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Educational programs in type 2 diabetes designed for community-dwelling older adults: A systematic review

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ABSTRACT

Aims: This systematic review aimed to assess the effectiveness of educational interventions in type 2 diabetes specifically designed for community-dwelling older adults.

Methods: In accordance with PRISMA guidelines, a systematic search of studies published between 2010 and 2021 was conducted across five electronic databases and manual sources. The study protocol was previously registered in PROSPERO (CRD42021288236).

Results: Twelve papers matched the inclusion criteria and were appraised using MERSQI. The features of the educational programs were heterogeneous, and none complied with the ten suggested standards for diabetes self-management education and support. Comprehensive gerontological assessment was not considered. Outcomes included biomedical, psychosocial, behavioral, and knowledge measures. HbA1c and knowledge showed improvements with a high certainty level according to GRADE.

Conclusions: Structured DSME programs aimed at older adults have great potential, however there is still room to improve. Applying the principles of a comprehensive gerontological approach and the standards for DSME as continuous monitoring and support could increase their benefits.

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Introduction

Building positive health behaviors is fundamental for achieving diabetes treatment goals and maximizing quality of life.^{1,2} To this end, diabetes self-management education and support (DSMES) is essential, as it is an ongoing process that addresses the comprehensive blend of clinical, educational, psychosocial, and behavioral aspects to facilitate the knowledge, decision-making, and skills required for optimal diabetes self-care.³

Over the past decade, scientific organizations have published position statements and consensus reports to guide the management of older adults with diabetes.⁴ However, despite having the highest prevalence of diabetes of any age-group,⁵ management strategies for older adults have often been extrapolated from trials in younger populations, which have restricted the approaches to care.⁶ Even within

an age range, older adults with type 2 diabetes (T2D) represent a heterogeneous group.⁷ Their medical, functional, cognitive and physical status vary widely and are at greater risk of presenting severe comorbidities and geriatric syndromes, such as polypharmacy, depressive symptoms, and cognitive impairment.^{6,8}

Older adults with diabetes experience multiple and competing psychosocial, functional and medical challenges that interfere with their diabetes care and psychosocial well-being.⁹ Additionally, the proportion of older adults with diabetes who are living alone and/or lack stable social support is increasing, which means they would have to deal with their condition amid minimum support.¹⁰

Self-management skills are crucial because people with diabetes are responsible for making most of the decisions that influence their diabetes.¹¹ Living with diabetes requires taking multiple daily self-management decisions and performing complex self-care tasks, all of which require visual, motor, cognitive and executive skills, but also a positive coping attitude.¹

There are well-established programs^{12–14} as well as systematic reviews exploring diabetes education interventions for the general adult population.^{15–17} However, there is little evidence regarding

Abbreviation: DSMES, diabetes self-management education and support; MERSQI, Medical Education Research Study Quality Instrument; GRADE, Grading of Recommendations, Assessment, Development and Evaluation; T2D, Type 2 diabetes

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DSMES in older adults,¹⁸ which includes two recent systematic reviews that addressed self-management and self-care respectively.^{10,19} Yet, we considered that an update of the evidence applying certain different inclusion criteria (study design, age range, and outcome type) plus exploring complementary topics would enrich and broaden the previous findings. Our review aims to assess the effectiveness of structured educational interventions tailored specifically for community-dwelling older adults with T2D and explore specific features when compared to general population interventions. In addition, we aim to determine if these interventions align with existing standards for DSME and a comprehensive gerontological approach.

Materials and methods

This systematic review was conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.²⁰ The review protocol was prospectively registered with the International Prospective Register of Systematic Reviews, PROSPERO (CRD42021288236).

Eligibility criteria

Studies were considered eligible if they met the following inclusion criteria: (a) participants were community-dwelling adults aged 60 and above, diagnosed with T2D, without neurocognitive disorder, (b) structured diabetes educational programs or interventions tailored specifically for older adults with T2D, (c) reporting control group. If applicable, both pre and post comparison groups, (d) study design: randomized controlled trials, nonrandomized controlled trials, pretest-posttest, quasi-experimental or interventional study with simple random sampling, (e) at least one patient-related quantitative outcome measure. Studies were excluded if: (a) participants had type 1 diabetes (T1D) or it was not specified, were institutionalized, were middle-aged, (b) intervention was not related to diabetes education, was electronically or digitally delivered without personal interaction, (c) studies focused on describing educational interventions without assessing quantitative findings, (d) studies without abstract.

Data sources and search strategy

A systematic search in five electronic databases including Scopus, Web of Science, Pubmed, Cochrane and CINAHL, was performed for original studies published in English or Spanish between January 2010 and October 2021. Supplementary manual searches were also conducted in reference lists of studies included in this review, to identify further relevant records. Search terms were a combination of population related terms (elder* OR ageing OR aging OR "elderly patients" OR "older persons" OR "older people" OR "older adults") and (diabetes OR "type 2 diabetes" OR T2D) and intervention related terms ("education program" OR "educational intervention" OR "education model" OR "self-management" OR "management intervention" OR "motivational education" OR "self-care" OR "group education" OR program* OR SME).

Study selection

Resulting files were exported to Mendeley software. After duplicate records were removed, two review members (V.I and R.R) independently screened the titles and abstracts and classified studies as 'included', 'excluded' or 'pending'. Full text of included or pending articles were retrieved and independently assessed for eligibility by the two reviewers. Resulting records were included in the systematic review. Disagreements in the selection process were resolved through discussion with the third reviewer (M.P).

Data extraction

Data was synthesized and extracted into a Microsoft Office Excel original form data including the study characteristics, intervention features, and outcome data. Two review authors (V.I and R.R) extracted data independently. Discrepancies were solved through discussion with the third author (M.P). Missing data was requested to the study authors.

Data items

Reported outcomes were split into four categories, corresponding to clinical, psychosocial, knowledge or behavior perspectives.

Data analysis

Cohen's *d*- effect size was calculated for each of the analyzed outcomes. Certainty of evidence was assessed using the GRADE (Grading of Recommendations, Assessment, Development and Evaluation) tool when at least two studies were available for each outcome.

The broad heterogeneity across the studies regarding the participants and the educational interventions' characteristics (sample size, study design, frequency, duration, and follow-up of the interventions, and outcome evaluation instrument) could potentially impact the outcomes. For instance, we considered it was not suitable to apply a meta-analysis.

Risk of bias assessment

Study quality was assessed using the Medical Education Research Study Quality Instrument (MERSQI), which was developed to appraise the methodologic quality of quantitative medical education research.²¹ This 10-item scale includes six domains: study design, sampling, type of data, validity of evaluation instrument, data analysis, and outcomes, which are scored on a scale of 1–3 and added to determine the total score. Total score ranges from 2 (low-quality research) to 18 (high-quality research). Two reviewers (VI, RR) independently scored each paper and came together with the third reviewer (MP) to agree on the final score. There was a high level of consistency between reviewers' scoring.

Results

Search results

The database and manual searches identified 201 potentially relevant articles (Fig. 1). Duplicate records were removed, resulting in 117 articles. After the screening of titles and abstracts, 27 met the inclusion criteria and were sought for retrieval. Three studies were not retrieved and 24 were full-text reading, from which 12 were included in this systematic review. The main reasons for the exclusion of studies following full-text screening are shown in Fig. 1.

Study characteristics

The interventions were conducted in the Middle East, Asia, North America and Europe. Table 1 summarizes the characteristics and variability of the studies and educational programs. A total of 1834 older adults living with T2D, 59.8% of them females, were included in the studies, with sample sizes ranging from 28 to 964. Except for one study tailored for female participants, all were mixed.

The number of sessions varied between 4 and 8, except for two programs with 12 sessions or more.^{22,23} Intervention delivery ranged between 1 or 2 months,^{24–29} 3 to 4 months^{22,23,30,31} and 6 months.^{32,33} The education format was group^{25–27,31} or mixed

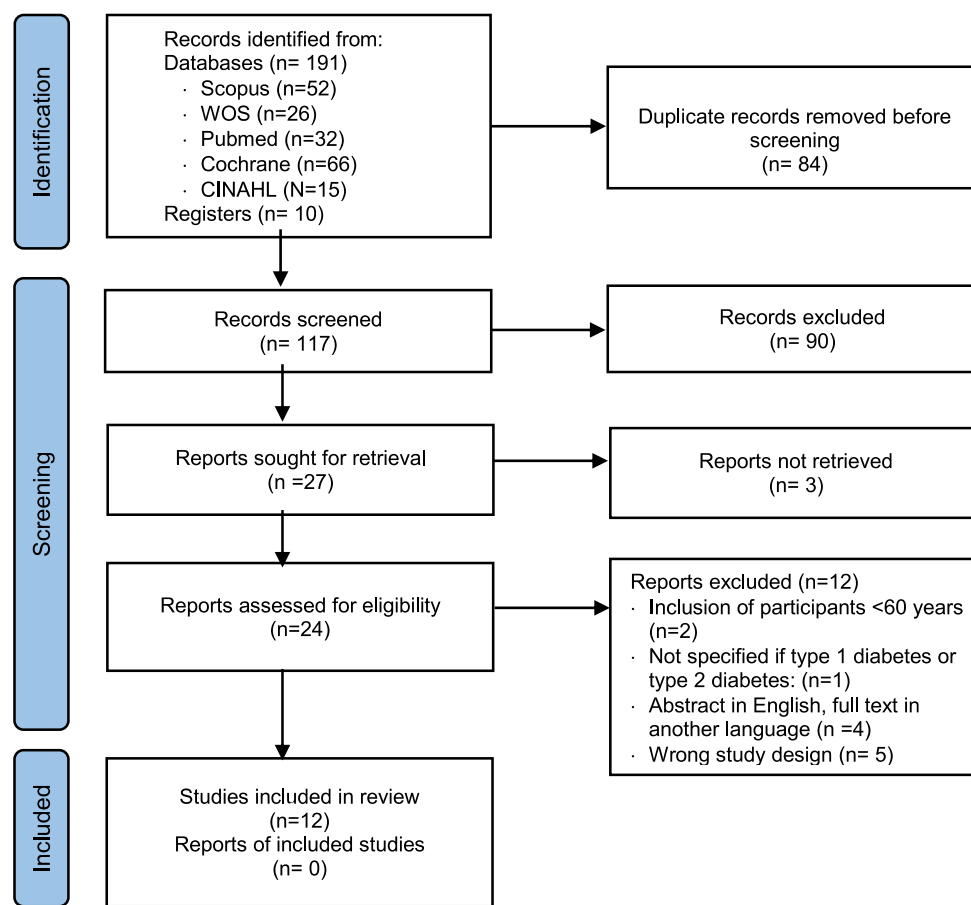


Fig. 1. PRISMA flow diagram of identification and selection of studies for systematic reviews.

(group + one to one)^{22–24,28–30,32,33}, all face to face. In addition to group education, mixed programs delivered individualized support. Once the intervention was completed, only two^{24,29} of the twelve studies provided reinforcement (2 individualized sessions).

Two educational programs^{27,28} were led by trained peers and another included them as part of the team.³³ Interventionists from nursing and nutrition were the most frequent, and none reported supporting services or counseling professionals from the social field. Four out of twelve invited participants' caregivers as part of the intervention.^{24,29,32,33} There were no reports on family/caregiver uptake. The setting was mainly at the community level and in primary care centers. Three had partial home visits (just the individualized support).^{30,32,33} Use of technology was reported for some of the individualized counselling as teleconferences²⁸ and phone calls.^{23,24,29} There were no reports of persons not using technological devices.

Study outcomes

Study outcomes are shown in Table 2. Effect size measures are shown in Appendix A and certainty of evidence according to GRADE in Appendix B (supplementary files). The most reported measures were HbA1c, quality of life, self-efficacy, and self-management. Psychosocial, behavioral, and clinical outcomes were reported in 8 studies, and knowledge in 4 out of 12 studies.

Studies used different data collection tools, even for the same outcome. Some used diabetes specific tools such as the Diabetes quality-of-life measure.²⁷ Just one study³ reported data collection tools tailored for older adults (The Diabetes Management Self-Efficacy Scale for Older Adults and The Diabetes Self-Management Knowledge

for Older Adults). Follow-up periods ranged from 1 to 12 months post intervention, with two studies^{26,31} having 2 or 3 follow ups.

Clinical outcomes

Of the six studies^{22–24,28–30} that measured HbA1c, four^{23,24,28,29} reported a significant reduction ($p < 0.001$) when comparing before and three months after the end of the intervention. Of them one²⁸ had a large effect size and two^{24,29} medium effect size and a high certainty of evidence according to GRADE. Two studies^{22,30} reevaluated three months later and did not find significant differences. Two^{24,29} out of four studies^{22,24,29,30} reported significant improvements with medium effect size in fasting blood glucose (FBG). Level of evidence was moderate.

Psychosocial outcomes

The effect on quality of life was variable. Four^{25–27,33} out of five studies^{25,27,31–33} reported significant differences in the intervention group, two^{26,27} with a large effect size. Certainty of evidence was low^{27,31–33} or very low.²⁶ Of the two studies that reevaluated this measure, just one²⁶ maintained the significant improvement in comparison to the control group. One³³ out of three programs^{33–35} that measured depressive symptoms showed a statistically significant improvement in the intervention group over the control group. Anxiety showed no significant difference.^{32,33} Both outcomes showed a small effect size and a moderate certainty of evidence.

Knowledge outcomes

The four studies^{23,24,29,30} measuring diabetes knowledge found that the intervention group had a significant improvement in this

Table 1
Characteristics of the studies and interventions included in the systematic review.

Author, year, country, reference	Study design	Initial/ final sample	Outcomes		Outcomes measured at	Methodology	Educational sessions					
			Primary	Secondary			Number	Session length (months)	Ongoing support ¹	Type	Caregiver	Setting
Askari et al. (2018) Iran ²⁹	Randomized clinical trial	N= 108 / N= 108	→HbA1c →FBG →Lipid profile	→Beliefs, attitudes, subjective norms and enabling factors	→T0 →3 months ¹	→IG: educational sessions →CG: usual care	8	1	Weeks 4 and 8 ¹	Mixed	Yes	Diabetes Center
Chen et al. (2021). Taiwan ²⁸	Double blind, block-randomized controlled clinical trial	N=28/ N= 28	→HbA1c →Self-management →Self-efficacy	→Lipid profile Body weight →BMI →BP	→T0 →End of intervention (month 1) →3 months ¹	IG: peer-led educational sessions CG: self-management manuals + usual care	4	1	NR	Mixed	No	Community setting
Ghasemi et al. (2019) Iran ²⁷	Randomized clinical trial	N= 56 / N= 44	Quality of life	No	→T0 →End of intervention (1 month) →1 month ¹	→IG: peer-led educational sessions →CG: researcher-led educational sessions	8	1	NR	Group	NR	Health care center
Kargar et al. (2015) Iran ²⁶	Interventional study with simple random sampling	N= 90 / N= NR	Quality of life	→No	→T0 →2 months ¹ →3 months ¹	→IG: educational sessions →CG: usual care	8	2	NR	Group	NR	Health care center
Lee et al. (2017) South Korea ²³	Randomized controlled study	N= 56/ N=51	Self-management behaviors	→Knowledge →Beliefs →Self-efficacy →HbA1C →Lipid profile →PA	→T0 →End of intervention (month 3)	→IG: educational sessions + phone calls →CG: volunteer option to assist to general diabetes sessions	12	3	NR	Mixed	NR	Senior center
Markle-Reid et al. (2018) Canada ³³	Multisite, single-blind, parallel, pragmatic, randomized controlled trial	N= 159 / N= 144	→Health-related quality of life	→Mental functioning →Depressive symptoms →Anxiety →Self-efficacy →Self-management →Costs	→T0 →End of intervention (month 6)	→IG: self-management sessions →CG: usual care	→2.6 home visits →4 group sessions ²	6	NR	Mixed	Yes	→Community center →Home
Miklavcic et al. (2020) Canada ³²	Multi-site, pragmatic, randomized controlled trial	N=132 / N=121	Health related quality of life- Physical functioning	→Mental functioning →Anxiety →Depressive symptoms →Self-efficacy →Self-management →Costs	→T0 →End of intervention (month 6)	→CG: self-management sessions →CG: usual care	→1.8 home visits ² →3.7 group sessions	6	NR	Mixed	Yes	→Primary care networks →Home
Ounnapiuruk et al. (2013) Thailand ³⁰	Quasi experimental	N=60/ N= 59	→Health behavior	→FBG →HbA1c →Knowledge →Self-efficacy	→T0 →End of intervention (month 3)	→IG: educational sessions →CG: usual care	→4 sessions →Home visits 3	3	NR	Mixed	NR	→Community center →Home
Rodríguez-Mañas et al. (2019). Multinational ³¹	Cluster-randomized multicenter clinical trial	N= 964 / N= 614	Functional performance	→Quality of life →Caregiver burden →Hypoglycemia episodes →Hospitalization →Cost-effectiveness	→T0 →Week 10 ¹ →Week 26 ¹ →1 year ¹	→IG: educational & exercise sessions →CG: usual care	→7 →32 exercise sessions	4	NR	Group	→NR	→Hospital o →Primary Care centers

(continued on next page)

Table 1 (Continued)

Author, year, country, reference	Study design	Initial/ final sample	Outcomes		Outcomes measured at	Methodology	Number	Educational sessions				
			Primary	Secondary				Session length (months)	Ongoing support ¹	Type	Caregiver	Setting
Saghaee et al (2020), Iran ²⁵	Pilot randomized control trial	N=17/ N=17	Self-efficacy	→ Self-care activities → Quality of life → Depression → Loneliness	→ T0 → Week 2 → End of the intervention (week 4)	→ IG: educational sessions → CG: 2 routine non-interactive educational sessions	8	1	NR	Group → NR	→ NR	Outpatient diabetes clinic
Sharifirad et al. (2011) Iran ²⁴	Parallel randomized controlled educational trial	N= 100 / N=97	→ HbA1c → FBG	→ Beliefs, attitudes, subjective norms and enabling factors	→ T0 → 3 months ¹	→ IG: educational sessions → CG: usual care	4	1	Weeks 4 y 8 ¹	Mixed	Yes	Diabetes Center
Song et al. (2012) South Korea ²²	Quasi experimental	N= 40 / N=37	→ Self-management behaviors → BMI → HbA1c → FBG → Lipid profile	→ BP → BMI → HbA1c → FBG → Lipid profile	→ T0 → End of the intervention (week 13)	→ IG: educational & exercise sessions → CG: usual care	→ 12 → 24 exercise sessions → 1 individual session	3	NR	Mixed	NR	Senior center

DM: diabetes; T2D: type 2 diabetes; NR: not reported; FBG: fasting blood glucose; HbA1c: glycated hemoglobin; BP: blood pressure; BMI: body mass index; IG: intervention group; CG: control group; ¹ after intervention was finished. ² average. ³ just for participants having difficulties with their glycemic range.

outcome, half^{24,29} with high effect size and half with small^{23,30} effect size. Certainty of evidence was high for three studies.^{23,24,29}

Behavioral outcomes

Six studies^{23,25,28,30,32,33} measured self-efficacy. Four^{23,25,28,30} found statistical improvements in the intervention group, half with high effect size^{28,30} and half with medium.^{23,25} Level of evidence was moderate. Self-management behaviors were evaluated in seven programs.^{22,23,25,28,30,32,33} Three^{22,28,30} showed a significant increase with a large effect size, and two^{23,33} with a moderate effect size. Certainty of evidence was moderate in five studies^{23,25,28,32,33} and very low in two.^{22,30} Three studies^{22,32,33} reported they were unable to measure self-monitoring blood glucose because most participants lack a glucometer at home.

Quality standards for educational programs

Of the twelve studies, just two met 75% or more of the 2017 National Standards for Diabetes Self-Management Education and Support recognized by the American Diabetes Association (ADA) and the Association of Diabetes Care & Education Specialists (ADCES).³⁶ Nine met 50% or less of the criteria (Table 3). Stakeholder input, ongoing support, use of technology, and quality improvement were the least accomplished standards. Evaluation of population characteristics and progress were the most commonly accomplished.

Risk of bias in studies

The range of scores for the included studies was 8.5–17.5 (scores for the 12 papers are shown in Appendix C- supplementary file). Eight studies had a high MERSQI score of 15.5 or greater.^{22–24,28,29,31–33} The main reasons for the low scoring were the study design, data assessed by study participants, the non-use of objective measures. Two reviewers (VI, RR) independently scored each paper and came together with the third reviewer (MP) to agree on the final score. There was a high level of consistency between reviewers' scoring.

Discussion

This review uncovers the disparate availability of structured educational interventions in T2D specifically targeted toward older adults. It also reveals the inconsistency with respect to the recommendations of international societies regarding the fact that education and support should be provided on an ongoing basis to all older people with diabetes.^{3,37}

We found no contraindications in literature for older adults to attend general DSMES programs. However, the IDF encompasses guiding principles and aims for managing older adults with T2D such as risk identification, planning for key transitions, patient safety, independence and quality of life enhancement, potential benefits versus potential risks analysis, life expectancy, and inclusion of family/caregivers to diabetes education.³⁷ Therefore, according to the recommendations and patient characteristics, it is important for adapted or tailored programs for older adults to be available.

Nevertheless, ensuring that older adults must receive diabetes education tailored for their age group could be a pitfall. Age limits for older adults are broadly defined (anywhere from 60 to 95+ years),³⁸ and even when refined, age is not excluding, but it is a factor to take into account as a cut-off point since it could act as an initial filter to identify candidate patients and tailor strategies according to their conditions such as functional and cognitive status, motivation, care environment and family support, so that they could take maximum advantage of the intervention.

Table 2
Reported outcomes by the studies, according to the length of the educational intervention.

Outcomes	1 month					2 months	3 months			4 months	6 months	
	Askari et al.	Sharifirad et al.	Ghasemi et al.	Chen et al.	Saghae et al.	Kargar et al.	Lee et al.	Ounnapirok et al.	Song et al.	Rodríguez- Mañas et al.	Markle-Reid et al.	Miklavcic et al.
CLINICAL												
HbA1c	+ ³	+ ³		+ ⁴			+ ⁰	∅ ⁰	∅ ⁰			
FBG	+ ³	+ ³						∅ ⁰	∅ ⁰			
Lipid profile	+ ³			+ ⁴			∅ ⁰		+ ⁰			
Blood pressure				+ ⁴			∅ ⁰					
BMI				+ ⁴					+ ⁰			
Functional performance										+ ⁰ , + ⁰ , + ⁶		
PSYCHOSOCIAL												
Quality of life			+ ⁰ , ∅ ¹		+ ⁴	+ ² , + ³				∅ ⁵	+ ⁵	∅ ⁵
Depressive symptoms					∅ ⁴						+ ⁵	∅ ⁵
Anxiety											∅ ⁵	∅ ⁵
Attitudes, subjective norms and enabling factors	+ ³	+ ³										
KNOWLEDGE												
Knowledge	+ ³	+ ³					+ ⁰	+ ⁰				
BEHAVIORAL												
Self-efficacy				+ ⁴	+ ⁴		+ ⁰	+ ⁰			∅ ⁵	∅ ⁵
Self-management				+ ⁴	∅ ⁴		+ ⁰	+ ⁰	+ ⁰		+ ⁵	∅ ⁵

HbA1c: Glycated hemoglobin; FBG: fasting blood glucose; BMI: body mass index. ⁰ immediately after intervention was finished.

¹ 1 month after the end of the intervention.

² 2 months after the end of the interventions.

³ 3 months after the end of the interventions.

⁴ 4 months after the end of the interventions.

⁵ 6 months after the end of the interventions.

⁶ 12 months after the end of the interventions.

+: statistically significant result; ∅: no statistical significance; *not evaluated due to lack of glucometers and/or instruction of the participants in monitoring.

Table 3

Accomplishment of the 2017 National Standards for Diabetes self-Management Education and Support (DSMES) according to the ADA and ADCES.

Standard	Askari et al.	Chen et al.	Ghasemi et al.	Kargar et al.	Lee et al.	Markle-Reid et al.	Miklavcic et al.	Ounnapirok et al.	Rodríguez-Mañas et al.	Saghaee et al.	Song et al.	Sharifirad et al.
Internal structure					x	x	x				x	
Stakeholder Input						x	x					
Evaluation of population characteristics	x	x	x	x	x	x	x	x	x	x	x	x
Evaluation of population needs					x	x	x				x	
Individualization	x	x			x	x	x	x			x	x
Quality coordinator overseeing DSMES services						x	x		x			
DSMES Team						x	x		x	x	x	
Curriculum		x	x		x			x		x	x	x
Ongoing Support	x											x
Participant Progress	x	x	x	x	x	x	x	x	x	x	x	x
Quality Improvement						x	x					
Technology usage	x	x										

ADA: American Diabetes Association; ADCES: Association of Diabetes Care & Education Specialists.

A regular comprehensive assessment of clinical, cognitive, psychosocial, and functional domains would provide a framework to determine targets and therapeutic approaches.³⁹ However, the absence of the Comprehensive Gerontological Assessment (CGA) in all the interventions make the feasibility for participants to apply and maintain what they learned unknown, whether established goals were realistic, or whether diabetes self-management was a priority for them. Besides, matching intervention modalities to the preferences and needs of the individuals will likely lead to an increased level of participation and engagement and ultimately to improved health outcomes.⁴⁰ In our studies less than half considered participants needs and priorities, coinciding with a recent review of self-care interventions for older adults with T2D.¹⁰

The interventions of our review had a high heterogeneity (e.g methodology, delivery strategies, resources, trajectory). Some studies had assets, such as the combination of group sessions with home visits or phone calls, the supplementing of an exercise program, caregiver inclusion, post-intervention follow-ups, and/or longer intervention length. Yet, there was gap in the accomplishment of the standards defining quality of DSMES according to the ADA. These standards do not endorse any one approach but rather seek to define the commonalities among effective and evidence-based DSMES strategies.³⁶

Traditionally, programs tended to focus on knowledge and glycaemic control³⁹ and more recent reviews reported a biomedical predominance.^{10,11,15,41} In our review we found a balance between psychosocial, behavioral and clinical outcomes and few reporting knowledge outcomes. Moreover, for older adults greater benefits in morbidity and mortality may result from improving cardiovascular risk factors such as blood lipids, a sedentary lifestyle, and food choices rather than from strict glycaemic control.¹⁰ Besides, many older people with diabetes have conditions that alter red blood cell life span, such as anemia, making HbA1c a less reliable measure of glucose control.⁸

The findings from this review suggest that older adults with T2D that participate in a structured DSME can benefit a wide spectrum of realms beyond their metabolic management. Even when there were no statistically significant changes or small effect size, a positive trend was found in all the interventions. A statistical reduction in HbA1c was reported in two meta-analyses of similar interventions tailored for older adults with T2D.^{10,19} Sherifali and colleagues¹⁹ also reported statistical improvements in HbA1c and total cholesterol, with no non-significant reductions in systolic and diastolic blood pressure and Seah and colleagues¹⁰ in HbA1c, lipid profile, blood pressure and diabetes self-care.

A recent systematic review about the impact of diabetes education in hypoglycemia determined a significant heterogeneity in

methods used to deliver diabetes education. Although there was no singular model that stood out as a superior intervention to others in all characteristics, those with longer duration, greater frequency, and more lengthy encounters tended to show a greater impact.⁴² In this review, sessions in longer duration studies were less frequent and did not show better outcomes than ones of a shorter duration. A possible reason may be that both were pragmatic designs, so they met the challenges of diabetes education in the real world.

Diabetes self-management requires ongoing assessment and modification to help the person overcome barriers and cope with the enduring and changing demands throughout the continuum of diabetes treatment and life transitions such as institutionalization, retirement, mourning or loss of independence.³ Our review studies were delivered in an episodic way, and just three out of twelve delivered post intervention support sessions. Initial improvements in metabolic and behavioral outcomes diminish approximately after 6 months from lack of self-management. At intervals longer than 12 months, there have been reports of a decline of more than 50% of knowledge learned.⁴³

Family members and caregivers are an underused resource for ongoing support. The ADA and the ADCES state that involving them is a key part of the process as they are part of the social environment, which is one of the most influential factors in diabetes self-care practices and in maintaining long-term improvements.³ Despite this recommendation, few of our studies attempted to involve them.

The particularities and challenges of aging affecting diabetes self-management often involve a sense of loss and demand a deep readjustment.³⁹ The presence of depressive symptoms might be especially relevant to older adults with T2D as they are at higher risk of experiencing depression compared to their peers without diabetes,¹⁰ which is a major self-management obstacle.³³ Yet, it was not routinely assessed in most of our review studies.

The figure of a diabetes educator could take on special relevance in this regard, as proactive identifying risks and applying the principles of patient-centered and shared decision making to guide the person in their self-management.⁴⁰ In our case, the only review study that included a diabetes educator was a pragmatic design study. We remark the importance that all professionals, and above all diabetes educators, must have a good comprehensive knowledge and understanding of their patients in their biopsychosocial sphere, rather than considering them analytic, as well as having the ability as educators to adapt to meet the frequently forgotten patients' needs. Having a case manager as part of the interdisciplinary staff might be a resource to explore, as some previous studies^{44–46} have already done.

There were limitations to this systematic review. Older adults participated voluntarily, which could mean a bias in the commitment and motivation towards the intervention. Most of the studies had a small

sample size and a short length that was not enough to measure long-term results, and outcome measurement tools were heterogeneous. Certain information was unclear, such as the exact duration from T2DM onset, the severity of the diabetic complications, medications used and modification, absence to the educational sessions, and no answers were obtained from the authors who were consulted for details. On the other hand, potential studies in languages other than English or Spanish could have been omitted, as well as state programs conducted by governments and not being published in journals.

These limitations among the few available studies reflect that structured diabetes education programs for older people are still a neglected topic, and the available research and experience are insufficient to meet the current and near future challenges.

The strengths of our review include an analysis of the educational interventions from a comprehensive gerontological point of view, which intends to contribute with the ascertains and aspects to improve and enhance the design of educational interventions, and avoid therapeutic inertia, especially lack of awareness of these programs and judging older persons' ability and potential to benefit from DSMES. The use of the GRADE instrument let us to classify the level of evidence for the analyzed outcomes. The selection of MERSQI to assess the methodological quality of the studies strengths our review, as this instrument is specifically targeted for medical education research.^{47,48}

The educational interventions showed a wide variability in terms of design, objectives, methodology and applied strategies. Although an educational program superior to the others is not highlighted, the strengths, weaknesses and challenges reported could serve as a reference point for the formulation of such a program, without losing sight of the fact that the characteristics of the interventions must be adapted to the needs and characteristics of the elderly and not the other way around.

There is high level of evidence that diabetes educational programs aimed at older adults with T2D could improve their HbA1c and their knowledge. The potential for these and additional benefits could be increased if continuous monitoring and support were provided after the intervention is completed. Age is an initial practical criterion to encourage people to make programs and/or advocate for this need, but it is fundamental that they are aligned to a comprehensive gerontological approach

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Competing interests

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Supplementary materials

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