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

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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 288 057 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 >780 000 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

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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 225 034 patients with coronary heart disease or ACS (one article did not report the total sample) and 524 59 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 ⁵⁰	CA	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	7
4	Kotb et al ⁵⁹	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 ⁵⁶	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 ⁵⁵	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 ⁵²	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													

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 ³⁰	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 ⁵⁸	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		Provider	Number of session(s), delivery mode, time, setting	Outcomes (primary outcomes were in bold) ↑, ↓: No change ↑↑: Increase ↓↓: Decrease	Synthesis methods
		Studies details	Educational content				
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	All internet-based interventions	Dietitians; exercise specialists; nurse practitioners; physiotherapist rehabilitation specialists, or did not describe.	Number of session: weekly or monthly or unclear; Total contact hours: unclear. Duration: from 6 weeks to 1 year	<ul style="list-style-type: none"> – Clinical outcomes; – Cardiovascular risk factors; – Lifestyle changes; – Compliance with medication; – Healthcare utilisation and costs; ↓ Adverse intervention effects 	Meta-analysis used Review Manager software
Barth, 2015 ⁴⁹ ; The Cochrane Library	Smoking cessation	Number of studies: 40 RCTs; Types of studies: RCTs; Total sample: 7928 participants	Psychosocial smoking cessation interventions	Cardiologist; general practitioner or physician or study nurse	Number of session: weekly or 2–3 times per week; Total contact hours: unclear. Duration: from 8 weeks to 1 year	<ul style="list-style-type: none"> ↑ Abstinence by self-report or validated 	Meta-analysis used Review Manager software
Kotb, 2014 ⁴⁸ ; PLoS One	Patients' outcomes	Number of studies: 26 studies; Types of studies: RCTs; Total sample: 4081 participants	Telephone-delivered postdischarge interventions	Dietitians; exercise specialist; health educators; nurses and pharmacists	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	<ul style="list-style-type: none"> ↓ All-cause hospitalisation; – All-cause mortality; ↓ Depression; – Anxiety; ↑ Smoking cessation; ↓ Systolic blood pressure; – LDL-c 	Meta-analysis used Review Manager software

Continued

Table 2 Continued

First author, year; journal	Primary objectives (to assess effect of interventions on....)	Intervention		Provider	Number of session(s), delivery mode, time, setting		Outcomes (primary outcomes were in bold) '-': No change '↑': Increase '↓': Decrease	Synthesis methods
		Studies details	Educational content					
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 ✓ BEHA (+) ✓ CVR (++) ✓ DIET (+++) ✓ EXERCISE (++) ✓ MED (++) ✓ PSY(++) ✓ SMOKING (+) □ 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 3 hours as well as a 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 □ BEHA ✓ CVR □ DIET □ EXERCISE □ MED □ PSY □ SMOKING □ 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; unclear 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 ✓ BEHA (-) □ CVR □ DIET □ EXERCISE □ MED ✓ PSY (-) □ SMOKING ✓ SELF (-)	A single health professional or by a multidisciplinary team	Number of session: 14.4 (range, 1–156); 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 intervention on...)	Intervention		Provider	Number of session(s), delivery mode, time, setting		Outcomes (primary outcomes were in bold) ↑: Increase ↓: Decrease	Synthesis methods
		Studies details	Educational content		Number of session(s)	Delivery mode, time, setting		
Aldcroft, 2011 ²⁰ ; <i>Journal of Cardipulmonary Rehabilitation & Prevention</i>	Health behaviour change	Number of studies: seven trials Types of studies: six randomised controlled trials and a quasi-experimental trial Total sample: 536 participants	All psychoeducational or behavioural intervention	Appropriately trained healthcare workers	Number of session: unclear; Total contact hours: unclear; Duration: 2–12 months	Strategies: did not 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	Number of studies: 24 papers reporting on 13 studies. Types of studies: RCTs; Total sample: 68 556 participants	Patient education	Nurse or did not describe	Number of session and duration: two visits to 4 weeks residential Format: four studies involved group sessions, five involved individualised education and three used both session types, with one study comparing the two approaches; Theoretical approach: did not describe	Postdischarge, other	– 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	Number of studies: 13 Types of studies: RCTs; Total sample: unclear	Interventions to change maladaptive illness beliefs	Cardiologist, nurse, psychologist or did not describe.	Number of session: unclear; Total contact hours: unclear; Duration: 4 days to 2 weeks or unclear	Inpatient settings, postdischarge, other	– Beliefs (or other illness cognition); – QoL; – Behaviour; – Anxiety or depression; – 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	Number of studies: a total of 14 studies were included Types of studies: RCTs; Total sample: 1792 participants	Psychoeducational cardiac rehabilitation intervention	Cardiologist, nurse psychologist or did not describe	Number of session: 4–20 or unclear. Total contact hours: 10–720 mins or unclear Duration: 4–29 weeks or unclear	Inpatient settings, postdischarge, other	↑ Prevalent smoking cessation, ↑ Continuous smoking cessation, – Mortality	Subgroup meta-analysis was used software

Continued

Table 2 Continued

First author, year, journal	Primary objectives (to assess effect of intervention on...)	Intervention		Provider	Number of session(s), delivery mode, time, setting		Outcomes (primary outcomes were in bold) ↑: Increase ↓: Decrease	Synthesis methods
		Studies details	Educational content					
Auer, 2008 ³⁴ , <i>Circulation</i>	Multiple cardiovascular risk factors and all-cause mortality	Number of studies: 27 articles reporting 26 studies	In-hospital multidimensional interventions of secondary prevention	Cardiac nurses; physician, or did not describe	Number of session: 1–5 or unclear; Total contact hours: 30–240 mins or unclear; Duration: 4 weeks–12 months	Strategies: Written material; audiotapes; presentations; face-to-face; Format: group or unclear; Theoretical approach: unclear	↓ All-cause mortality; ↓ Readmission rates; – Reinfection rates	Stata V.9.1
		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		□ BEHA □ CVR ✓ DIET (-) ✓ EXERCISE (-) ✓ MED ✓ PSY (-) ✓ SMOKING (-) □ SELF				
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: 1–5 or unclear; Total contact hours: 15 mins–9 hours Duration: within 4 weeks or did not report on the duration	Strategies: face-to-face; information booklets, audiotapes or videotapes Format: group sessions or individual counselling; Theoretical approach: TTM	↑ Abstinence by self-report or validated	Meta-analysis used Review Manager software
				✓ BEHA (+++) ✓ CVR (++) □ DIET □ EXERCISE □ MED ✓ PSY (+) ✓ SMOKING (+++) ✓ SELF (+++)				
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	Strategies: written, visual, audio, telephone contact; Format: did not describe; Theoretical approach: theoretical behaviour change principles	↓ Smoking; – Cholesterol level; – Physical activity; ↑ Dietary habits; ↓ Blood sugar levels; – BP levels; ↓ BMI; – Incidence of admission	Cochrane statistical package Review Manager
				✓ BEHA (-) ✓ CVR (-) □ DIET □ EXERCISE □ MED □ PSY □ SMOKING ✓ SELF (-)				
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: unclear; Total contact hours: unclear; Duration: unclear	Strategies: face-to-face, telephone contact or unclear; Format: unclear; Theoretical approach: unclear	↑ Abstinence; ↑ Smoking status	Data analyses were carried out in Review Manager V.4.2
				✓ BEHA (+++) ✓ CVR (++) □ DIET □ EXERCISE □ MED □ PSY □ SMOKING ✓ SELF (+++)				

Continued

Table 2 Continued

First author, year; journal	Primary objectives (to assess effect of intervention on...)	Intervention		Provider	Number of session(s), delivery mode, time, setting		Outcomes (primary outcomes were in bold)		Synthesis methods
		Studies details	Educational content						
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 Theoretical approach: unclear	Strategies: face-to-face, telephone contact and home visit; Format: group and individual or unclear	↓ Mortality, ↓ MI, – Hospitalisation rates	Performed analyses by using Review Manager V4.2 and Qualitative Data Synthesis	

Smoking, smoking cessation; CVD, 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; BCIs, 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

Primary objectives (to assess effect of interventions on...)	Intervention		Outcomes (primary outcomes were in bold.)			
	Studies details	Educational content	Provider	Number of session(s), delivery mode, time, setting	Synthesis methods	
First author, year, journal						
Choi, 2016 ⁴⁰ ; Diabetes Research and Clinical Practice	Number of studies: 53 studies (5 in English, 48 in Chinese); Types of studies: RCTs; Total sample: unclear	Diabetes education intervention	Unclear, did not describe	Number of session: unclear; Total contact hours: unclear; Duration: 30–150 min or unclear	Strategies: face-to-face, written materials; telephone contact and home visit; Format: unclear; Theoretical approach: unclear	HBa1c ; S-TATA V.12 and post discharge, other Review Manager V.5.3
Creaner, 2016 ⁴¹ ; Diabetic Medicine	Number of studies: 33; Types of studies: RCTs; Total sample: 7453 participants	Culturally appropriate health education	CHWs, clinical pharmacists dieticians, nurses, podiatrists, physiotherapists and psychologists	Number of session: 1–10 or unclear; Total contact hours: unclear; Duration: from a single session to 24 months	Strategies: face-to-face; phone contact; Format: group sessions (10 studies), individual sessions (13) or a combination of both; Theoretical approach: unclear	HBa1c , – HRQoL , – Adverse events , – BP, – BMI, – Lipid levels, – Diabetes complications, mortality and diabetes knowledge, and diabetes – Empowerment, – Self-efficacy and satisfaction
Huang, 2016 ⁴² ; European Journal of Internal Medicine	Number of studies: 17 studies; Types of studies: RCTs; Total sample: unclear	Lifestyle interventions	Nurse, pharmacist or unclear	Number of session: unclear; Total contact hours: unclear; Duration: 6 months–8 years	Strategies: unclear; Format: individual; group and mixed Theoretical approach: unclear	Cardiovascular risk factors such as, – BMI, – HBa1c , – BP, ↓ Level of cholesterol
Chen, 2015 ⁴³ ; Metabolism: Clinical and Experimental	Number of studies: 16 studies; Types of studies: RCTs; Total sample: per study ranged from 23 to 2575	Lifestyle intervention	Unclear, did not describe	Number of session: monthly; Total contact hours: unclear; Duration: <6 months–8 years	Strategies: unclear; Format: individual; group and mixed; Theoretical approach: unclear	Cardiovascular risk factors including – BMI, – HBa1c , ↓ SBP, DBP, – HDL-c and LDL-c
Terranova, 2015 ⁴⁴ ; Diabetes, Obesity and Metabolism	Number of studies: 10 individual studies (from 13 papers); Types of studies: RCTs; Total sample: ranging from 27 to 5145 participants	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	Strategies and format: face-to-face individual or group-based sessions, or a combination of those. One study delivered the intervention via the telephone Theoretical approach: unclear	Weight change ; – HBa1c
Pillay, 2015 ⁴⁵ ; Annals of Internal Medicine	Number of studies: 132; Types of studies: RCTs; Total sample: unclear	Behavioural programme	Trained individuals	Number of session: unclear; Total contact hours: range, 7–40.5 hours; Duration: 4 or more weeks	Strategies: unclear; Format: unclear; Theoretical approach: unclear	– HBa1c ; ↑ BMI
The analysis was conducted by using a Bayesian network model						

Continued

Table 3 Continued

First author, year; journal	Primary objectives (to assess effect of interventions on...)	Intervention		Provider	Number of session(s), delivery mode, time, setting	Outcomes (primary outcomes were in bold)	Synthesis methods
		Studies details	Educational content				
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	Number of session: 1-3; Total contact hours: 10 min-6 hours; Duration: 8 weeks-12 months Theoretical approach: TTM, social ecological theory, SCT and self-determination theory	↓ HbA1c; ↓ Death; ↓ Cognitions, behaviours, ↓ Social support, ↓ Cardiovascular risk factors, ↓ Complications, ↓ Emotional outcomes, ↓ Hypoglycaemia, ↓ Adverse effects, ↓ CE and economic data	Meta-analysis using Review Manager software or narrative presentation
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	Number of session: 13.1; Total contact hours: 0.25-160 hours; Duration: 0.25-48 months Theoretical approach: unclear	↓ Diabetes knowledge; ↓ Self-management; ↓ Behaviours; ↓ Clinical outcomes; ↓ Glycated haemoglobin; ↓ Cost-effectiveness analysis	Meta-analysis and bivariate meta-regression were conducted with Stata V.12.0
Saffari, 2014; ⁷⁴ <i>Primary Care Diabetes</i>	Glycaemic control.	Number of studies: 10; RCTs; Types of studies: Total sample: 960 patients	An educational intervention using SMS	Unclear, did not describe	Number of session: weekly, or two messages daily or unclear; Total contact hours: unclear; Duration: 3 months-1 year Theoretical approach: Unclear.	↑ Glycaemic control	Comprehensive Meta-analysis Software V.2.0
Odnoletkova, 2014; ⁴⁶ <i>Journal of Diabetes & Metabolism</i>	Cost-effectiveness (CE)	Number of studies: 17 studies; Types of studies: Total sample: unclear	Therapeutic education	General physician; nutritionists or unclear	Number of session: ~16; Total contact hours: unclear; Duration: unclear	↓ CE	Incremental cost-effectiveness ratio
Attidge, 2014; ³³ <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; dieticians; exercise physiologists; lay workers; nurses; podiatrists and psychologists	Number of session: one session to 24 months; Total contact hours: unclear; Duration: the median duration of interventions was 6 months Theoretical approach: unclear	↓ HbA1c; ↓ HRQoL; ↓ Adverse events; ↓ Mortality; ↓ Complications; -Satisfaction; ↑ Empowerment; ↑ Self-efficacy; ↓ Attitude; Knowledge; ↓ BP; ↓ BMI; ↓ Lipid levels; ↓ Health economics	Meta-analysis used Review Manager software
Vogt, 2013; ⁴⁵ <i>Journal of Medical Internet Research</i>	Health outcomes	Number of studies: 13 studies; Types of studies: RCTs; Total sample: 3813 patients	RCTs are being used in online self-management interventions	Healthcare professional	Number of session: 6 weekly sessions or unclear; Total contact hours: unclear; Duration: 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	Unclear

Continued

Table 3 Continued

First author, year; journal	Primary objectives (to assess effect of interventions on...)	Intervention		Provider	Number of session(s), delivery mode, time, setting	Outcomes (primary outcomes were in bold) ↑: Increase ↓: Decrease	Synthesis methods
		Studies details	Educational content				
Gucciardi, 2013 ⁴⁵ ; <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, self-management intervention	Dietitians (n=7/13); Multidisciplinary team (n=7/13); Nurse (n=5/13); Community peer worker (n=3/13)	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) Theoretical approach: SAT; empowerment Behaviour change model; modification theories; pharmaceutical care model; Behaviour change theory; PATHWAYS programme; symptom-focused management model; motivational interviewing	<ul style="list-style-type: none"> ↓ HbA1c levels; ↓ Anthropometrics; ↓ Physical activity; ↓ Diet outcomes 	A recently described method
Pal, 2013 ⁴⁶ ; <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	Nurse or other healthcare professionals	Number of session: unclear; Total contact hours: unclear; Duration: 1 session–18 months Theoretical approach: unclear	<ul style="list-style-type: none"> ↓ HRQoL; ↓ Death from any cause; ↓ HbA1c; ↓ Cognitions; ↓ Behaviours; ↓ Social support; ↓ Biological markers; ↓ Complications 	Formal meta-analysis and narrative synthesis
Nam, 2012 ⁴⁷ ; <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)	Nurses (36%), dietitians (36%), diabetes educators (5%), other professionals (9%) and non-professional staff (14%)	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	<ul style="list-style-type: none"> ↓ HbA1c level 	Meta-analysis
Stensbekk, 2012 ⁴⁸ ; <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	Group-based education	Community workers; dietitian; lay health advisors nurse and nutritionist	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 to 2 years Duration: 6 months to 2 years Theoretical approach: the discovery learning empowerment model and theory, the SCT and the social ecological theory, the self-efficacy and operant reinforcement theory	<ul style="list-style-type: none"> ↓ HbA1c; ↓ Lifestyle outcomes; ↓ Diabetes knowledge; ↓ Self-management skills; ↓ Psychosocial outcomes; ↓ Mortality rate; ↓ BMI; ↓ Blood pressure; ↓ Lipid profile 	Meta-analysis using Review Manager V.5
Anaeshi, 2012 ⁴⁹ ; <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	Foot health education	Podiatrist, psychologist or unclear	Number of session: unclear; Total contact hours: between 15 min and 14 hours; Duration: 3–30 months	<ul style="list-style-type: none"> ↓ LEA; ↓ Self-care 	Narrative synthesis

Continued

Table 3 Continued

First author, year; journal	Primary objectives (to assess effect of interventions on...)	Intervention		Provider	Number of session(s), delivery mode, time, setting	Outcomes (primary outcomes were in bold.) ↑: Increase ↓: Decrease '-': No change	Synthesis methods
		Studies details	Educational content				
Liu Gan, 2011 ⁶⁷ ; JBI Library of Systematic Reviews	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 Strategies: face-to-face; Format: group and individual; Theoretical approach: unclear	↓ HbA1c ; ↓ Medication adherence ; ↓ Blood glucose; – Tablet count; – Medication containers; – Diabetes complications; – Health service utilisation	Narrative summary form
Burke, 2011 ³⁸ ; JBI Database of Systematic Reviews and Implementation Reports	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 Strategies: face-to-face; Format: group and individual; Theoretical approach: unclear	↓ HbA1c ; ↓ Systolic and diastolic BP ; – LDL measurements	Meta-analysis
Ramadas, 2011 ⁷¹ ; International Journal of Medical Informatics	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 Strategies: email and SMS technologies that were commonly used together with the websites to reinforce the intervention, and website, print material Format: unclear; Theoretical approach: Wagner's Chronic Care Model; self-efficacy theory; social support theory; TTM; HBM; SCT	– Self-monitoring blood sugar ; – Weight loss; – Dietary behaviour; – Physical activity	Not statistically combined and re-analysed
Minet, 2010 ⁶¹ ; Patient Education and Counselling	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 counselor; researcher and pharmacist	Number of session: 3-26; Total contact hours: unclear; Duration: 4 weeks to 4 years Strategies: face-to-face; home visit; phone calls; Format: group and individual; Theoretical approach: unclear	↓ HbA1c	Meta-analysis and meta- regression used Stata's meta command
Hawthorne, 2010 ⁶⁴ ; Diabetic Medicine	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; dietitians; diabetes nurses; link workers and podiatrists	Number of session: unclear; Total contact hours: unclear; Duration: 1 session to 12 months Strategies: face-to-face; visual aids, leaflets and teaching materials; Format: group approach, one-to-one interviews and a mixed approach; Theoretical approach: SAT; Empowerment Behaviour Change Model; SCT; Management model and the Theory of Planned Behaviour	– QoL ; ↓ HbA1c ; ↓ BP ; ↑ Knowledge; – BMI; ↑ Lipid levels; – Diabetic complications, – Mortality rates, hospital admissions, hypoglycaemia	Meta-analysis using the Review Manager and narrative review
Fan, 2009 ⁷² ; Canadian Journal of Diabetes	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 1-38); Total contact hours: 17 (range 1-132); 17 contact hours (range 1-132); >20 (33%); 11-20 (21%); <10 (46%); Duration: 22 weeks (range 1-38); 33 weeks (26%); 9-24 weeks (37%); >24 weeks (37%) Strategies: Online/web- based (45%); video (2%); face-to-face (69%); phone contact (4%); Mixed (30%); Format: one-on-one (32%); group (40%); mixed (28%) Theoretical approach: unclear	↑ Diabetes knowledge ; ↑ Self-management behaviours ; ↓ HbA1c	Comprehensive meta- analysis (V2.0)

Continued

Table 3 Continued

First author, year; journal	Primary objectives (to assess effect of interventions on...)	Intervention		Provider	Number of session(s), delivery mode, time, setting	Outcomes (primary outcomes were in bold.) '-': No change '↑': Increase '↓': Decrease	Synthesis methods
		Studies details	Educational content				
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	Number of session: 16; Total contact hours: 20 min–7 hours; Duration: 4 weeks–1 year	Strategies: face-to-face; telephone; Inpatient settings Format: individual; unclear Theoretical approach: unclear	Meta-analysis – HbA1c; – Diabetes complications; – Health service utilisation and healthcare costs; – Psychosocial outcomes; – Diabetes knowledge; patient self-care behaviours; – Physical measures; metabolic
Alam, 2009 ⁴⁰ ; Patient Education and Counseling	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	Number of session: 1–16; Total contact hours: 20 min–28 hours; Duration: about 13.7 (±11.06) weeks	Strategies: face-to-face; telephone calls; single format and a combination; Theoretical approach: TTM; motivational interviewing	Meta-analysis ↓ HbA1c; ↓ Psychological distress
Kiunthi, 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	Number of session: unclear; Total contact hours: unclear; Duration: 3–12 months	Strategies: face-to-face; individual; unclear Format: group and individual; Theoretical approach: unclear	Unclear – Knowledge; – Psychological and biomedical outcome measures
Loveman, 2008 ⁴⁷ ; 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 technician; diabetes nurse; dietitians; educationalist; medical students; nurses; pharmacists; physician or physician assistant	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 61–32 hours over 1 year	Strategies: face-to-face; individual; Theoretical approach: cognitive-behavioural strategies; pedagogical principle	– 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	Number of session: unclear; Total contact hours: unclear; Duration: ~9 months or unclear	Strategies: face-to-face; telephone; Group based and unclear Format: face-to-face; group based and unclear Theoretical approach: unclear	– Adherence; – HbA1c; – Blood glucose
Hawthorne, 2008 ⁴³ ; 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	Number of session: unclear; Total contact hours: unclear; Duration: 1 session to 12 months	Strategies: face-to-face; booklet; Format: group intervention 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: TSM; Empowerment (S); Behaviour Change Model; Behaviour Change Theory; SCT; Management Model and the Theory of Planned Behaviour	Narrative presentation and meta-analysis ↓ HbA1c ↑ Knowledge scores – Other outcome measures

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Table 3 Continued						
First author, year; journal	Primary objectives (to assess effect of interventions on...)	Intervention		Provider	Number of session(s), delivery mode, time, setting	Outcomes (primary outcomes were in bold) ↑: Increase ↓: Decrease
		Studies details	Educational content			
Nield, 2007 ⁴³ ; 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: 20 min–22 hours; Duration: 11 weeks–6 months or unclear	– Weight; – Diabetic complications; – HbA1c; – QoL; – Medication use; – Cardiovascular disease risk
Zakaria, 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	– HbA1c
Deakin, 2005 ⁵⁴ ; 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	Metabolic control; Diabetes knowledge; QoL; Empowerment/self-efficacy
Vermeire, 2008 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	Direct indicators, such as ↓ Blood glucose level; – Indirect indicators, such as pill counts; – Health outcomes
Gary, 2003 ⁴⁸ ; 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 educator (4%)	Number of session: unclear; Total contact hours: unclear; Duration: 1 month to 19.2 months	– Glycaemic control; – Weight
Norris, 2002 ⁴⁵ ; 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	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: 16; Total contact hours: ~22 hours; Duration: ~26 months	Outcomes are summarised in a qualitative fashion ↑ Knowledge; ↑ Lifestyle behaviours; – Psychological and QoL outcomes; ↑ Glycaemic control; – Cardiovascular disease risk factors

Continued

Table 3 Continued

First author, year, journal	Primary objectives (to assess effect of interventions on...)	Intervention		Provider	Number of session(s), delivery mode, time, setting	Outcomes (primary outcomes were in bold.)		Synthesis methods
		Studies details	Educational content			↑: Increase ↓: Decrease ↔: No change		
<p>BASE, attitude social influence-efficacy; BCTs, 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; HBA1c, glycated haemoglobin; HBM, health belief model; HQoL, health-related quality of life, EDU, low-density lipoprotein cholesterol; LDL-c, low-density lipoprotein cholesterol; LEA, low-extremity amputation; MED, medication; MI, myocardial infarction; PA, physical activity; PRIDE, PRIDE general practice; Researching a haemoglobin, Researching a management goal, Identifying a routine, Identifying a management goal, Establishing rewards for progress; PSY, psychosocial issues (depression, anxiety); QoL, quality of life; RCTs, randomised controlled trials; SAT, social problem identification, Researching a routine, Identifying a management goal, Establishing rewards for progress; SMS, short message system; T2DM, type two diabetes mellitus; TTM, transtheoretical model.</p> <p>In the educational content: '+' minor focus; '+' moderate focus; '++' major focus; '+++' unclear what the intensity of the education was for any topic.</p> <p>In the outcomes: arrow up (↑) for improvement, arrow down (↓) for reduction, a dash (—) for no change or inconclusive evidence.</p>								

ASE, attitudes social influence-efficacy; BCIs, 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; CVD, 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; 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.

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*	
			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		
			Total mortality		
		Barth, 2008 ³⁶	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 Revascularisation Total cholesterol HDL cholesterol Triglycerides HRQOL	Some evidence
		Auer, 2008 ³⁴	All-cause mortality Readmission rates Reinfarction rates Smoking cessation rates	
		Clark, 2005 ⁴¹	Mortality MI Quality of life	Most of the included studies*
Patients with T2DM				
General health education	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 Saffari, 2014 ⁷⁴ Duke, 2009 ⁴⁶	HbA1c Glycaemic control HbA1c BP Knowledge, psychosocial outcomes and smoking habits Diabetes complications or health service utilisation and cost analysis	Some evidence
		Loveman, 2008 ⁶⁰	Diabetic control outcomes Weight Cholesterol or triglycerides	46.15% studies* 66.67% studies* 40.00% studies (+)
		Zabaleta, 2007 ⁷⁹	HbA1c	4.8% studies*
Culturally appropriate health education	Eight/20 622 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 Ricci-Cabello, 2014 ⁷³	HbA1c HRQoL AEs HbA1c Diabetes knowledge Behaviours Clinical outcomes	Some evidence No AEs 73.3% studies* 75% studies* 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	Showed neutral effects
		Gucciardi, 2013 ⁵²	HbA1c levels Anthropometrics Physical activity Diet outcomes	3 of 10 studies* 3 of 11 studies* One of five studies* Two of six studies*
		Nam, 2012 ⁶²	HbA1c level	
		Hawthorne, 2010 ⁵⁴	HbA1c Knowledge scores	
		Khunti, 2008 ⁵⁸	Knowledge levels Biomedical outcomes	Only one study reporting a significant improvement Only one study reporting a significant improvement
		Hawthorne, 2008 ⁵³	HbA1c Knowledge scores Other outcome measures	
		Huang, 2016 ⁵⁵	HbA1c BMI LDL-c and HDL-c	Some evidence
		Chen, 2015 ³⁹	HbA1c BMI SBP DBP HDL-c	
		Terranova, 2015 ⁷²	HbA1c level Weight	
		Pillay, 2015 ⁷¹	HbA1c levels BMI	
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)	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		Sufficient evidence
			Cognitive outcomes		
			Behavioural outcomes	Only one study reporting a significant improvement	
		Vugt, 2013 ⁷⁵	AEs	No AEs	
			Health behaviours	7 of 13 studies *	
			Clinical outcomes measures	Nine studies *	
			Psychological outcomes	Nine studies *	
		Pal, 2013 ⁶⁸	HbA1c		
			Depression		
			Quality of life		
			Weight		
		Steinsbekk, 2012 ⁷⁶	HbA1c		
			Main lifestyle outcomes		
			Main psychosocial outcomes		
		Minet, 2010 ⁶¹	Glycaemic control		
		Fan, 2009 ⁴⁷	Diabetes knowledge		
			Overall self-management behaviours		
			Overall metabolic outcomes		
			Overall weighted mean effect sizes		
		Deakin, 2005 ⁴³	Metabolic control (HbA1c)		
			Fasting blood glucose levels		
			Weight		
			Diabetes knowledge		
			SBP		
			Diabetes medication		
		Norris, 2002 ⁶⁵	Total GHb		
		Norris, 2001 ⁶⁴	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		Some evidence
			Incidence of LEA		

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
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, dietitians 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 dietitian 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.

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