

HEALTH LITERACY IN CHRONIC DIGESTIVE DISEASES: IMPLICATIONS FOR COLORECTAL CANCER SCREENING ADHERENCE AND PERSONALIZED PREVENTION – A NARRATIVE REVIEW

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Objectives: Health literacy is a significant determinant of health, influencing prevention, diagnosis, and long-term disease management. It may also impact participation in colorectal cancer (CRC) screening, particularly among patients with chronic digestive diseases who must engage in complex therapeutic decisions and sustained self-management. Although evidence increasingly links health literacy to preventive health care, its specific role in CRC screening adherence among patients with chronic digestive diseases remains insufficiently examined. This review aimed to synthesize current evidence on health literacy in chronic digestive diseases with particular emphasis on CRC screening adherence, and to propose an integrated conceptual framework linking chronic disease management to personalized cancer prevention.

Material and Methods: This narrative review followed the Scale for the Assessment of Narrative Review Articles (SANRA) recommendations, with the search and selection process guided by PRISMA 2020 principles. Literature published from January 2010 to July 2025 was identified using PubMed/MEDLINE, Embase, Scopus, Web of Science, ScienceDirect, and Google Scholar. Of 728 records identified, 48 publications were included and synthesized thematically. **Outcomes:** Health literacy influences several key determinants of CRC screening adherence, such as disease knowledge, self-efficacy, communication, and healthcare navigation. Patients with chronic digestive diseases maintain ongoing contact with gastroenterology services, which provide opportunities to incorporate health literacy interventions into routine care. Barriers at the patient, provider, organizational, and policy levels were identified, alongside evidence supporting plain-language communication, patient navigation, digital tools, and organizational health literacy. This review presents an integrated multilevel conceptual framework linking chronic digestive disease management to CRC prevention. **Conclusions:** Health literacy represents a modifiable factor in CRC screening adherence and is a fundamental element of personalized prevention. Incorporating health literacy-sensitive communication into routine gastroenterology care may enhance screening participation, reduce health inequalities, and strengthen organized CRC screening programs in Europe.

Keywords: health literacy; chronic digestive diseases; colorectal cancer screening; screening adherence; personalized prevention; organizational health literacy; implementation science.

INTRODUCTION

Health literacy is recognized as a highly influential determinant of health within contemporary health systems. Initially defined as the ability to read and comprehend medical information, the concept has evolved into a multidimensional concept encompassing the knowledge, motivation, and skills required to access, understand, evaluate, and apply health information throughout the lifespan [1,2]. Limited health literacy is consistently associated with poorer health outcomes, decreased utilization of preventive

services, lower treatment adherence, and increased premature mortality, independent of education level and socioeconomic status [3].

This conceptual evolution reflects a shift from viewing health literacy as an individual trait to recognizing it as a population-level determinant, influenced equally by the responsiveness of health organizations [4,5]. Among chronic conditions, digestive diseases including inflammatory bowel disease, metabolic dysfunction-associated steatotic liver disease (MASLD), liver cirrhosis, celiac disease, and gut-brain interaction disorders require ongoing patient engagement, complex therapeutic

regimens, and sustained behavioral changes. Consequently, health literacy serves as a determinant of both disease management and prevention [6]. Similar skills are necessary for participation in colorectal cancer (CRC) screening, which requires individuals to understand its preventive purpose, assess personal risk, correctly perform stool tests or prepare for colonoscopy, and adhere to follow-up recommendations [7].

CRC continues to be one of the leading causes of cancer incidence and mortality worldwide. Although organized screening is central to European cancer control strategies, participation rates remain inconsistent across countries and socioeconomic groups [8]. Although health literacy in chronic digestive diseases and the determinants of CRC screening in the general population have been extensively studied, these research areas have largely evolved independently. The sustained contact that patients with chronic digestive diseases have with gastroenterology services creates unique opportunities to integrate personalized cancer prevention into routine care; however, this potential remains underexplored [9].

The rapid advancement of digital health technologies and artificial intelligence further underscores the importance of this topic, as digital health literacy becomes an increasingly significant determinant of preventive health care utilization¹⁰. Accordingly, this narrative review critically synthesizes current evidence regarding the role of health literacy in chronic digestive diseases, with particular emphasis on adherence to colorectal cancer screening. It also proposes an integrated conceptual framework linking chronic disease management to personalized cancer prevention.

MATERIALS AND METHODS

Design

This narrative review integrates evidence on the relationship between health literacy and adherence to CRC screening in adults with chronic digestive disease, following the recommendations of the Scale for the Assessment of Narrative Review Articles (SANRA) to ensure methodological transparency. Although quantitative synthesis was beyond the scope given the heterogeneity of study designs and outcomes, the search and selection process were informed by the principles of the PRISMA 2020 Statement to improve reproducibility and reduce selection bias.

Search strategy

A search was conducted in PubMed/MEDLINE, Embase, Scopus, Web of Science Core Collection, and ScienceDirect; additionally, Google Scholar and manual screening of reference lists were performed for literature published between January 2010 and July 2025. Search terms used controlled vocabulary combined with free text keywords in three domains: health literacy (including functional, critical, communicative, digital, and organizational health literacy), chronic digestive diseases (inflammatory bowel disease, MASLD, liver cirrhosis, celiac disease, chronic pancreatitis, gut-brain interaction disorders), and colorectal cancer screening (fecal immunochemical testing, colonoscopy, adherence to screening).

Eligibility and selection

Eligible studies involved adults ≥ 18 years, used validated or widely accepted health literacy assessment instruments, addressed chronic digestive diseases and/or CRC screening, and were published in English or Romanian in peer-reviewed journals. Observational studies, randomized controlled trials, qualitative research, implementation studies, systematic reviews, and clinical guidelines were eligible.

Table 1
Characteristics of included studies

Characteristic	Summary
Study period	2010–2025
Databases searched	PubMed/MEDLINE, Embase, Scopus, Web of Science, ScienceDirect, Google Scholar
Records identified	728
Studies included	48
Study designs	Cross-sectional, cohort, qualitative, randomized controlled trials, systematic reviews, clinical guidelines
Geographic regions	North America, Europe, Asia, Australia
Main populations	Adults with chronic digestive diseases and CRC screening-eligible populations
Main outcomes	Health literacy, treatment adherence, CRC screening uptake, communication, healthcare navigation

Pediatric populations, conference abstracts, editorials without original synthesis, and duplicate publications were excluded. Of the 728 records identified through database and textbook searches,

48 publications were included in the final narrative synthesis after removing duplicates and applying the eligibility criteria (Table 1).

Data synthesis

Due to the substantial heterogeneity of populations, healthcare settings, health literacy instruments, and outcome measures, meta-analysis was deemed inappropriate. Instead, the evidence was thematically structured around three interrelated themes: (i) health literacy in the management of chronic digestive diseases, (ii) health literacy as a determinant of adherence to CRC screening, and (iii) health literacy-sensitive interventions that support an integrated conceptual

framework for personalized prevention.

RESULTS

Health literacy in chronic digestive disease management Early notions of health literacy emphasized functional reading and numeracy skills; contemporary models instead describe a multidimensional concept encompassing functional, communicative, critical, and digital competencies that enable patients to access, interpret, evaluate, and apply health information throughout the entire care process [2,11]. This evolution from functional literacy to organizational health literacy and precision public health is summarized in Fig. 1.

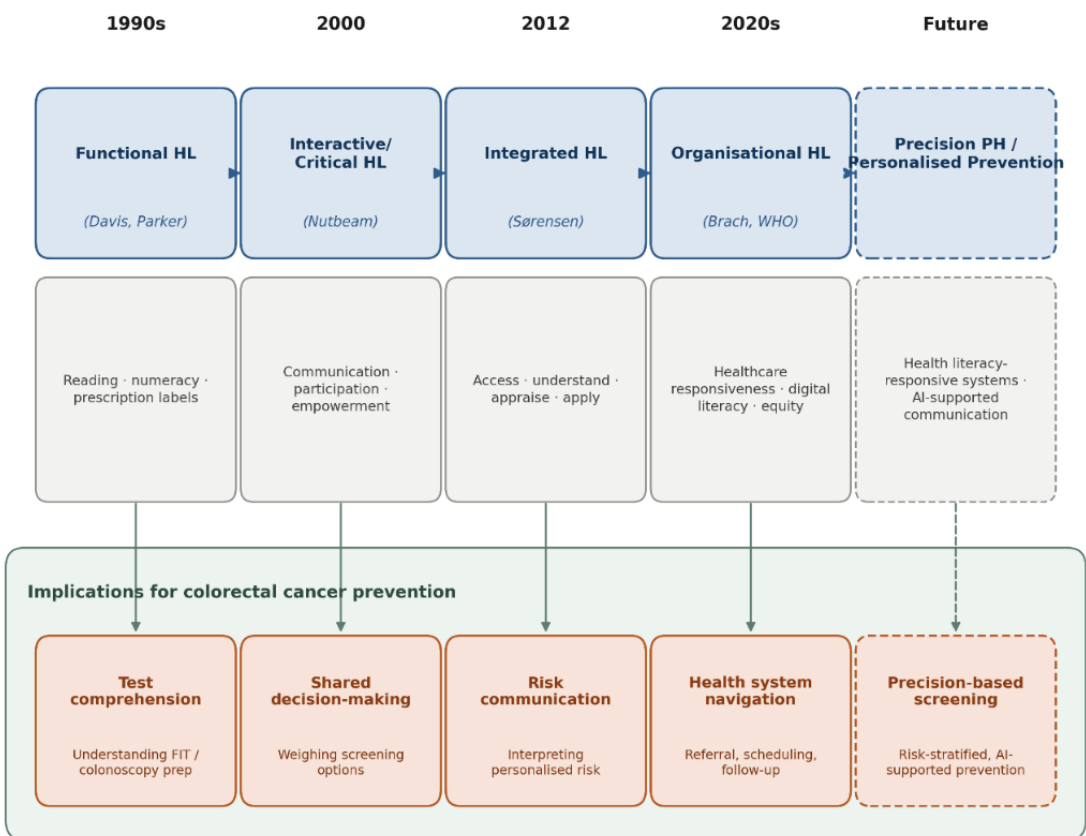


Fig. 1 – Evolution of the health literacy concept and its implications for colorectal cancer prevention. The concept of health literacy has evolved from functional reading and numeracy skills towards a multidimensional framework that incorporates communication, critical appraisal, digital competencies, organizational responsiveness, and precision public health, consequently supporting its inclusion into personalized colorectal cancer prevention.

This change has been accompanied by a rising recognition that responsibility for successful communication rests with both health care organizations and individual patients, a concept known as organizational health literacy. Chronic

digestive diseases provide a particularly informative model for this development, as they combine high clinical complexity with sustained patient involvement. In inflammatory bowel disease, MASLD, cirrhosis, celiac disease, and gut-brain

disorders, patients must interpret increasingly sophisticated medical information while making behavioral decisions such as medication adherence, dietary modification, symptom monitoring, and surveillance, and these factors determine long-term outcomes [6]. Despite differences in disease biology, available evidence shows a consistent pattern: patients with higher levels of health literacy report greater disease knowledge, stronger self-efficacy, and better communication with health professionals, while limited health literacy is associated with medication errors, reduced adherence to monitoring, and avoidable hospitalization [3,6]. It is important to note that the skills required for successful chronic disease management (interpreting risk, following complex instructions, and navigating health care systems) are largely the same skills required for participation in organized CRC screening, providing the conceptual basis for integrating cancer prevention into routine gastroenterology care [6,9].

Health literacy as a determinant of colorectal cancer screening adherence

Unlike many preventive interventions, screening for CRC is not a single clinical encounter but a multistep behavioral process: individuals must recognize their eligibility, understand the preventive purpose of screening, choose among modalities, correctly complete stool tests or prepare for colonoscopy, and adhere to follow-up procedures after abnormal findings [7]. Each stage demands the patients' ability to process information and navigate services, so adherence to screening depends as much on health system communication as program availability [3,9]. The evidence linking health literacy to participation in CRC screening is substantial. A systematic review found that lower

health literacy was consistently associated with reduced participation in screening across studies that used various assessment tools [12]. In the English Longitudinal Study on Aging, limited health literacy remained an independent barrier to participation in CRC screening after adjustment for socioeconomic status [13], and a more recent cross-sectional study of three organized Danish screening programs confirmed this association simultaneously for colorectal, breast, and cervical cancer screening [14]. These associations are not always independent of education level or access to health care, suggesting that health literacy functions as a mediator linking broader social determinants to preventive behavior rather than as an isolated explanatory variable [15]. Also available evidence indicates that health literacy influences screening through multiple interconnected mechanisms (Table 2). Adequate health literacy improves understanding of colorectal cancer epidemiology and the preventive rationale for screening by correcting common misconceptions, such as the belief that a negative result eliminates future risk [13]. This strengthens numerical interpretation of risk and confidence in performing screening tasks, from scheduling appointments to following bowel preparation instructions [16,17]. It also supports patient-physician communication, shared decision-making, and navigation through the multistep screening pathway, including invitation, sample submission, results communication, and colonoscopy referral [3,9]. Studies using multidimensional instruments such as the Health Literacy Questionnaire or HLS-EU-Q tend to detect stronger associations than those based on purely functional measures such as REALM or TOFHLA, sustaining the view that health communication, critical appraisal, and navigation matter at least as much as reading ability for screening participation [2,11].

Table 2

Evidence linking health literacy domains with colorectal cancer screening adherence

Domain	Strength of evidence	Public health implication
Disease knowledge	Strong	Improved awareness of screening purpose
Risk perception	Moderate–strong	Better-informed participation
Communication with clinicians	Strong	Greater acceptance of screening recommendation
Shared decision-making	Moderate	Improved informed choice between modalities
Healthcare navigation	Strong	Increased completion of the screening pathway
Digital health literacy	Emerging	Enhanced access to digital screening tools
Patient navigation (intervention)	Strong	Reduced disparities in underserved populations
Organisational health literacy	Emerging but consistent	Improved equity and programme performance

Chronic digestive diseases as an implementation opportunity

Patients with chronic digestive diseases occupy a distinct position in colorectal cancer prevention because they maintain long-term relationships with gastroenterology services that involve regular clinical evaluations, laboratory monitoring, dietary counseling, and endoscopic procedures [6]. This repeated contact provides natural opportunities to reinforce preventive messages alongside chronic disease management. The opportunity is most explicit in inflammatory bowel disease, where surveillance colonoscopy is already part of routine care because of the increased risk of colorectal neoplasia [18]. Similar opportunities exist in MASLD, where colorectal cancer risk is increasingly recognized as part of the metabolic disease spectrum [19], and in risk-stratified screening approaches gaining ground in European programs [9,20]. In spite of these advantages, few studies have evaluated gastroenterology clinics specifically as settings for literacy-sensitive CRC prevention; the majority of implementation research continues focusing on primary care or community populations [17,21].

Health literacy-responsive interventions and an integrated model

Interventions to improve participation in colorectal cancer (CRC) screening have traditionally focused on patient education; although these strategies improve awareness, their effect on sustained participation is generally modest, particularly among socioeconomically disadvantaged populations [22,23]. Contemporary approaches instead aim to reduce the cognitive, organizational, and communication burdens placed on health systems themselves. Plain language communication, teach-back (where patients explain information in their own words rather than simply confirming understanding), and structured, shared decision-making have gathered the strongest evidence of patient-centered communication tactics [24,25].

Patient navigation addressing practical, administrative, and emotional barriers to the screening process consistently improves stool test completion and colonoscopy participation, particularly among disadvantaged populations [26,27]. At an organizational level, simplified

referral pathways, multilingual resources, and coordinated multidisciplinary care reduce the burden that communication failures place on patients, extending benefits to the entire population rather than targeting only those identified as having limited literacy [28–30]. Digital tools such as electronic reminders, patient portals, and increasingly AI-assisted educational support provide additional opportunities for personalized communication; although limited digital health literacy risks amplifying inequalities unless these tools complement, rather than replace, face-to-face communication with physicians [10,31].

Text message reminders have demonstrated noticeable effects on screening completion in randomized trials [32], while systematic reviews confirm that isolated interventions produce only modest benefits compared with integrated, multicomponent approaches that include education, navigation, and organizational redesign [33]. These findings support a multi-level conceptual framework (Fig. 2) in which adherence to colorectal cancer screening emerges from interactions at the individual, clinical, organizational, and policy levels.

At the individual level, functional, communicative, critical, digital, and numerical skills shape knowledge, risk perception, self-efficacy, and confidence in interacting with health care professionals [1,2]. At the clinical level, plain language communication, teach-back, and shared decision-making during routine gastroenterology consultations covering medication reviews, surveillance, and dietary counseling create repeated opportunities to strengthen screening participation [6,18]. At the organizational level, simplified scheduling systems, coordinated referral pathways, and digital communication reduce the burden associated with organized screening and support unbiased access [5,28].

At the policy level, the European Beating Cancer Plan and the 2022 Council Recommendation on strengthening prevention through early detection provide the framework within which health literacy can be integrated into national screening programs [7,34].

Therefore, health literacy functions less as a fixed attribute of the patient and more as a dynamic interface between individuals and health systems, linking the management of chronic digestive diseases to the prevention of colorectal cancer.

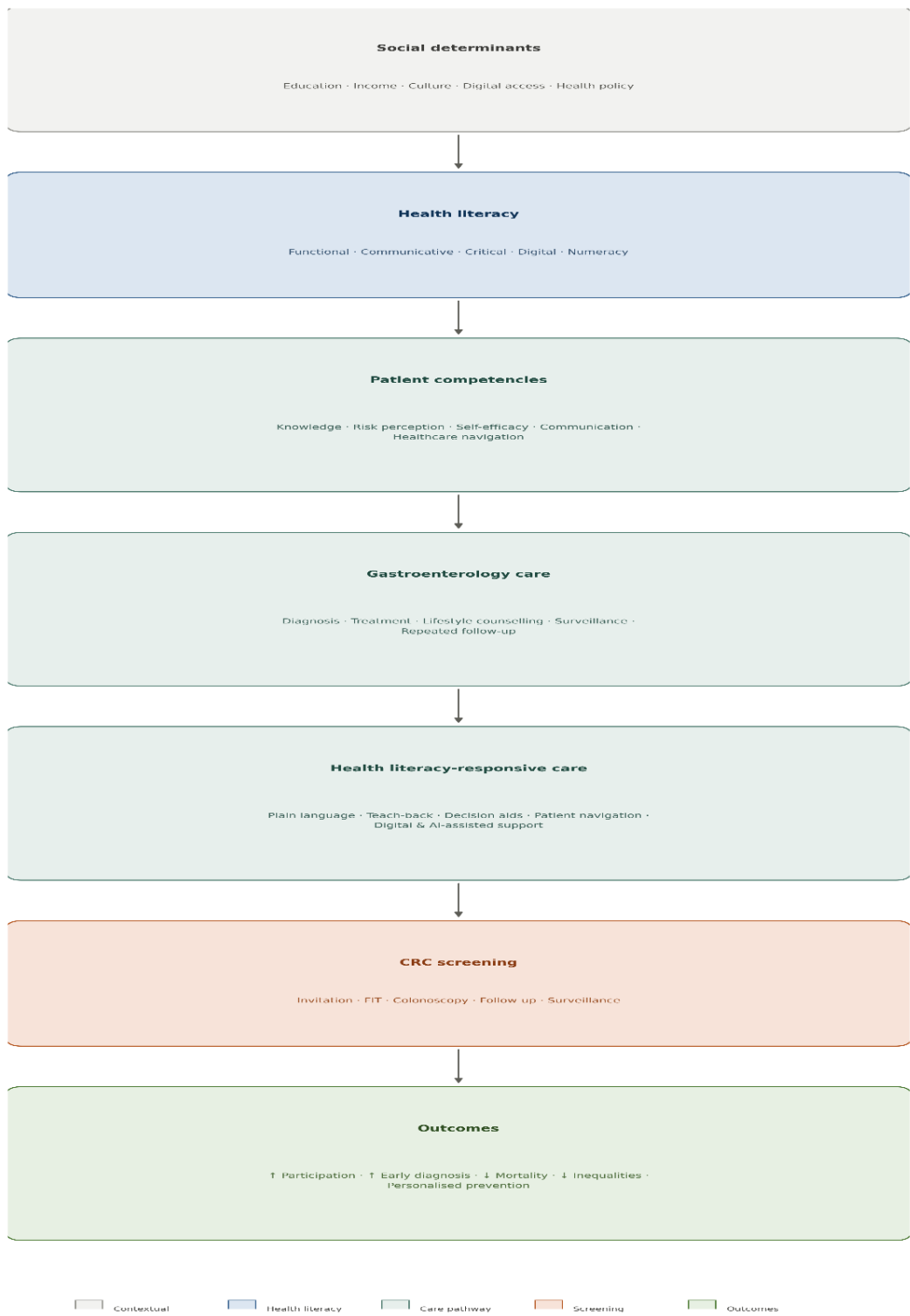


Fig. 2 – Health Literacy Responsive Gastroenterology Model for Personalized Colorectal Cancer Prevention. The proposed framework illustrates how health literacy operates across patient, clinical, organizational, and policy levels to improve colorectal cancer screening adherence and promote personalized prevention.

DISCUSSION

This narrative review summarizes evidence indicating that health literacy is a key factor in colorectal cancer screening adherence among

patients with chronic digestive diseases. While previous analyses have separately examined health literacy in gastroenterology or the determinants of colorectal cancer screening acceptance in the general population, the present analysis integrates

these fields into a single conceptual framework that links chronic disease management, preventive healthcare, and implementation science. The findings are consistent with previous systematic reviews associating limited health literacy with reduced acceptance of screening, greater misunderstanding of screening recommendations, and difficulty navigating healthcare systems [3,12,13]. This review extends existing knowledge in three ways. First, it adopts a comparative perspective, demonstrating that common health literacy mechanisms operate across inflammatory bowel disease, MASLD, cirrhosis, and celiac disease despite differences in pathophysiology [6]. Second, it introduces chronic digestive disease management as an implementation platform for colorectal cancer prevention, rather than treating chronic disease care and screening as separate healthcare activities. Third, it proposes a multilevel framework that links individual competencies, clinical communication, organizational responsiveness, and health policy, moving beyond descriptive associations to a model that can inform implementation research. These findings have direct implications for gastroenterology practice. Routine assessment of health literacy using brief validated instruments, such as the Newest Vital Sign or Brief Health Literacy Screen, is feasible within existing consultation time and can identify patients who may benefit from tailored communication. Universal application of plain language communication and supplementary instructions (teach back method) rather than selective use in patients suspected of limited literacy avoids stigma while improving understanding across the entire patient population [24,25]. Colorectal cancer prevention should be systematically integrated into routine monitoring rather than treated as an isolated preventive encounter, capitalizing on the long-term relationships that already exist between patients with chronic digestive diseases and gastroenterology services. At the public health level, these findings are directly relevant to the implementation of the European Beating Cancer Plan, which prioritizes increasing participation in organized screening while reducing avoidable cancer mortality [7,34]. Substantial inequalities in participation in CRC screening persist in Europe, depending on educational level, socioeconomic status and geographical location [8]; health literacy-sensitive interventions simplified communication, patient navigation and organizational redesign offer an evidence-based strategy for reducing these

disparities without requiring complete restructuring of the existing screening infrastructure. Evidence from Central and Eastern Europe remains relatively limited, and as organized CRC screening programs continue to expand in this region, integrating health literacy principles from the outset rather than adapting them later may offer particular advantages, including in the design of invitation systems and digital communication platforms [35]. This review has several strengths, including the integration of evidence from gastroenterology, oncology, behavioral medicine, and implementation science, and the development of an original conceptual framework that extends beyond narrative synthesis. However, some limitations must be acknowledged. The narrative design precluded formal assessment of risk of bias and quantitative synthesis. Considerable heterogeneity between health literacy instruments and screening outcomes limits direct comparison between studies, and most of the available evidence comes from North America and Western Europe, highlighting the need for further research in Central and Eastern Europe. Future research should prioritize longitudinal cohort studies assessing whether integrated health literacy assessment in gastroenterology services predicts long-term participation in screening, pragmatic implementation studies comparing integrated intervention packages with conventional education, and comparative European studies examining how differences in health organization and policy shape the effectiveness of health literacy-sensitive interventions [36].

CONCLUSIONS

Health literacy should be recognized as a modifiable determinant of colorectal cancer screening adherence and a strategic component of personalized prevention. Incorporating health literacy-sensitive communication and implementation strategies into routine gastroenterology care can improve screening participation, reduce health inequalities and strengthen organized colorectal cancer screening programs across Europe.

Key points

- Health literacy is a multidimensional determinant of colorectal cancer screening adherence, shaping knowledge, risk perception, communication, and health care navigation.
- Patients with chronic digestive diseases represent an underused population for the

integration of colorectal cancer prevention into routine gastroenterology care.

- Healthcare organizations sensitive to health literacy should complement patient-centered education by simplifying communication and improving accessibility.

- Digital tools and artificial intelligence create new opportunities for personalized prevention, but require careful implementation to avoid increasing inequalities.

- Future screening programs should integrate health literacy assessment, organizational redesign, and implementation science methods to improve participation and reduce disparities.

Conflict of interest None declared.

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