² = 32. 62 (P = 0. 1911 52 81 2100 153 942 988 884 923 1674 29 199 19 19 67 181 8 8 8 189 675 5 Chi ² = 60. 52 (P = 0.	225 307 299 589 9631 9596 9630 9632 4134 153 250 21 223 1193 76 11 209 1947 43, df = 01) 4232	9 (P = 0 90 189 190 95 95 204 204 204 204 204 204 204 204	225 702 295 294 2400 2401 4135 153 250 227 1193 74 13 412 2181 .00001)	5.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0	0.55 [0.39, 0.78] 1.00 [0.74, 1.36] 1.17 [0.87, 1.57] 0.74 [0.54, 1.00] 1.17 [1.00, 1.37] 1.24 [1.06, 1.45] 1.09 [0.93, 1.28] 1.14 [0.97, 1.33] 1.03 [0.94, 1.12] 1.20 [0.66, 2.16] 2.97 [2.00, 4.41] 5.82 [1.22, 27.85] 2.44 [1.53, 3.88] 1.32 [1.05, 1.68] 4.24 [0.87, 20.66] 3.11 [0.56, 17.33] 0.96 [0.54, 1.70] 2.70 [1.25, 5.83] 2.07 [1.49, 2.88]	

Table 3 presents the results of the secondary outcomes of screening intention. Six studies (3 RCTs and 3 pre- and postintervention studies) reported on screening intention, with two studies reporting on screening intention only. There was minor variability in the measurement of screening intention among the studies. For example, screening intention was treated as a dichotomous variable in some studies [37,45,54,58] or scored using a four-point [44] or five-point [59] Likert scale in others. Half of the studies (3/6, 50%) focused on cervical cancer, followed by breast cancer (2/6, 33%) and CRC (1/6, 17%). The intention to screen increased in all studies reporting on this

outcome, except for one in which it decreased. The highest increase in screening intention was observed in the study by Lee et al [58], where there was a 24% absolute increase in the intent to receive a Papanicolaou test postintervention (19/30, 63% preintervention and 26/30, 87% postintervention). The study included a 7-day text message–based intervention that included a high level of engagement with participants through quizzes, questions, and engagement in conversation [58]. Owing to the variability in how screening intention was measured or captured, we did not perform a meta-analysis on these data.

Table 3.	Cancer	screening	intention	outcome	among	included	studies	(n=6).

Study Study design		Outcome definition	Timeframe for as- sessing outcome	Outcome in compari- son group (if RCT ^a) or preintervention	Outcome in interven- tion group (if RCT) or postintervention	
Heydari and Noroozi [37]	RCT	Intention to get a mammogram (yes or no)	3 months	93% (56/60)	83% (50/60)	
Lee et al [44]	RCT	Intention to receive a mammo- gram in the future on a 4-point scale (1=not within a year, 2=within a year, 3=within 3 months, and 4=within 1 month) among intervention and control groups	1-week postinterven- tion	Group differences preintervention –0.64	Group differences postintervention 3.48	
Miller et al [45]	RCT	Intention to receive screening measured through the postpro- gram iPad survey	6 months	49% (112/227)	62% (138/223)	
Le and Holt [54]	Pre- and postintervention	Intent to get a Papanicolaou smear test (yes or no)	6 months	48% (22/46)	52% (24/46)	
Lee et al [58]	Pre- and postintervention	Intent to receive a Papanicolaou test (yes or no)	Within 1 year	63% (19/30)	87% (26/30)	
Lemos et al [59]	Pre- and postintervention	Intention to get a Papanicolaou test measured on a 5-point Lik- ert scale from 1 (definitely will not do) to 5 (definitely will do)	6 weeks	4.50 (SD 0.64)	4.82 (SD 0.48)	

^aRCT: randomized controlled trial.

Discussion

Principal Findings

Our systematic review identified 39 studies describing the effectiveness of social media and mHealth interventions on cancer screening participation and/or intention. The overall pooled OR for cancer screening participation was significant, favoring the intervention arm (OR 1.49, 95% CI 1.31-1.70). Effect sizes were similar across all cancer types, and estimates remained stable when trials deemed to be at high risk of bias were excluded, indicating that social media, and particularly mHealth interventions, can be effective for increasing cancer screening participation.

Two systematic reviews on this topic were published in 2017 [17,18]. Uy et al [17] evaluated the effectiveness of text messaging interventions on cancer screening and identified nine studies that met the inclusion criteria. Absolute screening rates for text messaging interventions were 1%-15% higher and relative screening rates were 4%-63% higher for intervention recipients in their study [17]. The authors concluded that text messaging interventions moderately increased screening rates for breast and cervical cancer; however, additional research is needed to better quantify this relationship [17]. Tamuzi et al [18] explored mHealth interventions for cervical cancer screening only. Their review identified 17 studies, and the authors were able to perform a meta-analysis on the results by type of intervention [18]. However, their definition of mHealth was different from ours. In their study, Tamuzi et al [18] included telephone, letter, and text message reminders, whereas only text message reminders were included in our study based on our adopted definition of mHealth interventions. Text message reminders are different from these other approaches because they are sent only to mobile devices compared with telephone calls, which may be made to landlines, for which coverage has been decreasing. In addition, text messages can be sent instantly, whereas letter or postcard reminders need to be delivered by the post. Moreover, text messages have the opportunity to reach those with no fixed addresses. For example, a recent systematic review on technology use among homeless adults showed that a majority (94%) owned a cell phone [68]. Overall, Tamuzi et al [18] found that call reminders were the only intervention to show a statistically significant pooled effect estimate. Only one study included in their review reported on the effect of text message reminders, and a meta-analysis of this type of intervention was, therefore, not possible [18].

The results of this study enhance our understanding of the effectiveness of social media and mHealth interventions for cancer screening. Although both previous reviews were published in 2017, nearly 44% (17/39) of the studies in this area have been published since that time. Our review provides a comprehensive and more contemporary understanding of this topic. In addition, although previous reviews focused primarily on breast and cervical cancer, our study provides valuable insights into the effectiveness of these interventions in CRC screening as well. We included 13 studies focused on CRC in our meta-analysis and found a significant pooled effect estimate, suggesting that the use of these types of interventions can be extended to CRC as well. In comparison with the study by Uy et al [17], we found that absolute screening rates between the intervention and comparison groups were higher in our study. This may suggest that multicomponent interventions that couple social media or mHealth with additional strategies may be more

effective at increasing screening rates compared with mHealth or social media strategies alone.

The results of our study must also be understood within the larger context of interventions for cancer screening. Brouwers et al [69] conducted a systematic review of interventions for increasing cancer screening rates and looked at client reminders, client incentives, mass media, small media, group education, one-on-one education, reducing structural barriers, reducing out-of-pocket costs to clients, provider assessment and feedback, and provider incentives. Similarly, the authors found wide heterogeneity across studies and interventions and chose not to meta-analyze their data. For example, their results showed that small media interventions, including videos or printed materials such as letters, brochures, newspapers, magazines, and billboards, resulted in a point percentage increase for cancer screening participation ranging from -32.8% to 26% among studies on breast cancer, cervical cancer, and CRC [69]. Our review showed that the absolute difference between the intervention and comparison arms was 14%. The magnitude of effect varied considerably among and between intervention categories in the review by Brouwers et al [69], suggesting that additional evidence is needed for interventions related to client reminders, mass media, group education, one-on-one education, reduction of structural barriers and out-of-pocket costs, and provider incentive interventions. Given the need for additional, high-quality evidence, it is difficult to ascertain whether social media and mHealth interventions fare similar, better, or worse than non-mHealth or non-social media interventions. In addition, costs should also be considered when making any comparisons between the effectiveness of these interventions to inform the translation of these findings into practice.

Although the pooled effect estimate in our meta-analysis was consistent in the subgroup and sensitivity analyses, significant heterogeneity remained. This may be because of the variability in populations, interventions, or outcome measurement across studies. For example, the populations randomized in the studies in our review included all adults up to 79 years [44], or highly specialized populations such as emergency department patients [62] or HIV-positive individuals [60]. Moreover, many of the studies included insured samples, which may not be reflective of population-level interventions, and therefore, must be considered in the generalizability of these results. In addition, the follow-up and the intensity of each intervention varied across studies. For example, some studies may have sent a single text message reminder [37], whereas other interventions included sending multiple text messages in combination with telephone reminders [33]. Interestingly, when we looked at studies conducted in LMIC settings and excluded those with a high risk of bias, the overall pooled OR was even larger with only moderate heterogeneity. These results suggest that the effectiveness of these interventions for cancer screening participation may be more pronounced in these settings. This

may be because there may be a limited number of other campaigns in these resource-low settings, whereas access to mobile phones and the internet has been reported to be comparable with that of developed nations [1].

Only a limited number of studies (n=4) tested social media interventions. As such, our results are more indicative of the effectiveness of mHealth interventions. A narrative systematic review focusing on describing the characteristics of social media interventions used for cancer prevention and management found that cancer screening participation or intention was not measured in any of the 18 studies included in the review [70]. The most common outcome measured in these studies was knowledge [70]. Although research related to social media and cancer screening participation has started to emerge [71], the inclusion of this work was limited in our review, as there are few RCTs and before and after comparisons also capturing the outcome of screening participation or intention. This suggests areas for future research to generate more evidence on the use of social media interventions for cancer screening participation. In addition, very few studies have been conducted on prostate and lung cancer screening, which is similar to what was observed in a previous study [17].

Our review and meta-analysis included a variety of mHealth and social media interventions and multicomponent interventions. Our review is comprehensive and contemporary and uses a rigorous systematic approach to screen and review the literature. As such, it includes a large number of studies for the most established screening programs for breast cancer, cervical cancer, and CRC. Owing to the large number of studies included in our review, we were able to calculate pooled effect estimates by cancer type to inform practice and future research. However, this study has limitations. Although we made every effort to obtain full-text articles, there were some records identified from our search that we could not locate. We also did not calculate a Cohen κ coefficient to report the interrater reliability between the 2 reviewers. Our review is also limited in regard to social media interventions, as only four studies were identified, with only one RCT included in the meta-analysis. This may be a reflection of current practice or due to the fact that it may be more difficult to link direct patient outcomes with the use of social media.

Conclusions

In conclusion, our results suggest that mHealth interventions may have a significant effect on cancer screening participation, particularly for breast cancer, cervical cancer, and CRC screening. Screening programs should consider the use of mHealth interventions to increase screening participation. Further research focusing on social media interventions for cancer screening participation is needed, as there was insufficient evidence available at the time of this review.

Acknowledgments

This study was supported by the Canadian Institutes of Health Research (grants FDN-148470 and GSO-157853). The funding agency had no role in the design or conduct of the study. The authors would like to acknowledge the contributions of Amina

Benmessaoud and Alawia Sherif for their help with data management and Dr Rahim Moineddin, a thesis committee member for AR's doctoral dissertation.

Conflicts of Interest

None declared.

References

- 1. World Health Organization. Global Difusion of eHealth: Making Universal Health Coverage Achievable. Report of the Third Global Survey on eHealth. Geneva: World Health Organization; 2016:1-160.
- 2. Moorhead SA, Hazlett DE, Harrison L, Carroll JK, Irwin A, Hoving C. A new dimension of health care: systematic review of the uses, benefits, and limitations of social media for health communication. J Med Internet Res 2013;15(4):e85 [FREE Full text] [doi: 10.2196/jmir.1933] [Medline: 23615206]
- Maher CA, Lewis LK, Ferrar K, Marshall S, De Bourdeaudhuij I, Vandelanotte C. Are health behavior change interventions that use online social networks effective? A systematic review. J Med Internet Res 2014;16(2):e40 [FREE Full text] [doi: 10.2196/jmir.2952] [Medline: 24550083]
- 4. Korda H, Itani Z. Harnessing social media for health promotion and behavior change. Health Promot Pract 2013 Jan;14(1):15-23. [doi: 10.1177/1524839911405850] [Medline: 21558472]
- Bull SS, Levine DK, Black SR, Schmiege SJ, Santelli J. Social media-delivered sexual health intervention: a cluster randomized controlled trial. Am J Prev Med 2012 Nov;43(5):467-474 [FREE Full text] [doi: 10.1016/j.amepre.2012.07.022] [Medline: 23079168]
- 6. Prochaska JJ, Coughlin SS, Lyons EJ. Social media and mobile technology for cancer prevention and treatment. Am Soc Clin Oncol Educ Book 2017;37:128-137 [FREE Full text] [doi: 10.1200/EDBK_173841] [Medline: 28561647]
- Hagg E, Dahinten VS, Currie LM. The emerging use of social media for health-related purposes in low and middle-income countries: a scoping review. Int J Med Inform 2018 Jul;115:92-105. [doi: <u>10.1016/j.ijmedinf.2018.04.010</u>] [Medline: <u>29779724</u>]
- 8. Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Pineros M. Global cancer observatory: cancer tomorrow. International Agency for Research on Cancer. 2018. URL: <u>https://gco.iarc.fr/tomorrow</u> [accessed 2020-09-15]
- Hewitson P, Glasziou P, Watson E, Towler B, Irwig L. Cochrane systematic review of colorectal cancer screening using the fecal occult blood test (hemoccult): an update. Am J Gastroenterol 2008 Jun;103(6):1541-1549. [doi: 10.1111/j.1572-0241.2008.01875.x] [Medline: 18479499]
- Nelson HD, Tyne K, Naik A, Bougatsos C, Chan BK, Humphrey L, U.S. Preventive Services Task Force. Screening for breast cancer: an update for the U.S. Preventive Services Task Force. Ann Intern Med 2009 Nov 17;151(10):727-737 [FREE Full text] [doi: 10.7326/0003-4819-151-10-200911170-00009] [Medline: 19920273]
- 11. Peirson L, Fitzpatrick-Lewis D, Ciliska D, Warren R. Screening for cervical cancer: a systematic review and meta-analysis. Syst Rev 2013 May 24;2:35 [FREE Full text] [doi: 10.1186/2046-4053-2-35] [Medline: 23706117]
- Sadate A, Occean BV, Beregi J, Hamard A, Addala T, de Forges H, et al. Systematic review and meta-analysis on the impact of lung cancer screening by low-dose computed tomography. Eur J Cancer 2020 Jul;134:107-114. [doi: 10.1016/j.ejca.2020.04.035] [Medline: 32502939]
- 13. Schreuders EH, Ruco A, Rabeneck L, Schoen RE, Sung JJ, Young GP, et al. Colorectal cancer screening: a global overview of existing programmes. Gut 2015 Oct;64(10):1637-1649. [doi: 10.1136/gutjnl-2014-309086] [Medline: 26041752]
- 14. Cancer Screening in Canada: An overview of screening participation for breast, cervical, and colorectal cancer. Toronto: Canadian Partnership Against Cancer. 2015. URL: <u>https://s22457.pcdn.co/wp-content/uploads/2019/01/</u> <u>Breast-Cervical-Colorectal-Screening-Participate-2015-EN.pdf</u> [accessed 2020-09-15]
- Youlden DR, Cramb SM, Dunn NA, Muller JM, Pyke CM, Baade PD. The descriptive epidemiology of female breast cancer: an international comparison of screening, incidence, survival and mortality. Cancer Epidemiol 2012 Jun;36(3):237-248. [doi: 10.1016/j.canep.2012.02.007] [Medline: 22459198]
- 16. Singh H, Bernstein CN, Samadder JN, Ahmed R. Screening rates for colorectal cancer in Canada: a cross-sectional study. CMAJ Open 2015;3(2):149-157 [FREE Full text] [doi: 10.9778/cmajo.20140073] [Medline: 26389092]
- 17. Uy C, Lopez J, Trinh-Shevrin C, Kwon SC, Sherman SE, Liang PS. Text messaging interventions on cancer screening rates: a systematic review. J Med Internet Res 2017 Aug 24;19(8):e296 [FREE Full text] [doi: 10.2196/jmir.7893] [Medline: 28838885]
- Tamuzi JL. Effectiveness of mHealth to increase cervical cancer screening: systematic review of interventions. Int J Pul Res Sci 2017 Oct 27;2(3):555586. [doi: <u>10.19080/ijoprs.2017.02.555586</u>]
- Parackal M, Parackal S, Eusebius S, Mather D. The use of Facebook advertising for communicating public health messages: a campaign against drinking during pregnancy in New Zealand. JMIR Public Health Surveill 2017 Aug 10;3(3):e49 [FREE Full text] [doi: 10.2196/publichealth.7032] [Medline: 28798011]

- Cavallo DN, Chou WS, McQueen A, Ramirez A, Riley WT. Cancer prevention and control interventions using social media: user-generated approaches. Cancer Epidemiol Biomarkers Prev 2014 Sep;23(9):1953-1956. [doi: 10.1158/1055-9965.EPI-14-0593] [Medline: 25103820]
- 21. Valle CG, Tate DF. Engagement of young adult cancer survivors within a Facebook-based physical activity intervention. Transl Behav Med 2017 Dec;7(4):667-679 [FREE Full text] [doi: 10.1007/s13142-017-0483-3] [Medline: 28374211]
- 22. Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Br Med J 2009 Jul 21;339:b2535 [FREE Full text] [doi: 10.1136/bmj.b2535] [Medline: 19622551]
- McGowan J, Sampson M, Salzwedel DM, Cogo E, Foerster V, Lefebvre C. Press peer review of electronic search strategies: 2015 guideline statement. J Clin Epidemiol 2016 Dec;75:40-46 [FREE Full text] [doi: <u>10.1016/j.jclinepi.2016.01.021</u>] [Medline: <u>27005575</u>]
- 24. Ruco A, Dossa F, Tinmouth J, Llovet D, Kishibe T, Baxter NN. Social media and mobile health technology for cancer screening: a systematic review and meta-analysis protocol. BMJ Open 2020 Feb 05;10(2):e035411 [FREE Full text] [doi: 10.1136/bmjopen-2019-035411] [Medline: 32029500]
- 25. Sterne JA, Savovic J, Page MJ, Elbers RG, Blencowe NS, Boutron I, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. Br Med J 2019 Aug 28;366:14898. [doi: 10.1136/bmj.14898] [Medline: 31462531]
- 26. EPOC Resources for review authors. Cochrane Effective Practice and Organisation of Care (EPOC). 2017. URL: <u>https://tinyurl.com/2du6ffc4</u> [accessed 2020-09-15]
- 27. McGuinness LA, Higgins JPT. Risk-of-bias VISualization (robvis): An R package and Shiny web app for visualizing risk-of-bias assessments. Res Synth Methods 2020 Apr 26:55-61 [FREE Full text] [doi: 10.1002/jrsm.1411] [Medline: 32336025]
- 28. Higgins J, Thomas J, Chandler J, Cumpston M, Li T, Page M, et al. Cochrane Handbook for Systematic Reviews of Interventions Version 6.2. Chichester, UK: John Wiley & Sons; 2019:1-728.
- 29. Arcas MM, Buron A, Ramis O, Esturi M, Hernández C, Macià F. [Can a mobile phone short message increase participation in breast cancer screening programmes?]. Rev Calid Asist 2014;29(4):188-196. [doi: <u>10.1016/j.cali.2014.02.003</u>] [Medline: <u>25002239</u>]
- 30. Baker DW, Brown T, Buchanan DR, Weil J, Balsley K, Ranalli L, et al. Comparative effectiveness of a multifaceted intervention to improve adherence to annual colorectal cancer screening in community health centers: a randomized clinical trial. JAMA Intern Med 2014 Aug;174(8):1235-1241. [doi: 10.1001/jamainternmed.2014.2352] [Medline: 24934845]
- Chung IY, Kang E, Yom CK, Kim D, Sun Y, Hwang Y, et al. Effect of short message service as a reminder on breast self-examination in breast cancer patients: a randomized controlled trial. J Telemed Telecare 2015 Apr;21(3):144-150. [doi: 10.1177/1357633X15571651] [Medline: 25697492]
- 32. Coronado GD, Rivelli JS, Fuoco MJ, Vollmer WM, Petrik AF, Keast E, et al. Effect of reminding patients to complete fecal immunochemical testing: a comparative effectiveness study of automated and live approaches. J Gen Intern Med 2018 Jan;33(1):72-78 [FREE Full text] [doi: 10.1007/s11606-017-4184-x] [Medline: 29019046]
- 33. Coronado GD, Thompson JH, Petrik AF, Nyongesa DB, Leo MC, Castillo M, et al. Patient-refined messaging for a mailed colorectal cancer screening program: findings from the PROMPT study. J Am Board Fam Med 2019;32(3):318-328 [FREE Full text] [doi: 10.3122/jabfm.2019.03.180275] [Medline: 31068396]
- Erwin E, Aronson KJ, Day A, Ginsburg O, Macheku G, Feksi A, et al. SMS behaviour change communication and eVoucher interventions to increase uptake of cervical cancer screening in the Kilimanjaro and Arusha regions of Tanzania: a randomised, double-blind, controlled trial of effectiveness. BMJ Innov 2019 Jan;5(1):28-34 [FREE Full text] [doi: 10.1136/bmjinnov-2018-000276] [Medline: 31645991]
- Firmino-Machado J, Varela S, Mendes R, Moreira A, Lunet N, SCAN-Cervical Cancer collaborators. A 3-step intervention to improve adherence to cervical cancer screening: the SCAN randomized controlled trial. Prev Med 2019 Jun;123:250-261. [doi: <u>10.1016/j.ypmed.2019.03.025</u>] [Medline: <u>30936001</u>]
- Hagoel L, Neter E, Stein N, Rennert G. Harnessing the question-behavior effect to enhance colorectal cancer screening in an mHealth experiment. Am J Public Health 2016 Nov;106(11):1998-2004. [doi: <u>10.2105/AJPH.2016.303364</u>] [Medline: <u>27631750</u>]
- Heydari E, Noroozi A. Comparison of two different educational methods for teachers' mammography based on the health belief model. Asian Pac J Cancer Prev 2015;16(16):6981-6986 [FREE Full text] [doi: 10.7314/apjcp.2015.16.16.6981] [Medline: 26514478]
- Hirst Y, Skrobanski H, Kerrison RS, Kobayashi LC, Counsell N, Djedovic N, et al. Text-message Reminders in Colorectal Cancer Screening (TRICCS): a randomised controlled trial. Br J Cancer 2017 May 23;116(11):1408-1414 [FREE Full text] [doi: 10.1038/bjc.2017.117] [Medline: 28441381]
- Huf S, Kerrison RS, King D, Chadborn T, Richmond A, Cunningham D, et al. Behavioral economics informed message content in text message reminders to improve cervical screening participation: two pragmatic randomized controlled trials. Prev Med 2020 Oct;139:106170. [doi: 10.1016/j.ypmed.2020.106170] [Medline: 32610059]

- Hwang KO, Ottenbacher AJ, Graham AL, Thomas EJ, Street RL, Vernon SW. Online narratives and peer support for colorectal cancer screening: a pilot randomized trial. Am J Prev Med 2013 Jul;45(1):98-107. [doi: <u>10.1016/j.amepre.2013.02.024</u>] [Medline: <u>23790994</u>]
- Kerrison RS, Shukla H, Cunningham D, Oyebode O, Friedman E. Text-message reminders increase uptake of routine breast screening appointments: a randomised controlled trial in a hard-to-reach population. Br J Cancer 2015 Mar 17;112(6):1005-1010 [FREE Full text] [doi: 10.1038/bjc.2015.36] [Medline: 25668008]
- 42. Khademolhosseini F, Noroozi A, Tahmasebi R. The effect of health belief model-based education through Telegram instant messaging services on Pap smear performance. Asian Pac J Cancer Prev 2017 Aug 27;18(8):2221-2226 [FREE Full text] [doi: 10.22034/APJCP.2017.18.8.2221] [Medline: 28843259]
- Lakkis NA, Atfeh AM, El-Zein YR, Mahmassani DM, Hamadeh GN. The effect of two types of sms-texts on the uptake of screening mammogram: a randomized controlled trial. Prev Med 2011 Oct;53(4-5):325-327. [doi: 10.1016/j.ypmed.2011.08.013] [Medline: 21871480]
- Lee H, Ghebre R, Le C, Jang YJ, Sharratt M, Yee D. Mobile phone multilevel and multimedia messaging intervention for breast cancer screening: pilot randomized controlled trial. JMIR Mhealth Uhealth 2017 Nov 07;5(11):e154 [FREE Full text] [doi: 10.2196/mhealth.7091] [Medline: 29113961]
- 45. Miller DP, Denizard-Thompson N, Weaver KE, Case LD, Troyer JL, Spangler JG, et al. Effect of a digital health intervention on receipt of colorectal cancer screening in vulnerable patients: a randomized controlled trial. Ann Intern Med 2018 Apr 17;168(8):550-557 [FREE Full text] [doi: 10.7326/M17-2315] [Medline: 29532054]
- Muller CJ, Robinson RF, Smith JJ, Jernigan MA, Hiratsuka V, Dillard DA, et al. Text message reminders increased colorectal cancer screening in a randomized trial with Alaska Native and American Indian people. Cancer 2017 Apr 15;123(8):1382-1389. [doi: 10.1002/cncr.30499] [Medline: 28001304]
- 47. Rashid RM, Mohamed M, Hamid ZA, Dahlui M. Is the phone call the most effective method for recall in cervical cancer screening?--results from a randomised control trial. Asian Pac J Cancer Prev 2013;14(10):5901-5904 [FREE Full text] [doi: 10.7314/apjcp.2013.14.10.5901] [Medline: 24289597]
- Reiter PL, Katz ML, Bauermeister JA, Shoben AB, Paskett ED, McRee A. Increasing human papillomavirus vaccination among young gay and bisexual men: a randomized pilot trial of the outsmart HPV intervention. LGBT Health 2018 Jul;5(5):325-329 [FREE Full text] [doi: 10.1089/lgbt.2018.0059] [Medline: 29979642]
- Richman AR, Maddy L, Torres E, Goldberg EJ. A randomized intervention study to evaluate whether electronic messaging can increase human papillomavirus vaccine completion and knowledge among college students. J Am Coll Health 2016;64(4):269-278. [doi: 10.1080/07448481.2015.1117466] [Medline: 26821923]
- Sly JR, Miller SJ, Jandorf L. The digital divide and health disparities: a pilot study examining the use of short message service (SMS) for colonoscopy reminders. J Rac Ethn Health Dispar 2014 Jul 11;1(4):231-237. [doi: 10.1007/s40615-014-0029-z]
- 51. Vidal C, Garcia M, Benito L, Milà N, Binefa G, Moreno V. Use of text-message reminders to improve participation in a population-based breast cancer screening program. J Med Syst 2014 Sep;38(9):118-124. [doi: 10.1007/s10916-014-0118-x] [Medline: 25073694]
- 52. Wanyoro A, Kabiru E. Use of mobile phone short text message service to enhance cervical cancer screening at Thika Level 5 hospital, Kiambu County, Kenya: a randomised controlled trial. Res Obstet Gynaecol 2017;5(1):10-20. [doi: 10.5923/j.rog.20170501.03]
- Wong MC, Ching JY, Huang J, Wong JC, Lam TY, Chan VC, et al. Effectiveness of reminder strategies on cancer screening adherence: a randomised controlled trial. Br J Gen Pract 2018 Sep;68(674):604-611 [FREE Full text] [doi: 10.3399/bjgp18X698369] [Medline: 30104327]
- Le D, Holt CL. CervixCheck: A spiritually-based text messaging intervention to promote cervical cancer awareness and Pap test screening intention among African-American women. J Health Commun 2018;23(9):842-853. [doi: 10.1080/10810730.2018.1528317] [Medline: 30300091]
- 55. Capik C, Gözüm S. The effect of web-assisted education and reminders on health belief, level of knowledge and early diagnosis behaviors regarding prostate cancer screening. Eur J Oncol Nurs 2012 Feb;16(1):71-77 [FREE Full text] [doi: 10.1016/j.ejon.2011.03.007] [Medline: 21530397]
- 56. Jessup DL, Glover IM, Daye D, Banzi L, Jones P, Choy G, et al. Implementation of digital awareness strategies to engage patients and providers in a lung cancer screening program: retrospective study. J Med Internet Res 2018 Feb 15;20(2):e52 [FREE Full text] [doi: 10.2196/jmir.8932] [Medline: 29449199]
- 57. Fornos LB, Urbansky KA, Villarreal R. Increasing cervical cancer screening for a multiethnic population of women in South Texas. J Cancer Educ 2014 Mar;29(1):62-68. [doi: <u>10.1007/s13187-013-0544-3</u>] [Medline: <u>24170274</u>]
- 58. Lee HY, Koopmeiners JS, Rhee TG, Raveis VH, Ahluwalia JS. Mobile phone text messaging intervention for cervical cancer screening: changes in knowledge and behavior pre-post intervention. J Med Internet Res 2014;16(8):e196 [FREE Full text] [doi: 10.2196/jmir.3576] [Medline: 25164545]
- 59. Lemos M, Rothes I, Oliveira F, Soares L. Raising cervical cancer awareness: analysing the incremental efficacy of Short Message Service. Health Edu J 2017 Sep 14;76(8):956-970 [FREE Full text] [doi: 10.1177/0017896917728306]

- 60. Ganta V, Moonie S, Patel D, Hunt AT, Richardson J, Di John D, et al. Timely reminder interventions to improve annual Papanicolaou (Pap) smear rates among HIV-infected women in an outpatient center of southern Nevada: a short report. AIDS Care 2017 Dec;29(9):1099-1101. [doi: 10.1080/09540121.2017.1322677] [Medline: 28460538]
- 61. Lam TY, Wong MC, Ching JY, Chan V, Ng SK, Hui SN, et al. 210 Effectiveness of Whatsapp reminder on compliance with colorectal cancer screening: a randomized controlled trial. Gastroenterology 2018 May;154(6):58-59. [doi: 10.1016/s0016-5085(18)30653-x]
- 62. Adler D, Abar B, Wood N, Bonham A. An intervention to increase uptake of cervical cancer screening among emergency department patients: results of a randomized pilot study. J Emerg Med 2019 Dec;57(6):836-843 [FREE Full text] [doi: 10.1016/j.jemermed.2019.07.021] [Medline: 31594738]
- 63. Romli R, Shahabudin S, Saddki N, Mokhtar N. Effectiveness of a health education program to improve knowledge and attitude towards cervical cancer and Pap smear: a controlled community trial in Malaysia. Asian Pac J Cancer Prev 2020 Mar 01;21(3):853-859 [FREE Full text] [doi: 10.31557/APJCP.2020.21.3.853] [Medline: 32212817]
- 64. Mahmud N, Doshi SD, Coniglio MS, Clermont M, Bernard D, Reitz C, et al. An automated text message navigation program improves the show rate for outpatient colonoscopy. Health Educ Behav 2019 Dec;46(6):942-946 [FREE Full text] [doi: 10.1177/1090198119869964] [Medline: 31431077]
- 65. Linde DS, Andersen MS, Mwaiselage J, Manongi R, Kjaer SK, Rasch V. Effectiveness of one-way text messaging on attendance to follow-up cervical cancer screening among human papillomavirus-positive Tanzanian women (Connected2Care): parallel-group randomized controlled trial. J Med Internet Res 2020 Apr 02;22(4):e15863 [FREE Full text] [doi: 10.2196/15863] [Medline: 32238335]
- Lyson HC, Le GM, Zhang J, Rivadeneira N, Lyles C, Radcliffe K, et al. Social media as a tool to promote health awareness: results from an online cervical cancer prevention study. J Cancer Educ 2019 Aug;34(4):819-822. [doi: 10.1007/s13187-018-1379-8] [Medline: 29948924]
- 67. Key KV, Adegboyega A, Bush H, Aleshire ME, Contreras OA, Hatcher J. #CRCFREE: Using social media to reduce colorectal cancer risk in rural adults. Am J Health Behav 2020 May 01;44(3):353-363. [doi: <u>10.5993/AJHB.44.3.8</u>] [Medline: <u>32295683</u>]
- Rhoades H, Wenzel SL, Rice E, Winetrobe H, Henwood B. No digital divide? Technology use among homeless adults. J Soc Distress Homeless 2017 Mar 22;26(1):73-77 [FREE Full text] [doi: 10.1080/10530789.2017.1305140] [Medline: 31097900]
- Brouwers MC, De Vito C, Bahirathan L, Carol A, Carroll JC, Cotterchio M, et al. What implementation interventions increase cancer screening rates? A systematic review. Implement Sci 2011 Sep 29;6:111 [FREE Full text] [doi: 10.1186/1748-5908-6-111] [Medline: 21958556]
- 70. Han CJ, Lee YJ, Demiris G. Interventions using social media for cancer prevention and management: a systematic review. Cancer Nurs 2018;41(6):19-31 [FREE Full text] [doi: 10.1097/NCC.00000000000534] [Medline: 28753192]
- Koïvogui A, Levi S, Finkler M, Lewkowicz S, Gombeaud T, Sabate JM, et al. Feasibility of encouraging participation in colorectal cancer screening campaigns by motivating people through the social network, Facebook. Colorectal Dis 2020 Oct;22(10):1325-1335. [doi: 10.1111/codi.15121] [Medline: 32397003]

Abbreviations

CRC: colorectal cancer
LMIC: low- and middle-income country
MeSH: Medical Subject Headings
mHealth: mobile health
OR: odds ratio
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PROSPERO: Prospective Register of Systematic Reviews
RCT: randomized controlled trial

Edited by R Kukafka; submitted 31.12.20; peer-reviewed by L Guo, E Neter; comments to author 08.02.21; revised version received 15.02.21; accepted 21.06.21; published 30.07.21

<u>Please cite as:</u> Ruco A, Dossa F, Tinmouth J, Llovet D, Jacobson J, Kishibe T, Baxter N Social Media and mHealth Technology for Cancer Screening: Systematic Review and Meta-analysis J Med Internet Res 2021;23(7):e26759 URL: <u>https://www.jmir.org/2021/7/e26759</u> doi: <u>10.2196/26759</u> PMID: <u>34328423</u>



©Arlinda Ruco, Fahima Dossa, Jill Tinmouth, Diego Llovet, Jenna Jacobson, Teruko Kishibe, Nancy Baxter. Originally published in the Journal of Medical Internet Research (https://www.jmir.org), 30.07.2021. This is an open-access article distributed under the terms of the Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work, first published in the Journal of Medical Internet Research, is properly cited. The complete bibliographic information, a link to the original publication on https://www.jmir.org/, as well as this copyright and license information must be included.