

BMJ Open Health education for patients with acute coronary syndrome and type 2 diabetes mellitus: an umbrella review of systematic reviews and meta-analyses

Xian-liang Liu,^{1,2,3} Yan Shi,¹ Karen Willis,⁴ Chiung-Jung (Jo) Wu,^{5,6,7,8} Maree Johnson^{9,10}

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For numbered affiliations see end of article.

Correspondence to

Xian-liang Liu;
liu.xianliang@myacu.edu.au

ABSTRACT

Objectives This umbrella review aimed to identify the current evidence on health education-related interventions for patients with acute coronary syndrome (ACS) or type two diabetes mellitus (T2DM); identify the educational content, delivery methods, intensity, duration and setting required. The purpose was to provide recommendations for educational interventions for high-risk patients with both ACS and T2DM.

Design Umbrella review of systematic reviews and meta-analyses.

Setting Inpatient and postdischarge settings.

Participants Patients with ACS and T2DM.

Data sources CINAHL, Cochrane Library, Joanna Briggs Institute, Journals@Ovid, EMBase, Medline, PubMed and Web of Science databases from January 2000 through May 2016.

Outcomes measures Clinical outcomes (such as glycated haemoglobin), behavioural outcomes (such as smoking), psychosocial outcomes (such as anxiety) and medical service use.

Results Fifty-one eligible reviews (15 for ACS and 36 for T2DM) consisting of 1324 relevant studies involving 2 880 57 patients (15 papers did not provide the total sample); 30 (58.8%) reviews were rated as high quality. Nurses only and multidisciplinary teams were the most frequent professionals to provide education, and most educational interventions were delivered postdischarge. Face-to-face sessions were the most common delivery formats, and many education sessions were also delivered by telephone or via web contact. The frequency of educational sessions was weekly or monthly, and an average of 3.7 topics was covered per education session. Psychoeducational interventions were generally effective at reducing smoking and admissions for patients with ACS. Culturally appropriate health education, self-management educational interventions, group medical visits and psychoeducational interventions were generally effective for patients with T2DM.

Conclusions Results indicate that there is a body of current evidence about the efficacy of health education, its content and delivery methods for patients with ACS or T2DM. These results provide recommendations about the content for, and approach to, health education intervention for these high-risk patients.

Strengths and limitations of this study

- This umbrella review is the first synthesis of systematic reviews or meta-analyses to consider health education-related interventions for patients with acute coronary syndrome (ACS) or type two diabetes mellitus (T2DM).
- These results provide recommendations about the content of a health education intervention for patients with ACS and T2DM.
- The diversity of the educational interventions seen in the reviews included in this umbrella review may reflect the uncertainty about the optimal strategy for providing health education to patients.
- This umbrella review found no reviews focused on patients with ACS and T2DM—the intended target group; instead, all of the systematic reviews and meta-analyses focused on only one of these two diseases.

INTRODUCTION

Acute coronary syndrome (ACS) is the leading cause of death worldwide. The risk of high mortality rates relating to ACS is markedly increased after an initial cardiac ischaemic event.¹ Globally, 7.2 million (13%) deaths are caused by coronary artery disease (CAD),² and it is estimated that >7 800 000 persons will experience ACS each year in the USA.³ Moreover, about 20%–25% of patients with ACS reportedly also have diabetes mellitus (DM); predominantly type two diabetes mellitus (T2DM)).^{4 5} Patients with ACS and DM have an increased risk of adverse outcomes such as death, recurrent myocardial infarction (MI), readmission or heart failure during follow-up.⁶ Longer median delay times from symptom onset to hospital presentation, have been reported among patients with ACS and DM than patients with ACS alone.⁷

DM is now considered to confer a risk equivalent to that of CAD for patients for future MI and cardiovascular mortality.⁸ Mortality

was significantly higher among patients with ACS and DM than among patients with ACS only following either ST segment elevation myocardial infarction (STEMI) (8.5% (ACS and DM) vs 5.4% (ACS)) or unstable angina/non-STEMI (NSTEMI) (2.1% (ACS and DM) vs 1.1% (ACS)).⁹ ACS and T2DM are often associated with high-risk factors such as low levels of physical exercise, obesity, smoking and unhealthy diet.¹⁰ Some of these and other risk factors, specifically glycaemia, high blood pressure (BP), lipidaemia and obesity, are frequently addressed by health education interventions.¹⁰

Health education interventions are comprehensive programmes that healthcare providers deliver to patients aimed at improving patients' clinical outcomes through the increase and maintenance of health behaviours.¹¹ Along with education about, for example, medication taking, these programmes seek to increase behaviours such as physical exercise and a healthy diet thus reducing patient morbidity or mortality.¹¹ Most diabetes education is provided through programmes within outpatient services or physicians' practices.¹² Many recent education programmes have been designed to meet national or international education standards^{13–15} with diabetes education being individualised to consider patients' existing needs and health conditions.¹⁶ Patients with T2DM have reported feelings of hopelessness and fatigue with low levels of self-efficacy, after experiencing an acute coronary episode.¹⁷

Although there are numerous systematic reviews of educational interventions relating to ACS or T2DM, an umbrella review providing direction on educational interventions for high-risk patients with both ACS and T2DM is not available, indicating a need to gather the current evidence and develop an optimal protocol for health education programmes for patients with ACS and T2DM. This umbrella review will examine the best available evidence on health education-related interventions for patients with ACS or T2DM. We will synthesise these findings to provide direction for health education-related interventions for high-risk patients with both ACS and T2DM.

An umbrella review is a new method to summarise and synthesise the evidence from multiple systematic reviews/meta-analyses into one accessible publication.¹⁸ Our aim is to systematically gather, evaluate and organise the current evidence relating the health education interventions for patients with ACS or T2DM, and proffer recommendations for the scope of educational content and delivery methods that would be suitable for patients with ACS and T2DM.

METHODS

Data sources

This umbrella review performed a literature search to identify systematic reviews and meta-analyses examining health education-related interventions for patients with ACS or T2DM. The search strategies are described in

online supplementary appendix 1. This umbrella review searched eight databases for articles published from January 2000 to May 2016: CINAHL, Cochrane Library, Joanna Briggs Institute, Journals@Ovid, EMBase, Medline, PubMed and Web of Science. The search was limited to English language only. The following broad MeSH terms were used: *acute coronary syndrome*; *angina, unstable*; *angina pectoris*; *coronary artery disease*; *coronary artery bypass*; *myocardial infarction*; *diabetes mellitus, type two*; *counseling*; *health education*; *patient education as topic*; *meta-analysis (publication type)*; and *meta-analysis* as a topic.

Inclusion criteria

Participants

All participants were diagnosed with ACS or T2DM using valid, established diagnostic criteria. The diagnostic standards included those described by the American College of Cardiology or American Heart Association,³ National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand,¹⁹ WHO²⁰ or other associations.

Intervention types

For this umbrella review, health education-related interventions refer to any planned activities or programmes that include behaviour modification, counselling and teaching interventions. Results considered for this review included changes in clinical outcomes (including BP levels, body weight, diabetes complications, glycated haemoglobin (HbA1c), lipid levels, mortality rate and physical activity levels), behavioural outcomes (such as diet, knowledge, self-management skills, self-efficacy and smoking), psychosocial outcomes (such as anxiety, depression, quality of life and stress) and medical service use (such as medication use, healthcare utilisation and cost-effectiveness) for patients with ACS or T2DM. These activities or programmes included any educational interventions delivered to patients with ACS or T2DM. The interventions are delivered in any format, including face-to-face, telephone and group-based or one-on-one, and the settings include community, hospital and home. The interventions were delivered by nurses (including diabetes nurse educators), physicians, community healthcare workers, dietitians, lay people, rehabilitation therapists or multidisciplinary teams.

Study types

Only systematic reviews and meta-analyses were included in this review.

Eligibility assessment

The title and abstract of all of the retrieved articles were assessed independently by two reviewers (XL-L, YS) based on the inclusion criteria. All duplicate articles were identified within EndNote V.X7²¹ and subsequently excluded. If the information from the titles and abstract was not clear, the full articles were retrieved. The decision to include an article was based on an appraisal of the full text of all retrieved articles. Any disagreements during this process

were settled by discussion and, if necessary, consensus was sought with a third reviewer. We developed an assessment form in which specific reasons for exclusion were detailed.

Assessment of methodological quality

The methodological quality and risk of bias were assessed for each of the included publications using the Assessment of Multiple Systematic Reviews (AMSTAR),²² independently by the same two reviewers (see table 1). The AMSTAR is an 11-item tool, with each item provided a score of 1 (specific criterion is met) or 0 (specific criterion is not met, unclear or not applicable).^{22 23} An overall score for the review methodological quality is then calculated as the sum of the individual item scores: high quality, 8–11; medium quality, 4–7 or low quality, 0–3.²³ If the required data were not available in the article, the original authors were contacted for more information. The low quality reviews (AMSTAR scale: 0–3) were excluded in this umbrella review.

Data extraction

Data were independently extracted by two reviewers using a predefined data extraction form. For missing or unclear information, the primary authors were contacted for clarification.

Statistical presentation of results from reviews

All of the results were extracted for each included systematic review or meta-analysis, and the overall effect estimates are presented in a tabular form. The number of systematic reviews or meta-analyses that reported the outcome, total sample (from included publications) and information of health education interventions is also presented in tables 2 and 3.²⁴ A final 'summary of evidence' was developed to present the intervention, included study synthesis, and indication of the findings from the included papers (table 4).²⁴ This umbrella review calculated the corrected covered area (CCA) (see online supplementary appendices 2 and 3). The CCA statistic is a measure of overlap of trials (the repeated inclusion of the same trial in subsequent systematic reviews included in an umbrella systematic review). A detailed description of the calculation is provided by the authors who note slight CCA as 0%–5%, moderate CCA as 6%–10%, high CCA as 11%–15% and very high CCA is >15%.²⁵ The lower the CCA the lower the likelihood of overlap of trials included in the umbrella review.

Synthesising the results and rating the evidence for effectiveness

The statements of evidence were based on a rating scheme to gather and rate the evidence across the included publications.²⁶ The statements of evidence were based on the following rating scheme: *sufficient evidence*, sufficient data to support decisions about the effect of the health education-related interventions.²⁶ A rating of *sufficient evidence* in this review is obtained when systematic reviews or meta-analyses with a large number of included articles

or participants produce a statistically significant result between the health education group and the control group.²⁶ *Some evidence*, is a less conclusive finding about the effects of the health education-related interventions²⁶ with statistically significant findings found in only a few included reviews or studies. *Insufficient evidence*, refers to not enough evidence to make decisions about the effects of the health education-related interventions, such as non-significant results between the health education group and the control group in the included systematic reviews or meta-analyses.²⁶ *Insufficient evidence to determine*, refers to not enough pooled data to be able to determine whether of the health education-related interventions are effective or not based on the included reviews.²⁶

RESULTS

Characteristics of included reviews

The selection process and number of studies at each step was illustrated as presented in figure 1. The database search yielded 692 publications, with removal of 197 duplicates and 371 articles that did not meet the inclusion criteria, 124 full-text articles were retrieved after applying the methodological quality rating (AMSTAR scale), and three studies^{27–29} were removed due to low scores ≤ 3 on the AMSTAR scale. Fifty-one systematic reviews or meta-analyses^{30–80} conducted between 2001 and 2016 and published in English were included (figure 1; tables 1–3); 15 relating to ACS. The overlap of the trials included in the 15 reviews and meta-analyses related to ACS was slight (CCA=2.6%). For the 36 systematic reviews relating to T2DM, the overlap of trials within these 35 reviews and meta-analyses (one review⁴⁷ did not report the included studies) was slight (CCA=2.1%). None of the articles included patients with both ACS and T2DM. The umbrella review involved a total of 2 774 93 patients, including 2 25 034 patients with coronary heart disease or ACS (one article did not report the total sample) and 52 459 patients with T2DM (16 papers did not report the total sample). The average sample size of included articles was 8161 (range, 536–68 556) participants, however, 63 studies related to ACS and 177 studies related to T2DM were included in more than one systematic review or meta-analysis (see online supplementary appendices 2 and 3 and CCA statistics). The sample of these studies would therefore be included more than once. Of the included systematic reviews or meta-analyses, 11 were published in *The Cochrane Library*. Nine of the articles described meta-analyses, 29 articles described systematic reviews and the remaining 13 articles were described as systematic reviews and meta-analyses or meta-regressions or narrative reviews.

Electronic database searches were conducted for all systematic reviews or meta-analyses, with an average of 6 databases searched (range, 2–16). The dates searched ranged widely from inception of the database through December 2014. Most of the included reviews were randomised controlled trials (RCTs), and an average of

Table 1 Methodological quality assessment of included systematic reviews and meta-analyses

Systematic review/ meta-analysis		Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Total score
Systematic reviews and meta-analysis involved patients with ACS													
1	Barth et al ⁶⁹	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11
2	Devi et al ⁴⁴	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes	10
3	Ghisi et al ⁶⁰	CA	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	7
4	Kotb et al ⁶⁹	CA	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	8
5	Brown et al ³⁷	Yes	No	Yes	CA	No	Yes	Yes	Yes	Yes	NA	Yes	7
6	Dickens et al ⁴⁵	CA	Yes	Yes	CA	No	Yes	Yes	Yes	Yes	Yes	Yes	8
7	Aldcroft et al ³¹	CA	No	Yes	CA	NO	Yes	Yes	Yes	Yes	No	Yes	6
8	Brown et al ⁷⁰	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes	10
9	Huttunen-Lenz et al ⁶⁶	CA	No	Yes	CA	No	Yes	Yes	Yes	Yes	No	No	5
10	Goulding et al ⁵¹	Yes	Yes	Yes	CA	No	Yes	Yes	Yes	Yes	No	Yes	8
11	Auer et al ³⁴	CA	Yes	Yes	CA	No	No	Yes	No	Yes	Yes	No	5
12	Barth et al ³⁶	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
13	Fernandez et al ⁴⁸	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	8
14	Barth et al ³⁵	CA	Yes	Yes	CA	No	Yes	CA	Yes	Yes	Yes	Yes	7
15	Clark et al ⁴¹	CA	Yes	Yes	CA	No	Yes	Yes	Yes	Yes	Yes	Yes	8
Systematic reviews and meta-analysis involved patients with T2DM													
16	Choi et al ⁴⁰	CA	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	8
17	Creamer et al ⁴²	Yes	Yes	Yes	CA	No	Yes	Yes	Yes	Yes	No	Yes	8
18	Huang et al ⁶⁵	CA	CA	Yes	CA	No	Yes	Yes	Yes	Yes	Yes	Yes	7
19	Chen et al ³⁹	CA	CA	Yes	CA	No	Yes	Yes	Yes	Yes	Yes	Yes	7
20	Pillay et al ⁷¹	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	9
21	Terranova et al ⁷²	CA	CA	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
22	Attridge et al ³³	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	10
23	Odnoletkova et al ⁶⁶	Yes	CA	Yes	CA	No	No	Yes	Yes	Yes	Yes	No	6
24	Pal et al ⁶⁷	CA	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	8
25	Ricci-Cabello et al ⁷³	Yes	CA	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	9
26	Saffari et al ⁷⁴	CA	Yes	Yes	CA	No	Yes	Yes	Yes	Yes	Yes	Yes	8
27	Gucciardi et al ⁶²	CA	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	7
28	Pal et al ⁶⁸	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	10
29	van Vugt et al ⁷⁵	CA	Yes	Yes	CA	No	Yes	Yes	Yes	NA	No	Yes	6

Continued

Table 1 Continued

Systematic review/ meta-analysis		Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Total score
30	Amaeshi ³²	CA	CA	Yes	No	No	Yes	Yes	Yes	NA	No	No	4
31	Nam et al ⁶²	CA	CA	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	8
32	Steinsbekk et al ⁷⁶	CA	Yes	Yes	CA	No	Yes	Yes	Yes	Yes	No	Yes	7
33	Burke et al ³⁸	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes	10
34	Lun Gan et al ⁵⁷	Yes	Yes	Yes	CA	No	Yes	Yes	Yes	Yes	No	Yes	8
35	Ramadas et al ⁷⁷	CA	CA	Yes	No	No	Yes	Yes	Yes	NA	No	Yes	5
36	Hawthorne et al ⁶⁴	Yes	Yes	Yes	CA	No	Yes	Yes	Yes	Yes	CA	Yes	8
37	Minet et al ⁶¹	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	9
38	Alam et al ⁸⁰	Yes	Yes	No	CA	No	Yes	Yes	Yes	Yes	Yes	Yes	8
39	Duke et al ⁴⁶	Yes	CA	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	8
40	Fan and Sidani ⁴⁷	Yes	No	Yes	CA	No	Yes	No	No	Yes	No	Yes	5
41	Hawthorne et al ⁶³	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11
42	Khunti et al ⁶⁸	CA	Yes	Yes	Yes	No	Yes	No	No	No	No	Yes	5
43	Loveman et al ⁶⁰	Yes	CA	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	8
44	Wens et al ⁷⁸	CA	Yes	Yes	CA	No	Yes	Yes	Yes	Yes	NA	Yes	7
45	Nield et al ⁶³	Yes	Yes	Yes	CA	Yes	Yes	Yes	Yes	Yes	No	Yes	9
46	Zabaleta and Forbes ⁷⁹	CA	CA	Yes	CA	Yes	Yes	Yes	Yes	NA	No	No	5
47	Deakin et al ⁴³	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11
48	Vermeire et al ⁸⁰	Yes	Yes	Yes	CA	Yes	Yes	Yes	Yes	Yes	No	Yes	9
49	Gary et al ⁴⁹	CA	Yes	No	Yes	No	Yes	Yes	No	Yes	No	Yes	6
50	Norris et al ⁶⁵	CA	No	Yes	No	No	Yes	Yes	Yes	CA	No	No	4
51	Norris et al ⁶⁴	CA	Yes	Yes	CA	No	Yes	Yes	Yes	NA	No	No	5

Item 1: 'Was an "a priori" design provided?'; Source: Shea et al²²; Item 2: 'Was there duplicate study selection and data extraction?'; Item 3: 'Was a comprehensive literature search performed?'; Item 4: 'Was the status of publication (ie, grey literature) used as an inclusion criterion?'; Item 5: 'Was a list of studies (included and excluded) provided?'; Item 6: 'Were the characteristics of the included studies provided?'; Item 7: 'Was the scientific quality of the included studies assessed and documented?'; Item 8: 'Was the scientific quality of the included studies used appropriately in formulating conclusions?'; Item 9: 'Were the methods used to combine the findings of studies appropriate?'; Item 10: 'Was the likelihood of publication bias assessed?'; Item 11: 'Was the conflict of interest stated?'

CA, cannot answer; NA, not applicable.

Table 2 Characteristics and interventions of included systematic reviews and meta-analysis involved patients with ACS

First author, year; journal	Primary objectives (to assess effect of interventions on...)	Intervention		Outcomes (primary outcomes were in bold) ↔: No change ↑: Increase ↓: Decrease
		Primary objectives (to assess effect of interventions on...)	Intervention	
Devi, 2015 ⁴⁴ ; The Cochrane Library	Lifestyle changes and medicines management	Number of studies: 11 completed trials (12 publications); Types of studies: RCTs; Total sample: 1392 participants	<p>Educational content</p> <p>All internet-based interventions</p> <p>√ BEHA (-) √ CVR (-) √ DIET (-) √ EXERCISE (-) □ MED √ PSY(-) √ SMOKING (-) □ SELF</p>	<p>Number of session(s), delivery mode, time, setting</p> <p>Number of session: weekly or monthly or unclear; Total contact hours: unclear. Duration: from 6 weeks to 1 year</p> <p>Provider</p> <p>Dietitians; exercise specialists; nurse practitioners; physiotherapist rehabilitation specialists, or did not describe.</p> <p>Strategies: internet-based and mobile phone-based intervention, such as email access, private-messaging function on the website, one-to-one chat facility, a synchronised group chat, an online discussion forum, or telephone consultations; or video files; Format: one-on-one chat sessions; 'ask an expert' group chat sessions; Theoretical approach: unclear</p> <p>Clinical outcomes; Cardiovascular risk factors; - Lifestyle changes; - Compliance with medication; - Healthcare utilisation and costs; ↓ Adverse intervention effects</p> <p>Meta-analysis used Review Manager software</p>
Barth, 2015 ⁶⁹ ; The Cochrane Library	Smoking cessation	Number of studies: 40 RCTs; Types of studies: RCTs; Total sample: 7928 participants	<p>Psychosocial smoking cessation interventions</p> <p>□ BEHA □ CVR □ DIET □ EXERCISE □ MED □ PSY √ SMOKING □ SELF</p>	<p>Number of session: weekly or 2-3 times per week; Total contact hours: unclear. Duration: from 8 weeks to 1 year</p> <p>Provider</p> <p>Cardiologist; general practitioner physician or study nurse</p> <p>Strategies: face-to-face, telephone contact, written educational materials, videotape, booklet or unclear; Format: one by one counselling; telephone call; group meetings or unclear; Theoretical approach: TTM, SCT</p> <p>Abstinence by self-report or validated</p> <p>Inpatient settings, postdischarge, other</p> <p>Meta-analysis used Review Manager software</p>
Kotb, 2014 ⁵⁹ ; PLoS One	Patients' outcomes	Number of studies: 26 studies; Types of studies: RCTs; Total sample: 4081 participants	<p>Telephone-delivered postdischarge interventions</p> <p>□ BEHA √ CVR □ DIET □ EXERCISE □ MED □ PSY □ SMOKING □ SELF</p>	<p>Number of session: 3-6 sessions/telephone calls and was greater than six calls in five studies; or unclear; Total contact hours: 40-180 mins or unclear; Duration: 1.5-6 months or unclear</p> <p>Provider</p> <p>Dietitians; exercise specialist; health educators; nurses and pharmacists</p> <p>Strategies: telephone calls; Format: unclear, did not describe the format; Theoretical approach: unclear</p> <p>All-cause hospitalisation; All-cause mortality; ↓ Depression; - Anxiety; ↑ Smoking cessation, ↓ Systolic blood pressure; - LDL-c</p> <p>Meta-analysis used Review Manager software</p>

Continued

Table 2 Continued

		Intervention		Outcomes (primary outcomes were in bold)		Synthesis methods	
Primary objectives (to assess effect of intervention on...)	Primary objectives (to assess effect of intervention on...)	Intervention	Outcomes (primary outcomes were in bold)	Synthesis methods	Synthesis methods	Synthesis methods	
First author, year; journal	Studies details	Educational content	Provider	Number of session(s), delivery mode, time, setting	Number of session(s), delivery mode, time, setting	Synthesis methods	
Ghisi, 2014 ⁵⁰ ; <i>Patient Education and Counseling</i>	Knowledge, health behaviour change, medication adherence, psychosocial well-being Number of studies: 42 articles; Types of studies: 30 were experimental; 23 RCTs and 7 quasi-experimental; and 11 observational and 1 used a mixed-methods design. Total sample: 16 079 participants	Any educational interventions <input checked="" type="checkbox"/> BEHA (+) <input checked="" type="checkbox"/> CVR (++) <input checked="" type="checkbox"/> DIET (+++) <input checked="" type="checkbox"/> EXERCISE (++) <input checked="" type="checkbox"/> MED (++) <input checked="" type="checkbox"/> PSY(++) <input checked="" type="checkbox"/> SMOKING (+) <input type="checkbox"/> SELF	Nurses (35.7%), a multidisciplinary team (31%), dietitians (14.3%) and a cardiologist (2.4%)	Number of session: 1–24 or unclear. Total contact hours: 5–10 min to full day of education Duration: 1–24 month; from daily education to every 6 months	Strategies: did not describe the strategies; Format: group (88.1%) by lectures (40.5%), group discussions (40.5%) and question and answer periods (7.1%). Individual education (88.1%) including individual counselling (50%), follow-up telephone contacts (31%) and home visits (7.1%). Theoretical approach: unclear	Knowledge; Behaviour; Psychosocial indicators	Narrative synthesis
Brown, 2013 ³⁷ ; <i>European Journal of Preventive Cardiology</i>	Mortality, morbidity, HRQoL and healthcare costs Number of studies: 24 papers reporting on 13 RCTs; Types of studies: RCTs; Total sample: 68 556 participants	Patient education <input type="checkbox"/> BEHA <input checked="" type="checkbox"/> CVR <input type="checkbox"/> DIET <input type="checkbox"/> EXERCISE <input type="checkbox"/> MED <input type="checkbox"/> PSY <input type="checkbox"/> SMOKING <input type="checkbox"/> SELF	Nurses or other healthcare professionals.	Number of session and duration: from a total of 2 visits to a 4-week residential stay reinforced with 11 months of nurse led follow-up Total contact hours: unclear	Strategies: face-to-face education sessions, telephone contact and interactive use of the internet; Format: group-based sessions, individualised education and four used a mixture of both sessions; Theoretical approach: unclear	Mortality; Non-fatal MI; Revascularisations; Hospitalisations; HRQoL; Withdrawals/dropouts; Healthcare utilisation and costs	Meta-analysis used Review Manager software
Dickens, 2013 ⁴⁵ ; <i>Psychosomatic Medicine</i>	Depression and depressive symptoms Number of studies: 62 independent studies Types of studies: RCTs; Total sample: 17 397	Psychological interventions <input checked="" type="checkbox"/> BEHA (-) <input type="checkbox"/> CVR <input type="checkbox"/> DIET <input type="checkbox"/> EXERCISE <input type="checkbox"/> MED <input checked="" type="checkbox"/> PSY (-) <input type="checkbox"/> SMOKING <input checked="" type="checkbox"/> SELF (-)	A single health professional or by a multidisciplinary team	Number of session: 14.4 (range, 1–150); Total contact hours: varying from 10 to 240 min Duration: unclear	Strategies: face-to-face sessions, telephone contact or unclear; Format: group or unclear; Theoretical approach: unclear	Depression; Adverse cardiac outcomes; Ongoing cardiac symptoms	Univariate analyses using comprehensive meta-analysis, multivariate meta-regression using SPSS V.15.0

Continued

Table 2 Continued

First author, year; journal	Primary objectives (to assess effect of interventions on...)	Intervention	Studies details	Educational content	Provider	Number of session(s), delivery mode, time, setting	Outcomes (primary outcomes were in bold)	Synthesis methods
Aldcroft, 2011 ²⁰ ; <i>Journal of Cardipulmonary Rehabilitation & Prevention</i>	Health behaviour change	All psychoeducational or behavioural intervention	Number of studies: seven trials Types of studies: six randomised controlled trials and a quasi-experimental trial Total sample: 536 participants	<input type="checkbox"/> BEHA <input checked="" type="checkbox"/> CVR (-) <input type="checkbox"/> DIET <input type="checkbox"/> EXERCISE <input type="checkbox"/> MED <input checked="" type="checkbox"/> PSY (-) <input type="checkbox"/> SMOKING <input type="checkbox"/> SELF	Appropriately trained healthcare workers	Number of session: describe the strategies; Format: group setting, combination of group and one-on-one education and one-on-one format only; Theoretical approach: TTM, interactionist role theory, Bandura's self-efficacy theory, Gordon's relapse prevention model and a cognitive behavioural approach	↓ Smoking rates; medication use; – Supplemental oxygen use; ↑ Physical activity; ↑ Nutritional habits	Meta-analysis and narrative presentation
Brown, 2011 ⁷⁰ ; <i>The Cochrane Library</i>	Mortality, morbidity, HRQoL and healthcare costs	Patient education	Number of studies: 24 papers reporting on 13 studies. Types of studies: RCTs; Total sample: 68 556 participants	<input checked="" type="checkbox"/> BEHA (-) <input checked="" type="checkbox"/> CVR (-) <input type="checkbox"/> DIET <input checked="" type="checkbox"/> EXERCISE <input type="checkbox"/> MED <input type="checkbox"/> PSY <input type="checkbox"/> SMOKING <input type="checkbox"/> SELF	Nurse or did not describe	Number of session and duration: two visits to 4 weeks residential Format: four sessions, 11 months of nurse led follow-up Total contact hours: unclear	– Total mortality; – Cardiovascular mortality; – Non-cardiovascular mortality; – Total cardiovascular (CV) events; – Fatal and/or non-fatal MI; – Other fatal and/or non-fatal CV events	Meta-analysis used Review Manager software
Goulding, 2010 ⁵¹ ; <i>Journal of Advanced Nursing</i>	Change maladaptive illness	Interventions to change maladaptive illness beliefs	Number of studies: 13 studies Types of studies: RCTs; Total sample: unclear	<input checked="" type="checkbox"/> BEHA (-) <input type="checkbox"/> CVR <input type="checkbox"/> DIET <input type="checkbox"/> EXERCISE <input type="checkbox"/> MED <input checked="" type="checkbox"/> PSY (-) <input type="checkbox"/> SMOKING <input type="checkbox"/> SELF	Cardiologist, nurse, psychologist or did not describe.	Number of session: unclear; Total contact hours: 4 days to 2 weeks or unclear Theoretical approach: Leventhal's framework	– Beliefs (or other illness cognition); – QoL; – Behaviour; – Anxiety or depression; being; – Psychological well-being; – Modifiable risk factors; protective factors	A descriptive data synthesis
Huttunen-Lenz, 2010 ⁵⁶ ; <i>British Journal of Health Psychology</i>	Smoking cessation	Psychoeducational cardiac rehabilitation intervention	Number of studies: a total of 14 studies were included Types of studies: RCTs; Total sample: 1792 participants	<input type="checkbox"/> BEHA <input type="checkbox"/> CVR <input type="checkbox"/> DIET <input type="checkbox"/> EXERCISE <input type="checkbox"/> MED <input type="checkbox"/> PSY <input checked="" type="checkbox"/> SMOKING <input type="checkbox"/> SELF	Cardiologist, nurse did not describe	Number of session: 4–20 or unclear. Total contact hours: 10–720 mins or unclear Duration: 4–29 weeks or unclear Theoretical approach: social learning theory; ASE model; TTM; behavioural multicomponent approach	↑ Prevalent smoking cessation, ↑ Continuous smoking cessation, – Mortality	Subgroup meta-analysis was used software

Continued

Table 2 Continued

		Intervention		Outcomes (primary outcomes were in bold)		
Primary objectives (to assess effect of intervention on...)	Studies details	Educational content	Provider	Number of session(s), delivery mode, time, setting	Synthesis methods	
Auer, 2008 ³⁴ , <i>Circulation</i>	Multiple cardiovascular risk factors and all-cause mortality Number of studies: 27 articles reporting 26 studies Types of studies: 16 clinical controlled trials and 10 before-after studies Total sample: 2467 patients in CCTs and 38, 581 patients in before-after studies	In-hospital multidimensional interventions of secondary prevention	Cardiac nurses; physician, or did not describe	Number of session: Written material; audiotapes; presentations; face-to-face; Total contact hours: 30–240 mins or unclear; Duration: 4 weeks–12 months unclear	Inpatient settings ↓ All-cause mortality; ↓ Readmission rates; – Reinfarction rates	Stata V.9.1
Barth, 2008 ³⁶ , <i>The Cochrane Library</i>	Smoking cessation Number of studies: 40 trials; Types of studies: RCTs; Total sample: 7682 patients	Psychosocial intervention	Cardiologist nurse, physician or study nurse	Number of session: face-to-face; information booklets, audiotapes or videotapes Total contact hours: 15 mins–9 hours Duration: within 4 weeks or did not report on the duration	Inpatient settings ↑ Abstinence by self-report or validated	Meta-analysis used Review Manager software
Fernandez, 2007 ⁴⁸ , <i>International Journal of Evidence-Based Healthcare</i>	Risk factor modification Number of studies: 17 trials; Types of studies: randomised, quasi-RCTs and clustered trials; Total sample: 4725 participants	Brief structured intervention	Case manager; dieticians; health educator; nurses; psychologist; and research assistants	Number of session: supportive counselling ranged from 1 to 7 calls for the duration of the study; Total contact hours: varied from 10 to 30 mins; Duration: unclear	Unclear, did not describe ↓ Smoking; – Cholesterol level; – Physical activity; ↑ Dietary habits; ↓ Blood sugar levels; ↓ BMI; – Incidence of admission	Cochrane statistical package Review Manager
Barth, 2006 ³⁵ , <i>Annals of Behavioural Medicine</i>	Smoking cessation Number of studies: 19 trials; Types of studies: RCTs; Total sample: 2548 patients	Psychosocial interventions	Unclear, did not describe	Number of session: face-to-face, telephone contact or unclear; Total contact hours: unclear; Duration: unclear	Unclear, did not describe ↑ Abstinence; ↓ Smoking status	Data analyses were carried out in Review Manager V.4.2

Continued

Table 2 Continued		Intervention		Outcomes (primary outcomes were in bold)			
First author, year; journal	Primary objectives (to assess effect of on...)	Studies details	Educational content	Provider	Number of session(s), delivery mode, time, setting	Synthesis methods	
Clark, 2005 ⁴¹ ; <i>Annals of Internal Medicine</i>	Mortality, MI	Number of studies: 63 randomised trials; Types of studies: RCTs; Total sample: 21 295 patients	Secondary prevention programmes	Nurse, multidisciplinary team or did not describe	Number of session: 1–12 or unclear Total contact hours: did not describe Duration: 0.75–48 months Strategies: face-to-face, telephone contact and home visit; Format: group and individual or unclear; Theoretical approach: unclear	↓ Mortality, ↓ MI, – Hospitalisation rates	Performed analyses by using Review Manager V.4.2 and Qualitative Data Synthesis

Smoking, smoking cessation; CVR, cardiovascular risk factors; PSY, psychosocial issues (depression, anxiety); DIET, diet; EXERCISE, exercise; MED, medication; BEHA, behavioural change (including lifestyle modification); SELF, self-management (including problems solving); DR, diabetes risks; CHD, coronary heart disease; CAD, coronary artery disease; CHW, community health worker; HbA1c, glycated haemoglobin; BP, blood pressure; LDL, low-density lipoprotein cholesterol; SMS, short message service; BC/Ts, behavioural change techniques; LEA, lower extremity amputation; PRIDE, Problem Identification, Researching one's routine, Identifying a management goal, Developing a plan to reach it, Expressing one's reactions and Establishing rewards for making progress; ASE, attitude social influence-efficacy; CVRF, cardiovascular risk factors; PA, physical activity; EDU, patient education; GP, general practice; RCTs, randomised controlled trials; CCTs, controlled clinical trials; HRQoL, health-related quality of life; QoL, quality of life; MI, myocardial infarction; CAD, coronary artery disease; CABG, coronary artery bypass graft surgery; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL-c, high-density lipoprotein cholesterol; TTM, transtheoretical model; SCT, social cognitive theory; HBM, health belief model; SAT, social action theory.

In the educational content: '+': minor focus; '++': moderate focus; '+++': major focus; '-': unclear what the intensity of the education was for any topic.

In the outcomes: arrow up (↑) for improvement, arrow down (↓) for reduction; a dash (–) for no change or inconclusive evidence. Primary outcomes were in bold.

25.6 (range, 7–132) studies was included per systematic review or meta-analyses. Of the total, 818 unique (non-repeated) studies were included in all of the reviews or meta-analyses, 286 included patients with ACS and 532 included patients with T2DM (see online supplementary appendix 2 and 3). The included reviews assessed the risk of bias using the Cochrane risk of bias tool (22 publications), JADA quality score (7 publications), Joanna Briggs quality assessment tool (2 publications), PEDro scale (1 publication), RCT Critical Appraisal Skills Programme (1 publication) and the SIGN-50 checklist (1 publication).

Methodological quality of included systematic reviews and meta-analyses

The methodological quality of the included publications is presented in table 1. Thirty (58.8%) publications were classified as high quality (scores 8–11) and 21 (41.2%) publications were classified as medium quality (scores 4–7). Twenty-five (49%) reviews specifically provided an a priori design, while the use of such a design was unclear for 26 (51%) publications. The inclusion of other forms of literature (such as grey literature) was described in 18 (35%) reviews. Only 14 out of 51 (27%) reviews included a table of included and excluded studies. Only two (4%) reviews did not provide a characteristics table of the included papers. The scientific quality of the included papers was evaluated and documented in 47 (92%) reviews. The scientific quality of the included studies was used appropriately to formulate conclusions in 47 (92%) reviews. The methods to combine the results of the included studies were appropriate in 43 (86%) reviews. Publication bias was assessed in only 19 (37%) reviews. Finally, conflicts of interest were reported in 47 (92%) reviews.

Characteristics of health educational interventions

The description of the health educational interventions followed the Workgroup for Intervention Development and Evaluation Research reporting guidelines for behaviour change interventions.⁸¹ The characteristics of the recipients, setting, delivery methods, intensity, duration and educational content of health educational interventions for patients with ACS or T2DM are summarised in tables 2 and 3. The delivery strategies for health education included face-to-face, internet-based, phone-based, videotape, written educational materials or mixed. The format included one-on-one (individualised), group or both. Face-to-face sessions were the most common delivery formats, and many education sessions were also delivered by telephone/web contact or individualised counselling. The number of sessions, total contact hours and durations varied, and there was limited information about the intensity of health education for patients provided. The frequency of educational sessions was weekly or monthly, and an average of 3.7 topics was covered per education session. Nurses and multidisciplinary teams were the most frequent educators, and most education programmes were delivered postdischarge.

Table 3 Characteristics and interventions of included systematic reviews and meta-analysis involved patients with T2DM

First author, year; journal Research and Clinical Practice	Intervention		Provider	Number of session(s), delivery mode, time, setting	Outcomes (primary outcomes were in bold.) -; No change ↑; Increase ↓; Decrease	Synthesis methods
	Primary objectives (to assess effect of interventions on...)	Educational content				
Choi, 2016 ⁴⁵ ; <i>Diabetes Research and Clinical Practice</i>	Glycaemic effect	Diabetes education intervention	Unclear, did not describe	Number of session: unclear; Total contact hours: unclear; Duration: 30–150 min or unclear	↓ HbA1c ↓ HbA1cSTATA V.12 and Review Manager V.5.3	Meta-analysis using the Review Manager statistical programme
Cremer, 2016 ⁴⁶ ; <i>Diabetic Medicine</i>	Successful outcomes and to suggest directions for future research	Culturally appropriate health education	CHWs, clinical pharmacists, dietitians, nurses, podiatrists, physiotherapists and psychologists	Number of session: 1–10 or unclear; Total contact hours: unclear; Duration: from a single session to 24 months	↑ BEHA (+) ↑ DIET (+) ↑ DR (-) ↑ EXERCISE (+) GC MED PSY SMOKING SELF (-)	<ul style="list-style-type: none"> ↑ HbA1c ↓ HbA1c ↓ HbA1c ↓ BP ↓ BMI ↓ Lipid levels ↓ Diabetes complications, mortality and diabetes knowledge ↓ Empowerment ↓ Self-efficacy and satisfaction
Huang, 2016 ⁴⁷ ; <i>European Journal of Internal Medicine</i>	Clinical markers of cardiovascular disease	Lifestyle interventions	Nurse, pharmacist or unclear	Number of session: unclear; Total contact hours: unclear; Duration: 6 months–8 years	<ul style="list-style-type: none"> BEHA (+) DIET (+) DR (-) EXERCISE (+) GC MED PSY SMOKING SELF (-) 	<ul style="list-style-type: none"> Cardiovascular risk factors such as, BMI, HbA1c, BP, Level of cholesterol
Chen, 2015 ⁴⁸ ; <i>Metabolism-Clinical and Experimental</i>	Clinical markers	Lifestyle intervention	Unclear, did not describe	Number of session: monthly; Total contact hours: unclear; Duration: <6 months–8 years	<ul style="list-style-type: none"> BEHA (+) DIET DR (-) EXERCISE GC MED (+) PSY SMOKING SELF (-) 	<ul style="list-style-type: none"> Cardiovascular risk factors including BMI, HbA1c, SBP, DBP, HDL-c and LDL-c
Teranova, 2015 ⁴⁹ ; <i>Diabetes, Obesity and Metabolism</i>	Weight loss	Lifestyle-based-only intervention	Dietician; diabetes educator; general physician; multidisciplinary team or nutritionist; nurse	Number of session: 1–42; Total contact hours: unclear; Duration: ranged from 16 weeks to 9 years	<ul style="list-style-type: none"> BEHA (+) DIET (+) DR (-) EXERCISE (+) GC MED PSY SMOKING SELF (-) 	<ul style="list-style-type: none"> Weight change; HbA1c
Pilly, 2015 ⁵¹ ; <i>Annals of Internal Medicine</i>	HbA1c level	Behavioural programme	Trained individuals	Number of session: unclear; Total contact hours: range, 7–40.5 hours; Duration: 4 or more weeks	<ul style="list-style-type: none"> BEHA (+) DIET (+) DR EXERCISE (+) GC (-) MED (-) PSY SMOKING SELF (-) 	<ul style="list-style-type: none"> HbA1c; BMI

Continued

Table 3 Continued

		Intervention			Outcomes (primary outcomes were in bold)	
First author, year; journal	Primary objectives (to assess effect of interventions on...)	Studies details	Educational content	Provider	Number of session(s), delivery mode, time, setting	Synthesis methods
Pai, 2014 ⁶⁷ ; <i>Diabetes Care</i>	Health status, cardiovascular risk factors and QoL	Number of studies: 20 papers describing 16 RCTs; Types of studies: Total sample: 3578 participants	Computer-based self-management interventions	Unclear, did not describe	Strategies: online/web-based; Phone contact Format: individual, group and mixed Theoretical approach: TTM, social ecological theory, SCT and self-determination theory	HRQoL, HbA1c, Death, Cognitions, behaviours, Social support, Cardiovascular risk factors, Complications, Emotional outcomes, Hypoglycaemia, ACE and economic data
Ricci-Cabello, 2014 ⁷³ ; <i>BMC Endocrine Disorders</i>	Knowledge, behaviours and clinical outcomes	Number of studies: 37 studies; Types of studies: almost two-thirds of the studies were RCTs, 27% studies were quasi-experimental design. Total sample: unclear	DSM educational programme	Dietitian; nurse; psychologist; physician; research team or staff	Strategies: face-to-face; telecommunication; both Format: one on one; group and mixed Theoretical approach: unclear	Diabetes knowledge; Self-management; Behaviours; Clinical outcomes; Glycated haemoglobin; Cost-effectiveness analysis
Saffari, 2014 ⁷⁴ ; <i>Primary Care Diabetes</i>	Glycaemic control.	Number of studies: 10; RCTs; Types of studies: 960 patients	An educational intervention using SMS	Unclear, did not describe	Strategies: SMS; sending and receiving data. Receive data through text-messaging by patients only. Used a website along with SMS; Format: Unclear. Theoretical approach: Unclear.	1 Glycaemic control
Odnoletkova, 2014 ⁶⁶ ; <i>Journal of Diabetes & Metabolism</i>	Cost-effectiveness (CE)	Number of studies: 17 studies; Types of studies: RCTs; Total sample: unclear	Therapeutic education	General physician; nutritionists or unclear	Strategies: face-to-face or unclear; Format: individual and group lessons; Theoretical approach: unclear	Incremental cost-effectiveness ratio
Attidge, 2014 ⁸³ ; <i>The Cochrane Library</i>	HbA1c level, knowledge and clinical outcomes	Number of studies: 33 trials; Types of studies: RCTs and quasi-RCTs; Total sample: 7453 participants	'Culturally appropriate' health education	CHWs; dietitians; exercise physiologists; lay workers; nurses; podiatrists and psychologists	Strategies: group intervention method, one-to-one sessions and a mixture of the two methods. Or a purely interactive patient-centred method Theoretical approach: empowerment theories; behaviour change theories, TTM of behaviour change and SCT	HbA1c; HRQoL; Adverse events; Mortality; Complications; Satisfaction; Empowerment; Self-efficacy; Attitude; Knowledge; BP; BMI; Lipid levels; Health economics
Vigt, 2013 ⁷⁵ ; <i>Journal of Medical Internet Research</i>	Health outcomes	Number of studies: 13 studies; Types of studies: RCTs; Total sample: 3813 patients	BCTs are being used in online self-management interventions	Healthcare professional	Strategies: online/web-based; Format: unclear. Theoretical approach: self-efficacy theory, social support theory, TTM, SCT, social-ecological model and cognitive behavioural therapy	Health behaviour change; Psychological well-being; Clinical parameters

Continued

Table 3 Continued

		Intervention		Outcomes (primary outcomes were in bold)		
First author, year; journal	Primary objectives (to assess effect of interventions on...)	Studies details	Educational content	Number of session(s), delivery mode, time, setting	Synthesis methods	
Gucciardi, 2013 ⁵⁷ ; <i>Patient Education and Counseling</i>	HbA1c level, physical activity and diet outcomes	Number of studies: 13 studies; Types of studies: RCTs and comparative studies; Total sample: unclear	DSME interventions.	Strategies: face-to-face (n=13/13); written literature (eg, handbook) (n=4/13); telephone (n=4/13); audiovisual (n=1/13) Format: one-on-one; (n=11/13); group (n=9/13) Theoretical approach: SAT; empowerment Behaviour change model; modification theories; pharmaceutical care model; Behaviour change theory; PATHWAYS programme; symptom-focused management model; motivational interviewing	Inpatient settings, postdischarge	A recently described method
Pal, 2013 ⁶⁸ ; <i>The Cochrane Library</i>	Health status and HRQoL	Number of studies: 16 studies; Types of studies: RCTs; Total sample: 3578 participants	Computer-based diabetes self-management intervention	Number of session: low intensity; <10 education sessions (n=7); high intensity; >10 education sessions (n=6); Total contact hours: unclear; Duration: <6 months (n=7/13); >6 months (n=6/13)	Inpatient settings, postdischarge, other	Formal meta-analysis and narrative synthesis
Nam, 2012 ⁶⁹ ; <i>Journal of Cardiovascular Nursing</i>	Glycaemic control	Number of studies: 12 RCTs; Types of studies: RCTs; Total sample: 1495 participants	Diabetes educational interventions (no drug intervention)	Strategies: online/web-based; phone contact Format: unclear; Theoretical approach: unclear	Inpatient settings, postdischarge, other	Formal meta-analysis and narrative synthesis
Stensbekk, 2012 ⁶⁶ ; <i>BMC Health Services Research</i>	Clinical, lifestyle and psychosocial outcomes	Number of studies: 21 studies (26 publications) Types of studies: RCTs; Total sample: 2833 participants	Diabetes educational interventions (no drug intervention)	Number of session: 1 month or less; 1–3 months and 12 months; Total contact hours: most studies did not describe, or from 1 session to more than 30 hours; Duration: from 1 session to 12 months, frequency; 1 session to 25 weekly or biweekly education	Inpatient settings, postdischarge, other	Meta-analysis
Amaeshi, 2012 ⁶⁷ ; <i>Podiatry Now</i>	Increasing good foot health practices that will ultimately reduce LEA	Number of studies: eight studies; Types of studies: RCT or clinical controlled trial (CCT); Total sample: unclear	Group-based education	Number of session and total contact hours: 30 hours over 2.5 months, 52 hours over 1 year and 36 or 96 hours over 6 months Duration: 6 months to 2 years	Inpatient settings, postdischarge, other	Meta-analysis using Review Manager V.5

Continued

Table 3 Continued

		Intervention		Outcomes (primary outcomes were in bold)		
First author, year; journal	Primary objectives (to assess effect of interventions on...)	Studies details	Educational content	Provider	Number of session(s), delivery mode, time, setting	Synthesis methods
Liu Gan, 2011 ⁶⁷ ; <i>JBI Library of Systematic Reviews</i>	Oral hypoglycaemic adherence	Number of studies: seven studies; Types of studies: RCTs; Total sample: unclear	Educational interventions	Nurses, pharmacists; other skilled healthcare professionals	Number of session: 1-12 or unclear; Total contact hours: 2-5 hours or unclear; Duration: 4-12 months	↓ HbA1c; Medication adherence; ↓ Blood glucose; ↓ Blood count; – Medication containers; – Diabetes complications; – Health service utilisation
Burke, 2011 ³⁸ ; <i>BMJ Database of Systematic Reviews and Implementation Reports</i>	HbA1c level BP	Number of studies: 11 RCTs and 4 quasi-experimental trials; Types of studies: RCTs and quasi-experimental trials; Total sample: 2240 patients	Group medical visits	Endocrinologists; DM nurse; family physician; nutritionist and rehab therapist	Number of session: 1-4 or unclear; Total contact hours: 2-4 hours or unclear; Duration: 1 session to 2 years	↓ HbA1c; –Systolic and diastolic BP; –LDL measurements
Ramadas, 2011 ⁷¹ ; <i>International Journal of Medical Informatics</i>	HbA1c level	Number of studies: 13 different studies; Types of studies: RCTs and quasi-experimental studies; Total sample: unclear	Web-based behavioural interventions	Dietician; endocrinologist; physicians; researchers or research staff members and study nurse	Number of session: unclear; Total contact hours: unclear; Duration: ranged between 12 and 32 weeks, with an average of 27.2±16.3 weeks	– Self-monitoring blood sugar; – Weight loss; – Dietary behaviour; – Physical activity
Minet, 2010 ⁶¹ ; <i>Patient Education and Counselling</i>	Glycaemic control	Number of studies: 47 studies; Types of studies: RCTs; Total sample: unclear	Self-care management interventions	Case nurse manager; group facilitator; nurse educator; multidisciplinary team; physiologist; physician; peer counsellor; researcher and pharmacist	Number of session: 3-26; Total contact hours: unclear; Duration: 4 weeks to 4 years	↓ HbA1c
Hawthorne, 2010 ⁶⁴ ; <i>Diabetic Medicine</i>	Effects of culturally appropriate health education	Number of studies: 10 trials; Types of studies: RCTs; Total sample: 1603 patients	Culturally appropriate health education	Exercise physiologists; dieticians; diabetes nurses; link workers and podiatrists	Number of session: unclear; Total contact hours: unclear; Duration: 1 session to 12 months	–QoL; ↓ HbA1c; BP; ↑ Knowledge; – BMI; ↓ Lipid levels; – Diabetic complications; – Mortality rates; hospital admissions; hypoglycaemia
Fan, 2009 ⁷² ; <i>Canadian Journal of Diabetes</i>	Knowledge, self-management behaviours and metabolic control	Number of studies: 50 studies; Types of studies: RCTs; Total sample: unclear	DSME intervention	Unclear; did not describe	Number of session: 10 (range 1-28); Total contact hours: 17 contact hours (range 4-60); Duration: 11-20 (21%); >20 (33%); 22 weeks (range 16-38); 33 weeks (26%); 9-24 weeks (37%); >24 weeks (37%)	↑ Diabetes knowledge; ↑ Self-management behaviours; ↓ HbA1c

Continued

Table 3 Continued

		Intervention			Outcomes (primary outcomes were in bold)	
First author, year; journal	Primary objectives (to assess effect of interventions on...)	Studies details	Educational content	Provider	Number of session(s), delivery mode, time, setting	Synthesis methods
Duke, 2009 ⁴⁶ ; The Cochrane Library	Metabolic control, diabetes knowledge and psychosocial outcomes	Number of studies: nine studies; Types of studies: RCTs; Total sample: 1359 participants	Individual patient education	Diabetes educators and dietitians	Strategies: face to face; telephone; Format: individual; Theoretical approach: unclear Number of session: 1-6; Total contact hours: 20min-7 hours; Duration: 4 weeks-1 year	– HbA1c; – Diabetes complications; – Health service utilisation and healthcare costs; – Psychosocial outcomes; – Diabetes knowledge, patient self-care behaviours; – Physical measures; metabolic
Alam, 2009 ⁴⁹ ; Patient Education and Counselling	Glycaemic control and psychological status	Number of studies: 35 trials; Types of studies: RCTs; Total sample: 1431 patients	Psycho-educational interventions	Generalists; psychological specialists; or did not report the specialist	Strategies: face to face; telephone calls; Format: group format, a single format and used a combination; Duration: about 13.7 (±11.06) weeks Theoretical approach: TTM; motivational interviewing Number of session: 1-16; Total contact hours: 20min-28 hours; Duration: about 13.7 (±11.06) weeks	↓ HbA1c; ↓ Psychological distress
Kivimäki, 2008 ⁴⁵ ; Diabetic Medicine	Knowledge and biomedical outcomes	Number of studies: nine studies; Types of studies: RCTs and RCT was followed by a before-and-after study; Total sample: 1004 patients	Any educational intervention	Unclear; did not describe	Strategies: face-to-face; individual; Format: group and individual; Theoretical approach: unclear Number of session: unclear; Total contact hours: unclear; Duration: 3-12 months	– Knowledge; – Psychological and biomedical outcome measures
Loveman, 2008 ⁶⁰ ; Health Technology Assessment	Clinical effectiveness.	Number of studies: 21 published trials; Types of studies: RCTs and CCTs; Total sample: unclear	Educational interventions	Community workers; diabetes research technicians; diabetes nurse, dietitians; educationalist; medical students; nurses; pharmacists; physician or physician assistant	Strategies: face-to-face; individual; Format: group and individual; Theoretical approach: cognitive-behavioural strategies; pedagogical principle Number of session: two to four intensive education of 1.5-2 hours followed-up with additional education at, 3 and 6 months; Total contact hours and duration: about 150 mins over 6 months or 61-92 hours over 1 year	– Diabetic control outcomes; – Diabetic end points; – QoL and cognitive measures
Wens, 2008 ⁷⁸ ; Diabetes Research and Clinical Practice	Improving adherence to medical treatment recommendations	Number of studies: eight studies; Types of studies: RCTs and controlling before and after studies Total sample: 772 patients	Interventions aimed at improving adherence to medical treatment	Diabetes educator; nurse or did not describe	Strategies: face-to-face; telephone; Format: face-to-face; group based and telemedicine; Theoretical approach: unclear Number of session: unclear; Total contact hours: unclear; Duration: ~9 months or unclear	– Adherence; – HbA1c; – Blood glucose
Hawthorne, 2008 ⁸³ ; The Cochrane Library	HbA1c level, knowledge and clinical outcomes	Number of studies: a total of 11 trials; Types of studies: RCTs; Total sample: 1603 patients	Culturally appropriate (or adapted) health education	Dietitians; diabetes nurses; exercise physiologists; link workers; podiatrists; psychologist and non-professional link worker	Strategies: face-to-face; booklet; Format: group interview method; one-to-one interviews; mixture of the two methods; purely interactive patient-centred method; semi-structured didactic format and combination of the two approaches Theoretical approach: SAT; Empowerment Behaviour Change Model; Behaviour Change Theory; SCT; Management Model and the Theory of Planned Behaviour Number of session: unclear; Total contact hours: unclear; Duration: 1 session to 12 months	↓ HbA1c ↑ Knowledge scores – Other outcome measures

Continued

Table 3 Continued

Primary objectives (to assess effect of interventions on...)		Intervention				Outcomes (primary outcomes were in bold)	
First author, year; journal	Primary objectives (to assess effect of interventions on...)	Studies details	Educational content	Provider	Number of session(s), delivery mode, time, setting	Synthesis methods	
Nield, 2007 ⁸³ ; The Cochrane Library	Metabolic control	Number of studies: 36 articles (16 trials); Types of studies: RCTs; Total sample: 1467 participants	Dietary advice	Exercise physiologist; dietitian; group facilitator; nutritionist; nurse educator; and physician	Number of session: 1-12; Total contact hours: 20min-22 hours; Duration: 11 weeks-6 months or unclear	Strategies: face-to-face; Format: group and individual; Theoretical approach: unclear	Weight; - Diabetic complications; - HbA1c; - QoL; - Medication use; - Cardiovascular disease risk
Zabalara, 2007 ⁷⁹ ; British Journal of Community Nursing	Clinical effectiveness	Number of studies: 21 studies; Types of studies: controlled trials; Total sample: unclear	Structured group diabetes education	Diabetes nurse educator; physician's assistant and physicians	Number of session: 4-6 or unclear; Total contact hours: 6-12 hours or unclear; Duration: 1-6 months or unclear	Strategies: face-to-face; Format: group; Theoretical approach: unclear	HbA1c A tabulative synthesis
Deakin, 2005 ⁸¹ ; The Cochrane Library	Clinical, lifestyle and psychosocial outcomes	Number of studies: 14 publications, reporting 11 studies; Types of studies: RCTs, and CCTs; Total sample: 1532 participants.	Group-based educational programmes	Health professionals, lay health advisors	Number of session: unclear; Total contact hours: from 6 to 32 hours; Duration: 3 hours per year for 2 years and 3 or 4 hours per year for 4 years	Strategies: unclear; Format: group; Theoretical approach: the Diabetes Treatment and Teaching Programme (DTP), empowerment model, adult learning model, public health model, HBM and TTM	Metabolic control; Diabetes knowledge; ↑ QoL; ↑ Empowerment/self-efficacy Summarised statistically
Vermeire, 2005 ⁸⁰ ; The Cochrane Library	Improving adherence to treatment recommendations	Number of studies: 21 articles; Types of studies: RCTs; cross-over study; controlled trial; controlled before and after studies; Total sample: 4135 patients	Interventions that were aimed at improving the adherence to treatment recommendations	Nurse, pharmacist and other healthcare professionals	Number of session: unclear; Total contact hours: unclear; Duration: unclear	Strategies: face-to-face; telephone, home visit; video; mailed educational materials; Format: unclear Theoretical approach: unclear	Direct indicators, such as ↓ Blood glucose level; - Indirect indicators, such as pill counts; - Health outcomes A descriptive review and subgroup meta-analysis
Gary, 2003 ⁴⁹ ; Diabetes Educator	Body weight and glycaemic control	Number of studies: 63 RCTs; Types of studies: RCTs; Total sample: 2720 patients	Educational and behavioural component interventions	Nurse (39%); dietitian (26%); physician (17%); other or not specified (23%); other professional (13%); psychologist (9%); exercise psychologist (9%) and health educator (4%)	Number of session: unclear; Total contact hours: unclear; Duration: 1 month to 19.2 months	Strategies: unclear; Format: unclear; Theoretical approach: SAT; contracting model and patient empowerment	Glycaemic control; - Weight Sufficient data were combined using meta-analysis
Norris, 2002 ⁴⁸ ; Diabetes Care	Total GHb	Number of studies: 31 studies Types of studies: RCTs; Total sample: 4263 patients	Self-management education	Dietitian; lay healthcare worker; nurse; physician with team; self (eg, computer-assisted instruction) and team (nurse, dietitian, etc)	Number of session: 6 (1-36); Total contact hours: 9.2 (1-28) hours; Duration: 6 (1.0-27) months	Strategies: online/web-based; video; face-to-face; phone contact; Format: group; individual and mixed; Theoretical approach: unclear	Total GHb Meta-analysis and meta-regression
Norris, 2001 ⁴⁴ ; Diabetes Care	Clinical outcomes, knowledge, metabolic control	Number of studies: 72 studies (64 papers); Types of studies: RCTs; Total sample: unclear	Self-management training interventions	CHWs; nurse; or other healthcare professionals	Number of session: 1-16; Total contact hours: -22 hours; Duration: -2.6 months	Strategies: online/web-based; video; (2%) face-to-face; phone contact; Format: group; individual and mixed; Theoretical approach: SAT; Fishbein and Ajzen HBM	Knowledge; ↑ Lifestyle behaviour; - Psychological and QoL outcomes; ↑ Glycaemic control; - Cardiovascular disease risk factors Outcomes are summarised in a qualitative fashion

Continued

Table 3 Continued

Primary objectives (to assess effect of interventions on...)	Studies details	Educational content	Provider	Number of session(s), delivery mode, time, setting	Outcomes (primary outcomes were in bold)	Synthesis methods
First author, year; journal	ASE, attitudes social influence-efficacy; BC's, behavioural change techniques; BEHA, behavioural change (including lifestyle modification); BMI, body mass index; BP, blood pressure; CABG, coronary artery bypass graft surgery; CAD, coronary artery disease; CCTS, controlled clinical trials; CHD, coronary heart disease; CHW, community health worker; CVR, cardiovascular risk factors; CVRF, cardiovascular risk factors; DIET, diet; DR, diabetes risks; DSM, diabetes self-management education; EDU, patient education; EXERCISE, exercise; GC, glycaemic regulation; GP, general practice; HbA1c, glycated haemoglobin; HBM, health belief model; HRQoL, health-related quality of life; LDL, low-density lipoprotein cholesterol; LDL-c, low-density lipoprotein cholesterol; LEA, lower extremity amputation; MED, medication; MI, myocardial infarction; PA, physical activity; PRIDE, Problem Identification, Researching one's routine, Identifying a management goal, Developing a plan to reach it, Expressing one's reactions and Establishing rewards for making progress; PSY, psychosocial issues (depression, anxiety); QoL, quality of life; RCTs, randomised controlled trials; SAT, social action theory; SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL-c, high-density lipoprotein cholesterol; SCT, social cognitive theory; SELF, self-management (including problems solving); SMOKING, smoking cessation; SMS, short message system; T2DM, type two diabetes mellitus; TTM, transtheoretical model.	In the educational content: '+', minor focus; '++', moderate focus; '+++', major focus; '-', unclear what the intensity of the education was for any topic. In the outcomes: arrow up (↑), for improvement, arrow down (↓), for reduction; a dash (—) for no change or inconclusive evidence.	↑: Increase ↓: Decrease			

Acute coronary syndrome

The educational content for patients with ACS covered cardiovascular risk factors in eight reviews (53.33%), psychosocial issues in eight reviews (53.33%), smoking cessation in six reviews (40.00%), exercise in five reviews (33.33%), behavioural change in five reviews (33.33%), diet in four reviews (26.67%), self-management in three reviews (20.00%) and medication in one review (6.67%). Two reviews only included smoking cessation and cardiovascular risk factors. The most common educational providers were nurses and a multidisciplinary team. Six studies^{31 36 48 51 56 69} (6/15, 40%) described the theoretical approach that underpinned the education intervention.

Type 2 diabetes mellitus

The educational content for patients with T2DM included diet in 23 reviews (63.89%), behavioural change in 21 reviews (58.33%), self-management in 20 reviews (55.56%), exercise in 17 reviews (47.22%), glycaemic regulation in 16 reviews (44.45%), medication in 13 reviews (36.11%), psychosocial issues in 9 reviews (25.00%), smoking cessation in 2 reviews (5.56%), cardiovascular risk factors in 2 reviews (5.56%) and DM risks in 1 review (2.78%). The most common providers were dietitians, nurses and a multidisciplinary team. The number of sessions, total contact hours and durations varied. Thirteen reviews^{30 33 43 49 52-54 60 64 67 75-77} (13/36, 36.11%) described the theoretical approach that underpinned the education intervention.

Effect of interventions

The outcomes of the included systematic reviews and meta-analyses are summarised in [table 4](#).

Patients with ACS

Three major types of health education-related interventions were used for patients with ACS: general health education (only included general health information), psychoeducational interventions and secondary prevention educational interventions (including strategies to promote a healthy lifestyle, manage medications and reduce cardiovascular complications) as well as internet-based interventions.

General health education

The findings are based on our synthesis of the findings from six systematic reviews.^{37 48 50 51 59 70} Overall, there were mixed effects of general health education on behavioural change or clinical outcomes in patients with ACS. There was *some evidence* of a positive effect of general health education on knowledge, behaviour, psychosocial indicators, beliefs and risk factor modification, but no effects for key clinical outcomes, such as cholesterol level, hospitalisation, mortality, MI and revascularisation. The results for health-related quality of life, healthcare utilisation and costs were mixed; several reviews reported a significant change, and other reviews reported no significant change for these outcomes. Only one review focused on telephone-based health education. There is *some evidence* that

Table 4 Summary of evidence from quantitative research syntheses

Intervention	Number of systematic reviews/meta-analysis, total participants	First author, year	Primary results/findings	Rating the evidence of effectiveness	
Patients with acute coronary syndrome					
General health education	Six/161 997 patients (Goulding <i>et al.</i> , 2010 ⁵¹ did not give the total sample size)	Ghisi, 2014 ⁵⁰	Knowledge	91% studies*	Some evidence
			Behaviour	77%/84%/65% studies*	
			Psychosocial indicators	43% studies*	
		Brown, 2013 ³⁷	Mortality		
			MI		
			Revascularisations		
			Hospitalisations		
			HRQoL		
			Withdrawals/dropouts		
			Healthcare utilisation and costs		
		Brown, 2011 ⁷⁰	Total mortality		
			MI		
			CABG		
			Hospitalisations		
			HRQoL	63.6% studies*	
		Goulding, 2010 ⁵¹	Healthcare costs	40% studies*	
			Withdrawal/dropout		
Goulding, 2010 ⁵¹	Beliefs	30.08% studies*			
	Secondary outcomes				
Fernandez, 2007 ⁴⁸	Smoking				
	Cholesterol level				
	Multiple risk factor modification				
Kotb, 2014 ⁵⁹	All-cause hospitalisation				
	All-cause mortality				
	Smoking cessation				
	Depression				
	Systolic blood pressure				
	Low-density lipoprotein				
	Anxiety				
Psychoeducational interventions	Six/37 883 patients	Barth, 2015 ⁶⁹	Abstinence by self-report or validated	Sufficient evidence	
			Dickens, 2013 ⁴⁵		Depression
		Aldcroft, 2011 ³¹	Smoking cessation		
			Physical activity		
		Huttunen-Lenz, 2010 ⁵⁶	Prevalent smoking cessation		
			Continuous smoking cessation		
		Barth, 2008 ³⁶	Total mortality		
			Abstinence by self-report or validated		
		Barth, 2006 ³⁵	Smoking status		
			Abstinence		
			Smoking status		

Continued

Table 4 Continued

Intervention	Number of systematic reviews/meta-analysis, total participants	First author, year	Primary results/findings	Rating the evidence of effectiveness	
Secondary prevention educational interventions (including Internet-based secondary prevention)	Three/25 154 patients	Devi, 2015 ⁴⁴	Mortality	Some evidence	
			Revascularisation		
			Total cholesterol		
			HDL cholesterol		
			Triglycerides		
		Auer, 2008 ³⁴	HRQOL		
			All-cause mortality		
			Readmission rates		
		Clark, 2005 ⁴¹	Reinfarction rates		
			Smoking cessation rates		
Patients with T2DM	Five/2319 patients (Choi <i>et al</i> , 2016 ⁴⁰ ; Loveman <i>et al</i> , 2008 ⁶⁰ ; Zabaleta <i>et al</i> , 2007 ⁷⁹ did not give the total sample size)	Choi, 2016 ⁴⁰	HbA1c	Some evidence	
			Saffari, 2014 ⁷⁴		Glycaemic control
					Duke, 2009 ⁴⁶
		Loveman, 2008 ⁶⁰	BP		
			Knowledge, psychosocial outcomes and smoking habits		No data
			Diabetes complications or health service utilisation and cost analysis		No data
			Diabetic control outcomes		46.15% studies*
			Weight		66.67% studies*
			Cholesterol or triglycerides (+)		40.00% studies (+)
			Zabaleta, 2007 ⁷⁹		HbA1c
Culturally appropriate health education	Eight/20622 patients (Ricci-Cabello <i>et al</i> , 2014 ⁷³ and Gucciardi <i>et al</i> , 2013 ⁵² did not give the total sample size)	Creamer, 2016 ⁴²	HbA1c	Some evidence	
			HRQoL		
			AEs		No AEs
		Ricci-Cabello, 2014 ⁷³	HbA1c		
			Diabetes knowledge		73.3% studies*
			Behaviours		75% studies*
			Clinical outcomes		Fasting blood glucose, HbA1c and BP improved in 71%, 59% and 57% of the studies

Continued

Table 4 Continued

Intervention	Number of systematic reviews/meta-analysis, total participants	First author, year	Primary results/findings	Rating the evidence of effectiveness
Lifestyle interventions+ behavioural programme	Six/10 440 patients (Huang <i>et al</i> , 2016 ⁵⁵ ; Pillay <i>et al</i> , 2015 ⁷¹ and Ramadas <i>et al</i> , 2011 ⁷⁷ did not give the total sample size)	Attridge, 2014 ³³	HbA1c Knowledge scores Clinical outcomes Other outcome measures	Some evidence
		Gucciardi, 2013 ⁵²	HbA1c levels Anthropometrics Physical activity Diet outcomes	
		Nam, 2012 ⁶²	HbA1c level	
		Hawthorne, 2010 ⁵⁴	HbA1c Knowledge scores	
		Khunti, 2008 ⁵⁸	Knowledge levels Biomedical outcomes	
		Hawthorne, 2008 ⁵³	HbA1c Knowledge scores Other outcome measures	
		Huang, 2016 ⁵⁵	HbA1c BMI LDL-c and HDL-c	
		Chen, 2015 ³⁹	HbA1c BMI SBP DBP HDL-c	
		Terranova, 2015 ⁷²	HbA1c level Weight	
		Pillay, 2015 ⁷¹	HbA1c levels BMI	
Ramadas, 2011 ⁷⁷	HbA1c	46.2% studies *		
Gary, 2003 ⁴⁹	Fast blood sugar Glycohaemoglobin HbA1 HbA1c Weight			

Continued

Table 4 Continued

Intervention	Number of systematic reviews/meta-analysis, total participants	First author, year	Primary results/findings	Rating the evidence of effectiveness				
Self-management educational interventions	Nine/19 597 patients (Minet <i>et al</i> , 2010 ⁶¹ ; Fan <i>et al</i> , 2009 ⁴⁷ and Norris <i>et al</i> , 2001 ⁶⁴ did not give the total sample size)	Pal, 2014 ⁶⁷	Cardiovascular risk factors Cognitive outcomes Behavioural outcomes	Only one study reporting a significant improvement	Sufficient evidence			
		Vugt, 2013 ⁷⁵	AEs Health behaviours Clinical outcomes measures	No AEs 7 of 13 studies * Nine studies *				
		Pal, 2013 ⁶⁸	Psychological outcomes HbA1c Depression Quality of life Weight	Nine studies * HbA1c Depression Quality of life Weight				
		Steinsbekk, 2012 ⁷⁶	HbA1c Main lifestyle outcomes Main psychosocial outcomes	HbA1c Main lifestyle outcomes Main psychosocial outcomes				
		Minet, 2010 ⁶¹ Fan, 2009 ⁴⁷	Glycaemic control Diabetes knowledge Overall self-management behaviours Overall metabolic outcomes	Glycaemic control Diabetes knowledge Overall self-management behaviours Overall metabolic outcomes				
		Deakin, 2005 ⁴³	Overall weighted mean effect sizes Metabolic control (HbA1c) Fasting blood glucose levels Weight Diabetes knowledge SBP Diabetes medication	Overall weighted mean effect sizes Metabolic control (HbA1c) Fasting blood glucose levels Weight Diabetes knowledge SBP Diabetes medication				
		Norris, 2002 ⁶⁵ Norris, 2001 ⁶⁴	Total GHb Knowledge Self-monitoring of blood glucose Self-reported dietary habits Glycaemic control	Total GHb Knowledge Self-monitoring of blood glucose Self-reported dietary habits Glycaemic control				
		Therapeutic education	One/total sample: unclear	Odnoletkova, 2014 ⁶⁶		Cost-effectiveness	Overall high in studies on prediabetes and varied in studies on T2DM	Insufficient evidence
		Foot health education	One/total sample: unclear	Amaeshi ³²		Diabetes complications Incidence of LEA		Some evidence

Continued

Table 4 Continued

Intervention	Number of systematic reviews/meta-analysis, total participants	First author, year	Primary results/findings	Rating the evidence of effectiveness	
Group medical visit	One/2240 patients	Burke, 2011 ³⁸	HbA1c BP and DBP SBP Cholesterol—LDL	Some evidence	
Psychoeducational intervention	One/1431 patients	Alam, 2009 ³⁰	HbA1c Psychological status	Some evidence	
Interventions aimed at improving adherence to medical treatment recommendations	Three/4907 patients (Lun Gan <i>et al.</i> , 2011 ⁵⁷ did not give the total sample size)	Lun Gan, 2011 ⁵⁷ Wens <i>et al.</i> , 2008 ⁷⁸ Vermeire, 2005 ⁸⁰	Oral hypoglycaemic adherence Adherence HbA1c	Five of seven studies * General conclusions could not be drawn	Some evidence
Dietary advice	One/1467 patients	Nield, 2007 ⁶³	Glycaemic control (addition of exercise to dietary advice) Weight Diabetic microvascular and macrovascular diseases	Insufficient evidence to determine Limited data Limited data	

*Intervention group is significantly better than control group, for example, '91% studies' means 91% studies reported a significant better compared with control group.

AEs, adverse events; BMI, body mass index; BP, blood pressure; CABG, coronary artery bypass graft surgery; HbA1c, glycated haemoglobin; HRQoL, health related quality of life; LDL-c, low-density lipoprotein cholesterol; LEA, lower extremity amputation; MI, myocardial infarction; RCTs, randomised controlled trials; SBP, systolic blood pressure, DBP, diastolic blood pressure, HDL-c, high density lipoprotein cholesterol; T2DM, type two diabetes mellitus.

telephone-based health education during cardiac rehabilitation might improve all-cause hospitalisation, anxiety, depression, smoking cessation and systolic BP, but there is no evidence for improvements in all-cause mortality and reductions in low-density lipoprotein cholesterol.⁵⁹

Psychoeducational interventions

Strategies for psychoeducational interventions have a specific focus on smoking cessation and depression. The findings are based on synthesis of results from six publications.^{31 35 36 45 56 69} There is *sufficient evidence* that psychoeducational programmes are effective at decreasing smoking, achieving smoking abstinence and reducing depression. One review reported no effect on smoking cessation³¹ or total mortality.⁵⁶

Secondary prevention educational interventions

The following statements are based on our synthesis of results from three papers.^{34 41 44} There is *some evidence* that secondary prevention educational interventions reduce MI readmission rates and improve quality of life, but the intervention was ineffective in reducing revascularisation, cholesterol levels and improving smoking cessation rates. The results are mixed for mortality and re-infarction rates; two reviews^{34 41} found positive effects on mortality, while one review⁴⁴ did not.

Patients with T2DM

Ten types of health education-related interventions were used for patients with T2DM: culturally appropriate health education (tailored to the religious beliefs, culture, literacy and linguistics of the geographical area), dietary advice, foot health education, group medical visits (a group education component taught by health professionals), general health education (only included general health information), improving the uptake and maintenance of medication regimes (eg, promoting the use of oral hypoglycaemic medications), lifestyle interventions (specific focus on dietary changes and increased physical activity, or stress management), psychoeducational interventions and self-management educational interventions (activities that promote or maintain the behaviours to manage T2DM often based on the National Standards for Diabetes Self-Management Education¹³) and therapeutic education (collaborative process needed to modify behaviour and more effectively manage risk factors).

Culturally appropriate health education

Findings are based on our synthesis of results from eight publications.^{33 42 52–54 58 62 72} Overall, there was *some evidence* of the effects of culturally appropriate health education on clinical outcomes for T2DM. There was *sufficient*

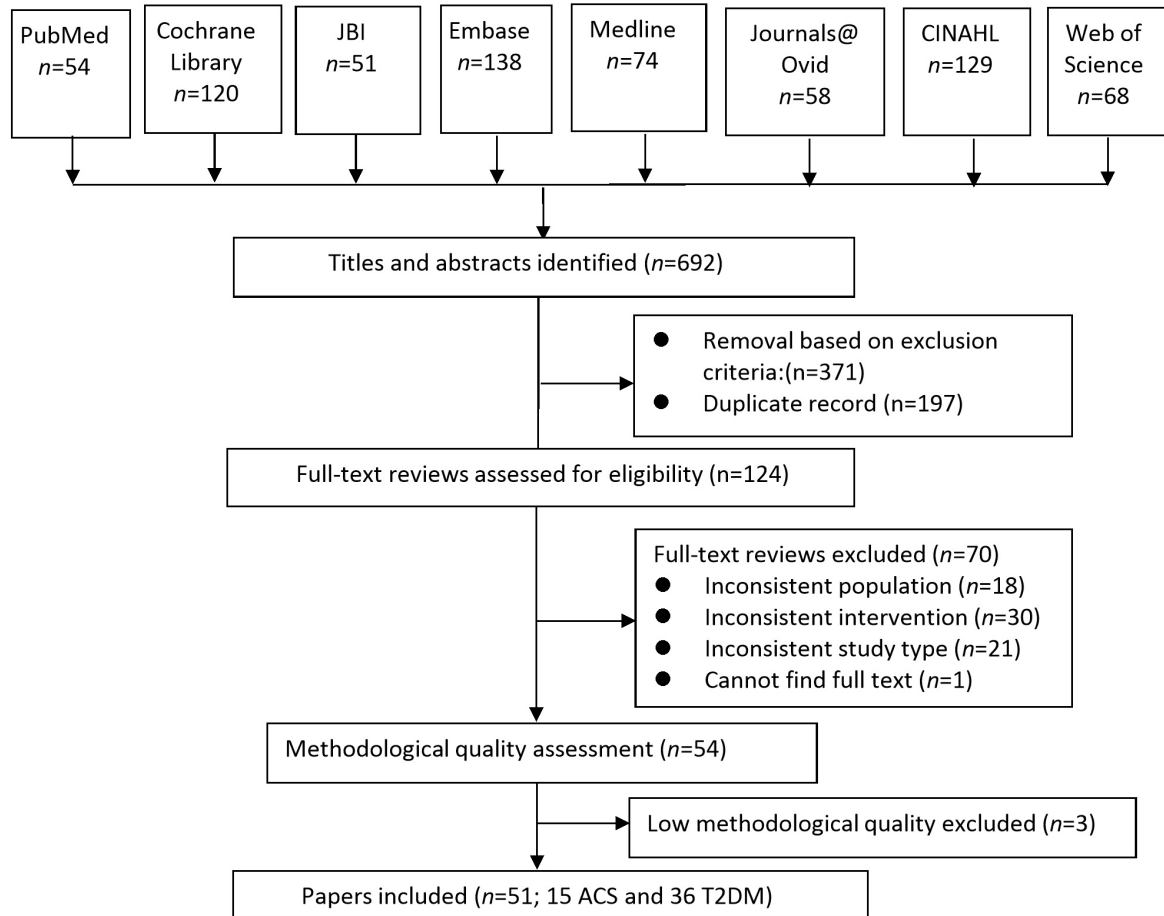


Figure 1 Flow chart of the systematic reviews and meta-analyses selection process.

evidence that culturally appropriate health education improves HbA1c reduction and knowledge scores. There is *some* evidence that physical activity and clinical outcomes (blood glucose, HbA1c, BP) were improved. There were no data relating to adverse events during the intervention and follow-up (such as hypoglycaemic events and mortality), and there was insufficient evidence about improvements in quality of life.

General health education

The statements are based on our synthesis of results from five papers.^{40 46 60 74 79} Overall, there were mixed effects of general health education programmes on clinical outcomes for T2DM, including HbA1c, cholesterol level and triglyceride level. There was *some evidence* of the effectiveness of general health education on the management of glycaemia, weight reduction and some diabetes management outcomes (HbA1c, diabetes complications). There were no data supporting the effectiveness of general health education on reduced health service utilisation, diabetes complications, improved knowledge, psychosocial outcomes or smoking habits.

Lifestyle interventions

The following statements are based on our synthesis of results from six reviews.^{39 49 55 71 72 77} Overall, there were mixed effects of the lifestyle interventions on cholesterol

level, HbA1c level and body weight. There is *some evidence* that lifestyle interventions or behavioural programmes are effective for blood glucose and BP management, but they were ineffective for reductions in HbA1c scores.^{71 72}

Uptake and maintenance of medication regimes

The statements are based on our synthesis of results from three publications.^{57 78 80} There is *some evidence* of the effectiveness of increased uptake and maintenance of medication regimes for taking medications for HbA1c regulation including oral hypoglycaemic agents.

Self-Management educational interventions

The statements are based on our synthesis of results from nine reviews.^{43 47 61 64 65 67 68 75 76} Overall, there was *sufficient evidence* of the effects of self-management education interventions on HbA1c level, knowledge, lifestyle outcomes and main psychosocial outcomes. However, there was *insufficient* evidence of the benefits of this education intervention on depression, quality of life and body weight.

Other health education-related interventions

Other health education-related interventions for patients with T2DM included therapeutic education, foot health education, group medical visits, psychoeducational interventions and dietary advice. Statements for all of these

interventions are based on our synthesis of results from one review.

There is *some evidence* that foot health education is effective in reducing the incidence of lower extremity amputation.³² There is *some evidence* that group medical visits are effective for improving HbA1c and systolic BP management.³⁸ There is also *some evidence* that psychoeducational programmes are effective for improving HbA1c regulation and psychological status.³⁰

Finally, there is *insufficient evidence* that dietary advice improves glycaemic and weight management or reduces microvascular and macrovascular diseases.⁶³ There is also *insufficient evidence* for the cost-effectiveness of therapeutic education for patients with T2DM.⁶⁶

DISCUSSION

This umbrella review identified 51 systematic reviews or meta-analyses (15 for ACS and 36 for T2DM) that assessed the outcomes of various aspects (such as the duration, contact hours, educational content, delivery mode) of the delivery of health education-related interventions relevant to high-risk patients with ACS and T2DM. Health education has become an integral part of the management for people with ACS and T2DM. The most appropriate focus of the education provided to patients with ACS and T2DM remains largely undefined in the literature. For example, it remains unknown if the focus should be primarily on cardiovascular risk factors, blood glucose monitoring or all educational components for patients with both conditions.^{70 76} In addition, should cardiovascular risk factors be the focus during the acute inpatient stay with other educational needs such as the smoking cessation occurring within the primary care or outpatient settings.^{31 69 70}

It remains challenging to determine the specific strategy or format that is the most effective delivery mode for patients with ACS or T2DM. There is very limited evidence to guide clinicians on the duration, contact hours, educational content, delivery mode, total length and setting of health education programme for cardiac patients.⁵⁰ For patients with DM, one study reported that more successful programme were longer than 6 months (longer duration), consisted of greater than 10 contact sessions (high intensity) and were one-on-one sessions with individualised assessment.⁸²

Use of theoretical orientation to develop educational intervention

For patients with ACS

Use of theory when designing behavioural change interventions may also influence effectiveness.⁷⁵ Health education using a cognitive behavioural strategy is most consistently effective in changing maladaptive illness beliefs,⁵¹ and studies using more than two behavioural change strategies reported significant differences between the intervention and control groups.³¹ In one review, a significant change in smoking cessation was not

observed in subgroup analyses between studies that did or did not report using a theory in intervention planning⁵⁶; however, the authors did not suggest that using a theory in programme planning should be disregarded but reported that examining actual theories or mechanisms underlying health education programmes is required.⁵⁶ Owing to the considerable overlap between different theories and the detailed description of the theoretical approach in only approximately 40% of the included papers, it is difficult to determine the most effective theoretical approach, but many models can be used with success, such as the health belief model (HBM), social cognitive theory (SCT) and transtheoretical model (TTM).^{56 67 69 75} Three reviews^{31 41 44} noted that some included studies used behavioural strategies such as goal setting. These strategies were found to be beneficial for patients with coronary heart disease.

For patients with T2DM

Although the theoretical approach underpinning the health education programme was not always described, 13 of the 36 reviews (36.11%) related to T2DM reported the theoretical approach used in their included studies. The most common theories were SCT (including self-efficacy), empowerment theories (eg, empowerment behaviour change model, self-determination and autonomy motivation theory, middle-range theory of community empowerment) and TTM. There is evidence that health education interventions based on a theoretical model are likely to be effective.⁴³ Vugt *et al* suggested that self-care education programmes should be based on theories and that theory-based self-care interventions are more effective than non-theory-based programmes.^{75 83} Theories could help to specify the key target health behaviours and behavioural change techniques required to generate the desired outcomes.⁷⁵ The decision regarding the theory should be based on the aim of the programme and factor for intervention.⁷⁷ Only one review reported that a theoretical approach underpinning the health education programme is not necessary for better outcomes.⁷⁶ Fourteen reviews^{30 33 40 46 52 57 60 63 64 67 68 73 75 77} reported that goal setting was conducted in the included studies. Goal setting by patients, health professionals or mutually agreed goals were linked to improved patient outcomes.

Educational content

For patients with ACS

Most reviews reported that the educational content of the interventions was comprehensive. The most common topics, of the average 3.7 topics per education session, were behavioural change, cardiovascular risk factors management, exercise, psychosocial issues and smoking cessation. An underlying principle of health education for patients with ACS is that knowledge is necessary, but not enough to develop health behaviours and change risk factors.^{31 50} Age, cognitive factors, environmental factors and social and economic background are also important considerations.⁵⁰ While interventions using a behavioural programme, telephone-based content or

self-care are effective for smoking cessation, there was insufficient evidence to support that any type of educational programme was more efficacious than the others.⁶⁹ Psychoeducation, which is defined as multimodal, educationally based, self-management interventions,³¹ led to enhanced physical activity levels within 6–12 months when added to cardiac rehabilitation (CR) and was more effective than an exercise programme or health education alone.^{31 56} Moreover, psychoeducational interventions were more effective for patients with ACS than other types of health education.^{31 56}

For patients with T2DM

The educational content for patients with T2DM focused more on behavioural change, diet, exercise, glycaemic regulation, medication and self-management. Health education that was self-management was more effective for patients with T2DM.^{40 47} In addition, based on the current evidence, the educational content should be culturally sensitive, especially for patients with T2DM^{33 42 54}; culturally appropriate diabetes health education may have a greater impact on the management of glycaemia and reduce diabetes complications.⁷⁷ The educational interventions for patients with T2DM focused primarily on HbA1c, lipid levels, quality of life and body weight. HBM and SCT were the most common theories used in the included reviews.

Teaching strategies and outcomes

For patients with ACS

Most reviews reported that the education was provided using multiple teaching methods and in multiple settings. Nurses and multidisciplinary teams were the most frequent people providing education, and most education programmes were delivered postdischarge. Although face-to-face sessions were the most common delivery format, many education sessions were also delivered by telephone or through individualised counselling. Telephone-based health education appeared to be effective for reducing hospitalisations, systolic BP, smoking rates, depression and anxiety.⁵⁹ The educational interventions for patients with ACS focused primarily on clinical outcomes (hospitalisation and mortality), modifiable risk factors (BP, low-density lipoprotein levels and smoking cessation) and other psychological outcomes (anxiety and depression).

For patients with T2DM

Mixed health education programmes generally included group sessions combined with educator-facilitated individual sessions, covering basic knowledge and problem-solving skills. These programmes produced greater benefits and larger effect sizes for blood glucose reduction and knowledge levels in patients with T2DM.⁴⁷ In contrast, individual education programmes have been reported as more effective in achieving outcomes than group-based education. This may be because education programmes might be more efficient at addressing

personal needs, with greater participant engagement.⁷³ However, one systematic review reported that individual and group patient education demonstrated similar outcomes among patients with T2DM.⁴⁶

Although face-to-face sessions were the most common delivery format, many education sessions were also delivered by telephone or individualised counselling. Face-to-face health education programmes were most effective for enhancing blood glucose regulation and knowledge levels, while mixed delivery models (face-to-face, phone contact, online or web-based or video) produced a moderate effect for knowledge levels.⁴⁷ Another review reported that face-to-face health education programmes generated a greater benefit for metabolic management than those delivered using electronic communication technology.⁷³

Nurses (including diabetes nurses educators), community workers, dieticians and multidisciplinary teams were the most frequent educators, and most of the education programmes were delivered postdischarge. Some reviews indicated that health education programmes delivered by a group of different educators, with some degree of education reinforcement at additional points of contact, may provide the best results.^{60 76} However, based on two studies that reported HbA1c at 12 months, it is indicated that the outcomes in studies with only a diabetes nurse as the educator also tended to do better than the outcomes in studies with a multidisciplinary team, while the biggest effect was seen when a dietician was the only educator.⁷⁶ Health education programmes delivered by one person may focus more on the patient's ability than the educational content or quality of the health education programmes.⁷⁶ However, no clear conclusion can be drawn whether having one educator delivering the intervention is best due to few information.⁶⁰

Delivery, timing and follow-up

For patients with ACS

Most educational sessions were delivered weekly. Few reviews provided information regarding the duration of education interventions; when the duration was reported, it varied from 4 weeks to 48 months. These findings suggest that there is a significant gap in the evidence in relation to the duration, contact hours, educational content, optimal delivery mode, total length and setting of health education programmes for cardiac patients.⁵⁰ For patients with ACS, one systematic review that included 7 studies with a total of 536 participants reported that studies with education lasting at least 6 months resulted in the most significant changes in the primary outcomes (such as behavioural change, smoking cessation)³¹ and that at least 12 months of follow-up is needed to evaluate the impact of telephone-based education.⁵⁹ Another review reported that the intensity of education programmes is important for efficacy regarding smoking cessation: interventions with a very low intensity and brief interventions do not have a significant effect,⁶⁹ and programmes for smoking cessation among patients with coronary heart

disease should last >1 month.⁶⁹ Most of the reviews were provided for patients with ACS in inpatient settings and then within postdischarge settings, five reviews^{31 36 45 48 59} did not explicitly state the settings in which the health education-related interventions were provided.

For patients with T2DM

Education sessions were delivered weekly or monthly. Longer health education programmes for T2DM (>6 months) produced larger effects for all primary outcomes (such as HbA1c).⁴⁷ Health education lasting >3 months resulted in the largest effect size compared with health education of a shorter duration (<3 months).³³ For HbA1c, the effect size at 6 months seemed to be significantly greater than at 3 and 12 months; in other words, the effect size peaked at 6 months.⁶² In general, health education of a greater intensity (longer duration and more sessions) was more effective for blood glucose reduction and knowledge levels among patients with T2DM.^{47 74} Compared with health education programmes covering only one topic, programmes that included multiple or mixed educational topics yielded consistently greater benefits in blood glucose reduction and knowledge levels.⁴⁷ In addition, health education programmes combined with specific behavioural change strategies (such as self-care strategies) seemed more effective than other programmes.⁴⁷ Health education-related

interventions were mainly delivered in hospital settings, primary care settings, diabetes centres or community-based settings, although six reviews^{32 39 55 58 67 72} did not explicitly state the delivery settings.

Recommendations about health education interventions for patients with ACS and T2DM

These results from included systematic reviews and meta-analyses help to provide recommendations about the content of a health education intervention for patients with ACS and T2DM, requiring further evaluation. Future development of educational programmes for patients with ACS and T2DM by healthcare professionals should consider the needs of people with these diseases.^{37 40 42 70} Based on the results and findings from this umbrella review, recommendations are made in [table 5](#). The acute life-threatening nature of ACS requires that increased emphasis should be placed on cardiovascular risk factors in any combined education programme. Both ACS and T2DM have common lifestyle factors such as inactivity and high fat diet requiring modifications.

Overall completeness and applicability of evidence

This overview potentially provides an estimate with the lowest level of bias for the impact of health education-related interventions for patients with ACS or T2DM and could be regarded as an all-inclusive summary of the

Table 5 Recommendations of health education programmes for patients with ACS and T2DM

		Patients with ACS	Patients with T2DM	Both ACS and T2DM
Theoretical approach		SCT, empowerment theories.	HBM; SCT.	HBM; SCT and empowerment theories
Behavioural strategies		Goal setting	Goal setting	Goal setting
Educational content		Behavioural change (such as smoking cessation), cardiovascular risk factors, exercise, medication and psychosocial issues	Behavioural change, diet, exercise, glycaemic control, medication and self-management	Behavioural change (such as smoking cessation), cardiovascular risk factors, diet, exercise, glycaemic control, medication, psychosocial issues and self-management
Healthcare professionals to deliver		Nurse or multidisciplinary team	Multidisciplinary team; dietitian or nurse	Nurse or multidisciplinary team
Teaching approaches	Strategies	Face to face; telephone or mixed	Face-to-face, written materials; telephone or mixed	Face-to-face, written materials; telephone contact or mixed
	Format	Individual (one by one) or mixed	Individual (one by one) or mixed	Individual (one by one) or mixed
Delivery timing	Contact hours	More than 30 min per time per week	More than 30 min per time per week	More than 30 min per time per week
	Duration	At least 6 months	About 6 months	At least 6 months
Duration of follow-up		At least 12 months	At least 12 months	At least 12 months
Settings		Inpatient and postdischarge settings	Hospital settings and primary care settings	Inpatient and postdischarge settings

ACS, acute coronary syndrome; T2DM, type two diabetes mellitus; SCT, social cognitive theory; HBM, health belief model.

current evidence base for health education for these patients. While this umbrella review identified evidence for each of the types of health education, there was only a small number of reviews within some categories (such as psychoeducational intervention³⁰ and dietary advice⁶³), and these studies were not very informative. This umbrella review also found no reviews that systematically analysed varying doses of health education; therefore, could not examine the dose-response effects. There was insufficient information about the evaluated doses (total contact hours and duration of education) to enable comparison of the benefits of differences in the magnitude of the doses across the different research. This umbrella review found no reviews focused on patients with ACS and T2DM; instead, all of the systematic reviews and meta-analyses focused on only one of these diseases.

Quality of the evidence

The methodological quality of the included systematic reviews and meta-analyses varied. All of the included reviews or meta-analyses were of moderate-to-high methodological quality, as assessed using AMSTAR. However, only 30 (58.8%) systematic reviews or meta-analyses were rated as high quality and only 3 (5.9%) systematic reviews or meta-analyses^{43 53 69} adequately met all 11 AMSTAR criteria. This indicates that some of the reviews included in this umbrella review may have limitations in their design, conduct and/or reporting that could have influenced the findings when considered both individually and collectively.^{32 65}

The quality of the primary studies in the included systematic reviews or meta-analyses also varied. The main sources of bias were inadequate reporting of allocation concealment and randomisation processes, as well as lack of outcome blinding.^{33 42 69 70} This bias in the methodological quality led to lower quality assessments, which varied by results within each included review. Other reasons for lower methodological quality included heterogeneity in, or inconsistency of, the effect and imprecise findings. Heterogeneity between studies in this umbrella review was described in terms of the intervention, participant characteristics and length of follow-up. Heterogeneity was an important factor indicating the complexity of the health education interventions.⁵⁶ The variability in the approaches, tools or scales used to measure outcomes between the included studies are likely to introduce some heterogeneity.³⁰ The heterogeneity of the educational interventions seen in the reviews included in this umbrella review may reflect the uncertainty about the optimal strategy for providing health education to patients.³⁷ In addition, 240 studies were included more than once in the included reviews and meta-analyses. However, the overall overlap of studies among reviews and meta-analyses-related ACS and T2DM was slight, CCA of 2.6% and 2.1%, respectively.²⁵

This umbrella review is the first synthesis of systematic reviews or meta-analyses to take a broad perspective on health education-related interventions for patients with

ACS or T2DM. Given that health education is complex, the biggest challenge for systematic reviews or meta-analyses of health education is accounting for the potential clinical heterogeneity in health education-related interventions (content and delivery approaches) and the population of patients who receive health education. To facilitate comparisons across systematic reviews of health education and the efficient future update of this umbrella review, future reviews or meta-analyses need high-quality research and to standardise their design and reporting, including the reporting of included study characteristics, assessment criteria for risk of bias, outcomes and methods to synthesise evidence synthesis.

CONCLUSIONS

For clinicians providing educational interventions to individuals with ACS and T2DM, the results from this review provide a contemporaneous perspective on current evidence on the effectiveness of health education (its content and delivery methods) for this high-risk patient group. The current evidence compiled by this umbrella review supports current international clinical guidelines, that theoretically based education interventions lasting 6 months, delivered in multiple modes (face to face, phone contact, online or web-based or video), and with individualised education delivered weekly, are more likely to generate positive outcomes. This review also supports health education-related interventions provided by health professionals, including nurses and multidisciplinary teams, delivering content including specific clinical factors for ACS and T2DM (BP, glycaemic level and medication), modifiable risk factors (unhealthy diet, inactivity and smoking) and other psychological factors (anxiety and depression). These health education interventions could be delivered postdischarge, such as rehabilitation centres, primary care centres and the community and should be at least 6 months in duration. The effectiveness of these programmes was based on HbA1c levels, knowledge, psychosocial outcomes, readmission rates and smoking status rather than clear evidence of reduced mortality, MI or short-term and long-term complications. In addition, psychoeducational interventions were more effective for patients with ACS, and health education that was culturally appropriate or taught self-management was more effective for patients with T2DM. We also found that longer durations and high-intensity health education provided in an individualised format were more helpful for patients with ACS or T2DM.

The fact that none of the included reviews included patients with both ACS and T2DM indicates a clear need for further rigorous experimental studies with patients with both diseases. Future research that includes these aspects of education are likely to determine the effectiveness of educational interventions focusing on cardiovascular and DM risk factors and complications within patients with ACS and T2DM.

Author affiliations¹Tenth People's Hospital, Tongji University, Shanghai, China²School of Nursing, Midwifery and Paramedicine, Australian Catholic University, Brisbane, QLD, Australia³School of Nursing, Jिंगgangshan University, Ji'An, China⁴Melbourne Health, La Trobe University, Melbourne, Victoria, Australia⁵School of Nursing, Midwifery and Paramedicine, University of the Sunshine Coast, Australia⁶School of Nursing, Queensland University of Technology (QUT), Brisbane, Australia⁷Royal Brisbane and Women's Hospital (RBWH), Australia⁸Mater Medical Research Institute-University of Queensland (MMRI-UQ), Australia⁹Faculty of Health Sciences, Australian Catholic University, North Sydney, NSW, Australia¹⁰Ingham Institute of Applied Medical Research, Sydney, NSW, Australia**Acknowledgements** We would like to thank the authors of the original articles who provided additional unpublished data.**Contributors** Study conception and design: XL-L, MJ, KW, C-JW, YS. Data collection: XL-L, YS. Data analysis: XL-L, YS, MJ, KW, C-JW. Manuscript drafts: XL-L, MJ, C-JW, KW, YS.**Funding** This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors. The lead author is a recipient of an Australian Catholic University Faculty of Health Sciences Tongji University Cotutelle PhD Scholarship.**Competing interests** None declared.**Provenance and peer review** Not commissioned; externally peer reviewed.**Data sharing statement** No additional data are available.**Open Access** This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) license, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: <http://creativecommons.org/licenses/by/4.0/>

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REFERENCES

1. Scarborough P, Wickramasinghe K, Bhatnagar P, *et al.* *Trends in coronary heart disease, 1961-2011*. London: British Heart Foundation, 2011.
2. Finegold JA, Asaria P, Francis DP. Mortality from ischaemic heart disease by country, region, and age: statistics from World Health Organisation and United Nations. *Int J Cardiol* 2013;168:934-45.
3. Amsterdam EA, Wenger NK, Brindis RG, *et al.* 2014 AHA/ACC guideline for the management of patients with Non-ST-Elevation acute coronary syndromes: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines. *J Am Coll Cardiol* 2014;64:e139-228.
4. Kahn M, Wheatcroft S. Acute coronary syndromes in diabetes. Fisher M, ed. *Heart Disease and Diabetes*. Oxford: Oxford University Press, 2008.
5. Hasin T, Hochadel M, Gitt AK, *et al.* Comparison of treatment and outcome of acute coronary syndrome in patients with versus patients without diabetes mellitus. *Am J Cardiol* 2009;103:772-8.
6. Franklin K, Goldberg RJ, Spencer F, *et al.* Implications of diabetes in patients with acute coronary syndromes: the global registry of acute coronary events. *Arch Intern Med* 2004;164:1457-63.
7. Ting HH, Chen AY, Roe MT, *et al.* Delay from symptom onset to hospital presentation for patients with non-ST-segment elevation myocardial infarction. *Arch Intern Med* 2010;170:1834-41.
8. Saely CH, Aczel S, Koch L, *et al.* Diabetes as a coronary artery disease risk equivalent: before a change of paradigm? *Eur J Cardiovasc Prev Rehabil* 2010;17:94-9.
9. Donahoe SM, Stewart GC, McCabe CH, *et al.* Diabetes and mortality following acute coronary syndromes. *JAMA* 2007;298:765-75.
10. Lakerveld J, Bot SD, Chinapaw MJ, *et al.* Motivational interviewing and problem solving treatment to reduce type 2 diabetes and cardiovascular disease risk in real life: a randomized controlled trial. *Int J Behav Nutr Phys Act* 2013;10:47.
11. Glanz K, Rimer BK, Viswanath K. *Health behavior and health education: theory, research, and practice*. Hoboken, NJ: John Wiley & Sons, 2008.
12. Powers MA, Bardsley J, Cypress M, *et al.* Diabetes self-management education and support in type 2 diabetes: a joint position statement of the American Diabetes Association, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics. *Diabetes Educ* 2017;43:40-53.
13. Haas L, Maryniuk M, Beck J, *et al.* National standards for diabetes self-management education and support. *Diabetes Educ* 2012;38:619-29.
14. Fisher EB, Boothroyd RI, Coufal MM, *et al.* Peer support for self-management of diabetes improved outcomes in international settings. *Health Aff* 2012;31:130-9.
15. Tang PC, Overhage JM, Chan AS, *et al.* Online disease management of diabetes: engaging and motivating patients online with enhanced resources-diabetes (EMPOWER-D), a randomized controlled trial. *J Am Med Inform Assoc* 2013;20:526-34.
16. American Diabetes Association. Standards of medical care in diabetes-2014. *Diabetes Care* 2014;37 Suppl 1:S14-80.
17. Jo Wu CJ, Chang AM, McDowell J. Perspectives of patients with type 2 diabetes following a critical cardiac event - an interpretative approach. *J Clin Nurs* 2008;17:16-24.
18. Becker LA OA. Chapter 22: overviews of reviews. In: Higgins JPT, Green S, eds. *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0*: The Cochrane Collaboration, 2011.
19. Chew DP, Scott IA, Cullen L, *et al.* National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand: Australian clinical guidelines for the management of acute coronary syndromes 2016. *Heart Lung Circ* 2016;25:895-951.
20. Alberti KG, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. *Diabet Med* 1998;15:539-53.
21. ThomsonReuters. EndNote version X7. 2016 <http://endnote.com/product-details/x7>
22. Shea BJ, Grimshaw JM, Wells GA, *et al.* Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. *BMC Med Res Methodol* 2007;7:10.
23. Sharif MO, Janjua-Sharif FN, Sharif FN, *et al.* Systematic reviews explained: AMSTAR-how to tell the good from the bad and the ugly. *Oral Health Dent Manag* 2013;12:9-16.
24. Aromataris E, Fernandez R, Godfrey CM, *et al.* Summarizing systematic reviews: methodological development, conduct and reporting of an umbrella review approach. *Int J Evid Based Healthc* 2015;13:132-40.
25. Pieper D, Antoine SL, Mathes T, *et al.* Systematic review finds overlapping reviews were not mentioned in every other overview. *J Clin Epidemiol* 2014;67:368-75.
26. Ryan RE, Weir M, Leslie B, *et al.* Evidence on optimal prescribing and medicines use for decision makers: scope and application of the Rx for change database. *J Pharm Pract Res* 2011;41:295-9.
27. Sapkota S, Brien JA, Greenfield JR, *et al.* A systematic review of interventions addressing adherence to anti-diabetic medications in patients with type 2 diabetes. *PLoS One* 2015;10:e0128581.
28. Walker RJ, Smalls BL, Bonilha HS, *et al.* Behavioral interventions to improve glycemic control in African Americans with type 2 diabetes: a systematic review. *Ethn Dis* 2013;23:401-8.
29. Heinrich E, Schaper NC, de Vries NK. Self-management interventions for type 2 diabetes: a systematic review. *European Diabetes Nursing* 2010;7:71-6.
30. Alam R, Sturt J, Lall R, *et al.* An updated meta-analysis to assess the effectiveness of psychological interventions delivered by psychological specialists and generalist clinicians on glycaemic control and on psychological status. *Patient Educ Couns* 2009;75:25-36.
31. Aldcroft SA, Taylor NF, Blackstock FC, *et al.* Psychoeducational rehabilitation for health behavior change in coronary artery disease: a systematic review of controlled trials. *J Cardiopulm Rehabil Prev* 2011;31:273-81.
32. Amaeshi IJ. Exploring the impact of structured foot health education on the rate of lower extremity amputation in adults with type 2 diabetes. *A systematic review. Podiatry Now* 2012;15:20-7.
33. Attridge M, Creamer J, Ramsden M, *et al.* Culturally appropriate health education for people in ethnic minority groups with type 2 diabetes mellitus. *Cochrane Database Syst Rev* 2014;9:CD006424.
34. Auer R, Gaume J, Rodondi N, *et al.* Efficacy of in-hospital multidimensional interventions of secondary prevention after acute coronary syndrome: a systematic review and meta-analysis. *Circulation* 2008;117:3109-17.

35. Barth J, Critchley J, Bengel J. Efficacy of psychosocial interventions for smoking cessation in patients with coronary heart disease: a systematic review and meta-analysis. *Ann Behav Med* 2006;32:10–20.
36. Barth J, Critchley JA, Bengel J. Psychosocial interventions for smoking cessation in patients with coronary heart disease. *Cochrane Libr* 2008.
37. Brown JP, Clark AM, Dalal H, et al. Effect of patient education in the management of coronary heart disease: a systematic review and meta-analysis of randomized controlled trials. *Eur J Prev Cardiol* 2013;20:701–14.
38. Burke RE, Ferrara SA, Fuller AM, et al. The effectiveness of group medical visits on diabetes mellitus type 2 (dm2) specific outcomes in adults: a systematic review. *JBIM Libr Syst Rev* 2011;9:833–85.
39. Chen L, Pei JH, Kuang J, et al. Effect of lifestyle intervention in patients with type 2 diabetes: a meta-analysis. *Metabolism* 2015;64:338–47.
40. Choi TS, Davidson ZE, Walker KZ, et al. Diabetes education for Chinese adults with type 2 diabetes: a systematic review and meta-analysis of the effect on glycemic control. *Diabetes Res Clin Pract* 2016;116:218–29.
41. Clark AM, Hartling L, Vandermeer B, et al. Meta-analysis: secondary prevention programs for patients with coronary artery disease. *Ann Intern Med* 2005;143:659–72.
42. Creamer J, Attridge M, Ramsden M, et al. Culturally appropriate health education for type 2 diabetes in ethnic minority groups: an updated cochrane review of randomized controlled trials. *Diabet Med* 2016;33:169–83.
43. Deakin T, McShane CE, Cade JE, et al. Group based training for self-management strategies in people with type 2 diabetes mellitus. *Cochrane Database Syst Rev* 2005;2:CD003417.
44. Devi R, Singh SJ, Powell J, et al. Internet-based interventions for the secondary prevention of coronary heart disease. *Cochrane Database Syst Rev* 2015;22:CD009386.
45. Dickens C, Cherrington A, Adeyemi I, et al. Characteristics of psychological interventions that improve depression in people with coronary heart disease: a systematic review and meta-regression. *Psychosom Med* 2013;75:211–21.
46. Duke SA, Colagiuri S, Colagiuri R. Individual patient education for people with type 2 diabetes mellitus. *Cochrane Database Syst Rev* 2009;1:CD005268.
47. Fan L, Sidani S. Effectiveness of diabetes self-management education intervention elements: a meta-analysis. *Can J Diabetes* 2009;33:18–26.
48. Fernandez R, Griffiths R, Everett B, et al. Effectiveness of brief structured interventions on risk factor modification for patients with coronary heart disease: a systematic review. *Int J Evid Based Healthc* 2007;5:370–405.
49. Gary TL, Genkinger JM, Guallar E, et al. Meta-analysis of randomized educational and behavioral interventions in type 2 diabetes. *Diabetes Educ* 2003;29:488–501.
50. Ghisi GL, Abdallah F, Grace SL, et al. A systematic review of patient education in cardiac patients: do they increase knowledge and promote health behavior change? *Patient Educ Couns* 2014;95:160–74.
51. Goulding L, Furze G, Birks Y. Randomized controlled trials of interventions to change maladaptive illness beliefs in people with coronary heart disease: systematic review. *J Adv Nurs* 2010;66:946–61.
52. Gucciardi E, Chan VW, Manuel L, et al. A systematic literature review of diabetes self-management education features to improve diabetes education in women of Black African/Caribbean and Hispanic/Latin American ethnicity. *Patient Educ Couns* 2013;92:235–45.
53. Hawthorne K, Robles Y, Cannings-John R, et al. Culturally appropriate health education for type 2 diabetes mellitus in ethnic minority groups. *Cochrane Database Syst Rev* 2008;3:CD006424.
54. Hawthorne K, Robles Y, Cannings-John R, et al. Culturally appropriate health education for type 2 diabetes in ethnic minority groups: a systematic and narrative review of randomized controlled trials. *Diabet Med* 2010;27:613–23.
55. Huang XL, Pan JH, Chen D, et al. Efficacy of lifestyle interventions in patients with type 2 diabetes: a systematic review and meta-analysis. *Eur J Intern Med* 2016;27:37–47.
56. Huttunen-Lenz M, Song F, Poland F. Are psychoeducational smoking cessation interventions for coronary heart disease effective? meta-analysis of interventions. *Br J Health Psychol* 2010;15(Pt 4):749–77.
57. Lun Gan JK, Brammer JD, Creedy DK. Effectiveness of educational interventions to promote oral hypoglycaemic adherence in adults with type 2 diabetes: a systematic review. *JBIM Libr Syst Rev* 2011;9:269–312.
58. Khunti K, Camosso-Stefinovic J, Carey M, et al. Educational interventions for migrant South Asians with type 2 diabetes: a systematic review. *Diabet Med* 2008;25:985–92.
59. Kotb A, Hsieh S, Wells GA. The effect of telephone support interventions on coronary artery disease (CAD) patient outcomes during cardiac rehabilitation: a systematic review and meta-analysis. *PLoS One* 2014;9:e96581.
60. Loveman E, Frampton GK, Clegg AJ. The clinical effectiveness of diabetes education models for type 2 diabetes: a systematic review. *Health Technol Assess* 2008;12:1–116.
61. Minet L, Møller S, Vach W, et al. Mediating the effect of self-care management intervention in type 2 diabetes: a meta-analysis of 47 randomised controlled trials. *Patient Educ Couns* 2010;80:29–41.
62. Nam S, Janson SL, Stotts NA, et al. Effect of culturally tailored diabetes education in ethnic minorities with type 2 diabetes: a meta-analysis. *J Cardiovasc Nurs* 2012;27:505–18.
63. Nield L, Moore HJ, Hooper L, et al. Dietary advice for treatment of type 2 diabetes mellitus in adults. *Cochrane Database Syst Rev* 2007;3:CD004097.
64. Norris SL, Engelgau MM, Narayan KM. Effectiveness of self-management training in type 2 diabetes: a systematic review of randomized controlled trials. *Diabetes Care* 2001;24:561–87.
65. Norris SL, Lau J, Smith SJ, et al. Self-management education for adults with type 2 diabetes: a meta-analysis of the effect on glycemic control. *Diabetes Care* 2002;25:1159–71.
66. Odnoletkova I, et al. Cost-Effectiveness of therapeutic education to prevent the development and progression of type 2 diabetes: systematic review. *J Diabetes Metab* 2014;05:438.
67. Pal K, Eastwood SV, Michie S, et al. Computer-based interventions to improve self-management in adults with type 2 diabetes: a systematic review and meta-analysis. *Diabetes Care* 2014;37:1759–66.
68. Pal K, Eastwood SV, Michie S, et al. Computer-based diabetes self-management interventions for adults with type 2 diabetes mellitus. *Cochrane Database Syst Rev* 2013;3:CD008776.
69. Barth J, Jacob T, Daha I, et al. Psychosocial interventions for smoking cessation in patients with coronary heart disease. *Cochrane Database Syst Rev* 2015;7:CD006886.
70. Brown JP, Clark AM, Dalal H, et al. Patient education in the management of coronary heart disease. *Cochrane Database Syst Rev* 2011;12:CD008895.
71. Pillay J, Armstrong MJ, Butalia S, et al. Behavioral programs for type 2 diabetes mellitus: a systematic review and network meta-analysis. *Ann Intern Med* 2015;163:848–60.
72. Terranova CO, Brakenridge CL, Lawler SP, et al. Effectiveness of lifestyle-based weight loss interventions for adults with type 2 diabetes: a systematic review and meta-analysis. *Diabetes Obes Metab* 2015;17:371–8.
73. Ricci-Cabello I, Ruiz-Pérez I, Rojas-García A, et al. Characteristics and effectiveness of diabetes self-management educational programs targeted to racial/ethnic minority groups: a systematic review, meta-analysis and meta-regression. *BMC Endocr Disord* 2014;14:60.
74. Saffari M, Ghanizadeh G, Koenig HG. Health education via mobile text messaging for glycemic control in adults with type 2 diabetes: a systematic review and meta-analysis. *Prim Care Diabetes* 2014;8:275–85.
75. van Vugt M, de Wit M, Cleijne WH, et al. Use of behavioral change techniques in web-based self-management programs for type 2 diabetes patients: systematic review. *J Med Internet Res* 2013;15:e279.
76. Steinsbekk A, Rygg LØ, Lisulo M, et al. Group based diabetes self-management education compared to routine treatment for people with type 2 diabetes mellitus: a systematic review with meta-analysis. *BMC Health Serv Res* 2012;12:213.
77. Ramadas A, Quek KF, Chan CK, et al. Web-based interventions for the management of type 2 diabetes mellitus: a systematic review of recent evidence. *Int J Med Inform* 2011;80:389–405.
78. Wens J, Vermeire E, Hearnshaw H, et al. Educational interventions aiming at improving adherence to treatment recommendations in type 2 diabetes: a sub-analysis of a systematic review of randomised controlled trials. *Diabetes Res Clin Pract* 2008;79:377–88.
79. Zabaleta AM, Forbes A. Structured group-based education for type 2 diabetes in primary care. *Br J Community Nurs* 2007;12:158–62.
80. Vermeire E, Wens J, Van Royen P, et al. Interventions for improving adherence to treatment recommendations in people with type 2 diabetes mellitus. *Cochrane Database Syst Rev* 2005;2:CD003638.
81. Albrecht L, Archibald M, Arseneau D, et al. Development of a checklist to assess the quality of reporting of knowledge translation interventions using the workgroup for intervention development



- and evaluation research (WIDER) recommendations. *Implement Sci* 2013;8:52.
82. Glazier RH, Bajcar J, Kennie NR, *et al.* A systematic review of interventions to improve diabetes care in socially disadvantaged populations. *Diabetes Care* 2006;29:1675–88.
83. Powers MA, Bardsley J, Cypress M, *et al.* Diabetes self-management education and support in type 2 diabetes: a joint position statement of the American Diabetes Association, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics. *Diabetes Care* 2015;38:1372–82.