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Effects of health literacy interventions on health-related outcomes in socioeconomically disadvantaged adults living in the community: a systematic review

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ABSTRACT

Objectives: The objectives of this review were: i) to identify and synthesize the best available evidence on the effectiveness on health-related outcomes of health literacy (HL) interventions for enabling socioeconomically disadvantaged people living in the community to access, understand, appraise and apply health information; and ii) to identify components of HL interventions associated with improved health-related outcomes.

Introduction: Health literacy is defined as a person's competence in accessing, understanding, appraising and applying health information in order to make sound health decisions. A high level of HL is positively related to better health outcomes. However, nearly half of the American and European population have low HL levels. Socioeconomically disadvantaged groups in particular present with the weakest HL levels, suggesting that differences in HL levels contribute to health disparities. Therefore, there is a need to understand the conditions under which HL interventions aiming at improving health-related outcomes among socioeconomically disadvantaged people can be implemented.

Inclusion criteria: This review considered studies on socioeconomically disadvantaged adults living in the community identified using the socially stratifying PROGRESS factors (Place of residence, Race/ethnicity, Occupation, Gender, Religion, Education, Socioeconomic status, Social capital).

This review considered studies evaluating the following interventions: i) targeting HL based on either a clinical and/or a public health approach, ii) delivered at the individual, interpersonal, community or societal level, iii) delivered by any healthcare/social work professional, and iv) using a single or multicomponent strategy. The comparator was no treatment, standard care or a variation of the intervention. All randomized and non-randomized controlled trials as well as quasi-experimental designs were included. Outcomes considered were: i) health-related quality of life and health-related outcomes, ii) health behavior outcomes, and iii) outcomes related to the access and use of healthcare services.

Methods: A three-step strategy was conducted for primary research published up to May 2018 across seven databases without any language restriction. A search for gray literature was also conducted. Titles and abstracts were screened for assessment against the inclusion criteria. Studies that met the inclusion criteria were retrieved in full and then assessed in detail against the inclusion criteria. Critical appraisal was undertaken using the standardized critical appraisal instruments from JBI. Data were extracted from included studies using standardized data extraction tools from JBI. A meta-analysis was not possible; findings have been presented in a narrative form.

Results: Twenty-one studies were included in the review. Three studies addressed the HL competency of understanding health information, and 18 addressed the competency of applying health information. Thirteen studies were found as effective based on a variety of health-related outcomes (mainly clinical outcomes), preventive health practices and behaviors, and health-promoting behaviors. Results enabled identification of some effective intervention operational components, including cultural appropriateness, tailoring, skills building, goal setting and active discussions. Multi-faceted interventions, combining both an information transfer medium and contact with an interventionist, appear to be more effective than single modality interventions. The use of an appropriate theoretical foundation is also an important factor for successful interventions.

Conclusion: To improve health-related outcomes among socioeconomically disadvantaged people, HL interventions are more likely to be successful if they are theory-based, are multi-faceted and use person-centered operational components such as cultural appropriateness, tailoring, skills building, goal setting and active discussions.

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The authors declare no conflict of interest.

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Summary of Findings

Effects of health literacy interventions on health-related outcomes in socioeconomically disadvantaged adults living in the community: a systematic review			
Bibliography: Stormacq C, Wosinski J, Boillat E, van den Broucke S. Effects of health literacy interventions on health-related outcomes in socioeconomically disadvantaged adults living in the community: a systematic review. <i>JBIEvid Synth</i> . 2020;??(?):??-??			
Outcomes	Ne of participants (studies)	Certainty of the evidence (GRADE)	Comments
Health literacy interventions compared to standard care, no intervention or delayed intervention (passive comparison)			
Health-related quality of life		○⊕○○	1 study showed moderate improvements health-related quality of life Certainty of the evidence is low due to indirectness and imprecision.
Health-related outcomes, including clinical outcomes and patient-reported outcomes	1275 (4 RCTs and one quasi-experimental study)	⊕○○○○	1 study showed small to moderate improvements in health-related outcomes Certainty of the evidence is very low due to indirectness and inconsistency across all studies, and imprecision (4 studies)
Health behaviors	3003 (6 RCTs and one quasi-experimental study)	⊕○○○○ VERY LOW	5 studies showed small to moderate improvements in health behaviors Certainty of the evidence is very low due to indirectness and inconsistency across all studies, and imprecision (5 studies)
Health literacy interventions compared to minimal/alternative intervention			
Health-related outcomes, including clinical outcomes and patient-reported outcomes	1917 (9 RCTs)	⊕○○○○	4 studies showed small to moderate improvements in health-related outcomes Certainty of the evidence is very low due to indirectness and inconsistency across all studies, and imprecision (9 studies)
Health behaviors	4728 (10 RCTs and one quasi-experimental study)	⊕○○○○ VERY LOW	6 studies showed small to moderate improvements in health behaviors Certainty of the evidence is very low due to indirectness and inconsistency across all studies, and imprecision (9 studies)
The outcomes of interest are health-related quality of life, health-related outcomes and health behaviors for which a single pooled effect estimate was not available and only a narrative synthesis of the evidence was provided. RCT: randomized controlled trial			
GRADE Working Group grades of evidence			
High certainty: We are very confident that the true effect lies close to that of the estimate of the effect			
Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different			
Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect			
Very low certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect			

Introduction

Literacy is “the capacity to read, write and have basic numeric skills,”^{1(p.291)} allowing people to effectively function and participate in society.¹ Approximately 25% of the adult population in the world are illiterate or have poor literacy skills.¹ Low literacy levels are associated with a variety of adverse health outcomes.² In addition to literacy skills required to adequately function in everyday life, the notion of literacy has expanded to include health literacy (HL) in order to effectively function in the healthcare system. “Health literacy is linked to literacy and entails people’s knowledge, motivation and competencies to access, understand, appraise and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course.”^{3(p.3)} Health literacy is a relatively new concept, introduced for the first time in the 1970 s, and has been discussed in studies over the last two decades. The HL concept has many implications for health care, health education and health promotion,⁴ and is strongly correlated with the social determinants of health, health behaviors and health outcomes.³ Therefore, HL is considered one of the most important issues in health care and public health³⁻⁵ and is increasingly being addressed in current health and social policies.

Health literacy: a public health concern

Today, each individual is confronted, at some point, with multiple health issues and decisions.⁶ Society and healthcare systems are becoming more complex.^{5,7} Consequently, requirements for literacy and optimal use of health information have become more and more important⁵ for maintaining a good health status. Increasingly, people are asked to take an active part in health decisions⁷ and become “informed patients.”⁶ To navigate this new healthcare environment,⁷ many abilities and skills are needed, such as information-seeking, communication, critical thinking and problem-solving.³ A good level of HL appears to positively influence health and the ability to effectively navigate the healthcare system, as shown by cross-sectional studies, via better choices and health decisions, more active involvement in discussions with health professionals,⁸⁻¹⁰ greater self-efficacy,¹¹⁻¹⁵ better abilities in self-care,¹¹ adoption

of positive health behaviors,¹⁶⁻¹⁹ increased prevention,²⁰⁻²² better health outcomes,¹⁷ social capital development⁶ and lower healthcare costs.²³ Good levels of HL contribute to improved global health in the general population.²⁴ According to a national study,²⁵ nearly half of the adult American population shows a low or marginal level of functional HL, particularly socially and socioeconomically disadvantaged groups. Similarly, in Europe, almost half of the population has limited HL.²⁶ Due to poor understanding of health messages,²⁷ low HL skills are associated with a range of adverse health effects:¹⁷ increased mortality,^{17,21} poorer self-reported health status,²⁸⁻³¹ greater use of emergency services but less use of preventive services, higher rates of chronic diseases and adoption of adverse health behaviors (smoking, consumption of alcohol and illicit products, sedentary lifestyles),²⁸ which lead to higher healthcare costs.^{5,7,21,28,29} Given the significant consequences of low HL, the importance of HL is increasingly being discussed in health policies in Europe, and HL has been recognized as a priority within the Strategy of the European Commission 2008-2013.^{3,32} A public health imperative,^{6,31} HL is also considered an important predictor of health status and health behaviors in the general population,³¹ and is recognized as a major determinant of health by the World Health Organization.³³ Therefore, HL is a key public health issue¹ and must take a central place in future research, actions and health policy debates.⁶

Health literacy dimensions and health literacy skills

To promote and maintain good health, to function effectively in the healthcare context and to enable people to act on their health condition, a set of skills or competencies is required. From this perspective, HL can be considered a “constellation of skills” or a multidimensional concept.^{3,34}

To describe the skills that are essential to function effectively in the health system, Sorensen *et al.*³ proposed an integrative conceptual model of HL. This model focuses on the three domains of the health continuum (health care, disease prevention and health promotion), and both clinical and community settings are considered. Besides basic reading and writing skills needed in everyday situations to function and participate effectively in society,³

defined as functional literacy,³⁵ four types of competencies, each representing an essential dimension of HL, are required in order to navigate the health continuum: "1) Access: refers to the ability to seek, find and obtain health information; 2) Understand: refers to the ability to comprehend the health information that is accessed; 3) Appraise: describes the ability to interpret, filter, judge and evaluate the health information that has been accessed; and 4) Apply: refers to the ability to communicate and use the information to make a decision to maintain and improve health."^{3(p.9)} Progressing on these four levels allows people to acquire a multitude of social, personal and cognitive skills that are essential for a greater control on one's own health,⁶ and "to exert greater control over life events and situations."^{4(p.264)} Therefore, HL "is not simply a set of functional capabilities" such as reading, writing and numeracy skills,^{35(p.2075)} but a wide range of complementary skills and competencies that can be built upon. However, HL does not impact health directly.^{14,15,36-38} Health literacy levels influence some health promotion or health education constructs, such as specific health related knowledge, self-care, self-management, self-efficacy, problem-solving, decision-making and empowerment.^{14,15,36,37} These can be considered proxy outcomes of a HL process and suggest that there are different ways to operationalize the HL concept in interventions. These interventions can take many forms, such as education and disease management interventions, interventions aiming at improving patient-provider communication, interventions aimed at improving access to health information, and interventions for improving usability of health-care systems and services. Therefore, proxy measures of the impact of HL on health-related outcomes need to be assessed.

Clinical approach and public health approach to health literacy

There are two complementary HL approaches to HL: the "clinical" approach and the "public health" approach.^{39,40} In the clinical approach, HL represents the necessary skills needed to navigate in a clinical setting and often include aspects such as selecting care providers,⁴¹ understanding and completing consent forms,^{1,41} and understanding medicine labels, how to take medication,^{1,41} verbal information given by health professionals,¹ and

how to manage the disease.⁴¹ In this context, HL is considered a construction at the individual or patient level,³⁹ and the focus is on the "therapeutic dyad" patient-healthcare provider.³⁹ From this clinical perspective, HL strategies should focus primarily on the effectiveness of clinical care. Health literacy interventions mainly focus on the improvement of HL skills and the adaptation of health communications at the patient level³⁹ in people with low HL levels and are related to patient education.

To extend the HL concept to the community setting, the "public health" approach, introduced by Freedman in 2009, was developed³⁹ to incorporate social and environmental factors, and other determinants of health that cause low levels of HL among populations. Public health literacy is defined as "the degree to which individuals and groups can obtain, process, understand, evaluate and act upon information needed to make public health decisions that benefit the community."^{39(p.448)} From this public health perspective, HL can be considered a tool, an asset or a means for individuals to exert greater control and to act on all personal, social and environmental factors that determine health, thus reflecting a health promotion orientation.³⁵ In this respect, this perspective can be operationalized across the continuum of strategies in health care, health prevention, health education and health promotion.³⁹ Therefore, public health literacy is a comprehensive HL conceptualization, and public health literacy interventions need to be assessed for their effectiveness.

The role of socio-economic status in health literacy, health outcomes and health disparities

Demographic and social factors, such as socioeconomic status (educational attainment, occupation, income),^{4,14,26} social support,^{3,14} culture and language³ and personal characteristics (e.g. age,^{3,29,40} gender,^{3,28} race and ethnicity),^{3,28} influence HL skills and are thus considered as antecedents of HL.^{3,17} These can have a positive impact on HL and promote good levels of HL. Conversely, antecedents can negatively impact HL (e.g. low level of education, disadvantaged socioeconomic status, belonging to a minority group, immigration), thereby becoming risk factors for low HL levels. Considering the relationship between socioeconomic status and HL, it is not surprising to note that the weakest health-related skills are found among the

most disadvantaged socioeconomic groups. Advantaged social and socioeconomic groups are those placed on the higher levels of the social hierarchy, and thus tend to have greater HL skills. Conversely, disadvantaged social and socioeconomic groups are those at the bottom of the social ladder, with a lack of material resources,⁴² lower educational attainment, and less desirable or underpaid profession. In a HL context, the socially and socioeconomically disadvantaged are those at risk of low HL levels. Thus, different HL levels contribute to health disparities.²⁰ A health disparity is defined as differences in health status and health outcomes^{43,44} between social groups "that is not only unnecessary and avoidable, but in addition, are considered unfair and unjust."^{44(p.219)} A health disparity includes differences that occur through age, sex, race/ethnicity, education, income, disability, geographic location, sexual orientation or religion,⁴⁵ and which systemically and adversely impact socially and economically disadvantaged groups.^{42,43} Health literacy levels then become a modifiable risk factor for health disparities on which it is possible to act to reach greater health equity. Therefore, ways to improve health status and reduce disparities among disadvantaged people through HL strategies need to be further explored.^{40,46}

Existing systematic reviews

A search undertaken in databases such as the Cochrane Database of Systematic Reviews, Best BETS, Campbell Collaboration and the *JBIM Database of Systematic Reviews and Implementation Reports* as well as PubMed found that there were no quantitative systematic reviews that examined HL interventions to improve health-related outcomes among socioeconomically disadvantaged groups. One systematic review focused on the relationship between HL, numeracy and health outcomes in the diabetes population.⁴⁷ This review shed light on certain HL proxy measures, such as knowledge, self-efficacy, self-care and self-monitoring, but there was not enough consistent evidence showing that HL levels were associated with diabetes-related outcomes. Two systematic reviews^{48,49} on the effectiveness of interventions for improving health-related outcomes of people with limited or low literacy only considered HL as the ability to read, write and use numbers effectively, and did not address HL as a broader concept. One systematic review⁵⁰ measuring interventions to mitigate the

effects of low HL and to improve health outcomes and use of healthcare services may be relevant to the topic of this proposed review, but it did not address the public health approach of HL and hence was not within the scope of this review. One systematic review⁵¹ on the effectiveness of interventions in primary healthcare and in the community for improving HL in adults and promoting positive change in lifestyle behavior did not refer to disadvantaged groups. The author had called for the inclusion of these groups in future HL studies.

This proposed systematic review aimed to identify and synthesize the best available evidence with regard to HL interventions in the community, allowing for a better understanding of the conditions under which effective HL interventions to improve health-related outcomes (including quality of life outcomes, clinical outcomes, health behaviors, and access and use of healthcare services) among socioeconomically disadvantaged people can be implemented. This will enable the development of interventions to reduce health disparities by implementing a comprehensive HL strategy. This review therefore addressed all dimensions and components of HL in order to shed light on interventions that can positively influence health outcomes and reduce health disparities.

Review objectives

The overall objective of this systematic review was to identify and synthesize the best available evidence on the effectiveness of health literacy interventions in socioeconomically disadvantaged people living in the community for improving health-related outcomes.

More specifically, the objectives of this systematic review were: i) to identify and synthesize evidence on the effectiveness of single or complex health literacy interventions in enabling socioeconomically disadvantaged people living in the community to access, understand, appraise and apply health information; and ii) to identify components and characteristics of HL interventions that are associated with improved health-related outcomes in socioeconomically disadvantaged people. This second objective, important for the development of future HL interventions, is a deviation from the *a priori* protocol.⁵²

Inclusion criteria

Participants

This review considered studies that included adults aged 18 years or over, male and female, of any

ethnicity and cultural group, and who are socially or socioeconomically disadvantaged in the community.

PROGRESS factors, including Place of residence, Race/ethnicity/culture/language, Occupation, Gender, Religion, Education, Socioeconomic status, Social capital or age,⁵³ served to identify “disadvantaged” people and social groups. These are “socially stratifying factors that drive variations in health outcomes”^{53(p.58)} and contribute to disparities in health. For example, people living in rural areas, from a minority group, with low education or low income,²⁶ are considered as disadvantaged and at risk of health disparities. In this review, studies considering any or several of these factors were considered for inclusion. In this review, studies conducted in any community setting were considered, such as community centers, community preventive services, community-based health promotion settings, community healthcare facilities, primary healthcare centers, homes or worksite settings.

Exclusion criteria: studies involving/targeting children aged under 18 years, people living in nursing or other institutional living facilities, people with cognitive impairments or dementia for whom HL—or one of its components—is difficult to measure or evaluate, healthcare professionals (e.g. physician, nurse), or non-health professionals (e.g. community workers, social workers), and studies which do not give an indication of the socioeconomic status were excluded

Interventions

This review considered studies focused on the following interventions:

- i) Those that targeted HL using a clinical approach (in a clinical setting, at the patient or individual level, e.g. patient-provider communication interventions or education and disease management interventions) and/or a public health approach (in a community setting, or at the population level, e.g. awareness campaigns and mass public education related to a health issue affecting the whole community), any of its dimensions, and operationalized by any healthcare, prevention, education or health promotion strategy.
- ii) Those delivered at the individual/intrapersonal level, encompassing the characteristics and personal factors of an individual, such as knowledge, skills, lifestyles, behavior and attitudes^{54,55}

(e.g. education interventions and disease management interventions); the interpersonal level, including social interactions, social influences and social support^{54,56} (e.g. interventions aimed at improving patient-provider interaction/communication); the community level, with a focus on populations, groups and organizations, and including social and physical environments considered to have an impact on health outcomes^{54,57} (e.g. interventions aimed to improve access to accurate and appropriate health information); or at the societal level, including economic, social, educational and health policies⁵⁴ (e.g. interventions for improving usability of a healthcare system and health services).

- iii) Those delivered by any healthcare or social work professional from within or outside the healthcare system, such as physician, nurse, community worker or social educator with a professional degree recognized in the country where the intervention takes place.
- iv) Those that were either single strategy or complex interventions.

Exclusion criteria: studies concerning general literacy (e.g. reading, writing and calculating) were excluded.

Comparators

This review considered studies that offered no comparison, a passive comparison (such as no treatment or standard care), or an active comparison (such as variation of the intervention).

Outcomes

This review considered studies that included the following outcome measures, based on the Outcome Model for Health Promotion⁴ and informed by the Outcomes of Interest to the Cochrane Consumers and Communication Review Group,⁵⁸ but were not limited to:

Primary outcomes: those considered as final outcomes of a HL process, that is, outcomes related to the capacity to apply health information in order to promote and maintain good health, such as: i) health-related quality of life and health-related outcomes (general health status, perceived health status, wellbeing, life expectancy, morbidity, mortality, disability); ii) health behaviors (self-efficacy, healthy lifestyles and preventive health practices, compliance/

adherence and behavior change); and iii) access and use of healthcare services (preventive service use, office visits, hospitalizations).

Examples of measurement tools for the primary outcomes included: health status: Short-Form-36 Health Survey,⁵⁹ quality of life: EuroQol,⁶⁰ well-being: Satisfaction with Life Scale,⁶¹ self-efficacy: Self-Efficacy Scale,⁶² disability: OECD Long-Term Disability Questionnaire,⁶³ health-related behaviors: Health-Promoting Lifestyle Profile,⁶⁴ and access to healthcare services: Unmet Health Care Needs indicators.⁶⁵

Secondary outcomes: those leading to the application of health information, comprising the basic level of HL and other components of a HL process, such as: i) functional HL (reading, writing and numeracy skills) as a prerequisite for more advanced HL skills (accessing, understanding, appraising and applying health information); ii) knowledge and understanding: information access and use, health-related knowledge acquisition, participant satisfaction with the information provided or received; iii) communication: communication enhancement, communication skills; iv) participant decision-making: (shared) decision-making process, decision made, satisfaction with the decisions made; v) support: social interactions, social support, help-seeking behavior; vi) skills acquisition: self-care and self-management skills, self-monitoring, self-advocacy, self-learning skills, social skills, coping skills, empowerment skills, critical thinking, problem-solving ability and navigation skills; vii) predisposing factors of health behavior change: attitudes, beliefs, intent to change health behavior; and viii) other relevant outcomes.

Exclusion criteria: studies that used cognitive impairment or dementia as an outcome of interest, studies considering HL levels as an outcome, and studies on cost-effectiveness outcomes of HL interventions were excluded.

To ensure quality of analyzed evidence, a decision was made to only consider reliable and validated patient-reported or clinical outcomes. This selection criteria deviates from the *a priori* protocol.⁵²

Types of studies

This review considered any experimental study design, including randomized controlled trials and non-randomized controlled trials, as well as quasi-experimental designs for inclusion.

Methods

This systematic review was conducted in accordance with the JBI methodology for systematic reviews of effectiveness.⁶⁶ This review was conducted in accordance with an *a priori* protocol.⁵²

Search strategy

The search strategy aimed to locate both published and unpublished studies. A three-step search strategy was utilized in this review. An initial limited search of MEDLINE and CINAHL was undertaken, followed by an analysis of the text words contained in the title and abstract, and of the index terms used to describe the article. A second search using all identified keywords and index terms was then undertaken across all included databases. Thirdly, the reference lists of all reports and articles that met inclusion criteria were searched for additional studies. Studies published in any language were considered for inclusion in this review. Assessment for inclusion of papers in languages other than Romance languages (e.g. Spanish, French, Portuguese, Italian) and Germanic languages (e.g. English, German, Dutch) were based on the English language abstracts, where available. Relevant studies were translated into English. No date limits were imposed on database searching. Individual search strategies were developed for each database to take into account the differences in Thesaurus terminology and indexing. Titles and abstracts of studies retrieved in the search were assessed for relevance against the inclusion and exclusion criteria. Bibliographic details of the studies were downloaded or manually entered into the references management database, EndNote X7.7 (Clarivate Analytics, PA, USA).

The databases searched included: PubMed, CINAHL, the Cochrane Central Register of Controlled Trials (CENTRAL), Embase, PsycINFO, TRoPHI and Web of Science.

The search for gray literature and unpublished studies included clinical trial registers, technical and official reports from government or academic institutions, conference papers and proceedings, theses and dissertations, and an internet search of Doaj, Google, Google Scholar, MedNar, Worldcat and Scopus. The databases searched for clinical trial registers included: ClinicalTrials.gov, EU Clinical Trial Register, Current Controlled Trials (CCT), and UK Clinical Trials Gateway. The databases searched for theses and dissertations included:

ProQuest Dissertations and Theses Global (PQDT Global) and DART-Europe E-theses portal. The search for gray literature and unpublished studies included a simplified version of the database search strategy.

The search strategy as detailed in the *a priori* protocol⁵² was altered. The ERIC database, essentially educational and aimed at a teaching audience, was not searched because it was not considered relevant to the target population of our systematic review. Moreover, due to the large number of references generated by the search strategy, a hand search of relevant journals not included in electronic databases was not conducted.

A PRISMA flow diagram was used to summarize the study selection process. It includes the total numbers of studies identified and screened from all databases used for the review and from hand searches, studies assessed for eligibility, studies included in the review, and studies excluded from the review with reasons for exclusions.⁶⁷ The search strategies used for the databases searched are detailed in Appendix I.

Study selection

Following the search, all identified citations were collated and uploaded into EndNote X7.7 and duplicates removed. In a first stage, titles and abstracts were screened by two independent reviewers for relevance. Studies that seemed relevant were retrieved in full. In a second stage, the full text of selected citations were assessed in detail against the inclusion criteria and study details imported into the JBI System for the Unified Management, Assessment and Review of information (JBI SUMARI; JBI, Adelaide, Australia). Full-text studies that did not meet the inclusion criteria were excluded, and reasons for exclusion recorded. Included studies underwent a process of critical appraisal. The results of the search are presented in a PRISMA flow diagram.⁶⁸ Any disagreements that arose between the reviewers were resolved through discussion, or with a third reviewer.

Assessment of methodological quality

Quantitative papers selected for retrieval were assessed independently by two reviewers for methodological validity prior to inclusion in the review using the standardized critical appraisal instruments from JBI for experimental and quasi-experimental

studies.⁶⁹ Studies that did not meet the 70% threshold for the relevant appraisal instrument were excluded. Any disagreements that arose between the reviewers were resolved through discussion, or with a third reviewer.

Data extraction

Quantitative data were extracted from papers included in the review using the standardized data extraction tool from JBI SUMARI. The data extracted included specific details about the interventions, populations, study methods and outcomes of significance to the review question and objectives. Authors of quantitative primary studies were contacted for missing information or to clarify unclear data.

Data synthesis

Statistical pooling of quantitative data in a meta-analysis was not possible. Therefore, the findings have been presented in narrative form, including tables and figures to aid in data presentation, where appropriate.

Assessing certainty in the findings

A Summary of Findings was created using GRADEpro software (McMaster University, ON, Canada). The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach for grading the quality of evidence was followed.⁷⁰

Results

Study inclusion

The comprehensive three-step strategy outlined above was conducted up to May 2018, using the databases and gray literature sources cited above, leading to the identification of 27,516 studies: PubMed (9915), CINAHL (3895), CENTRAL (1205), Embase (2710), PsycINFO (710), TROPHI (73), Web of Science (4094), ProQuest (52), Scopus (4385), ClinicalTrials.gov (104), EU Clinical Trial Register (1), CCT (89), UK Clinical Trial Gateway (72), and DART (211). Sixty-five additional references were identified using Doaj, Google, Google Scholar, MedNar and Worldcat. Seventy-one records were also identified through reference lists, resulting in a total of 27,652 studies. A total of 6504 duplicates were identified through EndNote X7.7 and hand searching were removed, resulting in 21,148 studies. These were screened for relevance based on title and abstract by two independent reviewers. From the 21,148 studies, 19,429 were

excluded based on title, and 1719 were selected for full-text analysis. Among these, 1552 studies did not meet the inclusion criteria and were excluded (reasons for exclusion available upon request), and 35 studies could not be retrieved in full text, resulting in 132 studies. These were then assessed for methodological quality. During the critical appraisal process, five authors of primary studies were contacted for additional information. All responded but two were unable to provide the requested information, leading

to the exclusion of these two studies. Among the remaining 130 studies, 109 were then excluded. As a result, 21 studies were retained for content analysis. The PRISMA flowchart of the selection process for papers is outlined in Figure 1.⁶⁸

Methodological quality

Among the 132 papers critically assessed for methodological validity, 111 studies were excluded on the basis of methodological quality because they did not

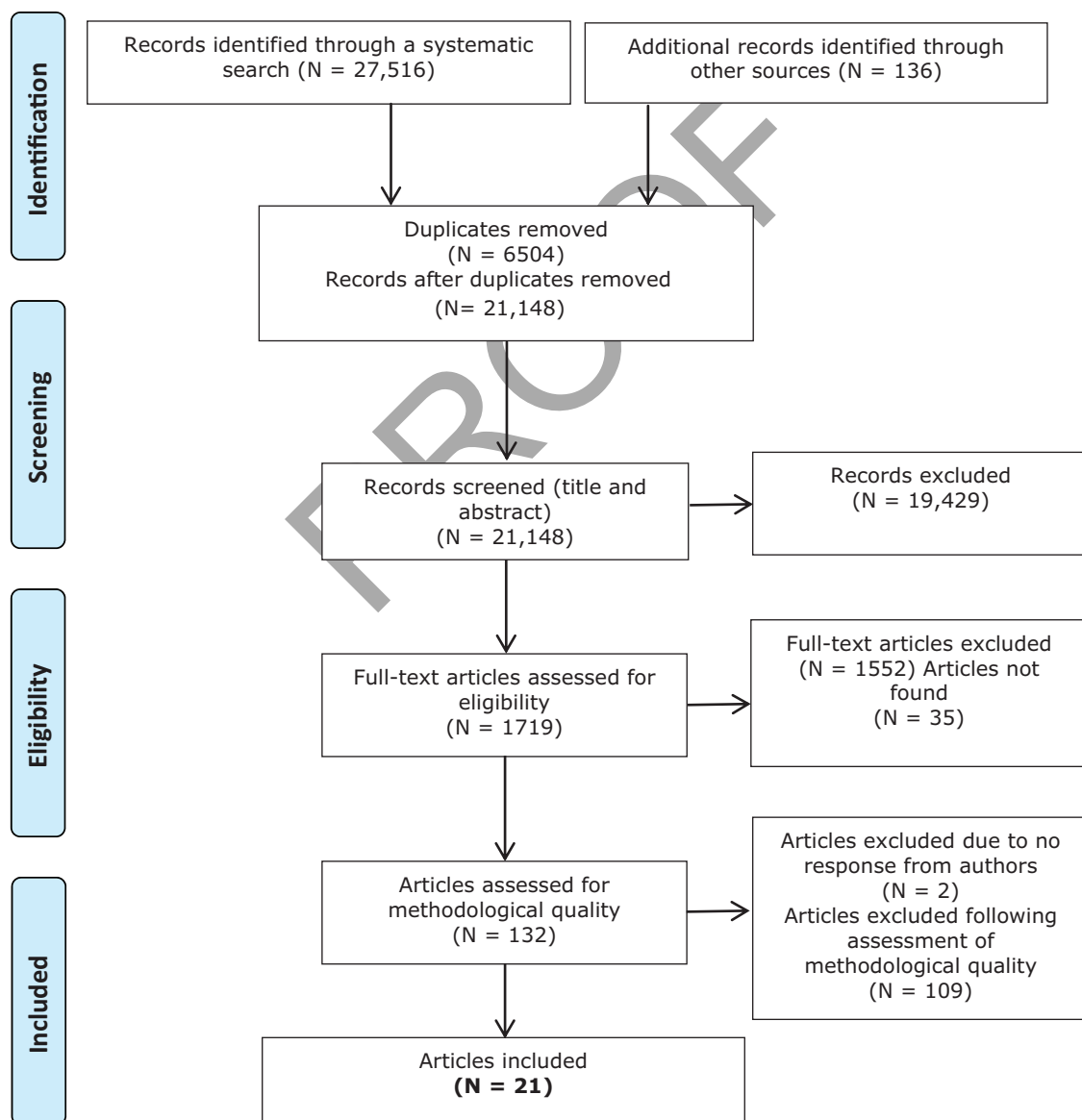


Figure 1: Search results and study selection and inclusion⁶⁸

meet the 70% cut-off checklist score.⁶⁹ The reasons for exclusion for each of the excluded studies are in Appendix II. Twenty-one studies met the reviewers' appraisal criteria. These 21 studies were assessed as being of high or very high quality. Tables 1 and 2 present the quality assessment scores for the 21 studies that were retained, according to study design. As these tables indicate, there was variation in the quality of the included studies. Two studies met all the critical appraisal criteria^{71,72}; three studies achieved a score of 90% or more⁷³⁻⁷⁵; seven studies achieved a score of 80% or more⁷⁶⁻⁸²; and nine studies achieved a score of a minimum of 70%.⁸³⁻⁹¹

Among the randomized controlled trials (RCTs), three were cluster RCTs.^{71,73,74} Sixteen studies were considered truly random,^{71,73,75-81,83,85-89,91} with a clear description of the specific randomization procedure used. Three studies used stratified randomization,^{74,84,90} which may have induced a risk of selection bias. Randomization was computer-based in 13 studies.^{71,73,75,77-79,81,84-86,89-91} The methods of randomization included block randomization^{73,78-80,83,87-89,91} and simple randomization.^{71,75,76,79,81,84,85,89}

Group allocation was concealed from the allocator in 14 studies,^{22,71,73-77,79,80,84-86,89,90} while the concealment of the allocation from the allocator was unclear or not mentioned in five studies,^{78,83,87,88,91} inducing potential performance bias.

Only 13 studies demonstrated equivalency between groups at baseline.^{71,73-76,80,81,83,84,86-88,91} Slight differences between participants in the experimental group (EG) and control group (CG) were identified in five studies,^{77-79,85,89} and comparability of groups was unclear in one study,⁹⁰ which may have induced selection bias.

Blinding of participants to the treatment allocation was applied in nine studies,^{71,74,76-78,83,84,88,91} but unclear in three studies,^{73,80,81} inducing performance bias. An unavoidable performance bias occurred in seven studies^{75,79,85-87,89,90} where blinding of participants was not possible due to the behavioral, psychosocial or computer-based nature of the intervention. For the same reasons, blinding of those delivering the treatment was not possible in all the included studies. Assessors were blinded to treatment allocation in ten studies.^{71,73-75,77-79,81,85,90} Assessors were aware of the assignment status of participants in three studies,^{76,80,89}

while blinding of assessors was not mentioned in six studies,^{83,84,86-88,91} which generates performance and detection bias.

In all studies, EGs and CGs were treated identically other than for the named intervention.

Intention-to-treat analysis was performed in 11 studies.^{71,74,75,77-80,83,87,89,90} In two studies where intention-to-treat was not conducted, attrition analysis was performed and missing data taken into account.^{73,76}

In six studies,^{81,84-86,88,91} withdrawal of study participants was not addressed, thus inducing attrition bias.

In all of the included studies, participants were analyzed in the groups to which they were randomized, and outcomes measured in the same way between groups.

Outcomes were measured consistently and in a reliable way in 14 studies.^{71,73-75,78-81,84,86,87,89-91} In contrast, the reliability of the measures used was unclear or insufficiently described in five studies,^{76,77,83,85,88} inducing possible detection bias.

All studies reported appropriate statistical analysis, appropriate use of statistical tests and appropriate trial design.

In regard to the two quasi-experimental studies, one met all the methodological criteria.⁷² In the other one,⁸² follow-up was incomplete and participants who withdrew were not included in the analysis, thus inducing attrition bias.

Further details of the critical appraisals for the included studies can be found in Tables 1 and 2.

Characteristics of included studies

The 21 studies retained for this review included 19 RCTs and two quasi-experimental studies.^{72,82} All studies were published between 2004⁸⁴ and 2017^{73,87} and were available in English. A table of the description of the included studies is provided in Appendix III.

Participants

All studies focused on socioeconomically disadvantaged people, as defined by the PROGRESS factors.⁵³ Seven studies included participants from ethnic minorities,^{71,74,76,79,80,86,89} four studies included low-income participants,^{73,77,84,91} and one study included participants based on their low socioeconomic status.⁹⁰ Nine studies used more than one PROGRESS factor to include participants.

Table 1: Critical appraisal results for randomized controlled trials

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Baig <i>et al.</i> , 2015 ⁸³	Y	U	Y	Y	NA	U	Y	Y	Y	Y	U	Y	Y
Block <i>et al.</i> , 2004 ⁸⁴	N	Y	Y	Y	NA	U	Y	U	Y	Y	Y	Y	Y
Gopalan <i>et al.</i> , 2013 ⁷⁶	Y	Y	Y	Y	NA	N	Y	Y	Y	Y	U	Y	Y
Heisler <i>et al.</i> , 2014 ⁸⁵	Y	Y	N	N	NA	Y	Y	Y	Y	Y	U	Y	Y
Jackson <i>et al.</i> , 2011 ⁷⁷	Y	Y	N	Y	NA	Y	Y	Y	Y	Y	U	Y	Y
Kim <i>et al.</i> , 2009 ⁸⁶	Y	Y	Y	N	NA	U	Y	N	Y	Y	Y	Y	Y
Koniak-Griffin <i>et al.</i> , 2015 ⁷⁸	Y	U	N	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y
Kripalani <i>et al.</i> , 2007 ⁷⁹	Y	Y	N	N	NA	Y	Y	Y	Y	Y	Y	Y	Y
Kripalani <i>et al.</i> , 2012 ⁷⁵	Y	Y	Y	N	NA	Y	Y	Y	Y	Y	Y	Y	Y
Lutes <i>et al.</i> , 2011 ⁸⁷	Y	U	Y	N	NA	U	Y	Y	Y	Y	Y	Y	Y
Martin <i>et al.</i> , 2011 ⁸⁸	Y	U	Y	Y	NA	U	Y	Y	Y	Y	U	Y	Y
Mohan <i>et al.</i> , 2014 ⁸⁹	Y	Y	N	N	NA	N	Y	Y	Y	Y	Y	Y	Y
Muchiri <i>et al.</i> , 2015 ⁹⁰	N	Y	U	N	NA	Y	Y	Y	Y	Y	Y	Y	Y
Peragallo <i>et al.</i> , 2012 ⁸⁰	Y	Y	Y	U	NA	N	Y	Y	Y	Y	Y	Y	Y
Phelan <i>et al.</i> , 2017 ⁷³	Y	Y	Y	U	NA	Y	Y	Y	Y	Y	Y	Y	Y
Sadler <i>et al.</i> , 2011 ⁷¹	Y	Y	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y
Samuel-Hodge <i>et al.</i> , 2009 ⁷⁴	N	Y	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y
Stockwell <i>et al.</i> , 2014 ⁹¹	Y	U	Y	Y	NA	U	Y	N	Y	Y	Y	Y	Y
Tu <i>et al.</i> , 2016 ⁸¹	Y	Y	Y	U	NA	Y	Y	U	Y	Y	Y	Y	Y
Total %	84	73	69	48	-	52	100	79	100	100	73	100	100

Y = yes; N = no; U = unclear; NA = not applicable.

JB1 critical appraisal checklist for randomized controlled trials: Q1 = Was true randomization used for assignment of participants to treatment groups? Q2 = Was allocation to treatment groups concealed? Q3 = Were treatment groups similar at baseline? Q4 = Were participants blind to treatment assignment? Q5 = Were those delivering treatment blind to treatment assignment? Q6 = Were outcome assessors blind to treatment assignment? Q7 = Were treatment groups treated identically other than the intervention of interest? Q8 = Was follow-up complete, and if not, were strategies to address incomplete follow-up utilized? Q9 = Were participants analyzed in the groups to which they were randomized? Q10 = Were outcomes measured in the same way for treatment groups? Q11 = Were outcomes measured in a reliable way? Q12 = Was appropriate statistical analysis used? Q13 = Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?

Table 2: Critical appraisal results for quasi-experimental studies

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Park, 2011 ⁷²	Y	Y	Y	Y	Y	Y	Y	Y	Y
Yang <i>et al.</i> , 2016 ⁸²	Y	Y	Y	Y	Y	N	Y	Y	Y
Total %	100	100	100	100	100	50	100	100	100

Y = Yes, N = No.

JB1 critical appraisal checklist for quasi-experimental studies (non-randomized experimental studies): Q1 = Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)? Q2 = Were the participants included in any comparisons similar? Q3 = Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest? Q4 = Was there a control group? Q5 = Were there multiple measurements of the outcome both pre and post the intervention/exposure? Q6 = Was follow-up complete, and if not, was follow-up adequately reported and strategies to deal with loss to follow-up employed? Q7 = Were the outcomes of participants included in any comparisons measured in the same way? Q8 = Were outcomes measured in a reliable way? Q9 = Was appropriate statistical analysis used?

Inclusion criteria were both based on ethnic minority and low income status of participants in four studies,^{78,81,83,85} on ethnic minority and low socioeconomic status in one study,⁷⁵ on rural place of residence and ethnic minority in one study,⁸⁷ on low educational attainment combined with old age in one study,⁷² on low income combined with old age in one study,⁸² and on rural place of residence associated with low income and ethnic minority in one study.⁸⁸ In addition the socioeconomically disadvantaged status, all studies included participants with health disparities: disparities in morbidity, mortality rates, burden of illness, risk factors and other health-related outcomes in 19 studies,^{71-78,80-90} disparities in access and use of health care services in three studies,^{79,81,90} disparities in health behaviors in two studies,^{82,89} and disparities in access to health information in one study.⁷⁹

Among the included studies, sample sizes ranged from 82⁹⁰ to 1153 participants.⁹¹ The number of participants included in the EGs ranged from 41^{86,90} to 576,⁹¹ and from 41⁹⁰ to 577⁹¹ in the CGs. The mean age of the participants ranged from 26.1⁷⁷ to 72.64⁸² years in the EGs, and from 26.9⁷⁷ to 72.11⁸² years in the CGs. Three studies expressed age of participants in categories.^{72,81,91}

Among the 12 studies that included both men and women,^{72,74-76,81-83,85,86,88-90} 10 studies included more women than men.^{72,74,75,81-83,85,88-90} Conversely, two studies included more men than women.^{76,86} Eight studies included only female participants,^{71,73,77,78,80,84,87,91} and one study only males.⁷⁹

Six studies^{75-77,79,81,89} recruited participants from various clinical settings such as pre-natal practices,⁷⁷ internal medicine practices,⁷⁶ primary care clinics^{75,79,81} and safety net clinics.⁸⁹ Fifteen studies^{71-74,78,80,82-88,90,91} recruited participants from community settings, including community health centers,^{73,82,85,87,88,90,91} community organizations,^{72,78,80,82,84} churches,^{74,78,80,83,86,87} grocery stores,^{82,86} laundromats,^{78,82} supermarkets,⁸⁰ beauty salons,⁷¹ ethnic media,⁸⁶ and programs providing services to low-income populations.⁸⁴

Eighteen studies were conducted in the United States of America (USA),^{71,73-81,83-89,91} two in South Korea,^{72,82} and one in South Africa.⁹⁰

Interventions

The included interventions addressed health issues in the three domains of the health continuum. For the health care domain, health topics addressed included diabetes control and/or self-management,^{74,76,83,85,86,90} medication adherence,^{75,88,89} and safe medication use.⁷² For the disease prevention domain, health issues included cardiovascular risks reduction,⁸² human immunodeficiency viruses (HIV) risk reduction,⁸⁰ breast cancer screening,⁷¹ colorectal cancer (CRC) and fecal occult blood testing (FOBT) screening,⁸¹ prostate cancer screening,⁷⁹ and promotion of influenza vaccination during pregnancy.⁹¹ For the health promotion domain, health topics included healthy lifestyle behaviors^{78,84,87} such as healthy eating and physical activity, nutrition and physical activity during pregnancy,⁷⁷ and weight loss in the postpartum period.⁷³

The length of intervention ranged from less than one hour^{77,79} (intervention in which participants received a handout or a unique session with a computer program just before the appointment with the doctor) to 12 months.^{73,74,87} The duration of the intervention was unclear or unspecified in five studies.^{71,75,81,88,89} The length of follow-up varied from a post-intervention assessment taking place immediately after treatment^{72-74,79,82,84,86,87} to 12 months post intervention.⁷⁵

The intervention was conducted individually in 12 studies,^{75-77,79,81,82,84,85,87-89,91} in a group format in four studies,^{72,80,83,90} and in combination in five studies.^{71,73,74,78,86}

Eleven studies were delivered at the individual level,^{72,73,75,76,81,82,84,85,88-90} four were delivered both at the individual and interpersonal level,^{77,79,80,91} five at both the individual and community level,^{71,74,78,83,87} and one at the individual, interpersonal and community level.⁸⁶ No study was delivered at the societal level. Five interventions used a single strategy,^{75,76,79,89,91} and 16 studies were complex interventions with multiple components.^{71-74,77,78,80-88,90}

One intervention⁸⁶ was exclusively delivered by health professionals. Five interventions were delivered by trained members of the community.^{71,78,80,83,87} One intervention⁹⁰ combined both health professionals and a lay interventionist (horticulture officer). Two interventions^{77,84} were computer-based, and one⁹¹ used text messages to

deliver health information to participants. Four interventions used printed information.^{75,76,79,89} The remaining seven studies^{72-74,81,82,85,88} used a combination of both interventionists (professional or lay) and educational materials to deliver the intervention.

Comparison

Among the 21 studies included in this review, 16 had two arms, four studies had three arms,^{72,76,79,84} and one study had four arms.⁷⁵ Eleven of the included studies had an active CG,^{71,73,74,78,79,83-85,87,88,90} and 10 had a passive CG.^{72,75-77,80-82,86,89,91} Active CG conditions included a minimal intervention in four studies,^{73,74,83,90} and an alternative intervention in seven studies.^{71,78,79,84,85,87,88} Passive CG conditions included standard or usual care in seven studies,^{75-77,81,82,89,91} no intervention in one study,⁷² and a delayed intervention in two studies.^{80,86}

Outcomes

For primary outcomes, measures and measurement tools used to assess outcomes varied across studies. Primary outcomes were classified into three categories: health-related quality of life, health-related outcomes and health behaviors. Among the included studies, none addressed access and use of healthcare services outcomes.

Health-related quality of life: Only one study⁸⁶ assessed health-related quality of life using the Diabetes Quality of Life Measure.⁹²

Health-related outcomes: Health-related outcomes as assessed in the studies included a variety of clinical outcomes, and only a few patient-reported outcomes. Clinical outcomes included HbA1c in seven studies,^{74,76,83,85-87,90} fasting blood glucose in three studies,^{78,82,86} total cholesterol in three studies,^{78,82,90} low-density lipoprotein (LDL) cholesterol in four studies,^{78,83,86,90} high-density lipoprotein (HDL) cholesterol in three studies,^{78,86,90} triglycerides in three studies,^{78,86,90} systolic and diastolic blood pressure in seven studies,^{74,78,82,83,86,87,90} waist circumference in three studies,^{73,78,83} weight assessed in different ways according to the context of the study,^{73,74,77,78,87} body mass index (BMI) in four studies,^{78,82,86,90} and chlamydia infection in one study.⁸⁰ Patient-reported outcomes included the diabetes-related health status⁹³ in one study,⁷⁴ the general health status

assessed via the MOS 36-Item Short-Form Health Survey (SF-36)⁹⁴ in one study,⁷⁴ and depression assessed via the 10-item Center for Epidemiologic Studies Depression Scale⁹⁵ in one study⁸⁰ and the Kim Depression Scale for Korean Americans⁹⁶ in another study.⁸⁶

Health behaviors: Outcomes related to health behaviors included:

- i) Healthy lifestyles, including healthy eating behaviors and physical activity outcomes. Healthy eating behaviors were assessed in two studies^{73,84} using the National Cancer Institute Automated Self-Administered 24-Hour dietary assessment tool,⁹⁷ or a 24-hour recall of number of fruits, vegetables and juices consumed. Physical activity levels were assessed in three studies^{73,74,78} using accelerometers.
- ii) Medication adherence, assessed in five studies^{75,85,87-89} using various measurement tools, including pill count,⁸⁸ the Morisky Medication Adherence Scale⁹⁸ in two studies,^{85,87} the Cumulative Medication Gap⁹⁹ in one study,⁷⁵ and the Adherence to Refills and Medications Scale¹⁰⁰ in one study.⁸⁹
- iii) Diabetes-related self-efficacy, assessed using the Diabetes Care Self-Efficacy Scale¹⁰¹ in three studies.^{85,87} and the Chronic Disease Self-Efficacy scale¹⁰¹ in one study.⁸⁶
- iv) Self-efficacy related to medication: assessed in one study⁷² using the Self-Efficacy for Appropriate Medication Use Scale.¹⁰²
- v) Preventive health practices, including condom use assessed in one study,⁸⁰ adherence to mammography screening guidelines in one study,⁷¹ receipt of influenza vaccination in one study,⁹¹ FOBT screening in one study,⁸¹ and prostate-specific antigen (PSA) test ordered and digital rectal examination in one study.⁷⁵

Secondary outcomes were classified into five categories:

Knowledge and understanding: Diabetes knowledge was assessed in three studies^{74,83,86} using the Diabetes Knowledge Questionnaire,¹⁰³ the Diabetes Knowledge Test,¹⁰⁴ and the Diabetes Knowledge Scale.¹⁰⁵

Skills acquisition: Empowerment was assessed in two studies^{74,87} using the Diabetes Empowerment Scale Short Form;¹⁰⁶ and diabetes self-care was assessed in two studies^{86,87} using the Summary of Diabetes Self-Care Activities measure.¹⁰⁷

Decision-making: Decision-making was assessed in one study⁸⁵ using the Anti-hyperglycemic Medication Decisional Conflict Scale.¹⁰⁸

Communication: Communication of health information with a healthcare provider was assessed in one study⁷⁹ in terms of frequency of discussion about prostate cancer with the doctor during the medical visit, and communication of health information and negotiation of safe sexual practices with the partner was assessed in one study⁸⁰ using the Communication with Partner scale.¹⁰⁹

Attitudes and beliefs: Perceived barriers to condom use were assessed in one study.⁸⁰

Review findings

The possibility of a meta-analysis based on two studies^{75,89} and pooling 640 participants was considered, but due to heterogeneity of the interventions, different follow-up times and differences in the ways the outcomes were measured in the two studies, a meta-analysis was not feasible. A narrative review of the findings of 21 studies was more appropriate.

In a first stage, studies included in the review were classified according to the HL competency addressed. None of the studies addressed the competency to *access* health information, i.e. interventions that assist socioeconomically disadvantaged people to develop their ability to seek, find and obtain reliable health information,³ or to make reliable health information available to socioeconomically disadvantaged people by creating HL-friendly settings using multiple channels and dissemination strategies.¹¹⁰ Likewise, none of the studies addressed the competency to *appraise* health information, i.e. interventions that assist socioeconomically disadvantaged people to evaluate the quality and credibility of health information and to develop their critical-thinking skills.^{3,111} Three studies addressed the competency to *understand* health information.^{75,76,89} They included interventions that assist socioeconomically disadvantaged people to develop their ability to comprehend health information³ by simplifying and improving health information materials (e.g. use of plain language, simple text, illustrations, pictographs, icons, meaningful formats and targeted information; development of easy-to-read and easy-to-use materials). Eighteen studies addressed the competency to *apply* health information.^{71-74,77-88,90,91} These interventions were

designed to: i) assist socioeconomically disadvantaged people to develop their ability to communicate, share, negotiate and use health information to make informed and appropriate decisions around specific health behaviors³ (e.g. improve or enhance the communication of health information as well as the decision-making, goal setting and problem-solving skills of socioeconomically disadvantaged people); and/or ii) assist socioeconomically disadvantaged people to develop their ability to act upon health information, to engage in appropriate health actions (positive health behaviors) and implement informed health decision-making by helping them to build, develop or improve specific skills such as self-monitoring, self-management, self-care, copings and self-efficacy. Within these HL competencies, interventions were then, in a second stage, grouped according to the three domains of the health continuum (health care, disease prevention and health promotion) and the health topic addressed. Finally, in the third stage, interventions were classified according to their theoretical foundations. Six studies did not specify a theoretical foundation.^{75,77,79,81,89,91} Theoretical underpinnings of the interventions were described in 15 studies^{71-74,76,78,80,82-88,90} and included the Social Cognitive Theory,¹¹²⁻¹¹⁵ Transtheoretical Model of Behavior Change,¹¹⁶⁻¹¹⁸ Health Belief Model,^{119,120} Community-based Participatory Research principles,^{121,122} Self-determination Theory,¹²³ Knowledge Attitude Behavior Model,¹²⁴ Freirian pedagogy,¹²⁵ Adult Learning Theory¹²⁶ and Small Changes model of behavior change.^{127,128}

A combination of various theoretical backgrounds was used in eight studies.^{71,74,76,80,82,83,88,90}

Within the included studies, a wide variety of operational components, that is, tools and techniques used to develop HL skills, were found. They included adaptation to the cultural setting and/or level of literacy,^{71-76,78,80,81,83,85-90} assessment of preferences and subsequent tailoring,^{73,74,77, 78,80, 82,84-88,90} skills training,^{72,74,77,78,80,82-88,90} goal setting,^{74,78,82-85,87,88,90} individual or group discussions,^{72-74,78,80-82,85-87,90} and group activities (such as role play).^{78,80} In the same manner, a wide range of HL materials, that is, specific tools or medium used to disseminate health information, were used within the interventions. They included print-based materials (such as handouts, booklets and brochures),^{71,72,74-76,78,79,81,82,84,85,87-90} interactive multimedia computer

programs,^{73,77,84,85,88} videos,^{73,78,80,81,88} text messages,⁹¹ and increasing awareness of community resources.^{74,83,87}

The HL competency and domain of the health continuum addressed, theoretical foundations used, as well as mode of delivery, intervention's operational components and HL materials

delivered for each included intervention are provided in Table 3. A full description of the studies, a summary of the significant findings for primary and secondary outcomes, as well as the tools used to assess them are shown in Appendix III. Only parametric results of the comparison of outcomes at post-test were reported.

Table 3: Health literacy competency addressed, health continuum domain, theoretical foundations and components of included interventions

HL competency	Health continuum domain and health topic	Theoretical foundations	Study	Mode of delivery, intervention's operational components and HL materials used
Understand	Health care: Medication adherence	Atheoretical	Kripalani <i>et al.</i> , 2012 ⁷⁵	Mode of delivery: Single strategy: Individual printed-based intervention: illustrated medication schedule in a grid format Intervention's operational components: No detail provided HL materials: Plain language, color illustrations, icons
			Mohan <i>et al.</i> , 2014 ⁸⁹	Mode of delivery: Single strategy: Individual printed-based intervention: illustrated medication schedule in a grid format Intervention's operational components: No detail provided HL materials: Plain language, color illustrations, icons, pictures
	Health care: Diabetes control and self-management	SCT (self-efficacy) ¹¹²⁻¹¹⁵ + HBM ^{119,120}	Gopalan <i>et al.</i> , 2013 ⁷⁶	Mode of delivery: Single strategy: Individual printed-based information about diabetes control (diabetes report cards) Intervention's operational components: No detail provided HL materials: Meaningful communication formats
Apply	Health care: Medication adherence	SCT ¹¹²⁻¹¹⁵ + TTM ¹¹⁶⁻¹¹⁸	Martin <i>et al.</i> , 2011 ⁸⁸	Mode of delivery: Complex strategy: 4 individual face-to-face sessions with a CHA using a multimedia computer-based program about hypertension medication adherence (CHA = liaison between the computer and the participant) + 4 follow-up phone contacts Intervention's operational components: Culturally appropriate intervention, tailoring, goal setting, skills training (self-monitoring) HL materials: Interactive multimedia computer program, low literacy videos and handouts, use of narratives
	Health care: Safe medication use	SCT (Self-efficacy) ¹¹²⁻¹¹⁵	Park, 2011 ⁷²	Mode of delivery: Complex strategy: 3 weekly 40-min group educational sessions (face-to-face) about safe medication, led by a nurse Intervention's operational components: Skills training (reading labels, calculating dosage, keeping a medication log), group discussions HL materials: Pictorial guide map, use of symbolic images, information booklet

Table 3: (Continued)

HL competency	Health continuum domain and health topic	Theoretical foundations	Study	Mode of delivery, intervention's operational components and HL materials used
	Health care: Diabetes control and self-management	SCT ¹¹²⁻¹¹⁵ + TTM (Stages of Change Model) ¹¹⁶⁻¹¹⁸ + adult learning theory ¹²⁶	Samuel-Hodge <i>et al.</i> , 2009 ⁷⁴	Mode of delivery: Complex strategy: One 60-min individual face-to-face counselling visit with a dietitian + 12 bi-weekly face-to-face group sessions about diabetes led by a dietitian and a church diabetes advisor or a health professional from the local community + one monthly phone contact with the church diabetes advisor Intervention's operational components: Culturally appropriate intervention, tailoring, goal setting, skills training (self-monitoring, planning meals, problem-solving), group discussions, small-group activities, game format HL materials: Visual and hands-on activities, awareness of community resources, printed postcard messages
		SCT ¹¹²⁻¹¹⁵ + HBM ^{119,120} + The Knowledge Attitude Behaviour model ¹²⁴	Muchiri <i>et al.</i> , 2015 ⁹⁰	Mode of delivery: Complex strategy: 8 2-hr weekly face-to-face education group sessions about diabetes and nutrition, led by a dietitian and a nutrition and food science university student + follow-up sessions + vegetable gardening with a horticulture officer Intervention's operational components: Culturally appropriate intervention, tailoring, group goal setting, skills training, group discussions HL materials: Educational materials (pamphlets and posters)
		SCT (self-efficacy theory) ¹¹²⁻¹¹⁵	Kim <i>et al.</i> , 2009 ⁸⁶	Mode of delivery: Complex strategy: 6 weekly face-to-face psycho-behavioral education sessions in groups led by a nurse and a nutritionist + monthly phone counselling Intervention's operational components: Culturally appropriate intervention, tailoring, skills training (self-monitoring, self-care, food labels reading, communication skills, problem-solving), individual discussions HL materials: No detail provided
		CBPR principles ^{121,122}	Heisler <i>et al.</i> , 2014 ⁸⁵	Mode of delivery: Complex strategy: One individual face-to-face 2-hr session with a CHW + web-based diabetes medication decision aid on tablet computer + 2 phone calls Intervention's operational components: Tailoring, motivational interviewing, goal setting, individual discussions HL materials: Interactive web-based decision aid program, use of graphical styles, pictographs and animations suited adapted to people with low literacy; printed educational booklets
		CBPR principles ^{121,122} + the self-determination theory ¹²³	Baig <i>et al.</i> , 2015 ⁸³	Mode of delivery: Complex strategy: 8 weekly 90-min group sessions (face-to-face) led by trained peer lay leaders with diabetes, or with a family member with diabetes Intervention's operational components: Motivational interviewing, goal setting, skills training (problem-solving) HL materials: Photovoice exercises (use of photographs and storytelling), awareness of community resources

Table 3: (Continued)

HL competency	Health continuum domain and health topic	Theoretical foundations	Study	Mode of delivery, intervention's operational components and HL materials used
	Disease prevention: Risk reduction	SCT (self-efficacy) ¹¹²⁻¹¹⁵	Yang <i>et al.</i> , 2016 ⁸²	Mode of delivery: Complex strategy: 8 40-min individual face-to-face sessions (home visits) by a nurse to promote healthy lifestyles + 4 10-min phone calls Intervention's operational components: Tailoring, goal setting, skills training (self-monitoring), individual discussions HL materials: Educational brochures
		SCT ¹¹²⁻¹¹⁵ + Freire's pedagogy ¹²⁵	Peragallo <i>et al.</i> , 2012 ⁸⁰	Mode of delivery: Complex strategy: 5 2-hr face-to-face educational sessions in groups about HIV risk reduction, led by Hispanic female facilitators + one booster sessions at 6-month follow-up Intervention's operational components: Culturally-adapted intervention, tailoring, skills training (activities promoting self-efficacy, condom use), group discussions HL materials: Videos
	Disease prevention: Risk message - promotion of influenza vaccination during pregnancy	Atheoretical	Stockwell <i>et al.</i> , 2014 ⁹¹	Mode of delivery: Single strategy: Individual text-based intervention: 5 weekly educational text messages about influenza vaccination Intervention's operational components: Group-specific appropriate intervention HL materials: Text messages written at a 4 th grade level
	Disease prevention: Risk message - screening	Atheoretical	Tu <i>et al.</i> , 2006 ⁸¹	Mode of delivery: Complex strategy: One individual face-to-face educational session about CRC screening, led by a health educator + FOBT instruction sheet and FOBT kit Intervention's operational components: Culturally appropriate intervention, individual discussions HL materials: Motivational video on CRC screening, motivational and informational pamphlet
			Kripalani <i>et al.</i> , 2007 ⁷⁹	Mode of delivery: Single strategy: Individual printed-based intervention: handouts about prostate cancer Intervention's operational components: No detail provided HL materials: Handouts with simple text, written at a 6 th grade reading level, large characters, color illustrations, focus on the most important information
		CBPR principles ^{121,122} + HBM ^{119,120}	Sadler <i>et al.</i> , 2011 ⁷¹	Mode of delivery: Complex strategy: Individual face-to-face discussions and group discussions about breast cancer screening with cosmetologists and other clients in a beauty salon (HL friendly environment) Intervention's operational components: Culturally appropriate intervention, individual and group discussions HL materials: Enlarged articles from lay newspapers and magazines, binders of information, posters, brochures, hands-on, storytelling

Table 3: (Continued)

HL competency	Health continuum domain and health topic	Theoretical foundations	Study	Mode of delivery, intervention's operational components and HL materials used
	Health promotion: Healthy lifestyle behaviors	TTM ¹¹⁶⁻¹¹⁸ (stages of readiness for change)	Block <i>et al.</i> , 2004 ⁸⁴	Mode of delivery: Complex strategy: Individual computer-based intervention: one-time experience with a CD-ROM during 15 to 20 minutes + phone calls Intervention's operational components: Tailoring, goal setting HL materials: Interactive CD-ROM, handouts and educational materials
		The Small Changes model of behavior change ¹²⁷⁻¹³¹	Lutes <i>et al.</i> , 2017 ⁸⁷	Mode of delivery: Complex strategy: Individual phone sessions: 16 20-30-min lifestyle coaching sessions with a CHW Intervention's operational components: Culturally appropriate intervention, tailoring, motivational interviewing, goal setting, skills training (coping, self-monitoring, problem-solving), individual discussions HL materials: Educational manual, awareness of community resources
		CBPR principles ^{121,122}	Koniak-Griffin <i>et al.</i> , 2015 ⁷⁸	Mode of delivery: Complex strategy: 8 face-to-face group education sessions led by promotoras (CHWs) + 8 individual teaching and coaching sessions (4 face-to-face sessions and 4 phone calls sessions) + physical activity DVD + culturally appropriate recipes Intervention's operational components: Culturally appropriate intervention, tailoring, goal setting, skills training (self-monitoring, problem-solving), individual and group discussions, role plays HL materials: Physical activity DVD, videos, low literacy culturally adapted brochures
	Health promotion: Healthy lifestyle behaviors during pregnancy	Atheoretical	Jackson <i>et al.</i> , 2011 ⁷⁷	Mode of delivery: Complex strategy: Individual computer-based intervention: one 10-15 min session with the multimedia interactive Video Doctor tool + educational worksheet Intervention's operational components: Motivational interviewing, tailored counselling HL materials: Multimedia interactive program, tailored educational messages
		SCT ¹¹²⁻¹¹⁵	Phelan <i>et al.</i> , 2017 ⁷³	Mode of delivery: Complex strategy: Individual internet-based weight loss program + face-to-face education sessions Intervention's operational components: Cultural adaptation, tailoring, individual and group discussions HL materials: Interactive multimedia program, videos, message board

CBPR = community-based participatory research; CHA = community health advisor; CHW = community health worker; CRC = colorectal cancer; FOBT = fecal occult blood testing; HBM = health belief model; HIV = human immunodeficiency virus; HL = health literacy; hrs = hours; min = minute(s); SCT = social cognitive theory; TTM = Transtheoretical Model of Behavior Change.

Interventions addressing the competency to understand health information in the Healthcare domain of the health continuum

***Effectiveness of an illustrated medication schedule for improving medication adherence*⁷⁵**

This RCT included 435 patients aged 18 years or over with coronary heart disease, mainly African Americans and with a low socioeconomic status (121 participants in EG₁, 102 in EG₂, 116 in EG₃, and 96 in the CG). Participants in EG₁ received: i) illustrated medication instructions (called the Universal Medication Schedule),¹³² consisting of a grid including textual, visual and illustrated information to make instructions more understandable and to take medicine correctly; and ii) a brief five-minute introduction to the tool from a pharmacist. Participants in EG₂ received mailed refill reminder postcards. Participants in EG₃ received both illustrated medication instructions and reminder postcards. Participants in the CG received usual care. Although participants in EG₃ and EG₂ had greater medication adherence (36.9% and 34.2%, respectively) than participants in the CG (28.3%), differences were not statistically significant at 12 months follow-up. This intervention offered a tool to facilitate the understanding of the medication treatment.

***Effectiveness of an illustrated medication schedule for improving medication adherence*⁸⁹**

This RCT included 200 Latino patients with diabetes, 99 participants in the EG and 101 in the CG. Participants in the EG received: i) an illustrated medication schedule (Universal Medication Schedule)¹³² in both Spanish and English, containing simplified and understandable medication instructions (using plain language, illustrations, pictures and icons); and ii) a brief two-minute introduction to the tool (using a video and a one-page sheet explaining how to use the tool). Participants in the CG received traditional prescription instructions. The results showed no significant differences between the groups in medication adherence at one-week follow-up. However, while the differences between the groups with regard to the overall understanding of medication and medication indications, medication strength, medication units and medication frequency were significant, these outcomes were assessed using a non-validated questionnaire in Spanish and were therefore not considered for this

systematic review. When evaluating the effectiveness of this type of education tool, medication understanding should be evaluated using validated questionnaires.

***Effectiveness of two different formats for communicating diabetes control*⁷⁶**

This RCT included 177 adult patients with poorly controlled diabetes, mainly African American women with low numeracy (58 in EG₁, 61 in EG₂ and 58 in the CG). The intervention provided participants with various meaningful formats to help them understand health information. Participants in EG₁ received feedback about their current glycemic control (HbA1c value) using diabetes report cards containing a letter grade system of evaluation, ranging from A to F. Participants in EG₂ received the same feedback but using faces expressing emotions (happiness, crying, etc.) to reflect the current HbA1c level. Participants in the CG received standard feedback about glycemic control (HbA1c level). Results showed no significant differences between groups in HbA1c levels at six months follow-up.

Combined findings

The competency of understanding health information in the Healthcare domain of the health continuum was addressed in three studies.^{75,76,89} In relation to the outcomes considered in this systematic review, none of these three interventions showed any effectiveness. Based on our findings, interventions that aim to improve the understanding of health information should: i) assess understanding skills directly (to be consistent with the purpose of the study), rather than hypothesize that a good understanding or comprehension of health information will lead to better health outcomes (in the three above mentioned studies which addressed the competency of understanding health information, there was too big a gap between understanding skills and the health outcomes measured); and ii) use validated measurement tools to assess understanding skills.

Interventions addressing the competency of applying health information in the Healthcare domain of the health continuum

***Effectiveness of a multimedia medication adherence intervention*⁸⁸**

This RCT included 434 rural low-income hypertensive adults, mainly African Americans (221 in the EG and 213 in the CG). In the EG, the intervention

included: i) four sessions of an adherence promotion program delivered by a community health advisor using a computer-based program. This computer program delivered tailored health information about hypertension, medication adherence and self-monitoring (using a cyber-nurse, a video doctor, tailored feedback, discussion points with the community health advisor, videos, narratives and goal setting); and ii) follow-up phone calls two weeks after each session to review and reinforce the goals set. Participants in the CG received a computer-based program delivering general information about cancer. At six months, the differences between both groups were not statistically significant, despite the greater proportion of adherent participants in the EG compared to the CG.

Effectiveness of a culturally relevant interactive pictorial education for safe medication use⁷²

This RCT included 136 Korean community dwelling older adults with a low educational level (45 in EG₁, 45 in EG₂, and 46 in the CG). Participants in EG₁ received three sessions of interactive pictorial education for safe medication delivered by a nurse, using a pictorial guide map with symbolic images and an information booklet. The intervention was informed by the self-efficacy theory¹¹³ and enabled participants to make healthy choices, initiate discussions about medication, read labels, calculate the dosage, and keep a medication log. Participants in EG₂ received conventional education about safe medication during three education sessions and received an information booklet. Participants in the CG received no intervention. At post-test, there was a significant improvement in self-efficacy in EG₁ and EG₂ compared to the CG ($P < 0.001$), with higher improvements in EG₁ than in EG₂ ($P < 0.05$). These results suggest that an educational intervention using written health information in combination with visual materials, visual cues and an active discussion with a healthcare provider to communicate health messages is more effective than text-based information alone. The combination of these different elements promoted the understanding and retention of information. Since post-test outcomes were assessed immediately after the intervention and only three weeks after baseline measurements, it is unclear if these results would have lasted over a longer period of time. Although self-efficacy is a proxy measure of the actual behavior, it is unclear if the participants effectively increased their capacity to use medication safely.

Effectiveness of a culturally appropriate, church-based diabetes self-management program⁷⁴

This RCT included 201 African Americans with type 2 diabetes (117 in the EG and 84 in the CG). Participants in the EG received a diabetes self-management intervention including an eight-month intensive phase followed by a four-month reinforcement phase. The intensive phase, led by a dietician and a church health advisor, included four components: i) one individual counselling session to assess dietary habits, psychological issues and barriers; ii) 12 group education sessions focusing on diabetes, nutrition, dietary behaviors and physical activity; iii) eight monthly phone contacts from a diabetes advisor; and iv) three postcard messages from the diabetes care provider. After this intensive phase, participants underwent a four-month reinforcement phase during which they received one monthly phone contact. Participants in the CG received a minimal intervention, including, by mail, two pamphlets on diabetes self-care, and three bimonthly newsletters with general health information and study updates. At eight months and just after the intensive phase, there was significant reduction in HbA1c levels in the EG compared to the CG ($P = 0.009$), as well as significant higher diabetes knowledge ($P = 0.003$) and significant improvement in diabetes-related mental well-being ($P = 0.004$). However, no significant differences were found between the groups at eight months follow-up for physical activity, systolic blood pressure, weight, SF-36 scores (physical and mental health components scores), and diabetes-related social well-being. At 12 months follow-up, just after the reinforcement phase, the significant differences that had been observed at eight months were no longer significant, except for diabetes-related mental well-being ($P = 0.02$). A culturally appropriate multicomponent educational and behavioral intervention for ethnic minorities with type 2 diabetes thus seemed effective for glycemic control, knowledge and diabetes-related mental well-being. However, due to the multiple educational and behavioral components of the intervention, it is unclear which of the element contributed (the most) to the effectiveness of the intervention.

Effects of a nutrition education program on Hb1Ac and other diabetes-related outcomes⁹⁰

This RCT included 82 African adults with a low socio-economic status and with type 2 diabetes (41

in the EG and 41 in the CG). Participants in the EG received a nutrition education program which consisted of: i) eight group education sessions about diabetes and nutrition; ii) six follow-up sessions; iii) a demonstration of vegetable gardening; and iv) educational materials (pamphlets and posters). During sessions, participants were asked to set group goals. Participants in the CG received the educational materials only, in addition to their usual care. No differences in HbA1c, BMI, total cholesterol, LDL-cholesterol, HDL-cholesterol, triglycerides and blood pressure were found between groups at post-test (six months) or at 12 months follow-up.

Effects of a community-based self-help intervention program on type 2 diabetes⁸⁶

This RCT included 83 Korean American immigrants with type 2 diabetes and an uncontrolled glucose level (41 in the EG and 42 in the CG). Participants in the EG received a culturally tailored behavioral intervention program including: i) six weekly educational sessions offered by bilingual nurses, focusing on type 2 diabetes and diabetes management guidelines, glucose and blood pressure self-monitoring, problem solving and communication skills; and ii) monthly telephone counseling by a nurse for five months including reinforcement of knowledge, discussion of barriers to self-management, and problem-solving. Participants in the CG received a delayed intervention. At post-test, compared to the CG, the EG demonstrated a significant reduction in HbA1c levels ($P=0.01$), significantly lower levels of triglycerides ($P=0.00$), and significant improvements in diabetes knowledge ($P=0.00$), self-care activities ($P=0.00$), self-efficacy ($P=0.01$), and quality of life ($P=0.03$). No significant differences between the groups were found for fasting blood glucose (FBG), BMI, blood pressure, HDL, LDL and depression scores. These findings indicate that a culturally tailored intervention focusing on self-efficacy and self-care may improve healthy choices among immigrants with diabetes type 2.

Effectiveness of an interactive e-Health diabetes medication decision aid⁸⁵

This RCT included 188 low income Latinos and African Americans with diabetes and low HL, 93 in the EG and 95 in the CG. Participants in the EG received one two-hour session led by a community health worker (CHW), during which a diabetes medication decision aid was delivered via tablet

computers. The tablet program, called iDecide (or iDecido in Spanish), provided participants with tailored health information about diabetes, complications and medication. With the help of the CHW, the participants were invited to navigate the program, set goals and develop action plans related to diabetes medication. In addition, they received two printed educational booklets and two follow-up phone calls at three and six weeks to discuss the action plan. The intervention enabled participants to proactively engage with the health information received, improve their communication with their health care provider, and negotiate and make informed decisions. Participants in the CG received one session with the CHW, the same evidence-based information using print consumer booklets^{133,134} but without tailoring and goal setting, and also two follow-up phone calls. In the two groups, discussions with the CHW were based on motivational interviewing principles. At three months, there were significant improvements in diabetes care self-efficacy in the EG compared to the CG ($p=0.05$). However, no significant differences between groups were found in medication decisional conflict, medication adherence and HbA1c values. Both groups showed significant within-group improvements for all the outcomes, which raises the question of the importance of the modality being used to deliver health information and the intervention. Indeed, the improved diabetes outcomes, irrespective of whether the information was delivered through an interactive tool or by traditional printed education materials, suggest that the motivational interviewing component delivered by CHWs, a common ingredient in both groups, was effective. It is also noted that the only difference found between the groups was in self-efficacy, and not in health-related outcomes. Perhaps there should have been a longer duration between measuring self-efficacy and measuring health-related outcomes, to allow participants the time to implement their strategies.

Effectiveness of a church-based self-management intervention among Latinos with diabetes⁸³

This RCT included 100 low-income Mexican American adults with diabetes, 50 in the EG and 50 in the CG. Participants in the EG received a multicomponent and tailored diabetes self-management education intervention delivered by lay leaders including: eight group sessions providing

information about diabetes, nutrition and physical activity, and addressing goal setting, problem solving, anticipating obstacles, exploring behavioral alternatives and stimulus control. Participants in the CG received enhanced usual care, including one diabetes lecture on diabetes self-management by a health educator. At six months follow-up, there was no significant difference between the EG and the CG with regard to HbA1c levels, LDL, blood pressure, waist circumference, diabetes self-empowerment or diabetes knowledge.

Combined findings

Within the competency of applying health information, the Healthcare domain of the health continuum was addressed in five studies on diabetes self-management^{74,83,85,86,90} and two on medication adherence or safe medication use.^{72,88} On outcomes, a large number of outcomes was explored and mixed results were found. Congruent with the Healthcare domain of the health continuum, outcomes most frequently assessed were clinical outcomes (e.g. HbA1c, blood pressure). Outcomes related to health behaviors were less explored.

For effective interventions, the common component was a person-centered approach including motivational interviewing and tailoring. Active discussions with healthcare providers or lay interventionists seemed to be an important component for mobilizing health information, developing HL skills and adopting healthy behaviors. The cultural appropriateness of the interventions, as well as skills training (such as self-monitoring, and self-care) also appeared to be preferred components for achieving effectiveness. In addition, to facilitate access to health information, interventions should take contextual realities into account and must address structural barriers such as location. Finally, using CHWs might have been beneficial as long as they received sufficient instruction and training to deliver the content of the intervention appropriately and effectively.

Interventions addressing the competency of applying health information in the Disease Prevention domain of the health continuum

Descriptive summary of interventions

*Effectiveness of a cardiovascular disease prevention program*⁸²

This RCT included 88 low-income community-dwelling elderly people, aged 65 years or over with

hypertension, 42 in the EG and 46 in the CG. Participants in the EG received a home cardiovascular disease prevention program led by nurses, including: i) eight home sessions during which the nurse assessed the participants' cardiovascular risks, gave feedback, gave oral and written information about hypertension and healthy lifestyles, and encouraged them to set goals and develop an action plan to follow healthy lifestyles; and ii) four follow-up phone calls. Participants in the CG received usual care. At post-test, there were no significant differences between the groups for any of the outcomes, excepted diastolic blood pressure ($p = 0.018$).

*Effectiveness of a HIV risk reduction intervention*⁸⁰

This RCT included 548 community-dwelling adult Hispanic women reporting sexual activity in the three months prior to the study (274 in the EG and 274 in the CG). Participants in the EG received a culturally specific peer group intervention including: i) five group sessions addressing HIV risk reduction topics (sexually transmitted infections, prevention, communication and negotiation with the partner, partner violence and substance use) by means of PowerPoint presentations, skills demonstrations and exercises, role play, videos and discussions; and ii) one booster session. Participants in the CG received a condensed delayed intervention (one session) 12 months later. At six months, no significant differences were found between both groups with regard to the outcomes. At 12 months, there was a significant difference between groups in condom use, with a higher proportion of participants in the EG reporting condom use than in the CG ($P = 0.01$). The cultural adaptation of the intervention, as well as the participatory approach used, were strengths of this intervention. The participatory approach enabled the participants to collect information, appraise it and make positive health choices, as shown by the significant positive long-term results in condom use. The increased proportion of participants using condoms in the long term may have reflected an improvement in critical thinking skills and the ability to assess risks over time.

*Effectiveness of influenza vaccine text message reminders*⁹¹

This RCT included 1153 low-income women initiating prenatal care, 576 of whom participated in the EG and 577 in the CG. Participants in the EG received health information and health education

about influenza during pregnancy through five weekly text messages. The text messages covered various topics such as risk of influenza for the pregnant woman and fetus, vaccine safety and vaccine recommendations. Participants in the CG received usual care. At four months follow-up, there was a higher rate of vaccination in the EG than in the CG ($P = 0.048$). Text messages are a simple, convenient and cost-effective tool to send specific health information to a large number of people simultaneously.²¹ Hence, text messages can be an effective tool for delivering health information and encouraging the adoption of positive health behaviors within a population with limited access to health information.

Effectiveness of a health education intervention for promoting colorectal cancer screening⁸¹

This RCT included 210 low income Chinese Americans aged 50 to 78 years, 105 in the EG and 105 in the CG. Participants in the EG received a culturally-adapted education program promoting FOBT screening from a bicultural Chinese American health educator just before or after a medical visit, according to the patient's preference. Participants viewed a motivational video about CRC screening and received printed educational pamphlets, and a FOBT kit. Participants in the CG received usual care. At six months follow-up, the incidence of FOBT screening were higher in the EG compared to the CG (OR = 5.98, 95% CI = 3.29-10.85), suggesting that a linguistically appropriate education intervention delivered by a health educator and including educational video and print materials was effective for improving CRC screening among ethnic minorities. The cultural adaptation of health information and educational materials, as well as the delivery of the intervention by a health educator from an ethnic minority, may also have contributed to the effectiveness of the intervention. Another key component which probably increased the effectiveness of the intervention was that participants were provided with a tool to implement the health decision (in this case, the FOBT kit).

Effectiveness of a low-literacy intervention for promoting discussion of prostate cancer⁷⁹

This RCT included 250 men, mainly African Americans, aged 45 to 70 years (86 in EG₁, 83 in EG₂, and 81 in the CG). Participants in EG₁ received a colored two-sided high-detail patient education handout, including information about prostate

cancer screening and other related prostate cancer issues in the waiting room before the medical visit. This handout encouraged participants to ask the doctor for more information as a concluding message. This high-detail handout followed the recommendations for the development of low-literacy educational materials and was written with large characters, at a 6th grade reading level, with simple text, illustrations and highlighting the most important information. Also in the waiting room before the medical visit, participants in EG₂ received a one-sided low-detail handout about prostate cancer, with the statement "Ask your doctor about prostate cancer today!" (with the word "today" highlighted). This handout simply encouraged them to talk the doctor about prostate cancer, without any information about screening. This low-detail handout was written at a 5th grade reading level. Participants in the CG received a handout showing a food pyramid. At post-test, the frequency of discussions about prostate cancer with the doctor was significantly higher in EG₂ than in the CG ($p = 0.008$). No significant differences in communication were found between EG₁ and the CG. In addition, rate of PSA tests ordered was also significantly higher in EG₁ ($p = 0.02$) and EG₂ ($p = 0.03$) than in the CG, with higher rates in EG₁ than in EG₂. No significant differences were found between the groups for DRE. As pointed out by the authors, the results of this study suggested that handouts that were too long and containing too much information were not useful and did not allow immediate assimilation of the essential message. Conversely, a simple handout containing a clear, short and unique messages was an effective way to empower people to discuss preventive health topics with their healthcare provider.¹⁷ The illustrations included in the handout, which allowed a clear and easy association of the population with the health message, may also have contributed to its effectiveness. Moreover, the positive results could also be explained by the fact that the risk message called for a unique behavior.

Effectiveness of a community-based breast cancer screening promotion program delivered by cosmetologists⁷¹

This RCT included 984 African American women, 481 in the EG and 503 in the CG. Participants in the EG received The Black Cosmetologists Promoting Health Program delivered in beauty salons. Participants were placed in a HL-friendly

environment. Cosmetologists initiated proactive discussions with their clients about the importance of early breast cancer detection and adherence to breast cancer screening guidelines using various techniques (e.g. storytelling) and educational materials (e.g. articles from lay newspapers and magazines, binders containing health information about breast cancer, breast cancer model, posters and brochures). The intervention provided participants with culturally appropriate health information regarding breast cancer screening and enabled them to make informed health choices. Participants in the CG received an equivalent training program about diabetes. Outcomes were assessed in the subgroup of participants aged 40 years and over, including 232 participants (112 in the EG and 120 in the CG). At six months follow-up, the odds of adhering to mammography screening were 2.0 times higher in participants in the EG than participants in the CG ($P < 0.01$). Creating a HL-friendly environment seemed to be an effective strategy to disseminate health information about a specific health topic in a population with limited access and low exposure to health information. Several other factors may also have contributed to the effectiveness of the intervention, including the community-based participatory approach, the place-based strategy that was used to reach people and deliver health messages (information delivered locally and in a familiar place), the use of lay interventionists, and the delivery of culturally appropriate health information.

Combined findings

Within the competency of applying health information, the Disease Prevention domain of the health continuum was addressed in two studies on risk reduction^{80,82} and in four studies on risk messages.^{71,79,81,91} On outcomes, a large number of outcomes were again explored. Mostly, HL interventions in the Disease Prevention domain of the health continuum were effective for improving preventive health behaviors and practices such as vaccination and screenings. On risk reduction, a participatory approach and congruent application of the theoretical foundations seem to lead to effectiveness. Regarding risk messages, effective strategies for implementing education in deprived communities are to deliver simple, short, targeted health messages focusing on only one specific action

at a time, with essential health information easily and clearly understood. Creating HL-friendly settings, providing the tools or means to implement the health decision, and cultural appropriateness of the intervention are also components that can contribute to effectiveness.

Interventions addressing the competency of applying health information in the health promotion domain of the health continuum

*Effectiveness of a computer-based CD-ROM nutrition behavior-change program*⁸⁴

This RCT included 481 low-income participants aged 40 to 65 years (162 in EG₁, 160 in EG₂, and 159 in the CG). Participants in EG₁ received: i) a 15- to 20-minute long computer-based CD-ROM nutrition education session, with different modules delivering tailored interactive nutritional information and tips to increase fruit and vegetable consumption; the participants had to choose goals to increase consumption as suggested by the program; ii) handouts and educational materials to take home, and iii) two reminder phone calls after two months. Participants in EG₂ received the same computer-based intervention, but without the two reminder phone calls. Participants in the CG received a 15- to 20-minute long computer-based stress management CR-ROM program. At post-test, a significant higher intake of fruit and vegetables was noted for EG₁ compared to the CG ($P = 0.016$). A subgroup analysis by educational levels revealed that participants from EG₁ with a low education level (high school or less) showed a greater increase of fruit and vegetable intake than those from the CG ($P = 0.01$). This suggests that an interactive computer program with tailoring and goal setting is an effective way to increase fruit and vegetable intake among a low-income population. However, due to the multi-component design of the intervention, it is difficult to determine which component was the most effective (the interactive aspect of the program, tailored feedback and health messages, goal setting or educational printed materials).

*Effectiveness of a lifestyle intervention for improving diabetes outcomes*⁸⁷

This RCT included 200 rural adult African American women with type 2 diabetes (100 in the EG and 100 in the CG). Participants in the EG received a culturally appropriate phone-based diabetes self-management intervention in the form of lifestyle

coaching led by a CHW. The intervention included information about diabetes, materials for self-monitoring and goal setting. During the 16 sessions, the CHW helped participants to set and review small change goals, discussed successes, challenges and barriers, and gave information on topics such as self-monitoring, time management, modifiable practice and problem solving. Participants in the CG were included in a mail-based education group and received 16 mailings of diabetes education materials, including information about diet selection, healthy snacking, managing medications, monitoring blood glucose, and engaging in physical activity. The results indicated that there were no differences between the EG and CG at post-test for HbA1c, systolic and diastolic blood pressure, self-care scores, medication adherence, empowerment or self-efficacy. However, participants in the EG had a moderate but significantly greater weight loss than participants in the CG ($P=0.046$). Therefore, conclusions about the effectiveness of using the telephone for delivering an intervention aimed at changing health behaviors are limited and further studies are needed to demonstrate their effectiveness in HL interventions.

Effectiveness of a preventive lifestyle behavior intervention for reducing risk factors for cardiovascular disease⁷⁸

This RCT included 223 overweight and underserved low-income immigrant Latinas (111 in the EG and 112 in the CG). Participants in the EG received a lifestyle behavior change intervention (Mujeres Sanas y Precavidas [Healthy Women Prepared for Life]), including: i) eight culturally relevant group educational sessions led by *promotoras* (female community health workers) and delivered in Spanish. The education contained information about various cardiovascular topics, diabetes, hypertension, healthy behaviors, nutrition and physical activity; and ii) eight individual teaching and coaching sessions from the *promotora* (by phone or home visits) to reinforce class content, and to help participants set personal goals for lifestyle changes. Participants in the CG received a safety/disaster preparedness group educational program. At nine months follow-up, there was a significant difference in physical activity (average daily step count) between the EG and CG ($p=0.04$) due to a significant decrease in physical activity levels in the CG, as well as a small significant

decrease in waist circumference in the EG ($p=0.04$), but no significant differences in the average daily duration for moderate physical activity, weight, BMI, cholesterol (total cholesterol, HDL and LDL), triglycerides and blood glucose. These mixed results could be explained by the fact that the intervention aimed at several behavior change goals at a time, whereas motivational interview theories posit that it is better to work on one goal at a time. Moreover, the use of non-validated measurement tools (the data from which were not taken into account for this review) made it difficult to draw definite conclusions. Nevertheless, the community-based participatory approach as well as use of lay facilitators can be strategies to consider for the promotion of healthy lifestyles in future interventions.

Effects of a multimedia teaching and counselling tool on diet and physical activity during pregnancy⁷⁷

This RCT included 321 low-income ethnically diverse pregnant women (158 in the EG and 163 in the CG). Prior to the medical visit, participants in the EG received one session (10 to 15 minutes) with a computerized, multimedia interactive “Video Doctor” tool that provided tailored counseling and educational messages about healthy diets, physical activity and weight gain during pregnancy. At the end of the session, the program provided the participant with an educational worksheet, and the clinician with a cueing sheet, with tailored counseling statements to be used during the consultation. Participants in the CG received usual care. At four weeks follow-up, no significant differences were observed between the groups with regard to the proportion of women gaining weight above Institute of Medicine guidelines or mean weight gain. Nevertheless, this computer program could be an interesting tool to improve the effectiveness of medical consultation and communication between patients and providers, and to help patients receive individualized, targeted and needs-focused health information. Further testing of this type of interactive tool in future studies to demonstrate its effectiveness in facilitating change in behavior is therefore warranted.

Effectiveness of a postpartum weight loss Internet-based program for low income postpartum women⁷³

This RCT included 370 low-income overweight postpartum women, 174 of whom participated in

the EG and 196 in the CG. Participants in the EG received: i) an internet-based weight loss program in English and Spanish. This program, including weekly lessons, a diary, automated feedback, educational videos and motivational messages, provided health information about weight loss, nutrition and physical activity. The program also provided tailored calorie goals, and goals to increase physical activity, as well as physical activity trackers to help participants achieve their goals; and ii) 12 monthly face-to-face group sessions. Participants in the CG received standard Woman and Infant Care (WIC) services, as well as six newsletters every two months with information about weight control, exercise, nutrition and wellness. At post-test, there was a significantly greater weight loss in the EG than in the CG ($P < 0.001$), as well as a significantly greater reduction in waist circumference ($P < 0.001$), a significantly greater percentage weight loss ($P < 0.002$), a significant greater proportion of women achieving 5% ($P = 0.005$) and 10% ($P = 0.007$) or more weight loss, and a significantly higher proportion of women returning to preconception weight or below ($P < 0.001$). No significant differences between the groups were found for physical activity levels and dietary intake. Hence, the intervention helped women to make decisions and renew their commitment on a weekly basis based on information and feedback received. As the intervention had many components, it was not possible to know which one contributed the most to the positive outcome. Nevertheless, the results indicated that an evidence informed internet weight-loss program may decrease the need for face-to-face contact, thus facilitating access and adherence by low-income women to the program. Access to the internet must be evaluated prior to choosing this type of program. It is unclear if an internet-based program may be recommended to increase physical activity.

Combined findings

Within the competency of applying health information, the Health Promotion domain of the health continuum was addressed in five studies.^{73,77,78,84,87} All of these, excepted one,⁷⁷ were found to be effective for healthy life styles outcomes (such as healthy eating and physical activity) or health-related outcomes (such as weight loss). Their results suggested that strategies leading to effectiveness seem to

include tailoring of health information delivered, active discussion using motivational interviewing techniques, skills training and goal setting. In addition, interventions should be informed by validated behavior change theories such as the Social Cognitive Theory,^{77,112-114} with the aim of achieving a single objective. Again, the cultural appropriateness of the intervention, use of community-based participatory principles and use of lay interventionists appear to be effective approaches for the development of future HL interventions.

Discussion

The purpose of this systematic review was to identify and synthesize the best available information on effective HL intervention strategies that increase health-related outcomes for socioeconomically disadvantaged people.

On outcomes, our review found mixed results. Most of the included studies (62%) showed effectiveness for health outcomes, even if partial. Regarding the three studies addressing the competency of understanding health information,^{75,76,89} no effectiveness was found for the outcomes considered in this review. In two studies, the absence of significant result could be due to the short follow-up period,⁸⁹ or the high attrition rate.⁷⁶ The lack of significant results also suggests that interventions testing the effectiveness of meaningful communication formats (using for example plain language, illustrations, pictograms and icons) should perhaps assess the understanding of health information directly rather than through clinical or behavioral outcomes. As such, this type of intervention requires further study, particularly in the context of chronic medication use among socioeconomically disadvantaged people. Eighteen studies out of 21 addressed the competency of applying health information. This seems logical and congruent with the theoretical framework of Sorensen *et al.*,³ with decision-making, communication and implementation of health information being the final outcomes of an HL process. Although almost half of the included studies were in the Healthcare domain of the health continuum, the most effective interventions were those in the Disease Prevention and Health Promotion domains. Within interventions, evaluated outcomes were congruent with the health continuum domain addressed. Thus, effective interventions in the Healthcare domain had positive effects on clinical outcomes

(such as HbA1c), self-efficacy and knowledge; effective interventions in the Disease Prevention domain had positive effects on a variety of preventive health practices and behaviors, and effective interventions in the Health Promotion domain had positive effects on health behaviors and health outcomes directly related to behavior change. Among studies that did not demonstrate any effect, the lack of significant result could be partly due to: i) high attrition rates,^{83,88} which itself could be attributed to contextual or implementation problems (e.g. personnel and infrastructure). This highlights the importance of context, which needs to be favorable and conducive to the intervention; ii) inadequate duration of the interventions, which was not in line with the objectives of the intervention; iii) too short follow-up periods; or iv) insufficient training of lay or peer trainers delivering the intervention, if any.

Among included studies, data provided were not sufficient for identifying clear theoretical patterns for effective interventions. How theories were used and incorporated within each intervention was not described in detail. However, theory-based interventions appeared to be more effective than atheoretical ones. Moreover, the use of an appropriate theory, congruent with the aim of the intervention, emerged as an important factor for successful interventions. Our results identified three main behavior change theories and models: i) the Social Cognitive Theory and the key concept of self-efficacy,^{112,113} useful for the development of the HL competency of applying health information, when health decisions need to be made and implemented; ii) the Transtheoretical Model of behavior change,¹¹⁸ useful for assessing the readiness level of participants and helping them implement and maintain a desired health behavior; and iii) the Health Belief Model¹²⁰ that enables health professionals to elicit beliefs, barriers and expectations of the client. The use of a specific theory leads to the selection of specific intervention strategies and operational tools.¹³⁵ This can lead in turn to better health outcomes and greater effectiveness. Therefore, the use of an appropriate behavior change theory should be a critical issue for the development of future HL interventions. Another theoretical foundation highlighted by our results was the use of participatory designs, such as community-based participatory research.^{136,137} Community-based participatory research is an ecological approach that seems particularly useful at the community level for

the development of an intervention, and is defined as “a partnership approach to research that equitably involves community members, practitioners and academic researchers in all aspects of the process, enabling all partners to contribute their expertise and share responsibility and ownership”.^{138(p.2094)} The involvement of community members as research partners at all stages of the research process presents several advantages: i) development of an intervention (including intervention content, modalities and materials) tailored to the target group and corresponding to its needs, preferences, values, beliefs and relevant health issues, and taking into account the available community resources as well as the context;^{139,140} ii) improved recruitment, retention, participation and motivation, especially in hard-to-reach populations;^{121,141} and iii) improved effectiveness of the intervention for health-related and behavioral outcomes, with more sustainable effects.^{139,141,142} Community-based participatory research has been described as an approach that is particularly adapted to address health disparities^{138,142} and suitable for disadvantaged groups.¹⁴¹ Therefore, community-based participatory research seems to be a promising approach for the development of HL skills among socioeconomically disadvantaged people, and for the development of group-specific appropriate HL interventions.

Among effective included studies, the results allowed us to identify some operational components that could be seen as key to the success of HL interventions in socioeconomically disadvantaged people. These operational components included appropriateness of the content in terms of culture and literacy levels of the participants, tailoring, skills training, goal setting, and individual or group discussions.

Cultural appropriateness was found as a key operational component of HL interventions, as demonstrated by nine RCTs.^{71,73,74,78,80,81,86,87,91} Cultural appropriateness refers to a group-specific intervention that is adapted to the needs, preferences, attitudes, norms and cultural values of the target group.¹⁴³ As highlighted in a recent systematic review,¹⁴⁴ culturally appropriate interventions are more successful than standardized interventions in changing health outcomes because they identify and address systemic barriers (such as financial, geographical and communication barriers), and increase community engagement by the involvement of

community members in the development and implementation phases of an intervention. Furthermore, such interventions are relevant to the cultural context, values, needs and perspectives of the target population. Conversely, a mismatch between the intervention and the context and target population may limit the effectiveness of the intervention. For example, interventions that are not congruent with the language spoken by participants can lead to problems in understanding the intervention's content; interventions that are not congruent with the ethnicity can lead to resistance to the intervention due to conflicts in beliefs, values and norms; a lack of congruence with the participants' socioeconomic status may be a barrier to accessing social resources and can lead to culturally different life experiences; and interventions that do not take the place of residence (urban versus rural) into account can lead to a lack of participation or adherence due to geographical and environmental barriers.¹⁴⁵ To be effective, an intervention must therefore be appropriate to the target group, in terms of both its content and form of delivery.¹⁴⁵ In this regard, Kreuter *et al.*¹⁴⁶ describe five types of strategies that can help make health interventions culturally appropriate: i) peripheral strategies such as creating intervention materials with a visual style relevant to the target group (e.g. by using specific colors, pictures, illustrations or declarative titles) and reflecting "the social and cultural world of the audience";^{146(p.135)} ii) evidential strategies such as providing information and evidence (e.g. epidemiological data, risk factor data) specific to the target population in order to increase the perceived relevance of health messages; iii) linguistic strategies such as adapting an intervention's content and materials to the language of the target population; iv) constituent-involving strategies based on the experience of (lay) community members and their participation in designing, planning and implementing the intervention; and v) sociocultural strategies such as incorporating the values, beliefs, behaviors, context, and other social and cultural characteristics of the target population in building the intervention.¹⁴⁶ Our conclusions are consistent with other systematic reviews that also concluded that health interventions were more effective when they were culturally appropriate. A systematic review focusing on socially disadvantaged groups concluded that cultural appropriateness was one feature amongst others that contributed to the

effectiveness of interventions to improve diabetes care.¹⁴⁷ Another systematic review focusing on ethnic minority groups found that culturally appropriate health education interventions were more effective than standardized interventions for type 2 diabetes.¹⁴⁸

Tailoring was found to be an effective strategy as demonstrated in nine studies.^{73,74,78,80,82,84-87} Tailoring is defined as "creating communications in which information about a given individual is used to determine what specific content he or she will receive, the contexts or frames surrounding the content, by whom it will be presented and even through which channels it will be delivered."^{149(p.1)} Tailoring allows the delivery of individualized health information in accordance with the participants' needs and preferences.¹⁴⁹ It can be viewed as a client centered approach.¹⁵⁰ Tailoring health information provides individuals with more meaningful messages that are more likely to be read and thus increase the recall of health information and relevance of an intervention.¹⁴⁹ Various systematic reviews and meta-analyses have shown that tailored interventions are more effective than generic interventions for changing health behaviors.^{151,152} Therefore, our results suggest that, in addition to cultural appropriateness of the intervention for a specific group, future HL interventions must also be tailored and oriented to the individual needs of participants.

The development of specific skills useful to a HL process, also called *skills training*, was found to be an effective component in seven studies.^{72,74,78,80,82,86,87} In addition to the four main HL competencies, HL can be viewed as a "constellation of skills,"¹⁵³ including, but not limited to, decision-making, problem-solving, critical thinking, communication and self-management. These are considered critical to the application of health information and adequate functioning in the health system.³ Our results showed the importance of supporting socio-economically disadvantaged people in the development of specific skills throughout the HL process, enabling them to apply health information and achieve behavioral change. Making a health decision must be followed by developing the self-efficacy needed to successfully implement a behavior. Skills-building interventions enhance and increase self-efficacy, which in turn foster behavior change.¹¹³

Congruent with tailoring, *goal setting* is another operational component found to be effective in six studies.^{74,78,82,84,85,87} Goals "refer to inherently valued, futuristic outcomes that are derived from a level

of dissatisfaction with a present condition or circumstance.”^{154(p.33)} As a means to translate health information into actual health behaviors, this person-centered approach¹⁵⁵ supports health behavioral change¹⁵⁶ and is therefore a strategy that can be used to improve health-related outcomes among socioeconomically disadvantaged people. Although first applied in clinical settings,¹⁵⁶ our review showed that helping people to set specific and realistic goals was also used in disease prevention and health promotion. As such, personalized goal setting can be viewed as a means to enabling individuals to improve and increase control over their own health.¹⁵⁷

Individual and/or group discussions with either a professional or a lay interventionist also appear to be a preferred operational component to develop HL competencies, as suggested in ten studies.^{71-74,78,81,82,85-87} This is congruent with the use of tailoring and goal setting. Active discussions are a person-centered communication method that can be seen as a strategy that enhances the usability of health information. Indeed, through interactions with the intervention provider, questions can be asked, clarifications sought, and feedback provided. Moreover, discussions provide an opportunity to review HL materials, if any, and to ensure good understanding using, for example, teach-back techniques. The teach-back method has been defined as a “technique in which the clinician asks the patient to restate or demonstrate the knowledge or technique just taught,”^{158(p.3)} and has been found as an effective strategy for transmitting clear and understandable information to people.¹⁵⁹

Our systematic review failed to clearly identify intervention modalities that are most likely to have an impact on effectiveness. For the Healthcare domain of the health continuum, effective interventions took the form of individual or group health education sessions delivered by an interventionist. For the Disease Prevention and the Health Promotion domains, no clear trend could be identified, with effective interventions taking various forms, such as health education sessions, phone sessions, print-based interventions, HL-friendly environment interventions and eHealth interventions. However, complex or multifaceted interventions, combining both a medium of information transfer (such as print materials, interactive tools or videos) and contact with an interventionist (either health professional-led or trained peer-led, either individual, group or phone

sessions) appear to be more effective than single modality interventions. Regarding the person delivering the intervention, peer support or the use of peer leaders could be a promising strategy for HL intervention conducted in a community setting, as suggested in five of the included studies.^{71,74,78,85,87} Peer support is defined as support provided by a member of the community sharing the same cultural characteristics as the target population, with experiential knowledge related to a specific health issue,¹⁶⁰ and good knowledge of community and local resources.⁸⁸ As shown in the included studies, trained peers could facilitate behavior change during interactions with the participant by providing information and knowledge, emotional support, and social support^{78,160} through mutual exchange and discussion of key health issues, thereby increasing the motivation of participants.⁷⁸ Moreover, trained peers could help and strengthen the development of various skills useful to a HL process such as self-efficacy, problem-solving, self-care and self-monitoring, coping, goal setting, communication skills or navigating the healthcare system.¹⁶¹ However, due to the multi-component nature of interventions using lay interventionists, the results of our review did not provide evidence that peer support is an effective modality of a HL intervention. Therefore, the use of lay interventionists needs further studies to assess its effectiveness in a HL context. Finally, interventions seemed more effective if they included recurrent contacts, multiple sessions and follow-up activities such as follow-up phone calls, as shown in nine studies.^{72-74,78,82,84-87} This suggest that a dose-response relation existed between the number of contacts and the effect of HL interventions, and that the learning effect was enhanced by this process.

Limitations of the review

Due to the substantial heterogeneity of HL interventions between the included studies, and due to the large number of health-related outcomes addressed, comparisons between studies were challenging, which limited the drawing of conclusions about effectiveness and prevented us from performing a meta-analysis. We were limited in our access to studies. We were unable to contact the authors of two potentially eligible studies for additional information, and therefore, these studies could not be included in this systematic review. However, in spite of these limitations, the

conclusions of this systematic review provide the best evidence available on the effectiveness of HL interventions specifically addressed to socioeconomically disadvantaged people.

Eighty-five percent of the studies were conducted in the USA, with the majority of those identifying socio-economically disadvantaged subjects with the PROGRESS factor Race, thus favoring mono-cultural interventions. However, if tailoring does not take into account individual life trajectories that may vary considerably in terms of cultural creolization, it may neglect key determinants of health behavior.¹⁶²

The included studies mostly focused on individual skills and behavior change. However, accessing information may be a skill that is best developed using a participatory approach with an ecological and population focus.¹³⁶ From that perspective, outcomes of health behavior may be replaced by Quality of Life measures,^{136,137} and studies of effectiveness may be more useful at the end of the HL process where health outcomes can be measured. Both research methodology and outcome should be congruent with the HL competence that is addressed.

Conclusion

In conclusion, this systematic review highlights some important features of effective HL interventions among socioeconomically disadvantaged people. Health literacy interventions are more likely to be successful if they are theory-based. The interventions need to be designed in congruence with tested and competence appropriate theories and models. It is clear that a person-centered approach contributes to better health-related outcomes through the use of five essential operational components, including group-specific appropriateness of the intervention, tailoring, skills training, goal setting and active discussions (individual or in group) with the intervention provider. With intervention modalities, multifaceted interventions combining both a communication medium and contact with an interventionist appear to be more effective than single modality interventions. Finally, repetition of health information through recurrent contacts and multiple sessions, as well as follow-up activities are important aspects to consider in HL interventions.

Recommendations for practice

Based on the JBI Grades of Recommendation,¹⁶³ this systematic review has level B evidence, indicating

that the recommendations are “weak”. Future HL interventions must be culturally or group-specific appropriate, while being person-centered. This makes it possible to take into account both the context, particularities and characteristics at the community level, and characteristics at the individual level. Future interventions must be able to combine these two complementary approaches – a participatory approach and tailoring – in order to reach greater effectiveness. In the same vein, future HL interventions should adopt an ecological perspective, transversal to all HL competencies, in order to take into account the multiple factors influencing health, HL and HL interventions, and thus achieve more sustainable effects.¹⁶⁴ And finally, future HL interventions must be theory-based, with solid theoretical foundations consistent with the goals and objectives of the intervention.

Recommendations for research

Future research on HL interventions must be cognizant of the fact that HL is a process. Future research focusing on the terminal skills of an HL process, such as decision-making and use of health information, must first ensure that skills in accessing and understanding are effectively developed. As described by the Sorensen’s definition of HL,³ maintaining or improving quality of life is the ultimate goal of an HL process. As such, and in addition to behavioral outcomes, future research on HL interventions must also measure quality of life outcomes.

The research design, as well as intervention modalities, must be adapted to the HL competency addressed. In the same way, tools and measuring instruments must be congruent with the HL skills developed. This is particularly important for the competencies of accessing, understanding and appraising, for which more effectiveness studies are needed. Moreover, our review points out the importance of using reliable and validated measurement tools in future research on HL interventions.

More studies conducted in various countries are needed to test the effectiveness of interventions in various cultural and socio-economic contexts.

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Appendix I: Search strategy

PubMed (search performed on May 22, 2018)

Search	Query
#1	((“Socioeconomic Factors”[Mesh:NoExp] OR “Social Class”[Mesh] OR “socioeconomic status”[tiab] OR “socio economic status”[tiab] OR “disadvantaged”[tiab] OR “Ethnic Groups”[Mesh:NoExp] OR “Minority Groups”[Mesh] OR “Social Determinants of Health”[Mesh] OR “Educational Status”[Mesh] OR “Employment”[Mesh] OR “Unemployment”[Mesh] OR “Income”[Mesh:NoExp] OR “Medical Indigency”[Mesh] OR “Occupations”[Mesh] OR “Poverty”[Mesh] OR “Rural Population”[Mesh] OR “rural”[tiab]) NOT (“Child”[Mesh] OR “Adolescent”[Mesh] OR “Infant”[Mesh]))
#2	((“Health Literacy”[Mesh] OR “health literacy” OR “eHealth literacy” OR “numeracy”[tiab] OR “public health literacy”[tiab] OR “health competences”[tiab] OR “health information”[tiab] OR “Access to Information”[Mesh] OR “Comprehension”[Mesh] OR “access* health information”[tiab] OR “evaluating health information”[tiab] OR “applying health information”[tiab] OR “health information processing”[tiab] OR “health information application”[tiab] OR “health information use”[tiab] OR “information need”[tiab] OR “information seeking”[tiab] OR “Information Seeking Behavior”[Mesh] OR “Consumer Health Information”[Mesh:NoExp] OR “Health Communication”[Mesh] OR “health message”[tiab] OR “Computer Literacy”[Mesh] OR “Information Literacy”[Mesh:NoExp] OR “educational material”[tiab] OR “Teaching Materials”[Mesh:NoExp] OR “healthcare information”[tiab] OR “Pamphlets”[Mesh] OR “plain language”[tiab] OR “Health Education”[Mesh:NoExp] OR “Patient education as topic”[Mesh:NoExp] OR “Health Fairs”[Mesh] OR “Early Medical Intervention”[Mesh] OR “Health Promotion”[Mesh] OR “Sanitation”[Mesh:NoExp]) NOT “Literacy”[Mesh])
#3	((“Quality of Life”[Mesh] OR “Health Status”[Mesh:NoExp] OR “subjective health”[tiab] OR “Health Status Indicators”[Mesh:NoExp] OR “Health Status Disparities”[Mesh] OR “Healthcare Disparities”[Mesh] OR “Mental Health”[Mesh] OR “Diagnostic Self Evaluation”[Mesh] OR “Self-Examination”[Mesh] OR “wellbeing”[tiab] OR “well-being”[tiab] OR “wellness”[tiab] OR “Life Expectancy”[Mesh] OR “Mortality, Premature”[Mesh] OR “Mortality”[Mesh:NoExp] OR “Morbidity”[Mesh:NoExp] OR “Chronic Disease/prevention and control”[Mesh] OR “disability”[tiab] OR “Health Behavior”[Mesh:NoExp] OR “Risk Reduction Behavior”[Mesh:NoExp] OR “Choice Behavior”[Mesh:NoExp] OR “Self Efficacy”[Mesh] OR “Life Style”[Mesh:NoExp] OR “Sedentary Lifestyle”[Mesh] OR “Healthy Lifestyle”[Mesh] OR “Patient Compliance”[Mesh:NoExp] OR “Medication Adherence”[Mesh] OR “Health Knowledge, Attitudes, Practice”[Mesh] OR “Attitude to Health”[Mesh:NoExp] OR “Health Services Misuse”[Mesh:NoExp] OR “Patient Medication Knowledge”[Mesh] OR “Negotiating”[Mesh] OR “Decision making”[Mesh:NoExp] OR “Social Support”[Mesh:NoExp] OR “patient provider communication”[tiab] OR “Professional-Patient Relations”[Mesh] OR “Help-Seeking Behavior”[Mesh] OR “Social Skills”[Mesh] OR “Self Care”[Mesh] OR “self management”[tiab] OR “self monitoring”[tiab] OR “coping”[tiab] OR “empowerment”[tiab] OR “Power (Psychology)”[Mesh] OR “self learning”[tiab] OR “critical thinking”[tiab] OR “Problem Solving”[Mesh] OR “Patient Navigation”[Mesh] OR “Health Services Accessibility”[Mesh:NoExp] OR “Patient Participation”[Mesh] OR “Consumer Behavior”[Mesh] OR “Community Participation”[Mesh] OR “consumer participation”[tiab] OR “information recall”[tiab] OR “civic engagement”[tiab] OR “Health Equity”[Mesh] OR “Office Visits”[Mesh:NoExp] OR “Hospitalization”[Mesh:NoExp] OR “Patient Satisfaction”[Mesh] OR “Informed Consent”[Mesh] OR “Patient Preference”[Mesh]))
#4	#1 AND #2 AND #3

CINAHL (search performed on May 22, 2018)

Search	Query
#1	(((MM "Socioeconomic Factors") OR (MH "Social Class") OR "socioeconomic status" OR "socio economic status" OR "disadvantaged" OR (MM "Ethnic Groups") OR (MH "Minority Groups") OR (MH "Social Determinants of Health") OR (MH "Educational Status") OR (MH "Employment") OR (MH "Unemployment") OR (MH "Employment Status") OR (MM "Income") OR (MM "Occupations and Professions") OR (MH "Poverty") OR (MH "Rural Population"))) NOT ((MH "Child") OR (MH "Adolescence") OR (MH "Infant"))))
#2	(((MH "Health Literacy") OR "health literacy" OR "eHealth literacy" OR "numeracy" OR "public health literacy" OR "health competences" OR (MH "Health Information+") OR (MH "Access to Information") OR "access* health information" OR "evaluating health information" OR "applying health information" OR "health information application" OR "health information processing" OR "health information use" OR (MH "Information Needs") OR "information seeking" OR (MH "Information Seeking Behavior") OR "health communication" OR "health message*" OR (MH "Computer Literacy") OR (MM "Information Literacy") OR "educational material" OR (MM "Teaching Materials") OR "healthcare information" OR (MH "Pamphlets") OR "plain language" OR (MH "Information Resources") OR (MH "Health Education") OR (MH "HIV Education") OR (MH "Nutrition Education") OR (MH "Dental Health Education") OR (MH "Diabetes Education") OR (MH "Patient Education") OR (MH "Health Fairs") OR (MM "Early Intervention") OR (MH "Health Promotion") OR (MM "Sanitation"))) NOT (MH "Literacy"))
#3	(((MH "Quality of Life") OR (MH "Health Status") OR (MH "Functional Status") OR (MH "Mental Status") OR "subjective health" OR (MH "Health Status Indicators") OR (MH "Health Status Disparities") OR (MH "Healthcare Disparities") OR (MH "Mental Health") OR (MH "Self Assessment") OR (MH "Self Diagnosis+") OR (MH "Psychological Well-Being") OR "well-being" OR (MH "Wellness") OR (MH "Life Expectancy") OR (MM "Mortality") OR (MM "Morbidity") OR (MH "Chronic Disease/PC") OR "disability" OR (MH "Health Behavior") OR (MH "Risk Taking Behavior") OR (MH "Behavioral Changes") OR (MH "Self-Efficacy") OR (MH "Life Style Changes") OR (MH "Life Style, Sedentary") OR (MM "Life Style") OR (MH "Patient Compliance") OR (MH "Medication Compliance") OR (MH "Health Knowledge") OR (MH "Attitude to Health") OR (MH "Health Beliefs") OR (MH "Health Services Misuse") OR (MH "Negotiation") OR (MH "Decision Making, Patient") OR (MH "Decision Making") OR (MM "Support, Psychosocial") OR "social support" OR (MH "Professional-Patient Relations") OR (MH "Physician-Patient Relations") OR (MH "Help Seeking Behavior") OR (MH "Social Skills") OR (MH "Self Care") OR (MH "Blood Glucose Self-Monitoring") OR "self management" OR "self monitoring" OR (MH "Coping") OR (MH "Empowerment") OR "self learning" OR (MH "Critical Thinking") OR (MH "Problem Solving") OR (MH "Patient Navigation") OR (MH "Health Services Accessibility") OR (MH "Consumer Participation") OR "community participation" OR "information recall" OR "civic engagement" OR "health equity" OR (MM "Hospitalization") OR (MH "Office Visits") OR (MH "Patient Satisfaction") OR (MH "Consent") OR "patient preference" OR (MH "Communication Skills") OR (MH "Skill Acquisition") OR (MH "Skill Retention"))
#4	#1 AND #2 AND #3

CENTRAL (search performed on May 22, 2018)

Search	Query
#1	((“Socioeconomic Factors” OR “Social Class” OR “Vulnerable Populations” OR “Ethnic Groups” OR “Minority Groups” OR “Social Determinants of Health” OR “Educational Status” OR “Employment” OR “Unemployment” OR “Income” OR “Medical Indigency” OR “Occupations” OR “Poverty” OR “Rural Population”) NOT (“Child” OR “Adolescent” OR “Infant”))
#2	((Health Literacy OR “eHealth literacy” OR “numeracy” OR “public health literacy” OR “health competences” OR “health information” OR “Access to Information” OR “Comprehension” OR “access* health information” OR “evaluating health information” OR “applying health information” OR “health information processing” OR “health information application” OR “health information use” OR “information need” OR “information seeking” OR “Information Seeking Behavior” OR “Consumer Health Information” OR “Health Communication” OR “health message*” OR “Computer Literacy” OR “Information Literacy” OR “educational material” OR “Teaching Materials” OR “healthcare information” OR “Pamphlets” OR “plain language” OR “Health Education” OR “Patient education as topic” OR “Health Fairs” OR “Early Medical Intervention” OR “Health Promotion” OR “Sanitation”) NOT “Literacy”)
#3	((“Quality of Life” OR “Health Status” OR “subjective health” OR “Health Status Indicators” OR “Health Status Disparities” OR “Healthcare Disparities” OR “Mental Health” OR “Diagnostic Self Evaluation” OR “Self-Examination” OR “wellbeing” OR “well-being” OR “wellness” OR “Life Expectancy” OR “Mortality, Premature” OR “Mortality” OR “Morbidity” OR “Chronic Disease” OR “disability” OR “Health Behavior” OR “Risk Reduction Behavior” OR “Choice Behavior” OR “Motivation” OR “Self Efficacy” OR “Life Style” OR “Healthy Lifestyle” OR “health habits” OR “Patient Compliance” OR “Medication Adherence” OR “Health Knowledge, Attitudes, Practice” OR “Attitude to Health” OR “Patient Medication Knowledge” OR “Negotiating” OR “Decision making” OR “Social Support” OR “patient provider communication” OR “Professional-Patient Relations” OR “Help-Seeking Behavior” OR “Social Skills” OR “Self Care” OR “self management” OR “self monitoring” OR “coping” OR “empowerment” OR “Power (Psychology)” OR “self learning” OR “critical thinking” OR “Problem Solving” OR “Patient Navigation” OR “Health Services Accessibility” OR “Patient Participation” OR “Consumer Behavior” OR “Community Participation” OR “consumer participation” OR “information recall” OR “civic engagement” OR “Health Equity” OR “Hospitalization” OR “Office Visits” OR “Patient Satisfaction” OR “Informed Consent” OR “Patient Preference”))
#4	#1 AND #2 AND #3
	Search all text, limit trials

Embase (search performed on May 22, 2018)

Search	Query
#1	((‘socioeconomics’/de OR ‘social class’/exp OR ‘social status’/exp OR disadvantaged OR ‘ethnic group’/de OR ‘minority group’/exp OR ‘social determinants of health’/exp OR ‘educational status’/exp OR ‘employment’/exp OR ‘income’/de OR ‘household income’/exp OR ‘income group’/exp ‘occupation’/de OR ‘poverty’/exp OR ‘rural population’/exp) NOT (‘child’/exp OR ‘adolescent’/exp OR ‘infant’/exp))
#2	((‘health literacy’/br OR ‘numeracy’/exp OR ‘public health literacy’ OR ‘health competences’ OR ‘medical information’/exp OR ‘access to information’/exp OR ‘comprehension’/exp OR ‘access* health information’ OR ‘evaluating health information’ OR ‘applying health information’ OR ‘health information processing’ OR ‘health information application’ OR ‘health information use’ OR ‘information need’ OR ‘information seeking’/exp OR ‘consumer health information’/exp OR ‘health message*’ OR ‘information literacy’/exp OR ‘educational material’ OR ‘healthcare information’ OR ‘plain language’ OR ‘health education’/de OR ‘diabetes education’/exp OR ‘HIV education’/exp OR ‘nutrition education’/exp OR ‘patient education’/exp OR ‘early intervention’/exp OR ‘health promotion’/exp OR ‘sanitation’/de OR ‘sanitation education’/exp) NOT (‘reading’/exp OR ‘literacy programs’/exp))
#3	(‘health outcomes’/exp OR ‘quality of life’/de OR ‘health status’/de OR ‘functional status’/exp OR ‘health status indicator’/exp OR ‘health disparity’/exp OR ‘subjective health’ OR ‘health care disparity’/exp OR ‘mental health’/exp OR ‘self evaluation’/exp OR ‘self examination’/exp OR ‘wellbeing’/exp OR ‘subjective well being’/exp OR ‘physical well-being’/exp OR ‘psychological well-being’/exp OR ‘life expectancy’/exp OR ‘premature mortality’/exp OR ‘mortality’/de OR ‘mortality rate’/de OR ‘morbidity’/de OR ‘chronic disease’/exp OR ‘chronic disease prevention and control’/exp OR ‘disability’/de OR ‘invalidity’/exp OR ‘limited mobility’/exp OR ‘physical disability’/exp OR ‘work disability’/exp OR ‘health behavior’/de OR ‘health belief’/exp OR ‘high risk behavior’/exp OR ‘risk reduction’/exp OR ‘decision making’/de OR ‘patient decision making’/exp OR ‘shared decision making’/exp OR ‘motivation’/exp OR ‘self concept’/de OR ‘lifestyle’/exp OR ‘lifestyle modification’/exp OR ‘healthy lifestyle’/exp OR ‘health habits’ OR ‘patient compliance’/exp OR ‘medication compliance’/exp OR ‘attitude to health’/exp OR ‘interpersonal communication’/de OR ‘communication skill’/exp OR ‘social support’/exp OR ‘help seeking behavior’/exp OR ‘self care’/de OR ‘self management’/exp OR ‘self monitoring’/exp OR ‘coping behavior’/de OR ‘empowerment’/exp OR ‘self learning’ OR ‘critical thinking’/exp OR ‘problem solving’/de OR ‘navigation’/exp OR ‘patient participation’/exp OR ‘consumer attitude’/exp OR ‘community participation’/exp OR ‘information recall’ OR ‘civic engagement’/exp OR ‘health equity’/exp OR ‘hospitalization’/exp OR ‘ambulatory care’/exp OR ‘patient satisfaction’/exp OR ‘informed consent’/exp OR ‘patient preference’/exp)
#4	#1 AND #2 AND #3

PsycINFO (search performed on May 22, 2018)

Search	Query
#1	Socioeconomic Status/
#2	exp Social Class/
#3	“Racial and Ethnic Groups”/
#4	Minority Groups/
#5	Social Determinants of Health.mp.
#6	exp Educational Attainment Level/
#7	Employment Status/
#8	income level/
#9	exp Lower Income Level/
#10	disadvantaged/
#11	poverty/
#12	adolescent.mp.
#13	child.mp.
#14	infant.mp.
#15	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11
#16	12 or 13 or 14
#17	15 not 16
#18	exp Health Literacy/
#19	eHealth literacy.mp.
#20	numeracy.mp.
#21	public health literacy.mp.
#22	health competences.mp.
#23	health information.mp.
#24	Access to Information.mp.
#25	access* health information.mp.
#26	evaluating health information.mp.
#27	applying health information.mp.
#28	health information processing.mp.
#29	information need.mp.
#30	information seeking/
#31	information literacy/
#32	Health Communication.mp.
#33	health message*.mp.
#34	computer literacy/ or computer searching/
#35	healthcare information.mp.

(Continued)	
Search	Query
#36	Pamphlet*.mp.
#37	plain language.mp.
#38	health education/ or drug education/ or sex education/ or client education/
#39	early intervention/
#40	health promotion/
#41	literacy/
#42	18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40
#43	42 not 41
#44	“quality of life”/
#45	health status.mp.
#46	mental health/
#47	physical health/
#48	health disparities/
#49	health knowledge/
#50	well being/
#51	self-evaluation/
#52	wellness.mp.
#53	life expectancy/
#54	“death and dying”/
#55	chronic illness/
#56	health behavior/
#57	risk perception/
#58	risk taking/
#59	choice behavior/
#60	self-efficacy/
#61	lifestyle/ or lifestyle changes/
#62	Healthy Lifestyle.mp.
#63	treatment compliance/
#64	decision making/
#65	negotiation/
#66	disabilities/
#67	social support/
#68	help seeking behavior/
#69	health care seeking behavior/

(Continued)	
Search	Query
#70	social skills/
#71	self-care skills/
#72	self-management/
#73	behavior modification/
#74	self-monitoring/
#75	coping behavior/
#76	empowerment/
#77	critical thinking/
#78	problem solving/
#79	client participation/
#80	community involvement/
#81	information recall.mp.
#82	health equity.mp.
#83	disease management/
#84	client satisfaction/
#85	informed consent/
#86	Patient Preference.mp.
#87	44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80 or 81 or 82 or 83 or 84 or 85 or 86
#88	17 and 43 and 87

TROPHI (search performed on May 22, 2018)

Search	Query
#1	Freetext: “Socioeconomic Factors”
#2	Freetext: “Social Class”
#3	Freetext: “socioeconomic status”
#4	Freetext: “socio economic status”
#5	Freetext: disadvantaged
#6	Freetext: “Ethnic Groups”
#7	Freetext: “Minority Groups”
#8	Freetext: “Social Determinants of Health”
#9	Freetext: “Educational Status”
#10	Freetext: “Educational attainment”
#11	Freetext: Employment
#12	Freetext: Unemployment
#13	Freetext: Income
#14	Freetext: Occupation
#15	Freetext: Poverty
#16	Freetext: rural
#17	Freetext: “Rural Population”
#18	1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17
#19	Freetext: “Health Literacy”
#20	Freetext: “eHealth literacy”
#21	Freetext: numeracy
#22	Freetext: “public health literacy”
#23	Freetext: “health competences”
#24	Freetext: “health information”
#25	Freetext: Comprehension
#26	Freetext: “information need”
#27	Freetext: “information seeking”
#28	Freetext: “Health Communication”
#29	Freetext: “health message”
#30	Freetext: “health messages”
#31	Freetext: “Computer Literacy”
#32	Freetext: “Information Literacy”
#33	Freetext: “educational material”
#34	Freetext: “Teaching Materials”
#35	Freetext: “healthcare information”
#36	Freetext: Pamphlets

(Continued)	
Search	Query
#37	Freetext: “plain language”
#38	Freetext: “Health Education”
#39	Freetext: “Patient education ”
#40	Freetext: “Health Fairs”
#41	Freetext: “Health Promotion”
#42	Freetext: Sanitation
#43	19 OR 20 OR 21 OR 22 OR 23 OR 24 OR 25 OR 26 OR 27 OR 28 OR 29 OR 30 OR 31 OR 32 OR 33 OR 34 OR 35 OR 36 OR 37 OR 38 OR 39 OR 40 OR 41 OR 42
#44	Freetext: “Quality of Life”
#45	Freetext: “Health Status”
#46	Freetext: “subjective health”
#47	Freetext: “Health Status Indicators”
#48	Freetext: “Health Status Disparities”
#49	Freetext: “Healthcare Disparities”
#50	Freetext: disparities
#51	Freetext: inequalities
#52	Freetext: inequities
#53	Freetext: “Mental Health”
#54	Freetext: Self-Examination
#55	Freetext: wellbeing
#56	Freetext: well-being
#57	Freetext: wellness
#58	Freetext: “Life Expectancy”
#59	Freetext: Mortality
#60	Freetext: Morbidity
#61	Freetext: “Chronic Disease”
#62	Freetext: disability
#63	Freetext: disabilities
#64	Freetext: “Health Behavior”
#65	Freetext: “Risk Reduction Behavior”
#66	Freetext: “Self Efficacy”
#67	Freetext: “Life Style”
#68	Freetext: “Healthy Lifestyle”
#69	Freetext: “Patient Compliance”
#70	Freetext: “Medication Adherence”
#71	Freetext: “Attitude to Health”
#72	Freetext: “Patient Medication Knowledge”
#73	Freetext: Negotiating

(Continued)	
Search	Query
#74	Freetext: “Decision making”
#75	Freetext: “Social Support”
#76	Freetext: “patient provider communication”
#77	Freetext: “Help-Seeking Behavior”
#78	Freetext: “Social Skills”
#79	Freetext: “Self Care”
#80	Freetext: “self management”
#81	Freetext: “self monitoring”
#82	Freetext: coping
#83	Freetext: empowerment
#84	Freetext: “self learning”
#85	Freetext: “critical thinking”
#86	Freetext: “Problem Solving”
#87	Freetext: “Patient Navigation”
#88	Freetext: Navigation
#89	Freetext: “Patient Participation”
#90	Freetext: “Consumer Behavior”
#91	Freetext: “Community Participation”
#92	Freetext: “consumer participation”
#93	Freetext: “information recall”
#94	Freetext: “civic engagement”
#95	Freetext: “Health Equity”
#96	Freetext: Hospitalization
#97	Freetext: “Office Visits”
#98	Freetext: “Patient Satisfaction”
#99	Freetext: “Informed Consent”
#100	Freetext: “Patient Preference”
#101	44 OR 45 OR 46 OR 47 OR 48 OR 49 OR 50 OR 51 OR 52 OR 53 OR 54 OR 55 OR 56 OR 57 OR 58 OR 59 OR 60 OR 61 OR 62 OR 63 OR 64 OR 65 OR 66 OR 67 OR 68 OR 69 OR 70 OR 71 OR 72 OR 73 OR 74 OR 75 OR 76 OR 77 OR 78 OR 79 OR 80 OR 81 OR 82 OR 83 OR 84 OR 85 OR 86 OR 87 OR 88 OR 89 OR 90 OR 91 OR 92 OR 93 OR 94 OR 95 OR 96 OR 97 OR 98 OR 99 OR 100
#102	18 AND 43 AND 101

Web of Science (search performed on May 22, 2018)

Search	Query
#1	((“Socioeconomic Factors” OR “Social Class” OR “socioeconomic status” OR “socio economic status” OR “disadvantaged” OR “Ethnic Groups” OR “Minority Groups” OR “Social Determinants of Health” OR “Educational Status” OR “Employment” OR “Unemployment” OR “Income” OR “Medical Indigency” OR “Occupations” OR “Poverty” OR “Rural Population” OR “rural”) NOT (“Child” OR “Adolescent” OR “Infant”))
#2	((“Health Literacy” OR “eHealth literacy” OR “numeracy” OR “public health literacy” OR “health competences” OR “health information” OR “Access to Information” OR “Comprehension” OR “access* health information” OR “evaluating health information” OR “applying health information” OR “health information processing” OR “health information application” OR “health information use” OR “information need” OR “information seeking” OR “Information Seeking Behavior” OR “Consumer Health Information” OR “Health Communication” OR “health message*” OR “Computer Literacy” OR “Information Literacy” OR “educational material” OR “Teaching Materials” OR “healthcare information” OR “Pamphlets” OR “plain language” OR “Health Education” OR “Patient education” OR “Health Fairs” OR “Early Medical Intervention” OR “Health Promotion” OR “Sanitation”) NOT “Literacy”)
#3	(“Quality of Life” OR “Health Status” OR “subjective health” OR “Health Status Indicators” OR “Health Status Disparities” OR “Healthcare Disparities” OR “Mental Health” OR “Diagnostic Self Evaluation” OR “Self-Examination” OR “wellbeing” OR “well-being” OR “wellness” OR “Life Expectancy” OR “Mortality, Premature” OR “Mortality” OR “Morbidity” OR “Chronic Disease/prevention and control” OR “disability” OR “Health Behavior” OR “Risk Reduction Behavior” OR “Choice Behavior” OR “Self Efficacy” OR “Life Style” OR “Sedentary Lifestyle” OR “Healthy Lifestyle” OR “Patient Compliance” OR “Medication Adherence” OR “Health Knowledge, Attitudes, Practice” OR “Attitude to Health” OR “Health Services Misuse” OR “Patient Medication Knowledge” OR “Negotiating” OR “Decision making” OR “Social Support” OR “patient provider communication” OR “Professional-Patient Relations” OR “Help-Seeking Behavior” OR “Social Skills” OR “Self Care” OR “self management” OR “self monitoring” OR “coping” OR “empowerment” OR “Power (Psychology)” OR “self learning” OR “critical thinking” OR “Problem Solving” OR “Patient Navigation” OR “Health Services Accessibility” OR “Patient Participation” OR “Consumer Behavior” OR “Community Participation” OR “consumer participation” OR “information recall” OR “civic engagement” OR “Health Equity” OR “Office Visits” OR “Hospitalization” OR “Patient Satisfaction” OR “Informed Consent” OR “Patient Preference”)
#4	#1 AND #2 AND #3

ProQuest Dissertations & Theses A&I (search performed on May 22, 2018)

Search	Query
#1	su(((“socioeconomic Factors” OR “Social Class” OR “socioeconomic status” OR “social economic status” OR “disadvantaged” OR “Ethnic Groups” OR “Minority Groups” OR “Social Determinants of Health” OR “Educational Status” OR “Employment” OR “Unemployment” OR “Income” OR “Medical indigence” OR “Occupations” OR “Poverty” OR “Rural Population” OR “rural”) NOT (“Child” OR “Adolescent” OR “Infant”))))
#2	su(((“Health Literacy” OR “health literacy” OR “numerary” OR “public health literacy” OR “health competences” OR “health information” OR “Access to Information” OR “Comprehension” OR “access* health information” OR “evaluating health information” OR “applying health information” OR “health information processing” OR “health information application” OR “health information use” OR “information need” OR “information seeking” OR “Information Seeking Behavior” OR “Consumer Health Information” OR “Health Communication” OR “health message*” OR “Computer Literacy” OR “Information Literacy” OR “educational material” OR “Teaching Materials” OR “healthcare information” OR “Pamphlets” OR “plain language” OR “Health Education” OR “Patient education” OR “Health Fairs” OR “Early Medical Intervention” OR “Health Promotion” OR “Sanitation”) NOT “Literacy”)))
#3	su((“Quality of Life” OR “Health Status” OR “subjective health” OR “Health Status Indicators” OR “Health Status Disparities” OR “Healthcare Disparities” OR “Mental Health” OR “Diagnostic Self Evaluation” OR “Self-Examination” OR “wellbeing” OR “well-being” OR “wellness” OR “Life Expectancy” OR “Mortality, Premature” OR “Mortality” OR “Morbidity” OR “Chronic Disease/prevention and control” OR “disability” OR “Health Behavior” OR “Risk Reduction Behavior” OR “Choice Behavior” OR “Self Efficacy” OR “Life Style” OR “Sedentary Lifestyle” OR “Healthy Lifestyle” OR “Patient Compliance” OR “Medication Adherence” OR “Health Knowledge, Attitudes, Practice” OR “Attitude to Health” OR “Health Services Misuse” OR “Patient Medication Knowledge” OR “Negotiating” OR “Decision making” OR “Social Support” OR “patient provider communication” OR “Professional-Patient Relations” OR “Help-Seeking Behavior” OR “Social Skills” OR “Self Care” OR “self management” OR “self monitoring” OR “coping” OR “empowerment” OR “Power (Psychology)” OR “self learning” OR “critical thinking” OR “Problem Solving” OR “Patient Navigation” OR “Health Services Accessibility” OR “Patient Participation” OR “Consumer Behavior” OR “Community Participation” OR “consumer participation” OR “information recall” OR “civic engagement” OR “Health Equity” OR “Office Visits” OR “Hospitalization” OR “Patient Satisfaction” OR “Informed Consent” OR “Patient Preference”)))
#4	#1 AND #2 AND #3

Scopus (search performed on May 22, 2018)

Search	Query
#1	((TITLE-ABS("Socioeconomic Factors") OR TITLE-ABS("Social Class") OR TITLE-ABS("socioeconomic status") OR TITLE-ABS("socio economic status") OR TITLE-ABS(disadvantaged) OR TITLE-ABS("Ethnic Groups") OR TITLE-ABS("Minority Groups") OR TITLE-ABS("Social Determinants of Health") OR TITLE-ABS("Educational Status") OR TITLE-ABS("Employment") OR TITLE-ABS("Unemployment") OR TITLE-ABS("Income") OR TITLE-ABS("Medical Indigency") OR TITLE-ABS("Occupations") OR TITLE-ABS("Poverty") OR TITLE-ABS("Rural Population") OR TITLE-ABS(rural)) AND NOT (TITLE-ABS(child) OR TITLE-ABS(adolescent) OR TITLE-ABS(infant)))
#2	((TITLE-ABS("Health Literacy") OR TITLE-ABS("eHealth literacy") OR TITLE-ABS("numeracy") OR TITLE-ABS("public health literacy") OR TITLE-ABS("health competences") OR TITLE-ABS("health information") OR TITLE-ABS("Access to Information") OR TITLE-ABS("Comprehension") OR TITLE-ABS("access* health information") OR TITLE-ABS("evaluating health information") OR TITLE-ABS("applying health information") OR TITLE-ABS("health information processing") OR TITLE-ABS("health information application") OR TITLE-ABS("health information use") OR TITLE-ABS("information need") OR TITLE-ABS("information seeking") OR TITLE-ABS("Information Seeking Behavior") OR TITLE-ABS("Consumer Health Information") OR TITLE-ABS("Health Communication") OR TITLE-ABS("health message") OR TITLE-ABS("Computer Literacy") OR TITLE-ABS("Information Literacy") OR TITLE-ABS("educational material") OR TITLE-ABS("Teaching Materials") OR TITLE-ABS("healthcare information") OR TITLE-ABS("Pamphlets") OR TITLE-ABS("plain language") OR TITLE-ABS("Health Education") OR TITLE-ABS("Patient education") OR TITLE-ABS("Health Fairs") OR TITLE-ABS("Early Medical Intervention") OR TITLE-ABS("Health Promotion") OR TITLE-ABS("Sanitation")) AND NOT TITLE-ABS("Literacy"))
#3	(TITLE-ABS("Quality of Life") OR TITLE-ABS("Health Status") OR TITLE-ABS("subjective health") OR TITLE-ABS("Health Status Indicators") OR TITLE-ABS("Health Status Disparities") OR TITLE-ABS("Healthcare Disparities") OR TITLE-ABS("Mental Health") OR TITLE-ABS("Diagnostic Self Evaluation") OR TITLE-ABS("Self-Examination") OR TITLE-ABS("wellbeing") OR TITLE-ABS("well-being") OR TITLE-ABS("wellness") OR TITLE-ABS("Life Expectancy") OR TITLE-ABS("Mortality, Premature") OR TITLE-ABS("Mortality") OR TITLE-ABS("Morbidity") OR TITLE-ABS("Chronic Disease/prevention and control") OR TITLE-ABS("disability") OR TITLE-ABS("Health Behavior") OR TITLE-ABS("Risk Reduction Behavior") OR TITLE-ABS("Choice Behavior") OR TITLE-ABS("Self Efficacy") OR TITLE-ABS("Life Style") OR TITLE-ABS("Sedentary Lifestyle") OR TITLE-ABS("Healthy Lifestyle") OR TITLE-ABS("Patient Compliance") OR TITLE-ABS("Medication Adherence") OR TITLE-ABS("Health Knowledge, Attitudes, Practice") OR TITLE-ABS("Attitude to Health") OR TITLE-ABS("Health Services Misuse") OR TITLE-ABS("Patient Medication Knowledge") OR TITLE-ABS("Negotiating") OR TITLE-ABS("Decision making") OR TITLE-ABS("Social Support") OR TITLE-ABS("patient provider communication") OR TITLE-ABS("Professional-Patient Relations") OR TITLE-ABS("Help-Seeking Behavior") OR TITLE-ABS("Social Skills") OR TITLE-ABS("Self Care") OR TITLE-ABS("self management") OR TITLE-ABS("self monitoring") OR TITLE-ABS("coping") OR TITLE-ABS("empowerment") OR TITLE-ABS("Power (Psychology)") OR TITLE-ABS("self learning") OR TITLE-ABS("critical thinking") OR TITLE-ABS("Problem Solving") OR TITLE-ABS("Patient Navigation") OR TITLE-ABS("Health Services Accessibility") OR TITLE-ABS("Patient Participation") OR TITLE-ABS("Consumer Behavior") OR TITLE-ABS("Community Participation") OR TITLE-ABS("consumer participation") OR TITLE-ABS("information recall") OR TITLE-ABS("civic engagement") OR TITLE-ABS("Health Equity") OR TITLE-ABS("Office Visits") OR TITLE-ABS("Hospitalization") OR TITLE-ABS("Patient Satisfaction") OR TITLE-ABS("Informed Consent") OR TITLE-ABS("Patient Preference"))
#4	#1 AND #2 AND #3

ClinicalTrials.gov (search performed on May 22, 2018)

Search	Query
#1	("health literacy" OR "health education" OR "health promotion" OR "health information")
#2	("Socioeconomic Factors" OR "Social Class" OR "socioeconomic status" OR "disadvantaged" OR "Ethnic Groups" OR "Minority Groups")
#3	#1 AND #2
	Limit: Trial completed

EU Clinical Trial Register (search performed on May 22, 2018)

Search	Query
#1	((("Socioeconomic Factors" OR "Social Class" OR "socioeconomic status" OR "socio economic status" OR "disadvantaged" OR "Ethnic Groups" OR "Minority Groups" OR "Social Determinants of Health" OR "Educational Status" OR "Employment" OR "Unemployment" OR "Income" OR "Medical Indigency" OR "Occupations" OR "Poverty" OR "Rural Population" OR "rural") NOT ("Child" OR "Adolescent" OR "Infant"))
#2	((("Health Literacy" OR "eHealth literacy" OR "numeracy" OR "public health literacy" OR "health competences" OR "health information" OR "Access to Information" OR "Comprehension" OR "access* health information" OR "evaluating health information" OR "applying health information" OR "health information processing" OR "health information application" OR "health information use" OR "information need" OR "information seeking" OR "Information Seeking Behavior" OR "Consumer Health Information" OR "Health Communication" OR "health message*" OR "Computer Literacy" OR "Information Literacy" OR "educational material" OR "Teaching Materials" OR "healthcare information" OR "Pamphlets" OR "plain language" OR "Health Education" OR "Patient education" OR "Health Fairs" OR "Early Medical Intervention" OR "Health Promotion" OR "Sanitation") NOT "Literacy")
#3	("Quality of Life" OR "Health Status" OR "subjective health" OR "Health Status Indicators" OR "Health Status Disparities" OR "Healthcare Disparities" OR "Mental Health" OR "Diagnostic Self Evaluation" OR "Self-Examination" OR "wellbeing" OR "well-being" OR "wellness" OR "Life Expectancy" OR "Mortality, Premature" OR "Mortality" OR "Morbidity" OR "Chronic Disease/prevention and control" OR "disability" OR "Health Behavior" OR "Risk Reduction Behavior" OR "Choice Behavior" OR "Self Efficacy" OR "Life Style" OR "Sedentary Lifestyle" OR "Healthy Lifestyle" OR "Patient Compliance" OR "Medication Adherence" OR "Health Knowledge, Attitudes, Practice" OR "Attitude to Health" OR "Health Services Misuse" OR "Patient Medication Knowledge" OR "Negotiating" OR "Decision making" OR "Social Support" OR "patient provider communication" OR "Professional-Patient Relations" OR "Help-Seeking Behavior" OR "Social Skills" OR "Self Care" OR "self management" OR "self monitoring" OR "coping" OR "empowerment" OR "Power (Psychology)" OR "self learning" OR "critical thinking" OR "Problem Solving" OR "Patient Navigation" OR "Health Services Accessibility" OR "Patient Participation" OR "Consumer Behavior" OR "Community Participation" OR "consumer participation" OR "information recall" OR "civic engagement" OR "Health Equity" OR "Office Visits" OR "Hospitalization" OR "Patient Satisfaction" OR "Informed Consent" OR "Patient Preference")
#4	#1 AND #2 AND #3

Current Controlled Trials (CCT) (search performed on May 22, 2018)

Search	Query
#1	("Socioeconomic Factors" OR "Social Class" OR "socioeconomic status" OR "socioeconomic status" OR "disadvantaged" OR "Ethnic Groups" OR "Minority Groups" OR "Social Determinants of Health" OR "Educational Status" OR "Employment" OR "Unemployment" OR "Income" OR "Medical Indigency" OR "Occupations" OR "Poverty" OR "Rural Population" OR "rural")
#2	("Health Literacy" OR "eHealth literacy" OR "numeracy" OR "public health literacy" OR "health competences" OR "health information" OR "Access to Information" OR "Comprehension" OR "access* health information" OR "evaluating health information" OR "applying health information" OR "health information processing" OR "health information application" OR "health information use" OR "information need" OR "information seeking" OR "Information Seeking Behavior" OR "Consumer Health Information" OR "Health Communication" OR "health message*" OR "Computer Literacy" OR "Information Literacy" OR "educational material" OR "Teaching Materials" OR "healthcare information" OR "Pamphlets" OR "plain language" OR "Health Education" OR "Patient education" OR "Health Fairs" OR "Early Medical Intervention" OR "Health Promotion" OR "Sanitation")
#3	("Quality of Life" OR "Health Status" OR "subjective health" OR "Health Status Indicators" OR "Health Status Disparities" OR "Healthcare Disparities" OR "Mental Health" OR "Diagnostic Self Evaluation" OR "Self-Examination" OR "wellbeing" OR "well-being" OR "wellness" OR "Life Expectancy" OR "Mortality, Premature" OR "Mortality" OR "Morbidity" OR "Chronic Disease/prevention and control" OR "disability" OR "Health Behavior" OR "Risk Reduction Behavior" OR "Choice Behavior" OR "Self Efficacy" OR "Life Style" OR "Sedentary Lifestyle" OR "Healthy Lifestyle" OR "Patient Compliance" OR "Medication Adherence" OR "Health Knowledge, Attitudes, Practice" OR "Attitude to Health" OR "Health Services Misuse" OR "Patient Medication Knowledge" OR "Negotiating" OR "Decision making" OR "Social Support" OR "patient provider communication" OR "Professional-Patient Relations" OR "Help-Seeking Behavior" OR "Social Skills" OR "Self Care" OR "self management" OR "self monitoring" OR "coping" OR "empowerment" OR "Power (Psychology)" OR "self learning" OR "critical thinking" OR "Problem Solving" OR "Patient Navigation" OR "Health Services Accessibility" OR "Patient Participation" OR "Consumer Behavior" OR "Community Participation" OR "consumer participation" OR "information recall" OR "civic engagement" OR "Health Equity" OR "Office Visits" OR "Hospitalization" OR "Patient Satisfaction" OR "Informed Consent" OR "Patient Preference")
#4	#1 AND #2 AND #3
	Limit: Trial completed

UK Clinical Trials Gateway (search performed on May 22, 2018)

Search	Query
#1	“Health Literacy” OR “eHealth literacy” OR “numeracy” OR “public health literacy” OR “health competences” OR “health information” OR “Access to Information” OR “Comprehension” OR “access* health information” OR “evaluating health information” OR “applying health information” OR “health information processing” OR “health information application” OR “health information use” OR “information need” OR “information seeking” OR “Information Seeking Behavior” OR “Consumer Health Information” OR “Health Communication” OR “health message*” OR “Computer Literacy” OR “Information Literacy” OR “educational material” OR “Teaching Materials” OR “healthcare information” OR “Pamphlets” OR “plain language” OR “Health Education” OR “Patient education” OR “Health Fairs” OR “Early Medical Intervention” OR “Health Promotion” OR “Sanitation”
	Limit: Trial completed

DART-Europe E-theses portal (search performed on May 22, 2018)

Search	Query
#1	(“health literacy” OR “health information” OR “information need” OR “information seeking” OR “health communication” OR “health education” OR “patient education” OR “health promotion”) AND (“socioeconomic factors” OR “disadvantaged” OR “socioeconomic” OR “rural”)

DOAJ, Google, Google Scholar, MedNar, Worldcat (search performed on May 22, 2018)

Search	Query
#1	(“Socioeconomic Factors” OR “socioeconomic status” OR “socio economic status” OR “disadvantaged” OR “Ethnic Groups” OR “Minority Groups” OR “Educational Status” OR “Employment” OR “Unemployment” OR “Income” OR “Occupations” OR “Poverty” OR “Rural Population” OR “rural”) AND (“Health Literacy” OR “health competences” OR “health information” OR “health message” OR “information need” OR “information seeking” OR “health communication”)

Appendix II: Studies excluded on methodological quality

Randomized controlled trials

Agurs-Collins TD, Kumanyika SK, Ten Have TR, Adams-Campbell LL. A randomized controlled trial of weight reduction and exercise for diabetes management in older African-American subjects. *Diabetes Care*. 1997;20(10):1503–11.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Au LE, Whaley SE, Gurzo K, Meza M, Rosen NJ, Ritchie LD. Evaluation of Online and In-Person Nutrition Education Related to Salt Knowledge and Behaviors among Special Supplemental Nutrition Program for Women, Infants, and Children Participants. *J Acad Nutr Diet*. 2017;117(9):1384–95.

Reason for exclusion: 8 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Auslander W, Haire-Joshu D, Houston C, Rhee C-W, Williams JH. A controlled evaluation of staging dietary patterns to reduce the risk of diabetes in African-American women. *Diabetes Care*. 2002;25(5):809–14.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Ayala GX, Baquero B, Laraia BA, Ji M, Linnan L. Efficacy of a store-based environmental change intervention compared with a delayed treatment control condition on store customers' intake of fruits and vegetables. *Public Health Nutr*. 2013;16(11):1953–60.

Reason for exclusion: 7 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Balcazar HG, Byrd TL, Ortiz M, Tondapu SR, Chavez M. A randomized community intervention to improve hypertension control among Mexican Americans: using the promotoras de salud community outreach model. *J Health Care Poor Underserved*. 2009;20(4):1079–94.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, detection bias that seriously weakened confidence in the results.

Barton JL, Trupin L, Schillinger D, Evans-Young G, Imboden J, Montori VM, et al. Use of Low-Literacy Decision Aid to Enhance Knowledge and Reduce Decisional Conflict Among a Diverse Population of Adults With Rheumatoid Arthritis: Results of a Pilot Study. *Arthritis Care Res*. 2016;68(7):889–98.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance and detection bias that seriously weakened confidence in the results.

Braich PS, Almeida DR, Hollands S, Coleman MT. Effects of pictograms in educating 3 distinct low-literacy populations on the use of postoperative cataract medication. *Can J Ophthalmol*. 2011;46(3):276–81.

Reason for exclusion: 7 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Buller DB, Woodall WG, Zimmerman DE, Slater MD, Heimendinger J, Waters E, *et al.* Randomized trial on the 5 a day, the Rio Grande Way Website, a web-based program to improve fruit and vegetable consumption in rural communities. *J Health Commun.* 2008;13(3):230–49.

Reason for exclusion: 7 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Campbell MK, Honess-Morreale L, Farrell D, Carbone E, Brasure M. A tailored multimedia nutrition education pilot program for low-income women receiving food assistance. *Health Educ Res.* 1999;14(2):257–67.

Reason for exclusion: 7 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Campbell MK, James A, Hudson MA, Carr C, Jackson E, Oakes V, *et al.* Improving multiple behaviors for colorectal cancer prevention among African American church members. *Health Psychol.* 2004;23(5):492–502.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Champion VL, Springston JK, Zollinger TW, Saywell RM, Monahan PO, Zhao Q, *et al.* Comparison of three interventions to increase mammography screening in low income African American women. *Cancer Detect Prev.* 2006;30(6):535–44.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Consedine NS, Horton D, Magai C, Kukafka R. Breast screening in response to gain, loss, and empowerment framed messages among diverse, low-income women. *J Health Care Poor Underserved.* 2007;18(3):550–66.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Cordasco KM, Asch SM, Bell DS, Guterman JJ, Gross-Schulman S, Ramer L, *et al.* A low-literacy medication education tool for safety-net hospital patients. *Am J Prev Med.* 2009;37(6):S209–16.

Reason for exclusion: 6 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Davis TC, Berkel HJ, Arnold CL, Nandy I, Jackson RH, Murphy PW. Intervention to Increase Mammography Utilization in a Public Hospital. *J Gen Intern Med.* 13(4):230–3.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Deavenport A, Modeste N, Marshak HH, Neish C. Closing the gap in mammogram screening: an experimental intervention among low-income Hispanic women in community health clinics. *Health Educ Behav.* 2011;38(5):452–61.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Deren S, Davis WR, Beardsley M, Tortu S, Clatts M. Outcomes of a risk-reduction intervention with high-risk populations: the Harlem AIDS project. *AIDS Educ Prev.* 1995; 7(5):379-90.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

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.

Reason for exclusion: 6 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Dollahite JS, Pijai EI, Scott-Pierce M, Parker C, Trochim W. A randomized controlled trial of a community-based nutrition education program for low-income parents. *J Nutr Educ Behav.* 2014;46(2):102-9.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Eakin EG, Bull SS, Riley KM, Reeves MM, McLaughlin P, Gutierrez S. Resources for health: a primary-care-based diet and physical activity intervention targeting urban Latinos with multiple chronic conditions. *Health Psychol.* 2007;26(4):392-400.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Elder JP, Ayala GX, Slymen DJ, Arredondo EM, Campbell NR. Evaluating psychosocial and behavioral mechanisms of change in a tailored communication intervention. *Health Educ Behav.* 2009;36(2):366-80.

Reason for exclusion: 6 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Elder JP, Candelaria J, Woodruff SI, Golbeck AL, Criqui MH, Talavera GA, et al. Initial results of 'Language for Health': cardiovascular disease nutrition education for English-as-a-second-language students. *Health Educ Res.* 1998;13(4):567-75.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Elder JP, Candelaria JI, Woodruff SI, Criqui MH, Talavera GA, Rupp JW. Results of language for health: cardiovascular disease nutrition education for Latino English-as-a-second-language students. *Health Educ Behav.* 2000;27(1):50-63.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Ell K, Vourlekis B, Lee P-J, Xie B. Patient navigation and case management following an abnormal mammogram: a randomized clinical trial. *Prev Med.* 2007;44(1):26–33.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Friedman LC, Everett TE, Peterson L, Ogbonnaya KI, Mendizabal V. Compliance with fecal occult blood test screening among low-income medical outpatients: A randomized controlled trial using a videotaped intervention. *J Cancer Educ.* 2001;16(2):85-8.

Reason for exclusion: 10 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Gans KM, Risica PM, Strolla LO, Fournier L, Kirtania U, Upegui D, *et al.* Effectiveness of different methods for delivering tailored nutrition education to low income, ethnically diverse adults. *Int J Behav Nutr Phys Act.* 2009;6:24.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection and performance bias that seriously weakened confidence in the results.

Gathirua-Mwangi WG, Monahan PO, Stump T, Rawl SM, Skinner CS, Champion VL. Mammography adherence in African-American women: results of a randomized controlled trial. *Ann Behav Med.* 2016;50(1):70–8.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of performance, attrition and detection bias that seriously weakened confidence in the results.

Gerber BS, Brodsky IG, Lawless KA, Smolin LI, Arozullah AM, Smith EV, *et al.* Implementation and evaluation of a low-literacy diabetes education computer multimedia application. *Diabetes Care.* 2005;28(7):1574–80.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Greenlee H, Gaffney AO, Aycinena AC, Koch P, Contento I, Karmally W, *et al.* ¡Cocinar Para Su Salud!: Randomized Controlled Trial of a Culturally Based Dietary Intervention among Hispanic. *Breast Cancer Survivors. J Acad Nutr Diet.* 2015;115(5):709-23.e3.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Grindel CG, Brown L, Caplan L, Blumenthal D. The effect of breast cancer screening messages on knowledge, attitudes, perceived risk, and mammography screening of African American women in the rural South. *Oncol Nurs Forum.* 2004;31(4):801-8.

Reason for exclusion: 6 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Han H-R, Kim J, Kim KB, Jeong S, Levine D, Li C, *et al.* Implementation and success of nurse telephone counseling in linguistically isolated Korean American patients with high blood pressure. *Patient Educ Couns.* 2010;80(1):130–4.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Havas S, Anliker J, Greenberg D, Block G, Block T, Blik C, *et al.* Final results of the Maryland WIC food for life program. *Prev Med.* 2003;37(5):406–16.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Hayashi T, Farrell MA, Chaput LA, Rocha DA, Hernandez M. Lifestyle intervention, behavioral changes, and improvement in cardiovascular risk profiles in the California WISEWOMAN project. *J Womens Health.* 2010;19(6):1129–38.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of performance, attrition and detection bias that seriously weakened confidence in the results.

Hill-Briggs F, Lazo M, Peyrot M, Doswell A, Chang Y-T, Hill MN, *et al.* Effect of problem-solving-based diabetes self-management training on diabetes control in a low income patient sample. *J Gen Intern Med.* 2011;26(9):972–8.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Holstad MM, DiIorio C, Kelley ME, Resnicow K, Sharma S. Group motivational interviewing to promote adherence to antiretroviral medications and risk reduction behaviors in HIV infected women. *AIDS Behav.* 2011;15(5):885–96.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Howard-Pitney B, Winkleby MA, Albright C, Bruce B, Fortmann SP. The Stanford Nutrition Action Program: a dietary fat intervention for low-literacy adults. *Am J Public Health.* 1997;87(12):1971–6.

Reason for exclusion: 6 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Hyman DJ, Ho KS, Dunn JK, Simons-Morton D. Dietary intervention for cholesterol reduction in public clinic patients. *Am J Prev Med.* 1998;15(2):139–45.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Jacobs AD, Ammerman AS, Ennett ST, Campbell MK, Tawney KW, Aytur SA, *et al.* Effects of a tailored follow-up intervention on health behaviors, beliefs, and attitudes. *J Womens Health.* 2004;13(5):557–68.

Reason for exclusion: 6 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Jacobson TA, Thomas DM, Morton FJ, Offutt G, Shevlin J, Ray S. Use of a low-literacy patient education tool to enhance pneumococcal vaccination rates: a randomized controlled trial. *JAMA*. 1999;282(7):646–50.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Jandorf L, Cooperman JL, Stossel LM, Itzkowitz S, Thompson HS, Villagra C, et al. Implementation of culturally targeted patient navigation system for screening colonoscopy in a direct referral system. *Health Educ Res*. 2013;28(5):803–15.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of performance, attrition and detection bias that seriously weakened confidence in the results.

Jandorf L, Gutierrez Y, Lopez J, Christie J, Itzkowitz SH. Use of a patient navigator to increase colorectal cancer screening in an urban neighborhood health clinic. *J Urban Health*. 2005;82(2):216–24.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Jason LA, Tait E, Goodman D, Buckenberger L, Gruder CL. Effects of a televised smoking cessation intervention among low-income and minority smokers. *Am J Community Psychol*. 1988;16(6):863–76.

Reason for exclusion: 7 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Jibaja ML, Kingery P, Neff NE, Smith Q, Bowman J, Holcomb JD. Tailored, interactive soap operas for breast cancer education of high-risk Hispanic women. *J Cancer Educ*. 2000;15(4):237–42.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Jiamjariyapon T, Ingsathit A, Pongpirul K, Vipattawat K, Kanchanakorn S, Saeit A, et al. Effectiveness of Integrated Care on Delaying Progression of stage 3–4 Chronic Kidney Disease in Rural Communities of Thailand (ESCORT study): a cluster randomized controlled trial. *BMC Nephrol*. 2017;18(1):83.

Reason for exclusion: 7 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Juon H-S, Lee S, Strong C, Rimal R, Kirk GD, Bowie J. Effect of a Liver Cancer Education Program on Hepatitis B Screening Among Asian Americans in the Baltimore–Washington Metropolitan Area, 2009–2010. *Prev Chronic Dis*. 2014;11:130258.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Kandula NR, Dave S, De Chavez PJ, Bharucha H, Patel Y, Seguil P, et al. Translating a heart disease lifestyle intervention into the community: the South Asian Heart Lifestyle Intervention (SAHELI) study; a randomized control trial. *BMC Public Health*. 2015;15:1064.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Kangovi S, Mitra N, Grande D, Huo H, Smith RA, Long JA. Community health worker support for disadvantaged patients with multiple chronic diseases: a randomized clinical trial. *Am J Public Health*. 2017;107(10):1660–7.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Keyserling TC, Hodge CDS, Jilcott SB, Johnston LF, Garcia BA, Gizlice Z, et al. Randomized trial of a clinic-based, community-supported, lifestyle intervention to improve physical activity and diet: the North Carolina enhanced WISEWOMAN project. *Prev Med*. 2008;46(6):499–510.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Khare MM, Carpenter RA, Huber R, Bates NJ, Cursio JF, Balmer PW, et al. Lifestyle intervention and cardiovascular risk reduction in the Illinois WISEWOMAN Program. *J Womens Health*. 2012;21(3):294–301.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Khare MM, Cursio JF, Locklin CA, Bates NJ, Loo RK. Lifestyle intervention and cardiovascular disease risk reduction in low-income Hispanic immigrant women participating in the Illinois WISEWOMAN program. *J Community Health*. 2014;39(4):737–46.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Kim KB, Han H-R, Huh B, Nguyen T, Lee H, Kim MT. The effect of a community-based self-help multimodal behavioral intervention in Korean American seniors with high blood pressure. *Am J Hypertens*. 2014;27(9):1199–208.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Kim MT, Kim KB, Huh B, Nguyen T, Han H-R, Bone LR, et al. The effect of a community-based self-help intervention: Korean Americans with type 2 diabetes. *Am J Prev Med*. 2015;49(5):726–37.

Reason for exclusion: 6 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Kocken PL, Joosten-van Zwanenburg E, de Hoop T. Effects of health education for migrant females with psychosomatic complaints treated by general practitioners: a randomised controlled evaluation study. *Patient Educ Couns*. 2008;70(1):25–30.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of performance, attrition and detection bias that seriously weakened confidence in the results.

Kopelowicz A, Zarate R, Smith VG, Mintz J, Liberman RP. Disease management in Latinos with schizophrenia: a family-assisted, skills training approach. *Schizophr Bull.* 2003;29(2):211–28.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and attrition bias that seriously weakened confidence in the results.

Kreuter MW, Holmes K, Alcaraz K, Kalesan B, Rath S, Richert M, et al. Comparing narrative and informational videos to increase mammography in low-income African American women. *Patient Educ Couns.* 2010;81 Suppl:S6–14.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Kumanyika SK, Adams-Campbell L, Van Horn B, Ten Have TR, Treu JA, Askov E, et al. Outcomes of a cardiovascular nutrition counseling program in African-Americans with elevated blood pressure or cholesterol level. *J Am Diet Assoc.* 1999;99(11):1380–91.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Kumar MS, Sarma PS, Thankappan KR. Community-based group intervention for tobacco cessation in rural Tamil Nadu, India: a cluster randomized trial. *J Subst Abuse Treat.* 2012;43(1):53–60.

Reason for exclusion: 6 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Larkey LK, Herman PM, Roe DJ, Garcia F, Lopez AM, Gonzalez J, et al. A cancer screening intervention for underserved Latina women by lay educators. *J Womens Health.* 2012;21(5):557–66.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of performance, attrition, and detection bias that seriously weakened confidence in the results.

Lee E, Menon U, Nandy K, Szalacha L, Kviz F, Cho Y, et al. The effect of couples intervention to increase breast cancer screening among Korean Americans. *Oncol Nurs Forum.* 2014;41(3):E185–93.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Lipkus IM, Lyna PR, Rimer BK. Using tailored interventions to enhance smoking cessation among African-Americans at a community health center. *Nicotine Tob Res.* 1999;1(1):77–85.

Reason for exclusion: 8 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Lu C-H, Tang S-T, Lei Y-X, Zhang M-Q, Lin W-Q, Ding S-H, et al. Community-based interventions in hypertensive patients: a comparison of three health education strategies. *BMC Public Health.* 2015;15:33.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of performance, attrition and detection bias that seriously weakened confidence in the results.

Miller SM, Hui SA, Wen K-Y, Scarpato J, Zhu F, Buzaglo J, *et al.* Tailored telephone counseling to improve adherence to follow-up regimens after an abnormal pap smear among minority, underserved women. *Patient Educ Couns.* 2013;93(3):488–95.

Reason for exclusion: 6 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Navarro AM, Senn KL, McNicholas LJ, Kaplan RM, Roppé B, Campo MC. Por La Vida model intervention enhances use of cancer screening tests among Latinas. *Am J Prev Med.* 1998;15(1):32–41.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Nguyen TT, Le G, Nguyen T, Le K, Lai K, Gildengorin G, *et al.* Breast cancer screening among Vietnamese Americans: a randomized controlled trial of lay health worker outreach. *Am J Prev Med.* 2009;37(4):306–13.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Nitzke S, Kritsch K, Boeckner L, Greene G, Hoerr S, Horacek T, *et al.* A stage-tailored multi-modal intervention increases fruit and vegetable intakes of low-income young adults. *Am J Health Promot.* 2007;22(1):6–14.

Reason for exclusion: 6 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Nuño T, Martinez ME, Harris R, García F. A promotora-administered group education intervention to promote breast and cervical cancer screening in a rural community along the US–Mexico border: a randomized controlled trial. *Cancer Causes Control.* 2011;22(3):367–74.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Okuyemi KS, James AS, Mayo MS, Nollen N, Catley D, Choi WS, *et al.* Pathways to health: a cluster randomized trial of nicotine gum and motivational interviewing for smoking cessation in low-income housing. *Health Educ Behav.* 2007;34(1):43–54.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Osborn CY, Amico KR, Cruz N, O’Connell AA, Perez-Escamilla R, Kalichman SC, *et al.* A brief culturally tailored intervention for Puerto Ricans with type 2 diabetes. *Health Educ Behav.* 2010;37(6):849–62.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and attrition bias that seriously weakened confidence in the results.

Paskett E, Tatum C, Rushing J, Michielutte R, Bell R, Foley KL, *et al.* Randomized trial of an intervention to improve mammography utilization among a triracial rural population of women. *J Natl Cancer Inst.* 2006;98(17):1226–37.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Pekmezi DW, Neighbors CJ, Lee CS, Gans KM, Bock BC, Morrow KM, *et al.* A culturally adapted physical activity intervention for Latinas: a randomized controlled trial. *Am J Prev Med.* 2009;37(6):495–500.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Philis-Tsimikas A, Fortmann A, Lleba-Ocana L, Walker C, Gallo LC. Peer-led diabetes education programs in high-risk Mexican Americans improve glycemic control compared with standard approaches: a Project Dulce promotora randomized trial. *Diabetes Care.* 2011;34(9):1926–31.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of performance, attrition and detection bias that seriously weakened confidence in the results.

Reijneveld SA, Westhoff MH, Hopman-Rock M. Promotion of health and physical activity improves the mental health of elderly immigrants: results of a group randomised controlled trial among Turkish immigrants in the Netherlands aged 45 and over. *J Epidemiol Community Health.* 2003;57(6):405–11.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Rosal MC, Ockene IS, Restrepo A, White MJ, Borg A, Olendzki B, *et al.* Randomized Trial of a Literacy-Sensitive, Culturally Tailored Diabetes Self-Management Intervention for Low-Income Latinos: Latinos en Control. *Diabetes Care.* 2011;34(4):838–44.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

Ruggiero L, Riley BB, Hernandez R, Quinn LT, Gerber BS, Castillo A, *et al.* Medical assistant coaching to support diabetes self-care among low-income racial/ethnic minority populations: randomized controlled trial. *West J Nurs Res.* 2014;36(9):1052–73.

Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, attrition and detection bias that seriously weakened confidence in the results.

Russell KM, Champion VL, Monahan PO, Millon-Underwood S, Zhao Q, Spacey N, *et al.* Randomized trial of a lay health advisor and computer intervention to increase mammography screening in African American women. *Cancer Epidemiol Prev Biomark.* 2010;19(1):201–10.

Reason for exclusion: 5 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection and performance bias that seriously weakened confidence in the results.

Sanderson M, Khabele D, Brown CL, Harbi K, Alexander LR, Coker AL, *et al.* Results of a Health Education Message Intervention on HPV Knowledge and Receipt of Follow-up Care among Latinas Infected with High-risk Human Papillomavirus. *J Health Care Poor Underserved.* 2015;26(4):1440–55.

Reason for exclusion: 6 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

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Reason for exclusion: 4 criteria on the critical appraisal checklist for randomized controlled trials not met, leading to a risk of selection, performance, and detection bias that seriously weakened confidence in the results.

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Appendix III: Characteristics of included studies

Randomized controlled trials

Study	Country	Setting/context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Baig <i>et al.</i> , 2005 ⁸³	USA	In the community Participants recruited from churches	100 low-income Mexican American adults aged 18 years or older, English or Spanish speaking, with a diagnosis of diabetes			EG: "Picture Good Health/Imagine una Buena Salud": church-based diabetes self-management intervention Aim: to improve diabetes self-management and diabetes outcomes Intervention delivered by: trained lay leaders with diabetes, or with a family member with diabetes Eight weekly 90-min group sessions Sessions included: 1) information about diabetes, nutrition and physical activity; 2) photovoice exercises (use of photographs and storytelling); 3) healthy recipes learning; 4) assistance from patient navigators in finding a primary care provider if necessary CG: enhanced usual care: one 90-min diabetes lecture on diabetes self-management by a health educator + assistance from patient navigators in finding a primary care provider + delayed minimal intervention	HbA1c Direct LDL Blood pressure Waist circumference DKQ-24 DES Measurements at baseline, post-test (3m.) & 6m.	Post-test: - No significant difference between groups in HbA1c levels, LDL, blood pressure and waist circumference 6 m. follow-up: - No significant difference between groups in HbA1c levels, LDL, blood pressure, waist circumference, DES scores and DKQ-24 scores
Block <i>et al.</i> , 2004 ⁸⁴	USA	In the community Participants recruited through flyers from community-based organizations, programs providing services to a low-income population, and other social services programs	481 low-income women aged 40 to 65 years old			EGs: "Little by Little": CD-ROM nutrition behavior-change program Aim: to increase fruit and vegetable consumption Intervention delivered by: computer-based EG ₁ : One-time experience with the CD-ROM nutrition behavior-change program during 15 to 20 minutes Intervention components: - dietary screening (brief assessment of fruit and vegetable intake) and immediate feedback - flexibility: participants could choose among different modules, according to their interest. Modules provided participants with nutritional messages and tips to increase fruits and vegetables intake, suggestions for specific situations (eating out, packing lunch, cooking at home) and for barriers to healthy eating - goal setting: the program suggested several goals to work toward - take-home handouts and educational materials - 2 reminder phone calls 2 months after using the computer program EG ₂ : same one-time experience with the Little by Little CD-ROM computer program, but without reminder phone calls CG: computer-based stress management CR-ROM program for 15 to 20 minutes	Fruit and vegetable intake Measurements at baseline & post-test (2m.)	Post-test: - Significantly higher fruit and vegetable intake in the EG ₁ (MD EG ₁ = 1.32; MD CG = 1.20; p = 0.016) compared to the CG - No significant difference in fruit and vegetable intake in the EG ₂ compared to the CG Subgroups analysis by educational levels: - Among participants with a low educational attainment (HS or less): significantly greater increase in fruits and vegetables among participants from the EG ₁ (MD EG ₁ = 1.22; MD CG = -0.04; p = 0.01); and no significant difference between the EG ₂ and the CG

(Continued)

Study	Country	Setting/context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Gopalan et al., 2013 ⁷⁶	USA	Clinical setting Participants recruited from urban, academic internal medicine practices	177 adult patients with poorly controlled diabetes, with recent HbA1c value greater than 8% (majority of African American women with low numeracy)			EGs: two formats for communicating diabetes control: letter grades (A through F) vs. faces expressing representative emotions Aim: to improve the understanding of information about diabetes control and disease management EG₁: one mailed individualized information about current glycemic control using a "diabetes report card" containing letter grades ranging from A to F (From Grade "A" (best grade) for HbA1c ≤ 7%, to Grade "F" for HbA1c value over 10%) + one updated report card 3 months after. EG₂: mailed individualized information about current glycemic control using a report card containing faces whose emotion reflected current glycemic control (From "happiest face" (symbol) for HbA1c ≤ 7%, to "crying face" for HbA1c value over 10%) CG: standard care: mailed individualized information about current glycemic control using a report card containing the actual HbA1c value	HbA1c Measurements at baseline, and 6m.	6 m.: - No significant difference between groups in HbA1c levels
			N	58 ^a	58			
				61 ^b				
			Mean age in y.	58 ^a	57			
				55 ^b				
			Ethnicity (%)					
			African-American	87 ^a	84			
				79 ^b				
			White	3 ^a	4			
				7 ^b				
			Other	10 ^a	12			
				15 ^b				
			Women (%)	22 ^a	29			
				28 ^b				
			Education Level (%)					
			Some HS	14 ^a	24			
				15 ^b				
			Completed HS	41 ^a	29			
				41 ^b				
			Some college	26 ^a	26			
				18 ^b				
			College degree	12 ^a	10			
				20 ^b				
			> college	7 ^a	10			
				7 ^b				
			Income (%)					
			≤ \$20,000	57 ^a	61			
				41 ^b				
			\$20,000–\$50,000	29 ^a	28			
				46 ^b				
			\$50,000–\$80,000	11 ^a	7			
				9 ^b				
			> \$80,000	4 ^a	4			
				5 ^b				

(Continued)

Study	Country	Setting/context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Heisler et al., 2014 ⁸⁵	USA	In the community Participants recruited from a community health center	188 low income Latino and African American with diabetes and low HL, aged 21 years or older			EG: iDecide/iDecido health information tool: personally tailored, interactive web-based diabetes medication decision aid Aim: to help people gain information and decision support to more actively participate in treatment decision-making Intervention delivered by: CHWs on tablet computers One 2-hr session with the CHW, to explore issues related to diabetes medication using the iDecide program iDecide program: 4 main sections using a graphical style, pictographs and animations suited to patients with low literacy providing: 1) tailored information (based upon baseline survey and HbA1c levels, preferences and priorities) about diabetes, factors influencing blood sugar (medication, foods, physical activity), and risk of diabetes complications; 2) information and discussion about participant's current risk of complications; 3) information and discussion about participant's current diabetes medications (e.g. description of mechanisms of action), other treatments opportunities, barriers to taking medication; 4) goal setting and development of action plans to improve adherence, overcome barriers to taking medications and for diabetes management; identification of questions and concerns to discuss with their doctor. + print education booklets developed by the AHRQ ("Pills for Type 2 Diabetes" and "Premixed Insulin for Type 2 Diabetes")^{133,134} + two follow-up phone calls 3 and 6 weeks after to discuss the action plan and any additional questions CG: One 1.5-hr session with a CHW: same support and evidence-based information as the EG but using print education booklets developed by the AHRQ: ("Pills for Type 2 Diabetes" and "Premixed Insulin for Type 2 Diabetes")^{133,134} and without tailoring. Booklets included information (including pictures, tables and graphs to summarize the information) about diabetes, available medication classes, administration methods, side effects, risk of diabetes complications, and suggested questions to discuss with health care providers + two follow-up calls	Anti-hyperglycemic medication decisional conflict Diabetes care self-efficacy Medication adherence HbA1c Measurements at baseline, post-test (3m.)	Post-test: - Significant improvement in Diabetes Care Self-Efficacy [Mean EG = 83.3 (19.5); Mean CG = 80.0 (16.6); $p = 0.05$] in the EG compared to the CG - No significant difference between groups in medication decisional conflict, medication adherence and HbA1c values.
			N	93	95			
			Mean age in y.	51	52			
			Men (n)	22	32			
			Women (n)	71	63			
			Unemployed (%)	68	64			
			Education: < HS (%)	39	65			
			Annual Income (%)					
			≤ \$15,000	59	61			
			> \$15,000	16	17			
			Unknown	25	22			

(Continued)

Study	Country	Setting/context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Jackson et al., 2011 ⁷⁷	USA	Clinical setting Participants recruited from prenatal care practices (public hospitals, academic practices, and community hospital)	321 low-income ethnically diverse pregnant women aged 18 years or older and less than 26 weeks of gestation			EG: Keep Fit program: Video Doctor counseling (computerized, multimedia interactive Video Doctor tool) Aim: to deliver targeted counseling messages on nutrition, exercise, and weight gain during pregnancy	Weight gain at term delivery Weight gain above the IOM guidelines Measurements at baseline & 4w.	4 w.: - No significant difference between groups in the proportion of women gaining weight above IOM guidelines, and in mean weight gain
			N	158	163	Computer-based intervention		
			Mean age in y.	26	27	3 components:		
			Race/ethnicity (%)			- One 10-15 min Video Doctor session prior to the prenatal care appointment with the clinician, including: a) a behavioral risk assessment (food intake, physical activity, knowledge about diet during pregnancy); and b) tailored counselling and education messages: in the manner of a confidential face-to-face discussion with a health care provider (based on principles of motivational interviewing), using an actor-portrayed Video Doctor, brief messages, and video clips on nutrition, exercise, and weight gain. Topics included information about healthy diet (increasing intake of fruits and vegetables, whole grains, healthful fats, and decreasing sugary foods) and physical activity		
			Hispanic	39	42	- Cueing Sheet for the clinician printed at the end of the session with the Video Doctor: including a summary of the patient's risk profile and suggestions for counselling statements during the medical visit		
			African-American	24	23	- Educational Worksheet for the patient, including information presented by the Video Doctor and questions for self-reflection		
			Asian	16	13	CG: usual care		
			White, non-Hispanic	12	13			
			Other/mixed	9	8			
			Education (%)					
			< HS	20	28			
			HS graduate	28	17			
			College and above	52	55			
			Medicaid (%)	85	85			
Kim et al., 2009 ⁸⁶	USA	In the community Participants recruited from ethnic media, ethnic Korean churches, and Korean grocery stores	83 Korean American immigrants aged 30 years or older, with diabetes and an uncontrolled glucose level (HbA1c $\geq$ 7.5%)			EG: community-based self-help intervention program for type 2 diabetes (SHIP-DM): culturally tailored behavioral intervention program Aim: to achieve better glycemic control, to empower patients with greater diabetes-related knowledge, self-efficacy, and self-help skills	DKT Stanford Chronic Disease Self-Efficacy scale SDSCA KDSKA DQOL HbA1c FBG Lipid: HDL, LDL, triglyceride Systolic blood pressure Diastolic blood pressure BMI Measurements at baseline, & post-test (30 w.)	Post-test: - Significant reduction in HbA1c levels in the EG compared to the CG [MD EG = -1.3 (1.3); MD CG = -0.4 (1.4); p = 0.01] - Significant lower levels of triglyceride in the EG compared to the CG [MD EG = -84.6 (384.4); MD CG = -4.2 (115.8); p = 0.00] - Significant improvements in diabetes knowledge [MD EG = 2.4 (2.3); MD CG = 0.7 (2.4); p = 0.00], self-care activities [MD EG = 17.5 (16.9); MD CG = 2.5 (15.4); p = 0.00], self-efficacy [MD EG = 6.6 (14.4); MD CG = -0.9 (15.1); p = 0.01], and quality of life [MD EG = -4.6 (17.3); MD CG = 0.3 (16.4); p = 0.03] - No significant difference between groups in FBG, BMI, systolic blood pressure, diastolic blood pressure, HDL, LDL, and depression scores
			N	41	42	Intervention delivered by: a bilingual nurse + a nutritionist		
			Mean age in y.	56	57	3 components:		
			Men (%)	62	49	- 6 weekly psycho-behavioral education sessions in groups (nurse + nutritionist). Aim: improving diabetes knowledge and promoting diabetes self-care behaviors for glucose control. Sessions included information about diabetes and diabetes management guidelines, complications, healthy eating, food labels reading, medications and interactions, problem-solving skills, and communication skills with physicians.		
			Women (%)	37	51	- home glucose and blood pressure telemonitoring, with monthly reports sent to the participants		
			Married (%)	90	85	- monthly individualized telephone counseling by a nurse for 24 weeks (10-25 min): to reinforce knowledge, discuss about problems and barriers, overcome barriers, and for emotional support		
			Employed (%)	6	80	CG: delayed intervention		
			High education level (%)	52	44			
			Family income > \$40,000 (%)	63	55			

(Continued)

Study	Country	Setting/context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Koniak-Griffin et al., 2015 ⁷⁸	USA	In the community Participants recruited from parent education centers, churches, laundromats, and organizations providing basic services to children and families	223 underserved low-income immigrant Latinas, aged 35 to 64 years, overweight (BMI ≥ 25)			EG: 6-month Lifestyle Behavior Intervention “Mujeres Sanas y Precavidas” (Healthy Women Prepared for Life) Aim: to promote healthy lifestyle behaviors (diet and physical activity) for reduction of cardiovascular disease risk Intervention delivered by: CHWs (promotoras) - 8 group education sessions based on the “Your Heart, Your Life” (Su Corazón, Su Vida) program (promotora-led educational program for Latinas),¹⁶⁵ led by promotoras. Participants received health information and education about heart functioning, heart attack symptoms, heart-healthy eating, physical activity, cholesterol, living smoke free, diabetes, and hypertension using a variety of approaches to motivate behavioral changes such as videos, role plays, and low-literacy culturally adapted brochures - 8 Individual Teaching and Coaching sessions (4 home visits plus 4 telephone calls) from the promotoras: to reinforce class content, to help participants setting personal goals for lifestyle changes, offer support and help them to overcome barriers to lifestyle change. - pedometer to promote self-monitoring + physical activity DVD + culturally-appropriate recipes CG: safety/disaster preparedness group educational program (8 sessions during 6 m.) led by promotoras + 8 sessions of individual teaching and coaching for more in-depth discussion about class content	Physical activity: accelerometer Weight BMI Waist circumference Blood pressure Total serum cholesterol HDL cholesterol LDL cholesterol Triglycerides Blood glucose Measurements at baseline & 9m.	9 m.: - Significant difference in average daily steps count (physical activity) (MD EG = -2; MD CG = -1130; p = 0.04) due to a significant decrease in the CG - Significant decrease in waist circumference in the EG (MD EG = -2.99; MD CG = -0.71; p = 0.04) in the EG compared to the CG - No significant difference in average daily minute in moderate physical activity between groups, as well as in weight, BMI, cholesterol (total cholesterol, HDL and LDL), triglycerides, and blood glucose
			N	111	112			
			Mean age in y.	43	46			
			Education (n)					
			≤ 8th grade	57	60			
			9th–12th grade	37	38			
			≥ 13 years	16	12			
			Marital status (n)					
			Married/with partner	84	77			
			Divorced/ widowed/ single	27	35			
			Income (n)					
			≤ \$20,000	57	65			
			\$20,001–\$40,000	32	32			
			\$40,001–\$75,000	22	15			
			Unemployed (n)	78	87			
			No health insurance (n)	78	74			
Kripalani et al., 2007 ⁷⁹	USA	Primary care clinical setting Participants recruited from primary care clinics	250 men, mainly African Americans, aged between 45 to 70 years.			EGs: handouts about prostate cancer Aim: to empower men to discuss prostate cancer with their physician, to promote informed decision-making for prostate cancer screening Before the appointment with the doctor, in the waiting room: EG₁: high-detail patient education handout (one single color-printed page) on prostate cancer screening, including prostate related information such as its function and location, prevalence and symptoms of prostate cancer, available screening tests, as well as advantages and disadvantages of screening (information to be shared with patient as recommended by experts). The handout concluded with a message to ask the doctor for more information. Use of large characters, simple text written at a 6th grade reading level, illustrations, with a focus on the most important information, and following recommendations for low-literacy educational materials. EG₂: low-detail handout with less information than EG₁: only few information (prevalence of prostate cancer only – no information about screening tests), simply encouraging patients to talk to their doctor about prostate cancer. No information about screening tests. Text written at a 5th grade reading level, only one illustration of the gland's location CG: control handout, with a picture of a food pyramid	Frequency of discussion about prostate cancer with the doctor during the medical visit PSA test ordered DRE Measurements at baseline & immediate post-test	Post-test: - Significant higher odds of prostate cancer discussion in the EG₂ compared to the CG (OR = 2.32; 95% CI = 1.24 - 4.34; p = 0.008) - Non significant difference in frequency of discussion between the EG₁ and the CG - Higher odds of PSA ordered in the EG₁ (OR = 6.66; 95% CI = 1.44 - 30.74; p = 0.02) and in the EG₂ (OR = 5.70; 95% CI = 1.21 - 26.91; p = 0.03), compared to the CG - No significant difference between groups in DRE
			N	86 ^a	83			
				81 ^b				
			Mean age in y.	56 ^a	55			
				58 ^b				
			Race (n)					
			African-American	72 ^a	80			
				74 ^b				
			Caucasian	12 ^a	3			
				5 ^b				
			Other	2 ^a	0			
				2 ^b				
			Education mean in y.	11 ^a	11			
				10 ^b				
			REALM (n)					
			≤ 3rd grade	30 ^a	33			
				31 ^b				
			4th–6th grade	9 ^a	19			
				18 ^b				
			7th–8th grade	18 ^a	19			
				20 ^b				
			≥ 9th grade	29 ^a	12			
				12 ^b				

(Continued)								
Study	Country	Setting/context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Kripalani <i>et al.</i> , 2012 ⁷⁵	USA	Primary care clinical setting Participants recruited from primary care clinics	435 patients aged 18 years or older with coronary heart disease, mainly African American and with a low socioeconomic status			EGs: Improving Medication Adherence through Graphically Enhanced interventions in Coronary Heart Disease (IMAGE-CHD) Aim: to improve medication adherence EG ₁ : illustrated medication schedule in a grid format (called the Universal Medication Schedule), ¹³² including the medicine's name, indication, dosing instructions in plain language, a color picture of each medication, an icon to show its purpose, and how much medicine should be taken at each time (morning, noon, evening, night) + brief 5-min introduction to the tool with a pharmacist + medication schedule updated quarterly and mailed with a short letter summarizing changes + phone call to discuss changes and answer questions EG ₂ : mailed refill reminder postcards, including the refill date as well as other important reminders such as the opening hours of the pharmacy (+ another reminder two weeks after if the participants did not refill their medications) EG ₃ : illustrated medication schedule + refill reminder postcards CG: usual care	CMG Measurements at baseline & 12m.	12 m.: - No significant difference in adherence rates between groups
			N	121 ^a	96			
				102 ^b				
				116 ^c				
			Mean age in y.	64 ^a	64			
				65 ^b				
				63 ^c				
			Women (%)	54 ^a	55			
				52 ^b				
				60 ^c				
			African-American (%)	88 ^a	91			
				91 ^b				
				94 ^c				
			Education mean in y.	11 ^a	11			
				11 ^b				
				11 ^c				
			REALM (%)					
			≤ 6th grade	42 ^a	45			
				52 ^b				
				42 ^c				
≥ 7th grade	58 ^a	55						
	48 ^b							
	58 ^c							
Lutes <i>et al.</i> , 2017 ⁸⁷	USA	In the community Participants recruited through rural primary care practices + community-based strategy using mailings, dispersed announcements and flyers in local churches and community centers, and advertised by word of mouth in local community gatherings	200 rural adult African American women, aged 19 to 75 years old, with type 2 diabetes and HbA1c ≥ 7.0%			EG: EMPOWER intervention (Empowering Rural African American Women and Communities to Improve Diabetes Outcomes): lifestyle intervention Aim: to make small changes in diet and physical activity, to improve diabetes outcomes Intervention delivered by: CHWs Small changes lifestyle coaching, including 16 20-30 minute sessions by phone over 12 months. First session: Participants received the EMPOWER treatment manual and materials for self-monitoring (recording forms, pedometer, weight scale and glucose monitor). Following sessions focused on diabetes self-management behaviors and included: - a patient check-in: self-monitoring behaviors, successes, challenges, and barriers to treatment - information about self-monitoring, nutrition, physical activity, skill power, diabetes and medication, time management, communication, coping, use of community resources, and problem solving - specific goal setting for the upcoming weeks, using a specific goal-setting model (to alter the quality, quantity, or frequency of a current dietary or physical activity behavior), with identification and implementation of strategies and plans to achieve the behavioral goal CG: Mail-based education group: 16 mailings of diabetes educational materials from the Academy of Nutrition and Dietetics regarding diet selection, healthy snacking, managing medications, monitoring blood glucose, and engaging in physical activity	HbA1c Weight Blood pressure DES-SF Diabetes Self-Efficacy MMAS-8 SDSCA Measurement at baseline and post-test (12m.)	Post-test.: - No significant differences between groups in HbA1c, systolic and diastolic blood pressure, self-care scores, medication adherence, empowerment, and self-efficacy - Significant greater weight loss among participants from the EG [MD EG = -1.35 (6.22); MD CG = -0.39 (4.57); p = 0.046] compared to the CG
			N	100	100			
			Mean age in y.	53	54			
			Education (%)					
			HS or less	48	47			
			Annual income (%)					
			< \$30,000	75	82			

(Continued)

Study	Country	Setting/context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Martin et al., 2011 ⁸⁸	USA	In the community Participants recruited from community clinics providing free hypertension medications to individuals living in poverty	434 rural, low-income hypertensive adults, aged 19 years or older, mainly African Americans			EG: The adherence promotion (AP) intervention: multimedia computer-based program Aim: to improve hypertension medication adherence, by changing individual behaviors such as goal setting and self-monitoring Intervention delivered by: CHAs + computer-based 4 sessions using a multimedia computer based program delivered via a "Cyber Nurse" (audio recording of a female voice giving guidance and instructions) and a "Video Doc" (videos of an African-American physician), with a CHA who served as the liaison between the computer and the participant. The computer program included: - Assessments (medical problems, height, weight, blood pressure, medication adherence); - CHA/participant discussion points; - Video Doc tailored feedback; - Low-literacy video displays of tailored health information about hypertension according to the participant's responses to the assessments: Video Doc clips, and narratives from hypertensive individuals about challenges and successes with hypertension medication, consequences of non-adherence, perceived benefits for taking medication, and self-monitoring techniques; - Goal setting + handouts + 4 phone contact with the CHA 2 weeks after each session: to discuss goals set, and to review and reinforce medication adherence strategies CG: 4 home visits by a CHA, including general cancer information via laptop computers, including specific cancers, symptoms, risk factors, early detection methods, and lifestyle behaviors	Medication adherence CES-D Measurements at baseline & 6m.	6 m.: - Greater proportion of adherent participants in the EG compared to the CG, but difference between groups not significant
			N	221	213			
			Mean age in y.	57	55			
			Men (n)	76	65			
			Women (n)	145	148			
			Race (n)					
			Black	209	201			
			White or other	12	11			
			Education (n)					
			< HS	109	110			
			= HS	85	78			
			> HS	27	25			
			Income (n)					
			<\$15,000	180	175			
			≥\$15,000	41	38			
			Marital status (n)					
			Married / partnered	76	76			
			Other	145	137			
			Employment status (n)					
			Employed	60	52			
			Unemployed	57	62			
			Other	104	99			
Mohan et al., 2014 ⁸⁹	USA	Clinical setting Participants recruited from a safety net clinic	200 Latino patients aged 18 years or older with diabetes and with a least 1 chronic medication			EG: PictureRx medication lists (plain language medication lists) Aim: to improve medication management by addressing barriers to health literacy Based on the prescribed medication regimen, each participant received an education tool: a printed color illustrated medication schedule in the form of a grid, including (called the Universal Medication Schedule):¹³² - how much medicine should be taken at each time (morning, noon, evening, night) - a picture of each medication - a labelled icon to show the purpose of the medicine - medication instructions in plain language + a 2-min video and a 1-page sheet to explain how to use the illustrated medication schedule. CG: usual care: traditional prescription instructions	ARMS Measurements at 1w.	1 w.: - No significant difference between groups in medication adherence
			N	99	101			
			Mean age in y.	50	49			
			Men (n)	38	23			
			Women (n)	61	78			
			Education mean in y.	8	8			
			HL (mean BHLS score)	10	10			
			Limited HL (%)	58	60			

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Study	Country	Setting/context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Muchiri <i>et al.</i> , 2015 ⁹⁰	South Africa	In the community, in a resource-limited setting (limited infrastructure such as facilities and services, lack of health professional specialists) Participants recruited from community health centers	82 black African adults with a low socio-economic status, and with type 2 diabetes aged 40–70 years			EG: nutrition education tailored to the needs and preference of participants Aim: to improve glycaemic control (HbA1c) and other clinical outcomes (BMI, blood lipids, blood pressure) through improved dietary behaviours (dietary intake including portions of starchy foods) and behaviour-mediating factors (knowledge, beliefs and attitudes, self-efficacy and goal setting)	HbA1c	6 and 12 m.: - No significant differences between groups in HbA1c, BMI, total cholesterol, LDL, HDL, triglycerides, and blood pressure
			N	41	41	Intervention delivered by: dietitians, nutrition and food science university student, horticulture officer 3 components: - eight weekly group sessions (2 to 2.5 h) about diabetes: pathophysiology, risk factors, symptoms, complications, treatment, nutrition (dietary principles, food groups, meal balance, portion control, planning meals on a limited budget) - follow-up sessions: four 1.5h monthly meetings and two 1.5h bi-monthly meetings - vegetable gardening: demonstration of sowing/transplantation of vegetables + education materials (pamphlets and posters) CG: usual care + education materials (pamphlets and posters)	Measurements at baseline, 6m. & 12m.	
			Mean age in y.	60	58			
			Men (n)	5	6			
			Women (n)	36	35			
			Marital status (n)					
			Single	6	6			
			Married	25	28			
			Widowed	6	6			
			Separated/divorced	4	1			
			Education level (n)					
			No formal education	2	5			
			Grade 1–6	11	11			
			Grade 7–9	18	16			
			Grade 10–12	7	8			
			Post grade 12	3	1			
			Employment status (n)					
			Employed	2	6			
			Not employed	39	35			
Peragallo <i>et al.</i> , 2012 ⁸⁰	USA	In the community Participants recruited through flyers from churches, supermarkets, and community organizations.	548 community-dwelling adult Hispanic women, aged between 18 and 50 y. old, reporting sexual activity in the last 3 months			EG: SEPA intervention (Salud/Health, Educacion/Education, Promocion/Promotion, Autocuidado/Self-care) = HIV risk reduction intervention Aim: to reduce HIV risk factors Intervention delivered by: bilingual and bicultural Hispanic female facilitators five, 2-h sessions delivered in small groups. Sessions covered HIV/AIDS in the Hispanic community, STIs, HIV/AIDS prevention (e.g., condom use), negotiation and communication with the partner, IPV and substance abuse. Self-efficacy skills building using role play, participatory sessions, videos and discussions + booster session to discuss topics related to the HIV intervention at 6-month follow-up CG: delayed intervention control group, one-session, condensed version of SEPA after their 12-month assessment	Chlamydia infection	Post-test: - No significant difference between groups in chlamydia infection rates, in condom use, in partner communication, in perceived barriers to condom use, and in depression scores 12 m.: - Higher proportion of participants in the EG reporting condom use than in the CG (EG = 49%, CG = 35%; p = 0.01) - No significant difference between groups in chlamydia infection rates, in partner communication, in perceived barriers to condom use, and in depression scores
			N	274	274	Condom use		
			Mean age in y.	39	38	The Communication with Partner Scale		
			Education in y.	14	13	Perceived barriers to condom use		
			Employed (n)	92	88	CES-D		
			Monthly income < \$2000 (n)	196	185	Measurements at baseline, post-test (6m.) & 12m.		
			Living with a partner (n)	181	199			
			Health insurance (n)	92	114			

(Continued)

Study	Country	Setting/context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Phelan et al., 2017 ^{7,3}	USA	In the community Participants recruited from WIC clinics	370 low-income postpartum women (6 weeks to 12 months postpartum), aged 18 to 40 years old, with a BMI ≥ 25 , or with a BMI between 22 and 24.9 but exceeding pre-pregnancy weight by 4.5 kg or more			EG: Fit Moms/Mamás Activas intervention: culturally and linguistically adapted, primarily internet-based behavioral weight loss intervention Aim: to promote weight loss Intervention delivered by: internet-based intervention, not mentioned for group sessions	Weight	Post-test: - Significant greater weight loss in the EG compared to the CG (MD EG = -3.2 [-4.1, -2.4]; MD CG = -0.9 [-1.7, -0.1]; $p < 0.001$) - Significant reduction in waist circumference (MD EG = -4.0 [-5.1, -2.9]; MD CG = -1.2 [-2.2, -0.2]; $p < 0.001$) - Significant greater percentage weight loss (MD EG = -5.0 [-6.3, -3.7]; MD CG = -1.9 [-3.13, -0.7]; $p < 0.002$) - Significant greater proportion achieving 5% or more weight loss (EG: 85/174 (48.7%); CG: 63/193 (31.9%); $p = 0.005$) - Significant greater proportion achieving 10% or more weight loss (EG: 45/174 (26.0%); CG: 25/193 (12.8%); $p = 0.007$) - Significant higher proportion of women returning to pre-conception weight or below in the EG compared to the CG (EG: 51/152 (35.6%); CG: 36/172 (20.9%); $p < 0.001$) - No significant difference between groups in physical activity and dietary intake
			N	174	196	Standard WIC care + a 12-month internet-based weight loss program.	Proportion of women returning to pre-conception weight	
			Mean age in y.	27	29	Content of the internet program: guidance and resources, automated feedback, weekly lessons, a web diary, a weight and physical activity tracker, instructional and inspirational videos, and a message board	Physical activity: accelerometer	
			Hispanic/Latino (%)	84	80	+ monthly face-to-face group sessions at WIC clinics.	ASA24	
			Marital status (%)			CG: standard WIC care + 6 newsletters every 2 months with information about weight control, exercise, nutrition and wellness	Waist circumference	
			Married or with significant other	81	75		Percentage weight loss	
			Divorced	3	7		Proportion achieving 5% or more weight loss	
			Widowed/single	15	19		Proportion achieving 10% or more weight loss	
			Education (%)				Measurement at baseline & post-test (12 m.)	
			Grade school or junior high	21	22			
			HS	37	36			
			Some college and college	41	41			
			Employment (%)					
			Unemployed	71	77			
			Employed	29	23			
			Annual household income (%)					
			< \$10,000	17	21			
			\$10,000-\$19,999	3	31			
			\$20,000-\$29,999	32	26			
			$\geq$ \$30,000	21	22			

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Study	Country	Setting/context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Sadler et al., 2011 ⁷¹	USA	In the community, intervention delivered in beauty salons Participants recruited from beauty salons	984 African American women aged 20 years or older			EG: The Black Cosmetologists Promoting Health Program: beauty salon-based education program	Adherence to mammography screening guidelines Measurements at baseline & 6 m.	6 m.: Subgroup of participants aged 40 y. or more: - Odds of being adherent in mammography screening significantly 2.0 times higher among participants in the EG, compared to participants in the CG (OR = 2.0; 95% CI = 1.03 – 3.85; p < 0.01)
			N	481	503	Aim: to increase the odds of African American women adhering to recommended breast cancer screening guidelines		
			Mean age in y.	40	40	Intervention delivered by: cosmetologists		
			Education (n)			Delivery of health information by cosmetologists in beauty salons to their client through proactive discussions about the importance of adherence to breast cancer screening guidelines for early breast cancer detection and prompt treatment.		
			< HS	57	58	Various techniques used by cosmetologists to deliver Breast Cancer screening messages to their clients:		
			Some college	256	258	- “Mirror Challenges” placed in the corner of the cosmetologists’ mirror to stimulate discussions about attitude and beliefs regarding breast cancer;		
			Completed college	155	177	- storytelling;		
			Missing value	13	10	- use of hands-on to facilitate discussion, - enlarged articles from lay newspapers and magazines - binder of information - soft plastic breast cancer model to show how a breast cancer lump felt - breast cancer posters and brochures in plexiglass stands throughout the salons CG: equivalent training program about diabetes		

(Continued)

Study	Country	Setting/context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Samuel-Hodge et al., 2009 ⁷⁴	USA	In the community Participants recruited from African American churches	201 African Americans aged 20 years or older, with type 2 diabetes			EG: "A New DAWN" (Diabetes Awareness and Wellness Network) Aim: to (1) promote change in dietary, physical activity, medication adherence, and glucose self-monitoring behaviors to improve metabolic control 4 components: - One 60-min individual counselling visit with a dietitian: assessment of dietary habits, psychosocial issues, eating patterns, and barriers to dietary and physical activity behavior changes + setting of behavior goals - Group education sessions: 12 biweekly interactive group education sessions (90 to 120 minutes) led by a dietitian and the church diabetes advisor a health professional from the local community: 1) information about diabetes (risk factors, causes, symptoms), food (carbohydrates, protein, fat, and serving sizes, and their effect on blood glucose), healthy eating, blood glucose monitoring, blood pressure control, planning meals, diabetes medication; 2) 15 minutes of physical activity + taste testing of recipes - One monthly phone contact with the church diabetes advisor: support for behavior change to improve diabetes self-management (related to behavior goals set with the dietitian during the individual counselling session) - 3 printed postcard messages of encouragement from health care providers (physician), tailored to behavioral goals and including brief messages and recommendations relevant to dietary behavior, physical activity, and HbA1c and blood pressure control CG: minimal intervention: - mailing of two pamphlets on diabetes self-care ("Healthy Eating" and "Staying Active") from the American Diabetes Association - 3 bimonthly newsletters with general health information and study updates	HbA1c Weight Blood pressure PA: accelerometer The Diabetes Knowledge Scale SF-36 Diabetes-related health status Measurements at baseline, 8m. & 12 m.	8 m.: - Significant reduction in HbA1c in the EG compared to the CG [Mean EG = 7.4 (0.1); Mean CG = 7.8 (0.1); Difference = 0.4; 95% CI (0.1, 0.6); p = 0.009] - Significant higher diabetes knowledge in the EG compared to the CG [Mean EG = 10.7 (0.2); Mean CG = 9.8 (0.2); Difference = -0.9; 95% CI (-1.5, -0.3); p = 0.003] - Significant improvement of diabetes-related mental well-being in the EG compared to the CG [Mean EG = 28.2 (0.6); Mean CG = 26.0 (0.4); Difference = -2.1; 95% CI (-3.6, -0.7); p = 0.004] - No significant difference between groups in physical activity (hours per day and total hours), systolic blood pressure, weight, SF-36 physical and mental health components scores, and diabetes-related health status (social well-being) - Significant reduction in diastolic blood pressure in the CG compared to the EG [Mean EG = 75 (0.8); Mean CG = 72 (0.5); Difference = -3.3; 95% CI (-5.2, -1.4); p < 0.001] 12 m.: - Significant difference between groups in diabetes-related mental well-being [Mean EG = 27.8 (0.7); Mean CG = 25.4 (0.7); Difference = -2.3; 95% CI (-4.2, -0.5); p = 0.02] - Difference in HbA1c and in diastolic blood pressure between groups no longer significant - No significant difference between groups in physical activity (hours per day and total hours), systolic blood pressure, weight, SF-36 physical and mental health components scores, and diabetes-related health status (social well-being)
			N	117	84			
			Mean age in y.	57	61			
			Men (n)	42	31			
			Women (n)	75	53			
			Education mean in y.	13	12			
			Living with a partner (n)	58	48			
			Currently employed (n)	56	39			
			Household income < \$30,000 (n)	32	21			

(Continued)

Study	Country	Setting/context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Stockwell et al., 2014 ⁹¹	USA	In the community Participants recruited from community-based clinics	1153 low-income women, obstetric patients, initiating prenatal care			EG: influenza vaccine-related text messages Aim: to encourage influenza vaccination	Receipt of influenza vaccination Measurements at baseline & 4m.	4 m.: - Higher rates of vaccination in the EG compared to the CG (49.3% vs. 46.6% respectively; p = 0.048)
			N	576	577	Intervention delivered by: text messages		
			Age			Usual care + 5 weekly, automated text message (written at a fourth grade level)		
			< 20	41	50	influenza vaccine reminders providing educational health information about:		
			20 – 29	338	308	- increased risk for influenza-related disease during pregnancy and early childhood;		
			30 – 39	179	189	- vaccine safety;		
			≥ 40	18	30	- influenza vaccine recommendations and suggestion to discuss the vaccine with the doctor during the next prenatal visit.		
			Insurance status (n)			+ additional text messages if desired by participants about influenza risk, common misperceptions, side effects		
			Uninsured	179	181	CG: usual care: routine automated telephone pre and postnatal appointment reminders provided directly from the clinic network		
			Medicaid / SCHIP	394	387			
			Private	3	9			
Tu et al., 2006 ⁸¹	USA	Clinical setting, primary care setting Participants recruited from a community clinic	210 low income Chinese Americans aged 50 to 78 years			EG: CRC screening education Aim: to promote CRC screening and FOBT	FOBT screening Measurements at baseline & 6m.	6 m.: - Higher proportion of participants in the EG received FOBT screening (69.5%), compared to participants in the CG (27.6%) (no p-value given), with higher odds of FOBT screening in the EG compared to the CG (OR = 5.98, 95% CI = 3.29-10.85)
			N	105	105	Intervention delivered by: health educator		
			Age (%)			One session of CRC screening education with the health educator, including a motivational video on CRC screening, print materials (motivational pamphlet, FOBT instruction sheet, CRC informational pamphlet from the Federation of Chinese American and Canadian Medical Societies), and the delivery of a FOBT kit		
			50 – 64	59	49	CG: usual care		
			65+	41	50			
			Men (%)	36	38			
			Women (%)	64	62			
			Insurance (%)					
			Public	82	84			
			Private	12	11			
			None	6	5			

^a = EG₁; ^b = EG₂; ^c = EG₃; AHRQ = Agency of Health Research and Quality; AIDS = acquired immune deficiency syndrome; ARMS = Adherence to Refills and Medications Scale; ASA-24 = Automated Self-Administered 24-Hour; BHLIS = Brief Health Literacy Screen; BMI = body mass index; CBE = clinical breast examinations; CES-D = Center for Epidemiologic Studies - Depression Scale; CG = control group; CHA = community health advisor; CHW = community health worker; CMG = Cumulative Medication Gap; CRC = colorectal cancer; DES = Diabetes Empowerment Scale; DKQ-24 = Diabetes Knowledge Questionnaire; DRE = digital rectal examination; DKT = Diabetes Knowledge Test; DQOL = Diabetes Quality of Life Measure; EG = experimental group; FBG = fasting blood glucose; FOBT = fecal occult blood testing; GED = General Educational Development test; HbA1c = glycated hemoglobin; HDL = high density lipoprotein; HIV = human Immunodeficiency virus; HL = health literacy; HS = high school; IOM = Institute of Medicine; KDSKA = Kim Depression Scale for Korean Americans; LDL = low density lipoprotein; m. = month(s); MD = mean difference; MMAS-8-item = Morisky Medication Adherence Scale; MVPA = moderate to vigorous physical activity; PA = physical activity; PAR-Q = Physical Activity Recall Questionnaire; PSA = prostate specific antigen; REALM = the Rapid Estimate of Adult Literacy in Medicine; SCHIP = State Children's Health Insurance Program; SDSCA = Summary of Diabetes Self-Care Activities scale; SF-36 = Short Form-36; STI = sexually transmitted infection; STOFHLA = Short Test of Functional Health Literacy in Adults; TOFHLA = Test of Functional Health Literacy in Adults; w. = week(s); WIC = woman, infant and children; y. = year(s).

Quasi-experimental studies

Study	Country	Setting/ context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Park, 2011 ⁷²	Korea	In the community Participants recruited from senior centers	136 community dwelling older adults aged 65 years or older, with a low educational level			EG ₁ : interactive pictorial education for safe medication (3 40-min group sessions, once a week during 3 weeks) Aim: to reduce medication misuse and non-adherence, and improve self-efficacy and knowledge towards safe medication Intervention delivered by: nurses Use of a pictorial guide map with symbolic images. Each part of the pictorial guide map explored a variety of medication-related topics and situations such as usage, reading medication labels, calculating the dosage, side effects, drug interactions and storage using pictorial cards adapted to the learning patterns and psycho-motor skills of older adults. Participants progressed on the map. At each stop point, pictorial cards were used to ask a set of medication related questions to participants, leading to interactive discussion with other participants and the nurse + information booklet EG ₂ : 3 40-min sessions of conventional education only (same content as the EG ₁) + information booklet (written text information) CG: no intervention	SEAMS Measurements at baseline & post-test (3w.)	Post-test: - Significant improvement in self-efficacy in the EG ₁ and the EG ₂ compared to the CG [MD EG ₁ = 4.31; MD EG ₂ = 1.98; MD CG = 0.03; p < 0.001], with higher improvements in the EG ₁ compared to the EG ₂ (p < 0.05)
			N	45 ^a	46			
				45 ^b				
			Age					
			65-69	7 ^a	7			
				9 ^b				
			70-74	12 ^a	1			
				14 ^b				
			75-79	10 ^a	13			
				10 ^b				
			≥ 80	16 ^a	14			
				12 ^b				
			Women (n)	21 ^a	22			
				22 ^b				
			Men (n)	24 ^a	24			
				23 ^b				
			Education					
			None (illiterate)	4 ^a	5			
				5 ^b				
			None (literate)	6 ^a	7			
				6 ^b				
			Elementary	23 ^a	22			
				22 ^b				
			Middle school	10 ^a	10			
				11 ^b				
			≥ HS	2 ^a	2			
				1 ^b				
			Marital status (n)					
			Married	20 ^a	19			
				20 ^b				
			Widowed	22 ^a	25			
				23 ^b				
			Divorced	3 ^a	2			
				2 ^b				

(Continued)

Study	Country	Setting/ context	Participant characteristics			Intervention	Outcomes measured and follow-up	Description of main results
				EG	CG			
Yang <i>et al.</i> , 2016 ⁸²	South Korea	In the community Participants recruited in the community using flyers distributed in public housing, health clinics, playgrounds, junior colleges, public aid office, grocery stores, and laundromats; or by word of mouth	88 low-income community-dwelling elderly aged 65 years or older with hypertension			EG: 3-month community-based CVD prevention program (CVD-PP) on cardiac health behavior and modifiable cardiovascular risk factors Aim: to help people to adhere to lifestyle modifications, improve self-efficacy, enhancing health behaviors and reducing modifiable cardiovascular risk factors Intervention delivered by: nurses - 8 40-min home visits. During the first visit, participants were encouraged to follow healthy lifestyles (physical activity, healthy diet, smoking cessation). During the second visit, participants received the results of their lab tests indicating cardiovascular risk factors. Participants were encouraged to set priorities and goals, and develop action plans. Participants were also instructed to blood pressure self-monitoring. During visits 3 to 8, behavioral changes were monitored, and emotional support and counseling were offered - 4 10-min phone calls + educational brochures on hypertension, risks of CVDs, and healthy behavior CG: usual standard care	SBP DBP Total Cholesterol Fasting Glucose BMI Measurements at baseline & post-test (3m.)	Post-test: - Significant decreases in DBP in the EG compared to the CG [MD EG = -2.52 (11.20); MD CG = 2.50 (2.36); p = 0.018] - No significant difference between groups in total cholesterol, SBP, BMI and fasting glucose
			N	42	46			
			Mean age in y.	73	72			
			Men (n)	9	17			
			Women (n)	33	29			
			Education (%)					
			None	38	37			
			Elementary school	24	24			
			Middle	12	13			
			HS	12	20			
			≥ College	14	6			

^a = EG₁; ^b = EG₂; BMI = body mass index; CG = control group; CVD = cardiovascular disease; DBP = diastolic blood pressure; EG = experimental group; HS = high school; m. = months; SBP = systolic blood pressure; SEAMS = Self-Efficacy for Appropriate Medication Use Scale; w. = weeks.