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Global Interventions to Improve Colorectal Cancer Screening in Primary Health Care: A Review

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Abstract

Background

Colorectal cancer is the third most commonly diagnosed cancer and the second most common cause of cancer death worldwide. Screening programs are an important strategy for early detection. This study aimed to examine global lessons learned from the implementation of colorectal cancer screening programs and interventions in primary health care using research methods.

Methods

A literature review was conducted using PubMed, Scopus, Web of Science, Embase, SID, MagIran, and Google Scholar. Relevant studies published between 2002 and 2026 in English and Persian were retrieved using appropriate keywords. EndNote 20 was used for reference management, and the extracted data were analyzed.

Results

Out of a total of 5020 initial articles, 42 final articles were selected and included in the study. Studies were categorized by intervention type at three levels: operating system, provider-centered, and patient-centered. In all studies, some degree of positive and effective impact was observed. Recommendations from the studies were categorized into four main categories: human, financial, and Information sources and mechanical/process.

Conclusions

It seems that if multimodal interventions are designed with the consideration of software systems to improve healthcare services between the provider and the patient, more effective cancer screening programs will be created.

Introduction

Colorectal cancer is the third most commonly diagnosed cancer and the second most common cause of cancer death worldwide(1, 2). Colorectal cancer (CRC) accounts for approximately 10% of cancer deaths worldwide(3). The report projects that by 2040, the burden of CRC will increase to 3.2 million new cases (a 63% increase) and 1.6 million deaths annually (a 73% increase) (4). CRC screening is highly effective at reducing CRC incidence and mortality through early detection of precancerous polyps or early-stage CRC, as well as early management and treatment (1, 5). Endoscopy-based (colonoscopy or sigmoidoscopy) and stool-based (faecal occult blood test, faecal immunochemical test (FIT), and faecal guaiac occult blood test) tests are widely used as patient screening methods for early detection of CRC

(1, 6). If detected early, more than 90% of cases can be successfully treated, and the significant risk of CRC-related mortality can be substantially reduced, allowing patients to survive for at least 5 years (1, 7). Consequently, healthcare costs for CRC management can be significantly reduced (6, 7). Given the high incidence and mortality of colorectal cancer (CRC), secondary capital from this disease is of great importance (8, 9). Therefore, early detection and secondary capital can be used for prompt treatment and prevention (10, 11). In this regard, colorectal cancer screening programs are used in many parts of the world to detect colorectal cancer and reduce mortality. Despite the effectiveness of screening programs in detecting early and treatable stages of cancer, unfortunately, people at risk do not participate in screening programs and do not take advantage of this opportunity (10–13). Several barriers prevent people from accessing colorectal cancer screening, including lack of awareness of the importance of colorectal cancer screening (14); lack of knowledge about colorectal cancer (14–16); concerns related to fear, pain, embarrassment, or worry (14, 16–18); deterministic attitudes (14, 18); and the belief that testing is unnecessary in the absence of symptoms (14, 15, 17). Provider and health care system barriers include lack of insurance coverage (14–16) and provider recommendations (15–17, 19).

Given the importance of screening and the problems involved, developing strategies to improve adherence to screening is essential to achieving the goal of increasing screening rates. In this regard, this study aimed to examine global lessons learned from programs and interventions implemented for colorectal cancer screening in primary health care through a review.

Research Method

The study was conducted using a large-scale review method using the Arkesi and Omalia framework in 2026 (20). This framework consists of six stages: identifying the research question; finding relevant studies; selecting/screening studies; categorizing and dividing data; synthesizing, summarizing, and reporting the results; and finally providing practical guidelines and recommendations.

Phase One: Identifying the research question

This study aimed to answer the following questions:

1- What programs and interventions have been implemented for colorectal cancer screening in the world?

2- What results have the implemented programs and interventions yielded?

3- What recommendations have been made for more effective implementation of programs and interventions to improve the health of the community in a global dimension?

Phase Two: Identification of relevant studies

Search strategy:

Keywords in three main areas – colorectal cancer, screening, and primary health care – were identified through a rapid literature review using Medical Subject Headings (MeSH). An experienced medical librarian was involved in developing the initial search strategy. In the initial phase, each area was searched separately. After that, a subsequent search was conducted, combining all areas to ensure the appropriateness of the final search strategy. Data were collected from SID, MagIran, PubMed, Scopus, Web of Knowledge, Embase, and Google Scholar search engines for the period 2002–2026 and restricted to English and Persian. A hand search was also conducted in WHO reports, using the same main keywords and references as those used for the selected articles. In addition, the references of all available articles were searched for articles that were not identified through electronic searches. A detailed search strategy for each database is provided in Appendix 1.

Inclusion criteria

- - All studies that report on the experiences and outcomes of programs and interventions designed for colorectal cancer screening at the primary health care level.
- - Studies conducted between 2002 and 2026.

Exclusion criteria

- - Articles in the form of protocols, statements of views, letters to the editor, and presented at conferences (conference abstracts) and articles that do not contain primary information.
- - Studies were conducted to assess the feasibility, validity, and validation of tools.
- - Articles whose full text is not available despite emailing the corresponding author.
- - Studies published in languages other than English and Persian.

Phase Three: Study Selection/Screening

All stages of article selection and screening were carried out independently by two members of the research team. Disagreements were resolved by discussion in the first stage. If necessary, disagreements were referred to a third person who had more information and experience. First, the titles of all articles were reviewed, and those incompatible with the study objectives were excluded. In the next step, the abstracts and full texts of the articles were reviewed, and studies that did not meet the exclusion criteria and were weakly related to the study objectives were identified and excluded. EndNote X20 resource management software was used to organize, review, and identify duplicates. The PRISMA flowchart was used to report the results of the selection and screening process (21).

Phase Four: Data Classification/Divided

To extract data aligned with the study objectives, data from 5 articles were first extracted on a trial basis, and deficiencies and issues in the initial form were resolved. Data extraction from the articles was

performed independently by two members of the research team. The extracted information in the form included: author, year of publication of the article, country, location of the study, brief description of the interventions, use of technological techniques in the interventions (email, Internet, software, and similar), unidimensional interventions (use of one type of intervention) or multidimensional (use of several interventions or interventions that were multimodal), duration of follow-up of participants, results and recommendations. The data extraction form was designed in Microsoft Word 2016.

Phase Five: Synthesis, Summary and Reporting of Results

After extracting data from the data extraction form, the information was manually analyzed, summarized, and reported using content analysis. Thematic analysis is a method for identifying, analyzing, and reporting patterns (themes) within texts and is widely used in qualitative data analysis (22, 23). The analysis process included familiarization with the articles (immersion in the results), identification and extraction of primary themes (selection of articles that are most related to the primary themes), classification of articles into defined themes, review and finalization of the findings of each theme using the thematic results of the articles, ensuring the validity of the themes and extracted findings through discussion and consensus between the student and the supervisors and advisors.

Phase Six: Providing Practical Guidelines and Recommendations

After extracting and reporting the results, practical guidelines and recommendations were developed based on the findings and insights from the research team.

Findings

Of the 5020 articles found in databases and other sources, 2005 were excluded due to overlap across sources. In the title and abstract review, 2835 were excluded. In the full-text review, 132 articles were excluded, and 42 were included in the study. A summary of data extraction information from the final articles is provided in Appendices 2 and 3 (9, 24–64). Figure 1 shows the screening process of colorectal cancer screening interventions in primary health care.

Records identified from*:

- Databases (n = 4999)
- Additional records identified through other sources (n = 21)

Figure 1: Screening process for colorectal cancer screening intervention studies in primary health care

A review of the study types showed that clinical trial studies accounted for 45.23% (19 studies), intervention studies for 42.85% (18 studies), quasi-experimental studies for 7.1% (3 studies), and cohort and qualitative studies for 2.3% each of the final articles. The information from the review of articles was analyzed and reported based on author, year of publication, country, study location, brief description of

interventions in the intervention and control groups, use of technological techniques in the interventions (email, Internet, software, and similar), unidimensional (using one type of intervention) or multidimensional (using several interventions or interventions that were multimodal), duration of follow-up of participants, results, and recommendations. Demographic information of the interventions (descriptively) is shown based on the variables listed in Table 1.

In the final review of articles, the breakdown of countries that had designed and implemented colorectal cancer screening interventions at the primary health care level is shown in Fig. 2. The largest number of studies was from the United States (29 studies). Of the 42 articles reviewed, 39 studies were conducted in high-income countries (the United States, Canada, Australia, France, the United Kingdom, and China).

Interventions implemented:

The target groups for interventions included adults, at-risk groups, and the population served by primary health care centers. Studies were classified by intervention type into three levels: system-centered, provider-centered, and patient-centered (Table 2). The largest number of studies (27) were patient-centered interventions. All studies observed some degree of positive and effective impact of interventions on the target groups.

Use of technology:

Of the 42 articles included in the study, 38 studies (90%) used various technological methods (email, phone call, DVD, educational videos, infographics, films, animations, websites, SMS, pamphlets, educational booklets, PowerPoint, visual flipcharts, educational applications, posters, etc.) in implementing interventions. In contrast, 4 studies did not use any of the mentioned methods.

Table 1
Demographic information of colorectal cancer screening interventions based on variables examined in the study

Variable	Variable Level	Number of interventions
Country	High-income countries	31
	Low- and middle-income countries	26
Study location/setting	Community level	10
	Healthcare centres	32
Type of intervention:	Health system level	25
	Healthcare provider level	13
Unidimensional or multidimensional study	Unidimensional	15
	Multidimensional	27
Duration of study	≤ 8 weeks	3
	≥ 9 < 24	9
	≥ 24 ≤ 48	23
	48	17

Recommendations identified for implementing colorectal cancer screening interventions in primary health care

During implementation, obstacles or challenges may be observed, or points may be discovered that will be useful in increasing the effectiveness of future programs. In this regard, the recommendations and solutions proposed in the studies under review were categorized into four main dimensions: human resources (8 cases), information resources (12 cases), financial resources (4 cases), and process solutions (14 cases) (Table 3).

Table 2
Cortical cancer screening interventions in global evidence

System-based interventions	Patient guide/navigator initiative (an evidence-based interprofessional improvement plan) (25, 49, 54, 59)
	Community health worker initiative as primary care team (28, 51)
	Health care coordinators initiative(48)
	Community health advisor initiative to provide screening recommendations (34)
	Layout Health Educators Initiative for Community Education (60)
	Messaging from the Patient Portal Program (MyChart) Based on the Electronic Health Record (58)
	Quality Improvement Models Using the Deming Cycle (PDSA) (39, 46, 47, 62)
	Telemedicine Intervention Led by Human Virtual Physicians (37)
Provider-based interventions	to determine financial incentives/rewards for physician participation (27)
	Targeted educational interventions for Providers (32, 58, 61)
	Evidence-based interventions and provider incentives (29)
Patient-centered interventions:	Production and distribution of educational content aimed at increasing knowledge of the target group (26, 32, 36, 42, 58)
	Customization of invitations signed by the patient's GP (30, 43, 55, 64)
	Distribution of faecal immunochemical test (FIT) kits, patient education and reminder calls (24, 34, 48)
	Interactive voice call, reminder letter, postal test kit (50, 51)
	Sending a postal letter with motivational content, with the ability to contact the support telephone and request the kit (44)
	Targeted intervention, tailored message pages and telephone reminders (TIPI) (31, 52)
	Web and telephone intervention tailored to age, race, family history of colorectal cancer, knowledge and beliefs about colorectal cancer (35)
	Help Patient decision-making with online videos (45, 54, 57)
	Financial incentives for patients to complete the FIT test (41)
	Electronic health record-related letters ("automated"), telephone guidance ("automated"), and nurse guidance (40)
	The role of physician counselling in motivating patients to make screening decisions (38)

	Mobile health (mHealth) intervention: text messaging, educational video, telephone call (56, 63)
	Educational intervention based on the theory of planned behaviour for family members or friends of the screening target group (9, 53)
	Distribution of faecal immunochemical test (FIT) kits, patient education and reminder calls (24, 34, 48)
	Interactive voice call, reminder letter, postal test kit (50, 51)
	Sending a postal letter with motivational content, with the ability to contact the support telephone and request the kit (44)

Table 3
Recommendations identified for colorectal cancer screening interventions in primary health care

Area	solutions
Human resources	- Use the capacity of community health workers/navigators/guides/patient care coordinators for integrated screening and filling gaps in the health system (25, 28, 48, 49, 51, 54, 59) - Use the capacity of trusted individuals in the target community to increase the likelihood of success and sustainability of evidence-based improvement initiatives and changes (25) - Pay attention to providing adequate training and appropriate justification for providers and intervention implementers (48) - Pay attention to planning processes to prepare providers to implement the intervention (motivation, skills, knowledge and staff resources) (24)
	- Pay attention to the participation of health care providers in a key role in improving screening (58) - Pay attention to the participation of all people involved in screening in the planning process to create a sense of ownership and commitment (46, 48) - Reduce provider workload by having a team-based workflow for screening recommendations (39, 46) - Use staff input to create and sustain sustainable change in quality improvement projects (46)
Information sources	Consider the specific ethnic, language, gender, and cultural norms of the target group in designing interventions (26, 36, 42, 50) - Consider designing interventions that are evidence-based, adaptable, and compatible with existing workflows (24) - Use a multifaceted approach to intervention design (34) - Need for a systematic approach to colorectal cancer screening (50) - Use integrated information infrastructures, including electronic health records (50) - Use the Deming cycle (PDCA) to identify gaps and design appropriate interventions (28) - Use data-driven information to provide performance feedback to staff (46)
	- Design future studies to examine the long-term effectiveness of programs (44) - Plan to implement a pilot program and assess the benefits of the plan for large-scale implementation (25) - Design future studies to understand the role of language and acculturation in the effectiveness of the intervention (34)
	- Integrate the patient portal with the electronic health record system for widespread information dissemination and facilitate patient interaction with

Area	solutions
	community health workers (58)
Financial resources	- : Determine targeted rewards and performance-based payments to increase active participation of providers (27) - Allocate sufficient financial grants or incentives to community health workers/navigators/patient guides (25, 49) - Determine sustainable funding sources to support the continuation of project implementation and consolidation (25, 42) - Allocate incentives to encourage providers to actively participate in the implementation of the plan (25, 27)
Mechanical/process	- Create appropriate and efficient incentive items for greater participation (25, 27, 30, 42) - Consider digital platforms as efficient and cost-effective tools for preventive health communication (58) - Strengthening non-digital communication methods to ensure equitable access (58) - Determining appropriate tools and specific time frames for reminders to increase adherence to screening (25) - Developing simple, practical, and transparent guidelines to guide the target group (42) - Creating attractiveness in the educational content produced using graphic formats, humorous methods (42) - Using more user-friendly and desirable styles to convey educational content (42) - Designing customized interventions (30, 50) - Following up on the implementation of interventions over a longer period of time (30) - Planning continuous and regular monitoring to implement and consolidate the effectiveness of interventions (42)
	- Pathophysiology of implemented interventions and removing barriers to greater effectiveness (30) - Controlling confounding factors to conduct studies with less potential for bias (30) - Need for future studies to examine the dynamics of health beliefs, norms, culture, and factors in everyday situations (36)

Discussion

Given the breadth and sensitivity of the public health issue, various factors can influence the advancement of goals, programs, and interventions. In general, in this regard, the three main pillars of

the health system, the provider, and the target group of the intervention are the focus for the development, coordination, and implementation of the program. The designed intervention needs to be appropriate to the country's structure and health system and can be included and accepted within that context. While these interventions must be able to meet the perceived needs of patients, it is necessary to design an evidence-based intervention and have the power to adapt and adapt to the existing workflows in the health system, and at the same time, providers must have the necessary preparation, including motivation, skills, knowledge, and sufficient number of staff, to implement and achieve the anticipated goals of the intervention (24). We expect the interventions to be effective enough to achieve the intended goals.

Establishing effective communication between the provider and the target screening group facilitates the implementation of colorectal cancer screening programs. Inadequate training, uncertainty about the relevance of screening, insufficient time during consultations to explain the test, and practical and administrative barriers are among the factors that may hinder the participation of general practitioners and primary care providers in screening programs (30, 65). The fact that general practitioners and health care providers have difficulty convincing the target group to undergo screening despite the absence of symptoms of colorectal disease, or that they tend to provide medical advice in a technical, medically specialized manner (65), makes it difficult to establish appropriate communication. Therefore, it was felt that programs should be developed and implemented to address existing gaps and establish effective interaction. Based on the evidence, the use of the Deming cycle (PDCA) to identify gaps and design appropriate interventions was an effective strategy and has been widely used in the management of colorectal cancer screening (28). Quality improvement projects using this cycle have successfully identified low-cost, scalable initiatives, particularly in resource-limited settings (39, 46–48, 58, 62).

Among the interventions implemented at the provider level, targeted provider education programs have improved adherence to guidelines and screening. Ensuring that all residents and providers, regardless of their level of education, have ongoing access to current protocols has enhanced consistency in clinical decision-making and patient communication (58, 61, 66). Evidence-based interventions and provider incentives have also been shown to improve uptake of colorectal cancer screening (27, 29). More attention needs to be paid to the fact that staff motivation is an important element for dynamic engagement in creating and sustaining changes resulting from system interventions (46).

Communication was a significant barrier that needed to be addressed because some patients did not actively seek care at primary care facilities, requiring approaches to re-engage them. One approach was to redesign the primary care team, including the use of team builders such as community health workers as patient navigators (25, 28, 48, 49, 51, 54, 59). Culturally sensitive community-based approaches have been more effective than traditional approaches, particularly in minority populations (49). Individuals from the target population who are familiar with the community's needs, organizations, and leaders, and who are more culturally appropriate, have proven to be effective extensions of the team in providing care outside the health facility, filling gaps in this area (28, 51, 59). However, it should also be noted that

initiatives such as implementing patient navigation have high costs that cannot be recouped. Therefore, implementation may be challenging for health facilities in resource-poor communities (54, 67).

A common reason for patients' reluctance to undergo screening is likely to be a lack of preference or awareness about colorectal cancer screening, which may interfere with the implementation and effectiveness of designed interventions. This barrier needs to be addressed in the design and implementation of interventions, and strategies need to be considered (30). In issues with cultural norms such as colorectal screening, using the potential of effective educational methods with a certain level of sophistication can reduce the burden of stigma and embarrassment in this area and help reduce any potential feelings of shame (42). Based on evidence from studies, in the design and implementation of educational interventions, it is necessary to consider the cultural sensitivity of colorectal cancer screening and the barriers in this regard, and to prepare the content with appropriate cultural protocols, in such a way that the specific characteristics of the target group, local language, gender and cultural norms are taken into account (26, 42, 50). When choosing the appropriate educational tool, it is necessary to select formats that the target group can relate to and through which the educational content is conveyed accurately (68). According to studies, the audiovisual educational style is more desirable than the textual style, especially for the low-literate target group (26, 42). Using humour in the transmission of educational materials (42), creating attractiveness in educational content through graphic formats and user-friendly applications, and other approaches can be effective in this regard. It is also important to carefully examine the path from production to transmission of educational content and identify potential obstacles that could disrupt this process.

Moreover, corrective measures should be considered (42). To make these interventions more effective, barriers related to workload and insufficient time for providers to properly convey explanations and educational materials should be addressed and removed. Based on evidence and considering recent developments in technology, the use of digital platforms and applications as efficient tools is highly practical in terms of cost-effectiveness, effectiveness, and high-speed transmission of educational content. Of course, the necessary considerations regarding the target groups of illiterates, the elderly, and those who do not have access to this digital space should also be addressed, and non-digital educational tools should be strengthened in the program (46, 58). Given that various barriers, including factors related to the patient, provider, and health system, are effective in achieving screening goals, the outcomes of multifaceted interventions will be better than those of single-component studies in increasing colorectal screening rates and will be effective (33, 50, 58). Population-based information interventions were a successful multimodal intervention with a systematic approach, implemented through an interactive voice response (IVR) initiative to increase screening among moderate-risk men and women in a non-profit integrated care delivery system (51). On the other hand, evidence suggests that customized approaches and interventions, although difficult to implement, are more effective (50). It seems that designing multimodal interventions and adopting a customization approach can have significant effects when combined effectively (44).

Conclusion

Designing interventions in the context of quality improvement projects using management tools such as the Deming PDCA cycle provided an opportunity for all stakeholders to participate in a team-based partnership and to implement new initiatives to improve the target community's level of awareness. It seems that if multimodal interventions are designed with a systematic approach that strengthens effective interaction between the provider and the patient within an integrated service system, this will lead to more effective achievement of the goals of colorectal cancer screening programs. In this regard, adopting a forward-looking perspective on the strategy for community-based interventions in this field will bring health policymakers closer to realizing the goal of a healthy society.

Declarations

Ethics Declaration:

This article is derived from the author's thesis and was approved by the Ethics Committee of Iran University of Medical Sciences (Ethics Code: **IR.IUMS.REC.1403.159**).

Consent for publication:

Not applicable.

Availability of data and materials:

All data analyzed in this study are available from the published studies cited in the manuscript.

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The authors declare that they have no competing interests" in this section.

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Authors' contributions:

EH, AA, HP: Conceptualization, methodology, literature search, data curation, formal analysis, interpretation, and writing – original draft. AS and RH: Translation, writing – review and editing, and final approval of the manuscript. All authors read and approved the final manuscript.

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Figures

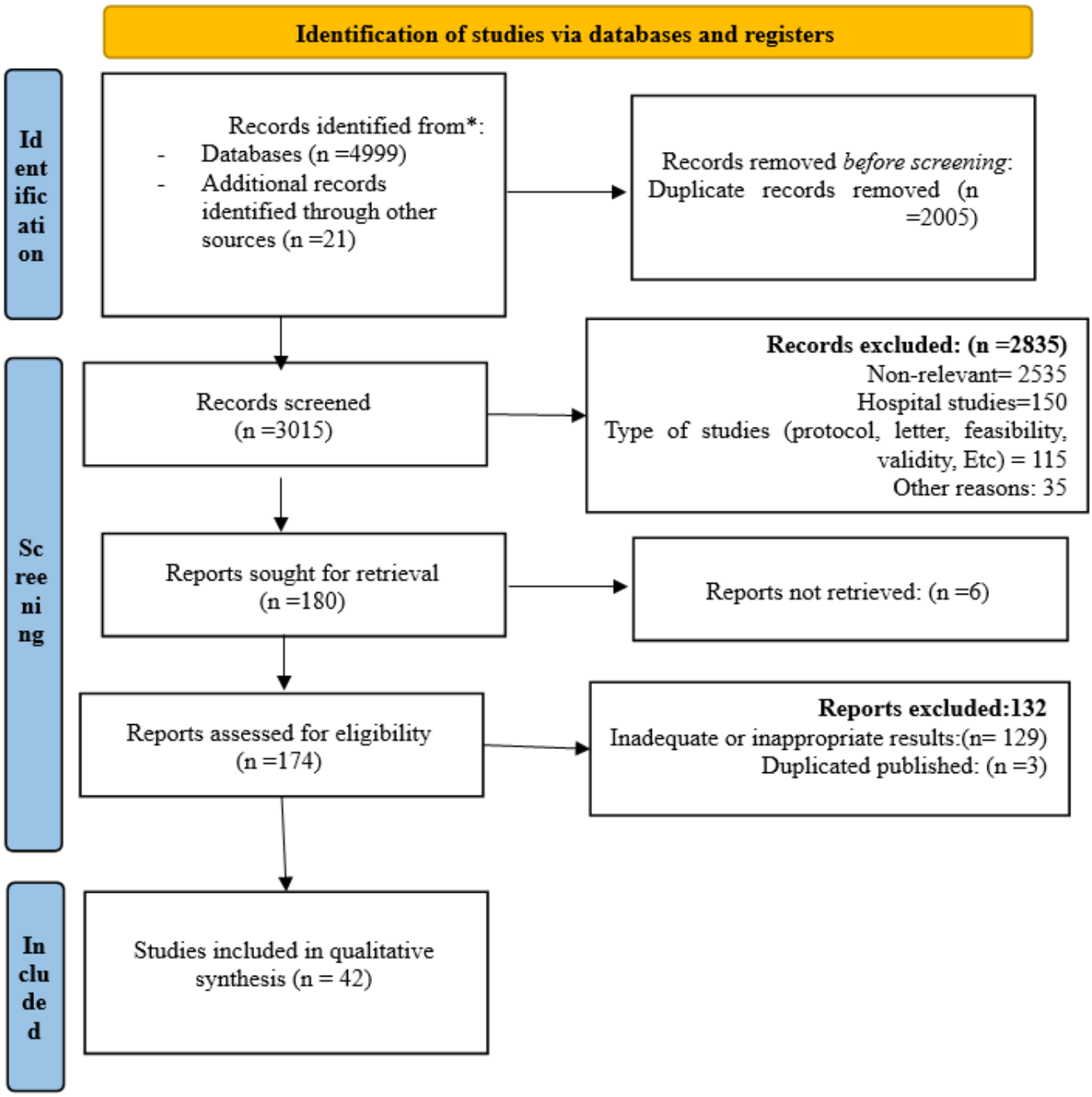


Figure 1

Screening process for colorectal cancer screening intervention studies in primary health care

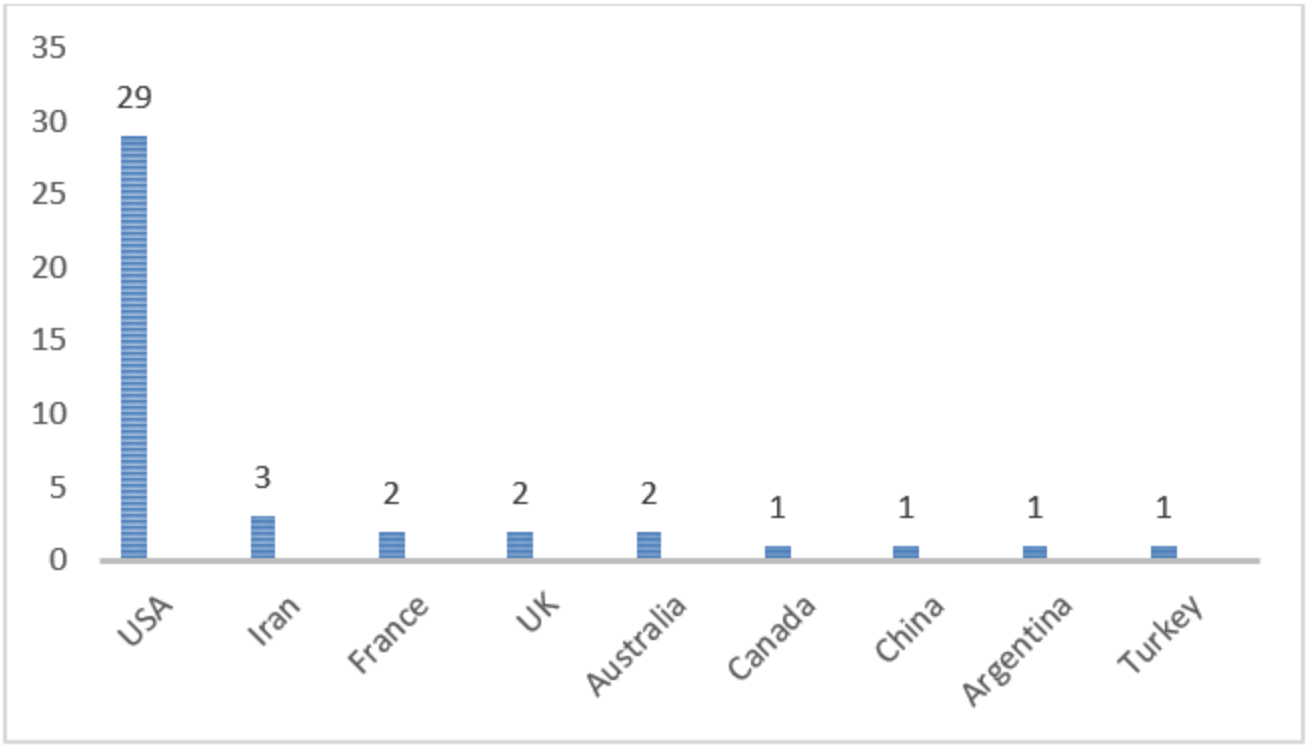


Figure 2

Classification of final articles by study country