# The Health Literacy Programs and Colorectal Cancer Prevention: A Systematic Review

## ABSTRACT

Background and Objectives: Low health literacy has been associated with less performance of preventive behaviors, but its impact on colorectal cancer (CRC) prevention is unclear. The aim of this study was to assess outcomes of health literacy interventions across the CRC prevention.

Materials and Methods: This review study was based on PRISMA checklist. Searches in Scopus, PUBMED/MEDLINE, Web of Science and google scholar between 2011-2023 were conducted. Studies were included if they reported health literacy interventional programs across CRC prevention and were written in English.

Results: Our search yielded 284 records. After identifying duplicates, 12 articles were deleted. In the next step, the titles and abstracts of the remaining 272 articles were reviewed and evaluated, and 210 articles were excluded from the study due to the irrelevance of the title or abstract. In the next stage, after assessing full text of remaining articles, 51 articles were deleted due to the lack of eligibility. Finally, 11 articles were systematically reviewed. The time of publication in all these articles was between 2011 and 2021 and the research method of all of them was interventional. Screening was the most prevalent primary outcomes. Of all eleven studies, ten studies worked on screening and one study worked on prevention. Overall, the selected articles demonstrated positive outcomes for CRC prevention.

Conclusion: Health literacy programs could increase the rate of performing CRC prevention.

**Paper Type:** A Systematic Review Article

Keywords: Health Literacy; Prevention; Colorectal Cancer; Systematic review.

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## Introduction

CRC is the third most common cancer and the second leading cause of death both among women and men worldwide. It is estimated that, the total number of deaths from CRC will increase by 72% in the next ten years (1)Unfortunately, certain populations, mainly low socioeconomic status groups, have not benefited equally from cancer screening and continue to have elevated cancer mortality rates (2).

Limited health literacy may be a reason for the low rate of preventive behaviors and cancer screening tests and may be a contributing factor to cancer screening disparities(3). Health literacy is defined as the degree of an individual's capacity to obtain, communicate, process and understand the basic health information and services in order to make the best health decisions (4). Nowadays, health literacy has been considered as a strategy for decreasing health disparities among vulnerable groups, because of its potential to enhance control over one's health. Therefore, the role for health literacy in screening of CRC has especially garnered recent attention(5). With the rapid cancer incidence increase, and the surge in online health information, efforts targeted to cancer screening and health literacy are both relevant and crucial to supporting overall health and well-being of whole population (6, 7).

Health literacy is a new concept, with much of the research accumulated over the past decade. The Canadian Council for Learning identified a framework for better demonstration of health literacy which has been classified health literacy in five categories which are: health promotion (i.e. actions taken to increase control over one's health), health protection (i.e. actions taken to preserve and protect health), disease prevention (i.e. actions taken to prevent the onset of illness or disease), health care (i.e. actions taken to seek care) and navigation (i.e. actions taken to utilize programs, services and care). This framework identifies the variety of health activities and behaviors that impact individuals' health-related decisions and ultimately their health outcomes(8).

Those with inadequate health literacy have difficulty in accessing care across the cancer continuum (e.g., prevention, screening, diagnosis, treatment)(4). Removing the barriers for individuals with inadequate health literacy across the cancer care prevention may improve outcomes(9).

Health literacy research mostly has been focused on observational studies examining the prevalence of limited health literacy and/or characterizing the relationship between health literacy and outcomes. In a review study, authors found that inadequate health literacy was associated with lower health services use leading to poorer health outcomes (10).

In the other review study, the authors showed that mental health literacy interventional programs employ strategies to increase knowledge of the symptoms of mental illness, attitude to mental health problems and seeking help in the intervention group(11).

Results of one study indicated that higher health literacy leads to more perceived self-efficacy and better self-care performance and indicated that adolescent's health literacy seems associated with important health

outcomes then considering the importance of health literacy in adolescents, designing and implementing educational intervention for promoting health literacy is significantly important(3).

The purpose of this systematic review was to identify and characterize the literature on health literacy interventional programs in CRC screening. Specifically, our aims were to review and representation of studies across the CRC screening, and report on the strength of evidence (study design), intervention types and outcomes assessed within the existing literature reporting health literacy interventions in CRC screening.

## Materials and Methods

This systematic review was conducted in adherence to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol(12).

In this literature review our questions were: (1) What intervention types are employed? (2) What are the primary outcomes?

## Search strategy

We searched four electronic databases including PubMed, Scopus, Web of Science and Google scholar between January 2011 and December 2021 to review the latest health literacy intervention on CRC preventive behaviors. The search was run on Feb 15, 2023 with an updated search on March 19, 2023. The search process was conducted using the following keywords: (health literacy) AND (prevention OR screening) AND (colorectal cancer OR colon cancer OR rectal cancer OR colorectal neoplasm OR colon neoplasm OR rectal neoplasm). Keywords were combined with and without search quotation marks using the Boolean “AND” and “OR” operators, and the "*" star wildcard was used to expand the search if needed. Thematic search was also performed using medical subject headings (MeSH) at the PubMed database according to PRISMA guidelines.

## Inclusion and exclusion criteria

We included studies that contained a health literacy intervention based on randomized controlled trials or quasi- experimental which designed to improve preventive behaviors for CRC and were written in English. Articles were about the prevalence of health literacy in a population, or those that reported associations between health literacy and cancer outcomes were excluded; moreover, thesis and abstracts of conference papers were excluded from the study.

## Data Extraction

For all selected studies, the following details were extracted: name of the first author, year of study, sample size, domain, type of intervention, primary outcomes of health literacy and quality assessment score. Two reviewers independently screened the studies for eligibility. Only when a consensus was not possible was a third reviewer consulted. The hand search was performed in reference collections from the articles extracted from electronic databases.

## Results

Our search yielded 284 records. After identifying duplicates, 12 articles were deleted. In the next step, the titles and abstracts of the remaining 272 articles were reviewed and evaluated, and 210 articles were excluded from the study due to the irrelevance of the title or abstract. In the next stage, after assessing full text of remaining articles, 51 articles were deleted due to the lack of eligibility. Finally, 11 articles were

systematically reviewed. The time of publication in all these articles was between 2011 and 2021 and the research method of all of them was interventional. The flow of selected articles for inclusion in the review study based on the PRISMA chart has been shown in Figure1. The Characteristic of the Included Studies has been shown in Table1.

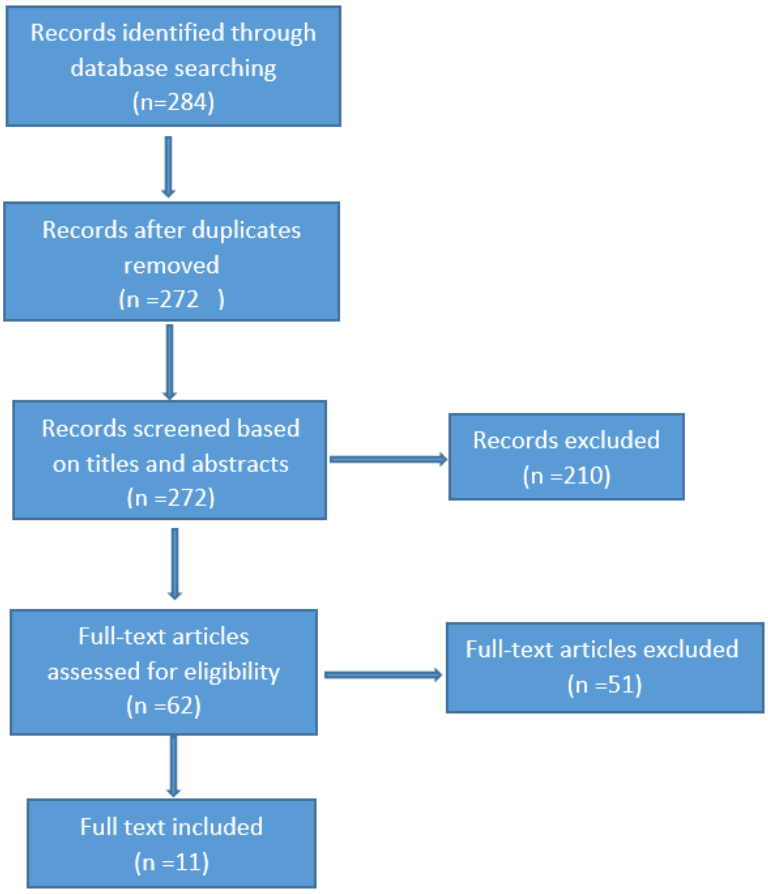


Figure 1. PRISMA flow diagram

Screening was the most prevalent primary outcomes. Of all eleven studies, ten studies worked on screening (13, 14, 16-23) and one study worked on prevention (15).

Three interventions investigated short term outcomes (within 6 months of the intervention) and found mixed results. Based on the results of Katz et al. activation intervention improved CRC screening at 2 months when compared to screening information-only arm (20). Primary outcome of Atkin et al. was the return of the Fecal Occult Blood Testing (FOBT) within 18 weeks of the invitation and found no difference between a standard information booklet compared to a booklet and information leaflet (18). Hoffman et al. showed improving CRC screening intentions or completion at 3 months when assessing an entertainment education intervention (15).

Four interventions found improved completion of CRC screening within 6 to18-months of the intervention (16, 19, 21, 22). Davis et al. demonstrated FIT completion rate

was 78.1% for intervention group and 83.5% for control group (p=.17). The targeted low-literacy multicomponent materials were not significantly different or more effective in increasing FIT uptake compared to the non-targeted materials (16). Tong et al. showed, intervention group had greater changes after the intervention than the control group for ever screening (p=0.068) and being up-to-date (p<0.0001). In multivariable regression analyses, the intervention group had a greater increase than the control group in reporting ever screening (AOR = 1.73, 95% CI: 1.07–2.79) and being up-to-date (AOR = 1.71, 95% CI: 1.26–2.32). A higher CRC knowledge score mediated the intervention effect for both screening outcomes (19). In Horne et al. study, the intervention group was more likely to report being up-to-date with CRC screening at the exit interview (OR 1.55, 95 % CI 1.07–2.23). When examining the screening modalities separately, the patient navigator increased screening for colonoscopy/sigmoidoscopy (OR 1.53, 95 % CI 1.07–2.19), but not FOBT screening. Analyses of moderation revealed stronger effects of navigation among participants 65–69 years and those with an adequate health literacy level (21). Baker et al. showed, intervention patients were much more likely than those in usual care to complete FOBT (82.2% vs 37.3%; P < .001). Of the 185 intervention patients completing screening, 10.2% completed prior to their due date (intervention was not given), 39.6% within 2 weeks (after initial intervention), 24.0% within 2 to 13 weeks (after automated call/text reminder), and 8.4% between 13 and 26 weeks (after personal call) (22).

Two interventions evaluated completion and return of three fecal occult blood tests (FOBTs) over three years (>3 years) and found that screening was not sustained over all three years (13, 14). Davis et al. showed, while baseline screening rates were < 3% before intervention, screening rates were 38.6% with enhanced usual care, 57.1% with education and 60.6% with additional nurse support after intervention. Those additionally receiving nurse support were 1.60 fold more likely to complete screening than those receiving enhanced usual care (95% CI 1.06 – 2.42, p=0.024) (13). In Arnold et al. study, among the participants, the education arm (p = .015, screening ratio = 2.34, 95% CI 1.18 – 4.65) and the nurse arm (p = .036, screening ratio = 2.07, 95% CI 1.05 – 4.11) had significantly higher rates of FOBT testing than the enhanced care arm (14).

Prevention outcome was the result of just one study. Based on the results, knowledge in intervention group increase 2.7 while in control group increase 0.4, p< .01); mean of decisional conflict in intervention group was 11.0 while in control group was 39.6; p< .01);and based on results of that, improved knowledge(15). The culturally-tailored decision aid significantly increased patients' knowledge of CRC screening recommendations and options. It also significantly reduced their decisional conflict and improved their self-advocacy. No significant differences were observed in participants' attitudes, norms, or intentions. At three months, 23% of all patients had completed a colonoscopy. Designing targeted, engaging patient decision aids promise for improving patient decision making and self-advocacy.

Table 1. Summary of the Characteristic of the Included Studies

| Author | Domain | Sample size | Intervention | Primary Outcome | Significance | Quality assessment score |
|---|---|---|---|---|---|---|
| Davis, 2013(13) | Screening | -Enhanced Usual Care (n=275)<br>- Education (n=282)<br>- Nurse (n=404) | Three kind of interventions: 1) enhanced usual care, 2) literacy-informed education of patients, and 3) education plus nurse support. | Return of three FOBT kits over the three-year period, was achieved by 4.7% in Enhanced Care, 11.4% in Education and 13.6% in the Nurse arm (p=0.005). | Baseline screening rates were < 3%. After the interventions, screening rates were 38.6% with enhanced usual care, 57.1% with education and 60.6% with additional nurse support. Those additionally receiving nurse support were 1.60 fold more likely to complete screening than those receiving enhanced usual care (95% CI 1.06 – 2.42, p=0.024). | 5 |
| Arnold, 2016(14) | Screening | - Enhanced Usual Care (n=38)<br>- Education (n=52)<br>- Nurse (n=116) | Three kind of interventions: enhanced care (screening recommendation and FOBT kit mailed annually), education (patients additionally received a health literacy appropriate pamphlet and simplified FOBT instructions), or nurse support (same as education but with nurse follow-up) | Return of three FOBT kits over the three-year period, was achieved by 4.7% in Enhanced Care, 11.4% in Education and 13.6% in the Nurse arm (p=0.005). | Among the participants, the education arm (p = .015, screening ratio = 2.34, 95% CI 1.18 – 4.65) and the nurse arm (p = .036, screening ratio = 2.07, 95% CI 1.05 – 4.11) had significantly higher rates of FOBT testing than the enhanced care arm. | 5 |
| Hoffman, 2016(15) | Prevention | - Intervention(n=59)<br>- Control(n=29) | A decision aid video containing culturally tailored information about CRC screening options in an entertainment health literacy education format compared to an attention control video about hypertension | Knowledge about CRC screening behavior and improve decision making ability in 3 month | Mean of knowledge in intervention group increase 2.7 while in control group increase 0.4, p< .01); mean of decisional conflict in intervention group was 11.0 while in control group was 39.6; p< .01); | 3 |

| Author | Domain | Sample size | Intervention | Primary Outcome | Significance | Quality assessment score |
|---|---|---|---|---|---|---|
| Davis, 2017(16) | Screening | - Intervention(n=210)<br>- Control(n=205) | Assessed a multicomponent intervention incorporating a targeted health literacy compared to standard, non-targeted information | Screening with FIT within 180 days of delivery of the intervention | FIT completion rate was 78.1% for intervention group and 83.5% for control group (p=.17). The targeted low-literacy multicomponent materials were not significantly different or more effective in increasing FIT uptake compared to the non-targeted materials. | 5 |
| Meppelink, 2015(17) | Screening | - low health literacy group(n = 279)<br>-high health literacy group(n = 280) | Using a two (illustrated vs. text-only) by two (no difficult vs. difficult text) between-subjects | Recall for screening, attitudes and intention to screen | Increase reminding for non-difficult text in low HL group vs. the difficult-high HL group;<br>Illustrations added to difficult text for LHL group improved recall (8.49 to 10.88 for LHL vs. 13.25 to 14.77 for HHL illustration addition);<br>Attitude toward screening increase with adding illustrations; | 5 |
| Atkin, 2017(18) | Screening | - intervention (n = 79,104)<br>- control group (n = 84,421) | Evaluated a standard information booklet compared to a standard information booklet and information leaflet | Completed FOBT screening within 18 weeks of delivery the intervention | uptake was similar between the intervention and control groups 57.3% and 57.6%; OR = 1.02, 95% CI: 0.92–1.13, p = 0.77) | 5 |
| Tong, 2017(19) | Screening | - intervention (n = 161)<br>- control group (n = 168) | Assessed CRC education over 3 months delivered by a lay health educator compared to education about nutrition and physical activity delivered by a health educator | CRC screening within 24 weeks of delivery the intervention | The intervention group had greater changes after the intervention than the control group for ever screening (p=0.068) and being up-to-date (p<0.0001). The intervention group had a greater increase than the control | 3 |

| Author | Domain | Sample size | Intervention | Primary Outcome | Significance | Quality assessment score |
|---|---|---|---|---|---|---|
| | | | | | group in reporting ever screening (AOR = 1.73, 95% CI: 1.07–2.79) and being up-to-date (AOR = 1.71, 95% CI: 1.26–2.32) | |
| Katz, 2012(20) | Screening | - CRC screening information plus patient activation and barriers counseling group (n = 138)<br>- CRC screening information group (n = 132) | Evaluated whether screening information, activating patients to ask for a screening test, and telephone barriers counseling improved CRC screening when compared to screening information | Completion of CRC screening within 2 month of delivery the intervention | More patients randomized to the activation group completed a screening test (19.6% vs. 9.9%; OR = 2.35, 95% CI: 1.14–5.56; P = 0.020). | 5 |
| Horne, 2016(21) | Screening | - intervention group receiving patient navigator in addition to printed educational material(n=578)<br>- control group receiving only printed educational materials(n=642) | Comparing patient education to a patient education plus patient navigation intervention to improve up-to-date CRC screening | Completion of CRC Screening | The intervention group was more likely to report being up-to-date with CRC screening at the exit interview (OR 1.55, 95 % CI 1.07–2.23) | 5 |
| Baker, 2014(22) | Screening | - intervention group (n = 225) - control group with usual care (n = 225) | Usual care included computerized reminders, standing FIT orders, and clinician feedback. The intervention group also received a mailed reminder, a free FIT with low-literacy instructions, and a postage-paid return envelope; an automated telephone and text message | Completion of FOBT within 6 month of delivery the intervention | Intervention patients were much more likely than those in usual care to complete FOBT (82.2% vs 37.3%; P < .001) | 5 |

| Author | Domain | Sample size | Intervention | Primary Outcome | Significance | Quality assessment score |
|---|---|---|---|---|---|---|
| | | | reminding them that they were due for screening and that a FIT was being mailed to them; an automated telephone and text reminder 2 weeks later for those who did not return the FIT; and personal telephone outreach by a CRC screening navigator after 3 months. | | | |
| Freed, 2013(23) | Screening | - intervention group (n = 30)<br>- control group with usual care (n = 30) | The experimental text had a lower Flesch-Kincaid reading grade level (7.4 versus 9.6), was more focused on addressing screening barriers, and employed more comparative tables than the control text. | Recognition memory | Recognition memory was higher in the experimental group (2.54 versus 1.09, t= −3.63, P = 0.001), including after adjustment for age, education, and health literacy (β = 0.42, 95% CI 0.17, 0.68, P = 0.001) | 5 |

Two interventions investigated recall and recognition memory in relation to CRC screening tests (17, 23). One of them found increased recall for non-difficult text in the limited health literacy group vs. the difficult-high adequate health literacy group. Moreover, illustrations added to difficult text improved recall for the limited health literacy group (17). The other study, evaluated low Flesh-Kincaid reading level versus a control text and reported that the lower reading level text improved recognition memory across health literacy levels (23).

One study examined use of various information presentations to assess knowledge, attitudes, literacy and intentions for those with limited health literacy using the SAHL-D and they reported a health literacy effect modification; moreover, they found increased recall for non-difficult text in the limited health literacy group vs. the difficult-high adequate health literacy group. Furthermore, illustrations added to difficult text for limited health literacy group improved recall (limited health literacy 8.49 to 10.88 vs. adequate health literacy 13.25 to 14.77) (17).

One intervention reported improvements for those with adequate health literacy. They assessed health literacy with the REALM-R and found an effect on CRC screening for those with adequate health literacy (OR 2.17, 95 % CI 1.03–4.56), but not for those with limited health literacy (21).

## Discussion

We reviewed interventions designed to address health literacy in the context of CRC prevention and screening. All interventions were focused on adults and some of them included a clinician component in the intervention. Behavior-oriented outcomes were the primary focus of outcome measures, which included screening intention and completion. Knowledge, comprehension, and recall were the second most common outcomes. In line with the results of this study, the primary outcomes of a systematic review with the aim of assessing the effect of health literacy interventions on pregnancy outcomes showed that knowledge of participants in 10 of 13 studies was improved after the intervention (24). A systematic review of health literacy interventions for people living with HIV showed, significant improvements in knowledge, behavioral skills, and e-Health literacy after interventions (p = 0•001–0•05). Health literacy interventions have the potential to promote HIV-related knowledge, behavioral skills, and self-management practices (25). Results of the other systematic review showed, promising interventions were tailored to the needs of patients, addressing functional, interactive and critical skills and use not difficult animated spoken text (26).

While all the studies included in this review were in the context of health literacy and CRC, none of them investigating improved health literacy as a primary outcome. These findings build upon a prior review outlining the limited scope of health literacy outcomes in CRC research (27). Moreover, investigations evaluating the role of health literacy, demonstrated mixed results. Improvements among those with adequate health literacy were often in contrast to the stated purpose of addressing the needs of those with limited health literacy. Interventions that improve outcomes only for

those with adequate health literacy run the risk of exacerbating disparities in outcomes.

Multilevel interventions appeared to have the greatest impact on outcomes. These multilevel interventions included clinician communication training, navigation supports, patient education and activation, and caregiver/family support. These findings support the existing literature describing use of multiple strategies in health literacy interventions since health literacy is a constellation of skills and demands (9, 28). The skills associated with health literacy (e.g., numeracy, listening, speaking, reading) interact with system-level demands (e.g., health insurance complexity, navigation skills, perceived barriers) and may benefit from a multilevel intervention approach. Multilevel interventions can address several factors, such as access and utilization of health care (e.g., navigation, complexity), provider-patient interaction (e.g., communication, knowledge), and self-care (e.g., motivation, self-efficacy) (29). Study designs that incorporate both interventions and evaluation at multiple levels of influence, and how these interact to produce health outcomes for populations with limited health literacy, would help advance this line of research (30).

The use of health literacy in multivariate analyses is an underdeveloped area of the literature. One intervention observed improved outcomes for those with limited health literacy (17). And one intervention reported improvements for those with adequate health literacy (21). Other studies incorporated health literacy level in their study inception and design but results and analyses appeared to be incomplete or insufficiently powered to fully evaluate effects across health literacy levels. Opportunities to use more rigorous analyses to assess the effect of health literacy level are critically needed to develop the health literacy field.

Many of the articles reviewed for this investigation reported on the phases of development of a single intervention. The formative work and feasibility testing that is needed to develop an evidence-based intervention is formidable. Furthermore, interventions developed for specific populations require intensive foundational work to ensure implementation of the intervention in the future. Yet, few interventions included implementation measures (e.g., fidelity, cost, sustainability)(31). These critical implementation measures can facilitate translation of interventions into a variety of real-world settings. Thus, the inclusion of implementation science measures may advance the field and enhance intervention scalability.

**Study Limitations and Strengths:** This review is not without limitations. Only interventions reported in English were included. Increasing the scope to include investigations in multiple languages would enhance these findings. Standardized measures were not used across studies and therefore we were unable to complete a meta-analysis of the outcomes. The proliferation of context specific health literacy measures has contributed to the use of a wide variety of measures. Including standardized outcome measures may help to synthesize results in future investigations.

## Conclusion

Further research is needed in the development and implementation of evidence-based health literacy interventions to improve cancer prevention outcome. Designing research investigations that are powered to evaluate multilevel interventions and include explicit evaluations of health literacy impacts would advance the field. Attention to improving health literacy specific skills among those with limited health literacy should be a central focus of intervention development in order to avoid contributing to disparities.

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**Consent for publication:** Not applicable

**Ethical approval and consent to participate:** The study was conducted in accordance with the Declaration of Helsinki. This article is excluded from research project with ethical code IR.MUMS.FHMPM.REC.1400.008 which was approved in Mashhad University of Medical Sciences.

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**Author contributions:** All authors have their own responsibilities in this review manuscript. All authors read the final draft of the manuscript and confirmed it.

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