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Interventions used by health professionals in older adults with low levels of health literacy: a scoping review

Intervenções utilizadas por profissionais de saúde em idosos com baixo letramento em saúde: uma revisão de escopo

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Abstract

This scoping review sought to identify, synthesize, and assess the available evidence on the aims and effects of interventions used by health professionals in older adults with low levels of health literacy. Relevant articles were selected from the databases from April 2017 to April 2020. The Joanna Briggs Institute Manual for Evidence Synthesis was used for conducting this scoping review, and a total of 22 studies were reviewed. The positive effects observed for each type of intervention, yielding significant results for some of the outcomes and improvements in intragroup scores, demonstrated that the interventions had good acceptability by older adults with limited health literacy. However, we were not able to determine which intervention strategies had a significant positive effect on health outcomes in these patients. Further high-quality randomized clinical trials employing greater methodological rigor for assessing results are needed to elucidate the potential benefits of interventions in this population.

Keywords: cognitive aging; health literacy; health personnel.

Resumo

Uma revisão de escopo foi conduzida para identificar, resumir e avaliar a evidência existente sobre os objetivos e efeitos das intervenções utilizadas por profissionais de saúde em idosos com baixo letramento em saúde. Artigos relevantes foram selecionados de bases de dados entre abril de 2017 a abril de 2020. Os autores consultaram o manual de síntese de evidências do The Joanna Briggs Institute para a condução desta revisão de escopo. Ao final, foram selecionados 22 estudos. Os efeitos positivos observados para cada tipo de intervenção, produzindo resultados significativos para alguns desfechos e melhoria na pontuação intragrupos, demonstraram que as intervenções têm boa aceitação por parte dos idosos com baixo letramento digital. No entanto, não foi possível concluir quais estratégias tiveram efeitos positivos significativos para melhoria de desfechos em saúde nesses pacientes. Futuros ensaios clínicos randomizados de alta qualidade com rigor metodológico para avaliação dos resultados são necessários para elucidar os potenciais benefícios das intervenções para essa população.

Palavras-chave: envelhecimento; letramento em saúde; pessoal de saúde.



INTRODUCTION

Functional health literacy, defined by the term health literacy, constitutes a multidimensional concept that has evolved in recent decades. Typically construed as the application of a set of skills to access, understand, and assess information and take appropriate health-related decisions for oneself, one's family or community, health literacy has become an important determinant of health and outcomes.¹⁻³ Low patient literacy can negatively influence a number of health outcomes, including medication adherence,⁴ chronic pain management,⁵ knowledge on disease,⁶ need for care and hospitalization in chronic disease,⁷ and mortality.⁸

It is important to consider aging in the health context, particularly in relation to low levels of functional health literacy. Older adults are among the health care users most impacted by low functional health literacy. The effect of low literacy is also greater in situations of chronic disease, which require long-term care, as well as in low-income and low-education settings.^{9,10} Health literacy is negatively associated with age^{11,12} and cognitive decline.¹³ In older adults, low health literacy acts as a progressive barrier to an individual's involvement in protection behaviors and health promotion, as well as to the control of acute or chronic conditions.¹¹

However, it is important to bear in mind that functional health literacy is not a non-modifiable condition, but a health determinant that should be exploited in practice by health professionals from the field to help enhance an individual's self-care skills.¹⁴ In this context, some authors^{13,15,16,17} highlight the health-related materials produced to inform, guide, and prepare patients for self-care, which are often written for a level exceeding the average reading skills of the lay public. This scenario can have disastrous consequences in situations of low health literacy and act as a confounder when studying the concept. Therefore, health care should also center on the communication skills of health professionals in facilitating the understanding of information and promoting active engagement of individuals, as well as be sensitive to the settings in which health actions are implemented.³

Improving the quality of health care services involves implementing strategies aimed at measuring health outcomes. To achieve this goal, strategies and interventions appropriate for individuals with low functional health literacy are important and require professionals to have skills and knowledge in this area.⁶ These strategies, if well planned and targeted, lead to improved health literacy skills, particularly regarding the health of older adults and management of chronic diseases. These benefits can extend to include patient self-care management, positively impacting communication,

treatment compliance, and health status, translating to greater life satisfaction for older patients and a lower cost burden for health systems.^{11,18}

Understanding the impact of functional health literacy on health outcomes in older adults is vital to providing effective care.⁹ In this context, previous interventions involving health literacy have sought mainly to make health information and services more usable.¹⁹ To achieve this goal, health professionals should have the necessary knowledge and skills to promote health literacy among their patients,²⁰ ensuring that they are actively involved in self-care.

Given the social gradient of the older contingent of the population, which owing to a higher vulnerability calls for adaptation in the delivery of health care services, the objective of this study was to identify, synthesize, and assess the available evidence on the aims and effects of any interventions used by health professionals in older adults with low health literacy.

METHODS

A scoping review or mapping review is commonly used to clarify definitions and conceptual boundaries regarding a particular field or area when an extensive body of literature is heterogeneous in nature and not amenable to accurate systematic reviewing.²¹ The Joanna Briggs Institute (JBI) Manual for Evidence Synthesis was consulted for conducting this scoping review. The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews (PRISMA-ScR) and previously published recommendations on scoping review methodology.²² The study centered on addressing the research question devised based on PCC (problem/population, concept, and context): what were the interests and effects of interventions used by health professionals in older adults with low health literacy in relation to the usual means of promoting self-care in randomized clinical trials? As recommended, the protocol was initially pre-registered on the International Prospective Register of Systematic Reviews (PROSPERO, CRD42018087014). However, after identifying a broader question on this topic, the authors opted for a scoping review. As we recognize this as a protocol deviation, it should be known that the deviation did not significantly impact the accuracy or reliability of the obtained data.

Population

The review involved community-dwelling and hospitalized older adults aged ≥ 50 years with a low literacy level and chronic disease.

Concept

Functional health literacy, defined by the term health literacy, is typically construed as the application of a set of skills to access, understand, and assess information and take appropriate health-related decisions for oneself, one's family or community. Health literacy has become an important determinant of health and outcomes.

Context

The context entails a framework which investigated community-dwelling and hospitalized older adults with a low literacy level who underwent any interventions by health professionals to address chronic diseases.

Search strategy

The databases searched were Medline (via PubMed), COCHRANE library, PsycINFO, SCOPUS, Web of Science, Scientific Electronic Library Online (SciELO), Latin American and Caribbean Health Sciences Literature (LILACS), and Banco de Dados em Enfermagem (BDENF). The search strategy entailed the use of health descriptors (descritores da saúde — DeCS) and medical subject headings (MeSH), in their possible permutations, using the Boolean operators AND/OR: health literacy and health personnel. Although the problem (P) was related to older adults with low health literacy, we decided not to include the MeSH descriptor “aged” (entry term “elderly”) in the search because it acted as a limiter. The references of articles included in the review, and of other relevant reviews, were hand-searched.^{23,24} The article selection process began in December 2017 and was finalized in April 2020, where

the year 2000 was defined as the lower limit for publication dates. The search strategy used in the Medline database (via PubMed) is outlined in Table 1.

Study selection

After reading article titles and abstracts, the studies were screened according to eligibility criteria for inclusion:

- studies involving older adults aged ≥ 50 years — the age bracket for older adults was broadened to reflect the importance of health promotion and disease prevention in individuals aged under 60 years²⁵ (population);
- original study articles in which health professionals planned, applied, or evaluated interventions in older adults with low health literacy (concept);
- randomized clinically controlled trials (type of evidence source);
- community-dwelling and hospitalized older adults aged 50 years and over (context); and
- articles published in Portuguese and English.

Exclusion criteria included:

- studies involving the planning, application, or evaluation of health education interventions but not drawing on the health literacy concept, despite including older participants;
- non-clinically controlled trials, discussion articles, editorials, summaries, notes, books, book chapters, abstracts presented at conference proceedings, dissertations, theses, qualitative studies, bibliographic studies, documental (desk)-based studies, case studies, and surveys.

TABLE 1. Search strategy on PubMed.

Search	Filter	Number of articles
#1	“Health Literacy”[Mesh] OR “Health Literacy” OR “Literacy, Health”	7870
#2	“Health Personnel”[Mesh] OR “Health Personnel” OR “Personnel, Health” OR “Health Care Providers” OR “Health Care Provider” OR “Provider, Health Care” OR “Providers, Health Care” OR “Healthcare Providers” OR “Healthcare Provider” OR “Provider, Healthcare” OR “Providers, Healthcare” OR “Healthcare Workers” OR “Healthcare Worker”	641 433
#3	((“Health Literacy”[Mesh] OR “Health Literacy” OR “Literacy, Health”)) AND ((“Health Personnel”[Mesh] OR “Health Personnel” OR “Personnel, Health” OR “Health Care Providers” OR “Health Care Provider” OR “Provider, Health Care” OR “Providers, Health Care” OR “Healthcare Providers” OR “Healthcare Provider” OR “Provider, Healthcare” OR “Providers, Healthcare” OR “Healthcare Workers” OR “Healthcare Worker”))	1871
#4	((“Health Literacy”[Mesh] OR “Health Literacy” OR “Literacy, Health”)) AND ((“Health Personnel”[Mesh] OR “Health Personnel” OR “Personnel, Health” OR “Health Care Providers” OR “Health Care Provider” OR “Provider, Health Care” OR “Providers, Health Care” OR “Healthcare Providers” OR “Healthcare Provider” OR “Provider, Healthcare” OR “Providers, Healthcare” OR “Healthcare Workers” OR “Healthcare Worker”)) Filters: Publication date from 2000/01/01 to 2018/08/01	1283

Study selection was performed by searching the scientific databases and identifying potential studies based on titles, abstracts, and keywords. The authors used Rayyan (<https://rayyan.qcri.org>), a web and mobile app for systematic reviews, to analyze the articles' titles and abstracts.²⁶ If they disagreed, a third author was consulted. The articles retrieved were then screened by reading the full texts. Selection differences were discussed and resolved by consensus. When no consensus could be reached, a third researcher was consulted to deliberate on the issue.

RESULTS

The flowchart of the study selection process is depicted in Figure 1. After removing duplicates, 2939 records were

screened based on their titles and abstracts. A total of 134 studies were eligible for full-text review. Finally, 22 studies were included in the present review.²⁷⁻⁴⁸

Study type

Regarding the study types, 21 of the included articles were randomized clinical trials²⁷⁻⁴⁷ and 1 was a mixed method study involving qualitative and experimental research.⁴⁸

Assessment of health literacy

Among the studies that assessed health literacy, 2 (10.53%) used the results to select the study sample which comprised older adults with low health literacy.^{27,28} Low or limited health literacy levels were found in many studies.²⁹⁻³⁶ A longitudinal

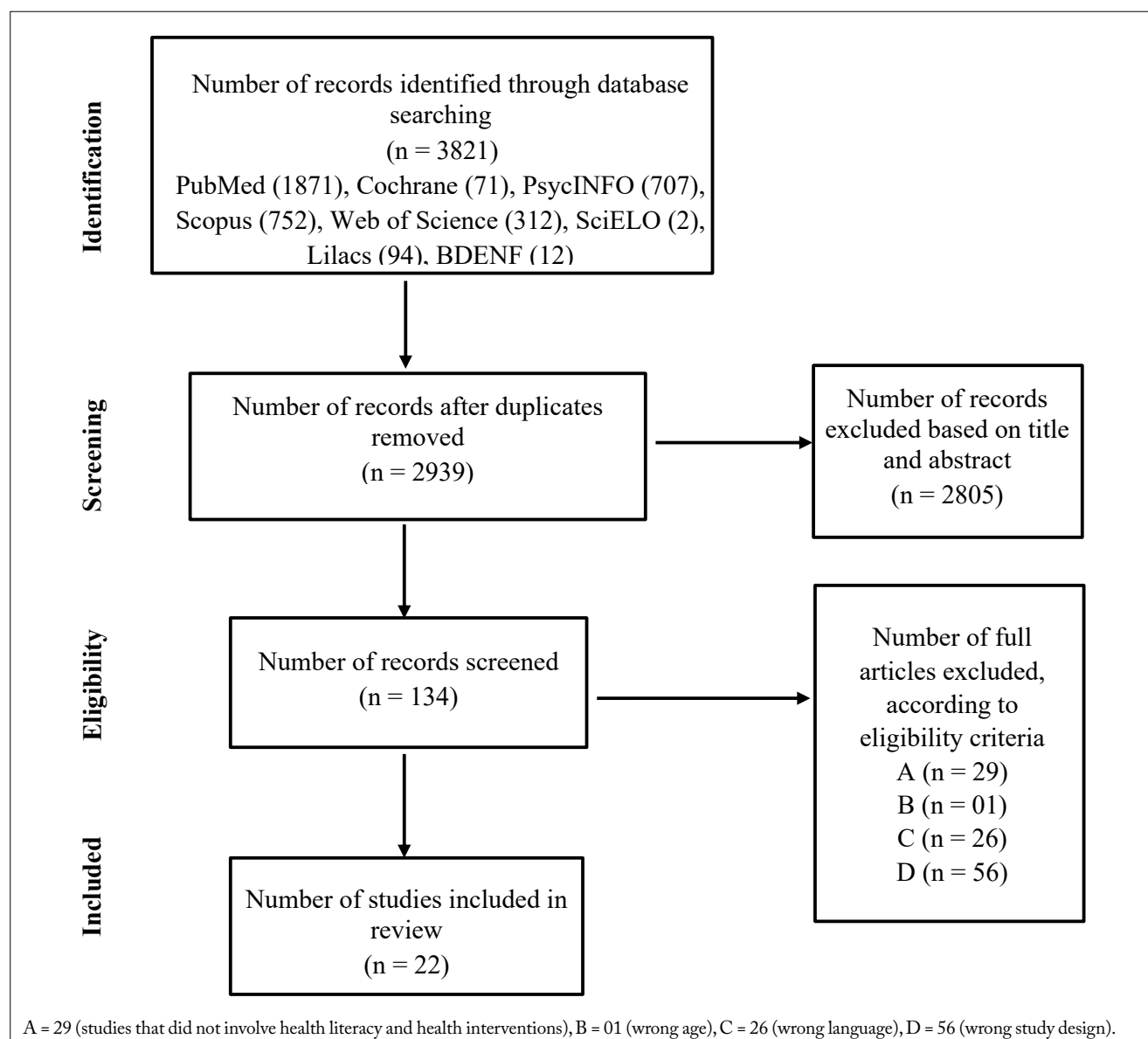


FIGURE 1. Flowchart of the study selection process.

study found major disparities in scores among individuals of different ages, skin colors, and genders.³⁷

Population

Most of the included studies involved community-dwelling older adults^{27-31,33-48} and 1 study involved hospitalized patients.³²

Methodology

The interventions employed different technical resources and methodologies. Approaches included cognitive training sessions;^{38,45} an individual self-management educational intervention;^{32,35,40} group sessions;^{31,48,49} the use of FamLit (a family-focused strategy);³⁹ written material containing practical accessible information about the health/disease status of the target participants;^{40,41,43} complemented by consultations with professionals;^{37,40,41,44} the use of graphically-enhanced interventions;^{34,35} written material;^{40,41,43} and the use of telemedicine or telephone for educational interventions or support/follow-up.^{27-31,41,42} Some interventions employed tailored interventions via an iPad app (mPATH-CRC) as a tool for improving colorectal cancer screening rates,³³ as well as the digital Medtable tool³⁴ and the “Talking Pill Bottles” device³⁷ for pharmacy care. Some studies used graphically enhanced interventions^{34,35} and audiovisual education.⁴⁶

Duration of intervention

The period for which strategies were applied varied from 1 month,³² 3 months,^{37,47} 6 months,^{38-40,46} 7 months,⁴² or 9 months⁴¹ up to 1 year,^{30,31,34,36,43,44,48} 18 months,³⁵ 2 years,^{27,28,33} 4 years,²⁹ or 10 years.⁴⁵

Follow-up

With regard to intervention follow-up, most studies assessed results biweekly;⁴⁷ every 14 days;³² at 3 weeks, 3 months, and 6 months;⁴⁶ at 11 and 35 months;⁴⁵ at 2 to 8 weeks;³⁵ monthly;^{30,37,40,48} at 2 to 9 months;⁴⁴ every 3 months;³⁸ at 3 to 6 months;³⁴ at 4 to 6 months;³³ every 6 months;^{28,29,39} at 6 and 12 months;^{31,43} at 6 and 24 months;²⁷ at 7 months;⁴² and after 1 year.^{36,41} One longitudinal study involved assessments shortly after intervention and again at 1, 2, 3, 5, and 10 years post-intervention.³⁷

Aim of interventions

Concerning the aims of interventions, 11 studies focused on managing older adults with cardiovascular diseases such as hypertension^{27-29,37,44,48} and heart failure (HF),^{30-32,41,47} 3 involved interventions for older patients with diabetes mellitus,^{29,34,42} 2 focused on colorectal cancer screening,^{33,39} 2 aimed to improve health literacy in older patients,^{38,45} and 1

study aimed to improve the management of radiation therapy side effects.⁴⁶ In addition, some interventions were aimed at patients with glaucoma,⁴⁰ psoriatic arthritis,⁴³ and chronic obstructive pulmonary disease.³⁵ The studies that applied interventions in older adults with heart disease sought to improve health outcomes by optimizing treatment, behavior, and blood pressure control, self-management, and by reducing rates of treatment or readmission.^{27-32,36,41,47,49} The strategies planned for older adults with diabetes mellitus sought to improve self-management in care and in controlling blood sugar levels, encouraging behavioral changes through healthy lifestyle choices and self-management of the condition⁴² and promoting better use of the prescribed medication.³⁴ The studies on cancer employed strategies for increasing screening and self-care behaviors.^{33,39} However, their primary and secondary outcomes differed methodologically in terms of the means of assessment adopted by the authors, including previously published scales, specific instruments for the investigated condition, or instruments they had devised and published themselves. Adherence to medication and treatment was the most commonly assessed outcome.^{27-29,34-37,40,41,43,47} Other assessed outcomes included the health knowledge held by participants,^{27,28,31,38,45} self-efficacy,^{27,30,37,43,44} quality of life,^{30,32,41,42} physical and mental health,^{42,43} and health behaviors.^{27,28,30,31,42,46} Patient-professional communication, lifestyle, and social support were measured²⁷ as well as perception of the disease and self-care.^{42,46} Satisfaction was rated by 5 studies,^{32,34,41,43,44} one of which measured patient satisfaction with pharmacy services and total direct costs.⁴¹ Considering clinical outcomes, 3 studies assessed HF measures,^{31,32,41} 3 studies assessed blood pressure values,^{27,29,37} 3 studies analyzed diabetes control,^{34,42,44} while 2 studies assessed mortality and all-cause readmission for HF.^{30,31}

Key findings

As to the obtained results, out of the 22 reviewed studies, 3 reported statistically significant differences in primary outcome measures favoring the intervention groups^{33,38,46} and 5 found significant results for 1, 2, or 3 secondary outcomes.^{27,31,35,45,47} Twelve studies reported no statistically significant differences between groups.^{28,29,31,32,35-37,39,40,43,44,46,47} One study observed improvements in primary outcomes at the time of the intervention, but loss of these gains during the post-intervention period.⁴¹

Although not all outcomes differed statistically between intervention and control groups, most interventions had a positive effect on intragroup scores, as evidenced by comparisons of baseline vs post-intervention values.

Regarding significant results of interventions, a study investigating adherence to colorectal cancer screening promoted a significant increase in screening rates.³³ In the intervention group, 41.3% of the patients underwent fecal occult blood tests, flexible sigmoidoscopy, or colonoscopy, vs 32.4% in the control group ($p < 0.003$). According to the authors, this result confirmed that a health care provider-directed intervention based on training workshops and individualized feedback on screening rates significantly increased adherence to colorectal cancer screening among older adults treated at a general clinic in a large urban area, supporting wider implementation of this type of intervention. A study addressing self-care behaviors in managing the side effects of radiation therapy in individuals with prostate cancer found that self-care behaviors significantly increased in the intervention group compared to the control group from baseline to 6 months ($p = 0.05$).⁴⁶ Another study, assessing patients' general health status, self-management skills, and disease-management abilities identified an interaction between time and group ($p < 0.001$), as well as statistically significant differences between the 2 groups for some variables in controlling behavioral risk factors such as drug compliance, physical activity, and diet ($p < 0.05$).⁴⁸

Notable significant results for intervention groups include some actions centered on patients with HF, such as a study that applied the American College of Cardiology Patient Navigator Program.³² There was a statistically significant difference in HF specific education ($p = 0.0002$), and documented education increased by 59% in the intervention group. In addition, there was a statistically significant increase in 14-day follow-up visits scheduled prior to discharge in the intervention group ($p = 0.0044$). The results showed that, out of the scheduled appointments, patients included in the Navigator program were more likely to follow up with a cardiologist (56.8%) than the control group (18.6%). The use of this program in the discharge process resulted in a 53.2% decrease in the number of patients discharged without a scheduled follow-up visit. Another study,³⁰ which compared the efficacy of a HF self-management program in the intervention group relative to the control, although only statistically significant for self-care behavior in terms of weight measurement, showed intragroup improvements in knowledge (mean difference in scores of 12 percentage points) ($p < 0.001$) and self-efficacy (mean difference in scores of 2 percentage points) ($p = 0.0026$). Differences were also found for mortality and hospitalization rates, which were lower among patients in the intervention group. The intervention group also had improved results in a study assessing knowledge and blood pressure reading;³⁷ significantly higher scores were seen at day 90 post-intervention

compared to baseline ($p < 0.001$). Regarding the self-efficacy of intervention participants, the study that tested the effect of a product named "Talking Pill Bottles"³⁷ (a device with a base sized to accommodate most common prescriptions and a 60-second recording capacity) found that 101 of the 134 participants reported the highest level of confidence when faced with a situation of not having someone to remind them to take their medication ($M = 2.73$, maximum score 3.0).

Self-efficacy, a secondary outcome of a study that applied an intervention for improving blood pressure control,²⁷ showed a significant increase after treatment in the intervention group from baseline to 6-month follow-up, whereas it showed a decrease in the usual care group ($p = 0.007$). Another study, aimed at enhancing health outcomes in patients with arthritis, assessed the self-efficacy variable both at baseline and 6 months post-intervention.⁴³ Results showed an improvement in the intervention group from baseline to 12 months when compared to the standard care group. Differences between groups were statistically significant at 6 and 12 months ($p = 0.05$). By contrast, a study evaluating post-visit self-efficacy scores of diabetes patients found no significant difference between intervention and control groups ($p = 0.60$).⁴⁴ According to the authors, the absence of a difference in self-efficacy scores between the intervention and control groups suggests that the management strategies employed by physicians needed to be reinforced over patient visits.

Regarding health literacy levels, one of the studies aimed at improving them found a significant result for the total health literacy score on 4 dimensions (health knowledge, health beliefs, health behaviors, and health skills) in the intervention group relative to the control group ($p < 0.005$).³⁸ Although detecting differences in health literacy between subgroups was not necessarily a goal of the other studies, some of them included analyses of subgroups according to literacy. For example, a study on HF self-management demonstrated that, among other outcomes, the lower rate of hospitalization or death in the intervention group was greater for patients with low literacy.³⁰ In a study aimed at reducing HF readmission rates,³² the intervention was tailored to the patient's health literacy and social needs. The results showed a strong correlation between the education intervention and readmission rates, which were lower in the group receiving the intervention and almost reached statistical significance ($p = 0.15$).

In one study,⁴⁰ aimed at improving glaucoma medication adherence, individuals with inadequate or marginal health literacy skills were more likely to report a physical disability that made proper drop instillation more difficult ($p = 0.020$). However, the number of days without medication in the 6 months following enrollment was similar in the control and intervention groups.

For each literacy level, the number of days without medicine was lower in the intervention than in the control group, and the magnitude of the difference increased as literacy decreased.

Another study,³³ investigating colorectal cancer screening, found that among patients with health literacy skills corresponding to a reading level of less than ninth grade, screening was completed by 56% of those in the intervention group vs 30% of those in the control group ($p < 0.01$ [$p = 0.002$]). However, another study³⁴ found that patients who received the intervention had greater knowledge about indications for medications, irrespective of literacy status. One study⁴² found evidence that the health literacy intervention could have a positive impact on patients' mental health, while another randomized controlled trial found, in the literacy subgroup, greater improvement among patients with chronic obstructive pulmonary disease with low literacy compared to those with higher literacy.³⁵ The results of one of the studies suggested that the intervention was well accepted by patients with low health literacy.³⁷ The main characteristics of the included studies can be found in Table 2.²⁷⁻⁴⁸

DISCUSSION

This review aimed to map evidence literature on the interests and effects of interventions used by health professionals in older adults with low health literacy in relation to the usual means of promoting self-care in randomized clinical trials. All the articles included in this review were published internationally, pointing to the need for more studies exploring this issue in Brazil. In the present scoping review, the interventions focused predominantly on disease and its management for improving behaviors such as adherence to medication and health outcomes. The results also revealed a dearth of actions aimed at promotion and prevention in this area and with a wider impact on the living, socioeconomic, and environmental health conditions of older adults, as these issues were not addressed by the studies included in this review. This understanding is congruent with the recognition that healthy aging goes beyond the absence of disease,²⁵ calling for the replacement of curative models by integrated care centering on the needs of the aging population and considering the environments in which this population lives and interacts, including a better quantification of resources and costs.

Regarding the effects of interventions, few results proved to be statistically significant, ie, favorable for older adults with low functional health literacy and with potential to positively affect the health of these individuals. Given that the results suggested subtle benefits of interventions, these gains

warrant further confirmation in larger studies with better methodological quality. The level of health literacy, in most studies, did not appear to be a determinant for the obtained data. However, it is important to note that the instruments used to assess health literacy differed among studies and, although all of them evaluate functional health skills, their associations with age differ and their scores are variable. These findings corroborate a study that suggested that the theoretical understanding of health literacy and aging is hampered by the use of instruments that assess a broad array of different constructs as 'health literacy',¹² as well as by the use of inconsistent measures of cognitive ability by the few studies examining cognitive processes and a lack of longitudinal studies exploring this topic.

This study has several methodological strengths. Among them, a systematic, comprehensive, and sensitive literature search, study selection, data extraction, and synthesis performed by 2 independent reviewers. As a limitation, it should be noted that this review included studies with community-dwelling and hospitalized patients, which could render comparisons between both groups more difficult. Moreover, different methodologies and durations of interventions may hinder the discovery of key findings. Lastly, the fact that the scoping review was not registered on Open Science Framework as recommended can be considered a limitation as well.

Limitations in many activities of daily life can occur due to the aging process and worsening of chronic diseases. This review points out the need to implement health promotion and disease management approaches that may prevent the exacerbation of chronic diseases that can negatively impact the quality of life of older people. Additionally, self-care strategies that ensure autonomy and independence may avoid costs to the public health system.

CONCLUSION

The reviewed data suggest that the available evidence on the effect of interventions used by health professionals in older adults with low health literacy failed to promote statistically significant improvements in glycemia and hypertension outcomes. Adherence to medication and treatment, followed by self-efficacy and satisfaction, were the most frequently assessed outcomes. However, positive effects observed for each type of intervention, yielding significant results for some of the outcomes and improvements in intragroup scores, demonstrated that the interventions had good acceptability by older adults with limited health literacy. It was not possible, however, to conclude which intervention strategies had a significant positive effect on improving health outcomes in these

TABLE 2. Main characteristics of the included studies.

Author	Year	Country	Type of study	n	Age (M)	Setting	Population	Methodology adopted	Duration of intervention	Follow up	Aim of intervention	Key findings
Bosworth et al. ²⁷	2005	United States of America	RCT	294	63	Outpatient primary care clinic	Veterans with hypertension	Use of telephone	2 years	6 and 24 months post-baseline measures	To emphasize positive gain-framing	Individuals receiving the nurse-administered intervention had a greater increase in confidence with following hypertension treatment ($p < 0.007$) than the usual care group.
Bosworth et al. ²⁸	2008	United States of America	RCT	317	60	Two outpatient primary care clinics	Adults with hypertension	Telephone – Morisky Self-Reported Medication-Taking Scale	2 years	Every 6 months	To achieve blood pressure control	Self-reported medication adherence increased by 9% in the behavioral group vs 1% in the non-behavioral group.
Bove et al. ²⁹	2013	United States of America	RCT	241	60	Urban population	Adults with hypertension and diabetes	Internet- and telephone-based telemedicine	4 years	Every 6 months	To reduce blood pressure	In individuals with hypertension, engagement in a care system with or without telemedicine resulted in significant BP reduction. Telemedicine for nondiabetic patients resulted in a greater reduction in systolic BP compared with usual care.
DeWalt et al. ³⁰	2006	United States of America	RCT	123	62	Community-dwelling patients	Patients with heart failure who took furosemide	Use of telemedicine or telephone for educational intervention or support/follow-up	1 year	Phone calls (days 3, 7, 14, 21, 28, and 56, and monthly during months 3–6)	To promote education on self-care emphasizing daily weight measurement, self-adjustment of diuretic dose, and symptom recognition and response	Patients in the intervention group had a lower rate of hospitalization or death.

Continue...

TABLE 2. Continuation.

Author	Year	Country	Type of study	n	Age (M)	Setting	Population	Methodology adopted	Duration of intervention	Follow up	Aim of intervention	Key findings
DeWalt et al. ³¹	2012	United States of America	RCT	605	60	Patients from general internal medicine and cardiology clinics at 4 sites: University of North Carolina at Chapel Hill; Feinberg School of Medicine, Northwestern University; University of California, San Francisco—San Francisco General Hospital; and Olive View—UCLA Medical Center.	Patients with heart failure	In-person, literacy-sensitive training, and a multisession group via telephone-based support.	1 year	6 and 12 months	To reduce hospitalization for heart failure	Among those with low literacy, the multisession training yielded a lower incidence of all-cause hospitalization and death (incidence rate ratio, 0.75; 95%CI, 0.45 – 1.25), and among those with higher literacy, the multisession intervention yielded a higher incidence (incidence rate ratio, 1.22; 95%CI 0.99 – 1.50; interaction p = 0.048). For heart failure-related hospitalization, among those with low literacy, multisession training yielded a lower incidence (incidence rate ratio, 0.53; 95%CI 0.25 – 1.12), and among those with higher literacy, it yielded a higher incidence (incidence rate ratio, 1.32; 95%CI 0.92 – 1.88; interaction p = 0.005).
Di Palo et al. ³²	2017	United States of America	RCT	94	69	Inpatients	Hospitalized patients with heart failure	Individual self-management educational intervention (American College of Cardiology Patient Navigator Program)	1 month	Each 14 days	To identify hospitalized patients with heart failure and improve transitions and outcomes, reducing hospitalizations	The 30-day all-cause readmission rate was 17.6% for the Patient Navigator Program and 25.6% for the medical center. Compared to the medical center, there was a statistically significant increase in education and follow-up

Continue...

TABLE 2. Continuation.

Author	Year	Country	Type of study	n	Age (M)	Setting	Population	Methodology adopted	Duration of intervention	Follow up	Aim of intervention	Key findings
Ferreira et al. ³³	2005	United States of America	RCT	1978	68	Two clinic firms at a Veterans Affairs Medical Center	Patients without CRC or polyps and who had not received CRC screening	Workshop on rationale and guidelines. mPATH-CRC, a tool for improving CRC screening rates	2 years	4-6 months	To test the primary hypothesis that a provider-directed intervention would increase rates of CRC screening recommendations by providers and rates of completion of CRC screening tests by patients	Among patients with HL skills of less than ninth grade reading level, screening was completed by 55.7% of patients in the intervention group versus 30% of controls (p = 0.01)
Graumlich et al. ³⁴	2016	United States of America	RCT	674	64	Outpatient primary care clinics	Patients with type II diabetes mellitus	Medtable tool or usual care. Graphically-enhanced interventions	Up to 1 year	3 to 6 months	To test the effectiveness of a medication-planning tool (Medtable)	Patients who received Medtable had greater knowledge about indications for medications in their regimens and were more satisfied with information about their medications
Kiser et al. ³⁵	2012	United States of America	RCT	99	63	Patients enrolled at a general internal medicine practice from the University of North Carolina, Chapel Hill, NC	Patients with COPD	One-on-one education session that used a literacy-sensitive handout titled Living With COPD	18 months	2 to 8 weeks	To test the impact of a literacy-sensitive, multicomponent self-management intervention on inhaler technique scores of COPD patients and to determine if its effects differ by literacy	Patients in the intervention group had greater mean improvement from baseline in metered dose inhaler technique scores compared to those in the usual care group (difference in mean change 2.1; 95%CI 1.1 – 3.0). Patients in the intervention group also had greater mean improvements in metered dose inhaler technique scores than those in the usual care group whether they had low HL (difference in mean change 2.8; 95%CI 0.6 – 4.9) or higher HL (1.8; 95%CI 0.7 – 2.9).

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TABLE 2. Continuation.

Author	Year	Country	Type of study	n	Age (M)	Setting	Population	Methodology adopted	Duration of intervention	Follow up	Aim of intervention	Key findings
Kripalani et al. ³⁶	2012	United States of America	RCT	435	64	Primary care clinics of an urban, safety net health system in Atlanta, GA	Patients with established CHD	Illustrated medication schedules (Universal Medication Schedule) and postcard reminders	1 year	1 year	To test the effect of 2 low-literacy interventions on medication adherence.	Illustrated medication schedules led to significantly greater odds of adherence among patients who took more than 8 medications at baseline (OR=2.2; 95%CI 1.21 – 4.04) or had low self-efficacy for managing medications (OR=2.15; 95%CI 1.11 – 4.16); a trend was seen among patients who reported non-adherence at baseline (OR=1.89; 95%CI 0.99 – 3.60).
Lam et al. ³⁷	2017	United States of America	RCT	134	70	2 community pharmacies	Patients with antihypertensive prescriptions who screened positive for low HL based on the Test of Functional Health Literacy-short form	Antihypertensive medications and recordings of pharmacist counseling in “Talking Pill Bottles” Participants in the control arm received antihypertensive medications and usual care instructions.	3 months	Every 30 days on days 30, 60, and 90.	To test the effect of “Talking Pill Bottles” on medication self-efficacy, knowledge, adherence, and blood pressure readings among patients with hypertension and low HL and to assess patients’ acceptance of this innovation	Audio-assisted medication instructions in “Talking Pill Bottles” positively affected blood pressure control and was well accepted by patients with low HL
Liu et al. ³⁸	2018	China	RCT	263	79	Nursing homes	Senior citizens from nursing homes with no cognitive disorders.	Teach-back and traditional methods. Cognitive training sessions	6 months	Every 3 months	To explore the effectiveness of the teach-back method for improving the HL of older adults in nursing homes.	The teach-back method improved the HL level of older adults

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TABLE 2. Continuation.

Author	Year	Country	Type of study	n	Age (M)	Setting	Population	Methodology adopted	Duration of intervention	Follow up	Aim of intervention	Key findings
Miller et al. ³⁹	2018	Unites States of America	RCT	450	57	6 community-based primary care practices.	Patients scheduled to see a primary care provider who were due for CRC screening	An iPad application that displayed a CRC screening decision aid, let patients order their own screening tests, and sent automated follow-up electronic messages to support patients (mPATH-CRC)	6 months	6 months	To examine the effect of a digital health intervention, Mobile Patient Technology for Health-CRC (mPATH-CRC), on rates of CRC screening	Compared with usual care, more mPATH-CRC participants could state a screening preference, planned to be screened within 6 months, discussed screening with their provider, and had a screening test ordered. Half of the mPATH-CRC participants (53%; 118 out of 223) "self-ordered" a test via the software
Muir et al. ⁴⁰	2012	Unites States of America	RCT	127	66	Patients of the Durham Veterans' Affairs Medical Center	Veterans with glaucoma	One-on-one sessions. Informational video and written material containing practical accessible information about the health/disease status	6 months	Once a month	To test an educational intervention targeted to HL levels with the goal of improving glaucoma medication adherence	Participants in the intervention group experienced less mean DWM than those in the control group, and the ES increased as literacy decreased: adequate literacy, ES = 0.069; marginal, ES = 0.183, inadequate, ES = 0.363. Decreasing HL skills were associated with decreasing self-reported satisfaction with care (slope = 0.017, SE = 0.005, p = 0.002)
Murray et al. ⁴¹	2004	Unites States of America	RCT	314	Over 50 years	Patients treated at Wishard Health Services (Indianapolis, Indiana)	Older patients with CHF and low HL	Verbal patient education; written icon-based education; contact with physician and nurses in person, by telephone, by paging, and by e-mail	9 months	Endpoints continuing through month 12	To improve medication adherence and health outcomes in older patients with CHF and low HL	The intervention improved the health outcomes of older patients with CHF

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TABLE 2. Continuation.

Author	Year	Country	Type of study	n	Age (M)	Setting	Population	Methodology adopted	Duration of intervention	Follow up	Aim of intervention	Key findings
Protheroe et al. ⁴²	2016	United Kingdom	RCT	76	63	Six family doctor practices in Blackpool, England	Patients aged over 18 years with poorly controlled diabetes	Structured interview and supporting phone calls	7 months	7 months	To assess the effect of a LHT intervention in patients with low HL and poorly controlled diabetes from a socioeconomically disadvantaged population, compared with usual care	Participants in the LHT arm had significantly improved mental health and illness perception. The intervention was associated with lower resource use, better patient self-care management, and better QALY profile at 7-month follow-up
Rudd et al. ⁴³	2009	United States of America	RCT	127	58	Arthritis center in an urban teaching hospital	Patients with rheumatoid arthritis, psoriatic arthritis, and inflammatory polyarthritis	Plain language information materials and/or 2 individualized sessions with an arthritis educator	1 year	6 and 12 months	To reduce literacy barriers and enhance health outcomes among patients with inflammatory arthritis	In mixed models controlling for baseline score and demographic factors, the intervention group showed improvements in the mental health score at 6 and 12 months (3.0 and 3.7 points, respectively), while the control group showed diminished scores (4.5 and 2.6 points, respectively) ($p = 0.03$ and 0.01)
Seligman et al. ⁴⁴	2005	United States of America	RCT	63 physicians/ 182 patients	63	An urban, academic, public hospital	Primary care physicians affiliated with a public hospital and patients with diabetes and limited HL	Visits and questionnaires	1 year	2 to 9 months	To determine whether notifying physicians of their patients' limited HL skills affected physicians' visit-specific management strategies, satisfaction, or perceived effectiveness, or patients' self-efficacy	Intervention physicians were more likely than control physicians to use management strategies recommended for patients with limited HL (OR 3.2, $p = 0.04$). However, intervention physicians felt less satisfied with their visits (81 vs 93%, $p = 0.01$) and were marginally less effective (38 vs 53%, $p = 0.10$). Intervention and control patients' post-visit self-efficacy scores were similar (12.6 vs 12.9, $p = 0.6$). Sixty-four percent of intervention physicians and 96% of patients felt the HL screening was useful

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TABLE 2. Continuation.

Author	Year	Country	Type of study	n	Age (M)	Setting	Population	Methodology adopted	Duration of intervention	Follow up	Aim of intervention	Key findings
Verney et al. ⁴⁵	2019	United States of America	RCT	2.802	-	Six different sites across Eastern United States	Community-dwelling older adults	Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) study	10 years	11 and 35 months	To examine the impact of cognitive training on changes in HL over 10 years in older adults	HL was generally stable across the ACTIVE intervention groups over 10 years. Cognitive training did not significantly impact HL
Wilson et al. ⁴⁶	2010	United States of America	RCT	70	67	Radiation oncology departments of 3 large urban hospitals located in Midwestern United States	Confirmed cancer diagnosis and scheduled for at least 20 radiation therapy sessions	Audiovisual education program (easy-to-read radiation therapy side effect pamphlet on skin problems) and behavioral contracting	6 months	3 weeks, 3 and 6 months	To test the effectiveness of an audiovisual education program and behavioral contracting to promote self-care behaviors in managing radiation side effects	The nursing interventions of education and behavioral contracting significantly increased men's self-care behaviors in managing radiation side effects. An increase in self-care behaviors was especially shown in men with low literacy skills
Wu et al. ⁴⁷	2019	United States of America	RCT	43	66	Academic medical center in Southeastern United States	Patients with HF and their care partners	The family focus of the FamLit intervention	3 months	Biweekly	To test the efficacy of a multi-component, family-focused, literacy-sensitive intervention on medication adherence in patients with HF	After the 3-month intervention, intervention patients had significantly better medication adherence than control patients. At 6 months (3 months post-intervention), the effect on adherence was sustained in the FamLit intervention group, while adherence decreased in the control group
Zhang et al. ⁴⁸	2019	China	Mixed method	1668	-	Participants living in the community	Patients diagnosed with hypertension	Questionnaire and group format	1 year	Every month	To explore an innovative community-based hypertension self-management model and to evaluate its effects	There was a significant difference in general health and HL after intervention in the intervention group ($p < 0.05$).

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patients. Further high-quality randomized clinical trials with greater methodological rigor for assessing results are warranted. Future studies should investigate whether interventions provided at inpatient or outpatient settings might offer different outcomes considering the impact of disease severity.

Conflict of interest

The authors declare no conflicts of interest.

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Authors' contribution

HS: conceptualization, investigation, funding acquisition, methodology, resources, writing – original draft, writing – review and editing. MC: conceptualization, data curation, formal analysis, investigation, project administration, supervision, writing – review and editing. SZ: data curation, formal analysis, investigation, resources, software, validation, visualization, writing – original draft. VA: methodology, resources, visualization, writing – review & editing. RM: methodology, supervision, visualization, writing – original draft. AN: conceptualization, data curation, investigation, methodology, project administration, supervision, validation, writing – review & editing.

REFERENCES

- Nutbeam D. The evolving concept of health literacy. *Soc Sci Med*. 2008;67(12):2072-8. <https://doi.org/10.1016/j.socscimed.2008.09.050>
- Poureslami I, Nimmon L, Rootman I, Fitzgerald MJ. Health literacy and chronic disease management: drawing from expert knowledge to set an agenda. *Health Promot Int*. 2016;32(4):743-54. <https://doi.org/10.1093/heapro/daw003>
- Rudd RE. The evolving concept of health literacy: new directions for health literacy studies. *J Commun Healthc*. 2015;8(1):7-9. <https://doi.org/10.1179/1753806815Z.0000000000105>
- Martins NFF, Abreu DPG, Silva BT, Semedo DSRC, Pelzer MT, Ienczak FS. Functional health literacy and adherence to the medication in older adults: integrative review. *Rev Bras Enferm*. 2017;70(4):868-74. <https://doi.org/10.1590/0034-7167-2016-0625>
- Edward J, Carreon LY, Williams MV, Glassman S, Li J. The importance and impact of patients' health literacy on low back pain management: a systematic review of literature. *Spine J*. 2018;18(2):370-6. <https://doi.org/10.1016/j.spinee.2017.09.005>
- Moraes KL, Brasil VV, Oliveira GF, Cordeiro JABL, Silva AMTC, Boaventura RP, et al. Functional health literacy and knowledge of renal patients on pre-dialytic treatment. *Rev Bras Enferm*. 2017;70(1):155-62. <https://doi.org/10.1590/0034-7167-2015-0169>
- Taylor DM, Fraser S, Dudley C, Oniscu GC, Tomson C, Ravanar R, et al. Health literacy and patient outcomes in chronic kidney disease: a systematic review. *Nephrol Dial Transplant*. 2017;33(9):1545-58. <https://doi.org/10.1093/ndt/gfx293>
- Wolf MS, Feinglass J, Thompson J, Baker DW. In search of 'low health literacy': threshold vs. gradient effect of literacy on health status and mortality. *Soc Sci Med*. 2010;70(9):1335-41. <https://doi.org/10.1016/j.socscimed.2009.12.013>
- Parnell TA. Low health literacy and implications. In: Parnell TA. *Health literacy in nursing: providing person-centered care*. New York: Springer Publishing Company; 2015. <https://doi.org/10.1891/9780826161734.0002>
- Mcculloch EC. Older adults. In: Parnell TA. *Health literacy in nursing: providing person-centered care*. New York: Springer Publishing Company; 2015. <https://doi.org/10.1891/9780826161734.0014>
- Chesser AK, Woods NK, Smothers K, Rogers N. Health literacy and older adults: a systematic review. *Gerontol Geriatr Med*. 2016;2:2333721416630492. <https://doi.org/10.1177/2333721416630492>
- Kobayashi LC, Wardle J, Wolf MS, von Wagner C. Aging, and functional health literacy: a systematic review and meta-analysis. *J Gerontol B Psychol Sci Soc Sci*. 2016;71(3):445-57. <https://doi.org/10.1093/geronb/gbu161>
- Geboers B, Uiters E, Reijneveld SA, Jansen CJM, Almansa J, Nooyens ACJ, et al. Health literacy among older adults is associated with their 10-years' cognitive functioning and decline-the Doetinchem Cohort Study. *BMC Geriatr*. 2018;18(1):77. <https://doi.org/10.1186/s12877-018-0766-7>
- Santos JEM, Brasil VV, Moraes KL, Cordeiro JABL, Oliveira GF, Bernardes CP, et al. Comprehension of the education handout and health literacy of pacemaker users. *Rev Bras Enferm*. 2017;70(3):633-9. <https://doi.org/10.1590/0034-7167-2016-0336>
- Rudd RE. Needed action in health literacy. *J Health Psychol*. 2013;18(8):1004-10. <https://doi.org/10.1177/1359105312470128>
- Rudd RE, Keller DB. Health literacy: new developments and research. *J Commun Healthc*. 2009;2(3):240-57. <https://doi.org/10.1179/cih.2009.2.3.240>
- Morony S, Flynn M, McCaffery KJ, Jansen J, Webster AC. Readability of written materials for CKD patients: a systematic review. *Am J Kidney Dis*. 2015;65(6):842-50. <https://doi.org/10.1053/j.ajkd.2014.11.025>
- Vargas CR, Chuang DJ, Lee BT. Assessment of patient health literacy: a national survey of plastic surgeons. *Plast Reconstr Surg*. 2014;134(6):1405-14. <https://doi.org/10.1097/PRS.0000000000000737>
- Jacobs RJ, Ownby RL, Acevedo A, Waldrop-Valverde D. A qualitative study examining health literacy and chronic illness self-management in Hispanic and non-Hispanic older adults. *J Multidiscip Healthc*. 2017;10:167-77. <https://doi.org/10.2147/JMDH.S135370>
- Karuranga S, Sørensen K, Coleman C, Mahmud AJ. Health literacy competencies for European health care personnel. *Health Lit Res Pract*. 2017;1(4):e247-e256. <https://doi.org/10.3928/24748307-20171005-01>
- Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol*. 2005;8(1):19-32. <https://doi.org/10.1080/1364557032000119616>
- Peters MDJ, Marnie C, Tricco AC, Pollock D, Munn Z, Alexander L, et al. Updated methodological guidance for the conduct of scoping reviews. *JBI Evid Synth*. 2020;18(10):2119-126. <https://doi.org/10.11124/JBIES-20-00167>
- Clement S, Ibrahim S, Crichton N, Wolf M, Rowlands G. Complex interventions to improve the health of people with limited literacy: a systematic review. *Patient Educ Couns*. 2009;75(3):340-51. <https://doi.org/10.1016/j.pec.2009.01.008>
- Lowe W, Ballinger C, Protheroe J, Lueddeke J, Nutbeam D, Armstrong R, et al. Effectiveness of musculoskeletal education interventions in people with low literacy levels: a systematic review. *Arthritis Care Res (Hoboken)*. 2013;65(12):1976-85. <https://doi.org/10.1002/acr.22085>
- World Health Organization. World report on ageing and health. Luxembourg: WHO; 2015.

26. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan – a web and mobile app for systematic reviews. *Syst Rev*. 2016;5(1):210. <https://doi.org/10.1186/s13643-016-0384-4>
27. Bosworth HB, Olsen MK, Gentry P, Orr M, Dudley T, McCant F, et al. Nurse administered telephone intervention for blood pressure control: a patient-tailored multifactorial intervention. *Patient Educ Couns*. 2005;57(1):5-14. <https://doi.org/10.1016/j.pec.2004.03.011>
28. Bosworth HB, Olsen MK, Neary A, Orr M, Grubber J, Svetkey L, et al. Take Control of Your Blood Pressure (TCYB) study: a multifactorial tailored behavioral and educational intervention for achieving blood pressure control. *Patient Educ Couns*. 2008;70(3):338-47. <https://doi.org/10.1016/j.pec.2007.11.014>
29. Bove AA, Homko CJ, Santamore WP, Kashem M, Kerper M, Elliott DJ. Managing hypertension in urban underserved subjects using telemedicine--a clinical trial. *Am Heart J*. 2013;165(4):615-21. <https://doi.org/10.1016/j.ahj.2013.01.004>
30. DeWalt DA, Malone RM, Bryant ME, Kosnar MC, Corr KE, Rothman RL, et al. A heart failure self-management program for patients of all literacy levels: a randomized, controlled trial [ISRCTN11535170]. *BMC Health Serv Res*. 2006;6:30. <https://doi.org/10.1186/1472-6963-6-30>
31. DeWalt DA, Schillinger D, Ruo B, Bibbins-Domingo K, Baker DW, Holmes GM, et al. Multisite randomized trial of a single-session versus multisession literacy-sensitive self-care intervention for patients with heart failure. *Circulation*. 2012;125(23):2854-62. <https://doi.org/10.1161/CIRCULATIONAHA.111.081745>
32. Di Palo KE, Patel K, Assafin M, Piña IL. Implementation of a patient navigator program to reduce 30-day heart failure readmission rate. *Prog Cardiovasc Dis*. 2017;60(2):259-66. <https://doi.org/10.1016/j.pcad.2017.07.004>
33. Ferreira MR, Dolan NC, Fitzgibbon ML, Davis TC, Gorby N, Ladewski L, et al. Health care provider-directed intervention to increase colorectal cancer screening among veterans: results of a randomized controlled trial. *J Clin Oncol*. 2005;23(7):1548-54. <https://doi.org/10.1200/JCO.2005.07.049>
34. Graumlich JF, Wang H, Madison A, Wolf MS, Kaiser D, Dahal K, et al. Effects of a patient-provider, collaborative, medication-planning tool: a randomized, controlled trial. *J Diabetes Res*. 2016;2016:2129838. <https://doi.org/10.1155/2016/2129838>
35. Kiser K, Jonas D, Warner Z, Scanlon K, Shilliday BB, DeWalt DA. A randomized controlled trial of a literacy-sensitive self-management intervention for chronic obstructive pulmonary disease patients. *J Gen Intern Med*. 2012;27(2):190-5. <https://doi.org/10.1007/s11606-011-1867-6>
36. Kripalani S, Schmotzer B, Jacobson TA. Improving medication adherence through graphically enhanced interventions in coronary heart disease (IMAGE-CHD): a randomized controlled trial. *J Gen Intern Med*. 2012;27(12):1609-17. <https://doi.org/10.1007/s11606-012-2136-z>
37. Lam AY, Nguyen JK, Parks JJ, Morisky DE, Berry DL, Wolpin SE. Addressing low health literacy with "Talking Pill Bottles": a pilot study in a community pharmacy setting. *J Am Pharm Assoc* (2003). 2017;57(1):20-9.e3. <https://doi.org/10.1016/j.japh.2016.07.003>
38. Liu YB, Li YF, Liu L, Chen YL. Effectiveness of the teach-back method for improving the health literacy of senior citizens in nursing homes. *Jpn J Nurs Sci*. 2018;15(3):195-202. <https://doi.org/10.1111/jjns.12192>
39. Miller Jr 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;168(8):550-7. <https://doi.org/10.7326/M17-2315>
40. Muir KW, Ventura A, Stinnett SS, Enfieldjian A, Allingham RR, Lee PP. The influence of health literacy level on an educational intervention to improve glaucoma medication adherence. *Patient Educ Couns*. 2012;87(2):160-4. <https://doi.org/10.1016/j.pec.2011.09.009>
41. Murray MD, Young JM, Morrow DG, Weiner M, Tu W, Hoke SC, et al. Methodology of an ongoing, randomized, controlled trial to improve drug use for elderly patients with chronic heart failure. *Am J Geriatr Pharmacother*. 2004;2(1):53-65. [https://doi.org/10.1016/s1543-5946\(04\)90007-4](https://doi.org/10.1016/s1543-5946(04)90007-4)
42. Protheroe J, Rathod T, Bartlam B, Rowlands G, Richardson G, Reeves D. The feasibility of health trainer improved patient self-management in patients with low health literacy and poorly controlled diabetes: a pilot randomised controlled trial. *J Diabetes Res*. 2016;2016:6903245. <https://doi.org/10.1155/2016/6903245>
43. Rudd RE, Blanch DC, Gall V, Chibnik LB, Wright EA, Reichmann W, et al. A randomized controlled trial of an intervention to reduce low literacy barriers in inflammatory arthritis management. *Patient Educ Couns*. 2009;75(3):334-9. <https://doi.org/10.1016/j.pec.2009.03.001>
44. Seligman HK, Wang FF, Palacios JL, Wilson CC, Daher C, Piette JD, et al. Physician notification of their diabetes patients' limited health literacy. A randomized, controlled trial. *J Gen Intern Med*. 2005;20(11):1001-7. <https://doi.org/10.1111/j.1525-1497.2005.00189.x>
45. Verney SP, Gibbons LE, Dmitrieva NO, Kucider AM, Williams MW, Meyer OL, et al. Health literacy, sociodemographic factors, and cognitive training in the active study of older adults. *Int J Geriatr Psychiatry*. 2019;34(4):563-70. <https://doi.org/10.1002/gps.5051>
46. Wilson FL, Mood D, Nordstrom CK, Risk J. The effect of low literacy on the self-care behaviors of men receiving radiation therapy. *Nurs Sci Q*. 2010;23(4):326-33. <https://doi.org/10.1177/0894318410380254>
47. Wu JR, Mark B, Knafl GJ, Dunbar SB, Chang PP, DeWalt DA. A multi-component, family-focused and literacy-sensitive intervention to improve medication adherence in patients with heart failure – a randomized controlled trial. *Heart Lung*. 2019;48(6):507-14. <https://doi.org/10.1016/j.hrtlng.2019.05.011>
48. Zhang Y, Liu S, Sheng X, Lou J, Fu H, Sun X. Evaluation of a community-based hypertension self-management model with general practitioners. *Int J Health Plann Manage*. 2019;34(3):960-74. <https://doi.org/10.1002/hpm.2867>
49. Foster ED, Deardorff A. Open Science Framework (OSF). *J Med Libr Assoc*. 2017;105(2):203-6. <https://doi.org/10.5195/jmla.2017.88>